BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3235-RiverLa Off to RiverLa On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2297*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1346*	pc/h/ln
S	*65.0*	mph
D = v_p / S	*20.7*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3235-RiverLa Off to RiverLa On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2519*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1469*	pc/h/ln
S	*64.9*	mph
D = v_p / S	*22.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3240-EB On from River Landing
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1400	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2297	
	Ramp Volume, V_R: 620	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2297	0.90	Level	11	0	0.948	1.00	2693
Ramp	620	0.90	Level	10	0	0.952	1.00	723
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2693 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3416	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3416	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 23.0 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.370 (Exibit 13-11)

S_R= 56.5 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 56.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3240-EB On from River Landing
Date Performed	4/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1400	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2519	
	Ramp Volume, V_R: 510	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2519	0.90	Level	10	0	0.952	1.00	2939
Ramp	510	0.90	Level	10	0	0.952	1.00	595
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2939 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3534	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3534	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 24.0 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.385 (Exibit 13-11)

S_R= 56.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 56.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3250-RiverLanding to LongPoint*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2917*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*11*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1710*	pc/h/ln
S	*63.6*	mph
D = v_p / S	*26.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3250-RiverLanding to LongPoint*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3029*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1767*	pc/h/ln
S	*63.1*	mph
D = v_p / S	*28.0*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3260-EB Off to Long Point
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 225	V_D = veh/h
	Freeway Volume, V_F: 2917	
	Ramp Volume, V_R: 1064	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2917	0.90	Level	11	0	0.948	1.00	3419
Ramp	1064	0.90	Level	20	0	0.909	1.00	1300
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3419 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3419	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	2119	Exhibit 13-8	4700	No
V_R	1300	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3419	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 31.6 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.415 (Exhibit 13-12)

S_R= 55.5 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 55.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3260-EB Off to Long Point
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	225
Freeway Volume, V_F	3029
Ramp Volume, V_R	1140
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3029	0.90	Level	10	0	0.952	1.00	3534
Ramp	1140	0.90	Level	16	0	0.926	1.00	1368
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 1.000 using Equation (Exhibit 13-7)
V_{12} = 3534 pc/h
V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3534	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	2166	Exhibit 13-8	4700	No
V_R	1368	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3534	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 32.6 (pc/mi/ln)
LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.421 (Exhibit 13-12)
S_R= 55.3 mph (Exhibit 13-12)
S_0= N/A mph (Exhibit 13-12)
S = 55.3 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3265-LongPt Off to LongPtWB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1853*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1086*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*65.0*	mph	S	mph
D = v_p / S	*16.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3265-LongPt Off to LongPtWB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1889*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1102*	pc/h/ln
S	*65.0*	mph
D = v_p / S	*17.0*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3270-EB On from Long Point WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 925	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1853	
	Ramp Volume, V_R: 488	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1853	0.90	Level	11	0	0.948	1.00	2172
Ramp	488	0.90	Level	8	0	0.962	1.00	564
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2172 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2736	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2736	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 20.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.335 (Exibit 13-11)

S_R= 57.3 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 57.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3270-EB On from Long Point WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 925	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1889	
	Ramp Volume, V_R: 488	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1889	0.90	Level	10	0	0.952	1.00	2204
Ramp	488	0.90	Level	7	0	0.966	1.00	561
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2204 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2765	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2765	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 21.0 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.337 (Exibit 13-11)

S_R= 57.3 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 57.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3280-EB On from Long Point EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h		V_D = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	625
Deceleration Lane Length L_D	
Freeway Volume, V_F	2341
Ramp Volume, V_R	321
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	45.0

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2341	0.90	Level	11	0	0.948	1.00	2744
Ramp	321	0.90	Level	21	0	0.905	1.00	394
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2744 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3138	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3138	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 25.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.355 (Exibit 13-11)

S_R= 56.8 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 56.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3280-EB On from Long Point EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 625	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2377	
	Ramp Volume, V_R: 622	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2377	0.90	Level	10	0	0.952	1.00	2773
Ramp	622	0.90	Level	9	0	0.957	1.00	722
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2773 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3495	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3495	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.5 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.393 (Exibit 13-11)

S_R= 56.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 56.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3290-LongPt.toUS17/Hungryneck*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2662*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1553*	pc/h/ln	Design LOS	
S	*64.7*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*24.0*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3290-LongPt.toUS17/Hungryneck*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2999*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*8*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1733*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*63.4*	mph	S	mph
D = v_p / S	*27.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3300-EB Off to US17/Hungryneck
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	225	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	2662	V_D =	veh/h
		Ramp Volume, V_R	1156		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2662	0.90	Level	10	0	0.952	1.00	3106
Ramp	1156	0.90	Level	4	0	0.980	1.00	1310
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3106 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3106	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1796	Exhibit 13-8	4500	No
V_R	1310	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3106	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 28.9 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.416 (Exhibit 13-12)

S_R= 49.6 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.6 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3300-EB Off to US17/Hungryneck
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	225	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	2999	V_D =	veh/h
		Ramp Volume, V_R	990		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2999	0.90	Level	8	0	0.962	1.00	3466
Ramp	990	0.90	Level	4	0	0.980	1.00	1122
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3466 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3466	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	2344	Exhibit 13-8	4500	No
V_R	1122	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3466	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 32.0 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.399 (Exhibit 13-12)

S_R= 49.8 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.8 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3310-US17/Hungryneck to US17*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1506*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*9*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*	
			Up/Down %		

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*874*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*15.9*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3310-US17/Hungryneck to US17*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2009*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1155*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*21.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3320-EB Off to US17 SB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 250	V_D = veh/h
	Freeway Volume, V_F: 1506	
	Ramp Volume, V_R: 1069	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1506	0.90	Level	9	0	0.957	1.00	1749
Ramp	1069	0.90	Level	13	0	0.939	1.00	1265
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1749 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1749	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	484	Exhibit 13-8	4500	No
V_R	1265	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1749	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 17.0 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.412 (Exhibit 13-12)

S_R= 49.6 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.6 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3320-EB Off to US17 SB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 250	V_D = veh/h
	Freeway Volume, V_F: 2009	
	Ramp Volume, V_R: 1048	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2009	0.90	Level	7	0	0.966	1.00	2310
Ramp	1048	0.90	Level	12	0	0.943	1.00	1234
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2310 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2310	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1076	Exhibit 13-8	4500	No
V_R	1234	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2310	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 21.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.409 (Exhibit 13-12)

S_R= 49.7 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.7 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3325-US17 SB Off to US17 SB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*437*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*254*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*4.6*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3325-US17 SB Off to US17 SB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*961*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*553*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*10.1*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3330-EB On from US17 SB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 725	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 437	
	Ramp Volume, V_R: 369	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	437	0.90	Level	9	0	0.957	1.00	507
Ramp	369	0.90	Level	3	0	0.985	1.00	416
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 507 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	923	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	923	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 7.9 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.295 (Exibit 13-11)

S_R= 51.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3330-EB On from US17 SB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 725	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 961	
	Ramp Volume, V_R: 297	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	961	0.90	Level	7	0	0.966	1.00	1105
Ramp	297	0.90	Level	3	0	0.985	1.00	335
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1105 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1440	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1440	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 12.0 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.301 (Exibit 13-11)

S_R= 51.1 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3340-EB On from US17 NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 550	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 806	
	Ramp Volume, V_R: 24	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	806	0.90	Level	9	0	0.957	1.00	936
Ramp	24	0.90	Level	4	0	0.980	1.00	27
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 936 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	963	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	963	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 9.5 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.282 (Exibit 13-11)

S_R= 51.3 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3340-EB On from US17 NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h		V_D = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	550
Deceleration Lane Length L_D	
Freeway Volume, V_F	1258
Ramp Volume, V_R	32
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1258	0.90	Level	7	0	0.966	1.00	1447
Ramp	32	0.90	Level	3	0	0.985	1.00	36
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1447 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1483	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1483	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 13.6 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.289 (Exibit 13-11)

S_R= 51.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4010-WB Off to US17 NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	300	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	1129	V_D =	veh/h
		Ramp Volume, V_R	319		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1129	0.90	Level	9	0	0.957	1.00	1311
Ramp	319	0.90	Level	13	0	0.939	1.00	377
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1311 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1311	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	934	Exhibit 13-8	4500	No
V_R	377	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1311	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 12.8 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.332 (Exhibit 13-12)

S_R= 50.7 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4010-WB Off to US17 NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	1146
Ramp Volume, V_R	456
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1146	0.90	Level	7	0	0.966	1.00	1318
Ramp	456	0.90	Level	8	0	0.962	1.00	527
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1318 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1318	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	791	Exhibit 13-8	4500	No
V_R	527	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1318	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 12.9 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.345 (Exhibit 13-12)

S_R= 50.5 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.5 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4015-US17 NB off to US17 NB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*810*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*470*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*55.0*	mph	S	mph
D = v_p / S	*8.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*A*		Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4015-US17 NB off to US17 NB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*690*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*397*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*55.0*	mph	S	mph
D = v_p / S	*7.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*A*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4020-WB On from US17 NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 775	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 810	
	Ramp Volume, V_R: 951	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	810	0.90	Level	9	0	0.957	1.00	941
Ramp	951	0.90	Level	9	0	0.957	1.00	1104
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 941 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2045	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2045	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 16.1 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.312 (Exibit 13-11)

S_R= 50.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 50.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4020-WB On from US17 NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 775	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 690	
	Ramp Volume, V_R: 929	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	690	0.90	Level	7	0	0.966	1.00	793
Ramp	929	0.90	Level	8	0	0.962	1.00	1074
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 793 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1867	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1867	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 14.7 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.307 (Exibit 13-11)

S_R= 51.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4030-US17 to US17/Hungryneck*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1761*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1022*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*55.0*	mph	S	mph
D = v_p / S	*18.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4030-US17 to US17/Hungryneck*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1619*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*931*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*16.9*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4020-WB On from US17/Hungrynec
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h		V_D = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	425
Deceleration Lane Length L_D	
Freeway Volume, V_F	1761
Ramp Volume, V_R	853
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1761	0.90	Level	9	0	0.957	1.00	2045
Ramp	853	0.90	Level	26	0	0.885	1.00	1071
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2045 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3116	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3116	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 26.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.371 (Exibit 13-11)

S_R= 50.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 50.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4020-WB On from US17/Hungrynec
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h		V_D = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	425
Deceleration Lane Length L_D	
Freeway Volume, V_F	1619
Ramp Volume, V_R	1233
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1619	0.90	Level	7	0	0.966	1.00	1862
Ramp	1233	0.90	Level	15	0	0.930	1.00	1473
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1862 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3335	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3335	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.1 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.392 (Exibit 13-11)

S_R= 49.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 49.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4050-US17/Hungryneck to LongPt*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2614*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1525*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*64.8*	mph	S	mph
D = v_p / S	*23.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4050-US17/Hungryneck to LongPt*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2852*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1648*	pc/h/ln	Design LOS	
S	*64.1*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*25.7*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4060-WB Off to Long Point
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 250	V_D = veh/h
	Freeway Volume, V_F: 2614	
	Ramp Volume, V_R: 532	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2614	0.90	Level	10	0	0.952	1.00	3050
Ramp	532	0.90	Level	23	0	0.897	1.00	659
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3050 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3050	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	2391	Exhibit 13-8	4700	No
V_R	659	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3050	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 28.2 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.357 (Exhibit 13-12)

S_R= 56.8 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 56.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4060-WB Off to Long Point
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	250	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	2852	V_D =	veh/h
		Ramp Volume, V_R	1213		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2852	0.90	Level	8	0	0.962	1.00	3296
Ramp	1213	0.90	Level	9	0	0.957	1.00	1408
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3296 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3296	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	1888	Exhibit 13-8	4700	No
V_R	1408	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3296	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.425 (Exhibit 13-12)

S_R= 55.2 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 55.2 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4065-LongPt Off to LongPtEB On*
Date Performed	*4/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2082*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1220*	pc/h/ln
S	*65.0*	mph
D = v_p / S	*18.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4065-LongPt Off to LongPtEB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1639*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*956*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*65.0*	mph	S	mph
D = v_p / S	*14.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4070-WB On from Long Point EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	950
Deceleration Lane Length L_D	
Freeway Volume, V_F	2082
Ramp Volume, V_R	543
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	25.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2082	0.90	Level	11	0	0.948	1.00	2441
Ramp	543	0.90	Level	19	0	0.913	1.00	661
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2441 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3102	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3102	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 23.4 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.360 (Exibit 13-11)

S_R= 56.7 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 56.7 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4070-WB On from Long Point EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 950	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1639	
	Ramp Volume, V_R: 604	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1639	0.90	Level	10	0	0.952	1.00	1912
Ramp	604	0.90	Level	14	0	0.935	1.00	718
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1912 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2630	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2630	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 19.7 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.328 (Exibit 13-11)

S_R= 57.5 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 57.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4080-WB On from Long Point WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1025	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2625	
	Ramp Volume, V_R: 1438	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2625	0.90	Level	11	0	0.948	1.00	3077
Ramp	1438	0.90	Level	6	0	0.971	1.00	1646
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3077 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4723	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4723	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 35.1 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 0.668 (Exibit 13-11)

S_R= 49.6 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 49.6 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4080-WB On from Long Point WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1025	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2243	
	Ramp Volume, V_R: 1044	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2243	0.90	Level	10	0	0.952	1.00	2617
Ramp	1044	0.90	Level	7	0	0.966	1.00	1201
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2617 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3818	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3818	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.406 (Exibit 13-11)

S_R= 55.7 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 55.7 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4090-Long Point to Island Park*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4063*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2381*	pc/h/ln
S	*51.4*	mph
D = v_p / S	*46.4*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4090-Long Point to Island Park*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3287*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1917*	pc/h/ln	Design LOS	
S	*61.2*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*31.3*	pc/mi/ln	S	mph
LOS	*D*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4100-WB Off to Island Park
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 775	V_D = veh/h
	Freeway Volume, V_F: 4063	
	Ramp Volume, V_R: 1099	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4063	0.90	Level	11	0	0.948	1.00	4763
Ramp	1099	0.90	Level	10	0	0.952	1.00	1282
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4763 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4763	Exhibit 13-8	4700	Yes
$V_{FO} = V_F - V_R$	3481	Exhibit 13-8	4700	No
V_R	1282	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4763	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 38.2 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.673 (Exhibit 13-12)

S_R= 49.5 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4100-WB Off to Island Park
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 775	V_D = veh/h
	Freeway Volume, V_F: 3287	
	Ramp Volume, V_R: 595	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3287	0.90	Level	10	0	0.952	1.00	3835
Ramp	595	0.90	Level	16	0	0.926	1.00	714
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3835 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3835	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	3121	Exhibit 13-8	4700	No
V_R	714	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3835	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.622 (Exhibit 13-12)

S_R= 50.7 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.7 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4105 - Is. Pk Off to Is. Pk On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2964*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*11*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1737*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*63.4*	mph	S	mph
D = v_p / S	*27.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4105 - Is. Pk Off to Is. Pk On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2692*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1570*	pc/h/ln
S	*64.6*	mph
D = v_p / S	*24.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4110-WB On from Island Park Dr
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1400	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2964	
	Ramp Volume, V_R: 575	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2964	0.90	Level	11	0	0.948	1.00	3474
Ramp	575	0.90	Level	7	0	0.966	1.00	661
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3474 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4135	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4135	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.6 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.439 (Exibit 13-11)

S_R= 54.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 54.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4110-WB On from Island Park Dr
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1400	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2692	
	Ramp Volume, V_R: 667	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2692	0.90	Level	10	0	0.952	1.00	3141
Ramp	667	0.90	Level	5	0	0.976	1.00	760
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3141 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3901	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3901	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 26.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.388 (Exibit 13-11)

S_R= 56.1 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 56.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4120-IslandParktoClementsFerry*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3539*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2055*	pc/h/ln
S	*58.9*	mph
D = v_p / S	*34.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4120-IslandParktoClementsFerry*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3359*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*8*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1941*	pc/h/ln
S	*60.8*	mph
D = v_p / S	*31.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4130-WB Off to Clements Ferry
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	240
Freeway Volume, V_F	3539
Ramp Volume, V_R	444
Freeway Free-Flow Speed, S_{FF}	60.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3539	0.90	Level	9	0	0.957	1.00	4109
Ramp	444	0.90	Level	17	0	0.922	1.00	535
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 1.000 using Equation (Exhibit 13-7)
V_{12} = 4109 pc/h
V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4109	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	3574	Exhibit 13-8	4600	No
V_R	535	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4109	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 37.4 (pc/mi/ln)
LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.346 (Exhibit 13-12)
S_R= 53.8 mph (Exhibit 13-12)
S_0= N/A mph (Exhibit 13-12)
S = 53.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4130-WB Off to Clements Ferry
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	240
Freeway Volume, V_F	3359
Ramp Volume, V_R	368
Freeway Free-Flow Speed, S_{FF}	60.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3359	0.90	Level	8	0	0.962	1.00	3882
Ramp	368	0.90	Level	17	0	0.922	1.00	444
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3882 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3882	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	3438	Exhibit 13-8	4600	No
V_R	444	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3882	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.5 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.338 (Exhibit 13-12)

S_R= 53.9 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 53.9 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4135-ClFerry Off to ClFerry On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3095*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*11*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1814*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*59.2*	mph	S	mph
D = v_p / S	*30.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4135-ClFerry Off to ClFerry On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2991*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1753*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*59.6*	mph	S	mph
D = v_p / S	*29.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-526 WB
Analysis Year	2018 Build - Proposed Site	Junction	From Clements Ferry
Analysis Time Period:	AM Peak	Segment ID	4140
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	60	60	45
Volume, V (veh/h)	3,095	4,069	974
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	11%	11%	20%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.95	0.95	0.91
Demand Flow Rate, v_p (pc/h/ln)	1,814	1,590	1,190
Capacity Flow Rate, c (pc/h/ln)	2,300	2,300	2,100
v/c ratio	0.79	0.69	0.57
Density, D_{MD} (pc/mi/ln)	31.7	27.8	20.8
LOS	D	C	C

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-526 WB
Analysis Year	2018 Build - Proposed Site	Junction	From Clements Ferry
Analysis Time Period:	PM Peak	Segment ID	4140
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	60	60	45
Volume, V (veh/h)	2,991	3,352	361
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	11%	11%	47%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.95	0.95	0.81
Demand Flow Rate, v_p (pc/h/ln)	1,753	1,310	495
Capacity Flow Rate, c (pc/h/ln)	2,300	2,300	2,100
v/c ratio	0.76	0.57	0.24
Density, D_{MD} (pc/mi/ln)	30.7	22.9	8.7
LOS	D	C	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4150-ClementsFerry to Virginia*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4069*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2385*	pc/h/ln
S	*48.8*	mph
D = v_p / S	*48.9*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4150-ClementsFerry to Virginia*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3352*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1965*	pc/h/ln
S	*57.6*	mph
D = v_p / S	*34.1*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4160 - Virginia to Rhett
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	1415ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	3007	0.90	13	0	1.5	1.2	0.939	1.00	3558
V_{RF}	93	0.90	75	0	1.5	1.2	0.727	1.00	142
V_{FR}	1062	0.90	13	0	1.5	1.2	0.939	1.00	1257
V_{RR}	33	0.90	75	0	1.5	1.2	0.727	1.00	50
V_{NW}	3608							V =	5007
V_W	1399								
VR	0.279								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1399 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1578 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	932 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2510 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	357

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5007 pc/h	Weaving intensity factor, W	0.355
Weaving segment capacity, c_w	5628 veh/h	Weaving segment speed, S	43.5 mph
Weaving segment v/c ratio	0.835	Average weaving speed, S_W	48.2 mph
Weaving segment density, D	38.4 pc/mi/ln	Average non-weaving speed, S_{NW}	41.9 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	5364 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4160 - Virginia to Rhett
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	1415ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2340	0.90	13	0	1.5	1.2	0.939	1.00	2769
V_{RF}	572	0.90	13	0	1.5	1.2	0.939	1.00	677
V_{FR}	1012	0.90	13	0	1.5	1.2	0.939	1.00	1198
V_{RR}	248	0.90	10	0	1.5	1.2	0.952	1.00	289
V_{NW}	3058							V =	4933
V_W	1875								
VR	0.380								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1875 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	2054 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	819 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2873 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	303

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4933 pc/h	Weaving intensity factor, W	0.395
Weaving segment capacity, c_w	5392 veh/h	Weaving segment speed, S	41.5 mph
Weaving segment v/c ratio	0.859	Average weaving speed, S_W	47.3 mph
Weaving segment density, D	39.6 pc/mi/ln	Average non-weaving speed, S_{NW}	38.6 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	6459 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4165-Rhett Off to Rhett On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3100*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*15*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.930*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1851*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*58.9*	mph	S	mph
D = v_p / S	*31.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4165-Rhett Off to Rhett On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2912*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*14*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.935*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1731*	pc/h/ln	Design LOS	
S	*59.7*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*29.0*	pc/mi/ln	S	mph
LOS	*D*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4170-WB On from Rhett
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 625	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3100	
	Ramp Volume, V_R: 710	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3100	0.90	Level	15	0	0.930	1.00	3703
Ramp	710	0.90	Level	7	0	0.966	1.00	816
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3703 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4519	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4519	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 36.4 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

M_S = 0.623 (Exibit 13-11)

S_R= 48.8 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 48.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4170-WB On from Rhett
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 625	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2912	
	Ramp Volume, V_R: 582	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2912	0.90	Level	14	0	0.935	1.00	3462
Ramp	582	0.90	Level	7	0	0.966	1.00	669
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3462 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4131	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4131	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 33.5 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.507 (Exibit 13-11)

S_R= 50.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 50.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4180-Rhett to Rivers*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3810*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*15*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.930*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2275*	pc/h/ln
S	*49.4*	mph
D = v_p / S	*46.0*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4180-Rhett to Rivers*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3494*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*14*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.935*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2077*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*53.1*	mph	S	mph
D = v_p / S	*39.1*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4190-WB Off to Rivers NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	725	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3810	V_D =	veh/h
		Ramp Volume, V_R	225		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3810	0.90	Level	15	0	0.930	1.00	4551
Ramp	225	0.90	Level	2	0	0.990	1.00	253
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4551 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4551	Exhibit 13-8	4500	Yes
$V_{FO} = V_F - V_R$	4298	Exhibit 13-8	4500	No
V_R	253	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4551	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 36.9 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.321 (Exhibit 13-12)

S_R= 50.8 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4190-WB Off to Rivers NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	725	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3494	V_D =	veh/h
		Ramp Volume, V_R	168		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3494	0.90	Level	14	0	0.935	1.00	4154
Ramp	168	0.90	Level	2	0	0.990	1.00	189
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4154 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4154	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	3965	Exhibit 13-8	4500	No
V_R	189	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4154	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 33.5 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.315 (Exhibit 13-12)

S_R= 50.9 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.9 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4200-WB Off to Rivers SB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	700	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3585	V_D =	veh/h
		Ramp Volume, V_R	215		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	25.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3585	0.90	Level	17	0	0.922	1.00	4322
Ramp	215	0.90	Level	6	0	0.971	1.00	246
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4322 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4322	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	4076	Exhibit 13-8	4500	No
V_R	246	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4322	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.1 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.580 (Exhibit 13-12)

S_R= 47.5 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 47.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4200-WB Off to Rivers SB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	700	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3326	V_D =	veh/h
		Ramp Volume, V_R	61		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	25.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3326	0.90	Level	15	0	0.930	1.00	3973
Ramp	61	0.90	Level	18	0	0.917	1.00	74
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3973 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3973	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	3899	Exhibit 13-8	4500	No
V_R	74	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3973	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 32.1 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.565 (Exhibit 13-12)

S_R= 47.7 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 47.7 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4205-RiversSB Off to Rivers On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3370*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*17*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.922*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2031*	pc/h/ln
S	*53.7*	mph
D = v_p / S	*37.8*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4205-RiversSB Off to Rivers On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3265*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*15*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.930*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1950*	pc/h/ln	Design LOS	
S	*54.4*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*35.8*	pc/mi/ln	S	mph
LOS	*E*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4210 - Rivers to I-26 WB
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	725ft
Freeway free-flow speed, FFS	55 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	2223	0.90	17	0	1.5	1.2	0.922	1.00	2680
V_{RF}	359	0.90	17	0	1.5	1.2	0.922	1.00	433
V_{FR}	1147	0.90	54	0	1.5	1.2	0.787	1.00	1619
V_{RR}	186	0.90	54	0	1.5	1.2	0.787	1.00	262
V_{NW}	2942							V =	4994
V_W	2052								
VR	0.411								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2052 lc/h
Interchange density, ID	1.2 int/mi	Weaving lane changes, LC_W	2188 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	421 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2609 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	256

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4994 pc/h	Weaving intensity factor, W	0.621
Weaving segment capacity, c_w	4935 veh/h	Weaving segment speed, S	34.9 mph
Weaving segment v/c ratio	0.933	Average weaving speed, S_W	39.7 mph
Weaving segment density, D	47.7 pc/mi/ln	Average non-weaving speed, S_{NW}	32.2 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	6804 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4210 - Rivers to I-26 WB
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	725ft
Freeway free-flow speed, FFS	55 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	1875	0.90	15	0	1.5	1.2	0.930	1.00	2240
V_{RF}	289	0.90	15	0	1.5	1.2	0.930	1.00	345
V_{FR}	1390	0.90	39	0	1.5	1.2	0.837	1.00	1846
V_{RR}	215	0.90	39	0	1.5	1.2	0.837	1.00	285
V_{NW}	2525							V =	4716
V_W	2191								
VR	0.465								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2191 lc/h
Interchange density, ID	1.2 int/mi	Weaving lane changes, LC_W	2327 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	335 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2662 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	220

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4716 pc/h	Weaving intensity factor, W	0.631
Weaving segment capacity, c_w	4805 veh/h	Weaving segment speed, S	34.9 mph
Weaving segment v/c ratio	0.913	Average weaving speed, S_W	39.5 mph
Weaving segment density, D	45.0 pc/mi/ln	Average non-weaving speed, S_{NW}	31.7 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	7415 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4215-I-26 WB Off to I-26 WB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2582*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*17*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.922*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1556*	pc/h/ln	Design LOS	
S	*55.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*28.3*	pc/mi/ln	S	mph
LOS	*D*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4215-I-26 WB Off to I-26 WB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2164*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*15*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.930*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1292*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*23.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4220 - I-26 WB to I-26 EB C-D
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	550ft
Freeway free-flow speed, FFS	55 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	2044	0.90	17	0	1.5	1.2	0.922	1.00	2464
V_{RF}	275	0.90	7	0	1.5	1.2	0.966	1.00	316
V_{FR}	538	0.90	8	0	1.5	1.2	0.962	1.00	622
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	2464							V =	3402
V_W	938								
VR	0.276								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	938 lc/h
Interchange density, ID	1.2 int/mi	Weaving lane changes, LC_W	1042 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	228 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1270 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	163

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	3402 pc/h	Weaving intensity factor, W	0.437
Weaving segment capacity, c_w	5212 veh/h	Weaving segment speed, S	42.8 mph
Weaving segment v/c ratio	0.602	Average weaving speed, S_W	42.8 mph
Weaving segment density, D	26.5 pc/mi/ln	Average non-weaving speed, S_{NW}	42.8 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	5325 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4220 - I-26 WB to I-26 EB C-D
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	3	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	550ft	Freeway maximum capacity, C_{IFL}	2250
Freeway free-flow speed, FFS	55 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1690	0.90	15	0	1.5	1.2	0.930	1.00	2019
V_{RF}	338	0.90	5	0	1.5	1.2	0.976	1.00	385
V_{FR}	474	0.90	8	0	1.5	1.2	0.962	1.00	548
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	2019							V =	2952
V_W	933								
VR	0.316								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	933 lc/h
Interchange density, ID	1.2 int/mi	Weaving lane changes, LC_W	1037 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	136 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1173 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	133

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	2952 pc/h	Weaving intensity factor, W	0.411
Weaving segment capacity, c_w	5168 veh/h	Weaving segment speed, S	43.5 mph
Weaving segment v/c ratio	0.531	Average weaving speed, S_W	43.4 mph
Weaving segment density, D	22.6 pc/mi/ln	Average non-weaving speed, S_{NW}	43.6 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	5757 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4225-I-26 EB CD Off to On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2319*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*17*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.922*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1398*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*25.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4225-I-26 EB CD Off to On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2028*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*15*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.930*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1211*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*22.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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F-5147

Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4230-I-26EBCD to International
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	3135ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1557	0.90	10	0	1.5	1.2	0.952	1.00	1817
V_{RF}	1485	0.90	20	0	1.5	1.2	0.909	1.00	1815
V_{FR}	762	0.90	13	0	1.5	1.2	0.939	1.00	902
V_{RR}	727	0.90	20	0	1.5	1.2	0.909	1.00	889
V_{NW}	2706							V =	5423
V_W	2717								
VR	0.501								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	542

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5423 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	4562 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.132	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	7838 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4230-I-26EBCD to International
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	3	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	3135ft	Freeway maximum capacity, C_{IFL}	2300
Freeway free-flow speed, FFS	60 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	1125	0.90	9	0	1.5	1.2	0.957	1.00	1306
V_{RF}	985	0.90	22	0	1.5	1.2	0.901	1.00	1215
V_{FR}	903	0.90	10	0	1.5	1.2	0.952	1.00	1054
V_{RR}	789	0.90	22	0	1.5	1.2	0.901	1.00	973
V_{NW}	2279							V =	4548
V_W	2269								
VR	0.499								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2269 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	2594 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1591 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	4185 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	714

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4548 pc/h	Weaving intensity factor, W	0.284
Weaving segment capacity, c_w	4603 veh/h	Weaving segment speed, S	42.1 mph
Weaving segment v/c ratio	0.946	Average weaving speed, S_W	50.1 mph
Weaving segment density, D	36.0 pc/mi/ln	Average non-weaving speed, S_{NW}	36.4 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	7814 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4235-Interna Off to Interna On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3042*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1775*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*59.4*	mph	S	mph
D = v_p / S	*29.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4235-Interna Off to Interna On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2110*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1225*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*20.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4240-WB On from International
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 875	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3042	
	Ramp Volume, V_R: 405	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3042	0.90	Level	10	0	0.952	1.00	3549
Ramp	405	0.90	Level	21	0	0.905	1.00	497
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3549 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4046	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4046	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 31.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.465 (Exibit 13-11)

S_R= 51.6 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.6 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4240-WB On from International
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 875	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2110	
	Ramp Volume, V_R: 605	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2110	0.90	Level	9	0	0.957	1.00	2450
Ramp	605	0.90	Level	12	0	0.943	1.00	713
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2450 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3163	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3163	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 24.3 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.334 (Exibit 13-11)

S_R= 54.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 54.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4250-Montague to Dorchester
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	950ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	2750	0.90	9	0	1.5	1.2	0.957	1.00	3193
V_{RF}	451	0.90	9	0	1.5	1.2	0.957	1.00	524
V_{FR}	697	0.90	15	0	1.5	1.2	0.930	1.00	833
V_{RR}	114	0.90	15	0	1.5	1.2	0.930	1.00	136
V_{NW}	3329							V =	4686
V_W	1357								
VR	0.290								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1357 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	1513 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	623 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2136 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	316

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4686 pc/h	Weaving intensity factor, W	0.428
Weaving segment capacity, c_w	5610 veh/h	Weaving segment speed, S	43.8 mph
Weaving segment v/c ratio	0.799	Average weaving speed, S_W	46.5 mph
Weaving segment density, D	35.7 pc/mi/ln	Average non-weaving speed, S_{NW}	42.7 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	5472 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4250-Montague to Dorchester
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	3	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	950ft	Freeway maximum capacity, C_{IFL}	2300
Freeway free-flow speed, FFS	60 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2222	0.90	8	0	1.5	1.2	0.962	1.00	2568
V_{RF}	625	0.90	8	0	1.5	1.2	0.962	1.00	722
V_{FR}	493	0.90	16	0	1.5	1.2	0.926	1.00	592
V_{RR}	139	0.90	16	0	1.5	1.2	0.926	1.00	167
V_{NW}	2735							V =	4049
V_W	1314								
VR	0.325								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1314 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	1470 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	501 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1971 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	260

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4049 pc/h	Weaving intensity factor, W	0.402
Weaving segment capacity, c_w	5553 veh/h	Weaving segment speed, S	45.0 mph
Weaving segment v/c ratio	0.701	Average weaving speed, S_W	47.1 mph
Weaving segment density, D	30.0 pc/mi/ln	Average non-weaving speed, S_{NW}	44.1 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	5848 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4255-Dorches Off to Dorches On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3201*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1858*	pc/h/ln
S	*58.8*	mph
D = v_p / S	*31.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4255-Dorches Off to Dorches On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2847*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1645*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*27.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4260-Dorchester to Leeds
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	1750ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2328	0.90	9	0	1.5	1.2	0.957	1.00	2703
V_{RF}	458	0.90	17	0	1.5	1.2	0.922	1.00	552
V_{FR}	873	0.90	17	0	1.5	1.2	0.922	1.00	1052
V_{RR}	172	0.90	17	0	1.5	1.2	0.922	1.00	207
V_{NW}	2910							V =	4514
V_W	1604								
VR	0.355								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1604 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	1837 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	970 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2807 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	509

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4514 pc/h	Weaving intensity factor, W	0.328
Weaving segment capacity, c_w	5630 veh/h	Weaving segment speed, S	43.7 mph
Weaving segment v/c ratio	0.767	Average weaving speed, S_W	48.9 mph
Weaving segment density, D	34.5 pc/mi/ln	Average non-weaving speed, S_{NW}	41.2 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	6185 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4260-Dorchester to Leeds
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	1750ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2576	0.90	7	0	1.5	1.2	0.966	1.00	2962
V_{RF}	484	0.90	17	0	1.5	1.2	0.922	1.00	583
V_{FR}	271	0.90	15	0	1.5	1.2	0.930	1.00	324
V_{RR}	51	0.90	17	0	1.5	1.2	0.922	1.00	61
V_{NW}	3023							V =	3930
V_W	907								
VR	0.231								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	907 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	1140 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	993 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2133 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	529

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	3930 pc/h	Weaving intensity factor, W	0.264
Weaving segment capacity, c_w	5980 veh/h	Weaving segment speed, S	47.9 mph
Weaving segment v/c ratio	0.635	Average weaving speed, S_W	50.6 mph
Weaving segment density, D	27.3 pc/mi/ln	Average non-weaving speed, S_{NW}	47.2 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	4853 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4265-Leeds Off to Leeds On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2786*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*10*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*	
			Up/Down %		

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1625*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*27.1*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4265-Leeds Off to Leeds On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3060*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1777*	pc/h/ln
S	*59.4*	mph
D = v_p / S	*29.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4270-WB On from Leeds
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 825	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2786	
	Ramp Volume, V_R: 218	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2786	0.90	Level	10	0	0.952	1.00	3250
Ramp	218	0.90	Level	19	0	0.913	1.00	265
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3250 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3515	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3515	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 27.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.378 (Exibit 13-11)

S_R= 53.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 53.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4270-WB On from Leeds
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 825	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3060	
	Ramp Volume, V_R: 683	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3060	0.90	Level	9	0	0.957	1.00	3553
Ramp	683	0.90	Level	5	0	0.976	1.00	778
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3553 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4331	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4331	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 33.7 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.543 (Exibit 13-11)

S_R= 50.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 50.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4280-Leeds to Paul Cantrell*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3004*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1752*	pc/h/ln
S	*59.6*	mph
D = v_p / S	*29.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4280-Leeds to Paul Cantrell*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3743*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*9*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2173*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*54.0*	mph	S	mph
D = v_p / S	*40.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4290-WB Off to PaulCantrell WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	825	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3004	V_D =	veh/h
		Ramp Volume, V_R	1238		
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3004	0.90	Level	10	0	0.952	1.00	3505
Ramp	1238	0.90	Level	28	0	0.877	1.00	1568
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3505 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3505	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	1937	Exhibit 13-8	4600	No
V_R	1568	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3505	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 27.0 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.439 (Exhibit 13-12)

S_R= 52.1 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 52.1 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4290-WB Off to PaulCantrell WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	825
Freeway Volume, V_F	3743
Ramp Volume, V_R	1987
Freeway Free-Flow Speed, S_{FF}	60.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3743	0.90	Level	9	0	0.957	1.00	4346
Ramp	1987	0.90	Level	15	0	0.930	1.00	2373
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 1.000 using Equation (Exhibit 13-7)
V_{12} = 4346 pc/h
V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4346	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	1973	Exhibit 13-8	4600	No
V_R	2373	Exhibit 13-10	2100	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4346	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 34.2 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.512 (Exhibit 13-12)
S_R= 50.8 mph (Exhibit 13-12)
S_0= N/A mph (Exhibit 13-12)
S = 50.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4300-WB Off to PaulCantrell EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 525	V_D = veh/h
	Freeway Volume, V_F: 1766	
	Ramp Volume, V_R: 665	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1766	0.90	Level	10	0	0.952	1.00	2060
Ramp	665	0.90	Level	5	0	0.976	1.00	757
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2060 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2060	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	1303	Exhibit 13-8	4600	No
V_R	757	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2060	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 17.2 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.626 (Exhibit 13-12)

S_R= 48.7 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 48.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4300-WB Off to PaulCantrell EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	525	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	1756	V_D =	veh/h
		Ramp Volume, V_R	708		
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	25.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1756	0.90	Level	9	0	0.957	1.00	2039
Ramp	708	0.90	Level	4	0	0.980	1.00	802
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2039 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2039	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	1237	Exhibit 13-8	4600	No
V_R	802	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2039	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 17.1 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.630 (Exhibit 13-12)

S_R= 48.7 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 48.7 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4305-PaulCEB Off to PaulCEB On*
Date Performed	*4/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1101*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*642*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*10.7*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4305-PaulCEB Off to PaulCEB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1048*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*608*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*60.0*	mph	S	mph
D = v_p / S	*10.1*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*A*		Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4310-WB On from PaulCantrellEB
Date Performed	4/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 700	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1101	
	Ramp Volume, V_R: 268	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1101	0.90	Level	10	0	0.952	1.00	1285
Ramp	268	0.90	Level	7	0	0.966	1.00	308
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1285 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1593	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1593	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 13.4 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.277 (Exibit 13-11)

S_R= 55.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 55.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4310-WB On from PaulCantrellEB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 700	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1048	
	Ramp Volume, V_R: 215	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1048	0.90	Level	9	0	0.957	1.00	1217
Ramp	215	0.90	Level	7	0	0.966	1.00	247
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1217 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1464	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1464	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 12.4 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.275 (Exibit 13-11)

S_R= 55.1 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 55.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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Appendix E

Traffic Analysis Worksheets

2018 Opening Year

Build Proposed Project Alternatives 1 - 4

US Highway 17

MAJOR MERGE SEGMENTS ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US 17 NB
Analysis Year	2018 Build - Proposed Site	Junction	From I-26 EB & WB
Analysis Time Period:	AM Peak	Segment ID	5010
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of On-Ramp	Freeway Downstream of On-Ramp	On-Ramp
Number of Lanes, N	2	4	2
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	1,991	3,324	1,333
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	2%	2%	4%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream of On-Ramp	Freeway Downstream of On-Ramp	On-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.99	0.99	0.98
Demand Flow Rate, v_p (pc/h/ln)	1,117	933	755
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,200
v/c ratio	0.50	0.41	0.34
	Below Capacity	Below Capacity	Below Capacity

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

MAJOR MERGE SEGMENTS ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US 17 NB
Analysis Year	2018 Build - Proposed Site	Junction	From I-26 EB & WB
Analysis Time Period:	PM Peak	Segment ID	5010
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of On-Ramp	Freeway Downstream of On-Ramp	On-Ramp
Number of Lanes, N	2	4	2
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	2,149	2,863	714
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	2%	2%	7%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream of On-Ramp	Freeway Downstream of On-Ramp	On-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.99	0.99	0.97
Demand Flow Rate, v_p (pc/h/ln)	1,206	803	411
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,200
v/c ratio	0.54	0.36	0.19
	Below Capacity	Below Capacity	Below Capacity

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 NB
Agency or Company	Atkins	Junction	5020-NB On from Meeting
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1125	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3324	
	Ramp Volume, V_R: 466	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3324	0.90	Level	2	0	0.990	1.00	3730
Ramp	466	0.90	Level	10	0	0.952	1.00	544
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.150 using Equation (Exhibit 13-6)

V_{12} = 559 pc/h

V_3 or V_{av34} 1585 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 1492 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4274	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2036	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 14.1 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.250 (Exibit 13-11)

S_R= 51.8 mph (Exhibit 13-11)

S_0= 52.8 mph (Exhibit 13-11)

S = 52.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 NB
Agency or Company	Atkins	Junction	5020-NB On from Meeting
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1125	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2863	
	Ramp Volume, V_R: 839	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2863	0.90	Level	2	0	0.990	1.00	3213
Ramp	839	0.90	Level	5	0	0.976	1.00	956
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.377 using Equation (Exhibit 13-6)

V_{12} = 1211 pc/h

V_3 or V_{av34} 1001 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 1285 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4169	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2241	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 15.5 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.256 (Exibit 13-11)

S_R= 51.7 mph (Exhibit 13-11)

S_0= 53.3 mph (Exhibit 13-11)

S = 52.4 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 NB
Agency or Company	Atkins	Junction	5030-NB On from E Bay
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 925	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3790	
	Ramp Volume, V_R: 327	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3790	0.90	Level	4	0	0.980	1.00	4295
Ramp	327	0.90	Level	14	0	0.935	1.00	389
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.169 using Equation (Exhibit 13-6)

V_{12} = 727 pc/h

V_3 or V_{av34} 1784 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 1718 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4684	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2107	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 15.9 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.270 (Exibit 13-11)

S_R= 51.5 mph (Exhibit 13-11)

S_0= 52.2 mph (Exhibit 13-11)

S = 51.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 NB
Agency or Company	Atkins	Junction	5030-NB On from E Bay
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 925	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3702	
	Ramp Volume, V_R: 1143	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3702	0.90	Level	3	0	0.985	1.00	4175
Ramp	1143	0.90	Level	3	0	0.985	1.00	1289
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.057 using Equation (Exhibit 13-6)

V_{12} = 237 pc/h

V_3 or V_{av34} 1969 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 1670 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5464	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2959	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 22.2 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.313 (Exibit 13-11)

S_R= 50.9 mph (Exhibit 13-11)

S_0= 52.3 mph (Exhibit 13-11)

S = 51.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 NB*
Agency or Company	*Atkins*	From/To	*5040-E Bay to SC-703*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4117*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.980*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*4*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1166*	pc/h/ln	Design LOS	
S	*55.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*21.2*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 NB*
Agency or Company	*Atkins*	From/To	*5040-E Bay to SC-703*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4845*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.980*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*4*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1373*	pc/h/ln	Design LOS	
S	*55.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*25.0*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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MAJOR DIVERGE SEGMENTS ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US-17 NB
Analysis Year	2018 Build - Proposed Site	Junction	Off to SC-703
Analysis Time Period:	AM Peak	Segment ID	5050
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Off-Ramp	Freeway Downstream of Off-Ramp	Off-Ramp
Number of Lanes, N	4	2	2
Free-Flow Speed, FFS (mph)	55	45	40
Volume, V (veh/h)	4,117	3,071	1,046
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	4%	3%	8%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.99	0.96
Demand Flow Rate, v_p (pc/h/ln)	1,166	1,732	604
Capacity Flow Rate, c (pc/h/ln)	2,200	2,100	2,000
v/c ratio	0.53	0.82	0.30
Density, D_{MD} (pc/mi/ln)	20.4	30.3	10.6
LOS	C	D	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

MAJOR DIVERGE SEGMENTS ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US-17 NB
Analysis Year	2018 Build - Proposed Site	Junction	Off to SC-703
Analysis Time Period:	PM Peak	Segment ID	5050
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Off-Ramp	Freeway Downstream of Off-Ramp	Off-Ramp
Number of Lanes, N	4	2	2
Free-Flow Speed, FFS (mph)	55	45	40
Volume, V (veh/h)	4,845	3,369	1,476
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	4%	3%	5%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.99	0.98
Demand Flow Rate, v_p (pc/h/ln)	1,373	1,900	841
Capacity Flow Rate, c (pc/h/ln)	2,200	2,100	2,000
v/c ratio	0.62	0.90	0.42
Density, D_{MD} (pc/mi/ln)	24.0	33.3	14.7
LOS	C	D	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US-17 NB
Analysis Year	2018 Build - Proposed Site	Junction	Off to Bowman
Analysis Time Period:	AM Peak	Segment ID	5060
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	3	2	1
Free-Flow Speed, FFS (mph)	45	45	45
Volume, V (veh/h)	2,438	1,779	659
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	4%	6%	2%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.97	0.99
Demand Flow Rate, v_p (pc/h/ln)	921	1,018	740
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	2,100
v/c ratio	0.44	0.48	0.35
Density, D_{MD} (pc/mi/ln)	16.1	17.8	13.0
LOS	B	B	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US-17 NB
Analysis Year	2018 Build - Proposed Site	Junction	Off to Bowman
Analysis Time Period:	PM Peak	Segment ID	5060
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	3	2	1
Free-Flow Speed, FFS (mph)	45	45	45
Volume, V (veh/h)	3,241	2,552	689
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	3%	5%	2%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.99	0.98	0.99
Demand Flow Rate, v_p (pc/h/ln)	1,218	1,453	773
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	2,100
v/c ratio	0.58	0.69	0.37
Density, D_{MD} (pc/mi/ln)	21.3	25.4	13.5
LOS	C	C	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 NB*
Agency or Company	*Atkins*	From/To	*5065-Bowman Off to Bowman On*
Date Performed	*4/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1779*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1018*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*18.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 NB*
Agency or Company	*Atkins*	From/To	*5065-Bowman Off to Bowman On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2552*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*5*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1453*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*26.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	US-17 NB
Weaving Segment Location	5070-Bowman On to I-526 WB Off
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	825ft
Freeway free-flow speed, FFS	45 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1024	0.90	6	0	1.5	1.2	0.971	1.00	1172
V_{RF}	267	0.90	14	0	1.5	1.2	0.935	1.00	317
V_{FR}	755	0.90	9	0	1.5	1.2	0.957	1.00	877
V_{RR}	196	0.90	14	0	1.5	1.2	0.935	1.00	233
V_{NW}	1405							V =	2599
V_W	1194								
VR	0.459								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1194 lc/h
Interchange density, ID	0.3 int/mi	Weaving lane changes, LC_W	1293 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	159 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1452 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	35

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	2599 pc/h	Weaving intensity factor, W	0.353
Weaving segment capacity, c_w	5072 veh/h	Weaving segment speed, S	34.3 mph
Weaving segment v/c ratio	0.497	Average weaving speed, S_W	37.2 mph
Weaving segment density, D	25.2 pc/mi/ln	Average non-weaving speed, S_{NW}	32.2 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	7356 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	US-17 NB
Weaving Segment Location	5070-Bowman On to I-526 WB Off
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	825ft
Freeway free-flow speed, FFS	45 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1849	0.90	5	0	1.5	1.2	0.976	1.00	2106
V_{RF}	595	0.90	7	0	1.5	1.2	0.966	1.00	684
V_{FR}	703	0.90	8	0	1.5	1.2	0.962	1.00	812
V_{RR}	226	0.90	8	0	1.5	1.2	0.962	1.00	261
V_{NW}	2367							V =	3863
V_W	1496								
VR	0.387								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc
Interchange density, ID	0.3 int/mi
Minimum RF lane changes, LC_{RF}	1 lc/pc
Minimum FR lane changes, LC_{FR}	1 lc/pc
Minimum RR lane changes, LC_{RR}	lc/pc
Minimum weaving lane changes, LC_{MIN}	1496 lc/h
Weaving lane changes, LC_W	1595 lc/h
Non-weaving lane changes, LC_{NW}	357 lc/h
Total lane changes, LC_{ALL}	1952 lc/h
Non-weaving vehicle index, I_{NW}	59

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	3863 pc/h
Weaving segment capacity, c_w	5306 veh/h
Weaving segment v/c ratio	0.710
Weaving segment density, D	42.1 pc/mi/ln
Level of Service, LOS	E
Weaving intensity factor, W	0.446
Weaving segment speed, S	30.6 mph
Average weaving speed, S_W	35.7 mph
Average non-weaving speed, S_{NW}	28.0 mph
Maximum weaving length, L_{MAX}	6539 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 NB*
Agency or Company	*Atkins*	From/To	*5075-526 WB Off to 526 WB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1291*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*739*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*13.4*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 NB*
Agency or Company	*Atkins*	From/To	*5075-526 WB Off to 526 WB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2444*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1392*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*25.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US 17 NB
Analysis Year	2018 Build - Proposed Site	Junction	From I-526 WB
Analysis Time Period:	AM Peak	Segment ID	5080
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	45	45	45
Volume, V (veh/h)	1,291	1,610	319
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	6%	6%	13%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.97	0.94
Demand Flow Rate, v_p (pc/h/ln)	739	614	377
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	2,100
v/c ratio	0.35	0.29	0.18
Density, D_{MD} (pc/mi/ln)	12.9	10.7	6.6
LOS	B	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US 17 NB
Analysis Year	2018 Build - Proposed Site	Junction	From I-526 WB
Analysis Time Period:	PM Peak	Segment ID	5080
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	45	45	45
Volume, V (veh/h)	2,444	2,900	456
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	5%	5%	8%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.98	0.96
Demand Flow Rate, v_p (pc/h/ln)	1,392	1,101	527
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	2,100
v/c ratio	0.66	0.52	0.25
Density, D_{MD} (pc/mi/ln)	24.4	19.3	9.2
LOS	C	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 SB
Agency or Company	Atkins	Junction	6010-Off to I-526 EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	450
Freeway Volume, V_F	2415
Ramp Volume, V_R	369
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2415	0.90	Level	6	0	0.971	1.00	2764
Ramp	369	0.90	Level	3	0	0.985	1.00	416
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2764 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2764	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	2348	Exhibit 13-8	4500	No
V_R	416	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2764	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 24.0 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.335 (Exhibit 13-12)

S_R= 50.6 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.6 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 SB
Agency or Company	Atkins	Junction	6010-Off to I-526 EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
- ☐ Yes ☐ On
- ☑ No ☐ Off
- L_{up} = ft
- V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	450
Freeway Volume, V_F	1909
Ramp Volume, V_R	297
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
- ☐ Yes ☐ On
- ☑ No ☐ Off
- L_{down} = ft
- V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1909	0.90	Level	5	0	0.976	1.00	2174
Ramp	297	0.90	Level	3	0	0.985	1.00	335
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2174 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2174	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1839	Exhibit 13-8	4500	No
V_R	335	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2174	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 18.9 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.328 (Exhibit 13-12)

S_R= 50.7 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.7 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US 17 SB*
Agency or Company	*Atkins*	From/To	*6015-526 EB Off to 526 EB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2046*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1171*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*21.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 SB*
Agency or Company	*Atkins*	From/To	*6015-526 EB Off to 526 EB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1612*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*918*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*55.0*	mph	S	mph
D = v_p / S	*16.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	US-17 SB
Weaving Segment Location	6020-I-526 EB On to Bowman Off
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	650ft
Freeway free-flow speed, FFS	45 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1635	0.90	6	0	1.5	1.2	0.971	1.00	1871
V_{RF}	855	0.90	13	0	1.5	1.2	0.939	1.00	1012
V_{FR}	411	0.90	12	0	1.5	1.2	0.943	1.00	484
V_{RR}	214	0.90	13	0	1.5	1.2	0.939	1.00	253
V_{NW}	2124							V =	3620
V_W	1496								
VR	0.413								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	1012 lc/h
Interchange density, ID	0.3 int/mi	Weaving lane changes, LC_W	1156 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	19 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	1175 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	41

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	3620 pc/h	Weaving intensity factor, W	0.361
Weaving segment capacity, c_w	7367 veh/h	Weaving segment speed, S	34.8 mph
Weaving segment v/c ratio	0.477	Average weaving speed, S_W	37.0 mph
Weaving segment density, D	26.0 pc/mi/ln	Average non-weaving speed, S_{NW}	33.4 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	5264 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	US-17 SB
Weaving Segment Location	6020-I-526 EB On to Bowman Off
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	650ft
Freeway free-flow speed, FFS	45 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1215	0.90	5	0	1.5	1.2	0.976	1.00	1384
V_{RF}	790	0.90	12	0	1.5	1.2	0.943	1.00	930
V_{FR}	397	0.90	9	0	1.5	1.2	0.957	1.00	461
V_{RR}	258	0.90	12	0	1.5	1.2	0.943	1.00	304
V_{NW}	1688							V =	3079
V_W	1391								
VR	0.452								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	930 lc/h
Interchange density, ID	0.3 int/mi	Weaving lane changes, LC_W	1074 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	0 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	1074 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	33

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	3079 pc/h	Weaving intensity factor, W	0.336
Weaving segment capacity, c_w	7270 veh/h	Weaving segment speed, S	35.8 mph
Weaving segment v/c ratio	0.413	Average weaving speed, S_W	37.5 mph
Weaving segment density, D	21.5 pc/mi/ln	Average non-weaving speed, S_{NW}	34.6 mph
Level of Service, LOS	B	Maximum weaving length, L_{MAX}	5702 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 SB*
Agency or Company	*Atkins*	From/To	*6025-Bowman Off to Bowman On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2490*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*6*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1425*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*25.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 SB*
Agency or Company	*Atkins*	From/To	*6025-Bowman Off to Bowman On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2005*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1142*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*20.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 SB
Agency or Company	Atkins	Junction	6030-SB On from Bowman
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 900	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2490	
	Ramp Volume, V_R: 705	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2490	0.90	Level	6	0	0.971	1.00	2850
Ramp	705	0.90	Level	2	0	0.990	1.00	791
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2850 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3641	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3641	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 27.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.389 (Exibit 13-11)

S_R= 49.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 49.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 SB
Agency or Company	Atkins	Junction	6030-SB On from Bowman
Date Performed	4/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 900	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2005	
	Ramp Volume, V_R: 718	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2005	0.90	Level	5	0	0.976	1.00	2283
Ramp	718	0.90	Level	2	0	0.990	1.00	806
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2283 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3089	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3089	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 23.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.326 (Exibit 13-11)

S_R= 50.8 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 50.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 SB
Agency or Company	Atkins	Junction	6035-SB On from Wingo Way
Date Performed	4/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 875	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2488	
	Ramp Volume, V_R: 796	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2488	0.90	Level	3	0	0.985	1.00	2806
Ramp	796	0.90	Level	2	0	0.990	1.00	893
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2806 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3699	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3699	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.4 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.400 (Exibit 13-11)

S_R= 49.8 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 49.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 SB
Agency or Company	Atkins	Junction	6035-SB On from Wingo Way
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	875
Deceleration Lane Length L_D	
Freeway Volume, V_F	2383
Ramp Volume, V_R	811
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2383	0.90	Level	3	0	0.985	1.00	2687
Ramp	811	0.90	Level	2	0	0.990	1.00	910
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2687 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3597	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3597	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 27.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.385 (Exibit 13-11)

S_R= 50.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 50.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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MAJOR MERGE SEGMENTS ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US 17 SB
Analysis Year	2018 Build - Proposed Site	Junction	From SC-703
Analysis Time Period:	AM Peak	Segment ID	6040
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of On-Ramp	Freeway Downstream of On-Ramp	On-Ramp
Number of Lanes, N	2	4	2
Free-Flow Speed, FFS (mph)	55	55	40
Volume, V (veh/h)	3,284	4,616	1,332
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	3%	4%	6%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream of On-Ramp	Freeway Downstream of On-Ramp	On-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.99	0.98	0.97
Demand Flow Rate, v_p (pc/h/ln)	1,852	1,308	762
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,000
v/c ratio	0.82	0.58	0.38
	Below Capacity	Below Capacity	Below Capacity

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

MAJOR MERGE SEGMENTS ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US 17 SB
Analysis Year	2018 Build - Proposed Site	Junction	From SC-703
Analysis Time Period:	PM Peak	Segment ID	6040
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of On-Ramp	Freeway Downstream of On-Ramp	On-Ramp
Number of Lanes, N	2	4	2
Free-Flow Speed, FFS (mph)	55	55	40
Volume, V (veh/h)	3,194	4,382	1,188
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	3%	4%	6%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream of On-Ramp	Freeway Downstream of On-Ramp	On-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.99	0.98	0.97
Demand Flow Rate, v_p (pc/h/ln)	1,801	1,242	680
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,000
v/c ratio	0.80	0.55	0.34
	Below Capacity	Below Capacity	Below Capacity

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 SB*
Agency or Company	*Atkins*	From/To	*6045-SC-703 to E Bay*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4616*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.980*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1308*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*23.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 SB*
Agency or Company	*Atkins*	From/To	*6045-SC-703 to E Bay*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2018 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4382*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.980*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1242*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*22.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 SB
Agency or Company	Atkins	Junction	6050-Off to Morrison
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☐ No	☑ Off
L_{up} =	ft	Deceleration Lane Length L_D	200	L_{down} =	885 ft
V_u =	veh/h	Freeway Volume, V_F	4616	V_D =	488 veh/h
		Ramp Volume, V_R	567		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4616	0.90	Level	4	0	0.980	1.00	5231
Ramp	567	0.90	Level	8	0	0.962	1.00	655
UpStream								
DownStream	488	0.90	Level	7	0	0.966	1.00	561

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 2650 pc/h

V_3 or V_{av34} 1290 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5231	Exhibit 13-8	9000	No
$V_{FO} = V_F - V_R$	4576	Exhibit 13-8	9000	No
V_R	655	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2650	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 25.2 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.357 (Exhibit 13-12)

S_R= 50.4 mph (Exhibit 13-12)

S_0= 59.2 mph (Exhibit 13-12)

S = 54.4 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 SB
Agency or Company	Atkins	Junction	6050-Off to Morrison
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	4
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	200
Freeway Volume, V_F	4382
Ramp Volume, V_R	482
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{down} = 885 ft

V_D = 354 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4382	0.90	Level	4	0	0.980	1.00	4966
Ramp	482	0.90	Level	8	0	0.962	1.00	557
UpStream								
DownStream	354	0.90	Level	8	0	0.962	1.00	409

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 2479 pc/h

V_3 or V_{av34} 1243 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4966	Exhibit 13-8	9000	No
$V_{FO} = V_F - V_R$	4409	Exhibit 13-8	9000	No
V_R	557	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2479	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 23.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.348 (Exhibit 13-12)

S_R= 50.5 mph (Exhibit 13-12)

S_0= 59.4 mph (Exhibit 13-12)

S = 54.6 mph (Exhibit 13-13)

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FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US-17 SB
Analysis Year	2018 Build - Proposed Site	Junction	Off to Meeting
Analysis Time Period:	AM Peak	Segment ID	6060
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	4	3	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	4,049	3,561	488
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	4%	2%	7%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.99	0.97
Demand Flow Rate, v_p (pc/h/ln)	1,147	1,332	561
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,100
v/c ratio	0.51	0.59	0.27
Density, D_{MD} (pc/mi/ln)	20.1	23.3	9.8
LOS	C	C	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US-17 SB
Analysis Year	2018 Build - Proposed Site	Junction	Off to Meeting
Analysis Time Period:	PM Peak	Segment ID	6060
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	4	3	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	3,900	3,546	354
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	3%	2%	8%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.99	0.99	0.96
Demand Flow Rate, v_p (pc/h/ln)	1,100	1,326	409
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,100
v/c ratio	0.49	0.59	0.19
Density, D_{MD} (pc/mi/ln)	19.3	23.2	7.2
LOS	B	C	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US-17 SB
Analysis Year	2018 Build - Proposed Site	Junction	Off to I-26 WB
Analysis Time Period:	AM Peak	Segment ID	6070
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	3	2	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	3,561	2,373	1,188
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	2%	2%	5%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.99	0.99	0.98
Demand Flow Rate, v_p (pc/h/ln)	1,332	1,332	1,353
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,200
v/c ratio	0.59	0.59	0.62
Density, D_{MD} (pc/mi/ln)	23.3	23.3	23.7
LOS	C	C	C

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US-17 SB
Analysis Year	2018 Build - Proposed Site	Junction	Off to I-26 WB
Analysis Time Period:	PM Peak	Segment ID	6070
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	3	2	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	3,546	2,355	1,191
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	2%	2%	4%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.99	0.99	0.98
Demand Flow Rate, v_p (pc/h/ln)	1,326	1,321	1,350
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,200
v/c ratio	0.59	0.59	0.61
Density, D_{MD} (pc/mi/ln)	23.2	23.1	23.6
LOS	C	C	C

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	152	2850	69	55	2427	58	0	0	87	0	0	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0			6.0			6.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.95	1.00			1.00			1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85			0.86			0.86
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00			1.00			1.00
Satd. Flow (prot)	1752	5036	1568	1752	3505	1568			1611			1580
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00			1.00			1.00
Satd. Flow (perm)	1752	5036	1568	1752	3505	1568			1611			1580
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	169	3167	77	61	2697	64	0	0	97	0	0	68
RTOR Reduction (vph)	0	0	10	0	0	11	0	0	54	0	0	17
Lane Group Flow (vph)	169	3167	67	61	2697	53	0	0	43	0	0	51
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	2%	2%	2%	4%	4%	4%
Turn Type	Prot	NA	Perm	Prot	NA	Perm			Over			Over
Protected Phases	5	2		1	6				1			5
Permitted Phases			2			6			1			5
Actuated Green, G (s)	19.0	146.8	146.8	11.2	139.0	139.0			11.2			19.0
Effective Green, g (s)	19.0	146.8	146.8	11.2	139.0	139.0			11.2			19.0
Actuated g/C Ratio	0.11	0.86	0.86	0.07	0.82	0.82			0.07			0.11
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0			6.0			6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0			3.0			3.0
Lane Grp Cap (vph)	195	4348	1354	115	2865	1282			106			176
v/s Ratio Prot	c0.10	c0.63		0.03	c0.77				0.03			0.03
v/s Ratio Perm			0.04			0.03						
v/c Ratio	0.87	0.73	0.05	0.53	0.94	0.04			0.40			0.29
Uniform Delay, d1	74.3	4.3	1.7	76.9	12.3	2.9			76.2			69.3
Progression Factor	1.00	1.00	1.00	0.77	1.90	0.02			1.00			1.00
Incremental Delay, d2	30.8	1.1	0.1	1.8	3.4	0.0			2.5			0.9
Delay (s)	105.0	5.4	1.7	60.9	26.8	0.1			78.7			70.2
Level of Service	F	A	A	E	C	A			E			E
Approach Delay (s)		10.2			26.9			78.7			70.2	
Approach LOS		B			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	115	3184	70	54	2322	40	0	0	87	0	0	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0			6.0			6.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.95	1.00			1.00			1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85			0.86			0.86
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00			1.00			1.00
Satd. Flow (prot)	1752	5036	1568	1752	3505	1568			1611			1580
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00			1.00			1.00
Satd. Flow (perm)	1752	5036	1568	1752	3505	1568			1611			1580
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	128	3538	78	60	2580	44	0	0	97	0	0	68
RTOR Reduction (vph)	0	0	10	0	0	8	0	0	20	0	0	20
Lane Group Flow (vph)	128	3538	68	60	2580	36	0	0	77	0	0	48
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	2%	2%	2%	4%	4%	4%
Turn Type	Prot	NA	Perm	Prot	NA	Perm			Over			Over
Protected Phases	5	2		1	6				1			5
Permitted Phases			2			6			1			5
Actuated Green, G (s)	14.5	125.8	125.8	12.2	123.5	123.5			12.2			14.5
Effective Green, g (s)	14.5	125.8	125.8	12.2	123.5	123.5			12.2			14.5
Actuated g/C Ratio	0.10	0.84	0.84	0.08	0.82	0.82			0.08			0.10
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0			6.0			6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0			3.0			3.0
Lane Grp Cap (vph)	169	4223	1315	142	2885	1290			131			152
v/s Ratio Prot	c0.07	0.70		0.03	c0.74				0.05			0.03
v/s Ratio Perm			0.04			0.02						
v/c Ratio	0.76	0.84	0.05	0.42	0.89	0.03			0.59			0.32
Uniform Delay, d1	66.0	6.6	2.0	65.5	8.9	2.4			66.5			63.1
Progression Factor	1.00	1.00	1.00	1.05	1.52	0.08			1.00			1.00
Incremental Delay, d2	17.5	2.1	0.1	1.0	2.4	0.0			6.5			1.2
Delay (s)	83.5	8.7	2.1	69.5	15.8	0.2			73.0			64.3
Level of Service	F	A	A	E	B	A			E			E
Approach Delay (s)		11.1			16.8			73.0			64.3	
Approach LOS		B			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	14.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	419	2202	316	339	2297	125	161	234	167	64	253	82
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1827	1827	1827	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	466	2447	351	377	2552	139	179	260	186	71	281	91
Adj No. of Lanes	2	3	1	2	3	1	1	2	1	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	4	4	4	2	2	2	2	2	2
Cap, veh/h	481	2827	1009	413	2706	922	204	440	391	185	330	371
Arrive On Green	0.28	1.00	1.00	0.12	0.54	0.54	0.08	0.12	0.12	0.05	0.09	0.09
Sat Flow, veh/h	3408	5036	1568	3375	4988	1553	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	466	2447	351	377	2552	139	179	260	186	71	281	91
Grp Sat Flow(s),veh/h/ln	1704	1679	1568	1688	1663	1553	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	22.9	0.0	0.0	18.7	81.5	6.8	14.0	11.8	17.0	6.1	13.3	7.9
Cycle Q Clear(g_c), s	22.9	0.0	0.0	18.7	81.5	6.8	14.0	11.8	17.0	6.1	13.3	7.9
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	481	2827	1009	413	2706	922	204	440	391	185	330	371
V/C Ratio(X)	0.97	0.87	0.35	0.91	0.94	0.15	0.88	0.59	0.48	0.38	0.85	0.25
Avail Cap(c_a), veh/h	481	2827	1009	417	2706	922	204	440	391	188	333	373
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.62	0.62	0.62	0.16	0.16	0.16	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	60.6	0.0	0.0	73.7	36.4	15.4	65.1	70.3	54.6	64.9	75.9	52.8
Incr Delay (d2), s/veh	24.5	2.4	0.6	5.5	1.7	0.1	32.6	2.1	0.9	1.3	18.6	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.4	0.6	0.2	9.1	37.8	2.9	3.4	5.9	7.5	3.0	7.4	3.5
LnGrp Delay(d),s/veh	85.1	2.4	0.6	79.1	38.1	15.5	97.8	72.4	55.5	66.2	94.5	53.2
LnGrp LOS	F	A	A	E	D	B	F	E	E	E	F	D
Approach Vol, veh/h		3264			3068			625			443	
Approach Delay, s/veh		14.0			42.1			74.6			81.5	
Approach LOS		B			D			E			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	26.8	101.4	20.0	21.8	30.0	98.2	14.7	27.1
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	21.0	95.0	14.0	16.0	24.0	92.0	9.0	21.0
Max Q Clear Time (g_c+I1), s	20.7	2.0	16.0	15.3	24.9	83.5	8.1	19.0
Green Ext Time (p_c), s	0.0	91.0	0.0	0.2	0.0	8.5	0.0	0.9

Intersection Summary	
HCM 2010 Ctrl Delay	34.8
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	415	2553	303	291	2040	129	203	264	309	119	226	173
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	461	2837	337	323	2267	143	226	293	343	132	251	192
Adj No. of Lanes	2	3	1	2	3	1	1	2	1	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3	2	2	2	2	2	2
Cap, veh/h	498	2820	1003	318	2554	889	226	448	348	192	378	400
Arrive On Green	0.29	1.00	1.00	0.09	0.51	0.51	0.08	0.13	0.13	0.06	0.11	0.11
Sat Flow, veh/h	3408	5036	1568	3408	5036	1568	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	461	2837	337	323	2267	143	226	293	343	132	251	192
Grp Sat Flow(s),veh/h/ln	1704	1679	1568	1704	1679	1568	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	19.7	0.0	0.0	14.0	60.5	6.5	12.0	11.8	19.0	9.0	10.2	15.5
Cycle Q Clear(g_c), s	19.7	0.0	0.0	14.0	60.5	6.5	12.0	11.8	19.0	9.0	10.2	15.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	498	2820	1003	318	2554	889	226	448	348	192	378	400
V/C Ratio(X)	0.92	1.01	0.34	1.02	0.89	0.16	1.00	0.65	0.98	0.69	0.66	0.48
Avail Cap(c_a), veh/h	523	2820	1003	318	2554	889	226	448	348	192	378	400
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.44	0.44	0.44	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	52.3	0.0	0.0	68.0	33.1	15.5	60.7	62.4	58.2	57.6	64.4	47.6
Incr Delay (d2), s/veh	11.9	12.7	0.4	33.0	1.8	0.1	59.6	3.4	44.0	9.8	4.4	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.0	3.3	0.1	8.0	28.3	2.8	3.7	6.0	18.4	1.5	5.2	6.9
LnGrp Delay(d),s/veh	64.1	12.7	0.4	101.1	34.9	15.6	120.3	65.8	102.2	67.4	68.8	48.5
LnGrp LOS	E	F	A	F	C	B	F	E	F	E	E	D
Approach Vol, veh/h		3635			2733			862			575	
Approach Delay, s/veh		18.1			41.7			94.6			61.7	
Approach LOS		B			D			F			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	20.0	90.0	18.0	22.0	27.9	82.1	15.0	25.0
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0	12.0	16.0	23.0	75.0	9.0	19.0
Max Q Clear Time (g_c+I1), s	16.0	2.0	14.0	17.5	21.7	62.5	11.0	21.0
Green Ext Time (p_c), s	0.0	80.8	0.0	0.0	0.3	12.4	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	38.0
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	238	2029	166	193	2453	267	119	188	173	185	210	189
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1827	1827	1827	1827	1845	1845	1845	1863	1863	1863
Adj Flow Rate, veh/h	264	2254	184	214	2726	297	132	209	192	206	233	210
Adj No. of Lanes	1	3	1	1	3	1	1	1	1	2	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	4	4	4	3	3	3	2	2	2
Cap, veh/h	247	2817	996	234	2699	941	134	250	359	223	230	382
Arrive On Green	0.12	0.56	0.56	0.09	0.54	0.54	0.08	0.14	0.14	0.06	0.12	0.12
Sat Flow, veh/h	1740	4988	1553	1740	4988	1553	1757	1845	1568	3442	1863	1583
Grp Volume(v), veh/h	264	2254	184	214	2726	297	132	209	192	206	233	210
Grp Sat Flow(s),veh/h/ln	1740	1663	1553	1740	1663	1553	1757	1845	1568	1721	1863	1583
Q Serve(g_s), s	20.0	61.0	8.2	13.8	92.0	15.8	12.8	18.8	18.3	10.1	21.0	19.7
Cycle Q Clear(g_c), s	20.0	61.0	8.2	13.8	92.0	15.8	12.8	18.8	18.3	10.1	21.0	19.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	247	2817	996	234	2699	941	134	250	359	223	230	382
V/C Ratio(X)	1.07	0.80	0.18	0.91	1.01	0.32	0.98	0.84	0.53	0.93	1.01	0.55
Avail Cap(c_a), veh/h	247	2817	996	275	2699	941	134	250	359	223	230	382
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.46	0.46	0.46	0.59	0.59	0.59	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	63.3	29.4	12.4	51.0	39.0	16.3	78.4	71.7	57.5	79.1	74.5	56.4
Incr Delay (d2), s/veh	58.6	1.2	0.2	20.6	15.8	0.5	72.1	21.4	1.5	40.2	62.6	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
%ile BackOfQ(50%),veh/ln	15.6	28.3	3.6	11.3	45.9	6.9	8.9	11.1	8.1	6.1	14.8	8.8
LnGrp Delay(d),s/veh	121.9	30.5	12.6	71.6	54.8	16.8	150.5	93.1	59.1	119.3	137.2	58.1
LnGrp LOS	F	C	B	E	F	B	F	F	E	F	F	E
Approach Vol, veh/h		2702			3237			533			649	
Approach Delay, s/veh		38.2			52.4			95.0			105.9	
Approach LOS		D			D			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	22.0	102.0	19.0	27.0	26.0	98.0	17.0	29.0
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	20.0	92.0	13.0	21.0	20.0	92.0	11.0	23.0
Max Q Clear Time (g_c+I1), s	15.8	63.0	14.8	23.0	22.0	94.0	12.1	20.8
Green Ext Time (p_c), s	0.2	28.8	0.0	0.0	0.0	0.0	0.0	1.0

Intersection Summary	
HCM 2010 Ctrl Delay	55.1
HCM 2010 LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	293	2573	115	202	2132	163	99	173	245	203	200	229
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	326	2859	128	224	2369	181	110	192	272	226	222	254
Adj No. of Lanes	1	3	1	1	3	1	1	1	1	2	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3	2	2	2	2	2	2
Cap, veh/h	326	2887	993	201	2552	899	106	211	317	229	224	433
Arrive On Green	0.15	0.57	0.57	0.09	0.51	0.51	0.06	0.11	0.11	0.07	0.12	0.12
Sat Flow, veh/h	1757	5036	1568	1757	5036	1568	1774	1863	1583	3442	1863	1583
Grp Volume(v), veh/h	326	2859	128	224	2369	181	110	192	272	226	222	254
Grp Sat Flow(s),veh/h/ln	1757	1679	1568	1757	1679	1568	1774	1863	1583	1721	1863	1583
Q Serve(g_s), s	23.0	84.1	4.9	13.0	65.7	8.4	9.0	15.3	17.0	9.8	17.9	18.0
Cycle Q Clear(g_c), s	23.0	84.1	4.9	13.0	65.7	8.4	9.0	15.3	17.0	9.8	17.9	18.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	326	2887	993	201	2552	899	106	211	317	229	224	433
V/C Ratio(X)	1.00	0.99	0.13	1.11	0.93	0.20	1.03	0.91	0.86	0.98	0.99	0.59
Avail Cap(c_a), veh/h	326	2887	993	201	2552	899	106	211	317	229	224	433
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.18	0.18	0.18	0.73	0.73	0.73	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	52.9	31.6	11.0	52.1	34.5	15.4	70.5	65.7	58.0	69.9	65.9	47.2
Incr Delay (d2), s/veh	21.4	5.3	0.0	88.1	5.7	0.4	96.5	38.0	20.4	55.0	58.1	2.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	15.4	40.1	2.1	13.3	31.6	3.7	7.3	10.1	12.7	6.4	12.8	9.3
LnGrp Delay(d),s/veh	74.3	36.8	11.0	140.1	40.2	15.8	167.6	103.8	78.4	124.9	124.1	49.2
LnGrp LOS	F	D	B	F	D	B	F	F	E	F	F	D
Approach Vol, veh/h		3313			2774			574			702	
Approach Delay, s/veh		39.5			46.7			103.9			97.3	
Approach LOS		D			D			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	19.0	92.0	15.0	24.0	29.0	82.0	16.0	23.0
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	13.0	86.0	9.0	18.0	23.0	76.0	10.0	17.0
Max Q Clear Time (g_c+I1), s	15.0	86.1	11.0	20.0	25.0	67.7	11.8	19.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	8.3	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	52.7
HCM 2010 LOS	D

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	2280	107	111	2839	74	106
Number	2	12	1	6	3	18
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1827	1827	1863	1863
Adj Flow Rate, veh/h	2533	119	123	3154	82	118
Adj No. of Lanes	3	1	1	3	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	4	2	2
Cap, veh/h	3823	1319	220	4267	146	215
Arrive On Green	1.00	1.00	0.11	1.00	0.08	0.08
Sat Flow, veh/h	5152	1553	1740	5152	1774	1583
Grp Volume(v), veh/h	2533	119	123	3154	82	118
Grp Sat Flow(s),veh/h/ln	1663	1553	1740	1663	1774	1583
Q Serve(g_s), s	0.0	0.0	2.2	0.0	7.5	11.7
Cycle Q Clear(g_c), s	0.0	0.0	2.2	0.0	7.5	11.7
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	3823	1319	220	4267	146	215
V/C Ratio(X)	0.66	0.09	0.56	0.74	0.56	0.55
Avail Cap(c_a), veh/h	3823	1319	323	4267	179	244
HCM Platoon Ratio	2.00	2.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	0.49	0.49	0.09	0.09	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	6.3	0.0	74.3	68.0
Incr Delay (d2), s/veh	0.5	0.1	0.2	0.1	3.3	2.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	4.2	0.0	3.8	5.3
LnGrp Delay(d),s/veh	0.5	0.1	6.5	0.1	77.7	70.2
LnGrp LOS	A	A	A	A	E	E
Approach Vol, veh/h	2652			3277	200	
Approach Delay, s/veh	0.4			0.3	73.2	
Approach LOS	A			A	E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	15.0	135.1				150.1		19.9
Change Period (Y+Rc), s	6.0	6.0				6.0		6.0
Max Green Setting (Gmax), s	19.0	116.0				141.0		17.0
Max Q Clear Time (g_c+I1), s	4.2	2.0				2.0		13.7
Green Ext Time (p_c), s	0.2	112.9				137.4		0.2

Intersection Summary	
HCM 2010 Ctrl Delay	2.8
HCM 2010 LOS	A

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	2921	100	128	2428	69	148
Number	2	12	1	6	3	18
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1863	1863
Adj Flow Rate, veh/h	3246	111	142	2698	77	164
Adj No. of Lanes	3	1	1	3	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	2	2
Cap, veh/h	3761	1286	194	4264	130	211
Arrive On Green	1.00	1.00	0.12	1.00	0.07	0.07
Sat Flow, veh/h	5202	1568	1757	5202	1774	1583
Grp Volume(v), veh/h	3246	111	142	2698	77	164
Grp Sat Flow(s),veh/h/ln	1679	1568	1757	1679	1774	1583
Q Serve(g_s), s	0.0	0.0	3.7	0.0	6.3	11.0
Cycle Q Clear(g_c), s	0.0	0.0	3.7	0.0	6.3	11.0
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	3761	1286	194	4264	130	211
V/C Ratio(X)	0.86	0.09	0.73	0.63	0.59	0.78
Avail Cap(c_a), veh/h	3761	1286	241	4264	130	211
HCM Platoon Ratio	2.00	2.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	0.19	0.19	0.30	0.30	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	29.7	0.0	67.3	62.9
Incr Delay (d2), s/veh	0.6	0.0	2.7	0.2	7.0	16.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	5.6	0.1	3.4	7.5
LnGrp Delay(d),s/veh	0.6	0.0	32.4	0.2	74.3	79.6
LnGrp LOS	A	A	C	A	E	E
Approach Vol, veh/h	3357			2840	241	
Approach Delay, s/veh	0.5			1.8	77.9	
Approach LOS	A			A	E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	15.0	118.0				133.0		17.0
Change Period (Y+Rc), s	6.0	6.0				6.0		6.0
Max Green Setting (Gmax), s	13.0	108.0				127.0		11.0
Max Q Clear Time (g_c+I1), s	5.7	2.0				2.0		13.0
Green Ext Time (p_c), s	0.2	105.0				123.7		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	4.0
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	219	2056	111	188	2656	351	146	78	174	208	88	148
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1827	1827	1827	1827	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	243	2284	123	209	2951	390	162	87	193	231	98	164
Adj No. of Lanes	1	3	1	1	3	1	2	1	1	2	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	4	4	4	2	2	2	2	2	2
Cap, veh/h	227	3022	1087	234	2816	1023	334	175	251	334	175	317
Arrive On Green	0.21	1.00	1.00	0.06	0.56	0.56	0.09	0.09	0.09	0.09	0.09	0.09
Sat Flow, veh/h	1740	4988	1553	1740	4988	1553	3548	1863	1583	3548	1863	1583
Grp Volume(v), veh/h	243	2284	123	209	2951	390	162	87	193	231	98	164
Grp Sat Flow(s),veh/h/ln	1740	1663	1553	1740	1663	1553	1774	1863	1583	1774	1863	1583
Q Serve(g_s), s	18.0	0.0	0.0	8.6	96.0	19.5	7.4	7.5	16.0	10.7	8.6	15.7
Cycle Q Clear(g_c), s	18.0	0.0	0.0	8.6	96.0	19.5	7.4	7.5	16.0	10.7	8.6	15.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	227	3022	1087	234	2816	1023	334	175	251	334	175	317
V/C Ratio(X)	1.07	0.76	0.11	0.89	1.05	0.38	0.49	0.50	0.77	0.69	0.56	0.52
Avail Cap(c_a), veh/h	227	3022	1087	337	2816	1023	334	175	251	334	175	317
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.67	0.67	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.2	0.0	0.0	22.1	37.0	13.2	73.1	73.2	68.5	74.6	73.6	60.7
Incr Delay (d2), s/veh	69.7	1.2	0.1	18.6	31.2	1.1	1.1	2.2	13.3	6.0	3.9	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	15.0	0.3	0.0	6.6	51.9	10.9	3.7	4.0	9.6	5.5	4.6	7.0
LnGrp Delay(d),s/veh	124.9	1.2	0.1	40.7	68.2	14.3	74.2	75.3	81.8	80.6	77.6	62.2
LnGrp LOS	F	A	A	D	F	B	E	E	F	F	E	E
Approach Vol, veh/h		2650			3550			442			493	
Approach Delay, s/veh		12.5			60.6			77.8			73.9	
Approach LOS		B			E			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	17.0	109.0		22.0	24.0	102.0		22.0
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s	21.0	93.0		16.0	18.0	96.0		16.0
Max Q Clear Time (g_c+I1), s	10.6	2.0		17.7	20.0	98.0		18.0
Green Ext Time (p_c), s	0.4	89.9		0.0	0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	44.7
HCM 2010 LOS	D

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	211	2741	117	192	2269	262	114	94	186	314	172	173
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	234	3046	130	213	2521	291	128	102	207	349	191	192
Adj No. of Lanes	1	3	1	1	3	1	2	1	1	2	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3	2	2	2	2	2	2
Cap, veh/h	229	2787	1035	211	2652	993	378	199	285	378	199	327
Arrive On Green	0.20	1.00	1.00	0.07	0.53	0.53	0.11	0.11	0.11	0.11	0.11	0.11
Sat Flow, veh/h	1757	5036	1568	1757	5036	1568	3548	1863	1583	3548	1863	1583
Grp Volume(v), veh/h	234	3046	130	213	2521	291	128	102	207	349	191	192
Grp Sat Flow(s),veh/h/ln	1757	1679	1568	1757	1679	1568	1774	1863	1583	1774	1863	1583
Q Serve(g_s), s	15.0	0.0	0.0	11.0	71.2	12.5	5.0	7.8	16.0	14.6	15.3	16.0
Cycle Q Clear(g_c), s	15.0	0.0	0.0	11.0	71.2	12.5	5.0	7.8	16.0	14.6	15.3	16.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	229	2787	1035	211	2652	993	378	199	285	378	199	327
V/C Ratio(X)	1.02	1.09	0.13	1.01	0.95	0.29	0.34	0.51	0.73	0.92	0.96	0.59
Avail Cap(c_a), veh/h	229	2787	1035	211	2652	993	378	199	285	378	199	327
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.38	0.38	0.38	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	45.2	0.0	0.0	37.5	33.6	12.4	62.1	63.3	58.0	66.4	66.7	53.7
Incr Delay (d2), s/veh	42.6	44.6	0.1	64.0	9.2	0.7	0.5	2.2	8.9	27.6	52.6	2.7
Initial Q Delay(d3),s/veh	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.1	11.5	0.0	12.4	35.2	7.2	2.5	4.1	8.8	8.6	10.8	7.4
LnGrp Delay(d),s/veh	88.0	44.6	0.1	101.6	42.9	13.1	62.6	65.6	66.9	94.0	119.3	56.4
LnGrp LOS	F	F	A	F	D	B	E	E	E	F	F	E
Approach Vol, veh/h		3410			3025			437			732	
Approach Delay, s/veh		45.9			44.1			65.4			90.8	
Approach LOS		D			D			E			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	17.0	89.0		22.0	21.0	85.0		22.0
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s	11.0	83.0		16.0	15.0	79.0		16.0
Max Q Clear Time (g_c+I1), s	13.0	2.0		18.0	17.0	73.2		18.0
Green Ext Time (p_c), s	0.0	80.4		0.0	0.0	5.8		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	50.6
HCM 2010 LOS	D

Notes

User approved volume balancing among the lanes for turning movement.

Appendix E
Traffic Analysis Worksheets

2018 Opening Year

Build Proposed Project Alternative 2

North Charleston Intersections

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	139	0	0	0	0	0	1573	406
Number				7	4	14				5	2	12
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				0	1827	0				0	1827	1827
Adj Flow Rate, veh/h				0	154	0				0	1748	451
Adj No. of Lanes				0	2	0				0	3	1
Peak Hour Factor				0.90	0.90	0.90				0.90	0.90	0.90
Percent Heavy Veh, %				0	4	0				0	4	4
Cap, veh/h				0	506	0				0	3193	994
Arrive On Green				0.00	0.15	0.00				0.00	0.64	0.64
Sat Flow, veh/h				0	3654	0				0	5152	1553
Grp Volume(v), veh/h				0	154	0				0	1748	451
Grp Sat Flow(s),veh/h/ln				0	1736	0				0	1663	1553
Q Serve(g_s), s				0.0	2.2	0.0				0.0	10.9	8.3
Cycle Q Clear(g_c), s				0.0	2.2	0.0				0.0	10.9	8.3
Prop In Lane				0.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				0	506	0				0	3193	994
V/C Ratio(X)				0.00	0.30	0.00				0.00	0.55	0.45
Avail Cap(c_a), veh/h				0	928	0				0	5601	1744
HCM Platoon Ratio				1.00	1.00	1.00				1.00	1.00	1.00
Upstream Filter(I)				0.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				0.0	21.4	0.0				0.0	5.6	5.1
Incr Delay (d2), s/veh				0.0	0.3	0.0				0.0	0.1	0.3
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				0.0	1.1	0.0				0.0	4.9	3.6
LnGrp Delay(d),s/veh				0.0	21.7	0.0				0.0	5.7	5.4
LnGrp LOS					C						A	A
Approach Vol, veh/h					154						2199	
Approach Delay, s/veh					21.7						5.7	
Approach LOS					C						A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		41.9		14.2				
Change Period (Y+Rc), s		6.0		6.0				
Max Green Setting (Gmax), s		63.0		15.0				
Max Q Clear Time (g_c+I1), s		12.9		4.2				
Green Ext Time (p_c), s		23.0		0.6				

Intersection Summary	
HCM 2010 Ctrl Delay	6.7
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	218	0	0	0	0	0	945	286
Number				7	4	14				5	2	12
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				0	1845	0				0	1827	1827
Adj Flow Rate, veh/h				0	242	0				0	1050	318
Adj No. of Lanes				0	2	0				0	3	1
Peak Hour Factor				0.90	0.90	0.90				0.90	0.90	0.90
Percent Heavy Veh, %				0	3	0				0	4	4
Cap, veh/h				0	768	0				0	2315	721
Arrive On Green				0.00	0.22	0.00				0.00	0.46	0.46
Sat Flow, veh/h				0	3689	0				0	5152	1553
Grp Volume(v), veh/h				0	242	0				0	1050	318
Grp Sat Flow(s),veh/h/ln				0	1752	0				0	1663	1553
Q Serve(g_s), s				0.0	2.2	0.0				0.0	5.4	5.2
Cycle Q Clear(g_c), s				0.0	2.2	0.0				0.0	5.4	5.2
Prop In Lane				0.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				0	768	0				0	2315	721
V/C Ratio(X)				0.00	0.32	0.00				0.00	0.45	0.44
Avail Cap(c_a), veh/h				0	2314	0				0	6980	2173
HCM Platoon Ratio				1.00	1.00	1.00				1.00	1.00	1.00
Upstream Filter(I)				0.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				0.0	12.4	0.0				0.0	6.9	6.8
Incr Delay (d2), s/veh				0.0	0.2	0.0				0.0	0.1	0.4
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				0.0	1.1	0.0				0.0	2.5	2.3
LnGrp Delay(d),s/veh				0.0	12.6	0.0				0.0	7.0	7.3
LnGrp LOS					B						A	A
Approach Vol, veh/h					242						1368	
Approach Delay, s/veh					12.6						7.1	
Approach LOS					B						A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		23.6		14.3				
Change Period (Y+Rc), s		6.0		6.0				
Max Green Setting (Gmax), s		53.0		25.0				
Max Q Clear Time (g_c+I1), s		7.4		4.2				
Green Ext Time (p_c), s		10.2		1.4				

Intersection Summary	
HCM 2010 Ctrl Delay	7.9
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	406	0	0	0	0	0	786	105	0	0	0
Number	3	8	18				1	6	16			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	0	1827	0				0	1810	1810			
Adj Flow Rate, veh/h	0	451	0				0	873	117			
Adj No. of Lanes	0	2	0				0	3	1			
Peak Hour Factor	0.90	0.90	0.90				0.90	0.90	0.90			
Percent Heavy Veh, %	0	4	0				0	5	5			
Cap, veh/h	0	855	0				0	2127	662			
Arrive On Green	0.00	0.25	0.00				0.00	0.43	0.43			
Sat Flow, veh/h	0	3654	0				0	5103	1538			
Grp Volume(v), veh/h	0	451	0				0	873	117			
Grp Sat Flow(s),veh/h/ln	0	1736	0				0	1647	1538			
Q Serve(g_s), s	0.0	4.2	0.0				0.0	4.5	1.7			
Cycle Q Clear(g_c), s	0.0	4.2	0.0				0.0	4.5	1.7			
Prop In Lane	0.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	0	855	0				0	2127	662			
V/C Ratio(X)	0.00	0.53	0.00				0.00	0.41	0.18			
Avail Cap(c_a), veh/h	0	3270	0				0	5717	1780			
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00			
Upstream Filter(I)	0.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	0.0	12.1	0.0				0.0	7.3	6.5			
Incr Delay (d2), s/veh	0.0	0.5	0.0				0.0	0.1	0.1			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	0.0	2.1	0.0				0.0	2.0	0.7			
LnGrp Delay(d),s/veh	0.0	12.6	0.0				0.0	7.4	6.6			
LnGrp LOS		B						A	A			
Approach Vol, veh/h		451						990				
Approach Delay, s/veh		12.6						7.3				
Approach LOS		B						A				

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						22.0		15.2
Change Period (Y+Rc), s						6.0		6.0
Max Green Setting (Gmax), s						43.0		35.0
Max Q Clear Time (g_c+I1), s						6.5		6.2
Green Ext Time (p_c), s						6.9		3.1

Intersection Summary	
HCM 2010 Ctrl Delay	9.0
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	285	0	0	0	0	0	1437	176	0	0	0
Number	3	8	18				1	6	16			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	0	1845	0				0	1827	1827			
Adj Flow Rate, veh/h	0	317	0				0	1597	196			
Adj No. of Lanes	0	2	0				0	3	1			
Peak Hour Factor	0.90	0.90	0.90				0.90	0.90	0.90			
Percent Heavy Veh, %	0	3	0				0	4	4			
Cap, veh/h	0	625	0				0	2899	903			
Arrive On Green	0.00	0.18	0.00				0.00	0.58	0.58			
Sat Flow, veh/h	0	3689	0				0	5152	1553			
Grp Volume(v), veh/h	0	317	0				0	1597	196			
Grp Sat Flow(s),veh/h/ln	0	1752	0				0	1663	1553			
Q Serve(g_s), s	0.0	4.1	0.0				0.0	9.8	3.0			
Cycle Q Clear(g_c), s	0.0	4.1	0.0				0.0	9.8	3.0			
Prop In Lane	0.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	0	625	0				0	2899	903			
V/C Ratio(X)	0.00	0.51	0.00				0.00	0.55	0.22			
Avail Cap(c_a), veh/h	0	1475	0				0	5699	1774			
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00			
Upstream Filter(I)	0.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	0.0	18.5	0.0				0.0	6.4	5.0			
Incr Delay (d2), s/veh	0.0	0.6	0.0				0.0	0.2	0.1			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	0.0	2.0	0.0				0.0	4.5	1.3			
LnGrp Delay(d),s/veh	0.0	19.2	0.0				0.0	6.6	5.1			
LnGrp LOS		B						A	A			
Approach Vol, veh/h		317						1793				
Approach Delay, s/veh		19.2						6.4				
Approach LOS		B						A				

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						35.0		14.9
Change Period (Y+Rc), s						6.0		6.0
Max Green Setting (Gmax), s						57.0		21.0
Max Q Clear Time (g_c+I1), s						11.8		6.1
Green Ext Time (p_c), s						17.2		1.6

Intersection Summary	
HCM 2010 Ctrl Delay	8.3
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	141	45	0	0	0	42	0	0	0	1289	422
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1863	1863	0	1863	0	1792	0	0	0	1810	1810
Adj Flow Rate, veh/h	0	157	50	0	0	0	47	0	0	0	1432	469
Adj No. of Lanes	0	1	1	0	1	0	1	0	0	0	3	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	2	2	0	2	0	6	0	0	0	5	5
Cap, veh/h	0	214	182	0	214	0	106	0	0	0	3673	1143
Arrive On Green	0.00	0.11	0.11	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.74	0.74
Sat Flow, veh/h	0	1863	1583	0	1863	0	1707	47		0	5103	1538
Grp Volume(v), veh/h	0	157	50	0	0	0	47	53.0		0	1432	469
Grp Sat Flow(s),veh/h/ln	0	1863	1583	0	1863	0	1707	D		0	1647	1538
Q Serve(g_s), s	0.0	9.0	3.2	0.0	0.0	0.0	2.9			0.0	11.6	12.5
Cycle Q Clear(g_c), s	0.0	9.0	3.2	0.0	0.0	0.0	2.9			0.0	11.6	12.5
Prop In Lane	0.00		1.00	0.00		0.00	1.00			0.00		1.00
Lane Grp Cap(c), veh/h	0	214	182	0	214	0	106			0	3673	1143
V/C Ratio(X)	0.00	0.73	0.27	0.00	0.00	0.00	0.44			0.00	0.39	0.41
Avail Cap(c_a), veh/h	0	420	357	0	420	0	200			0	3673	1143
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.00	0.00	0.00	1.00			0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	47.4	44.8	0.0	0.0	0.0	50.1			0.0	5.1	5.2
Incr Delay (d2), s/veh	0.0	4.8	0.8	0.0	0.0	0.0	2.9			0.0	0.3	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	5.0	1.4	0.0	0.0	0.0	1.5			0.0	5.3	5.6
LnGrp Delay(d),s/veh	0.0	52.2	45.6	0.0	0.0	0.0	53.0			0.0	5.4	6.3
LnGrp LOS		D	D				D				A	A
Approach Vol, veh/h		207			0						1901	
Approach Delay, s/veh		50.6			0.0						5.7	
Approach LOS		D									A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4				8
Phs Duration (G+Y+Rc), s	12.9	88.4		18.7				18.7
Change Period (Y+Rc), s	6.0	6.0		6.0				6.0
Max Green Setting (Gmax), s	13.0	64.0		25.0				25.0
Max Q Clear Time (g_c+I1), s	4.9	14.5		12.0				0.0
Green Ext Time (p_c), s	0.0	17.3		0.7				0.0

Intersection Summary	
HCM 2010 Ctrl Delay	11.0
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	316	62	0	0	0	55	0	0	0	784	204
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1863	1863	0	1863	0	1810	0	0	0	1827	1827
Adj Flow Rate, veh/h	0	351	69	0	0	0	61	0	0	0	871	227
Adj No. of Lanes	0	1	1	0	1	0	1	0	0	0	3	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	2	2	0	2	0	5	0	0	0	4	4
Cap, veh/h	0	427	363	0	427	0	123	0	0	0	3332	1038
Arrive On Green	0.00	0.23	0.23	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.67	0.67
Sat Flow, veh/h	0	1863	1583	0	1863	0	1723	61		0	5152	1553
Grp Volume(v), veh/h	0	351	69	0	0	0	61	50.2		0	871	227
Grp Sat Flow(s),veh/h/ln	0	1863	1583	0	1863	0	1723	D		0	1663	1553
Q Serve(g_s), s	0.0	18.8	3.7	0.0	0.0	0.0	3.6			0.0	7.4	6.0
Cycle Q Clear(g_c), s	0.0	18.8	3.7	0.0	0.0	0.0	3.6			0.0	7.4	6.0
Prop In Lane	0.00		1.00	0.00		0.00	1.00			0.00		1.00
Lane Grp Cap(c), veh/h	0	427	363	0	427	0	123			0	3332	1038
V/C Ratio(X)	0.00	0.82	0.19	0.00	0.00	0.00	0.50			0.00	0.26	0.22
Avail Cap(c_a), veh/h	0	831	707	0	831	0	229			0	3332	1038
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.00	0.00	0.00	1.00			0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	38.5	32.7	0.0	0.0	0.0	47.1			0.0	7.0	6.8
Incr Delay (d2), s/veh	0.0	4.0	0.3	0.0	0.0	0.0	3.1			0.0	0.2	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	10.1	1.6	0.0	0.0	0.0	1.8			0.0	3.4	2.7
LnGrp Delay(d),s/veh	0.0	42.5	33.0	0.0	0.0	0.0	50.2			0.0	7.2	7.3
LnGrp LOS		D	C				D				A	A
Approach Vol, veh/h		420			0						1098	
Approach Delay, s/veh		41.0			0.0						7.2	
Approach LOS		D									A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4				8
Phs Duration (G+Y+Rc), s	13.5	76.4		30.1				30.1
Change Period (Y+Rc), s	6.0	6.0		6.0				6.0
Max Green Setting (Gmax), s	14.0	41.0		47.0				47.0
Max Q Clear Time (g_c+I1), s	5.6	9.4		21.8				0.0
Green Ext Time (p_c), s	0.1	7.2		2.3				0.0

Intersection Summary	
HCM 2010 Ctrl Delay	17.9
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	14	196	0	522	76	72	0	0
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1863	0	0	1863	1863	0	1759	1900	1792	0	0
Adj Flow Rate, veh/h	0	0	0	0	16	218	0	580	84	80	0	0
Adj No. of Lanes	0	1	0	0	1	1	0	3	0	1	0	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	2	0	0	2	2	0	8	8	6	0	0
Cap, veh/h	0	206	0	0	206	1088	0	2448	350	158	0	0
Arrive On Green	0.00	0.00	0.00	0.00	0.11	0.11	0.00	0.58	0.58	0.09	0.00	0.00
Sat Flow, veh/h	0	1863	0	0	1863	1583	0	4406	607	1707	80	
Grp Volume(v), veh/h	0	0	0	0	16	218	0	435	229	80	37.7	
Grp Sat Flow(s),veh/h/ln	0	1863	0	0	1863	1583	0	1601	1652	1707	D	
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.6	4.1	0.0	5.4	5.5	3.6		
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	0.6	4.1	0.0	5.4	5.5	3.6		
Prop In Lane	0.00		0.00	0.00		1.00	0.00		0.37	1.00		
Lane Grp Cap(c), veh/h	0	206	0	0	206	1088	0	1846	952	158		
V/C Ratio(X)	0.00	0.00	0.00	0.00	0.08	0.20	0.00	0.24	0.24	0.51		
Avail Cap(c_a), veh/h	0	548	0	0	548	1379	0	1846	952	649		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	0.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	32.5	4.6	0.0	8.5	8.5	35.2		
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.3	0.6	2.5		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.0	0.3	4.9	0.0	2.4	2.6	1.8		
LnGrp Delay(d),s/veh	0.0	0.0	0.0	0.0	32.7	4.7	0.0	8.8	9.1	37.7		
LnGrp LOS					C	A		A	A	D		
Approach Vol, veh/h		0			234			664				
Approach Delay, s/veh		0.0			6.6			8.9				
Approach LOS					A			A				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4	5	6		8
Phs Duration (G+Y+Rc), s				15.0	13.5	53.0		15.0
Change Period (Y+Rc), s				6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s				24.0	31.0	47.0		24.0
Max Q Clear Time (g_c+I1), s				0.0	5.6	7.5		6.1
Green Ext Time (p_c), s				0.0	0.2	4.3		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	10.7
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	4	237	0	1084	96	34	0	0
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1863	0	0	1863	1863	0	1792	1900	1810	0	0
Adj Flow Rate, veh/h	0	0	0	0	4	263	0	1204	107	38	0	0
Adj No. of Lanes	0	1	0	0	1	1	0	3	0	1	0	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	2	0	0	2	2	0	6	6	5	0	0
Cap, veh/h	0	187	0	0	187	1168	0	2915	259	106	0	0
Arrive On Green	0.00	0.00	0.00	0.00	0.10	0.10	0.00	0.64	0.64	0.06	0.00	0.00
Sat Flow, veh/h	0	1863	0	0	1863	1583	0	4738	407	1723	38	
Grp Volume(v), veh/h	0	0	0	0	4	263	0	858	453	38	42.3	
Grp Sat Flow(s),veh/h/ln	0	1863	0	0	1863	1583	0	1631	1721	1723	D	
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.2	4.7	0.0	11.6	11.6	1.9		
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	0.2	4.7	0.0	11.6	11.6	1.9		
Prop In Lane	0.00		0.00	0.00		1.00	0.00		0.24	1.00		
Lane Grp Cap(c), veh/h	0	187	0	0	187	1168	0	2078	1096	106		
V/C Ratio(X)	0.00	0.00	0.00	0.00	0.02	0.23	0.00	0.41	0.41	0.36		
Avail Cap(c_a), veh/h	0	395	0	0	395	1344	0	2078	1096	501		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	0.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	36.3	3.7	0.0	8.0	8.0	40.3		
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.6	1.2	2.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.0	0.1	6.5	0.0	5.3	5.8	1.0		
LnGrp Delay(d),s/veh	0.0	0.0	0.0	0.0	36.3	3.8	0.0	8.6	9.2	42.3		
LnGrp LOS					D	A		A	A	D		
Approach Vol, veh/h		0			267			1311				
Approach Delay, s/veh		0.0			4.3			8.8				
Approach LOS					A			A				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4	5	6		8
Phs Duration (G+Y+Rc), s				15.0	11.5	63.0		15.0
Change Period (Y+Rc), s				6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s				19.0	26.0	57.0		19.0
Max Q Clear Time (g_c+I1), s				0.0	3.9	13.6		6.7
Green Ext Time (p_c), s				0.0	0.1	10.7		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	8.8
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	162	67	0	566	44	124	0	0
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1863	0	0	1776	1776	0	1759	1759	1759	0	0
Adj Flow Rate, veh/h	0	0	0	0	180	74	0	629	49	138	0	0
Adj No. of Lanes	0	1	0	0	1	1	0	3	1	1	0	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	2	0	0	7	7	0	8	8	8	0	0
Cap, veh/h	0	261	0	0	249	976	0	2433	757	190	0	0
Arrive On Green	0.00	0.00	0.00	0.00	0.14	0.14	0.00	0.51	0.51	0.11	0.00	0.00
Sat Flow, veh/h	0	1863	0	0	1776	1509	0	4961	1495	1675	138	
Grp Volume(v), veh/h	0	0	0	0	180	74	0	629	49	138	37.4	
Grp Sat Flow(s),veh/h/ln	0	1863	0	0	1776	1509	0	1601	1495	1675	D	
Q Serve(g_s), s	0.0	0.0	0.0	0.0	7.3	1.4	0.0	5.6	1.3	6.0		
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	7.3	1.4	0.0	5.6	1.3	6.0		
Prop In Lane	0.00		0.00	0.00		1.00	0.00		1.00	1.00		
Lane Grp Cap(c), veh/h	0	261	0	0	249	976	0	2433	757	190		
V/C Ratio(X)	0.00	0.00	0.00	0.00	0.72	0.08	0.00	0.26	0.06	0.73		
Avail Cap(c_a), veh/h	0	844	0	0	805	1449	0	2433	757	670		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	0.00	0.00	0.00	0.00	0.99	0.99	0.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	30.8	4.9	0.0	10.5	9.4	32.1		
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.3	0.2	5.3		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.0	3.8	1.4	0.0	2.5	0.6	3.0		
LnGrp Delay(d),s/veh	0.0	0.0	0.0	0.0	34.8	5.0	0.0	10.8	9.6	37.4		
LnGrp LOS					C	A		B	A	D		
Approach Vol, veh/h		0			254			678				
Approach Delay, s/veh		0.0			26.1			10.7				
Approach LOS					C			B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4	5	6		8
Phs Duration (G+Y+Rc), s				16.5	14.5	44.0		16.5
Change Period (Y+Rc), s				6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s				34.0	30.0	38.0		34.0
Max Q Clear Time (g_c+I1), s				0.0	8.0	7.6		9.3
Green Ext Time (p_c), s				0.0	0.3	4.4		1.3

Intersection Summary	
HCM 2010 Ctrl Delay	17.8
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	108	110	0	1061	86	93	0	0
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1863	0	0	1827	1827	0	1792	1792	1792	0	0
Adj Flow Rate, veh/h	0	0	0	0	120	122	0	1179	96	103	0	0
Adj No. of Lanes	0	1	0	0	1	1	0	3	1	1	0	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	2	0	0	4	4	0	6	6	6	0	0
Cap, veh/h	0	181	0	0	178	1110	0	3021	940	155	0	0
Arrive On Green	0.00	0.00	0.00	0.00	0.10	0.10	0.00	0.62	0.62	0.09	0.00	0.00
Sat Flow, veh/h	0	1863	0	0	1827	1553	0	5055	1524	1707	103	
Grp Volume(v), veh/h	0	0	0	0	120	122	0	1179	96	103	45.5	
Grp Sat Flow(s),veh/h/ln	0	1863	0	0	1827	1553	0	1631	1524	1707	D	
Q Serve(g_s), s	0.0	0.0	0.0	0.0	5.9	2.2	0.0	11.2	2.4	5.4		
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	5.9	2.2	0.0	11.2	2.4	5.4		
Prop In Lane	0.00		0.00	0.00		1.00	0.00		1.00	1.00		
Lane Grp Cap(c), veh/h	0	181	0	0	178	1110	0	3021	940	155		
V/C Ratio(X)	0.00	0.00	0.00	0.00	0.68	0.11	0.00	0.39	0.10	0.67		
Avail Cap(c_a), veh/h	0	464	0	0	455	1345	0	3021	940	407		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	0.00	0.00	0.00	0.00	0.98	0.98	0.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	40.3	4.1	0.0	8.9	7.2	40.6		
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	4.3	0.0	0.0	0.4	0.2	4.9		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.0	3.2	3.1	0.0	5.1	1.0	2.8		
LnGrp Delay(d),s/veh	0.0	0.0	0.0	0.0	44.6	4.1	0.0	9.3	7.4	45.5		
LnGrp LOS					D	A		A	A	D		
Approach Vol, veh/h		0			242			1275				
Approach Delay, s/veh		0.0			24.2			9.2				
Approach LOS					C			A				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4	5	6		8
Phs Duration (G+Y+Rc), s				15.0	14.4	63.0		15.0
Change Period (Y+Rc), s				6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s				23.0	22.0	57.0		23.0
Max Q Clear Time (g_c+I1), s				0.0	7.4	13.2		7.9
Green Ext Time (p_c), s				0.0	0.2	10.4		0.9

Intersection Summary	
HCM 2010 Ctrl Delay	13.7
HCM 2010 LOS	B

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	67	15	39	569	947	135
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1545	1545	1810	1810	1759	1759
Adj Flow Rate, veh/h	74	17	43	632	1052	150
Adj No. of Lanes	2	1	1	3	3	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	23	23	5	5	8	8
Cap, veh/h	342	158	412	3535	3437	1070
Arrive On Green	0.12	0.12	1.00	1.00	0.72	0.72
Sat Flow, veh/h	2854	1313	450	5103	4961	1495
Grp Volume(v), veh/h	74	17	43	632	1052	150
Grp Sat Flow(s),veh/h/ln	1427	1313	450	1647	1601	1495
Q Serve(g_s), s	1.3	0.7	0.7	0.0	4.6	1.8
Cycle Q Clear(g_c), s	1.3	0.7	5.3	0.0	4.6	1.8
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	342	158	412	3535	3437	1070
V/C Ratio(X)	0.22	0.11	0.10	0.18	0.31	0.14
Avail Cap(c_a), veh/h	596	274	412	3535	3437	1070
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.95	0.95	1.00	1.00
Uniform Delay (d), s/veh	22.8	22.5	0.3	0.0	3.0	2.6
Incr Delay (d2), s/veh	0.3	0.3	0.5	0.1	0.2	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.3	0.1	0.0	2.0	0.8
LnGrp Delay(d),s/veh	23.1	22.8	0.8	0.1	3.2	2.9
LnGrp LOS	C	C	A	A	A	A
Approach Vol, veh/h	91			675	1202	
Approach Delay, s/veh	23.1			0.1	3.2	
Approach LOS	C			A	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		47.1				47.1		12.9
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		36.0				36.0		12.0
Max Q Clear Time (g_c+I1), s		6.6				7.3		3.3
Green Ext Time (p_c), s		15.1				14.9		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	3.1
HCM 2010 LOS	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	129	43	28	961	698	83
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1624	1624	1827	1827	1792	1792
Adj Flow Rate, veh/h	143	48	31	1068	776	92
Adj No. of Lanes	2	1	1	3	3	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	17	17	4	4	6	6
Cap, veh/h	449	206	518	3433	3368	1049
Arrive On Green	0.15	0.15	1.00	1.00	0.69	0.69
Sat Flow, veh/h	3000	1380	623	5152	5055	1524
Grp Volume(v), veh/h	143	48	31	1068	776	92
Grp Sat Flow(s),veh/h/ln	1500	1380	623	1663	1631	1524
Q Serve(g_s), s	2.4	1.8	0.3	0.0	3.4	1.1
Cycle Q Clear(g_c), s	2.4	1.8	3.6	0.0	3.4	1.1
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	449	206	518	3433	3368	1049
V/C Ratio(X)	0.32	0.23	0.06	0.31	0.23	0.09
Avail Cap(c_a), veh/h	733	337	518	3433	3368	1049
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.88	0.88	1.00	1.00
Uniform Delay (d), s/veh	21.8	21.5	0.2	0.0	3.3	3.0
Incr Delay (d2), s/veh	0.4	0.6	0.2	0.2	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.7	0.1	0.1	1.6	0.5
LnGrp Delay(d),s/veh	22.2	22.0	0.3	0.2	3.5	3.1
LnGrp LOS	C	C	A	A	A	A
Approach Vol, veh/h	191			1099	868	
Approach Delay, s/veh	22.1			0.2	3.4	
Approach LOS	C			A	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		45.4				45.4		14.6
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		34.0				34.0		14.0
Max Q Clear Time (g_c+I1), s		5.4				5.6		4.4
Green Ext Time (p_c), s		15.6				15.5		0.4

Intersection Summary	
HCM 2010 Ctrl Delay	3.4
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	74	63	5	118	86	130	17	437	175	168	640	160
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1743	1743	1900	1845	1845	1845	1900	1845	1900	1810	1810	1810
Adj Flow Rate, veh/h	82	70	6	131	96	144	19	486	194	187	711	178
Adj No. of Lanes	1	1	0	1	1	1	0	3	0	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	9	9	9	3	3	3	3	3	3	5	5	5
Cap, veh/h	287	426	37	249	262	223	77	1848	710	552	2371	1174
Arrive On Green	0.07	0.27	0.27	0.14	0.14	0.14	0.56	0.56	0.56	0.16	1.00	1.00
Sat Flow, veh/h	1660	1583	136	1305	1845	1568	77	3320	1276	1723	3438	1538
Grp Volume(v), veh/h	82	0	76	131	96	144	254	224	221	187	711	178
Grp Sat Flow(s),veh/h/ln	1660	0	1719	1305	1845	1568	1692	1528	1454	1723	1719	1538
Q Serve(g_s), s	4.5	0.0	3.8	10.8	5.3	9.8	0.0	8.6	9.0	4.9	0.0	0.0
Cycle Q Clear(g_c), s	4.5	0.0	3.8	10.8	5.3	9.8	8.0	8.6	9.0	4.9	0.0	0.0
Prop In Lane	1.00		0.08	1.00		1.00	0.07		0.88	1.00		1.00
Lane Grp Cap(c), veh/h	287	0	463	249	262	223	976	850	809	552	2371	1174
V/C Ratio(X)	0.29	0.00	0.16	0.53	0.37	0.65	0.26	0.26	0.27	0.34	0.30	0.15
Avail Cap(c_a), veh/h	312	0	687	400	475	404	976	850	809	675	2371	1174
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97
Uniform Delay (d), s/veh	35.1	0.0	31.5	46.1	43.7	45.7	12.8	13.0	13.1	7.6	0.0	0.0
Incr Delay (d2), s/veh	0.5	0.0	0.2	1.7	0.9	3.1	0.6	0.8	0.8	0.3	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	0.0	1.8	4.0	2.8	4.4	4.2	3.8	3.7	2.3	0.1	0.1
LnGrp Delay(d),s/veh	35.6	0.0	31.7	47.8	44.6	48.8	13.5	13.7	13.9	7.9	0.3	0.3
LnGrp LOS	D		C	D	D	D	B	B	B	A	A	A
Approach Vol, veh/h		158			371			699			1076	
Approach Delay, s/veh		33.7			47.4			13.7			1.6	
Approach LOS		C			D			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4	5	6		8
Phs Duration (G+Y+Rc), s		83.7	14.3	22.0	15.0	68.7		36.3
Change Period (Y+Rc), s		6.0	6.0	6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s		63.0	10.0	29.0	17.0	40.0		45.0
Max Q Clear Time (g_c+I1), s		2.0	6.5	12.8	6.9	11.0		5.8
Green Ext Time (p_c), s		14.4	0.0	1.6	0.3	11.9		1.9

Intersection Summary	
HCM 2010 Ctrl Delay	14.9
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	115	119	5	112	56	149	4	752	205	129	462	123
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1776	1776	1900	1863	1863	1863	1900	1863	1900	1827	1827	1827
Adj Flow Rate, veh/h	128	132	6	124	62	166	4	836	228	143	513	137
Adj No. of Lanes	1	1	0	1	1	1	0	3	0	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	7	7	7	2	2	2	2	2	2	4	4	4
Cap, veh/h	317	457	21	237	260	221	34	2090	564	413	2332	1166
Arrive On Green	0.08	0.27	0.27	0.14	0.14	0.14	0.54	0.54	0.54	0.16	1.00	1.00
Sat Flow, veh/h	1691	1686	77	1246	1863	1583	4	3864	1043	1740	3471	1553
Grp Volume(v), veh/h	128	0	138	124	62	166	403	335	330	143	513	137
Grp Sat Flow(s),veh/h/ln	1691	0	1762	1246	1863	1583	1857	1543	1511	1740	1736	1553
Q Serve(g_s), s	7.2	0.0	7.1	10.9	3.4	11.5	0.0	14.6	14.7	3.7	0.0	0.0
Cycle Q Clear(g_c), s	7.2	0.0	7.1	10.9	3.4	11.5	14.5	14.6	14.7	3.7	0.0	0.0
Prop In Lane	1.00		0.04	1.00		1.00	0.01		0.69	1.00		1.00
Lane Grp Cap(c), veh/h	317	0	478	237	260	221	1036	834	817	413	2332	1166
V/C Ratio(X)	0.40	0.00	0.29	0.52	0.24	0.75	0.39	0.40	0.40	0.35	0.22	0.12
Avail Cap(c_a), veh/h	346	0	646	335	407	346	1036	834	817	474	2332	1166
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.98	0.98
Uniform Delay (d), s/veh	36.3	0.0	33.0	47.1	43.8	47.3	15.4	15.4	15.4	9.0	0.0	0.0
Incr Delay (d2), s/veh	0.8	0.0	0.3	1.8	0.5	5.1	1.1	1.4	1.5	0.5	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.4	0.0	3.5	3.9	1.8	5.4	7.7	6.5	6.5	1.8	0.1	0.1
LnGrp Delay(d),s/veh	37.1	0.0	33.3	48.9	44.3	52.4	16.5	16.9	16.9	9.5	0.2	0.2
LnGrp LOS	D		C	D	D	D	B	B	B	A	A	A
Approach Vol, veh/h		266			352			1068			793	
Approach Delay, s/veh		35.2			49.7			16.7			1.9	
Approach LOS		D			D			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4	5	6		8
Phs Duration (G+Y+Rc), s		82.9	15.1	22.0	15.0	67.9		37.1
Change Period (Y+Rc), s		6.0	6.0	6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s		66.0	11.0	25.0	13.0	47.0		42.0
Max Q Clear Time (g_c+I1), s		2.0	9.2	13.5	5.7	16.7		9.1
Green Ext Time (p_c), s		16.2	0.1	1.6	0.2	13.2		2.1

Intersection Summary	
HCM 2010 Ctrl Delay	18.7
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	12	18	80	15	17	14	613	30	21	763	8
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1845	1845	1900	1845	1845	1900
Adj Flow Rate, veh/h	6	13	20	89	17	19	16	681	33	23	848	9
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	3	3	3	3	3	3
Cap, veh/h	114	196	241	396	77	63	345	1648	80	398	1720	18
Arrive On Green	0.28	0.28	0.28	0.28	0.28	0.28	0.48	0.48	0.48	0.48	0.48	0.48
Sat Flow, veh/h	117	697	856	977	273	224	636	3403	165	726	3553	38
Grp Volume(v), veh/h	39	0	0	125	0	0	16	350	364	23	418	439
Grp Sat Flow(s),veh/h/ln	1669	0	0	1474	0	0	636	1752	1816	726	1752	1838
Q Serve(g_s), s	0.0	0.0	0.0	2.4	0.0	0.0	0.9	6.6	6.6	1.1	8.3	8.3
Cycle Q Clear(g_c), s	0.9	0.0	0.0	3.2	0.0	0.0	9.2	6.6	6.6	7.7	8.3	8.3
Prop In Lane	0.15		0.51	0.71		0.15	1.00		0.09	1.00		0.02
Lane Grp Cap(c), veh/h	551	0	0	536	0	0	345	848	879	398	848	890
V/C Ratio(X)	0.07	0.00	0.00	0.23	0.00	0.00	0.05	0.41	0.41	0.06	0.49	0.49
Avail Cap(c_a), veh/h	949	0	0	891	0	0	670	1743	1806	769	1743	1828
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	13.5	0.0	0.0	14.3	0.0	0.0	12.1	8.5	8.5	11.0	9.0	9.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.2	0.0	0.0	0.1	0.3	0.3	0.1	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	1.4	0.0	0.0	0.2	3.2	3.3	0.2	4.1	4.2
LnGrp Delay(d),s/veh	13.6	0.0	0.0	14.6	0.0	0.0	12.1	8.9	8.8	11.1	9.4	9.4
LnGrp LOS	B			B			B	A	A	B	A	A
Approach Vol, veh/h		39			125			730			880	
Approach Delay, s/veh		13.6			14.6			8.9			9.4	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		30.8		20.5		30.8		20.5
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		51.0		27.0		51.0		27.0
Max Q Clear Time (g_c+I1), s		10.3		5.2		11.2		2.9
Green Ext Time (p_c), s		13.7		0.9		13.6		0.9

Intersection Summary	
HCM 2010 Ctrl Delay	9.7
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	6	8	13	51	18	30	20	936	60	19	563	9
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1845	1845	1900	1863	1863	1900
Adj Flow Rate, veh/h	7	9	14	57	20	33	22	1040	67	21	626	10
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	3	3	3	2	2	2
Cap, veh/h	132	160	188	261	98	114	477	1834	118	298	1955	31
Arrive On Green	0.25	0.25	0.25	0.25	0.25	0.25	0.55	0.55	0.55	0.55	0.55	0.55
Sat Flow, veh/h	226	649	766	682	399	463	781	3344	215	507	3565	57
Grp Volume(v), veh/h	30	0	0	110	0	0	22	545	562	21	311	325
Grp Sat Flow(s),veh/h/ln	1641	0	0	1544	0	0	781	1752	1807	507	1770	1853
Q Serve(g_s), s	0.0	0.0	0.0	1.3	0.0	0.0	0.9	11.9	11.9	1.7	5.6	5.6
Cycle Q Clear(g_c), s	0.8	0.0	0.0	3.1	0.0	0.0	6.5	11.9	11.9	13.5	5.6	5.6
Prop In Lane	0.23		0.47	0.52		0.30	1.00		0.12	1.00		0.03
Lane Grp Cap(c), veh/h	480	0	0	473	0	0	477	961	991	298	970	1016
V/C Ratio(X)	0.06	0.00	0.00	0.23	0.00	0.00	0.05	0.57	0.57	0.07	0.32	0.32
Avail Cap(c_a), veh/h	688	0	0	672	0	0	798	1682	1734	507	1699	1778
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.9	0.0	0.0	17.7	0.0	0.0	9.0	8.6	8.6	13.1	7.2	7.2
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.5	0.5	0.1	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	1.5	0.0	0.0	0.2	5.7	5.9	0.2	2.7	2.9
LnGrp Delay(d),s/veh	16.9	0.0	0.0	18.0	0.0	0.0	9.0	9.2	9.1	13.2	7.4	7.4
LnGrp LOS	B			B			A	A	A	B	A	A
Approach Vol, veh/h		30			110			1129			657	
Approach Delay, s/veh		16.9			18.0			9.2			7.6	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		38.0		20.3		38.0		20.3
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		56.0		22.0		56.0		22.0
Max Q Clear Time (g_c+I1), s		15.5		5.1		13.9		2.8
Green Ext Time (p_c), s		16.4		0.7		16.7		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	9.2
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	39	54	10	126	79	119	9	546	272	183	755	47
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1759	1900	1900	1827	1827	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	43	60	11	140	88	132	10	607	302	203	839	52
Adj No. of Lanes	0	2	0	0	1	1	1	2	1	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	8	8	8	4	4	4	3	3	3	3	3	3
Cap, veh/h	137	330	60	240	122	389	420	2062	922	543	2489	1114
Arrive On Green	0.25	0.25	0.25	0.25	0.25	0.25	1.00	1.00	1.00	0.07	0.71	0.71
Sat Flow, veh/h	314	1317	241	771	488	1553	616	3505	1568	1757	3505	1568
Grp Volume(v), veh/h	43	0	71	228	0	132	10	607	302	203	839	52
Grp Sat Flow(s),veh/h/ln	314	0	1558	1259	0	1553	616	1752	1568	1757	1752	1568
Q Serve(g_s), s	4.7	0.0	4.4	17.7	0.0	8.6	0.0	0.0	0.0	5.2	11.2	1.2
Cycle Q Clear(g_c), s	26.6	0.0	4.4	22.1	0.0	8.6	0.1	0.0	0.0	5.2	11.2	1.2
Prop In Lane	1.00		0.15	0.61		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	137	0	390	362	0	389	420	2062	922	543	2489	1114
V/C Ratio(X)	0.31	0.00	0.18	0.63	0.00	0.34	0.02	0.29	0.33	0.37	0.34	0.05
Avail Cap(c_a), veh/h	264	0	571	532	0	569	420	2062	922	729	2489	1114
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.97	0.00	0.97	0.94	0.94	0.94	0.89	0.89	0.89
Uniform Delay (d), s/veh	55.1	0.0	36.2	44.8	0.0	37.7	0.0	0.0	0.0	7.2	6.8	5.3
Incr Delay (d2), s/veh	1.3	0.0	0.2	1.7	0.0	0.5	0.1	0.3	0.9	0.4	0.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	0.0	1.9	7.4	0.0	3.7	0.0	0.1	0.2	2.5	5.5	0.5
LnGrp Delay(d),s/veh	56.4	0.0	36.4	46.5	0.0	38.2	0.1	0.3	0.9	7.6	7.1	5.4
LnGrp LOS	E		D	D		D	A	A	A	A	A	A
Approach Vol, veh/h		114			360			919			1094	
Approach Delay, s/veh		43.9			43.5			0.5			7.1	
Approach LOS		D			D			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		93.2		36.8	15.0	78.2		36.8
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s		73.0		45.0	22.0	45.0		45.0
Max Q Clear Time (g_c+I1), s		13.2		24.1	7.2	2.1		28.6
Green Ext Time (p_c), s		17.6		2.4	0.5	16.2		2.2

Intersection Summary	
HCM 2010 Ctrl Delay	11.6
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	27	48	27	183	90	256	24	751	178	88	500	38
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1792	1900	1900	1845	1845	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	30	53	30	203	100	284	27	834	198	98	556	42
Adj No. of Lanes	0	2	0	0	1	1	1	2	1	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	6	6	6	3	3	3	3	3	3	3	3	3
Cap, veh/h	113	299	182	305	126	472	494	1891	846	473	2309	1033
Arrive On Green	0.30	0.30	0.30	0.30	0.30	0.30	1.00	1.00	1.00	0.07	0.66	0.66
Sat Flow, veh/h	201	993	603	850	419	1568	809	3505	1568	1757	3505	1568
Grp Volume(v), veh/h	37	0	76	303	0	284	27	834	198	98	556	42
Grp Sat Flow(s),veh/h/ln	273	0	1525	1269	0	1568	809	1752	1568	1757	1752	1568
Q Serve(g_s), s	3.3	0.0	4.5	24.1	0.0	19.0	0.0	0.0	0.0	2.7	7.9	1.2
Cycle Q Clear(g_c), s	31.6	0.0	4.5	28.4	0.0	19.0	0.2	0.0	0.0	2.7	7.9	1.2
Prop In Lane	0.81		0.40	0.67		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	135	0	459	431	0	472	494	1891	846	473	2309	1033
V/C Ratio(X)	0.28	0.00	0.17	0.70	0.00	0.60	0.05	0.44	0.23	0.21	0.24	0.04
Avail Cap(c_a), veh/h	255	0	632	595	0	650	494	1891	846	506	2309	1033
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.88	0.00	0.88	0.90	0.90	0.90	0.96	0.96	0.96
Uniform Delay (d), s/veh	48.9	0.0	31.6	42.0	0.0	36.7	0.0	0.0	0.0	9.1	8.5	7.3
Incr Delay (d2), s/veh	1.1	0.0	0.2	2.0	0.0	1.1	0.2	0.7	0.6	0.2	0.2	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	1.9	9.8	0.0	8.3	0.0	0.2	0.1	1.3	3.9	0.5
LnGrp Delay(d),s/veh	50.0	0.0	31.8	44.0	0.0	37.8	0.2	0.7	0.6	9.3	8.7	7.4
LnGrp LOS	D		C	D		D	A	A	A	A	A	A
Approach Vol, veh/h		113			587			1059			696	
Approach Delay, s/veh		37.8			41.0			0.6			8.7	
Approach LOS		D			D			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		87.1		42.9	14.7	72.4		42.9
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s		67.0		51.0	11.0	50.0		51.0
Max Q Clear Time (g_c+I1), s		9.9		30.4	4.7	2.2		33.6
Green Ext Time (p_c), s		15.7		3.5	0.1	15.1		3.3

Intersection Summary	
HCM 2010 Ctrl Delay	14.3
HCM 2010 LOS	B

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	195	183	158	526	712	112
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1827	1827	1845	1845
Adj Flow Rate, veh/h	217	203	176	584	791	124
Adj No. of Lanes	1	1	1	2	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	4	4	3	3
Cap, veh/h	291	259	498	2344	2367	1059
Arrive On Green	0.17	0.17	0.90	0.90	0.90	0.90
Sat Flow, veh/h	1723	1538	596	3563	3597	1568
Grp Volume(v), veh/h	217	203	176	584	791	124
Grp Sat Flow(s),veh/h/ln	1723	1538	596	1736	1752	1568
Q Serve(g_s), s	7.5	7.9	4.4	1.4	2.1	0.6
Cycle Q Clear(g_c), s	7.5	7.9	6.5	1.4	2.1	0.6
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	291	259	498	2344	2367	1059
V/C Ratio(X)	0.75	0.78	0.35	0.25	0.33	0.12
Avail Cap(c_a), veh/h	412	367	498	2344	2367	1059
HCM Platoon Ratio	1.00	1.00	1.33	1.33	1.33	1.33
Upstream Filter(I)	0.92	0.92	0.80	0.80	0.95	0.95
Uniform Delay (d), s/veh	24.8	25.0	1.6	1.1	1.1	1.1
Incr Delay (d2), s/veh	4.2	6.4	1.6	0.2	0.4	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.9	3.8	0.9	0.6	1.1	0.3
LnGrp Delay(d),s/veh	29.0	31.4	3.2	1.3	1.5	1.3
LnGrp LOS	C	C	A	A	A	A
Approach Vol, veh/h	420			760	915	
Approach Delay, s/veh	30.2			1.7	1.5	
Approach LOS	C			A	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		48.4				48.4		16.6
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		38.0				38.0		15.0
Max Q Clear Time (g_c+I1), s		4.1				8.5		9.9
Green Ext Time (p_c), s		15.3				14.4		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	7.3
HCM 2010 LOS	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	186	128	232	776	563	149
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1845	1845	1845	1845
Adj Flow Rate, veh/h	207	142	258	862	626	166
Adj No. of Lanes	1	1	1	2	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	3	3	3	3
Cap, veh/h	267	239	581	2418	2418	1082
Arrive On Green	0.15	0.15	0.92	0.92	1.00	1.00
Sat Flow, veh/h	1740	1553	675	3597	3597	1568
Grp Volume(v), veh/h	207	142	258	862	626	166
Grp Sat Flow(s),veh/h/ln	1740	1553	675	1752	1752	1568
Q Serve(g_s), s	7.2	5.4	4.0	1.9	0.0	0.0
Cycle Q Clear(g_c), s	7.2	5.4	4.0	1.9	0.0	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	267	239	581	2418	2418	1082
V/C Ratio(X)	0.77	0.60	0.44	0.36	0.26	0.15
Avail Cap(c_a), veh/h	388	346	581	2418	2418	1082
HCM Platoon Ratio	1.00	1.00	1.33	1.33	2.00	2.00
Upstream Filter(I)	0.95	0.95	0.68	0.68	0.98	0.98
Uniform Delay (d), s/veh	25.5	24.8	1.0	0.9	0.0	0.0
Incr Delay (d2), s/veh	5.6	2.2	1.7	0.3	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.9	2.4	0.9	0.8	0.1	0.1
LnGrp Delay(d),s/veh	31.1	27.0	2.6	1.2	0.3	0.3
LnGrp LOS	C	C	A	A	A	A
Approach Vol, veh/h	349			1120	792	
Approach Delay, s/veh	29.4			1.5	0.3	
Approach LOS	C			A	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		49.3				49.3		15.7
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		39.0				39.0		14.0
Max Q Clear Time (g_c+I1), s		2.0				6.0		9.2
Green Ext Time (p_c), s		18.5				17.5		0.5

Intersection Summary	
HCM 2010 Ctrl Delay	5.4
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	363	748	221	37	375	51	89	320	17	101	521	268
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1900	1827	1827	1900	1810	1810	1900	1827	1827	1827
Adj Flow Rate, veh/h	403	831	246	41	417	57	99	356	19	112	579	298
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	4	4	4	5	5	5	4	4	4
Cap, veh/h	469	1169	346	155	598	81	388	1703	91	446	1365	927
Arrive On Green	0.20	0.45	0.45	0.19	0.19	0.19	0.14	1.00	1.00	0.79	0.79	0.79
Sat Flow, veh/h	1723	2617	774	512	3072	417	1723	3321	177	984	3471	1553
Grp Volume(v), veh/h	403	546	531	41	235	239	99	184	191	112	579	298
Grp Sat Flow(s),veh/h/ln	1723	1719	1673	512	1736	1753	1723	1719	1778	984	1736	1553
Q Serve(g_s), s	22.0	31.6	31.7	8.7	15.5	15.7	3.8	0.0	0.0	3.9	6.6	5.4
Cycle Q Clear(g_c), s	22.0	31.6	31.7	9.4	15.5	15.7	3.8	0.0	0.0	3.9	6.6	5.4
Prop In Lane	1.00		0.46	1.00		0.24	1.00		0.10	1.00		1.00
Lane Grp Cap(c), veh/h	469	768	747	155	338	341	388	882	912	446	1365	927
V/C Ratio(X)	0.86	0.71	0.71	0.26	0.69	0.70	0.25	0.21	0.21	0.25	0.42	0.32
Avail Cap(c_a), veh/h	623	965	939	168	381	385	393	882	912	446	1365	927
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	0.66	0.66	0.66	0.97	0.97	0.97	0.99	0.99	0.99	0.93	0.93	0.93
Uniform Delay (d), s/veh	29.7	27.6	27.6	43.9	46.1	46.2	16.6	0.0	0.0	8.4	8.7	3.9
Incr Delay (d2), s/veh	6.3	1.2	1.2	0.9	4.5	4.7	0.3	0.5	0.5	1.3	0.9	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.1	15.3	14.9	1.3	7.8	8.0	1.8	0.1	0.1	1.2	3.1	2.3
LnGrp Delay(d),s/veh	36.0	28.8	28.8	44.8	50.6	50.9	16.9	0.5	0.5	9.6	9.6	4.8
LnGrp LOS	D	C	C	D	D	D	B	A	A	A	A	A
Approach Vol, veh/h		1480			515			474			989	
Approach Delay, s/veh		30.7			50.3			4.0			8.1	
Approach LOS		C			D			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6		8
Phs Duration (G+Y+Rc), s	14.7	54.4	31.0	29.9		69.1		60.9
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s	9.0	34.0	36.0	27.0		49.0		69.0
Max Q Clear Time (g_c+I1), s	5.8	8.6	24.0	17.7		2.0		33.7
Green Ext Time (p_c), s	0.1	8.6	1.0	6.3		9.8		13.9

Intersection Summary	
HCM 2010 Ctrl Delay	23.5
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	365	417	107	29	728	105	248	508	48	68	353	291
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1900	1827	1827	1900	1827	1827	1900	1845	1845	1845
Adj Flow Rate, veh/h	406	463	119	32	809	117	276	564	53	76	392	323
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	3	3	3
Cap, veh/h	434	1491	380	294	889	129	370	1234	116	218	713	640
Arrive On Green	0.20	0.54	0.54	0.29	0.29	0.29	0.27	0.77	0.77	0.34	0.34	0.34
Sat Flow, veh/h	1740	2740	699	813	3045	440	1740	3209	301	795	3505	1568
Grp Volume(v), veh/h	406	292	290	32	461	465	276	305	312	76	392	323
Grp Sat Flow(s),veh/h/ln	1740	1736	1704	813	1736	1749	1740	1736	1774	795	1752	1568
Q Serve(g_s), s	23.3	11.7	11.9	3.7	32.5	32.6	16.1	7.9	8.0	9.5	11.5	19.6
Cycle Q Clear(g_c), s	23.3	11.7	11.9	3.7	32.5	32.6	16.1	7.9	8.0	9.5	11.5	19.6
Prop In Lane	1.00		0.41	1.00		0.25	1.00		0.17	1.00		1.00
Lane Grp Cap(c), veh/h	434	944	927	294	507	511	370	667	682	218	713	640
V/C Ratio(X)	0.94	0.31	0.31	0.11	0.91	0.91	0.75	0.46	0.46	0.35	0.55	0.50
Avail Cap(c_a), veh/h	502	1024	1005	300	519	523	370	667	682	218	713	640
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.67	1.67	1.67
Upstream Filter(I)	0.91	0.91	0.91	0.76	0.76	0.76	0.97	0.97	0.97	0.96	0.96	0.96
Uniform Delay (d), s/veh	35.2	15.9	15.9	33.1	43.4	43.4	27.8	9.9	10.0	36.6	37.2	23.2
Incr Delay (d2), s/veh	21.8	0.2	0.2	0.1	16.0	15.9	7.7	2.2	2.1	4.2	2.9	2.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.6	5.6	5.6	0.8	17.9	18.0	8.4	4.0	4.1	2.3	5.8	8.9
LnGrp Delay(d),s/veh	57.1	16.0	16.1	33.3	59.3	59.2	35.5	12.1	12.1	40.7	40.1	26.0
LnGrp LOS	E	B	B	C	E	E	D	B	B	D	D	C
Approach Vol, veh/h		988			958			893			791	
Approach Delay, s/veh		32.9			58.4			19.3			34.4	
Approach LOS		C			E			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6		8
Phs Duration (G+Y+Rc), s	23.0	31.9	32.0	43.1		54.9		75.1
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s	17.0	20.0	31.0	38.0		43.0		75.0
Max Q Clear Time (g_c+I1), s	18.1	21.6	25.3	34.6		10.0		13.9
Green Ext Time (p_c), s	0.0	0.0	0.7	2.6		9.7		14.1

Intersection Summary	
HCM 2010 Ctrl Delay	36.6
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	15	52	112	15	45	123	25	281	17	93	550	37
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1776	1900	1845	1845	1900	1810	1810	1810
Adj Flow Rate, veh/h	17	58	124	17	50	137	28	312	19	103	611	41
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	7	7	7	3	3	3	5	5	5
Cap, veh/h	47	91	172	46	74	176	633	2488	151	918	2988	1337
Arrive On Green	0.16	0.16	0.16	0.16	0.16	0.16	0.74	0.74	0.74	0.15	1.00	1.00
Sat Flow, veh/h	80	558	1055	74	453	1077	769	3358	204	1723	3438	1538
Grp Volume(v), veh/h	199	0	0	204	0	0	28	162	169	103	611	41
Grp Sat Flow(s),veh/h/ln	1693	0	0	1604	0	0	769	1752	1809	1723	1719	1538
Q Serve(g_s), s	0.0	0.0	0.0	1.1	0.0	0.0	1.1	3.0	3.0	1.2	0.0	0.0
Cycle Q Clear(g_c), s	12.5	0.0	0.0	13.7	0.0	0.0	1.1	3.0	3.0	1.2	0.0	0.0
Prop In Lane	0.09		0.62	0.08		0.67	1.00		0.11	1.00		1.00
Lane Grp Cap(c), veh/h	310	0	0	296	0	0	633	1298	1340	918	2988	1337
V/C Ratio(X)	0.64	0.00	0.00	0.69	0.00	0.00	0.04	0.12	0.13	0.11	0.20	0.03
Avail Cap(c_a), veh/h	751	0	0	714	0	0	633	1298	1340	1104	2988	1337
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	0.97	0.00	0.00	1.00	1.00	1.00	0.87	0.87	0.87
Uniform Delay (d), s/veh	45.4	0.0	0.0	45.8	0.0	0.0	4.0	4.2	4.2	1.6	0.0	0.0
Incr Delay (d2), s/veh	2.2	0.0	0.0	2.8	0.0	0.0	0.1	0.2	0.2	0.0	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.2	0.0	0.0	6.4	0.0	0.0	0.3	1.5	1.6	0.5	0.1	0.0
LnGrp Delay(d),s/veh	47.6	0.0	0.0	48.6	0.0	0.0	4.1	4.4	4.4	1.7	0.1	0.0
LnGrp LOS	D			D			A	A	A	A	A	A
Approach Vol, veh/h		199			204			359			755	
Approach Delay, s/veh		47.6			48.6			4.4			0.3	
Approach LOS		D			D			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		105.4		24.6	14.7	90.7		24.6
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s		68.0		50.0	21.0	41.0		50.0
Max Q Clear Time (g_c+I1), s		2.0		15.7	3.2	5.0		14.5
Green Ext Time (p_c), s		7.8		3.0	0.2	7.4		3.0

Intersection Summary	
HCM 2010 Ctrl Delay	14.0
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	64	53	48	14	61	157	71	533	28	92	348	52
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1810	1900	1845	1845	1900	1827	1827	1827
Adj Flow Rate, veh/h	71	59	53	16	68	174	79	592	31	102	387	58
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	5	5	5	3	3	3	4	4	4
Cap, veh/h	115	94	68	43	97	224	677	2243	117	649	2724	1219
Arrive On Green	0.20	0.20	0.20	0.20	0.20	0.20	0.66	0.66	0.66	0.15	1.00	1.00
Sat Flow, veh/h	364	467	339	54	482	1110	932	3389	177	1740	3471	1553
Grp Volume(v), veh/h	183	0	0	258	0	0	79	306	317	102	387	58
Grp Sat Flow(s),veh/h/ln	1170	0	0	1647	0	0	932	1752	1813	1740	1736	1553
Q Serve(g_s), s	1.5	0.0	0.0	0.0	0.0	0.0	3.7	8.5	8.6	1.8	0.0	0.0
Cycle Q Clear(g_c), s	19.1	0.0	0.0	17.6	0.0	0.0	3.7	8.5	8.6	1.8	0.0	0.0
Prop In Lane	0.39		0.29	0.06		0.67	1.00		0.10	1.00		1.00
Lane Grp Cap(c), veh/h	278	0	0	365	0	0	677	1160	1200	649	2724	1219
V/C Ratio(X)	0.66	0.00	0.00	0.71	0.00	0.00	0.12	0.26	0.26	0.16	0.14	0.05
Avail Cap(c_a), veh/h	528	0	0	639	0	0	677	1160	1200	741	2724	1219
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	0.98	0.00	0.00	1.00	1.00	1.00	0.76	0.76	0.76
Uniform Delay (d), s/veh	45.0	0.0	0.0	45.2	0.0	0.0	7.5	8.3	8.3	4.1	0.0	0.0
Incr Delay (d2), s/veh	2.6	0.0	0.0	2.5	0.0	0.0	0.4	0.6	0.5	0.1	0.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.0	0.0	0.0	8.3	0.0	0.0	1.0	4.3	4.4	0.8	0.0	0.0
LnGrp Delay(d),s/veh	47.6	0.0	0.0	47.7	0.0	0.0	7.8	8.8	8.8	4.2	0.1	0.1
LnGrp LOS	D			D			A	A	A	A	A	A
Approach Vol, veh/h		183			258			702			547	
Approach Delay, s/veh		47.6			47.7			8.7			0.8	
Approach LOS		D			D			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		99.8		30.2	14.7	85.1		30.2
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s		73.0		45.0	15.0	52.0		45.0
Max Q Clear Time (g_c+I1), s		2.0		19.6	3.8	10.6		21.1
Green Ext Time (p_c), s		8.7		3.2	0.2	8.4		3.1

Intersection Summary	
HCM 2010 Ctrl Delay	16.3
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	2.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	0	220	139	19	356	340
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	250	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	5	5	2	2	3	3
Mvmt Flow	0	244	154	21	396	378

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1145	88	0	0	176	0
Stage 1	165	-	-	-	-	-
Stage 2	980	-	-	-	-	-
Critical Hdwy	6.9	7	-	-	4.16	-
Critical Hdwy Stg 1	5.9	-	-	-	-	-
Critical Hdwy Stg 2	5.9	-	-	-	-	-
Follow-up Hdwy	3.55	3.35	-	-	2.23	-
Pot Cap-1 Maneuver	189	943	-	-	1390	-
Stage 1	838	-	-	-	-	-
Stage 2	317	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	135	943	-	-	1390	-
Mov Cap-2 Maneuver	197	-	-	-	-	-
Stage 1	838	-	-	-	-	-
Stage 2	227	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.1		
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	943	1390	-
HCM Lane V/C Ratio	-	-	0.259	0.285	-
HCM Control Delay (s)	-	-	10.1	8.6	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	1	1	-

Intersection	
Int Delay, s/veh	4.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	0	339	296	28	233	146
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	250	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	4	4	2	2	3	3
Mvmt Flow	0	377	329	31	259	162

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	943	180	0	0	360	0
Stage 1	344	-	-	-	-	-
Stage 2	599	-	-	-	-	-
Critical Hdwy	6.88	6.98	-	-	4.16	-
Critical Hdwy Stg 1	5.88	-	-	-	-	-
Critical Hdwy Stg 2	5.88	-	-	-	-	-
Follow-up Hdwy	3.54	3.34	-	-	2.23	-
Pot Cap-1 Maneuver	257	826	-	-	1188	-
Stage 1	683	-	-	-	-	-
Stage 2	506	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	201	826	-	-	1188	-
Mov Cap-2 Maneuver	310	-	-	-	-	-
Stage 1	683	-	-	-	-	-
Stage 2	396	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13		
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	826	1188	-
HCM Lane V/C Ratio	-	-	0.456	0.218	-
HCM Control Delay (s)	-	-	13	8.9	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	2	1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	4	54	5	28	5	24	4	176	6	66	318	4
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1863	1776	1776	1776	1810	1810	1900
Adj Flow Rate, veh/h	4	60	6	31	6	27	4	196	7	73	353	4
Adj No. of Lanes	0	1	0	0	1	1	1	1	1	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	7	7	7	5	5	5
Cap, veh/h	103	505	48	518	86	487	418	702	597	544	706	8
Arrive On Green	0.31	0.31	0.31	0.31	0.31	0.31	0.40	0.40	0.40	0.40	0.40	0.40
Sat Flow, veh/h	28	1640	156	1151	281	1583	973	1776	1509	1141	1786	20
Grp Volume(v), veh/h	70	0	0	37	0	27	4	196	7	73	0	357
Grp Sat Flow(s),veh/h/ln	1825	0	0	1432	0	1583	973	1776	1509	1141	0	1806
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.5	0.1	3.0	0.1	1.9	0.0	6.0
Cycle Q Clear(g_c), s	1.1	0.0	0.0	0.6	0.0	0.5	6.1	3.0	0.1	4.9	0.0	6.0
Prop In Lane	0.06		0.09	0.84		1.00	1.00		1.00	1.00		0.01
Lane Grp Cap(c), veh/h	656	0	0	604	0	487	418	702	597	544	0	714
V/C Ratio(X)	0.11	0.00	0.00	0.06	0.00	0.06	0.01	0.28	0.01	0.13	0.00	0.50
Avail Cap(c_a), veh/h	903	0	0	796	0	705	754	1317	1119	939	0	1339
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.1	0.0	0.0	9.9	0.0	9.9	11.5	8.3	7.4	10.0	0.0	9.2
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	0.3	0.0	0.2	0.0	1.5	0.0	0.6	0.0	3.1
LnGrp Delay(d),s/veh	10.1	0.0	0.0	9.9	0.0	9.9	11.5	8.5	7.4	10.1	0.0	9.8
LnGrp LOS	B			A		A	B	A	A	B		A
Approach Vol, veh/h		70			64			207			430	
Approach Delay, s/veh		10.1			9.9			8.5			9.8	
Approach LOS		B			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		22.0		18.4		22.0		18.4
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		30.0		18.0		30.0		18.0
Max Q Clear Time (g_c+I1), s		8.0		2.6		8.1		3.1
Green Ext Time (p_c), s		3.6		0.5		3.6		0.5

Intersection Summary	
HCM 2010 Ctrl Delay	9.5
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	4	7	4	9	27	48	4	294	21	29	224	4
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1863	1810	1810	1810	1827	1827	1900
Adj Flow Rate, veh/h	4	8	4	10	30	53	4	327	23	32	249	4
Adj No. of Lanes	0	1	0	0	1	1	1	1	1	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	5	5	5	4	4	4
Cap, veh/h	181	295	120	185	436	450	526	740	629	465	734	12
Arrive On Green	0.28	0.28	0.28	0.28	0.28	0.28	0.41	0.41	0.41	0.41	0.41	0.41
Sat Flow, veh/h	230	1038	423	245	1537	1583	1090	1810	1538	1007	1793	29
Grp Volume(v), veh/h	16	0	0	40	0	53	4	327	23	32	0	253
Grp Sat Flow(s),veh/h/ln	1691	0	0	1781	0	1583	1090	1810	1538	1007	0	1822
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	1.0	0.1	5.1	0.4	0.9	0.0	3.7
Cycle Q Clear(g_c), s	0.3	0.0	0.0	0.6	0.0	1.0	3.8	5.1	0.4	6.0	0.0	3.7
Prop In Lane	0.25		0.25	0.25		1.00	1.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	595	0	0	621	0	450	526	740	629	465	0	745
V/C Ratio(X)	0.03	0.00	0.00	0.06	0.00	0.12	0.01	0.44	0.04	0.07	0.00	0.34
Avail Cap(c_a), veh/h	922	0	0	968	0	769	889	1342	1141	800	0	1351
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.1	0.0	0.0	10.2	0.0	10.4	9.2	8.3	6.9	10.5	0.0	7.9
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.4	0.0	0.1	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0	0.3	0.0	0.4	0.0	2.6	0.2	0.3	0.0	1.9
LnGrp Delay(d),s/veh	10.1	0.0	0.0	10.3	0.0	10.5	9.2	8.7	7.0	10.6	0.0	8.2
LnGrp LOS	B			B		B	A	A	A	B		A
Approach Vol, veh/h		16			93			354			285	
Approach Delay, s/veh		10.1			10.4			8.6			8.5	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		22.0		17.1		22.0		17.1
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		29.0		19.0		29.0		19.0
Max Q Clear Time (g_c+I1), s		8.0		3.0		7.1		2.3
Green Ext Time (p_c), s		3.6		0.3		3.6		0.4

Intersection Summary	
HCM 2010 Ctrl Delay	8.8
HCM 2010 LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	9	9	180	6	12	336
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1638	1638	1810	1900	1776	1776
Adj Flow Rate, veh/h	10	10	200	7	13	373
Adj No. of Lanes	2	1	2	0	1	2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	16	16	5	5	7	7
Cap, veh/h	140	64	1848	64	821	1839
Arrive On Green	0.05	0.05	0.55	0.55	0.55	0.55
Sat Flow, veh/h	3026	1392	3480	118	1115	3463
Grp Volume(v), veh/h	10	10	101	106	13	373
Grp Sat Flow(s),veh/h/ln	1513	1392	1719	1789	1115	1687
Q Serve(g_s), s	0.1	0.2	0.8	0.8	0.2	1.7
Cycle Q Clear(g_c), s	0.1	0.2	0.8	0.8	1.0	1.7
Prop In Lane	1.00	1.00		0.07	1.00	
Lane Grp Cap(c), veh/h	140	64	937	975	821	1839
V/C Ratio(X)	0.07	0.16	0.11	0.11	0.02	0.20
Avail Cap(c_a), veh/h	1650	759	1874	1950	1429	3678
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	13.4	13.5	3.2	3.2	3.5	3.4
Incr Delay (d2), s/veh	0.2	1.1	0.1	0.0	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.1	0.4	0.4	0.1	0.7
LnGrp Delay(d),s/veh	13.6	14.6	3.3	3.3	3.5	3.5
LnGrp LOS	B	B	A	A	A	A
Approach Vol, veh/h	20		207			386
Approach Delay, s/veh	14.1		3.3			3.5
Approach LOS	B		A			A

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		22.0				22.0		7.4
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		32.0				32.0		16.0
Max Q Clear Time (g_c+I1), s		2.8				3.7		2.2
Green Ext Time (p_c), s		3.8				3.8		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	3.8
HCM 2010 LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	6	7	317	13	10	231
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1696	1696	1827	1900	1810	1810
Adj Flow Rate, veh/h	7	8	352	14	11	257
Adj No. of Lanes	2	1	2	0	1	2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	12	12	4	4	5	5
Cap, veh/h	111	51	1876	74	739	1895
Arrive On Green	0.04	0.04	0.55	0.55	0.55	0.55
Sat Flow, veh/h	3134	1442	3495	135	983	3529
Grp Volume(v), veh/h	7	8	179	187	11	257
Grp Sat Flow(s),veh/h/ln	1567	1442	1736	1803	983	1719
Q Serve(g_s), s	0.1	0.2	1.5	1.5	0.2	1.1
Cycle Q Clear(g_c), s	0.1	0.2	1.5	1.5	1.7	1.1
Prop In Lane	1.00	1.00		0.07	1.00	
Lane Grp Cap(c), veh/h	111	51	957	994	739	1895
V/C Ratio(X)	0.06	0.16	0.19	0.19	0.01	0.14
Avail Cap(c_a), veh/h	1620	745	1973	2050	1315	3909
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	13.5	13.6	3.3	3.3	3.7	3.2
Incr Delay (d2), s/veh	0.2	1.4	0.1	0.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.1	0.7	0.8	0.0	0.5
LnGrp Delay(d),s/veh	13.8	15.0	3.4	3.4	3.7	3.2
LnGrp LOS	B	B	A	A	A	A
Approach Vol, veh/h	15		366			268
Approach Delay, s/veh	14.4		3.4			3.2
Approach LOS	B		A			A

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		22.0				22.0		7.0
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		33.0				33.0		15.0
Max Q Clear Time (g_c+I1), s		3.5				3.7		2.2
Green Ext Time (p_c), s		4.0				4.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	3.5
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	157	77	18	88	11	34	55	47	12	110	12
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1900	1759	1759	1900	1624	1624	1900	1863	1863	1900
Adj Flow Rate, veh/h	6	174	86	20	98	12	38	61	52	13	122	13
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	8	8	8	17	17	17	2	2	2
Cap, veh/h	517	349	173	401	713	87	412	249	212	457	507	54
Arrive On Green	0.31	0.31	0.31	0.04	0.46	0.46	0.31	0.31	0.31	0.31	0.31	0.31
Sat Flow, veh/h	1241	1144	566	1675	1538	188	1089	811	691	1275	1655	176
Grp Volume(v), veh/h	6	0	260	20	0	110	38	0	113	13	0	135
Grp Sat Flow(s),veh/h/ln	1241	0	1710	1675	0	1726	1089	0	1502	1275	0	1832
Q Serve(g_s), s	0.2	0.0	6.5	0.4	0.0	1.9	1.4	0.0	2.9	0.4	0.0	2.9
Cycle Q Clear(g_c), s	0.2	0.0	6.5	0.4	0.0	1.9	4.3	0.0	2.9	3.3	0.0	2.9
Prop In Lane	1.00		0.33	1.00		0.11	1.00		0.46	1.00		0.10
Lane Grp Cap(c), veh/h	517	0	522	401	0	800	412	0	460	457	0	561
V/C Ratio(X)	0.01	0.00	0.50	0.05	0.00	0.14	0.09	0.00	0.25	0.03	0.00	0.24
Avail Cap(c_a), veh/h	1018	0	1212	681	0	1786	579	0	691	652	0	842
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.7	0.0	14.9	10.6	0.0	8.0	15.2	0.0	13.6	14.8	0.0	13.5
Incr Delay (d2), s/veh	0.0	0.0	0.7	0.1	0.0	0.1	0.1	0.0	0.3	0.0	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	3.1	0.2	0.0	0.9	0.4	0.0	1.3	0.1	0.0	1.5
LnGrp Delay(d),s/veh	12.7	0.0	15.6	10.7	0.0	8.1	15.3	0.0	13.8	14.9	0.0	13.8
LnGrp LOS	B		B	B		A	B		B	B		B
Approach Vol, veh/h		266			130			151			148	
Approach Delay, s/veh		15.5			8.5			14.2			13.9	
Approach LOS		B			A			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	8.3	21.9		22.0		30.2		22.0
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s	11.0	37.0		24.0		54.0		24.0
Max Q Clear Time (g_c+I1), s	2.4	8.5		5.3		3.9		6.3
Green Ext Time (p_c), s	0.0	2.4		1.5		2.5		1.5

Intersection Summary	
HCM 2010 Ctrl Delay	13.6
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	7	94	55	38	172	16	60	114	47	9	49	5
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1900	1792	1792	1900	1681	1681	1900	1863	1863	1900
Adj Flow Rate, veh/h	8	104	61	42	191	18	67	127	52	10	54	6
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	6	6	6	13	13	13	2	2	2
Cap, veh/h	470	318	187	522	779	73	461	335	137	381	487	54
Arrive On Green	0.29	0.29	0.29	0.08	0.48	0.48	0.30	0.30	0.30	0.30	0.30	0.30
Sat Flow, veh/h	1146	1081	634	1707	1614	152	1207	1135	465	1200	1647	183
Grp Volume(v), veh/h	8	0	165	42	0	209	67	0	179	10	0	60
Grp Sat Flow(s),veh/h/ln	1146	0	1715	1707	0	1766	1207	0	1599	1200	0	1830
Q Serve(g_s), s	0.3	0.0	4.1	0.8	0.0	3.8	2.3	0.0	4.8	0.4	0.0	1.3
Cycle Q Clear(g_c), s	0.3	0.0	4.1	0.8	0.0	3.8	3.6	0.0	4.8	5.2	0.0	1.3
Prop In Lane	1.00		0.37	1.00		0.09	1.00		0.29	1.00		0.10
Lane Grp Cap(c), veh/h	470	0	505	522	0	853	461	0	472	381	0	541
V/C Ratio(X)	0.02	0.00	0.33	0.08	0.00	0.25	0.15	0.00	0.38	0.03	0.00	0.11
Avail Cap(c_a), veh/h	746	0	918	799	0	1565	773	0	886	691	0	1014
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.6	0.0	14.9	10.0	0.0	8.2	15.2	0.0	15.1	17.2	0.0	13.9
Incr Delay (d2), s/veh	0.0	0.0	0.4	0.1	0.0	0.1	0.1	0.0	0.5	0.0	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	2.0	0.4	0.0	1.8	0.8	0.0	2.2	0.1	0.0	0.7
LnGrp Delay(d),s/veh	13.6	0.0	15.3	10.1	0.0	8.4	15.4	0.0	15.6	17.2	0.0	14.0
LnGrp LOS	B		B	B		A	B		B	B		B
Approach Vol, veh/h		173			251			246			70	
Approach Delay, s/veh		15.2			8.6			15.6			14.5	
Approach LOS		B			A			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	10.2	21.9		22.0		32.2		22.0
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s	13.0	29.0		30.0		48.0		30.0
Max Q Clear Time (g_c+I1), s	2.8	6.1		7.2		5.8		6.8
Green Ext Time (p_c), s	0.0	2.3		1.7		2.5		1.7

Intersection Summary	
HCM 2010 Ctrl Delay	13.0
HCM 2010 LOS	B

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	185	244	123	215	355	151
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1743	1743	1759	1759
Adj Flow Rate, veh/h	206	271	137	239	394	168
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	9	9	8	8
Cap, veh/h	412	368	425	813	821	698
Arrive On Green	0.24	0.24	0.47	0.47	0.47	0.47
Sat Flow, veh/h	1740	1553	790	1743	1759	1495
Grp Volume(v), veh/h	206	271	137	239	394	168
Grp Sat Flow(s),veh/h/ln	1740	1553	790	1743	1759	1495
Q Serve(g_s), s	4.1	6.5	5.8	3.4	6.2	2.7
Cycle Q Clear(g_c), s	4.1	6.5	12.1	3.4	6.2	2.7
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	412	368	425	813	821	698
V/C Ratio(X)	0.50	0.74	0.32	0.29	0.48	0.24
Avail Cap(c_a), veh/h	731	653	662	1336	1348	1146
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	13.4	14.3	11.6	6.7	7.4	6.5
Incr Delay (d2), s/veh	0.9	2.9	0.4	0.2	0.4	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	3.1	1.3	1.6	3.1	1.2
LnGrp Delay(d),s/veh	14.3	17.2	12.0	6.9	7.9	6.7
LnGrp LOS	B	B	B	A	A	A
Approach Vol, veh/h	477			376	562	
Approach Delay, s/veh	15.9			8.7	7.5	
Approach LOS	B			A	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		24.9				24.9		15.6
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		31.0				31.0		17.0
Max Q Clear Time (g_c+I1), s		8.2				14.1		8.5
Green Ext Time (p_c), s		5.3				4.8		1.1

Intersection Summary	
HCM 2010 Ctrl Delay	10.7
HCM 2010 LOS	B

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	179	145	289	421	254	219
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1792	1792	1792	1792
Adj Flow Rate, veh/h	199	161	321	468	282	243
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	6	6	6	6
Cap, veh/h	326	291	557	1013	1013	861
Arrive On Green	0.19	0.19	0.57	0.57	0.57	0.57
Sat Flow, veh/h	1757	1568	841	1792	1792	1524
Grp Volume(v), veh/h	199	161	321	468	282	243
Grp Sat Flow(s),veh/h/ln	1757	1568	841	1792	1792	1524
Q Serve(g_s), s	5.0	4.5	15.3	7.4	3.9	4.0
Cycle Q Clear(g_c), s	5.0	4.5	19.2	7.4	3.9	4.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	326	291	557	1013	1013	861
V/C Ratio(X)	0.61	0.55	0.58	0.46	0.28	0.28
Avail Cap(c_a), veh/h	511	456	675	1266	1266	1076
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	18.0	17.8	10.4	6.2	5.4	5.4
Incr Delay (d2), s/veh	1.9	1.6	0.9	0.3	0.1	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	2.1	3.6	3.7	1.9	1.7
LnGrp Delay(d),s/veh	19.9	19.4	11.3	6.5	5.5	5.6
LnGrp LOS	B	B	B	A	A	A
Approach Vol, veh/h	360			789	525	
Approach Delay, s/veh	19.7			8.4	5.6	
Approach LOS	B			A	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		33.2				33.2		14.9
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		34.0				34.0		14.0
Max Q Clear Time (g_c+I1), s		6.0				21.2		7.0
Green Ext Time (p_c), s		8.5				6.0		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	10.0
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	104	694	82	76	347	27	44	269	59	22	509	85
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1900	1759	1759	1759	1827	1827	1900	1743	1743	1743
Adj Flow Rate, veh/h	116	771	91	84	386	30	49	299	66	24	566	94
Adj No. of Lanes	1	2	0	1	2	1	1	1	0	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	8	8	8	4	4	4	9	9	9
Cap, veh/h	378	883	104	220	930	416	217	555	122	346	630	536
Arrive On Green	0.08	0.28	0.28	0.08	0.28	0.28	0.06	0.38	0.38	0.04	0.36	0.36
Sat Flow, veh/h	1740	3128	369	1675	3343	1495	1740	1450	320	1660	1743	1482
Grp Volume(v), veh/h	116	428	434	84	386	30	49	0	365	24	566	94
Grp Sat Flow(s),veh/h/ln	1740	1736	1762	1675	1671	1495	1740	0	1770	1660	1743	1482
Q Serve(g_s), s	5.1	25.9	25.9	3.8	10.4	1.6	1.8	0.0	17.7	1.0	33.9	4.8
Cycle Q Clear(g_c), s	5.1	25.9	25.9	3.8	10.4	1.6	1.8	0.0	17.7	1.0	33.9	4.8
Prop In Lane	1.00		0.21	1.00		1.00	1.00		0.18	1.00		1.00
Lane Grp Cap(c), veh/h	378	490	497	220	930	416	217	0	677	346	630	536
V/C Ratio(X)	0.31	0.87	0.87	0.38	0.41	0.07	0.23	0.00	0.54	0.07	0.90	0.18
Avail Cap(c_a), veh/h	382	519	527	231	1000	447	248	0	722	411	711	605
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.9	37.7	37.7	27.7	32.5	29.3	24.3	0.0	26.5	21.0	33.3	24.0
Incr Delay (d2), s/veh	0.5	14.6	14.5	1.1	0.3	0.1	0.5	0.0	0.7	0.1	13.3	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.5	14.3	14.5	1.8	4.8	0.7	0.9	0.0	8.7	0.4	18.5	2.0
LnGrp Delay(d),s/veh	25.4	52.3	52.2	28.8	32.8	29.4	24.9	0.0	27.2	21.1	46.6	24.2
LnGrp LOS	C	D	D	C	C	C	C		C	C	D	C
Approach Vol, veh/h		978			500			414			684	
Approach Delay, s/veh		49.1			31.9			26.9			42.6	
Approach LOS		D			C			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.0	45.9	14.7	36.7	10.7	48.2	14.3	37.1
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	9.0	45.0	9.0	33.0	9.0	45.0	9.0	33.0
Max Q Clear Time (g_c+I1), s	3.8	35.9	7.1	12.4	3.0	19.7	5.8	27.9
Green Ext Time (p_c), s	0.0	4.0	0.0	8.3	0.0	6.5	0.0	3.2

Intersection Summary	
HCM 2010 Ctrl Delay	40.5
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	162	353	43	150	611	35	110	464	89	49	236	168
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1900	1792	1792	1792	1845	1845	1900	1792	1792	1792
Adj Flow Rate, veh/h	180	392	48	167	679	39	122	516	99	54	262	187
Adj No. of Lanes	1	2	0	1	2	1	1	1	0	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	6	6	6	3	3	3	6	6	6
Cap, veh/h	265	749	91	341	806	360	448	575	110	225	660	561
Arrive On Green	0.10	0.24	0.24	0.09	0.24	0.24	0.08	0.38	0.38	0.07	0.37	0.37
Sat Flow, veh/h	1740	3116	379	1707	3406	1524	1757	1505	289	1707	1792	1524
Grp Volume(v), veh/h	180	217	223	167	679	39	122	0	615	54	262	187
Grp Sat Flow(s),veh/h/ln	1740	1736	1760	1707	1703	1524	1757	0	1794	1707	1792	1524
Q Serve(g_s), s	8.4	11.9	12.0	8.0	20.8	2.2	4.5	0.0	35.2	2.0	11.8	9.7
Cycle Q Clear(g_c), s	8.4	11.9	12.0	8.0	20.8	2.2	4.5	0.0	35.2	2.0	11.8	9.7
Prop In Lane	1.00		0.22	1.00		1.00	1.00		0.16	1.00		1.00
Lane Grp Cap(c), veh/h	265	417	423	341	806	360	448	0	685	225	660	561
V/C Ratio(X)	0.68	0.52	0.53	0.49	0.84	0.11	0.27	0.00	0.90	0.24	0.40	0.33
Avail Cap(c_a), veh/h	274	429	435	372	873	391	452	0	789	253	788	670
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	29.8	36.0	36.1	28.1	39.7	32.7	18.6	0.0	31.7	23.6	25.5	24.9
Incr Delay (d2), s/veh	6.3	1.1	1.1	1.1	7.1	0.1	0.3	0.0	12.0	0.5	0.4	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.5	5.8	5.9	3.9	10.5	0.9	2.2	0.0	19.7	1.0	5.9	4.1
LnGrp Delay(d),s/veh	36.1	37.1	37.2	29.2	46.8	32.8	18.9	0.0	43.7	24.2	25.9	25.2
LnGrp LOS	D	D	D	C	D	C	B		D	C	C	C
Approach Vol, veh/h		620			885			737			503	
Approach Delay, s/veh		36.8			42.9			39.6			25.5	
Approach LOS		D			D			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.8	46.2	16.4	31.8	13.3	47.7	16.0	32.2
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	9.0	48.0	11.0	28.0	9.0	48.0	12.0	27.0
Max Q Clear Time (g_c+I1), s	6.5	13.8	10.4	22.8	4.0	37.2	10.0	14.0
Green Ext Time (p_c), s	0.1	7.0	0.0	3.1	0.0	4.5	0.1	5.9

Intersection Summary	
HCM 2010 Ctrl Delay	37.4
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	43	35	91	5	23	6	68	310	6	7	583	107
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1776	1900	1792	1792	1900	1845	1845	1900	1827	1827	1900
Adj Flow Rate, veh/h	48	39	101	6	26	7	76	344	7	8	648	119
Adj No. of Lanes	0	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	7	7	7	6	6	6	3	3	3	4	4	4
Cap, veh/h	129	108	196	380	323	87	291	1048	21	594	874	160
Arrive On Green	0.24	0.24	0.24	0.24	0.24	0.24	0.58	0.58	0.58	0.58	0.58	0.58
Sat Flow, veh/h	258	453	826	1197	1361	366	691	1802	37	1006	1502	276
Grp Volume(v), veh/h	188	0	0	6	0	33	76	0	351	8	0	767
Grp Sat Flow(s),veh/h/ln	1537	0	0	1197	0	1728	691	0	1838	1006	0	1778
Q Serve(g_s), s	1.7	0.0	0.0	0.0	0.0	1.0	6.0	0.0	6.6	0.3	0.0	21.1
Cycle Q Clear(g_c), s	6.8	0.0	0.0	0.3	0.0	1.0	27.1	0.0	6.6	6.8	0.0	21.1
Prop In Lane	0.26		0.54	1.00		0.21	1.00		0.02	1.00		0.16
Lane Grp Cap(c), veh/h	433	0	0	380	0	410	291	0	1069	594	0	1034
V/C Ratio(X)	0.43	0.00	0.00	0.02	0.00	0.08	0.26	0.00	0.33	0.01	0.00	0.74
Avail Cap(c_a), veh/h	529	0	0	457	0	521	493	0	1607	889	0	1554
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.8	0.0	0.0	19.4	0.0	19.7	20.2	0.0	7.2	8.9	0.0	10.2
Incr Delay (d2), s/veh	0.7	0.0	0.0	0.0	0.0	0.1	0.5	0.0	0.2	0.0	0.0	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.1	0.0	0.0	0.1	0.0	0.5	1.2	0.0	3.4	0.1	0.0	10.5
LnGrp Delay(d),s/veh	22.5	0.0	0.0	19.4	0.0	19.7	20.6	0.0	7.4	8.9	0.0	11.3
LnGrp LOS	C			B		B	C		A	A		B
Approach Vol, veh/h		188			39			427			775	
Approach Delay, s/veh		22.5			19.7			9.7			11.3	
Approach LOS		C			B			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		44.6		21.8		44.6		21.8
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		58.0		20.0		58.0		20.0
Max Q Clear Time (g_c+I1), s		23.1		3.0		29.1		8.8
Green Ext Time (p_c), s		10.1		1.2		9.5		0.9

Intersection Summary	
HCM 2010 Ctrl Delay	12.5
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	57	29	83	9	33	13	125	596	8	10	279	74
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1810	1900	1810	1810	1900	1863	1863	1900	1845	1845	1900
Adj Flow Rate, veh/h	63	32	92	10	37	14	139	662	9	11	310	82
Adj No. of Lanes	0	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	5	5	5	2	2	2	3	3	3
Cap, veh/h	194	112	213	489	354	134	486	919	12	296	705	186
Arrive On Green	0.28	0.28	0.28	0.28	0.28	0.28	0.50	0.50	0.50	0.50	0.50	0.50
Sat Flow, veh/h	380	397	753	1226	1252	474	988	1833	25	756	1407	372
Grp Volume(v), veh/h	187	0	0	10	0	51	139	0	671	11	0	392
Grp Sat Flow(s),veh/h/ln	1531	0	0	1226	0	1726	988	0	1858	756	0	1779
Q Serve(g_s), s	1.4	0.0	0.0	0.0	0.0	1.2	5.8	0.0	15.6	0.6	0.0	7.8
Cycle Q Clear(g_c), s	5.2	0.0	0.0	0.3	0.0	1.2	13.6	0.0	15.6	16.3	0.0	7.8
Prop In Lane	0.34		0.49	1.00		0.27	1.00		0.01	1.00		0.21
Lane Grp Cap(c), veh/h	519	0	0	489	0	487	486	0	931	296	0	891
V/C Ratio(X)	0.36	0.00	0.00	0.02	0.00	0.10	0.29	0.00	0.72	0.04	0.00	0.44
Avail Cap(c_a), veh/h	717	0	0	651	0	716	971	0	1844	667	0	1766
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	16.1	0.0	0.0	14.4	0.0	14.7	13.2	0.0	10.8	17.1	0.0	8.8
Incr Delay (d2), s/veh	0.4	0.0	0.0	0.0	0.0	0.1	0.3	0.0	1.1	0.1	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.3	0.0	0.0	0.1	0.0	0.6	1.6	0.0	8.1	0.1	0.0	3.9
LnGrp Delay(d),s/veh	16.5	0.0	0.0	14.4	0.0	14.8	13.5	0.0	11.9	17.2	0.0	9.2
LnGrp LOS	B			B		B	B		B	B		A
Approach Vol, veh/h		187			61			810			403	
Approach Delay, s/veh		16.5			14.7			12.1			9.4	
Approach LOS		B			B			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		33.8		21.6		33.8		21.6
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		55.0		23.0		55.0		23.0
Max Q Clear Time (g_c+I1), s		18.3		3.2		17.6		7.2
Green Ext Time (p_c), s		9.5		1.4		9.5		1.2

Intersection Summary	
HCM 2010 Ctrl Delay	12.1
HCM 2010 LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	53	0	365	86	0	617
Number	7	14	6	16	5	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1743	1743	1810	1810	0	1845
Adj Flow Rate, veh/h	59	0	406	0	0	686
Adj No. of Lanes	1	1	1	1	0	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	9	9	5	5	0	3
Cap, veh/h	184	164	1016	863	0	1035
Arrive On Green	0.11	0.00	0.56	0.00	0.00	0.56
Sat Flow, veh/h	1660	1482	1810	1538	0	1845
Grp Volume(v), veh/h	59	0	406	0	0	686
Grp Sat Flow(s),veh/h/ln	1660	1482	1810	1538	0	1845
Q Serve(g_s), s	1.2	0.0	4.6	0.0	0.0	9.5
Cycle Q Clear(g_c), s	1.2	0.0	4.6	0.0	0.0	9.5
Prop In Lane	1.00	1.00		1.00	0.00	
Lane Grp Cap(c), veh/h	184	164	1016	863	0	1035
V/C Ratio(X)	0.32	0.00	0.40	0.00	0.00	0.66
Avail Cap(c_a), veh/h	499	445	2818	2395	0	2872
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	15.0	0.0	4.5	0.0	0.0	5.6
Incr Delay (d2), s/veh	1.0	0.0	0.3	0.0	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	2.3	0.0	0.0	5.0
LnGrp Delay(d),s/veh	16.0	0.0	4.8	0.0	0.0	6.3
LnGrp LOS	B		A			A
Approach Vol, veh/h	59		406			686
Approach Delay, s/veh	16.0		4.8			6.3
Approach LOS	B		A			A

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		26.5		10.1		26.5		
Change Period (Y+Rc), s		6.0		6.0		6.0		
Max Green Setting (Gmax), s		57.0		11.0		57.0		
Max Q Clear Time (g_c+I1), s		11.5		3.2		6.6		
Green Ext Time (p_c), s		9.0		0.1		9.1		

Intersection Summary	
HCM 2010 Ctrl Delay	6.3
HCM 2010 LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	67	0	679	79	0	379
Number	7	14	6	16	5	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1776	1776	1827	1827	0	1863
Adj Flow Rate, veh/h	74	0	754	0	0	421
Adj No. of Lanes	1	1	1	1	0	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	7	7	4	4	0	2
Cap, veh/h	211	188	1069	909	0	1090
Arrive On Green	0.12	0.00	0.59	0.00	0.00	0.59
Sat Flow, veh/h	1691	1509	1827	1553	0	1863
Grp Volume(v), veh/h	74	0	754	0	0	421
Grp Sat Flow(s),veh/h/ln	1691	1509	1827	1553	0	1863
Q Serve(g_s), s	1.7	0.0	12.1	0.0	0.0	5.0
Cycle Q Clear(g_c), s	1.7	0.0	12.1	0.0	0.0	5.0
Prop In Lane	1.00	1.00		1.00	0.00	
Lane Grp Cap(c), veh/h	211	188	1069	909	0	1090
V/C Ratio(X)	0.35	0.00	0.71	0.00	0.00	0.39
Avail Cap(c_a), veh/h	450	401	2517	2139	0	2566
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	16.6	0.0	6.1	0.0	0.0	4.6
Incr Delay (d2), s/veh	1.0	0.0	0.9	0.0	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	6.1	0.0	0.0	2.5
LnGrp Delay(d),s/veh	17.6	0.0	6.9	0.0	0.0	4.8
LnGrp LOS	B		A			A
Approach Vol, veh/h	74		754			421
Approach Delay, s/veh	17.6		6.9			4.8
Approach LOS	B		A			A

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		30.2		11.2		30.2		
Change Period (Y+Rc), s		6.0		6.0		6.0		
Max Green Setting (Gmax), s		57.0		11.0		57.0		
Max Q Clear Time (g_c+I1), s		7.0		3.7		14.1		
Green Ext Time (p_c), s		10.4		0.1		10.2		

Intersection Summary	
HCM 2010 Ctrl Delay	6.8
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	63	4	33	4	4	4	21	393	4	4	516	77
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1900	1863	1900	1827	1827	1900	1810	1810	1900
Adj Flow Rate, veh/h	70	4	37	4	4	4	23	437	4	4	573	86
Adj No. of Lanes	1	1	0	0	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	4	4	4	5	5	5
Cap, veh/h	495	40	368	187	179	138	312	936	9	471	796	120
Arrive On Green	0.25	0.25	0.25	0.25	0.25	0.25	0.52	0.52	0.52	0.52	0.52	0.52
Sat Flow, veh/h	1402	157	1450	378	706	542	757	1807	17	917	1538	231
Grp Volume(v), veh/h	70	0	41	12	0	0	23	0	441	4	0	659
Grp Sat Flow(s),veh/h/ln	1402	0	1607	1627	0	0	757	0	1824	917	0	1769
Q Serve(g_s), s	1.7	0.0	1.0	0.0	0.0	0.0	1.3	0.0	8.1	0.1	0.0	15.0
Cycle Q Clear(g_c), s	2.0	0.0	1.0	0.3	0.0	0.0	16.3	0.0	8.1	8.2	0.0	15.0
Prop In Lane	1.00		0.90	0.33		0.33	1.00		0.01	1.00		0.13
Lane Grp Cap(c), veh/h	495	0	408	505	0	0	312	0	944	471	0	916
V/C Ratio(X)	0.14	0.00	0.10	0.02	0.00	0.00	0.07	0.00	0.47	0.01	0.00	0.72
Avail Cap(c_a), veh/h	619	0	550	644	0	0	785	0	2083	1043	0	2020
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.3	0.0	15.0	14.7	0.0	0.0	16.0	0.0	8.1	10.7	0.0	9.7
Incr Delay (d2), s/veh	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.4	0.0	0.0	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	0.5	0.1	0.0	0.0	0.3	0.0	4.1	0.0	0.0	7.4
LnGrp Delay(d),s/veh	15.5	0.0	15.1	14.7	0.0	0.0	16.1	0.0	8.4	10.7	0.0	10.8
LnGrp LOS	B		B	B			B		A	B		B
Approach Vol, veh/h		111			12			464			663	
Approach Delay, s/veh		15.3			14.7			8.8			10.8	
Approach LOS		B			B			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		33.2		19.3		33.2		19.3
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		60.0		18.0		60.0		18.0
Max Q Clear Time (g_c+I1), s		17.0		2.3		18.3		4.0
Green Ext Time (p_c), s		8.9		0.4		8.9		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	10.5
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	52	4	15	4	4	4	24	617	4	4	426	63
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1900	1863	1900	1845	1845	1900	1827	1827	1900
Adj Flow Rate, veh/h	58	4	17	4	4	4	27	686	4	4	473	70
Adj No. of Lanes	1	1	0	0	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	3	3	3	4	4	4
Cap, veh/h	465	71	302	178	167	125	423	977	6	330	830	123
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.53	0.53	0.53	0.53	0.53	0.53
Sat Flow, veh/h	1402	310	1319	363	731	547	851	1832	11	736	1556	230
Grp Volume(v), veh/h	58	0	21	12	0	0	27	0	690	4	0	543
Grp Sat Flow(s),veh/h/ln	1402	0	1630	1641	0	0	851	0	1843	736	0	1786
Q Serve(g_s), s	1.3	0.0	0.5	0.0	0.0	0.0	1.1	0.0	14.1	0.2	0.0	10.3
Cycle Q Clear(g_c), s	1.6	0.0	0.5	0.3	0.0	0.0	11.4	0.0	14.1	14.3	0.0	10.3
Prop In Lane	1.00		0.81	0.33		0.33	1.00		0.01	1.00		0.13
Lane Grp Cap(c), veh/h	465	0	373	471	0	0	423	0	983	330	0	952
V/C Ratio(X)	0.12	0.00	0.06	0.03	0.00	0.00	0.06	0.00	0.70	0.01	0.00	0.57
Avail Cap(c_a), veh/h	646	0	582	675	0	0	983	0	2194	813	0	2127
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.6	0.0	15.2	15.1	0.0	0.0	11.7	0.0	8.8	14.1	0.0	7.9
Incr Delay (d2), s/veh	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.9	0.0	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	0.2	0.1	0.0	0.0	0.3	0.0	7.3	0.0	0.0	5.1
LnGrp Delay(d),s/veh	15.7	0.0	15.2	15.1	0.0	0.0	11.8	0.0	9.7	14.1	0.0	8.4
LnGrp LOS	B		B	B			B		A	B		A
Approach Vol, veh/h		79			12			717			547	
Approach Delay, s/veh		15.6			15.1			9.8			8.5	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		32.9		17.5		32.9		17.5
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		60.0		18.0		60.0		18.0
Max Q Clear Time (g_c+I1), s		16.3		2.3		16.1		3.6
Green Ext Time (p_c), s		10.6		0.2		10.6		0.2

Intersection Summary	
HCM 2010 Ctrl Delay	9.6
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	14	4	4	4	4	24	4	403	15	119	400	15
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1638	1638	1900	1863	1863	1900	1827	1827	1900	1827	1827	1900
Adj Flow Rate, veh/h	16	4	4	4	4	27	4	448	17	132	444	17
Adj No. of Lanes	1	2	0	1	2	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	16	16	16	2	2	2	4	4	4	4	4	4
Cap, veh/h	390	304	261	441	338	303	495	901	34	492	901	34
Arrive On Green	0.19	0.19	0.19	0.19	0.19	0.19	0.52	0.52	0.52	0.52	0.52	0.52
Sat Flow, veh/h	1207	1589	1364	1402	1770	1583	909	1749	66	906	1748	67
Grp Volume(v), veh/h	16	4	4	4	4	27	4	0	465	132	0	461
Grp Sat Flow(s),veh/h/ln	1207	1556	1397	1402	1770	1583	909	0	1815	906	0	1815
Q Serve(g_s), s	0.5	0.1	0.1	0.1	0.1	0.6	0.1	0.0	6.8	4.5	0.0	6.7
Cycle Q Clear(g_c), s	1.0	0.1	0.1	0.2	0.1	0.6	6.9	0.0	6.8	11.4	0.0	6.7
Prop In Lane	1.00		0.98	1.00		1.00	1.00		0.04	1.00		0.04
Lane Grp Cap(c), veh/h	390	297	267	441	338	303	495	0	936	492	0	936
V/C Ratio(X)	0.04	0.01	0.02	0.01	0.01	0.09	0.01	0.00	0.50	0.27	0.00	0.49
Avail Cap(c_a), veh/h	691	685	615	790	779	697	1361	0	2664	1354	0	2664
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.0	13.4	13.4	13.5	13.4	13.6	8.7	0.0	6.5	10.2	0.0	6.4
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.4	0.3	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0	0.0	0.0	0.3	0.0	0.0	3.5	1.2	0.0	3.4
LnGrp Delay(d),s/veh	14.1	13.4	13.4	13.5	13.4	13.7	8.7	0.0	6.9	10.4	0.0	6.8
LnGrp LOS	B	B	B	B	B	B	A		A	B		A
Approach Vol, veh/h		24			35			469			593	
Approach Delay, s/veh		13.9			13.7			6.9			7.6	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		27.1		13.8		27.1		13.8
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		60.0		18.0		60.0		18.0
Max Q Clear Time (g_c+I1), s		8.9		3.0		13.4		2.6
Green Ext Time (p_c), s		7.8		0.2		7.7		0.2

Intersection Summary	
HCM 2010 Ctrl Delay	7.6
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	24	4	4	5	4	121	4	531	4	25	407	9
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1696	1696	1900	1863	1863	1900	1845	1845	1900	1845	1845	1900
Adj Flow Rate, veh/h	27	4	4	6	4	134	4	590	4	28	452	10
Adj No. of Lanes	1	2	0	1	2	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	12	12	12	2	2	2	3	3	3	3	3	3
Cap, veh/h	394	475	408	542	510	457	417	872	6	326	857	19
Arrive On Green	0.29	0.29	0.29	0.29	0.29	0.29	0.48	0.48	0.48	0.48	0.48	0.48
Sat Flow, veh/h	1135	1646	1413	1402	1770	1583	917	1830	12	812	1798	40
Grp Volume(v), veh/h	27	4	4	6	4	134	4	0	594	28	0	462
Grp Sat Flow(s),veh/h/ln	1135	1612	1447	1402	1770	1583	917	0	1842	812	0	1838
Q Serve(g_s), s	1.0	0.1	0.1	0.2	0.1	3.4	0.2	0.0	12.7	1.4	0.0	9.0
Cycle Q Clear(g_c), s	4.3	0.1	0.1	0.3	0.1	3.4	9.1	0.0	12.7	14.1	0.0	9.0
Prop In Lane	1.00		0.98	1.00		1.00	1.00		0.01	1.00		0.02
Lane Grp Cap(c), veh/h	394	465	417	542	510	457	417	0	878	326	0	876
V/C Ratio(X)	0.07	0.01	0.01	0.01	0.01	0.29	0.01	0.00	0.68	0.09	0.00	0.53
Avail Cap(c_a), veh/h	488	599	538	659	658	589	1039	0	2127	876	0	2122
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.8	13.0	13.0	13.1	13.0	14.1	12.5	0.0	10.3	15.8	0.0	9.3
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.9	0.1	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.0	0.1	0.0	1.5	0.0	0.0	6.7	0.3	0.0	4.6
LnGrp Delay(d),s/veh	15.9	13.0	13.0	13.1	13.0	14.5	12.5	0.0	11.2	15.9	0.0	9.8
LnGrp LOS	B	B	B	B	B	B	B		B	B		A
Approach Vol, veh/h		35			144			598			490	
Approach Delay, s/veh		15.2			14.4			11.3			10.2	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		30.4		20.7		30.4		20.7
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		59.0		19.0		59.0		19.0
Max Q Clear Time (g_c+I1), s		14.7		6.3		16.1		5.4
Green Ext Time (p_c), s		8.3		0.7		8.2		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	11.3
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	8.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	8	173	6	8	121	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	8	8	2	2
Mvmt Flow	9	192	7	9	134	4

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	284	11	0	0	16	0
Stage 1	11	-	-	-	-	-
Stage 2	273	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	706	1070	-	-	1602	-
Stage 1	1012	-	-	-	-	-
Stage 2	773	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	647	1070	-	-	1602	-
Mov Cap-2 Maneuver	647	-	-	-	-	-
Stage 1	1012	-	-	-	-	-
Stage 2	708	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.3		7.2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	1040	1602	-
HCM Lane V/C Ratio	-	-	0.193	0.084	-
HCM Control Delay (s)	-	-	9.3	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	1	0	-

Intersection	
Int Delay, s/veh	7.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	8	114	5	8	187	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	7	7	2	2
Mvmt Flow	9	127	6	9	208	7

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	432	10	0	0	14	0
Stage 1	10	-	-	-	-	-
Stage 2	422	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	581	1071	-	-	1604	-
Stage 1	1013	-	-	-	-	-
Stage 2	662	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	505	1071	-	-	1604	-
Mov Cap-2 Maneuver	505	-	-	-	-	-
Stage 1	1013	-	-	-	-	-
Stage 2	576	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.2		7.3
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	998	1604	-
HCM Lane V/C Ratio	-	-	0.136	0.13	-
HCM Control Delay (s)	-	-	9.2	7.6	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	3.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	409	366	170	27	39	280
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	0	-	-	0	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	8	8	12	12	4	4
Mvmt Flow	454	407	189	30	43	311

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	189	0	-	0	1505	-
Stage 1	-	-	-	-	189	-
Stage 2	-	-	-	-	1316	-
Critical Hdwy	4.18	-	-	-	6.44	-
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	2.272	-	-	-	3.536	-
Pot Cap-1 Maneuver	1350	-	-	-	132	0
Stage 1	-	-	-	-	838	0
Stage 2	-	-	-	-	248	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1350	-	-	-	88	-
Mov Cap-2 Maneuver	-	-	-	-	88	-
Stage 1	-	-	-	-	838	-
Stage 2	-	-	-	-	165	-

Approach	EB	WB	SB
HCM Control Delay, s			80.4
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1350	-	-	-	88	-
HCM Lane V/C Ratio	0.337	-	-	-	0.492	-
HCM Control Delay (s)	9	-	-	-	80.4	0
HCM Lane LOS	A	-	-	-	F	A
HCM 95th %tile Q(veh)	2	-	-	-	2	-

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	319	172	362	37	37	434
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	0	-	-	0	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	6	6	10	10	3	3
Mvmt Flow	354	191	402	41	41	482

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	402	0	-	0	1302	-
Stage 1	-	-	-	-	402	-
Stage 2	-	-	-	-	900	-
Critical Hdwy	4.16	-	-	-	6.43	-
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.254	-	-	-	3.527	-
Pot Cap-1 Maneuver	1135	-	-	-	177	0
Stage 1	-	-	-	-	673	0
Stage 2	-	-	-	-	395	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1135	-	-	-	122	-
Mov Cap-2 Maneuver	-	-	-	-	122	-
Stage 1	-	-	-	-	673	-
Stage 2	-	-	-	-	272	-

Approach	EB	WB	SB
HCM Control Delay, s			48.8
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1135	-	-	-	122	-
HCM Lane V/C Ratio	0.312	-	-	-	0.337	-
HCM Control Delay (s)	9.6	-	-	-	48.8	0
HCM Lane LOS	A	-	-	-	E	A
HCM 95th %tile Q(veh)	1	-	-	-	1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	95	8	302	4	7	4	121	21	4	4	134	69
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1696	1696	1900	1863	1900	1696	1696	1900	1900	1845	1845
Adj Flow Rate, veh/h	106	9	0	4	8	4	134	23	4	4	149	77
Adj No. of Lanes	0	1	1	0	1	0	1	1	0	0	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	12	12	12	2	2	2	12	12	12	3	3	3
Cap, veh/h	532	38	440	187	316	130	537	559	97	96	727	622
Arrive On Green	0.31	0.31	0.00	0.31	0.31	0.31	0.40	0.40	0.40	0.40	0.40	0.40
Sat Flow, veh/h	1181	124	1442	246	1033	427	1047	1408	245	10	1831	1568
Grp Volume(v), veh/h	115	0	0	16	0	0	134	0	27	153	0	77
Grp Sat Flow(s),veh/h/ln	1305	0	1442	1706	0	0	1047	0	1653	1841	0	1568
Q Serve(g_s), s	2.4	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.4	0.0	0.0	1.3
Cycle Q Clear(g_c), s	2.6	0.0	0.0	0.3	0.0	0.0	6.1	0.0	0.4	2.2	0.0	1.3
Prop In Lane	0.92		1.00	0.25		0.25	1.00		0.15	0.03		1.00
Lane Grp Cap(c), veh/h	570	0	440	633	0	0	537	0	656	822	0	622
V/C Ratio(X)	0.20	0.00	0.00	0.03	0.00	0.00	0.25	0.00	0.04	0.19	0.00	0.12
Avail Cap(c_a), veh/h	914	0	823	1071	0	0	771	0	1025	1231	0	972
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.6	0.0	0.0	9.8	0.0	0.0	10.0	0.0	7.5	8.0	0.0	7.7
Incr Delay (d2), s/veh	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	0.0	0.1	0.0	0.0	1.2	0.0	0.2	1.1	0.0	0.5
LnGrp Delay(d),s/veh	10.8	0.0	0.0	9.8	0.0	0.0	10.2	0.0	7.5	8.1	0.0	7.8
LnGrp LOS	B			A			B		A	A		A
Approach Vol, veh/h		115			16			161			230	
Approach Delay, s/veh		10.8			9.8			9.8			8.0	
Approach LOS		B			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		22.0		18.3		22.0		18.3
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		25.0		23.0		25.0		23.0
Max Q Clear Time (g_c+I1), s		8.1		4.6		4.2		2.3
Green Ext Time (p_c), s		1.7		0.6		1.8		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	9.2
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	64	7	138	4	6	5	290	117	4	4	31	103
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1727	1727	1900	1863	1900	1727	1727	1900	1900	1845	1845
Adj Flow Rate, veh/h	71	8	0	4	7	6	322	130	4	4	34	114
Adj No. of Lanes	0	1	1	0	1	0	1	1	0	0	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	10	10	10	2	2	2	10	10	10	3	3	3
Cap, veh/h	491	45	393	170	239	160	654	698	21	133	729	656
Arrive On Green	0.27	0.27	0.00	0.27	0.27	0.27	0.42	0.42	0.42	0.42	0.42	0.42
Sat Flow, veh/h	1168	170	1468	202	892	597	1145	1667	51	69	1742	1568
Grp Volume(v), veh/h	79	0	0	17	0	0	322	0	134	38	0	114
Grp Sat Flow(s),veh/h/ln	1338	0	1468	1691	0	0	1145	0	1718	1811	0	1568
Q Serve(g_s), s	1.4	0.0	0.0	0.0	0.0	0.0	8.9	0.0	1.9	0.0	0.0	1.7
Cycle Q Clear(g_c), s	1.7	0.0	0.0	0.3	0.0	0.0	9.3	0.0	1.9	0.5	0.0	1.7
Prop In Lane	0.90		1.00	0.24		0.35	1.00		0.03	0.11		1.00
Lane Grp Cap(c), veh/h	537	0	393	569	0	0	654	0	719	862	0	656
V/C Ratio(X)	0.15	0.00	0.00	0.03	0.00	0.00	0.49	0.00	0.19	0.04	0.00	0.17
Avail Cap(c_a), veh/h	772	0	653	858	0	0	1103	0	1393	1550	0	1272
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.8	0.0	0.0	10.4	0.0	0.0	9.4	0.0	7.0	6.6	0.0	7.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.1	0.0	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	0.0	0.1	0.0	0.0	2.9	0.0	0.9	0.2	0.0	0.8
LnGrp Delay(d),s/veh	11.0	0.0	0.0	10.4	0.0	0.0	9.9	0.0	7.1	6.6	0.0	7.1
LnGrp LOS	B			B			A		A	A		A
Approach Vol, veh/h		79			17			456			152	
Approach Delay, s/veh		11.0			10.4			9.1			7.0	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		22.0		16.2		22.0		16.2
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		31.0		17.0		31.0		17.0
Max Q Clear Time (g_c+I1), s		11.3		3.7		3.7		2.3
Green Ext Time (p_c), s		2.7		0.3		2.8		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	8.9
HCM 2010 LOS	A

Intersection	
Intersection Delay, s/veh	20.5
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	15	6	93	0	19	9	36	0	166	195	18
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	4	4	4
Mvmt Flow	0	17	7	103	0	21	10	40	0	184	217	20
Number of Lanes	0	0	1	0	0	0	1	1	0	0	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	2	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	2	1	2
HCM Control Delay	11.9	10.4	20.1
HCM LOS	B	B	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2	SBLn1
Vol Left, %	46%	0%	13%	68%	0%	32%
Vol Thru, %	54%	0%	5%	32%	0%	59%
Vol Right, %	0%	100%	82%	0%	100%	8%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	361	18	114	28	36	411
LT Vol	195	0	6	9	0	244
Through Vol	0	18	93	0	36	34
RT Vol	166	0	15	19	0	133
Lane Flow Rate	401	20	127	31	40	457
Geometry Grp	7	7	6	7	7	6
Degree of Util (X)	0.677	0.029	0.237	0.066	0.073	0.752
Departure Headway (Hd)	6.079	5.137	6.728	7.674	6.609	5.932
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	594	695	531	465	539	607
Service Time	3.825	2.882	4.8	5.455	4.389	3.978
HCM Lane V/C Ratio	0.675	0.029	0.239	0.067	0.074	0.753
HCM Control Delay	20.7	8	11.9	11	9.9	24.8
HCM Lane LOS	C	A	B	B	A	C
HCM 95th-tile Q	5.2	0.1	0.9	0.2	0.2	6.7

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	133	244	34
Peak Hour Factor	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	3	3	3
Mvmt Flow	0	148	271	38
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	2
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	24.8
HCM LOS	C

Lane

Intersection	
Intersection Delay, s/veh	23.6
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	28	8	188	0	15	5	158	0	108	270	24
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	3	3	3
Mvmt Flow	0	31	9	209	0	17	6	176	0	120	300	27
Number of Lanes	0	0	1	0	0	0	1	1	0	0	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	2	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	2	1	2
HCM Control Delay	17.4	13.4	32.6
HCM LOS	C	B	D

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2	SBLn1
Vol Left, %	29%	0%	12%	75%	0%	12%
Vol Thru, %	71%	0%	4%	25%	0%	82%
Vol Right, %	0%	100%	84%	0%	100%	6%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	378	24	224	20	158	285
LT Vol	270	0	8	5	0	233
Through Vol	0	24	188	0	158	17
RT Vol	108	0	28	15	0	35
Lane Flow Rate	420	27	249	22	176	317
Geometry Grp	7	7	6	7	7	6
Degree of Util (X)	0.817	0.045	0.5	0.051	0.346	0.635
Departure Headway (Hd)	6.999	6.137	7.227	8.202	7.094	7.221
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	517	580	495	434	504	497
Service Time	4.773	3.911	5.314	5.991	4.883	5.306
HCM Lane V/C Ratio	0.812	0.047	0.503	0.051	0.349	0.638
HCM Control Delay	34.1	9.2	17.4	11.4	13.6	22.2
HCM Lane LOS	D	A	C	B	B	C
HCM 95th-tile Q	8	0.1	2.8	0.2	1.5	4.4

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	35	233	17
Peak Hour Factor	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	3	3	3
Mvmt Flow	0	39	259	19
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	2
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	22.2
HCM LOS	C

Lane

Intersection	
Int Delay, s/veh	1.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	7	20	215	7	62	449
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	16	16	3	3	5	5
Mvmt Flow	8	22	239	8	69	499

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	880	243	0	0	247	0
Stage 1	243	-	-	-	-	-
Stage 2	637	-	-	-	-	-
Critical Hdwy	6.56	6.36	-	-	4.15	-
Critical Hdwy Stg 1	5.56	-	-	-	-	-
Critical Hdwy Stg 2	5.56	-	-	-	-	-
Follow-up Hdwy	3.644	3.444	-	-	2.245	-
Pot Cap-1 Maneuver	300	763	-	-	1302	-
Stage 1	766	-	-	-	-	-
Stage 2	501	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	278	763	-	-	1302	-
Mov Cap-2 Maneuver	278	-	-	-	-	-
Stage 1	766	-	-	-	-	-
Stage 2	464	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.3		1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	525	1302	-
HCM Lane V/C Ratio	-	-	0.057	0.053	-
HCM Control Delay (s)	-	-	12.3	7.9	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	1.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	8	77	482	8	22	238
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	10	10	3	3	4	4
Mvmt Flow	9	86	536	9	24	264

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	853	540	0	0	544	0
Stage 1	540	-	-	-	-	-
Stage 2	313	-	-	-	-	-
Critical Hdwy	6.5	6.3	-	-	4.14	-
Critical Hdwy Stg 1	5.5	-	-	-	-	-
Critical Hdwy Stg 2	5.5	-	-	-	-	-
Follow-up Hdwy	3.59	3.39	-	-	2.236	-
Pot Cap-1 Maneuver	319	527	-	-	1015	-
Stage 1	568	-	-	-	-	-
Stage 2	724	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	310	527	-	-	1015	-
Mov Cap-2 Maneuver	310	-	-	-	-	-
Stage 1	568	-	-	-	-	-
Stage 2	704	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	14		0.7
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	494	1015	-
HCM Lane V/C Ratio	-	-	0.191	0.024	-
HCM Control Delay (s)	-	-	14	8.6	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	1	0	-

Intersection	
Int Delay, s/veh	1.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	18	245	118	98	506	72
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	0	100	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	5	5	14	14	10	10
Mvmt Flow	20	272	131	109	562	80

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1390	-	0	0	240	0
Stage 1	186	-	-	-	-	-
Stage 2	1204	-	-	-	-	-
Critical Hdwy	6.45	-	-	-	4.2	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	-	-	-	2.29	-
Pot Cap-1 Maneuver	155	0	-	-	1281	-
Stage 1	839	0	-	-	-	-
Stage 2	280	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	87	-	-	-	1281	-
Mov Cap-2 Maneuver	87	-	-	-	-	-
Stage 1	839	-	-	-	-	-
Stage 2	157	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	58.3		
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	87	-	1281	-
HCM Lane V/C Ratio	-	-	0.23	-	0.439	-
HCM Control Delay (s)	-	-	58.3	0	10	-
HCM Lane LOS	-	-	F	A	A	-
HCM 95th %tile Q(veh)	-	-	1	-	2	-

Intersection	
Int Delay, s/veh	1.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	47	566	52	47	188	108
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	0	100	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	4	4	14	14	8	8
Mvmt Flow	52	629	58	52	209	120

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	622	-	0	0	110	0
Stage 1	84	-	-	-	-	-
Stage 2	538	-	-	-	-	-
Critical Hdwy	6.44	-	-	-	4.18	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	-	-	-	2.272	-
Pot Cap-1 Maneuver	447	0	-	-	1443	-
Stage 1	934	0	-	-	-	-
Stage 2	581	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	382	-	-	-	1443	-
Mov Cap-2 Maneuver	382	-	-	-	-	-
Stage 1	934	-	-	-	-	-
Stage 2	497	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.9		
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	382	-	1443	-
HCM Lane V/C Ratio	-	-	0.137	-	0.145	-
HCM Control Delay (s)	-	-	15.9	0	7.9	-
HCM Lane LOS	-	-	C	A	A	-
HCM 95th %tile Q(veh)	-	-	0	-	1	-

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	47	70	43	291	459	27
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	10	10	15	15
Mvmt Flow	52	78	48	323	510	30

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	782	270	540	0	-	0
Stage 1	525	-	-	-	-	-
Stage 2	257	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.3	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.3	-	-	-
Pot Cap-1 Maneuver	331	728	971	-	-	-
Stage 1	558	-	-	-	-	-
Stage 2	762	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	315	728	971	-	-	-
Mov Cap-2 Maneuver	315	-	-	-	-	-
Stage 1	558	-	-	-	-	-
Stage 2	724	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	15.4		
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	971	-	477	-	-
HCM Lane V/C Ratio	0.049	-	0.273	-	-
HCM Control Delay (s)	8.9	-	15.4	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0	-	1	-	-

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	56	48	87	542	227	70
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	8	8	12	12
Mvmt Flow	62	53	97	602	252	78

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	785	165	330	0	-	0
Stage 1	291	-	-	-	-	-
Stage 2	494	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.26	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.28	-	-	-
Pot Cap-1 Maneuver	330	850	1184	-	-	-
Stage 1	733	-	-	-	-	-
Stage 2	579	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	303	850	1184	-	-	-
Mov Cap-2 Maneuver	303	-	-	-	-	-
Stage 1	733	-	-	-	-	-
Stage 2	532	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	16.4		
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1184	-	431	-	-
HCM Lane V/C Ratio	0.082	-	0.268	-	-
HCM Control Delay (s)	8.3	-	16.4	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0	-	1	-	-

Intersection	
Int Delay, s/veh	15.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	389	264	0	379	232	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	350	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	11	11	15	15	16	16
Mvmt Flow	432	293	0	421	258	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	469	129	258	0	-	0
Stage 1	258	-	-	-	-	-
Stage 2	211	-	-	-	-	-
Critical Hdwy	7.02	7.12	4.4	-	-	-
Critical Hdwy Stg 1	6.02	-	-	-	-	-
Critical Hdwy Stg 2	6.02	-	-	-	-	-
Follow-up Hdwy	3.61	3.41	2.35	-	-	-
Pot Cap-1 Maneuver	501	869	1214	-	-	-
Stage 1	735	-	-	-	-	-
Stage 2	777	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	501	869	1214	-	-	-
Mov Cap-2 Maneuver	501	-	-	-	-	-
Stage 1	735	-	-	-	-	-
Stage 2	777	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	29.8		
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1214	-	501	869	-	-
HCM Lane V/C Ratio	-	-	0.863	0.338	-	-
HCM Control Delay (s)	0	-	42.5	11.2	-	-
HCM Lane LOS	A	-	E	B	-	-
HCM 95th %tile Q(veh)	0	-	9	1	-	-

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	95	85	0	544	190	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	350	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	34	34	12	12	17	17
Mvmt Flow	106	94	0	604	211	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	513	106	211	0	-	0
Stage 1	211	-	-	-	-	-
Stage 2	302	-	-	-	-	-
Critical Hdwy	7.48	7.58	4.34	-	-	-
Critical Hdwy Stg 1	6.48	-	-	-	-	-
Critical Hdwy Stg 2	6.48	-	-	-	-	-
Follow-up Hdwy	3.84	3.64	2.32	-	-	-
Pot Cap-1 Maneuver	419	834	1287	-	-	-
Stage 1	716	-	-	-	-	-
Stage 2	637	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	419	834	1287	-	-	-
Mov Cap-2 Maneuver	419	-	-	-	-	-
Stage 1	716	-	-	-	-	-
Stage 2	637	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	13.4		
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1287	-	419	834	-	-
HCM Lane V/C Ratio	-	-	0.252	0.113	-	-
HCM Control Delay (s)	0	-	16.5	9.9	-	-
HCM Lane LOS	A	-	C	A	-	-
HCM 95th %tile Q(veh)	0	-	1	0	-	-

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	0	75	693	232	51
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	225	-	-	325
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	16	16	25	25
Mvmt Flow	0	0	83	770	258	57

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	810	129	258	0	-	0
Stage 1	258	-	-	-	-	-
Stage 2	552	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.42	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.36	-	-	-
Pot Cap-1 Maneuver	318	897	1208	-	-	-
Stage 1	761	-	-	-	-	-
Stage 2	541	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	296	897	1208	-	-	-
Mov Cap-2 Maneuver	296	-	-	-	-	-
Stage 1	761	-	-	-	-	-
Stage 2	504	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0		
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1208	-	-	-	-
HCM Lane V/C Ratio	0.069	-	-	-	-
HCM Control Delay (s)	8.2	-	0	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	0	283	356	190	537
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	225	-	-	325
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	17	17	19	19
Mvmt Flow	0	0	314	396	211	597

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1038	106	211	0	-	0
Stage 1	211	-	-	-	-	-
Stage 2	827	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.44	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.37	-	-	-
Pot Cap-1 Maneuver	227	928	1254	-	-	-
Stage 1	804	-	-	-	-	-
Stage 2	390	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	170	928	1254	-	-	-
Mov Cap-2 Maneuver	170	-	-	-	-	-
Stage 1	804	-	-	-	-	-
Stage 2	292	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0		
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1254	-	-	-	-
HCM Lane V/C Ratio	0.251	-	-	-	-
HCM Control Delay (s)	8.8	-	0	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	1	-	-	-	-

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	414	52	170	400	823	933
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1776	1900	1863	1863	1845	1845
Adj Flow Rate, veh/h	514	0	189	444	914	1037
Adj No. of Lanes	2	1	1	2	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	7	0	2	2	3	3
Cap, veh/h	586	280	180	2634	2608	1167
Arrive On Green	0.17	0.00	0.74	0.74	0.25	0.25
Sat Flow, veh/h	3382	1615	225	3632	3597	1568
Grp Volume(v), veh/h	514	0	189	444	914	1037
Grp Sat Flow(s),veh/h/ln	1691	1615	225	1770	1752	1568
Q Serve(g_s), s	17.4	0.0	62.3	4.3	25.3	75.1
Cycle Q Clear(g_c), s	17.4	0.0	87.6	4.3	25.3	75.1
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	586	280	180	2634	2608	1167
V/C Ratio(X)	0.88	0.00	1.05	0.17	0.35	0.89
Avail Cap(c_a), veh/h	718	343	180	2634	2608	1167
HCM Platoon Ratio	1.00	1.00	1.00	1.00	0.33	0.33
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.18	0.18
Uniform Delay (d), s/veh	47.4	0.0	38.3	4.4	20.9	39.7
Incr Delay (d2), s/veh	10.2	0.0	80.6	0.1	0.1	2.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.0	0.0	9.8	2.1	12.4	33.5
LnGrp Delay(d),s/veh	57.6	0.0	118.9	4.5	21.0	41.8
LnGrp LOS	E		F	A	C	D
Approach Vol, veh/h	514			633	1951	
Approach Delay, s/veh	57.6			38.7	32.1	
Approach LOS	E			D	C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		93.6				93.6		26.4
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		83.0				83.0		25.0
Max Q Clear Time (g_c+I1), s		77.1				89.6		19.4
Green Ext Time (p_c), s		5.5				0.0		1.0

Intersection Summary	
HCM 2010 Ctrl Delay	37.7
HCM 2010 LOS	D

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	587	96	178	578	657	608
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1900	1863	1863	1845	1845
Adj Flow Rate, veh/h	752	0	198	642	730	676
Adj No. of Lanes	2	1	1	2	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	0	2	2	3	3
Cap, veh/h	861	400	326	2335	2312	1034
Arrive On Green	0.25	0.00	0.66	0.66	1.00	1.00
Sat Flow, veh/h	3480	1615	381	3632	3597	1568
Grp Volume(v), veh/h	752	0	198	642	730	676
Grp Sat Flow(s),veh/h/ln	1740	1615	381	1770	1752	1568
Q Serve(g_s), s	20.1	0.0	35.6	7.3	0.0	0.0
Cycle Q Clear(g_c), s	20.1	0.0	35.6	7.3	0.0	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	861	400	326	2335	2312	1034
V/C Ratio(X)	0.87	0.00	0.61	0.27	0.32	0.65
Avail Cap(c_a), veh/h	1076	499	326	2335	2312	1034
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.45	0.45
Uniform Delay (d), s/veh	35.0	0.0	11.7	6.9	0.0	0.0
Incr Delay (d2), s/veh	6.8	0.0	8.2	0.3	0.2	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.4	0.0	4.4	3.7	0.1	0.4
LnGrp Delay(d),s/veh	41.8	0.0	19.9	7.2	0.2	1.5
LnGrp LOS	D		B	A	A	A
Approach Vol, veh/h	752			840	1406	
Approach Delay, s/veh	41.8			10.1	0.8	
Approach LOS	D			B	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		70.0				70.0		30.0
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		58.0				58.0		30.0
Max Q Clear Time (g_c+I1), s		2.0				37.6		22.1
Green Ext Time (p_c), s		27.5				14.8		1.9

Intersection Summary	
HCM 2010 Ctrl Delay	13.7
HCM 2010 LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	558	318	104	710	1438	606
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1712	1900	1845	1845	1810	1810
Adj Flow Rate, veh/h	620	0	116	789	1598	673
Adj No. of Lanes	2	1	1	2	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	11	0	3	3	5	5
Cap, veh/h	712	353	238	2524	2028	907
Arrive On Green	0.22	0.00	0.10	0.96	0.59	0.59
Sat Flow, veh/h	3260	1615	1757	3597	3529	1538
Grp Volume(v), veh/h	620	0	116	789	1598	673
Grp Sat Flow(s),veh/h/ln	1630	1615	1757	1752	1719	1538
Q Serve(g_s), s	21.1	0.0	2.5	1.6	41.0	36.7
Cycle Q Clear(g_c), s	21.1	0.0	2.5	1.6	41.0	36.7
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	712	353	238	2524	2028	907
V/C Ratio(X)	0.87	0.00	0.49	0.31	0.79	0.74
Avail Cap(c_a), veh/h	992	491	238	2524	2028	907
HCM Platoon Ratio	1.00	1.00	1.33	1.33	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.83	0.83	1.00	1.00
Uniform Delay (d), s/veh	43.4	0.0	22.1	0.7	18.1	17.2
Incr Delay (d2), s/veh	6.3	0.0	1.3	0.3	3.2	5.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.1	0.0	2.2	0.7	20.2	16.9
LnGrp Delay(d),s/veh	49.7	0.0	23.4	1.0	21.3	22.6
LnGrp LOS	D		C	A	C	C
Approach Vol, veh/h	620			905	2271	
Approach Delay, s/veh	49.7			3.9	21.7	
Approach LOS	D			A	C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	15.0	73.9				88.9		31.1
Change Period (Y+Rc), s	6.0	6.0				6.0		6.0
Max Green Setting (Gmax), s	9.0	58.0				73.0		35.0
Max Q Clear Time (g_c+I1), s	4.5	43.0				3.6		23.1
Green Ext Time (p_c), s	0.1	13.4				45.5		2.0

Intersection Summary	
HCM 2010 Ctrl Delay	22.0
HCM 2010 LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	779	249	65	1100	1016	517
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1759	1900	1845	1845	1827	1827
Adj Flow Rate, veh/h	866	0	72	1222	1129	574
Adj No. of Lanes	2	1	1	2	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	8	0	3	3	4	4
Cap, veh/h	993	479	300	2185	1619	724
Arrive On Green	0.30	0.00	0.13	0.83	0.47	0.47
Sat Flow, veh/h	3351	1615	1757	3597	3563	1553
Grp Volume(v), veh/h	866	0	72	1222	1129	574
Grp Sat Flow(s),veh/h/ln	1675	1615	1757	1752	1736	1553
Q Serve(g_s), s	23.5	0.0	1.7	10.6	24.6	29.9
Cycle Q Clear(g_c), s	23.5	0.0	1.7	10.6	24.6	29.9
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	993	479	300	2185	1619	724
V/C Ratio(X)	0.87	0.00	0.24	0.56	0.70	0.79
Avail Cap(c_a), veh/h	1296	625	300	2185	1619	724
HCM Platoon Ratio	1.00	1.00	1.33	1.33	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.78	0.78	1.00	1.00
Uniform Delay (d), s/veh	31.9	0.0	13.2	4.0	20.2	21.6
Incr Delay (d2), s/veh	5.4	0.0	0.3	0.8	2.5	8.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.6	0.0	0.8	5.0	12.3	14.5
LnGrp Delay(d),s/veh	37.3	0.0	13.5	4.8	22.7	30.3
LnGrp LOS	D		B	A	C	C
Approach Vol, veh/h	866			1294	1703	
Approach Delay, s/veh	37.3			5.3	25.2	
Approach LOS	D			A	C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	15.0	50.6				65.6		34.4
Change Period (Y+Rc), s	6.0	6.0				6.0		6.0
Max Green Setting (Gmax), s	9.0	36.0				51.0		37.0
Max Q Clear Time (g_c+I1), s	3.7	31.9				12.6		25.5
Green Ext Time (p_c), s	0.1	3.8				28.4		2.9

Intersection Summary	
HCM 2010 Ctrl Delay	21.3
HCM 2010 LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	27	867	214	33	728	221	40	7	119	15	5	60
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1900	1827	1827	1827	1900	1776	1776	1845	1845	1900
Adj Flow Rate, veh/h	30	963	238	37	809	246	44	8	132	17	6	67
Adj No. of Lanes	1	2	0	1	2	1	0	1	1	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	4	4	4	7	7	7	3	3	3
Cap, veh/h	353	1653	408	279	2098	939	304	47	341	302	29	329
Arrive On Green	0.60	0.60	0.60	0.60	0.60	0.60	0.23	0.23	0.23	0.23	0.23	0.23
Sat Flow, veh/h	517	2735	674	455	3471	1553	931	210	1509	1232	130	1457
Grp Volume(v), veh/h	30	604	597	37	809	246	52	0	132	17	0	73
Grp Sat Flow(s),veh/h/ln	517	1719	1691	455	1736	1553	1141	0	1509	1232	0	1588
Q Serve(g_s), s	2.2	15.1	15.2	3.8	8.5	5.3	1.8	0.0	5.2	0.8	0.0	2.6
Cycle Q Clear(g_c), s	10.7	15.1	15.2	19.0	8.5	5.3	4.5	0.0	5.2	5.3	0.0	2.6
Prop In Lane	1.00		0.40	1.00		1.00	0.85		1.00	1.00		0.92
Lane Grp Cap(c), veh/h	353	1039	1022	279	2098	939	352	0	341	302	0	358
V/C Ratio(X)	0.09	0.58	0.58	0.13	0.39	0.26	0.15	0.00	0.39	0.06	0.00	0.20
Avail Cap(c_a), veh/h	458	1388	1365	371	2803	1254	446	0	449	390	0	472
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.0	8.5	8.5	14.4	7.2	6.6	23.4	0.0	23.2	25.1	0.0	22.2
Incr Delay (d2), s/veh	0.1	0.5	0.5	0.2	0.1	0.1	0.2	0.0	0.7	0.1	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	7.2	7.1	0.5	4.1	2.3	0.9	0.0	2.2	0.3	0.0	1.2
LnGrp Delay(d),s/veh	10.1	9.0	9.1	14.6	7.3	6.7	23.6	0.0	23.9	25.2	0.0	22.5
LnGrp LOS	B	A	A	B	A	A	C		C	C		C
Approach Vol, veh/h		1231			1092			184			90	
Approach Delay, s/veh		9.1			7.4			23.8			23.0	
Approach LOS		A			A			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		48.7		21.9		48.7		21.9
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		57.0		21.0		57.0		21.0
Max Q Clear Time (g_c+I1), s		21.0		7.2		17.2		7.3
Green Ext Time (p_c), s		21.6		1.0		22.9		1.0

Intersection Summary	
HCM 2010 Ctrl Delay	9.9
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	64	816	184	54	643	239	78	6	133	19	9	37
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1900	1827	1827	1827	1900	1827	1827	1845	1845	1900
Adj Flow Rate, veh/h	71	907	204	60	714	266	87	7	148	21	10	41
Adj No. of Lanes	1	2	0	1	2	1	0	1	1	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	3	3	3
Cap, veh/h	380	1683	378	305	2073	927	356	25	357	284	73	299
Arrive On Green	0.60	0.60	0.60	0.60	0.60	0.60	0.23	0.23	0.23	0.23	0.23	0.23
Sat Flow, veh/h	561	2818	633	495	3471	1553	1113	108	1553	1215	317	1299
Grp Volume(v), veh/h	71	558	553	60	714	266	94	0	148	21	0	51
Grp Sat Flow(s),veh/h/ln	561	1736	1715	495	1736	1553	1221	0	1553	1215	0	1615
Q Serve(g_s), s	5.1	13.3	13.3	5.7	7.2	5.8	3.9	0.0	5.6	1.0	0.0	1.7
Cycle Q Clear(g_c), s	12.3	13.3	13.3	19.0	7.2	5.8	5.6	0.0	5.6	6.7	0.0	1.7
Prop In Lane	1.00		0.37	1.00		1.00	0.93		1.00	1.00		0.80
Lane Grp Cap(c), veh/h	380	1037	1024	305	2073	927	381	0	357	284	0	371
V/C Ratio(X)	0.19	0.54	0.54	0.20	0.34	0.29	0.25	0.00	0.41	0.07	0.00	0.14
Avail Cap(c_a), veh/h	506	1425	1408	416	2850	1275	479	0	470	372	0	489
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.2	8.3	8.3	13.9	7.1	6.8	23.3	0.0	22.8	25.6	0.0	21.3
Incr Delay (d2), s/veh	0.2	0.4	0.4	0.3	0.1	0.2	0.3	0.0	0.8	0.1	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	6.3	6.3	0.8	3.4	2.5	1.6	0.0	2.5	0.4	0.0	0.8
LnGrp Delay(d),s/veh	10.5	8.7	8.8	14.3	7.2	7.0	23.7	0.0	23.5	25.7	0.0	21.4
LnGrp LOS	B	A	A	B	A	A	C		C	C		C
Approach Vol, veh/h		1182			1040			242			72	
Approach Delay, s/veh		8.8			7.5			23.6			22.7	
Approach LOS		A			A			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		47.5		22.0		47.5		22.0
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		57.0		21.0		57.0		21.0
Max Q Clear Time (g_c+I1), s		21.0		7.6		15.3		8.7
Green Ext Time (p_c), s		20.5		1.2		22.1		1.1

Intersection Summary	
HCM 2010 Ctrl Delay	10.1
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	19	23	230	81	7	9	499	1080	171	22	900	46
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1792	1792	1792	1597	1597	1900	1810	1810	1900	1810	1810	1810
Adj Flow Rate, veh/h	21	26	256	90	8	10	554	1200	190	24	1000	51
Adj No. of Lanes	1	1	1	1	1	0	2	3	0	1	3	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	6	6	6	19	19	19	5	5	5	5	5	5
Cap, veh/h	360	375	318	279	135	169	682	2189	347	81	1739	541
Arrive On Green	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.51	0.51	0.05	0.35	0.35
Sat Flow, veh/h	1337	1792	1524	937	646	808	3343	4302	681	1723	4940	1538
Grp Volume(v), veh/h	21	26	256	90	0	18	554	919	471	24	1000	51
Grp Sat Flow(s),veh/h/ln	1337	1792	1524	937	0	1454	1672	1647	1689	1723	1647	1538
Q Serve(g_s), s	1.0	0.9	12.2	6.5	0.0	0.8	12.1	14.5	14.5	1.0	12.6	1.7
Cycle Q Clear(g_c), s	1.7	0.9	12.2	7.4	0.0	0.8	12.1	14.5	14.5	1.0	12.6	1.7
Prop In Lane	1.00		1.00	1.00		0.56	1.00		0.40	1.00		1.00
Lane Grp Cap(c), veh/h	360	375	318	279	0	304	682	1676	860	81	1739	541
V/C Ratio(X)	0.06	0.07	0.80	0.32	0.00	0.06	0.81	0.55	0.55	0.30	0.58	0.09
Avail Cap(c_a), veh/h	395	421	358	303	0	342	1048	1936	993	203	1936	603
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.0	24.3	28.8	27.3	0.0	24.3	29.1	12.8	12.8	35.3	20.2	16.6
Incr Delay (d2), s/veh	0.1	0.1	11.4	0.7	0.0	0.1	2.9	0.3	0.5	2.0	0.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.4	6.2	1.7	0.0	0.3	5.8	6.6	6.8	0.5	5.8	0.7
LnGrp Delay(d),s/veh	25.0	24.4	40.2	28.0	0.0	24.3	32.0	13.1	13.3	37.3	20.5	16.7
LnGrp LOS	C	C	D	C		C	C	B	B	D	C	B
Approach Vol, veh/h		303			108			1944			1075	
Approach Delay, s/veh		37.8			27.3			18.5			20.7	
Approach LOS		D			C			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	21.6	32.9		22.0	9.6	45.0		22.0
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s	24.0	30.0		18.0	9.0	45.0		18.0
Max Q Clear Time (g_c+I1), s	14.1	14.6		9.4	3.0	16.5		14.2
Green Ext Time (p_c), s	1.5	12.4		1.1	0.0	19.9		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	21.2
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	44	4	446	186	12	10	269	1010	74	5	848	29
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1624	1624	1900	1827	1827	1900	1827	1827	1827
Adj Flow Rate, veh/h	49	4	496	207	13	11	299	1122	82	6	942	32
Adj No. of Lanes	1	1	1	1	1	0	2	3	0	1	3	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	17	17	17	4	4	4	4	4	4
Cap, veh/h	561	652	554	364	285	241	394	1920	140	24	1507	469
Arrive On Green	0.35	0.35	0.35	0.35	0.35	0.35	0.12	0.40	0.40	0.01	0.30	0.30
Sat Flow, veh/h	1381	1863	1583	780	814	689	3375	4744	346	1740	4988	1553
Grp Volume(v), veh/h	49	4	496	207	0	24	299	786	418	6	942	32
Grp Sat Flow(s),veh/h/ln	1381	1863	1583	780	0	1502	1688	1663	1766	1740	1663	1553
Q Serve(g_s), s	1.9	0.1	23.1	18.3	0.0	0.8	6.7	14.4	14.4	0.3	12.7	1.1
Cycle Q Clear(g_c), s	2.7	0.1	23.1	18.4	0.0	0.8	6.7	14.4	14.4	0.3	12.7	1.1
Prop In Lane	1.00		1.00	1.00		0.46	1.00		0.20	1.00		1.00
Lane Grp Cap(c), veh/h	561	652	554	364	0	526	394	1346	715	24	1507	469
V/C Ratio(X)	0.09	0.01	0.89	0.57	0.00	0.05	0.76	0.58	0.58	0.25	0.62	0.07
Avail Cap(c_a), veh/h	646	765	651	412	0	617	563	1346	715	201	1729	538
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.6	16.5	24.0	22.5	0.0	16.7	33.3	18.1	18.1	38.0	23.4	19.4
Incr Delay (d2), s/veh	0.1	0.0	13.5	1.4	0.0	0.0	3.7	0.7	1.2	5.1	0.6	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.1	12.1	4.1	0.0	0.3	3.3	6.7	7.2	0.2	5.8	0.5
LnGrp Delay(d),s/veh	17.7	16.5	37.5	23.9	0.0	16.8	37.0	18.7	19.3	43.1	23.9	19.4
LnGrp LOS	B	B	D	C		B	D	B	B	D	C	B
Approach Vol, veh/h		549			231			1503			980	
Approach Delay, s/veh		35.5			23.2			22.5			23.9	
Approach LOS		D			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	15.1	29.5		33.3	7.1	37.5		33.3
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s	13.0	27.0		32.0	9.0	31.0		32.0
Max Q Clear Time (g_c+I1), s	8.7	14.7		20.4	2.3	16.4		25.1
Green Ext Time (p_c), s	0.4	8.9		2.9	0.0	11.0		2.2

Intersection Summary	
HCM 2010 Ctrl Delay	25.2
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	475	0	308	223	1442	0	0	1061	150
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1727	0	1727	1776	1776	0	0	1810	1810
Adj Flow Rate, veh/h				528	0	342	248	1602	0	0	1179	167
Adj No. of Lanes				2	0	1	2	3	0	0	3	1
Peak Hour Factor				0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %				10	0	10	7	7	0	0	5	5
Cap, veh/h				875	0	402	372	2783	0	0	1901	592
Arrive On Green				0.27	0.00	0.27	0.11	0.57	0.00	0.00	0.38	0.38
Sat Flow, veh/h				3191	0	1468	3281	5007	0	0	5103	1538
Grp Volume(v), veh/h				528	0	342	248	1602	0	0	1179	167
Grp Sat Flow(s),veh/h/ln				1596	0	1468	1640	1616	0	0	1647	1538
Q Serve(g_s), s				11.4	0.0	17.4	5.7	16.6	0.0	0.0	15.2	5.9
Cycle Q Clear(g_c), s				11.4	0.0	17.4	5.7	16.6	0.0	0.0	15.2	5.9
Prop In Lane				1.00		1.00	1.00		0.00	0.00		1.00
Lane Grp Cap(c), veh/h				875	0	402	372	2783	0	0	1901	592
V/C Ratio(X)				0.60	0.00	0.85	0.67	0.58	0.00	0.00	0.62	0.28
Avail Cap(c_a), veh/h				1131	0	520	498	3067	0	0	2000	623
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				25.0	0.0	27.1	33.6	10.7	0.0	0.0	19.6	16.8
Incr Delay (d2), s/veh				0.7	0.0	10.2	2.1	0.2	0.0	0.0	0.5	0.3
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				5.1	0.0	8.2	2.7	7.3	0.0	0.0	7.0	2.5
LnGrp Delay(d),s/veh				25.6	0.0	37.3	35.7	10.9	0.0	0.0	20.2	17.0
LnGrp LOS				C		D	D	B			C	B
Approach Vol, veh/h					870			1850			1346	
Approach Delay, s/veh					30.2			14.2			19.8	
Approach LOS					C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		51.4			15.0	36.4		27.7
Change Period (Y+Rc), s		6.0			6.0	6.0		6.0
Max Green Setting (Gmax), s		50.0			12.0	32.0		28.0
Max Q Clear Time (g_c+I1), s		18.6			7.7	17.2		19.4
Green Ext Time (p_c), s		25.4			0.3	13.2		2.2

Intersection Summary	
HCM 2010 Ctrl Delay	19.5
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	630	0	244	528	1109	0	0	1242	238
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1759	0	1759	1810	1810	0	0	1827	1827
Adj Flow Rate, veh/h				700	0	271	587	1232	0	0	1380	264
Adj No. of Lanes				2	0	1	2	3	0	0	3	1
Peak Hour Factor				0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %				8	0	8	5	5	0	0	4	4
Cap, veh/h				798	0	367	670	3037	0	0	1717	535
Arrive On Green				0.25	0.00	0.25	0.20	0.61	0.00	0.00	0.34	0.34
Sat Flow, veh/h				3250	0	1495	3343	5103	0	0	5152	1553
Grp Volume(v), veh/h				700	0	271	587	1232	0	0	1380	264
Grp Sat Flow(s),veh/h/ln				1625	0	1495	1672	1647	0	0	1663	1553
Q Serve(g_s), s				17.8	0.0	14.3	14.6	11.0	0.0	0.0	21.5	11.5
Cycle Q Clear(g_c), s				17.8	0.0	14.3	14.6	11.0	0.0	0.0	21.5	11.5
Prop In Lane				1.00		1.00	1.00		0.00	0.00		1.00
Lane Grp Cap(c), veh/h				798	0	367	670	3037	0	0	1717	535
V/C Ratio(X)				0.88	0.00	0.74	0.88	0.41	0.00	0.00	0.80	0.49
Avail Cap(c_a), veh/h				871	0	401	740	3167	0	0	1744	543
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				31.1	0.0	29.8	33.3	8.5	0.0	0.0	25.5	22.2
Incr Delay (d2), s/veh				9.5	0.0	6.5	10.7	0.1	0.0	0.0	2.8	0.7
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				9.0	0.0	6.5	7.7	4.9	0.0	0.0	10.3	5.0
LnGrp Delay(d),s/veh				40.7	0.0	36.3	44.0	8.6	0.0	0.0	28.3	22.9
LnGrp LOS				D		D	D	A			C	C
Approach Vol, veh/h					971			1819			1644	
Approach Delay, s/veh					39.4			20.0			27.4	
Approach LOS					D			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		58.7			23.2	35.5		27.1
Change Period (Y+Rc), s		6.0			6.0	6.0		6.0
Max Green Setting (Gmax), s		55.0			19.0	30.0		23.0
Max Q Clear Time (g_c+I1), s		13.0			16.6	23.5		19.8
Green Ext Time (p_c), s		30.5			0.6	6.0		1.3

Intersection Summary	
HCM 2010 Ctrl Delay	27.0
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	9	83	322	98	41	14	237	382	196	5	206	24
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1827	1827	1845	1845	1900	1792	1792	1792	1900	1810	1900
Adj Flow Rate, veh/h	10	92	358	109	46	16	263	424	218	6	229	27
Adj No. of Lanes	0	1	1	1	1	0	1	1	1	0	2	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	3	3	3	6	6	6	5	5	5
Cap, veh/h	66	396	583	448	538	187	497	776	660	54	622	72
Arrive On Green	0.23	0.23	0.23	0.11	0.41	0.41	0.15	0.43	0.43	0.21	0.21	0.21
Sat Flow, veh/h	65	1737	1553	1757	1309	455	1707	1792	1524	23	2995	346
Grp Volume(v), veh/h	102	0	358	109	0	62	263	424	218	138	0	124
Grp Sat Flow(s),veh/h/ln	1801	0	1553	1757	0	1764	1707	1792	1524	1778	0	1586
Q Serve(g_s), s	0.0	0.0	14.4	3.3	0.0	1.7	8.7	13.5	7.3	0.0	0.0	5.2
Cycle Q Clear(g_c), s	3.5	0.0	14.4	3.3	0.0	1.7	8.7	13.5	7.3	5.0	0.0	5.2
Prop In Lane	0.10		1.00	1.00		0.26	1.00		1.00	0.04		0.22
Lane Grp Cap(c), veh/h	462	0	583	448	0	725	497	776	660	418	0	329
V/C Ratio(X)	0.22	0.00	0.61	0.24	0.00	0.09	0.53	0.55	0.33	0.33	0.00	0.38
Avail Cap(c_a), veh/h	563	0	673	582	0	962	932	1536	1305	706	0	597
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.3	0.0	19.5	17.1	0.0	13.8	17.9	16.2	14.4	26.2	0.0	26.2
Incr Delay (d2), s/veh	0.2	0.0	1.3	0.3	0.0	0.1	0.9	0.6	0.3	0.5	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	0.0	6.4	1.6	0.0	0.8	4.1	6.7	3.1	2.6	0.0	2.3
LnGrp Delay(d),s/veh	24.6	0.0	20.8	17.4	0.0	13.9	18.8	16.8	14.7	26.6	0.0	26.9
LnGrp LOS	C		C	B		B	B	B	B	C		C
Approach Vol, veh/h		460			171			905			262	
Approach Delay, s/veh		21.7			16.1			16.9			26.8	
Approach LOS		C			B			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4	5	6		8
Phs Duration (G+Y+Rc), s		39.4	14.1	23.5	17.4	22.0		37.7
Change Period (Y+Rc), s		6.0	6.0	6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s		66.0	14.0	22.0	31.0	29.0		42.0
Max Q Clear Time (g_c+I1), s		15.5	5.3	16.4	10.7	7.2		3.7
Green Ext Time (p_c), s		5.6	0.1	1.1	0.7	5.0		2.3

Intersection Summary	
HCM 2010 Ctrl Delay	19.5
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	9	51	388	176	65	7	253	288	153	4	333	28
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1845	1863	1863	1900	1810	1810	1810	1900	1827	1900
Adj Flow Rate, veh/h	10	57	431	196	72	8	281	320	170	4	370	31
Adj No. of Lanes	0	1	1	1	1	0	1	1	1	0	2	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	2	2	2	5	5	5	4	4	4
Cap, veh/h	83	376	600	469	684	76	449	784	666	48	639	53
Arrive On Green	0.23	0.23	0.23	0.11	0.42	0.42	0.16	0.43	0.43	0.20	0.20	0.20
Sat Flow, veh/h	133	1656	1568	1774	1647	183	1723	1810	1538	9	3163	262
Grp Volume(v), veh/h	67	0	431	196	0	80	281	320	170	214	0	191
Grp Sat Flow(s),veh/h/ln	1789	0	1568	1774	0	1830	1723	1810	1538	1817	0	1616
Q Serve(g_s), s	0.0	0.0	18.0	6.2	0.0	2.1	9.5	9.6	5.6	0.0	0.0	8.5
Cycle Q Clear(g_c), s	2.3	0.0	18.0	6.2	0.0	2.1	9.5	9.6	5.6	8.4	0.0	8.5
Prop In Lane	0.15		1.00	1.00		0.10	1.00		1.00	0.02		0.16
Lane Grp Cap(c), veh/h	459	0	600	469	0	760	449	784	666	414	0	327
V/C Ratio(X)	0.15	0.00	0.72	0.42	0.00	0.11	0.63	0.41	0.26	0.52	0.00	0.59
Avail Cap(c_a), veh/h	459	0	600	651	0	948	878	1532	1302	708	0	592
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.5	0.0	20.8	18.1	0.0	14.1	19.0	15.5	14.3	28.5	0.0	28.6
Incr Delay (d2), s/veh	0.1	0.0	4.1	0.6	0.0	0.1	1.4	0.3	0.2	1.0	0.0	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	8.7	3.1	0.0	1.1	4.6	4.9	2.4	4.3	0.0	3.9
LnGrp Delay(d),s/veh	24.7	0.0	25.0	18.7	0.0	14.2	20.5	15.8	14.5	29.5	0.0	30.2
LnGrp LOS	C		C	B		B	C	B	B	C		C
Approach Vol, veh/h		498			276			771			405	
Approach Delay, s/veh		24.9			17.4			17.2			29.9	
Approach LOS		C			B			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4	5	6		8
Phs Duration (G+Y+Rc), s		40.3	14.9	24.0	18.3	22.0		38.9
Change Period (Y+Rc), s		6.0	6.0	6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s		67.0	17.0	18.0	32.0	29.0		41.0
Max Q Clear Time (g_c+I1), s		11.6	8.2	20.0	11.5	10.5		4.1
Green Ext Time (p_c), s		5.5	0.3	0.0	0.8	4.7		2.5

Intersection Summary	
HCM 2010 Ctrl Delay	21.8
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	118	888	0	0	462	130	296	0	51	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0		6.0		6.0			
Lane Util. Factor	1.00	0.95			0.95		0.97		1.00			
Frt	1.00	1.00			0.97		1.00		0.85			
Flt Protected	0.95	1.00			1.00		0.95		1.00			
Satd. Flow (prot)	1671	3343			3294		2943		1357			
Flt Permitted	0.31	1.00			1.00		0.95		1.00			
Satd. Flow (perm)	543	3343			3294		2943		1357			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	131	987	0	0	513	144	329	0	57	0	0	0
RTOR Reduction (vph)	0	0	0	0	21	0	0	0	45	0	0	0
Lane Group Flow (vph)	131	987	0	0	636	0	329	0	12	0	0	0
Heavy Vehicles (%)	8%	8%	8%	6%	6%	6%	19%	19%	19%	2%	2%	2%
Turn Type	custom	NA			NA		Prot		Prot			
Protected Phases	5 8	2 5 8			6		7		7			
Permitted Phases	2						7		7			
Actuated Green, G (s)	72.1	72.1			43.0		24.5		24.5			
Effective Green, g (s)	72.1	72.1			43.0		24.5		24.5			
Actuated g/C Ratio	0.62	0.62			0.37		0.21		0.21			
Clearance Time (s)					6.0		6.0		6.0			
Vehicle Extension (s)					3.0		3.0		3.0			
Lane Grp Cap (vph)	636	2067			1214		618		285			
v/s Ratio Prot	0.05	c0.30			c0.19		c0.11		0.01			
v/s Ratio Perm	0.07											
v/c Ratio	0.21	0.48			0.52		0.53		0.04			
Uniform Delay, d1	9.7	12.0			28.8		41.0		36.7			
Progression Factor	0.97	0.86			1.00		1.00		1.00			
Incremental Delay, d2	0.1	0.1			0.4		0.9		0.1			
Delay (s)	9.6	10.5			29.2		41.8		36.8			
Level of Service	A	B			C		D		D			
Approach Delay (s)		10.4			29.2			41.1			0.0	
Approach LOS		B			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	21.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	116.6	Sum of lost time (s)	24.0
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	277	616	0	0	698	304	300	0	109	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0		6.0		6.0			
Lane Util. Factor	1.00	0.95			0.95		0.97		1.00			
Frt	1.00	1.00			0.95		1.00		0.85			
Flt Protected	0.95	1.00			1.00		0.95		1.00			
Satd. Flow (prot)	1703	3406			3282		3072		1417			
Flt Permitted	0.13	1.00			1.00		0.95		1.00			
Satd. Flow (perm)	231	3406			3282		3072		1417			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	308	684	0	0	776	338	333	0	121	0	0	0
RTOR Reduction (vph)	0	0	0	0	41	0	0	0	103	0	0	0
Lane Group Flow (vph)	308	684	0	0	1073	0	333	0	18	0	0	0
Heavy Vehicles (%)	6%	6%	6%	5%	5%	5%	14%	14%	14%	2%	2%	2%
Turn Type	custom	NA			NA		Prot		Prot			
Protected Phases	5 8	2 5 8			6		7		7			
Permitted Phases	2						7		7			
Actuated Green, G (s)	75.5	75.5			48.2		16.9		16.9			
Effective Green, g (s)	75.5	75.5			48.2		16.9		16.9			
Actuated g/C Ratio	0.65	0.65			0.42		0.15		0.15			
Clearance Time (s)					6.0		6.0		6.0			
Vehicle Extension (s)					3.0		3.0		3.0			
Lane Grp Cap (vph)	566	2220			1366		448		206			
v/s Ratio Prot	c0.15	0.20			c0.33		c0.11		0.01			
v/s Ratio Perm	0.20											
v/c Ratio	0.54	0.31			0.79		0.74		0.09			
Uniform Delay, d1	18.2	8.8			29.3		47.4		42.8			
Progression Factor	2.41	0.84			1.00		1.00		1.00			
Incremental Delay, d2	0.9	0.1			3.1		6.6		0.2			
Delay (s)	44.7	7.4			32.4		53.9		42.9			
Level of Service	D	A			C		D		D			
Approach Delay (s)		19.0			32.4			51.0			0.0	
Approach LOS		B			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	30.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	115.8	Sum of lost time (s)	24.0
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	654	556	75	683	0	0	0	0	352	0	224
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0					6.0		6.0
Lane Util. Factor		0.95	1.00	1.00	0.95					1.00		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		3312	1482	1671	3343					1626		1455
Flt Permitted		1.00	1.00	0.23	1.00					0.95		1.00
Satd. Flow (perm)		3312	1482	408	3343					1626		1455
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	727	618	83	759	0	0	0	0	391	0	249
RTOR Reduction (vph)	0	0	121	0	0	0	0	0	0	0	0	77
Lane Group Flow (vph)	0	727	497	83	759	0	0	0	0	391	0	172
Heavy Vehicles (%)	9%	9%	9%	8%	8%	8%	2%	2%	2%	11%	11%	11%
Turn Type		NA	custom	custom	NA					custom		custom
Protected Phases		2		1	1 6					7 8		7 8
Permitted Phases			2 7 8	6						7 8		7 8
Actuated Green, G (s)		41.0	93.6	54.0	54.0					46.6		46.6
Effective Green, g (s)		41.0	93.6	54.0	54.0					46.6		46.6
Actuated g/C Ratio		0.35	0.80	0.46	0.46					0.40		0.40
Clearance Time (s)		6.0		6.0								
Vehicle Extension (s)		3.0		3.0								
Lane Grp Cap (vph)		1164	1189	308	1548					649		581
v/s Ratio Prot		c0.22		0.03	c0.23					c0.24		0.12
v/s Ratio Perm			0.34	0.10								
v/c Ratio		0.62	0.42	0.27	0.49					0.60		0.30
Uniform Delay, d1		31.4	3.4	19.0	21.7					27.7		23.8
Progression Factor		1.00	1.00	0.44	1.09					1.00		1.00
Incremental Delay, d2		1.1	0.2	0.4	0.2					1.6		0.3
Delay (s)		32.5	3.7	8.8	23.9					29.3		24.1
Level of Service		C	A	A	C					C		C
Approach Delay (s)		19.2			22.5			0.0			27.3	
Approach LOS		B			C			A			C	

Intersection Summary			
HCM 2000 Control Delay	22.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	116.6	Sum of lost time (s)	24.0
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	706	392	98	900	0	0	0	0	187	0	196
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0					6.0		6.0
Lane Util. Factor		0.95	1.00	1.00	0.95					1.00		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		3343	1495	1703	3406					1570		1404
Flt Permitted		1.00	1.00	0.20	1.00					0.95		1.00
Satd. Flow (perm)		3343	1495	358	3406					1570		1404
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	784	436	109	1000	0	0	0	0	208	0	218
RTOR Reduction (vph)	0	0	106	0	0	0	0	0	0	0	0	65
Lane Group Flow (vph)	0	784	330	109	1000	0	0	0	0	208	0	153
Heavy Vehicles (%)	8%	8%	8%	6%	6%	6%	2%	2%	2%	15%	15%	15%
Turn Type		NA	custom	custom	NA					custom		custom
Protected Phases		2		1	1 6					7 8		7 8
Permitted Phases			2 7 8	6						7 8		7 8
Actuated Green, G (s)		42.8	87.7	64.3	64.3					38.9		38.9
Effective Green, g (s)		42.8	87.7	64.3	64.3					38.9		38.9
Actuated g/C Ratio		0.37	0.76	0.56	0.56					0.34		0.34
Clearance Time (s)		6.0		6.0								
Vehicle Extension (s)		3.0		3.0								
Lane Grp Cap (vph)		1235	1132	385	1891					527		471
v/s Ratio Prot		c0.23		0.04	c0.29					c0.13		0.11
v/s Ratio Perm			0.22	0.12								
v/c Ratio		0.63	0.29	0.28	0.53					0.39		0.32
Uniform Delay, d1		30.1	4.4	14.6	16.2					29.4		28.7
Progression Factor		1.00	1.00	0.72	0.97					1.00		1.00
Incremental Delay, d2		1.1	0.1	0.3	0.2					0.5		0.4
Delay (s)		31.1	4.5	10.7	15.9					29.9		29.1
Level of Service		C	A	B	B					C		C
Approach Delay (s)		21.6			15.4			0.0			29.5	
Approach LOS		C			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	20.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	115.8	Sum of lost time (s)	24.0
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	154	208	262	171	106	58	450	1167	269	36	575	83
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1792	1792	1792	1776	1776	1900	1810	1810	1810	1810	1810	1810
Adj Flow Rate, veh/h	171	231	291	190	118	64	500	1297	299	40	639	92
Adj No. of Lanes	1	2	1	1	2	0	1	2	1	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	6	6	6	7	7	7	5	5	5	5	5	5
Cap, veh/h	283	632	638	321	712	364	539	1909	854	151	910	407
Arrive On Green	0.19	0.19	0.19	0.09	0.33	0.33	0.23	0.56	0.56	0.26	0.26	0.26
Sat Flow, veh/h	1152	3406	1524	1691	2162	1106	1723	3438	1538	309	3438	1538
Grp Volume(v), veh/h	171	231	291	190	91	91	500	1297	299	40	639	92
Grp Sat Flow(s),veh/h/ln	1152	1703	1524	1691	1687	1581	1723	1719	1538	309	1719	1538
Q Serve(g_s), s	14.8	6.2	14.3	9.0	4.0	4.3	21.0	28.1	11.2	11.4	17.5	4.9
Cycle Q Clear(g_c), s	14.8	6.2	14.3	9.0	4.0	4.3	21.0	28.1	11.2	11.4	17.5	4.9
Prop In Lane	1.00		1.00	1.00		0.70	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	283	632	638	321	556	521	539	1909	854	151	910	407
V/C Ratio(X)	0.60	0.37	0.46	0.59	0.16	0.18	0.93	0.68	0.35	0.27	0.70	0.23
Avail Cap(c_a), veh/h	334	784	706	321	631	591	699	2276	1018	155	956	428
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	40.6	37.1	21.8	30.2	24.8	24.9	21.3	16.5	12.8	32.4	34.6	30.0
Incr Delay (d2), s/veh	2.2	0.4	0.5	2.9	0.1	0.2	16.0	0.6	0.2	0.9	2.2	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.9	3.0	6.1	1.0	1.9	1.9	16.3	13.3	4.7	1.0	8.5	2.1
LnGrp Delay(d),s/veh	42.8	37.4	22.3	33.1	24.9	25.0	37.3	17.2	13.0	33.3	36.8	30.2
LnGrp LOS	D	D	C	C	C	C	D	B	B	C	D	C
Approach Vol, veh/h		693			372			2096			771	
Approach Delay, s/veh		32.4			29.1			21.4			35.8	
Approach LOS		C			C			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6	7	8
Phs Duration (G+Y+Rc), s	30.3	33.6		40.3		63.9	15.0	25.3
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0	6.0	6.0
Max Green Setting (Gmax), s	34.0	29.0		39.0		69.0	9.0	24.0
Max Q Clear Time (g_c+I1), s	23.0	19.5		6.3		30.1	11.0	16.8
Green Ext Time (p_c), s	1.3	8.1		4.6		24.5	0.0	2.5

Intersection Summary	
HCM 2010 Ctrl Delay	26.9
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	80	119	494	252	272	58	300	744	154	26	1053	107
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1810	1810	1810	1900	1827	1827	1827	1827	1827	1827
Adj Flow Rate, veh/h	89	132	549	280	302	64	333	827	171	29	1170	119
Adj No. of Lanes	1	2	1	1	2	0	1	2	1	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	5	5	5	4	4	4	4	4	4
Cap, veh/h	204	488	452	311	830	173	365	2084	932	282	1372	614
Arrive On Green	0.14	0.14	0.14	0.10	0.29	0.29	0.15	0.60	0.60	0.40	0.40	0.40
Sat Flow, veh/h	983	3438	1538	1723	2832	592	1740	3471	1553	551	3471	1553
Grp Volume(v), veh/h	89	132	549	280	182	184	333	827	171	29	1170	119
Grp Sat Flow(s),veh/h/ln	983	1719	1538	1723	1719	1705	1740	1736	1553	551	1736	1553
Q Serve(g_s), s	9.6	3.9	16.0	11.0	9.4	9.7	14.6	14.1	5.6	3.8	34.6	5.7
Cycle Q Clear(g_c), s	9.6	3.9	16.0	11.0	9.4	9.7	14.6	14.1	5.6	3.8	34.6	5.7
Prop In Lane	1.00		1.00	1.00		0.35	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	204	488	452	311	504	500	365	2084	932	282	1372	614
V/C Ratio(X)	0.44	0.27	1.21	0.90	0.36	0.37	0.91	0.40	0.18	0.10	0.85	0.19
Avail Cap(c_a), veh/h	204	488	452	311	504	500	456	2312	1034	289	1418	634
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	45.6	43.1	39.8	40.5	31.5	31.6	29.1	11.8	10.1	21.7	31.1	22.3
Incr Delay (d2), s/veh	1.5	0.3	115.1	27.1	0.4	0.5	19.7	0.1	0.1	0.2	5.1	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.7	1.9	28.5	5.8	4.5	4.6	12.1	6.7	2.4	0.6	17.6	2.4
LnGrp Delay(d),s/veh	47.1	43.4	154.9	67.6	31.9	32.0	48.8	11.9	10.2	21.9	36.2	22.5
LnGrp LOS	D	D	F	E	C	C	D	B	B	C	D	C
Approach Vol, veh/h		770			646			1331			1318	
Approach Delay, s/veh		123.3			47.4			20.9			34.6	
Approach LOS		F			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6	7	8
Phs Duration (G+Y+Rc), s	23.1	50.5		39.0		73.6	17.0	22.0
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0	6.0	6.0
Max Green Setting (Gmax), s	23.0	46.0		33.0		75.0	11.0	16.0
Max Q Clear Time (g_c+I1), s	16.6	36.6		11.7		16.1	13.0	18.0
Green Ext Time (p_c), s	0.6	7.9		5.7		29.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	49.0
HCM 2010 LOS	D

Intersection	
Int Delay, s/veh	0.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	20	17	245	20	29	394
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	170	0	-	100	220	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	10	10	15	15	13	13
Mvmt Flow	22	19	272	22	32	438

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	774	272	0	0	272	0
Stage 1	272	-	-	-	-	-
Stage 2	502	-	-	-	-	-
Critical Hdwy	6.5	6.3	-	-	4.23	-
Critical Hdwy Stg 1	5.5	-	-	-	-	-
Critical Hdwy Stg 2	5.5	-	-	-	-	-
Follow-up Hdwy	3.59	3.39	-	-	2.317	-
Pot Cap-1 Maneuver	356	748	-	-	1230	-
Stage 1	756	-	-	-	-	-
Stage 2	592	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	347	748	-	-	1230	-
Mov Cap-2 Maneuver	347	-	-	-	-	-
Stage 1	756	-	-	-	-	-
Stage 2	577	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.3		
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	347	748	1230	-
HCM Lane V/C Ratio	-	-	0.064	0.025	0.026	-
HCM Control Delay (s)	-	-	16.1	9.9	8	-
HCM Lane LOS	-	-	C	A	A	-
HCM 95th %tile Q(veh)	-	-	0	0	0	-

Intersection	
Int Delay, s/veh	0.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	19	18	328	30	24	236
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	170	0	-	100	220	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	9	9	14	14	12	12
Mvmt Flow	21	20	364	33	27	262

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	680	364	0	0	364	0
Stage 1	364	-	-	-	-	-
Stage 2	316	-	-	-	-	-
Critical Hdwy	6.49	6.29	-	-	4.22	-
Critical Hdwy Stg 1	5.49	-	-	-	-	-
Critical Hdwy Stg 2	5.49	-	-	-	-	-
Follow-up Hdwy	3.581	3.381	-	-	2.308	-
Pot Cap-1 Maneuver	406	666	-	-	1141	-
Stage 1	688	-	-	-	-	-
Stage 2	724	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	396	666	-	-	1141	-
Mov Cap-2 Maneuver	396	-	-	-	-	-
Stage 1	688	-	-	-	-	-
Stage 2	707	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.7		
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	396	666	1141	-
HCM Lane V/C Ratio	-	-	0.053	0.03	0.023	-
HCM Control Delay (s)	-	-	14.6	10.6	8.2	-
HCM Lane LOS	-	-	B	B	A	-
HCM 95th %tile Q(veh)	-	-	0	0	0	-

Intersection	
Int Delay, s/veh	11

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	120	173	92	390	360	54
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	Free	-	None
Storage Length	0	0	-	0	175	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	12	12	15	15	15	15
Mvmt Flow	133	192	102	433	400	60

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	932	102	0	-	102	0
Stage 1	102	-	-	-	-	-
Stage 2	830	-	-	-	-	-
Critical Hdwy	6.78	6.38	-	-	4.25	-
Critical Hdwy Stg 1	5.58	-	-	-	-	-
Critical Hdwy Stg 2	5.98	-	-	-	-	-
Follow-up Hdwy	3.614	3.414	-	-	2.335	-
Pot Cap-1 Maneuver	265	923	-	0	1413	-
Stage 1	895	-	-	0	-	-
Stage 2	370	-	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	190	923	-	-	1413	-
Mov Cap-2 Maneuver	190	-	-	-	-	-
Stage 1	895	-	-	-	-	-
Stage 2	265	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	30.1		
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	190	923	1413	-
HCM Lane V/C Ratio	-	0.702	0.208	0.283	-
HCM Control Delay (s)	-	59.2	9.9	8.6	-
HCM Lane LOS	-	F	A	A	-
HCM 95th %tile Q(veh)	-	4	1	1	-

Intersection	
Int Delay, s/veh	21.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	351	296	62	115	166	89
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	Free	-	None
Storage Length	0	0	-	0	175	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	12	12	14	14	14	14
Mvmt Flow	390	329	69	128	184	99

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	487	69	0	-	69	0
Stage 1	69	-	-	-	-	-
Stage 2	418	-	-	-	-	-
Critical Hdwy	6.78	6.38	-	-	4.24	-
Critical Hdwy Stg 1	5.58	-	-	-	-	-
Critical Hdwy Stg 2	5.98	-	-	-	-	-
Follow-up Hdwy	3.614	3.414	-	-	2.326	-
Pot Cap-1 Maneuver	503	964	-	0	1459	-
Stage 1	926	-	-	0	-	-
Stage 2	609	-	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	440	964	-	-	1459	-
Mov Cap-2 Maneuver	440	-	-	-	-	-
Stage 1	926	-	-	-	-	-
Stage 2	532	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	32.1		
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	440	964	1459	-
HCM Lane V/C Ratio	-	0.886	0.341	0.126	-
HCM Control Delay (s)	-	50.2	10.7	7.8	-
HCM Lane LOS	-	F	B	A	-
HCM 95th %tile Q(veh)	-	9	2	0	-

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	126	12	11	356	153	21
Number	7	14	5	2	6	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1610	1610	1652	1900
Adj Flow Rate, veh/h	140	13	12	396	170	23
Adj No. of Lanes	2	1	1	2	2	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	18	18	15	15
Cap, veh/h	505	232	845	2194	1997	266
Arrive On Green	0.15	0.15	0.72	0.72	0.72	0.72
Sat Flow, veh/h	3442	1583	1024	3140	2867	371
Grp Volume(v), veh/h	140	13	12	396	95	98
Grp Sat Flow(s),veh/h/ln	1721	1583	1024	1530	1570	1587
Q Serve(g_s), s	2.0	0.4	0.2	2.3	1.0	1.0
Cycle Q Clear(g_c), s	2.0	0.4	1.2	2.3	1.0	1.0
Prop In Lane	1.00	1.00	1.00			0.23
Lane Grp Cap(c), veh/h	505	232	845	2194	1125	1138
V/C Ratio(X)	0.28	0.06	0.01	0.18	0.08	0.09
Avail Cap(c_a), veh/h	1053	484	845	2194	1125	1138
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.99	0.99	1.00	1.00	0.93	0.93
Uniform Delay (d), s/veh	21.1	20.4	2.6	2.6	2.4	2.4
Incr Delay (d2), s/veh	0.3	0.1	0.0	0.2	0.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.2	0.1	1.0	0.5	0.5
LnGrp Delay(d),s/veh	21.4	20.5	2.6	2.7	2.5	2.5
LnGrp LOS	C	C	A	A	A	A
Approach Vol, veh/h	153			408	193	
Approach Delay, s/veh	21.3			2.7	2.5	
Approach LOS	C			A	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		45.8		14.2		45.8		
Change Period (Y+Rc), s		6.0		6.0		6.0		
Max Green Setting (Gmax), s		31.0		17.0		31.0		
Max Q Clear Time (g_c+I1), s		4.3		4.0		3.0		
Green Ext Time (p_c), s		3.9		0.4		4.0		

Intersection Summary	
HCM 2010 Ctrl Delay	6.4
HCM 2010 LOS	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	23	10	11	154	321	119
Number	7	14	5	2	6	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1638	1638	1667	1900
Adj Flow Rate, veh/h	26	11	12	171	357	132
Adj No. of Lanes	2	1	1	2	2	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	16	16	14	14
Cap, veh/h	243	112	769	2499	1827	665
Arrive On Green	0.07	0.07	0.80	0.80	1.00	1.00
Sat Flow, veh/h	3442	1583	795	3194	2359	829
Grp Volume(v), veh/h	26	11	12	171	247	242
Grp Sat Flow(s),veh/h/ln	1721	1583	795	1556	1583	1520
Q Serve(g_s), s	0.4	0.4	0.2	0.6	0.0	0.0
Cycle Q Clear(g_c), s	0.4	0.4	0.2	0.6	0.0	0.0
Prop In Lane	1.00	1.00	1.00			0.54
Lane Grp Cap(c), veh/h	243	112	769	2499	1271	1221
V/C Ratio(X)	0.11	0.10	0.02	0.07	0.19	0.20
Avail Cap(c_a), veh/h	877	403	769	2499	1271	1221
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.77	0.77
Uniform Delay (d), s/veh	23.9	23.9	1.1	1.1	0.0	0.0
Incr Delay (d2), s/veh	0.2	0.4	0.0	0.1	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.2	0.0	0.3	0.1	0.1
LnGrp Delay(d),s/veh	24.1	24.3	1.1	1.2	0.3	0.3
LnGrp LOS	C	C	A	A	A	A
Approach Vol, veh/h	37			183	489	
Approach Delay, s/veh	24.1			1.2	0.3	
Approach LOS	C			A	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		50.1		9.9		50.1		
Change Period (Y+Rc), s		6.0		6.0		6.0		
Max Green Setting (Gmax), s		34.0		14.0		34.0		
Max Q Clear Time (g_c+I1), s		2.6		2.4		2.0		
Green Ext Time (p_c), s		4.5		0.0		4.5		

Intersection Summary	
HCM 2010 Ctrl Delay	1.8
HCM 2010 LOS	A

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	0	4	367	8	157
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	13	13	18	18
Mvmt Flow	0	0	4	408	9	174

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	309	92	183	0	-	0
Stage 1	96	-	-	-	-	-
Stage 2	213	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.36	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.33	-	-	-
Pot Cap-1 Maneuver	659	947	1313	-	-	-
Stage 1	917	-	-	-	-	-
Stage 2	802	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	656	947	1313	-	-	-
Mov Cap-2 Maneuver	656	-	-	-	-	-
Stage 1	917	-	-	-	-	-
Stage 2	799	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	0.1	
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1313	-	-	-	-
HCM Lane V/C Ratio	0.003	-	-	-	-
HCM Control Delay (s)	7.8	0	0	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	0	4	165	8	323
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	23	23	16	16
Mvmt Flow	0	0	4	183	9	359

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	289	184	368	0	-	0
Stage 1	188	-	-	-	-	-
Stage 2	101	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.56	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.43	-	-	-
Pot Cap-1 Maneuver	678	827	1050	-	-	-
Stage 1	825	-	-	-	-	-
Stage 2	912	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	675	827	1050	-	-	-
Mov Cap-2 Maneuver	675	-	-	-	-	-
Stage 1	825	-	-	-	-	-
Stage 2	908	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	0.2	
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1050	-	-	-	-
HCM Lane V/C Ratio	0.004	-	-	-	-
HCM Control Delay (s)	8.4	0	0	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Int Delay, s/veh	11.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	363	4	4	4	0	4	0	4	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	13	13	13	2	2	2	2	2	2
Mvmt Flow	403	4	4	4	0	4	0	4	4

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	22	22	4	25	20	7	4	0	0
Stage 1	13	13	-	7	7	-	-	-	-
Stage 2	9	9	-	18	13	-	-	-	-
Critical Hdwy	7.23	6.63	6.33	7.12	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	6.23	5.63	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	6.23	5.63	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	3.617	4.117	3.417	3.518	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	963	850	1048	986	874	1075	1618	-	-
Stage 1	980	863	-	1015	890	-	-	-	-
Stage 2	984	867	-	1001	885	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	957	848	1048	976	872	1075	1618	-	-
Mov Cap-2 Maneuver	957	848	-	976	872	-	-	-	-
Stage 1	980	861	-	1015	890	-	-	-	-
Stage 2	980	867	-	989	883	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	11.6	8.6	
HCM LOS	B	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1618	-	-	957	1023	1542	-	-
HCM Lane V/C Ratio	-	-	-	0.431	0.009	0.003	-	-
HCM Control Delay (s)	0	-	-	11.6	8.6	7.3	-	-
HCM Lane LOS	A	-	-	B	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	2	0	0	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	4	4	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	0	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	90	90	90
Heavy Vehicles, %	13	13	13
Mvmt Flow	4	4	0

Major/Minor	Major2		
Conflicting Flow All	9	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.23	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.317	-	-
Pot Cap-1 Maneuver	1542	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1542	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	8.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	159	4	4	4	0	4	0	6	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	25	25	25	2	2	2	2	2	2
Mvmt Flow	177	4	4	4	0	4	0	7	4

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	24	24	4	27	22	9	4	0	0
Stage 1	13	13	-	9	9	-	-	-	-
Stage 2	11	11	-	18	13	-	-	-	-
Critical Hdwy	7.35	6.75	6.45	7.12	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	6.35	5.75	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	6.35	5.75	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	3.725	4.225	3.525	3.518	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	932	826	1016	983	872	1073	1618	-	-
Stage 1	951	841	-	1012	888	-	-	-	-
Stage 2	953	843	-	1001	885	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	926	824	1016	973	870	1073	1618	-	-
Mov Cap-2 Maneuver	926	824	-	973	870	-	-	-	-
Stage 1	951	839	-	1012	888	-	-	-	-
Stage 2	949	843	-	989	883	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	9.9	8.6	
HCM LOS	A	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1618	-	-	925	1021	1481	-	-
HCM Lane V/C Ratio	-	-	-	0.201	0.009	0.003	-	-
HCM Control Delay (s)	0	-	-	9.9	8.6	7.4	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	1	0	0	-	-

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	4	4	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	0	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	90	90	90
Heavy Vehicles, %	23	23	23
Mvmt Flow	4	4	0

Major/Minor	Major2		
Conflicting Flow All	11	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.33	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.407	-	-
Pot Cap-1 Maneuver	1481	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1481	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	18	32	67	152	358	38
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	100	100	100	13	12	100
Mvmt Flow	20	36	74	169	398	42

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	652	220	440	0	-	0
Stage 1	419	-	-	-	-	-
Stage 2	233	-	-	-	-	-
Critical Hdwy	8.8	8.9	6.1	-	-	-
Critical Hdwy Stg 1	7.8	-	-	-	-	-
Critical Hdwy Stg 2	7.8	-	-	-	-	-
Follow-up Hdwy	4.5	4.3	3.2	-	-	-
Pot Cap-1 Maneuver	238	553	645	-	-	-
Stage 1	415	-	-	-	-	-
Stage 2	557	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	208	553	645	-	-	-
Mov Cap-2 Maneuver	208	-	-	-	-	-
Stage 1	415	-	-	-	-	-
Stage 2	486	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	17.4	3.7	
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	645	-	346	-	-
HCM Lane V/C Ratio	0.115	-	0.161	-	-
HCM Control Delay (s)	11.3	0.4	17.4	-	-
HCM Lane LOS	B	A	C	-	-
HCM 95th %tile Q(veh)	0	-	1	-	-

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	38	67	32	326	166	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	100	100	100	12	11	100
Mvmt Flow	42	74	36	362	184	20

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	446	102	204	0	-	0
Stage 1	194	-	-	-	-	-
Stage 2	252	-	-	-	-	-
Critical Hdwy	8.8	8.9	6.1	-	-	-
Critical Hdwy Stg 1	7.8	-	-	-	-	-
Critical Hdwy Stg 2	7.8	-	-	-	-	-
Follow-up Hdwy	4.5	4.3	3.2	-	-	-
Pot Cap-1 Maneuver	351	691	871	-	-	-
Stage 1	592	-	-	-	-	-
Stage 2	540	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	333	691	871	-	-	-
Mov Cap-2 Maneuver	333	-	-	-	-	-
Stage 1	592	-	-	-	-	-
Stage 2	512	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	14.5	1	
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	871	-	497	-	-
HCM Lane V/C Ratio	0.041	-	0.235	-	-
HCM Control Delay (s)	9.3	0.2	14.5	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	1	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	10	5	11	159	391	22
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	12	12	12	12
Mvmt Flow	11	6	12	177	434	24

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	560	229	459	0	-	0
Stage 1	447	-	-	-	-	-
Stage 2	113	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.34	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.32	-	-	-
Pot Cap-1 Maneuver	458	774	1031	-	-	-
Stage 1	611	-	-	-	-	-
Stage 2	899	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	452	774	1031	-	-	-
Mov Cap-2 Maneuver	452	-	-	-	-	-
Stage 1	611	-	-	-	-	-
Stage 2	887	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12.1	0.6	
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1031	-	525	-	-
HCM Lane V/C Ratio	0.012	-	0.032	-	-
HCM Control Delay (s)	8.5	0	12.1	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	22	11	5	359	173	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	11	11	10	10
Mvmt Flow	24	12	6	399	192	11

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	409	102	203	0	-	0
Stage 1	198	-	-	-	-	-
Stage 2	211	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.32	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.31	-	-	-
Pot Cap-1 Maneuver	570	933	1303	-	-	-
Stage 1	816	-	-	-	-	-
Stage 2	804	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	567	933	1303	-	-	-
Mov Cap-2 Maneuver	567	-	-	-	-	-
Stage 1	816	-	-	-	-	-
Stage 2	799	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.9	0.1	
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1303	-	652	-	-
HCM Lane V/C Ratio	0.004	-	0.056	-	-
HCM Control Delay (s)	7.8	0	10.9	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Cosgrove NB
Agency or Company	Atkins	Junction	7010 - Off to I-26 EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	125
Freeway Volume, V_F	2900
Ramp Volume, V_R	826
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2900	0.90	Level	10	0	0.952	1.00	3383
Ramp	826	0.90	Level	12	0	0.943	1.00	973
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.631 using Equation (Exhibit 13-7)
V_{12} = 2493 pc/h
V_3 or V_{av34} 890 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3383	Exhibit 13-8	6750	No
$V_{FO} = V_F - V_R$	2410	Exhibit 13-8	6750	No
V_R	973	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2493	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 24.6 (pc/mi/ln)
LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.386 (Exhibit 13-12)
S_R= 50.0 mph (Exhibit 13-12)
S_0= 60.3 mph (Exhibit 13-12)
S = 52.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Cosgrove NB
Agency or Company	Atkins	Junction	7010 - Off to I-26 EB
Date Performed	3/20/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 125	V_D = veh/h
	Freeway Volume, V_F: 1939	
	Ramp Volume, V_R: 444	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1939	0.90	Level	8	0	0.962	1.00	2241
Ramp	444	0.90	Level	19	0	0.913	1.00	540
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.679 using Equation (Exhibit 13-7)

V_{12} = 1695 pc/h

V_3 or V_{av34} 546 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2241	Exhibit 13-8	6750	No
$V_{FO} = V_F - V_R$	1701	Exhibit 13-8	6750	No
V_R	540	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1695	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 17.7 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.347 (Exhibit 13-12)

S_R= 50.5 mph (Exhibit 13-12)

S_0= 60.3 mph (Exhibit 13-12)

S = 52.6 mph (Exhibit 13-13)

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	Cosgrove NB
Weaving Segment Location	7020-I-26 EB On to I-26 WB Off
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	450ft
Freeway free-flow speed, FFS	45 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1210	0.90	9	0	1.5	1.2	0.957	1.00	1405
V_{RF}	298	0.90	9	0	1.5	1.2	0.957	1.00	346
V_{FR}	864	0.90	19	0	1.5	1.2	0.913	1.00	1051
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	1405							V =	2802
V_W	1397								
VR	0.499								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1397 lc/h
Interchange density, ID	0.2 int/mi	Weaving lane changes, LC_W	1485 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	0 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1485 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	13

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	2802 pc/h	Weaving intensity factor, W	0.580
Weaving segment capacity, c_w	4606 veh/h	Weaving segment speed, S	32.7 mph
Weaving segment v/c ratio	0.582	Average weaving speed, S_W	34.0 mph
Weaving segment density, D	21.4 pc/mi/ln	Average non-weaving speed, S_{NW}	31.6 mph
Level of Service, LOS	B	Maximum weaving length, L_{MAX}	7810 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	Cosgrove NB
Weaving Segment Location	7020-I-26 EB On to I-26 WB Off
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	450ft
Freeway free-flow speed, FFS	45 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	715	0.90	7	0	1.5	1.2	0.966	1.00	822
V_{RF}	138	0.90	14	0	1.5	1.2	0.935	1.00	164
V_{FR}	780	0.90	18	0	1.5	1.2	0.917	1.00	945
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	822							V =	1931
V_W	1109								
VR	0.574								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1109 lc/h
Interchange density, ID	0.2 int/mi	Weaving lane changes, LC_W	1197 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	0 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1197 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	7

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	1931 pc/h	Weaving intensity factor, W	0.489
Weaving segment capacity, c_w	4038 veh/h	Weaving segment speed, S	35.0 mph
Weaving segment v/c ratio	0.462	Average weaving speed, S_W	35.1 mph
Weaving segment density, D	13.8 pc/mi/ln	Average non-weaving speed, S_{NW}	34.7 mph
Level of Service, LOS	B	Maximum weaving length, L_{MAX}	8708 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Cosgrove NB
Agency or Company	Atkins	Junction	7030 - NB On from I-26 WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h		V_D = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	200
Deceleration Lane Length L_D	
Freeway Volume, V_F	1508
Ramp Volume, V_R	378
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1508	0.90	Level	9	0	0.957	1.00	1751
Ramp	378	0.90	Level	10	0	0.952	1.00	441
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.583 using Equation (Exhibit 13-6)

V_{12} = 1021 pc/h

V_3 or V_{av34} 730 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2192	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1462	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 15.4 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.320 (Exibit 13-11)

S_R= 50.8 mph (Exhibit 13-11)

S_0= 54.2 mph (Exhibit 13-11)

S = 51.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Cosgrove NB
Agency or Company	Atkins	Junction	7030 - NB On from I-26 WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 200	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 853	
	Ramp Volume, V_R: 345	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	853	0.90	Level	7	0	0.966	1.00	981
Ramp	345	0.90	Level	9	0	0.957	1.00	401
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.583 using Equation (Exhibit 13-6)

V_{12} = 572 pc/h

V_3 or V_{av34} 409 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1382	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	973	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 11.6 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.313 (Exibit 13-11)

S_R= 50.9 mph (Exhibit 13-11)

S_0= 55.0 mph (Exhibit 13-11)

S = 52.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Cosgrove SB
Agency or Company	Atkins	Junction	7040 - Off to I-26 WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	225
Freeway Volume, V_F	1008
Ramp Volume, V_R	157
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1008	0.90	Level	5	0	0.976	1.00	1148
Ramp	157	0.90	Level	21	0	0.905	1.00	193
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 1.000 using Equation (Exhibit 13-7)
V_{12} = 1148 pc/h
V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1148	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	955	Exhibit 13-8	4500	No
V_R	193	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1148	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 12.1 (pc/mi/ln)
LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.315 (Exhibit 13-12)
S_R= 50.9 mph (Exhibit 13-12)
S_0= N/A mph (Exhibit 13-12)
S = 50.9 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Cosgrove SB
Agency or Company	Atkins	Junction	7040 - Off to I-26 WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	225
Freeway Volume, V_F	1799
Ramp Volume, V_R	339
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1799	0.90	Level	4	0	0.980	1.00	2039
Ramp	339	0.90	Level	8	0	0.962	1.00	392
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 1.000 using Equation (Exhibit 13-7)
V_{12} = 2039 pc/h
V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2039	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1647	Exhibit 13-8	4500	No
V_R	392	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2039	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 19.8 (pc/mi/ln)
LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.333 (Exhibit 13-12)
S_R= 50.7 mph (Exhibit 13-12)
S_0= N/A mph (Exhibit 13-12)
S = 50.7 mph (Exhibit 13-13)

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	Cosgrove SB
Weaving Segment Location	7050-I-26 WB On to I-26 EB Off
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	475ft
Freeway free-flow speed, FFS	45 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	437	0.90	9	0	1.5	1.2	0.957	1.00	507
V_{RF}	353	0.90	22	0	1.5	1.2	0.901	1.00	435
V_{FR}	414	0.90	9	0	1.5	1.2	0.957	1.00	481
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	507							V =	1423
V_W	916								
VR	0.644								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	916 lc/h
Interchange density, ID	0.2 int/mi	Weaving lane changes, LC_W	970 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	0 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	970 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	5

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	1423 pc/h	Weaving intensity factor, W	0.397
Weaving segment capacity, c_w	3568 veh/h	Weaving segment speed, S	36.4 mph
Weaving segment v/c ratio	0.382	Average weaving speed, S_W	36.5 mph
Weaving segment density, D	13.0 pc/mi/ln	Average non-weaving speed, S_{NW}	36.1 mph
Level of Service, LOS	B	Maximum weaving length, L_{MAX}	9554 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	Cosgrove SB
Weaving Segment Location	7050-I-26 WB On to I-26 EB Off
Analysis Year	2018 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	475ft
Freeway free-flow speed, FFS	45 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1048	0.90	7	0	1.5	1.2	0.966	1.00	1205
V_{RF}	821	0.90	8	0	1.5	1.2	0.962	1.00	949
V_{FR}	412	0.90	7	0	1.5	1.2	0.966	1.00	474
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	1205							V =	2628
V_W	1423								
VR	0.541								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1423 lc/h
Interchange density, ID	0.2 int/mi	Weaving lane changes, LC_W	1477 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	0 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1477 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	11

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	2628 pc/h	Weaving intensity factor, W	0.553
Weaving segment capacity, c_w	4282 veh/h	Weaving segment speed, S	32.5 mph
Weaving segment v/c ratio	0.593	Average weaving speed, S_W	34.3 mph
Weaving segment density, D	27.0 pc/mi/ln	Average non-weaving speed, S_{NW}	30.5 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	8315 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	Cosgrove SB
Analysis Year	2018 Build - Proposed Site	Junction	From I-26 EB
Analysis Time Period:	AM Peak	Segment ID	7060
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	45	45	45
Volume, V (veh/h)	790	1,597	807
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	10%	10%	11%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.95	0.95	0.95
Demand Flow Rate, v_p (pc/h/ln)	461	621	946
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	2,100
v/c ratio	0.22	0.30	0.45
Density, D_{MD} (pc/mi/ln)	8.1	10.9	16.6
LOS	A	B	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	Cosgrove SB
Analysis Year	2018 Build - Proposed Site	Junction	From I-26 EB
Analysis Time Period:	PM Peak	Segment ID	7060
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	45	45	45
Volume, V (veh/h)	1,869	3,039	1,170
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	8%	8%	7%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.96	0.96	0.97
Demand Flow Rate, v_p (pc/h/ln)	1,080	1,171	1,346
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	2,100
v/c ratio	0.51	0.56	0.64
Density, D_{MD} (pc/mi/ln)	18.9	20.5	23.6
LOS	B	C	C

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Montague NB
Agency or Company	Atkins	Junction	8010 - Off to I-26 EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	350	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	1768	V_D =	veh/h
		Ramp Volume, V_R	552		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1768	0.90	Level	9	0	0.957	1.00	2053
Ramp	552	0.90	Level	5	0	0.976	1.00	629
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2053 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2053	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1424	Exhibit 13-8	4500	No
V_R	629	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2053	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 18.8 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.355 (Exhibit 13-12)

S_R= 50.4 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.4 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Montague NB
Agency or Company	Atkins	Junction	8010 - Off to I-26 EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	350
Freeway Volume, V_F	1987
Ramp Volume, V_R	597
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1987	0.90	Level	7	0	0.966	1.00	2285
Ramp	597	0.90	Level	4	0	0.980	1.00	677
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 1.000 using Equation (Exhibit 13-7)
V_{12} = 2285 pc/h
V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2285	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1608	Exhibit 13-8	4500	No
V_R	677	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2285	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 20.8 (pc/mi/ln)
LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.359 (Exhibit 13-12)
S_R= 50.3 mph (Exhibit 13-12)
S_0= N/A mph (Exhibit 13-12)
S = 50.3 mph (Exhibit 13-13)

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	Montague NB
Analysis Year	2018 Build - Proposed Site	Junction	From I-26 EB
Analysis Time Period:	AM Peak	Segment ID	8020
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	45	45	25
Volume, V (veh/h)	1,216	1,665	449
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	9%	7%	6%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.96	0.97	0.97
Demand Flow Rate, v_p (pc/h/ln)	706	638	514
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	1,900
v/c ratio	0.34	0.30	0.27
Density, D_{MD} (pc/mi/ln)	12.4	11.2	9.0
LOS	B	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	Montague NB
Analysis Year	2018 Build - Proposed Site	Junction	From I-26 EB
Analysis Time Period:	PM Peak	Segment ID	8020
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	45	45	25
Volume, V (veh/h)	1,390	1,637	247
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	7%	5%	9%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.98	0.96
Demand Flow Rate, v_p (pc/h/ln)	799	621	287
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	1,900
v/c ratio	0.38	0.30	0.15
Density, D_{MD} (pc/mi/ln)	14.0	10.9	5.0
LOS	B	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	Montague SB
Analysis Year	2018 Build - Proposed Site	Junction	Off to I-26 EB
Analysis Time Period:	AM Peak	Segment ID	8030
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	3	2	1
Free-Flow Speed, FFS (mph)	45	45	25
Volume, V (veh/h)	1,536	1,165	371
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	7%	9%	8%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.96	0.96
Demand Flow Rate, v_p (pc/h/ln)	589	676	429
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	1,900
v/c ratio	0.28	0.32	0.23
Density, D_{MD} (pc/mi/ln)	10.3	11.8	7.5
LOS	B	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	Montague SB
Analysis Year	2018 Build - Proposed Site	Junction	Off to I-26 EB
Analysis Time Period:	PM Peak	Segment ID	8030
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	3	2	1
Free-Flow Speed, FFS (mph)	45	45	25
Volume, V (veh/h)	1,872	1,404	468
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	5%	7%	6%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.97	0.97
Demand Flow Rate, v_p (pc/h/ln)	711	807	536
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	1,900
v/c ratio	0.34	0.38	0.28
Density, D_{MD} (pc/mi/ln)	12.4	14.1	9.4
LOS	B	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Montague SB
Agency or Company	Atkins	Junction	8040 - On from I-26 EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 550	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1165	
	Ramp Volume, V_R: 408	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1165	0.90	Level	9	0	0.957	1.00	1353
Ramp	408	0.90	Level	13	0	0.939	1.00	483
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1353 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1836	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1836	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 16.1 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.296 (Exibit 13-11)

S_R= 51.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Montague SB
Agency or Company	Atkins	Junction	8040 - On from I-26 EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 550	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1404	
	Ramp Volume, V_R: 237	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1404	0.90	Level	7	0	0.966	1.00	1615
Ramp	237	0.90	Level	7	0	0.966	1.00	273
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1615 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1888	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1888	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 16.6 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.297 (Exibit 13-11)

S_R= 51.1 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	PAR NB
Analysis Year	2018 Build-Proposed Site	Junction	Merge from 26 EB & WB
Analysis Time Period:	AM Peak	Segment ID	9010
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	2	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	133	371	238
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	18%	18%	18%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.92	0.92	0.92
Demand Flow Rate, v_p (pc/h/ln)	161	225	288
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,200
v/c ratio	0.07	0.10	0.13
Density, D_{MD} (pc/mi/ln)	2.8	3.9	5.0
LOS	A	A	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	PAR NB
Analysis Year	2018 Build-Proposed Site	Junction	Merge from 26 EB & WB
Analysis Time Period:	PM Peak	Segment ID	9010
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	2	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	38	163	125
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	17%	16%	16%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.92	0.93	0.93
Demand Flow Rate, v_p (pc/h/ln)	46	98	150
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,200
v/c ratio	0.02	0.04	0.07
Density, D_{MD} (pc/mi/ln)	0.8	1.7	2.6
LOS	A	A	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	PAR NB
Agency or Company	Atkins	Junction	9020 - Off to Local Access Rd
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build-Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	950	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	371	V_D =	veh/h
		Ramp Volume, V_R	371		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	371	0.90	Level	18	0	0.917	1.00	449
Ramp	371	0.90	Level	18	0	0.917	1.00	449
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 449 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	449	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	0	Exhibit 13-8	4500	No
V_R	449	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	449	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = -0.4 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.338 (Exhibit 13-12)

S_R= 50.6 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.6 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	PAR NB
Agency or Company	Atkins	Junction	9020 - Off to Local Access Rd
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build-Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	950	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	167	V_D =	veh/h
		Ramp Volume, V_R	167		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	167	0.90	Level	16	0	0.926	1.00	200
Ramp	167	0.90	Level	16	0	0.926	1.00	200
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 200 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	200	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	0	Exhibit 13-8	4500	No
V_R	200	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	200	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = -2.6 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.316 (Exhibit 13-12)

S_R= 50.9 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.9 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	PAR SB
Agency or Company	Atkins	Junction	9030 - On from Local Access Rd
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2018 Build-Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1000	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 0	
	Ramp Volume, V_R: 161	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	0	0.90	Level	0	0	1.000	1.00	0
Ramp	161	0.90	Level	18	0	0.917	1.00	195
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 0 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	195	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	195	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 0.6 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.236 (Exibit 13-11)

S_R= 51.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	PAR SB
Agency or Company	Atkins	Junction	9030 - On from Local Access Rd
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2018 Build-Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1000	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 0	
	Ramp Volume, V_R: 327	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	0	0.90	Level	0	0	1.000	1.00	0
Ramp	327	0.90	Level	16	0	0.926	1.00	392
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 0 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	392	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	392	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 2.1 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.237 (Exibit 13-11)

S_R= 51.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	PAR SB
Analysis Year	2018 Build-Proposed Site	Junction	Split to 26 EB & WB
Analysis Time Period:	AM Peak	Segment ID	9040
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	1	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	161	118	43
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	18%	18%	19%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.92	0.92	0.91
Demand Flow Rate, v_p (pc/h/ln)	97	143	52
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,200
v/c ratio	0.04	0.07	0.02
Density, D_{MD} (pc/mi/ln)	1.7	2.5	0.9
LOS	A	A	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	PAR SB
Analysis Year	2018 Build-Proposed Site	Junction	Split to 26 EB & WB
Analysis Time Period:	PM Peak	Segment ID	9040
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	1	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	327	232	95
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	16%	16%	17%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.93	0.93	0.92
Demand Flow Rate, v_p (pc/h/ln)	196	278	115
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,200
v/c ratio	0.09	0.13	0.05
Density, D_{MD} (pc/mi/ln)	3.4	4.9	2.0
LOS	A	A	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

Arterial Level of Service: NB #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Driveway	II	40	28.5	9.4	37.9	0.26	24.6	C
Carolina Ave	II	35	43.3	5.0	48.3	0.41	30.8	B
Reynolds Ave	II	35	44.7	9.1	53.8	0.43	28.7	B
Cosgrove Ave	II	40	30.5	25.6	56.1	0.30	19.2	D
McMillan Ave	II	40	15.4	9.3	24.7	0.13	19.5	D
Total	II		162.4	58.4	220.8	1.53	25.0	C

Arterial Level of Service: SB #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Cosgrove Ave	II	40	15.4	36.0	51.4	0.13	9.4	F
Reynolds Ave	II	40	30.5	18.5	49.0	0.30	22.0	D
Carolina Ave	II	35	44.7	6.7	51.4	0.43	30.1	B
Burton Ln	II	40	39.6	12.3	51.9	0.41	28.6	B
Stromboli Ave	II	40	28.5	4.1	32.6	0.26	28.6	B
Total	II		158.7	77.6	236.3	1.53	23.4	C

Arterial Level of Service: NB #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Driveway	II	40	28.5	10.0	38.5	0.26	24.2	C
Carolina Ave	II	35	43.3	7.3	50.6	0.41	29.4	B
Reynolds Ave	II	35	44.7	16.8	61.5	0.43	25.1	C
Cosgrove Ave	II	40	30.5	33.8	64.3	0.30	16.8	E
McMillan Ave	II	40	15.4	10.5	25.9	0.13	18.6	D
Total	II		162.4	78.4	240.8	1.53	22.9	C

Arterial Level of Service: SB #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Cosgrove Ave	II	40	15.4	31.0	46.4	0.13	10.4	F
Reynolds Ave	II	40	30.5	10.1	40.6	0.30	26.6	C
Carolina Ave	II	35	44.7	4.9	49.6	0.43	31.2	B
Burton Ln	II	40	39.6	8.3	47.9	0.41	31.0	B
Stromboli Ave	II	40	28.5	11.1	39.6	0.26	23.5	C
Total	II		158.7	65.4	224.1	1.53	24.6	C

Arterial Level of Service: NB #2

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Burton Ln	III	34	35.4	6.7	42.1	0.29	25.2	B
Reynolds Ave	III	35	50.6	9.2	59.8	0.42	25.4	B
Cosgrove Ave	III	35	27.9	19.3	47.2	0.23	17.7	D
Dorchester Rd	III	35	18.7	3.4	22.1	0.15	23.8	C
McMillan Ave	III	35	24.5	14.9	39.4	0.20	18.7	C
Total	III		157.1	53.5	210.6	1.30	22.2	C

Arterial Level of Service: SB #2

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Dorchester Rd	II	35	25.5	5.2	30.7	0.20	23.9	C
Cosgrove Ave	II	35	18.3	27.8	46.1	0.15	11.4	F
Reynolds Ave	II	35	27.6	2.6	30.2	0.23	27.7	C
Burton Ln	II	35	44.6	7.2	51.8	0.43	29.8	B
Stromboli Ave	II	37	32.4	2.0	34.4	0.29	30.8	B
Total	II		148.4	44.8	193.2	1.31	24.3	C

Arterial Level of Service: NB #2

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Burton Ln	III	34	35.4	9.7	45.1	0.29	23.5	C
Reynolds Ave	III	35	50.6	12.8	63.4	0.42	23.9	C
Cosgrove Ave	III	35	27.9	28.2	56.1	0.23	14.9	D
Dorchester Rd	III	35	18.7	3.9	22.6	0.15	23.3	C
McMillan Ave	III	35	24.5	19.0	43.5	0.20	16.9	D
Total	III		157.1	73.6	230.7	1.30	20.3	C

Arterial Level of Service: SB #2

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Dorchester Rd	II	35	25.5	5.5	31.0	0.20	23.7	C
Cosgrove Ave	II	35	18.3	43.7	62.0	0.15	8.5	F
Reynolds Ave	II	35	27.6	3.4	31.0	0.23	27.0	C
Burton Ln	II	35	44.6	9.2	53.8	0.43	28.7	B
Stromboli Ave	II	37	32.4	1.8	34.2	0.29	31.0	B
Total	II		148.4	63.6	212.0	1.31	22.2	C

Appendix E

Traffic Analysis Worksheets

2018 Opening Year

Build Proposed Project Alternatives 1, 3 & 4

North Charleston Intersections

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	185	10	234	59	9	5	114	215	146	5	355	151
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1827	1759	1759	1759	1743	1743	1900	1759	1759	1759
Adj Flow Rate, veh/h	206	11	260	66	10	6	127	239	162	6	394	168
Adj No. of Lanes	1	1	1	1	1	1	1	1	0	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	8	8	8	9	9	9	8	8	8
Cap, veh/h	565	574	488	465	553	470	372	436	296	391	791	673
Arrive On Green	0.31	0.31	0.31	0.31	0.31	0.31	0.45	0.45	0.45	0.45	0.45	0.45
Sat Flow, veh/h	1365	1827	1553	1042	1759	1495	790	970	657	925	1759	1495
Grp Volume(v), veh/h	206	11	260	66	10	6	127	0	401	6	394	168
Grp Sat Flow(s),veh/h/ln	1365	1827	1553	1042	1759	1495	790	0	1627	925	1759	1495
Q Serve(g_s), s	6.2	0.2	7.0	2.4	0.2	0.1	6.9	0.0	9.2	0.2	8.1	3.5
Cycle Q Clear(g_c), s	6.4	0.2	7.0	2.6	0.2	0.1	15.0	0.0	9.2	9.4	8.1	3.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.40	1.00		1.00
Lane Grp Cap(c), veh/h	565	574	488	465	553	470	372	0	732	391	791	673
V/C Ratio(X)	0.36	0.02	0.53	0.14	0.02	0.01	0.34	0.00	0.55	0.02	0.50	0.25
Avail Cap(c_a), veh/h	780	862	732	629	830	705	544	0	1087	593	1176	999
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	14.2	12.0	14.4	12.9	12.0	12.0	15.2	0.0	10.2	13.6	9.9	8.7
Incr Delay (d2), s/veh	0.4	0.0	0.9	0.1	0.0	0.0	0.5	0.0	0.6	0.0	0.5	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.4	0.1	3.1	0.7	0.1	0.1	1.5	0.0	4.1	0.1	3.9	1.5
LnGrp Delay(d),s/veh	14.6	12.0	15.3	13.1	12.0	12.0	15.8	0.0	10.9	13.7	10.4	8.9
LnGrp LOS	B	B	B	B	B	B	B		B	B	B	A
Approach Vol, veh/h		477			82			528			568	
Approach Delay, s/veh		14.9			12.9			12.0			10.0	
Approach LOS		B			B			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		28.9		22.0		28.9		22.0
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		34.0		24.0		34.0		24.0
Max Q Clear Time (g_c+I1), s		11.4		9.0		17.0		4.6
Green Ext Time (p_c), s		6.6		1.8		5.9		1.9

Intersection Summary	
HCM 2010 Ctrl Delay	12.2
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	179	13	132	150	12	5	277	421	71	5	254	219
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1776	1776	1776	1792	1792	1900	1792	1792	1792
Adj Flow Rate, veh/h	199	14	147	167	13	6	308	468	79	6	282	243
Adj No. of Lanes	1	1	1	1	1	1	1	1	0	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	7	7	7	6	6	6	6	6	6
Cap, veh/h	468	475	404	414	457	389	504	808	136	394	968	823
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.54	0.54	0.54	0.54	0.54	0.54
Sat Flow, veh/h	1374	1845	1568	1163	1776	1509	841	1495	252	824	1792	1524
Grp Volume(v), veh/h	199	14	147	167	13	6	308	0	547	6	282	243
Grp Sat Flow(s),veh/h/ln	1374	1845	1568	1163	1776	1509	841	0	1748	824	1792	1524
Q Serve(g_s), s	7.5	0.3	4.6	7.4	0.3	0.2	18.7	0.0	12.4	0.3	5.1	5.2
Cycle Q Clear(g_c), s	7.8	0.3	4.6	7.8	0.3	0.2	23.8	0.0	12.4	12.7	5.1	5.2
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.14	1.00		1.00
Lane Grp Cap(c), veh/h	468	475	404	414	457	389	504	0	944	394	968	823
V/C Ratio(X)	0.43	0.03	0.36	0.40	0.03	0.02	0.61	0.00	0.58	0.02	0.29	0.30
Avail Cap(c_a), veh/h	578	623	529	508	599	510	589	0	1121	477	1150	977
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.4	16.5	18.0	19.4	16.5	16.4	13.9	0.0	9.1	13.4	7.4	7.5
Incr Delay (d2), s/veh	0.6	0.0	0.6	0.6	0.0	0.0	1.4	0.0	0.6	0.0	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.9	0.2	2.0	2.4	0.2	0.1	4.5	0.0	6.1	0.1	2.6	2.2
LnGrp Delay(d),s/veh	20.0	16.5	18.6	20.0	16.5	16.4	15.3	0.0	9.7	13.4	7.6	7.7
LnGrp LOS	B	B	B	B	B	B	B		A	B	A	A
Approach Vol, veh/h		360			186			855			531	
Approach Delay, s/veh		19.3			19.6			11.7			7.7	
Approach LOS		B			B			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		38.0		21.3		38.0		21.3
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		38.0		20.0		38.0		20.0
Max Q Clear Time (g_c+I1), s		14.7		9.8		25.8		9.8
Green Ext Time (p_c), s		8.7		1.5		6.2		1.5

Intersection Summary	
HCM 2010 Ctrl Delay	12.8
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	239	559	82	65	299	18	44	280	48	12	520	133
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1900	1759	1759	1759	1827	1827	1900	1743	1743	1743
Adj Flow Rate, veh/h	266	621	91	72	332	20	49	311	53	13	578	148
Adj No. of Lanes	1	2	0	1	2	1	1	1	0	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	8	8	8	4	4	4	9	9	9
Cap, veh/h	404	742	108	231	598	268	238	640	109	372	666	566
Arrive On Green	0.14	0.24	0.24	0.08	0.18	0.18	0.07	0.42	0.42	0.03	0.38	0.38
Sat Flow, veh/h	1740	3039	445	1675	3343	1495	1740	1522	259	1660	1743	1482
Grp Volume(v), veh/h	266	354	358	72	332	20	49	0	364	13	578	148
Grp Sat Flow(s),veh/h/ln	1740	1736	1748	1675	1671	1495	1740	0	1781	1660	1743	1482
Q Serve(g_s), s	12.3	20.0	20.1	3.5	9.4	1.2	1.7	0.0	15.4	0.5	31.7	7.1
Cycle Q Clear(g_c), s	12.3	20.0	20.1	3.5	9.4	1.2	1.7	0.0	15.4	0.5	31.7	7.1
Prop In Lane	1.00		0.25	1.00		1.00	1.00		0.15	1.00		1.00
Lane Grp Cap(c), veh/h	404	424	427	231	598	268	238	0	749	372	666	566
V/C Ratio(X)	0.66	0.84	0.84	0.31	0.56	0.07	0.21	0.00	0.49	0.03	0.87	0.26
Avail Cap(c_a), veh/h	461	470	474	250	614	275	275	0	862	472	843	717
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	27.5	37.1	37.1	30.9	38.7	35.3	21.4	0.0	21.8	18.8	29.5	21.9
Incr Delay (d2), s/veh	2.8	11.5	11.7	0.8	1.0	0.1	0.4	0.0	0.5	0.0	8.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.2	10.9	11.1	1.6	4.4	0.5	0.8	0.0	7.7	0.2	16.7	2.9
LnGrp Delay(d),s/veh	30.3	48.6	48.8	31.7	39.7	35.4	21.9	0.0	22.3	18.9	37.5	22.2
LnGrp LOS	C	D	D	C	D	D	C		C	B	D	C
Approach Vol, veh/h		978			424			413			739	
Approach Delay, s/veh		43.7			38.2			22.2			34.1	
Approach LOS		D			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.8	45.5	20.6	24.5	8.8	49.5	13.9	31.2
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	9.0	50.0	18.0	19.0	9.0	50.0	9.0	28.0
Max Q Clear Time (g_c+I1), s	3.7	33.7	14.3	11.4	2.5	17.4	5.5	22.1
Green Ext Time (p_c), s	0.0	5.8	0.3	3.8	0.0	7.2	0.0	3.1

Intersection Summary	
HCM 2010 Ctrl Delay	36.5
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	219	296	43	120	491	23	110	478	75	36	266	288
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1900	1792	1792	1792	1845	1845	1900	1792	1792	1792
Adj Flow Rate, veh/h	243	329	48	133	546	26	122	531	83	40	296	320
Adj No. of Lanes	1	2	0	1	2	1	1	1	0	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	6	6	6	3	3	3	6	6	6
Cap, veh/h	326	732	106	353	666	298	405	607	95	226	655	556
Arrive On Green	0.13	0.24	0.24	0.08	0.20	0.20	0.08	0.39	0.39	0.06	0.37	0.37
Sat Flow, veh/h	1740	3045	440	1707	3406	1524	1757	1558	244	1707	1792	1524
Grp Volume(v), veh/h	243	186	191	133	546	26	122	0	614	40	296	320
Grp Sat Flow(s),veh/h/ln	1740	1736	1749	1707	1703	1524	1757	0	1802	1707	1792	1524
Q Serve(g_s), s	11.4	9.6	9.8	6.4	16.2	1.5	4.3	0.0	33.3	1.5	13.2	17.8
Cycle Q Clear(g_c), s	11.4	9.6	9.8	6.4	16.2	1.5	4.3	0.0	33.3	1.5	13.2	17.8
Prop In Lane	1.00		0.25	1.00		1.00	1.00		0.14	1.00		1.00
Lane Grp Cap(c), veh/h	326	417	421	353	666	298	405	0	701	226	655	556
V/C Ratio(X)	0.74	0.45	0.45	0.38	0.82	0.09	0.30	0.00	0.88	0.18	0.45	0.58
Avail Cap(c_a), veh/h	350	478	481	356	743	333	409	0	838	271	833	708
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	29.3	34.1	34.1	29.8	40.6	34.7	18.2	0.0	29.8	22.6	25.4	26.9
Incr Delay (d2), s/veh	7.8	0.7	0.8	0.7	6.6	0.1	0.4	0.0	9.0	0.4	0.5	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.2	4.7	4.8	3.1	8.2	0.6	2.1	0.0	18.3	0.7	6.7	7.6
LnGrp Delay(d),s/veh	37.1	34.8	34.9	30.5	47.3	34.8	18.6	0.0	38.8	23.0	25.9	27.8
LnGrp LOS	D	C	C	C	D	C	B		D	C	C	C
Approach Vol, veh/h		620			705			736			656	
Approach Delay, s/veh		35.7			43.6			35.5			26.7	
Approach LOS		D			D			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.7	44.5	19.5	26.6	12.2	47.0	14.8	31.3
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	9.0	49.0	15.0	23.0	9.0	49.0	9.0	29.0
Max Q Clear Time (g_c+I1), s	6.3	19.8	13.4	18.2	3.5	35.3	8.4	11.8
Green Ext Time (p_c), s	0.1	7.7	0.1	2.4	0.0	5.7	0.0	5.5

Intersection Summary	
HCM 2010 Ctrl Delay	35.5
HCM 2010 LOS	D

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	253	366	170	27	39	212
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	0	-	-	0	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	8	8	12	12	4	4
Mvmt Flow	281	407	189	30	43	236

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	189	0	-	0	1158	-
Stage 1	-	-	-	-	189	-
Stage 2	-	-	-	-	969	-
Critical Hdwy	4.18	-	-	-	6.44	-
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	2.272	-	-	-	3.536	-
Pot Cap-1 Maneuver	1350	-	-	-	215	0
Stage 1	-	-	-	-	838	0
Stage 2	-	-	-	-	365	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1350	-	-	-	170	-
Mov Cap-2 Maneuver	-	-	-	-	170	-
Stage 1	-	-	-	-	838	-
Stage 2	-	-	-	-	289	-

Approach	EB	WB	SB
HCM Control Delay, s			33.3
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1350	-	-	-	170	-
HCM Lane V/C Ratio	0.208	-	-	-	0.255	-
HCM Control Delay (s)	8.4	-	-	-	33.3	0
HCM Lane LOS	A	-	-	-	D	A
HCM 95th %tile Q(veh)	1	-	-	-	1	-

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	235	172	362	37	37	272
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	0	-	-	0	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	6	6	10	10	3	3
Mvmt Flow	261	191	402	41	41	302

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	402	0	-	0	1115	-
Stage 1	-	-	-	-	402	-
Stage 2	-	-	-	-	713	-
Critical Hdwy	4.16	-	-	-	6.43	-
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.254	-	-	-	3.527	-
Pot Cap-1 Maneuver	1135	-	-	-	229	0
Stage 1	-	-	-	-	673	0
Stage 2	-	-	-	-	484	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1135	-	-	-	176	-
Mov Cap-2 Maneuver	-	-	-	-	176	-
Stage 1	-	-	-	-	673	-
Stage 2	-	-	-	-	373	-

Approach	EB	WB	SB
HCM Control Delay, s			31.6
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1135	-	-	-	176	-
HCM Lane V/C Ratio	0.23	-	-	-	0.234	-
HCM Control Delay (s)	9.1	-	-	-	31.6	0
HCM Lane LOS	A	-	-	-	D	A
HCM 95th %tile Q(veh)	1	-	-	-	1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	95	8	302	4	7	4	121	21	4	4	134	69
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1696	1696	1900	1863	1900	1696	1696	1900	1900	1845	1845
Adj Flow Rate, veh/h	106	9	0	4	8	4	134	23	4	4	149	77
Adj No. of Lanes	0	1	1	0	1	0	1	1	0	0	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	12	12	12	2	2	2	12	12	12	3	3	3
Cap, veh/h	532	38	440	187	316	130	537	559	97	96	727	622
Arrive On Green	0.31	0.31	0.00	0.31	0.31	0.31	0.40	0.40	0.40	0.40	0.40	0.40
Sat Flow, veh/h	1181	124	1442	246	1033	427	1047	1408	245	10	1831	1568
Grp Volume(v), veh/h	115	0	0	16	0	0	134	0	27	153	0	77
Grp Sat Flow(s),veh/h/ln	1305	0	1442	1706	0	0	1047	0	1653	1841	0	1568
Q Serve(g_s), s	2.4	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.4	0.0	0.0	1.3
Cycle Q Clear(g_c), s	2.6	0.0	0.0	0.3	0.0	0.0	6.1	0.0	0.4	2.2	0.0	1.3
Prop In Lane	0.92		1.00	0.25		0.25	1.00		0.15	0.03		1.00
Lane Grp Cap(c), veh/h	570	0	440	633	0	0	537	0	656	822	0	622
V/C Ratio(X)	0.20	0.00	0.00	0.03	0.00	0.00	0.25	0.00	0.04	0.19	0.00	0.12
Avail Cap(c_a), veh/h	914	0	823	1071	0	0	771	0	1025	1231	0	972
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.6	0.0	0.0	9.8	0.0	0.0	10.0	0.0	7.5	8.0	0.0	7.7
Incr Delay (d2), s/veh	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	0.0	0.1	0.0	0.0	1.2	0.0	0.2	1.1	0.0	0.5
LnGrp Delay(d),s/veh	10.8	0.0	0.0	9.8	0.0	0.0	10.2	0.0	7.5	8.1	0.0	7.8
LnGrp LOS	B			A			B		A	A		A
Approach Vol, veh/h		115			16			161			230	
Approach Delay, s/veh		10.8			9.8			9.8			8.0	
Approach LOS		B			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		22.0		18.3		22.0		18.3
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		25.0		23.0		25.0		23.0
Max Q Clear Time (g_c+I1), s		8.1		4.6		4.2		2.3
Green Ext Time (p_c), s		1.7		0.6		1.8		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	9.2
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	64	7	138	4	6	5	290	117	4	4	31	103
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1727	1727	1900	1863	1900	1727	1727	1900	1900	1845	1845
Adj Flow Rate, veh/h	71	8	0	4	7	6	322	130	4	4	34	114
Adj No. of Lanes	0	1	1	0	1	0	1	1	0	0	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	10	10	10	2	2	2	10	10	10	3	3	3
Cap, veh/h	491	45	393	170	239	160	654	698	21	133	729	656
Arrive On Green	0.27	0.27	0.00	0.27	0.27	0.27	0.42	0.42	0.42	0.42	0.42	0.42
Sat Flow, veh/h	1168	170	1468	202	892	597	1145	1667	51	69	1742	1568
Grp Volume(v), veh/h	79	0	0	17	0	0	322	0	134	38	0	114
Grp Sat Flow(s),veh/h/ln	1338	0	1468	1691	0	0	1145	0	1718	1811	0	1568
Q Serve(g_s), s	1.4	0.0	0.0	0.0	0.0	0.0	8.9	0.0	1.9	0.0	0.0	1.7
Cycle Q Clear(g_c), s	1.7	0.0	0.0	0.3	0.0	0.0	9.3	0.0	1.9	0.5	0.0	1.7
Prop In Lane	0.90		1.00	0.24		0.35	1.00		0.03	0.11		1.00
Lane Grp Cap(c), veh/h	537	0	393	569	0	0	654	0	719	862	0	656
V/C Ratio(X)	0.15	0.00	0.00	0.03	0.00	0.00	0.49	0.00	0.19	0.04	0.00	0.17
Avail Cap(c_a), veh/h	772	0	653	858	0	0	1103	0	1393	1550	0	1272
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.8	0.0	0.0	10.4	0.0	0.0	9.4	0.0	7.0	6.6	0.0	7.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.1	0.0	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	0.0	0.1	0.0	0.0	2.9	0.0	0.9	0.2	0.0	0.8
LnGrp Delay(d),s/veh	11.0	0.0	0.0	10.4	0.0	0.0	9.9	0.0	7.1	6.6	0.0	7.1
LnGrp LOS	B			B			A		A	A		A
Approach Vol, veh/h		79			17			456			152	
Approach Delay, s/veh		11.0			10.4			9.1			7.0	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		22.0		16.2		22.0		16.2
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		31.0		17.0		31.0		17.0
Max Q Clear Time (g_c+I1), s		11.3		3.7		3.7		2.3
Green Ext Time (p_c), s		2.7		0.3		2.8		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	8.9
HCM 2010 LOS	A

Intersection	
Intersection Delay, s/veh	24.6
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	28	7	91	0	19	6	36	0	163	195	18
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	4	4	4
Mvmt Flow	0	31	8	101	0	21	7	40	0	181	217	20
Number of Lanes	0	0	1	0	0	0	1	1	0	0	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	2	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	2	1	2
HCM Control Delay	12.6	10.7	21
HCM LOS	B	B	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2	SBLn1
Vol Left, %	46%	0%	22%	76%	0%	29%
Vol Thru, %	54%	0%	6%	24%	0%	53%
Vol Right, %	0%	100%	72%	0%	100%	18%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	358	18	126	25	36	459
LT Vol	195	0	7	6	0	244
Through Vol	0	18	91	0	36	82
RT Vol	163	0	28	19	0	133
Lane Flow Rate	398	20	140	28	40	510
Geometry Grp	7	7	6	7	7	6
Degree of Util (X)	0.686	0.029	0.27	0.062	0.076	0.841
Departure Headway (Hd)	6.213	5.272	6.943	8.022	6.812	5.935
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	581	675	514	449	522	607
Service Time	3.977	3.035	5.034	5.722	4.611	3.995
HCM Lane V/C Ratio	0.685	0.03	0.272	0.062	0.077	0.84
HCM Control Delay	21.6	8.2	12.6	11.3	10.2	32.8
HCM Lane LOS	C	A	B	B	B	D
HCM 95th-tile Q	5.3	0.1	1.1	0.2	0.2	9

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	133	244	82
Peak Hour Factor	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	3	3	3
Mvmt Flow	0	148	271	91
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	2
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	32.8
HCM LOS	D

Lane

Intersection	
Intersection Delay, s/veh	25.8
Intersection LOS	D

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	53	9	158	0	15	8	158	0	115	270	24
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	3	3	3
Mvmt Flow	0	59	10	176	0	17	9	176	0	128	300	27
Number of Lanes	0	0	1	0	0	0	1	1	0	0	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	2	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	2	1	2
HCM Control Delay	18.1	13.7	36
HCM LOS	C	B	E

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2	SBLn1
Vol Left, %	30%	0%	24%	65%	0%	11%
Vol Thru, %	70%	0%	4%	35%	0%	76%
Vol Right, %	0%	100%	72%	0%	100%	12%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	385	24	220	23	158	305
LT Vol	270	0	9	8	0	233
Through Vol	0	24	158	0	158	37
RT Vol	115	0	53	15	0	35
Lane Flow Rate	428	27	244	26	176	339
Geometry Grp	7	7	6	7	7	6
Degree of Util (X)	0.844	0.046	0.508	0.059	0.353	0.683
Departure Headway (Hd)	7.101	6.232	7.481	8.295	7.236	7.258
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	509	571	479	429	493	495
Service Time	4.883	4.013	5.578	6.094	5.034	5.351
HCM Lane V/C Ratio	0.841	0.047	0.509	0.061	0.357	0.685
HCM Control Delay	37.7	9.3	18.1	11.6	14	24.7
HCM Lane LOS	E	A	C	B	B	C
HCM 95th-tile Q	8.6	0.1	2.8	0.2	1.6	5.1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	35	233	37
Peak Hour Factor	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	3	3	3
Mvmt Flow	0	39	259	41
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	2
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	24.7
HCM LOS	C

Lane

Intersection	
Int Delay, s/veh	0.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	20	17	245	20	29	394
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	170	0	-	100	220	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	15	15	13	13
Mvmt Flow	22	19	272	22	32	438

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	774	272	0	0	272	0
Stage 1	272	-	-	-	-	-
Stage 2	502	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.23	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.317	-
Pot Cap-1 Maneuver	367	767	-	-	1230	-
Stage 1	774	-	-	-	-	-
Stage 2	608	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	357	767	-	-	1230	-
Mov Cap-2 Maneuver	357	-	-	-	-	-
Stage 1	774	-	-	-	-	-
Stage 2	592	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13		
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	357	767	1230	-
HCM Lane V/C Ratio	-	-	0.062	0.025	0.026	-
HCM Control Delay (s)	-	-	15.8	9.8	8	-
HCM Lane LOS	-	-	C	A	A	-
HCM 95th %tile Q(veh)	-	-	0	0	0	-

Intersection	
Int Delay, s/veh	0.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	19	18	328	30	24	236
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	170	0	-	100	220	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	14	14	12	12
Mvmt Flow	21	20	364	33	27	262

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	680	364	0	0	364	0
Stage 1	364	-	-	-	-	-
Stage 2	316	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.22	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.308	-
Pot Cap-1 Maneuver	417	681	-	-	1141	-
Stage 1	703	-	-	-	-	-
Stage 2	739	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	407	681	-	-	1141	-
Mov Cap-2 Maneuver	703	-	-	-	-	-
Stage 1	703	-	-	-	-	-
Stage 2	722	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.3		
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	703	681	1141	-
HCM Lane V/C Ratio	-	-	0.03	0.029	0.023	-
HCM Control Delay (s)	-	-	10.3	10.4	8.2	-
HCM Lane LOS	-	-	B	B	A	-
HCM 95th %tile Q(veh)	-	-	0	0	0	-

Intersection	
Int Delay, s/veh	11

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	120	173	92	390	360	54
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	Free	-	None
Storage Length	0	0	-	0	175	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	12	12	15	15	15	15
Mvmt Flow	133	192	102	433	400	60

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	932	102	0	-	102	0
Stage 1	102	-	-	-	-	-
Stage 2	830	-	-	-	-	-
Critical Hdwy	6.78	6.38	-	-	4.25	-
Critical Hdwy Stg 1	5.58	-	-	-	-	-
Critical Hdwy Stg 2	5.98	-	-	-	-	-
Follow-up Hdwy	3.614	3.414	-	-	2.335	-
Pot Cap-1 Maneuver	265	923	-	0	1413	-
Stage 1	895	-	-	0	-	-
Stage 2	370	-	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	190	923	-	-	1413	-
Mov Cap-2 Maneuver	190	-	-	-	-	-
Stage 1	895	-	-	-	-	-
Stage 2	265	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	30.1		
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	190	923	1413	-
HCM Lane V/C Ratio	-	0.702	0.208	0.283	-
HCM Control Delay (s)	-	59.2	9.9	8.6	-
HCM Lane LOS	-	F	A	A	-
HCM 95th %tile Q(veh)	-	4	1	1	-

Intersection	
Int Delay, s/veh	21.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	351	296	62	115	166	89
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	Free	-	None
Storage Length	0	0	-	0	175	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	12	12	14	14	14	14
Mvmt Flow	390	329	69	128	184	99

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	487	69	0	-	69	0
Stage 1	69	-	-	-	-	-
Stage 2	418	-	-	-	-	-
Critical Hdwy	6.78	6.38	-	-	4.24	-
Critical Hdwy Stg 1	5.58	-	-	-	-	-
Critical Hdwy Stg 2	5.98	-	-	-	-	-
Follow-up Hdwy	3.614	3.414	-	-	2.326	-
Pot Cap-1 Maneuver	503	964	-	0	1459	-
Stage 1	926	-	-	0	-	-
Stage 2	609	-	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	440	964	-	-	1459	-
Mov Cap-2 Maneuver	440	-	-	-	-	-
Stage 1	926	-	-	-	-	-
Stage 2	532	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	32.1		
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	440	964	1459	-
HCM Lane V/C Ratio	-	0.886	0.341	0.126	-
HCM Control Delay (s)	-	50.2	10.7	7.8	-
HCM Lane LOS	-	F	B	A	-
HCM 95th %tile Q(veh)	-	9	2	0	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	18	32	67	152	358	38
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	500	-	-	500
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	100	100	100	13	12	100
Mvmt Flow	20	36	74	169	398	42

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	716	398	398	0	-	0
Stage 1	398	-	-	-	-	-
Stage 2	318	-	-	-	-	-
Critical Hdwy	7.4	7.2	5.1	-	-	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	4.4	4.2	3.1	-	-	-
Pot Cap-1 Maneuver	282	483	780	-	-	-
Stage 1	509	-	-	-	-	-
Stage 2	561	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	255	483	780	-	-	-
Mov Cap-2 Maneuver	255	-	-	-	-	-
Stage 1	509	-	-	-	-	-
Stage 2	508	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	16.6		
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	780	-	365	-	-
HCM Lane V/C Ratio	0.095	-	0.152	-	-
HCM Control Delay (s)	10.1	-	16.6	-	-
HCM Lane LOS	B	-	C	-	-
HCM 95th %tile Q(veh)	0	-	1	-	-

Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	38	67	32	326	166	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	500	-	-	500
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	100	100	100	12	11	100
Mvmt Flow	42	74	36	362	184	20

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	617	184	184	0	-	0
Stage 1	184	-	-	-	-	-
Stage 2	433	-	-	-	-	-
Critical Hdwy	7.4	7.2	5.1	-	-	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	4.4	4.2	3.1	-	-	-
Pot Cap-1 Maneuver	328	659	968	-	-	-
Stage 1	659	-	-	-	-	-
Stage 2	488	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	316	659	968	-	-	-
Mov Cap-2 Maneuver	316	-	-	-	-	-
Stage 1	659	-	-	-	-	-
Stage 2	470	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	15.1		
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	968	-	473	-	-
HCM Lane V/C Ratio	0.037	-	0.247	-	-
HCM Control Delay (s)	8.9	-	15.1	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0	-	1	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	10	5	11	159	391	22
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	12	12	12	12
Mvmt Flow	11	6	12	177	434	24

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	560	229	459	0	-	0
Stage 1	447	-	-	-	-	-
Stage 2	113	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.34	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.32	-	-	-
Pot Cap-1 Maneuver	458	774	1031	-	-	-
Stage 1	611	-	-	-	-	-
Stage 2	899	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	452	774	1031	-	-	-
Mov Cap-2 Maneuver	611	-	-	-	-	-
Stage 1	611	-	-	-	-	-
Stage 2	887	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.6	0.6	
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1031	-	657	-	-
HCM Lane V/C Ratio	0.012	-	0.025	-	-
HCM Control Delay (s)	8.5	0	10.6	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	22	11	5	359	173	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	11	11	10	10
Mvmt Flow	24	12	6	399	192	11

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	409	102	203	0	-	0
Stage 1	198	-	-	-	-	-
Stage 2	211	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.32	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.31	-	-	-
Pot Cap-1 Maneuver	570	933	1303	-	-	-
Stage 1	816	-	-	-	-	-
Stage 2	804	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	567	933	1303	-	-	-
Mov Cap-2 Maneuver	567	-	-	-	-	-
Stage 1	816	-	-	-	-	-
Stage 2	799	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.9	0.1	
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1303	-	652	-	-
HCM Lane V/C Ratio	0.004	-	0.056	-	-
HCM Control Delay (s)	7.8	0	10.9	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Arterial Level of Service: NB #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Driveway	II	40	28.5	9.4	37.9	0.26	24.6	C
Carolina Ave	II	35	43.3	5.0	48.3	0.41	30.8	B
Reynolds Ave	II	35	44.7	9.1	53.8	0.43	28.7	B
Cosgrove Ave	II	40	30.5	21.8	52.3	0.30	20.6	D
St Johns Ave	II	40	15.4	13.9	29.3	0.13	16.4	E
Total	II		162.4	59.2	221.6	1.53	24.9	C

Arterial Level of Service: SB #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Cosgrove Ave	II	40	15.4	32.6	48.0	0.13	10.0	F
Reynolds Ave	II	40	30.5	18.5	49.0	0.30	22.0	D
Carolina Ave	II	35	44.7	6.7	51.4	0.43	30.1	B
Burton Ln	II	40	39.6	12.3	51.9	0.41	28.6	B
Stromboli Ave	II	40	28.5	4.1	32.6	0.26	28.6	B
Total	II		158.7	74.2	232.9	1.53	23.7	C

Arterial Level of Service: NB #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Driveway	II	40	28.5	10.0	38.5	0.26	24.2	C
Carolina Ave	II	35	43.3	7.3	50.6	0.41	29.4	B
Reynolds Ave	II	35	44.7	16.8	61.5	0.43	25.1	C
Cosgrove Ave	II	40	30.5	30.0	60.5	0.30	17.8	D
St Johns Ave	II	40	15.4	15.6	31.0	0.13	15.5	E
Total	II		162.4	79.7	242.1	1.53	22.8	C

Arterial Level of Service: SB #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Cosgrove Ave	II	40	15.4	30.6	46.0	0.13	10.4	F
Reynolds Ave	II	40	30.5	10.1	40.6	0.30	26.6	C
Carolina Ave	II	35	44.7	4.9	49.6	0.43	31.2	B
Burton Ln	II	40	39.6	8.3	47.9	0.41	31.0	B
Stromboli Ave	II	40	28.5	11.1	39.6	0.26	23.5	C
Total	II		158.7	65.0	223.7	1.53	24.7	C

Arterial Level of Service: NB #2

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Burton Ln	III	34	35.4	6.7	42.1	0.29	25.2	B
Reynolds Ave	III	35	50.6	9.2	59.8	0.42	25.4	B
Cosgrove Ave	III	35	27.9	19.3	47.2	0.23	17.7	D
Dorchester Rd	III	35	18.7	3.4	22.1	0.15	23.8	C
McMillan Ave	III	35	24.5	14.9	39.4	0.20	18.7	C
Total	III		157.1	53.5	210.6	1.30	22.2	C

Arterial Level of Service: SB #2

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Dorchester Rd	II	35	25.5	5.2	30.7	0.20	23.9	C
Cosgrove Ave	II	35	18.3	27.8	46.1	0.15	11.4	F
Reynolds Ave	II	35	27.6	2.6	30.2	0.23	27.7	C
Burton Ln	II	35	44.6	7.2	51.8	0.43	29.8	B
Stromboli Ave	II	37	32.4	2.0	34.4	0.29	30.8	B
Total	II		148.4	44.8	193.2	1.31	24.3	C

Arterial Level of Service: NB #2

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Burton Ln	III	34	35.4	9.7	45.1	0.29	23.5	C
Reynolds Ave	III	35	50.6	12.8	63.4	0.42	23.9	C
Cosgrove Ave	III	35	27.9	28.2	56.1	0.23	14.9	D
Dorchester Rd	III	35	18.7	3.9	22.6	0.15	23.3	C
McMillan Ave	III	35	24.5	19.0	43.5	0.20	16.9	D
Total	III		157.1	73.6	230.7	1.30	20.3	C

Arterial Level of Service: SB #2

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Dorchester Rd	II	35	25.5	5.5	31.0	0.20	23.7	C
Cosgrove Ave	II	35	18.3	43.7	62.0	0.15	8.5	F
Reynolds Ave	II	35	27.6	3.4	31.0	0.23	27.0	C
Burton Ln	II	35	44.6	9.2	53.8	0.43	28.7	B
Stromboli Ave	II	37	32.4	1.8	34.2	0.29	31.0	B
Total	II		148.4	63.6	212.0	1.31	22.2	C

Appendix E
Traffic Analysis Worksheets

2038 Design Year

Build Proposed Project Alternatives 1-4

Appendix E
Traffic Analysis Worksheets

2038 Design Year

Build Proposed Project Alternatives 1-4

Interstate 26

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1010-EB Off to C-D
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	4
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	400
Freeway Volume, V_F	9143
Ramp Volume, V_R	1104
Freeway Free-Flow Speed, S_{FF}	60.0
Ramp Free-Flow Speed, S_{FR}	55.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9143	0.90	Level	16	0	0.926	1.00	10972
Ramp	1104	0.90	Level	5	0	0.976	1.00	1257
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.436 using Equation (Exhibit 13-7)
V_{12} = 5493 pc/h
V_3 or V_{av34} 2739 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = 5572 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10972	Exhibit 13-8	9200	Yes
$V_{FO} = V_F - V_R$	9715	Exhibit 13-8	9200	Yes
V_R	1257	Exhibit 13-10	2200	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5493	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 48.6 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.281 (Exhibit 13-12)
S_R= 54.9 mph (Exhibit 13-12)
S_0= 59.2 mph (Exhibit 13-12)
S = 57.0 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1010-EB Off to C-D
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 400	V_D = veh/h
	Freeway Volume, V_F: 5917	
	Ramp Volume, V_R: 586	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 55.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5917	0.90	Level	12	0	0.943	1.00	6969
Ramp	586	0.90	Level	9	0	0.957	1.00	680
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3422 pc/h

V_3 or V_{av34} 1773 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6969	Exhibit 13-8	9200	No
$V_{FO} = V_F - V_R$	6289	Exhibit 13-8	9200	No
V_R	680	Exhibit 13-10	2200	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3422	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.1 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.229 (Exhibit 13-12)

S_R= 55.9 mph (Exhibit 13-12)

S_0= 62.8 mph (Exhibit 13-12)

S = 59.2 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1015-Avai/Rem CD Off to CD On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8039*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*16*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.926*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2412*	pc/h/ln
S	*48.0*	mph
D = v_p / S	*50.2*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1015-Avai/Rem CD Off to CD On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5331*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*13*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.939*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1577*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*26.3*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 EB C-D
Analysis Year	2038 Build - Proposed Site	Junction	EB Off to Aviation Ave
Analysis Time Period:	AM Peak	Segment ID	1020
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	1	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	1,104	505	599
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	5%	5%	6%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.98	0.97
Demand Flow Rate, v_p (pc/h/ln)	1,257	575	686
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,100
v/c ratio	0.57	0.26	0.33
Density, D_{MD} (pc/mi/ln)	22.0	10.1	12.0
LOS	C	B	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 EB C-D
Analysis Year	2038 Build - Proposed Site	Junction	EB Off to Aviation Ave
Analysis Time Period:	PM Peak	Segment ID	1020
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	1	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	586	331	255
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	9%	7%	11%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.96	0.97	0.95
Demand Flow Rate, v_p (pc/h/ln)	680	381	299
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,100
v/c ratio	0.31	0.17	0.14
Density, D_{MD} (pc/mi/ln)	11.9	6.7	5.2
LOS	B	A	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB C-D*
Agency or Company	*Atkins*	From/To	*1025 - Avia Off to Avia WB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1010*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*575*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*10.5*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB C-D*
Agency or Company	*Atkins*	From/To	*1025 - Avia Off to Avia WB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*662*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*381*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*55.0*	mph	S	mph
D = v_p / S	*6.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*A*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 EB C-D
Analysis Year	2038 Build - Proposed Site	Junction	WB Aviation EB On Loop
Analysis Time Period:	AM Peak	Segment ID	1030
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	1	1
Free-Flow Speed, FFS (mph)	55	55	25
Volume, V (veh/h)	505	801	296
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	5%	4%	3%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.98	0.99
Demand Flow Rate, v_p (pc/h/ln)	575	908	334
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	1,900
v/c ratio	0.26	0.41	0.18
Density, D_{MD} (pc/mi/ln)	10.1	15.9	5.8
LOS	B	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 EB C-D
Analysis Year	2038 Build - Proposed Site	Junction	WB Aviation EB On Loop
Analysis Time Period:	PM Peak	Segment ID	1030
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	1	1
Free-Flow Speed, FFS (mph)	55	55	25
Volume, V (veh/h)	331	802	471
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	7%	4%	2%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.98	0.99
Demand Flow Rate, v_p (pc/h/ln)	381	909	529
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	1,900
v/c ratio	0.17	0.41	0.28
Density, D_{MD} (pc/mi/ln)	6.7	15.9	9.3
LOS	A	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-26 EB - Aviation-Remount C-D
Weaving Segment Location	1040-EB Aviation to Remount
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	2
Weaving segment length, L_S	535ft
Freeway free-flow speed, FFS	55 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	296	0.90	3	0	1.5	1.2	0.985	1.00	334
V_{RF}	308	0.90	10	0	1.5	1.2	0.952	1.00	359
V_{FR}	505	0.90	5	0	1.5	1.2	0.976	1.00	575
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	334							V =	1268
V_W	934								
VR	0.737								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	934 lc/h
Interchange density, ID	0.8 int/mi	Weaving lane changes, LC_W	972 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	0 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	972 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	14

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	1268 pc/h	Weaving intensity factor, W	0.362
Weaving segment capacity, c_w	2899 veh/h	Weaving segment speed, S	44.6 mph
Weaving segment v/c ratio	0.431	Average weaving speed, S_W	44.4 mph
Weaving segment density, D	14.2 pc/mi/ln	Average non-weaving speed, S_{NW}	45.2 mph
Level of Service, LOS	B	Maximum weaving length, L_{MAX}	10720 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25//2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-26 EB - Aviation-Remount C-D
Weaving Segment Location	1040-EB Aviation to Remount
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	2
Weaving segment length, L_S	535ft
Freeway free-flow speed, FFS	55 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	471	0.90	2	0	1.5	1.2	0.990	1.00	529
V_{RF}	548	0.90	5	0	1.5	1.2	0.976	1.00	624
V_{FR}	331	0.90	7	0	1.5	1.2	0.966	1.00	381
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	529							V =	1534
V_W	1005								
VR	0.655								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1005 lc/h
Interchange density, ID	0.8 int/mi	Weaving lane changes, LC_W	1043 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	14 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1057 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	23

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	1534 pc/h	Weaving intensity factor, W	0.387
Weaving segment capacity, c_w	3067 veh/h	Weaving segment speed, S	43.9 mph
Weaving segment v/c ratio	0.495	Average weaving speed, S_W	43.8 mph
Weaving segment density, D	17.5 pc/mi/ln	Average non-weaving speed, S_{NW}	44.1 mph
Level of Service, LOS	B	Maximum weaving length, L_{MAX}	9696 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB C-D*
Agency or Company	*Atkins*	From/To	*1045-Remount Off to Remount On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1208*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*695*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*12.6*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB C-D*
Agency or Company	*Atkins*	From/To	*1045-Remount Off to Remount On*
Date Performed	*4/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2038*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1149*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*20.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 EB C-D
Analysis Year	2038 Build - Proposed Site	Junction	Remount EB On Loop
Analysis Time Period:	AM Peak	Segment ID	1050
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	1	1
Free-Flow Speed, FFS (mph)	55	55	25
Volume, V (veh/h)	604	975	371
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	7%	5%	2%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.98	0.99
Demand Flow Rate, v_p (pc/h/ln)	695	1,110	416
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	1,900
v/c ratio	0.32	0.50	0.22
Density, D_{MD} (pc/mi/ln)	12.2	19.4	7.3
LOS	B	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	3/20/2014	Freeway/Direction	I-26 EB C-D
Analysis Year	2038 Build - Proposed Site	Junction	Remount EB On Loop
Analysis Time Period:	PM Peak	Segment ID	1050
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	1	1
Free-Flow Speed, FFS (mph)	55	55	25
Volume, V (veh/h)	1,019	1,446	427
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	3%	3%	2%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.99	0.99	0.99
Demand Flow Rate, v_p (pc/h/ln)	1,149	1,631	479
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	1,900
v/c ratio	0.52	0.74	0.25
Density, D_{MD} (pc/mi/ln)	20.1	28.5	8.4
LOS	C	D	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-26 EB
Weaving Segment Location	1060-Avi-Rem C-D to 526 C-D
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	5
Weaving segment length, L_S	1850ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4534	0.90	14	0	1.5	1.2	0.935	1.00	5390
V_{RF}	550	0.90	14	0	1.5	1.2	0.935	1.00	654
V_{FR}	3505	0.90	29	0	1.5	1.2	0.873	1.00	4459
V_{RR}	425	0.90	29	0	1.5	1.2	0.873	1.00	541
V_{NW}	5931							V =	11044
V_W	5113								
VR	0.463								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	2 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	652

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	11044 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	4845 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	2.130	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	7397 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-26 EB
Weaving Segment Location	1060-Avi-Rem C-D to 526 C-D
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	5	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1850ft	Freeway maximum capacity, C_{IFL}	2300
Freeway free-flow speed, FFS	60 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2833	0.90	11	0	1.5	1.2	0.948	1.00	3321
V_{RF}	769	0.90	11	0	1.5	1.2	0.948	1.00	901
V_{FR}	2498	0.90	31	0	1.5	1.2	0.866	1.00	3206
V_{RR}	677	0.90	31	0	1.5	1.2	0.866	1.00	869
V_{NW}	4190							V =	8297
V_W	4107								
VR	0.495								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	2 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	408

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	8297 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	4596 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.711	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	7768 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1065 - I-526 CD Off to CD On*
Date Performed	*4/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5084*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*14*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*	
			Up/Down %		

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.935*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2015*	pc/h/ln
S	*56.9*	mph
D = v_p / S	*35.4*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1065 - I-526 CD Off to CD On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3602*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1407*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*23.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 EB C-D
Analysis Year	2038 Build - Proposed Site	Junction	EB Off to I-526 WB
Analysis Time Period:	AM Peak	Segment ID	1070
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	1	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	3,930	1,422	2,508
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	29%	52%	16%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.87	0.79	0.93
Demand Flow Rate, v_p (pc/h/ln)	2,500	1,991	3,010
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,100
v/c ratio	1.14	0.91	1.43
Density, D_{MD} (pc/mi/ln)	43.8	34.8	52.7
LOS	F	D	F

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 EB C-D
Analysis Year	2038 Build - Proposed Site	Junction	EB Off to I-526 WB
Analysis Time Period:	PM Peak	Segment ID	1070
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	1	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	3,175	1,163	2,012
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	31%	55%	18%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.87	0.78	0.92
Demand Flow Rate, v_p (pc/h/ln)	2,037	1,648	2,437
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,100
v/c ratio	0.93	0.75	1.16
Density, D_{MD} (pc/mi/ln)	35.6	28.8	42.6
LOS	E	D	F

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB C-D*
Agency or Company	*Atkins*	From/To	*1075-I526 WB Off to I526 WB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2844*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*52*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.794*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1991*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*54.1*	mph	S	mph
D = v_p / S	*36.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB C-D*
Agency or Company	*Atkins*	From/To	*1075-I526 WB Off to I526 WB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2326*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*55*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.784*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1648*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*30.0*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	3/20/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-26 EB C-D
Weaving Segment Location	1080 - I-526 WB to I-526 EB
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	C-D Roadway/ Multilane Highways
Weaving number of lanes, N	2	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	620ft	Freeway maximum capacity, C_{IFL}	2250
Freeway free-flow speed, FFS	55 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{RF}	566	0.90	8	0	1.5	1.2	0.962	1.00	654
V_{FR}	1422	0.90	52	0	1.5	1.2	0.794	1.00	1991
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	0							V =	2645
V_W	2645								
VR	1.000								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.8 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	0

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	2645 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	2400 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.102	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	14232 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-26 EB C-D
Weaving Segment Location	1080 - I-526 WB to I-526 EB
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	C-D Roadway/ Multilane Highways
Weaving number of lanes, N	2	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	620ft	Freeway maximum capacity, C_{IFL}	2250
Freeway free-flow speed, FFS	55 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{RF}	498	0.90	7	0	1.5	1.2	0.966	1.00	573
V_{FR}	1163	0.90	55	0	1.5	1.2	0.784	1.00	1648
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	0							V =	2221
V_W	2221								
VR	1.000								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2221 lc/h
Interchange density, ID	0.8 int/mi	Weaving lane changes, LC_W	2266 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	0 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2266 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	0

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	2221 pc/h	Weaving intensity factor, W	0.628
Weaving segment capacity, c_w	2400 veh/h	Weaving segment speed, S	39.6 mph
Weaving segment v/c ratio	0.925	Average weaving speed, S_W	39.6 mph
Weaving segment density, D	28.1 pc/mi/ln	Average non-weaving speed, S_{NW}	33.7 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	14232 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB C-D*
Agency or Company	*Atkins*	From/To	*1085-I526 EB Off to I526 EB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1132*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*654*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*55.0*	mph	S	mph
D = v_p / S	*11.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB C-D*
Agency or Company	*Atkins*	From/To	*1085-I526 EB Off to I526 EB On*
Date Performed	*4/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*996*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*573*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*55.0*	mph	S	mph
D = v_p / S	*10.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*A*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 EB
Analysis Year	2038 Build - Proposed Site	Junction	I-526 EB Ramp Split
Analysis Time Period:	AM Peak	Segment ID	1088
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	2	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	2,403	2,104	299
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	9%	10%	3%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.96	0.95	0.99
Demand Flow Rate, v_p (pc/h/ln)	1,395	1,227	337
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,200
v/c ratio	0.63	0.56	0.15
Density, D_{MD} (pc/mi/ln)	24.4	21.5	5.9
LOS	C	C	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	3/20/2014	Freeway/Direction	I-26 EB
Analysis Year	2038 Build - Proposed Site	Junction	I-526 EB Ramp Split
Analysis Time Period:	PM Peak	Segment ID	1088
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	2	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	2,777	2,433	344
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	7%	7%	3%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.97	0.99
Demand Flow Rate, v_p (pc/h/ln)	1,597	1,399	388
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,200
v/c ratio	0.73	0.64	0.18
Density, D_{MD} (pc/mi/ln)	27.9	24.5	6.8
LOS	C	C	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	3/20/2014	Freeway/Direction	I-26 EB C-D
Analysis Year	2038 Build - Proposed Site	Junction	I-526 EB On
Analysis Time Period:	AM Peak	Segment ID	1090
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	1	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	566	865	299
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	8%	6%	3%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.96	0.97	0.99
Demand Flow Rate, v_p (pc/h/ln)	654	990	337
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,100
v/c ratio	0.30	0.45	0.16
Density, D_{MD} (pc/mi/ln)	11.4	17.3	5.9
LOS	B	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 EB C-D
Analysis Year	2038 Build - Proposed Site	Junction	I-526 EB On
Analysis Time Period:	PM Peak	Segment ID	1090
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	1	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	498	842	344
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	7%	5%	3%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.98	0.99
Demand Flow Rate, v_p (pc/h/ln)	573	959	388
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,100
v/c ratio	0.26	0.44	0.18
Density, D_{MD} (pc/mi/ln)	10.0	16.8	6.8
LOS	A	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-26 EB
Weaving Segment Location	1100 - I-526 CD to Montague SB
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	1550ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	4400	0.90	8	0	1.5	1.2	0.962	1.00	5084
V_{RF}	749	0.90	8	0	1.5	1.2	0.962	1.00	866
V_{FR}	684	0.90	16	0	1.5	1.2	0.926	1.00	821
V_{RR}	116	0.90	16	0	1.5	1.2	0.926	1.00	139
V_{NW}	5223							V =	6910
V_W	1687								
VR	0.244								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1687 lc/h
Interchange density, ID	0.8 int/mi	Weaving lane changes, LC_W	2040 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1146 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	3186 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	648

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6910 pc/h	Weaving intensity factor, W	0.399
Weaving segment capacity, c_w	7835 veh/h	Weaving segment speed, S	41.2 mph
Weaving segment v/c ratio	0.848	Average weaving speed, S_W	47.2 mph
Weaving segment density, D	41.9 pc/mi/ln	Average non-weaving speed, S_{NW}	39.6 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	4992 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	3/20/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-26 EB
Weaving Segment Location	1100 - I-526 CD to Montague SB
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	1550ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2606	0.90	6	0	1.5	1.2	0.971	1.00	2982
V_{RF}	609	0.90	6	0	1.5	1.2	0.971	1.00	697
V_{FR}	996	0.90	9	0	1.5	1.2	0.957	1.00	1156
V_{RR}	233	0.90	9	0	1.5	1.2	0.957	1.00	271
V_{NW}	3253							V =	5106
V_W	1853								
VR	0.363								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1853 lc/h
Interchange density, ID	0.8 int/mi	Weaving lane changes, LC_W	2206 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	740 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2946 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	403

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5106 pc/h	Weaving intensity factor, W	0.375
Weaving segment capacity, c_w	6421 veh/h	Weaving segment speed, S	42.9 mph
Weaving segment v/c ratio	0.772	Average weaving speed, S_W	47.7 mph
Weaving segment density, D	29.8 pc/mi/ln	Average non-weaving speed, S_{NW}	40.5 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	6268 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1105-Mont SB Off to Mont SB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5149*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1983*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*57.3*	mph	S	mph
D = v_p / S	*34.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1105-Mont SB Off to Mont SB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3215*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1226*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*20.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-26 EB
Weaving Segment Location	1110 - Montague SB to Mont. NB
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	470ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4620	0.90	8	0	1.5	1.2	0.962	1.00	5339
V_{RF}	414	0.90	9	0	1.5	1.2	0.957	1.00	481
V_{FR}	529	0.90	6	0	1.5	1.2	0.971	1.00	605
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	5339							V =	6425
V_W	1086								
VR	0.169								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1086 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	1228 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	584 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1812 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	251

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6425 pc/h	Weaving intensity factor, W	0.655
Weaving segment capacity, c_w	7742 veh/h	Weaving segment speed, S	44.1 mph
Weaving segment v/c ratio	0.798	Average weaving speed, S_W	42.2 mph
Weaving segment density, D	36.5 pc/mi/ln	Average non-weaving speed, S_{NW}	44.5 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	4222 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-26 EB
Weaving Segment Location	1110 - Montague SB to Mont. NB
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	470ft	Freeway maximum capacity, C_{IFL}	2300
Freeway free-flow speed, FFS	60 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2937	0.90	6	0	1.5	1.2	0.971	1.00	3361
V_{RF}	525	0.90	6	0	1.5	1.2	0.971	1.00	601
V_{FR}	278	0.90	10	0	1.5	1.2	0.952	1.00	324
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	3361							V =	4286
V_W	925								
VR	0.216								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	925 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	1067 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	177 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1244 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	158

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4286 pc/h	Weaving intensity factor, W	0.487
Weaving segment capacity, c_w	7678 veh/h	Weaving segment speed, S	47.5 mph
Weaving segment v/c ratio	0.542	Average weaving speed, S_W	45.3 mph
Weaving segment density, D	22.5 pc/mi/ln	Average non-weaving speed, S_{NW}	48.2 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	4699 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1115-Mont NB Off to Mont NB On*
Date Performed	*4/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5034*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1939*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*57.9*	mph	S	mph
D = v_p / S	*33.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1115-Mont NB Off to Mont NB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3462*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1321*	pc/h/ln	Design LOS	
S	*60.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*22.0*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1120 - EB On from Montague NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 850	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 5034	
	Ramp Volume, V_R: 735	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5034	0.90	Level	8	0	0.962	1.00	5817
Ramp	735	0.90	Level	8	0	0.962	1.00	849
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.601 using Equation (Exhibit 13-6)

V_{12} = 3498 pc/h

V_3 or V_{av34} 2319 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6666	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4347	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 33.7 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.546 (Exibit 13-11)

S_R= 50.2 mph (Exhibit 13-11)

S_0= 53.4 mph (Exhibit 13-11)

S = 51.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1120 - EB On from Montague NB
Date Performed	4/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 850	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D	V_D = veh/h
	Freeway Volume, V_F: 3462	
	Ramp Volume, V_R: 797	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3462	0.90	Level	6	0	0.971	1.00	3962
Ramp	797	0.90	Level	6	0	0.971	1.00	912
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.601 using Equation (Exhibit 13-6)

V_{12} = 2382 pc/h

V_3 or V_{av34} 1580 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4874	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3294	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 25.4 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.350 (Exibit 13-11)

S_R= 53.7 mph (Exhibit 13-11)

S_0= 56.1 mph (Exhibit 13-11)

S = 54.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1130 - Montague to Dorchester*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5769*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2211*	pc/h/ln
S	*53.2*	mph
D = v_p / S	*41.5*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1130 - Montague to Dorchester*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4259*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1625*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*27.1*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1140-EB Off to Dorchester Rd
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	380	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	5769	V_D =	veh/h
		Ramp Volume, V_R	608		
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5769	0.90	Level	7	0	0.966	1.00	6634
Ramp	608	0.90	Level	11	0	0.948	1.00	713
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.561 using Equation (Exhibit 13-7)

V_{12} = 4037 pc/h

V_3 or V_{av34} 2597 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6634	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	5921	Exhibit 13-8	6900	No
V_R	713	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4037	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.6 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.362 (Exhibit 13-12)

S_R= 53.5 mph (Exhibit 13-12)

S_0= 59.6 mph (Exhibit 13-12)

S = 55.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1140-EB Off to Dorchester Rd
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 380	V_D = veh/h
	Freeway Volume, V_F: 4259	
	Ramp Volume, V_R: 410	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4259	0.90	Level	6	0	0.971	1.00	4874
Ramp	410	0.90	Level	14	0	0.935	1.00	487
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.616 using Equation (Exhibit 13-7)

V_{12} = 3188 pc/h

V_3 or V_{av34} 1686 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4874	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	4387	Exhibit 13-8	6900	No
V_R	487	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3188	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 28.2 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.342 (Exhibit 13-12)

S_R= 53.8 mph (Exhibit 13-12)

S_0= 63.1 mph (Exhibit 13-12)

S = 56.7 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1145-Dorches Off to Dorches On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5161*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1978*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*57.4*	mph	S	mph
D = v_p / S	*34.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1145-Dorches Off to Dorches On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3849*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1468*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*24.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1150 - EB On from Dorchester
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☑ Off
L_{up} = ft	Acceleration Lane Length, L_A: 560	L_{down} = 2100 ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = 865 veh/h
	Freeway Volume, V_F: 5161	
	Ramp Volume, V_R: 709	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5161	0.90	Level	7	0	0.966	1.00	5935
Ramp	709	0.90	Level	11	0	0.948	1.00	831
UpStream								
DownStream	865	0.90	Level	12	0	0.943	1.00	1019

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 6011.09 (Equation 13-6 or 13-7)

P_{FM} = 0.676 using Equation (Exhibit 13-6)

V_{12} = 4013 pc/h

V_3 or V_{av34} 1922 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6766	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4844	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 39.4 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

M_S = 0.766 (Exibit 13-11)

S_R= 46.2 mph (Exhibit 13-11)

S_0= 54.9 mph (Exhibit 13-11)

S = 48.4 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1150 - EB On from Dorchester
Date Performed	4/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☑ Off
L_{up} = ft	Acceleration Lane Length, L_A: 560	L_{down} = 2100 ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = 1243 veh/h
	Freeway Volume, V_F: 3849	
	Ramp Volume, V_R: 526	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3849	0.90	Level	6	0	0.971	1.00	4405
Ramp	526	0.90	Level	13	0	0.939	1.00	622
UpStream								
DownStream	1243	0.90	Level	7	0	0.966	1.00	1429

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 8429.68 (Equation 13-6 or 13-7)

P_{FM} = 0.728 using Equation (Exhibit 13-6)

V_{12} = 3205 pc/h

V_3 or V_{av34} 1200 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5027	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3827	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 31.5 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.450 (Exibit 13-11)

S_R= 51.9 mph (Exhibit 13-11)

S_0= 57.5 mph (Exhibit 13-11)

S = 53.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1160-EB Off to Cosgrove SB
Date Performed	3/20/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{up} = 2100 ft

V_u = 709 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	200
Freeway Volume, V_F	5870
Ramp Volume, V_R	865
Freeway Free-Flow Speed, S_{FF}	60.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5870	0.90	Level	7	0	0.966	1.00	6750
Ramp	865	0.90	Level	12	0	0.943	1.00	1019
UpStream	709	0.90	Level	11	0	0.948	1.00	831
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = 5584.45 (Equation 13-12 or 13-13)

P_{FD} = 0.544 using Equation (Exhibit 13-7)

V_{12} = 4139 pc/h

V_3 or V_{av34} 2611 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6750	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	5731	Exhibit 13-8	6900	No
V_R	1019	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4139	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 38.0 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.390 (Exhibit 13-12)

S_R= 53.0 mph (Exhibit 13-12)

S_0= 59.5 mph (Exhibit 13-12)

S = 55.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1160-EB Off to Cosgrove SB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{up} = 2100 ft

V_u = 526 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	200
Freeway Volume, V_F	4375
Ramp Volume, V_R	1243
Freeway Free-Flow Speed, S_{FF}	60.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4375	0.90	Level	6	0	0.971	1.00	5007
Ramp	1243	0.90	Level	7	0	0.966	1.00	1429
UpStream	526	0.90	Level	13	0	0.939	1.00	622
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = 8019.91 (Equation 13-12 or 13-13)

P_{FD} = 0.569 using Equation (Exhibit 13-7)

V_{12} = 3465 pc/h

V_3 or V_{av34} 1542 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5007	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	3578	Exhibit 13-8	6900	No
V_R	1429	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3465	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 32.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.427 (Exhibit 13-12)

S_R= 52.3 mph (Exhibit 13-12)

S_0= 63.7 mph (Exhibit 13-12)

S = 55.4 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1165-Cosg SB Off to Cosg SB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5005*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1928*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*58.0*	mph	S	mph
D = v_p / S	*33.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1165-Cosg SB Off to Cosg SB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3132*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1201*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*20.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-26 EB
Weaving Segment Location	1170 - Cosgrove SB to Cos. NB
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	600ft	Freeway maximum capacity, C_{IFL}	2300
Freeway free-flow speed, FFS	60 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4697	0.90	8	0	1.5	1.2	0.962	1.00	5428
V_{RF}	423	0.90	2	0	1.5	1.2	0.990	1.00	475
V_{FR}	308	0.90	7	0	1.5	1.2	0.966	1.00	354
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	5428							V =	6257
V_W	829								
VR	0.132								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	829 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	1017 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	673 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1690 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	326

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6257 pc/h	Weaving intensity factor, W	0.512
Weaving segment capacity, c_w	7888 veh/h	Weaving segment speed, S	46.3 mph
Weaving segment v/c ratio	0.763	Average weaving speed, S_W	44.8 mph
Weaving segment density, D	33.8 pc/mi/ln	Average non-weaving speed, S_{NW}	46.5 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	3858 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-26 EB
Weaving Segment Location	1170 - Cosgrove SB to Cos. NB
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	600ft	Freeway maximum capacity, C_{IFL}	2300
Freeway free-flow speed, FFS	60 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2984	0.90	7	0	1.5	1.2	0.966	1.00	3432
V_{RF}	440	0.90	2	0	1.5	1.2	0.990	1.00	494
V_{FR}	148	0.90	14	0	1.5	1.2	0.935	1.00	176
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	3432							V =	4102
V_W	670								
VR	0.163								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	670 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	858 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	262 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1120 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	206

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4102 pc/h	Weaving intensity factor, W	0.370
Weaving segment capacity, c_w	7834 veh/h	Weaving segment speed, S	49.8 mph
Weaving segment v/c ratio	0.506	Average weaving speed, S_W	47.9 mph
Weaving segment density, D	20.6 pc/mi/ln	Average non-weaving speed, S_{NW}	50.3 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	4165 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1175-Cosg NB Off to Cosg NB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5120*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1972*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*57.5*	mph	S	mph
D = v_p / S	*34.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1175-Cosg NB Off to Cosg NB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3424*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1313*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*21.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1180 - EB On from Cosgrove NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 440	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 5120	
	Ramp Volume, V_R: 870	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5120	0.90	Level	8	0	0.962	1.00	5916
Ramp	870	0.90	Level	17	0	0.922	1.00	1049
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.590 using Equation (Exhibit 13-6)

V_{12} = 3489 pc/h

V_3 or V_{av34} 2427 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6965	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4538	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 37.6 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 0.646 (Exibit 13-11)

S_R= 48.4 mph (Exhibit 13-11)

S_0= 52.7 mph (Exhibit 13-11)

S = 49.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1180 - EB On from Cosgrove NB
Date Performed	4/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 440	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3424	
	Ramp Volume, V_R: 472	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3424	0.90	Level	7	0	0.966	1.00	3938
Ramp	472	0.90	Level	27	0	0.881	1.00	595
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.590 using Equation (Exhibit 13-6)

V_{12} = 2323 pc/h

V_3 or V_{av34} 1615 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4533	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2918	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 25.2 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.354 (Exibit 13-11)

S_R= 53.6 mph (Exhibit 13-11)

S_0= 56.0 mph (Exhibit 13-11)

S = 54.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1190 - Cosgrove to US-52*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5990*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*8*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2307*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*50.9*	mph	S	mph
D = v_p / S	*45.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*F*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1190 - Cosgrove to US-52*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3896*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1493*	pc/h/ln	Design LOS		
S	*60.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
D = v_p / S	*24.9*	pc/mi/ln	S		mph
LOS	*C*		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1200-EB Off to US-52 & PAR
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	340
Freeway Volume, V_F	5990
Ramp Volume, V_R	797
Freeway Free-Flow Speed, S_{FF}	60.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5990	0.90	Level	8	0	0.962	1.00	6922
Ramp	797	0.90	Level	26	0	0.885	1.00	1001
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.541 using Equation (Exhibit 13-7)

V_{12} = 4204 pc/h

V_3 or V_{av34} 2718 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 4222 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6922	Exhibit 13-8	6900	Yes
$V_{FO} = V_F - V_R$	5921	Exhibit 13-8	6900	No
V_R	1001	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4204	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 37.5 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.388 (Exhibit 13-12)

S_R= 53.0 mph (Exhibit 13-12)

S_0= 59.2 mph (Exhibit 13-12)

S = 55.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1200-EB Off to US-52
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 340	V_D = veh/h
	Freeway Volume, V_F: 3896	
	Ramp Volume, V_R: 664	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3896	0.90	Level	7	0	0.966	1.00	4480
Ramp	664	0.90	Level	16	0	0.926	1.00	797
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.611 using Equation (Exhibit 13-7)

V_{12} = 3049 pc/h

V_3 or V_{av34} 1431 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4480	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	3683	Exhibit 13-8	6900	No
V_R	797	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3049	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 27.4 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.370 (Exhibit 13-12)

S_R= 53.3 mph (Exhibit 13-12)

S_0= 64.1 mph (Exhibit 13-12)

S = 56.4 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1205 - PAR Off to PAR On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5193*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2000*	pc/h/ln	Design LOS	
S	*57.1*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*35.0*	pc/mi/ln	S	mph
LOS	*E*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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F-5449

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1205 - PAR Off to PAR On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3232*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*7*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1239*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*20.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	3/20/2014	Freeway/Direction	EB US-52 & PAR Off Ramp
Analysis Year	2038 Build - Proposed Site	Junction	US-52 & PAR EB Ramp Split
Analysis Time Period:	AM Peak	Segment ID	1208
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	1	1
Free-Flow Speed, FFS (mph)	45	55	45
Volume, V (veh/h)	797	492	305
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	26%	15%	45%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.88	0.93	0.82
Demand Flow Rate, v_p (pc/h/ln)	1,001	588	415
Capacity Flow Rate, c (pc/h/ln)	2,100	2,200	2,100
v/c ratio	0.48	0.27	0.20
Density, D_{MD} (pc/mi/ln)	17.5	10.3	7.3
LOS	B	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	3/20/2014	Freeway/Direction	EB US-52 & PAR Off Ramp
Analysis Year	2038 Build - Proposed Site	Junction	US-52 & PAR EB Ramp Split
Analysis Time Period:	PM Peak	Segment ID	1208
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	1	1
Free-Flow Speed, FFS (mph)	45	55	45
Volume, V (veh/h)	664	553	111
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	16%	11%	39%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.93	0.95	0.84
Demand Flow Rate, v_p (pc/h/ln)	797	648	147
Capacity Flow Rate, c (pc/h/ln)	2,100	2,200	2,100
v/c ratio	0.38	0.29	0.07
Density, D_{MD} (pc/mi/ln)	13.9	11.3	2.6
LOS	B	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1210 - EB On from PAR
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h		V_D = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1000
Deceleration Lane Length L_D	
Freeway Volume, V_F	5193
Ramp Volume, V_R	339
Freeway Free-Flow Speed, S_{FF}	60.0
Ramp Free-Flow Speed, S_{FR}	55.0

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5193	0.90	Level	8	0	0.962	1.00	6001
Ramp	339	0.90	Level	45	0	0.816	1.00	461
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.605 using Equation (Exhibit 13-6)

V_{12} = 3634 pc/h

V_3 or V_{av34} 2367 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6462	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4095	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 30.9 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.445 (Exibit 13-11)

S_R= 52.0 mph (Exhibit 13-11)

S_0= 53.1 mph (Exhibit 13-11)

S = 52.4 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1210 - EB On from PAR
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1000	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3232	
	Ramp Volume, V_R: 636	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 55.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3232	0.90	Level	7	0	0.966	1.00	3717
Ramp	636	0.90	Level	39	0	0.837	1.00	844
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.605 using Equation (Exhibit 13-6)

V_{12} = 2251 pc/h

V_3 or V_{av34} 1466 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4561	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3095	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 23.0 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.297 (Exibit 13-11)

S_R= 54.7 mph (Exhibit 13-11)

S_0= 56.5 mph (Exhibit 13-11)

S = 55.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1220 - PAR to Heriot*
Date Performed	*4/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5532*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2121*	pc/h/ln	Design LOS	
S	*55.1*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*38.5*	pc/mi/ln	S	mph
LOS	*E*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1220 - PAR to Heriot*
Date Performed	*4/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3868*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1476*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*60.0*	mph	S	mph
D = v_p / S	*24.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1230-EB Off to Heriot St
Date Performed	3/20/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	200
Freeway Volume, V_F	5532
Ramp Volume, V_R	706
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{down} = 1400 ft

V_D = 779 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5532	0.90	Level	7	0	0.966	1.00	6362
Ramp	706	0.90	Level	5	0	0.976	1.00	804
UpStream								
DownStream	779	0.90	Level	10	0	0.952	1.00	909

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = 1400.53 (Equation 13-12 or 13-13)

P_{FD} = 0.563 using Equation (Exhibit 13-7)

V_{12} = 3933 pc/h

V_3 or V_{av34} 2429 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6362	Exhibit 13-8	6750	No
$V_{FO} = V_F - V_R$	5558	Exhibit 13-8	6750	No
V_R	804	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3933	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 36.3 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.370 (Exhibit 13-12)

S_R= 50.2 mph (Exhibit 13-12)

S_0= 54.8 mph (Exhibit 13-12)

S = 51.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1230-EB Off to Heriot St
Date Performed	3/20/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	200
Freeway Volume, V_F	3868
Ramp Volume, V_R	499
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{down} = 1400 ft

V_D = 356 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3868	0.90	Level	6	0	0.971	1.00	4427
Ramp	499	0.90	Level	6	0	0.971	1.00	571
UpStream								
DownStream	356	0.90	Level	19	0	0.913	1.00	433

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = 543.19 (Equation 13-12 or 13-13)

P_{FD} = 0.623 using Equation (Exhibit 13-7)

V_{12} = 2974 pc/h

V_3 or V_{av34} 1453 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4427	Exhibit 13-8	6750	No
$V_{FO} = V_F - V_R$	3856	Exhibit 13-8	6750	No
V_R	571	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2974	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 28.0 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.349 (Exhibit 13-12)

S_R= 50.5 mph (Exhibit 13-12)

S_0= 58.6 mph (Exhibit 13-12)

S = 52.9 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1240-EB Off to Mt. Pleasant St
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	175	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	4826	V_D =	veh/h
		Ramp Volume, V_R	779		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4826	0.90	Level	7	0	0.966	1.00	5550
Ramp	779	0.90	Level	10	0	0.952	1.00	909
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.579 using Equation (Exhibit 13-7)

V_{12} = 3598 pc/h

V_3 or V_{av34} 1952 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5550	Exhibit 13-8	6750	No
$V_{FO} = V_F - V_R$	4641	Exhibit 13-8	6750	No
V_R	909	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3598	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 33.6 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.380 (Exhibit 13-12)

S_R= 50.1 mph (Exhibit 13-12)

S_0= 56.6 mph (Exhibit 13-12)

S = 52.2 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 EB
Agency or Company	Atkins	Junction	1240-EB Off to Mt. Pleasant St
Date Performed	3/20/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	175	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3369	V_D =	veh/h
		Ramp Volume, V_R	356		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3369	0.90	Level	6	0	0.971	1.00	3856
Ramp	356	0.90	Level	19	0	0.913	1.00	433
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.644 using Equation (Exhibit 13-7)

V_{12} = 2636 pc/h

V_3 or V_{av34} 1220 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3856	Exhibit 13-8	6750	No
$V_{FO} = V_F - V_R$	3423	Exhibit 13-8	6750	No
V_R	433	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2636	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 25.3 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.337 (Exhibit 13-12)

S_R= 50.6 mph (Exhibit 13-12)

S_0= 59.5 mph (Exhibit 13-12)

S = 53.1 mph (Exhibit 13-13)

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FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 EB
Analysis Year	2038 Build - Proposed Site	Junction	EB Off to US-17 NB
Analysis Time Period:	AM Peak	Segment ID	1250
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	3	2	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	4,047	2,594	1,453
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	6%	8%	7%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.96	0.97
Demand Flow Rate, v_p (pc/h/ln)	1,544	1,499	1,671
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,200
v/c ratio	0.69	0.67	0.76
Density, D_{MD} (pc/mi/ln)	27.0	26.2	29.2
LOS	C	C	D

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 EB
Analysis Year	2038 Build - Proposed Site	Junction	EB Off to US-17 NB
Analysis Time Period:	PM Peak	Segment ID	1250
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	3	2	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	3,013	2,261	752
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	5%	6%	12%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.97	0.94
Demand Flow Rate, v_p (pc/h/ln)	1,144	1,294	886
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,200
v/c ratio	0.51	0.58	0.40
Density, D_{MD} (pc/mi/ln)	20.0	22.6	15.5
LOS	B	C	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1260 - US17 NB to Cypress St*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2594*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1499*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*27.3*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1260 - US17 NB to Cypress St*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2261*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1294*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*55.0*	mph	S	mph
D = v_p / S	*23.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 EB
Analysis Year	2038 Build - Proposed Site	Junction	EB On from Cypress St
Analysis Time Period:	AM Peak	Segment ID	1270
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	2,594	2,674	80
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	8%	6%	19%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.96	0.97	0.91
Demand Flow Rate, v_p (pc/h/ln)	1,499	1,020	97
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,100
v/c ratio	0.67	0.45	0.05
Density, D_{MD} (pc/mi/ln)	26.2	17.9	1.7
LOS	C	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 EB
Analysis Year	2038 Build - Proposed Site	Junction	EB On from Cypress St
Analysis Time Period:	PM Peak	Segment ID	1270
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	2,261	2,395	134
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	6%	5%	10%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.98	0.95
Demand Flow Rate, v_p (pc/h/ln)	1,294	909	156
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,100
v/c ratio	0.58	0.40	0.07
Density, D_{MD} (pc/mi/ln)	22.6	15.9	2.7
LOS	C	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1280 - East Of Cypress*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2674*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*6*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1020*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*18.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 EB*
Agency or Company	*Atkins*	From/To	*1280 - East Of Cypress*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2395*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*5*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*909*	pc/h/ln	Design LOS	
S	*55.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*16.5*	pc/mi/ln	S	mph
LOS	*B*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 WB
Analysis Year	2038 Build - Proposed Site	Junction	WB Off to US-17 NB
Analysis Time Period:	AM Peak	Segment ID	2010
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	4	3	2
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	3,543	1,465	2,078
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	5%	6%	4%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.97	0.98
Demand Flow Rate, v_p (pc/h/ln)	1,009	559	1,178
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,200
v/c ratio	0.45	0.25	0.54
Density, D_{MD} (pc/mi/ln)	17.7	9.8	20.6
LOS	B	A	C

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 WB
Analysis Year	2038 Build - Proposed Site	Junction	WB Off to US-17 NB
Analysis Time Period:	PM Peak	Segment ID	2010
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	4	3	2
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	4,344	2,088	2,256
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	4%	4%	3%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.98	0.99
Demand Flow Rate, v_p (pc/h/ln)	1,231	789	1,272
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,200
v/c ratio	0.55	0.35	0.58
Density, D_{MD} (pc/mi/ln)	21.5	13.8	22.3
LOS	C	B	C

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	3/20/2014	Freeway/Direction	I-26 WB
Analysis Year	2038 Build - Proposed Site	Junction	WB Off to Romney St
Analysis Time Period:	AM Peak	Segment ID	2020
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	3	2	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	1,465	1,245	220
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	6%	6%	5%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.97	0.98
Demand Flow Rate, v_p (pc/h/ln)	559	712	251
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,100
v/c ratio	0.25	0.32	0.12
Density, D_{MD} (pc/mi/ln)	9.8	12.5	4.4
LOS	A	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 WB
Analysis Year	2038 Build - Proposed Site	Junction	WB Off to Romney St
Analysis Time Period:	PM Peak	Segment ID	2020
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	3	2	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	2,088	1,944	144
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	4%	4%	6%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.98	0.97
Demand Flow Rate, v_p (pc/h/ln)	789	1,102	165
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,100
v/c ratio	0.35	0.49	0.08
Density, D_{MD} (pc/mi/ln)	13.8	19.3	2.9
LOS	B	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2025- Romney Off to US17 SB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1245*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*712*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*12.9*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2025- Romney Off to US17 SB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1944*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.980*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1102*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*20.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 WB
Analysis Year	2038 Build - Proposed Site	Junction	WB On from US-17 SB
Analysis Time Period:	AM Peak	Segment ID	2030
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	1,245	2,487	1,242
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	6%	6%	8%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.97	0.96
Demand Flow Rate, v_p (pc/h/ln)	712	949	1,435
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,200
v/c ratio	0.32	0.42	0.65
Density, D_{MD} (pc/mi/ln)	12.5	16.6	25.1
LOS	B	B	C

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 WB
Analysis Year	2038 Build - Proposed Site	Junction	WB On from US-17 SB
Analysis Time Period:	PM Peak	Segment ID	2030
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	1,944	3,189	1,245
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	4%	5%	7%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.98	0.97
Demand Flow Rate, v_p (pc/h/ln)	1,102	1,211	1,432
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,200
v/c ratio	0.49	0.54	0.65
Density, D_{MD} (pc/mi/ln)	19.3	21.2	25.1
LOS	B	C	C

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2040 - WB On from Meeting
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 600	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2487	
	Ramp Volume, V_R: 384	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2487	0.90	Level	6	0	0.971	1.00	2846
Ramp	384	0.90	Level	9	0	0.957	1.00	446
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.594 using Equation (Exhibit 13-6)

V_{12} = 1691 pc/h

V_3 or V_{av34} 1155 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3292	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2137	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 18.2 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.300 (Exibit 13-11)

S_R= 51.1 mph (Exhibit 13-11)

S_0= 52.6 mph (Exhibit 13-11)

S = 51.6 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2040 - WB On from Meeting
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 600	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3189	
	Ramp Volume, V_R: 762	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3189	0.90	Level	5	0	0.976	1.00	3632
Ramp	762	0.90	Level	4	0	0.980	1.00	864
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.594 using Equation (Exhibit 13-6)

V_{12} = 2158 pc/h

V_3 or V_{av34} 1474 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4496	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3022	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 24.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.347 (Exibit 13-11)

S_R= 50.5 mph (Exhibit 13-11)

S_0= 51.5 mph (Exhibit 13-11)

S = 50.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2050 - Meeting to Mt Pleasant*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2871*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1095*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*19.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2050 - Meeting to Mt Pleasant*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3951*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1500*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*55.0*	mph	S	mph
D = v_p / S	*27.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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F-5480

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2060 - WB On from Mt Pleasant
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 275	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2871	
	Ramp Volume, V_R: 329	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2871	0.90	Level	6	0	0.971	1.00	3286
Ramp	329	0.90	Level	10	0	0.952	1.00	384
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.585 using Equation (Exhibit 13-6)

V_{12} = 1923 pc/h

V_3 or V_{av34} 1363 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3670	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2307	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 21.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.335 (Exibit 13-11)

S_R= 50.6 mph (Exhibit 13-11)

S_0= 51.9 mph (Exhibit 13-11)

S = 51.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2060 - WB On from Mt Pleasant
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 275	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3951	
	Ramp Volume, V_R: 786	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3951	0.90	Level	5	0	0.976	1.00	4500
Ramp	786	0.90	Level	4	0	0.980	1.00	891
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.585 using Equation (Exhibit 13-6)

V_{12} = 2633 pc/h

V_3 or V_{av34} 1867 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5391	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3524	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 30.8 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.429 (Exibit 13-11)

S_R= 49.4 mph (Exhibit 13-11)

S_0= 50.1 mph (Exhibit 13-11)

S = 49.7 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2070 - WB On from Heriot
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1165	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3200	
	Ramp Volume, V_R: 287	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3200	0.90	Level	7	0	0.966	1.00	3680
Ramp	287	0.90	Level	21	0	0.905	1.00	352
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.610 using Equation (Exhibit 13-6)

V_{12} = 2245 pc/h

V_3 or V_{av34} 1435 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4032	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2597	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 18.3 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.269 (Exibit 13-11)

S_R= 51.5 mph (Exhibit 13-11)

S_0= 51.6 mph (Exhibit 13-11)

S = 51.6 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2070 - WB On from Heriot
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1165	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 4737	
	Ramp Volume, V_R: 480	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4737	0.90	Level	6	0	0.971	1.00	5421
Ramp	480	0.90	Level	11	0	0.948	1.00	563
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.610 using Equation (Exhibit 13-6)

V_{12} = 3307 pc/h

V_3 or V_{av34} 2114 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5984	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3870	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.1 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.403 (Exibit 13-11)

S_R= 49.8 mph (Exhibit 13-11)

S_0= 49.2 mph (Exhibit 13-11)

S = 49.6 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2080 - Heriot to PAR*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3487*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1337*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*60.0*	mph	S	mph
D = v_p / S	*22.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2080 - Heriot to PAR*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5217*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1990*	pc/h/ln	Design LOS		
S	*57.2*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
D = v_p / S	*34.8*	pc/mi/ln	S		mph
LOS	*D*		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2090-WB Off to PAR
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 340	V_D = veh/h
	Freeway Volume, V_F: 3487	
	Ramp Volume, V_R: 657	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3487	0.90	Level	7	0	0.966	1.00	4010
Ramp	657	0.90	Level	44	0	0.820	1.00	891
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.619 using Equation (Exhibit 13-7)

V_{12} = 2821 pc/h

V_3 or V_{av34} 1189 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4010	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	3119	Exhibit 13-8	6900	No
V_R	891	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2821	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 25.5 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.378 (Exhibit 13-12)

S_R= 53.2 mph (Exhibit 13-12)

S_0= 65.1 mph (Exhibit 13-12)

S = 56.2 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2090-WB Off to PAR
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 340	V_D = veh/h
	Freeway Volume, V_F: 5217	
	Ramp Volume, V_R: 343	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5217	0.90	Level	6	0	0.971	1.00	5971
Ramp	343	0.90	Level	39	0	0.837	1.00	455
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.590 using Equation (Exhibit 13-7)

V_{12} = 3708 pc/h

V_3 or V_{av34} 2263 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5971	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	5516	Exhibit 13-8	6900	No
V_R	455	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3708	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 33.1 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.339 (Exhibit 13-12)

S_R= 53.9 mph (Exhibit 13-12)

S_0= 60.9 mph (Exhibit 13-12)

S = 56.4 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2100 - PAR Off to PAR On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2830*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*8*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1090*	pc/h/ln	Design LOS		
S	*60.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
D = v_p / S	*18.2*	pc/mi/ln	S		mph
LOS	*C*		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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F-5489

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2100 - PAR Off to PAR On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4874*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1868*	pc/h/ln
S	*58.7*	mph
D = v_p / S	*31.8*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	3/20/2014	Freeway/Direction	WB US-52 & PAR Off Ramp
Analysis Year	2038 Build - Proposed Site	Junction	US-52 & PAR WB Ramp Merge
Analysis Time Period:	AM Peak	Segment ID	2105
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	1	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	912	1,011	99
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	5%	9%	44%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.96	0.82
Demand Flow Rate, v_p (pc/h/ln)	1,039	1,174	134
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,100
v/c ratio	0.47	0.53	0.06
Density, D_{MD} (pc/mi/ln)	18.2	20.5	2.3
LOS	B	C	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	3/20/2014	Freeway/Direction	WB US-52 & PAR Off Ramp
Analysis Year	2038 Build - Proposed Site	Junction	US-52 & PAR WB Ramp Merge
Analysis Time Period:	PM Peak	Segment ID	2105
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	1	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	325	607	282
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	11%	24%	39%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.95	0.89	0.84
Demand Flow Rate, v_p (pc/h/ln)	381	755	374
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,100
v/c ratio	0.17	0.34	0.18
Density, D_{MD} (pc/mi/ln)	6.7	13.2	6.5
LOS	A	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2110 - WB On from US-52 & PAR
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 180	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2830	
	Ramp Volume, V_R: 1011	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2830	0.90	Level	8	0	0.962	1.00	3270
Ramp	1011	0.90	Level	9	0	0.957	1.00	1174
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.583 using Equation (Exhibit 13-6)

V_{12} = 1905 pc/h

V_3 or V_{av34} 1365 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4444	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3079	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 27.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.390 (Exibit 13-11)

S_R= 53.0 mph (Exhibit 13-11)

S_0= 56.9 mph (Exhibit 13-11)

S = 54.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2110 - WB On from US-52 & PAR
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 180	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 4874	
	Ramp Volume, V_R: 607	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4874	0.90	Level	7	0	0.966	1.00	5605
Ramp	607	0.90	Level	24	0	0.893	1.00	755
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.583 using Equation (Exhibit 13-6)

V_{12} = 3265 pc/h

V_3 or V_{av34} 2340 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6360	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4020	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 35.4 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

M_S = 0.522 (Exibit 13-11)

S_R= 50.6 mph (Exhibit 13-11)

S_0= 53.2 mph (Exhibit 13-11)

S = 51.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2120 - US-52 to Cosgrove*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3841*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1479*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*24.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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F-5495

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2120 - US-52 to Cosgrove*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5481*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2101*	pc/h/ln	Design LOS	
S	*55.4*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*37.9*	pc/mi/ln	S	mph
LOS	*E*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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F-5496

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2130-WB Off to Cosgrove NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	525	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3841	V_D =	veh/h
		Ramp Volume, V_R	429		
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3841	0.90	Level	8	0	0.962	1.00	4438
Ramp	429	0.90	Level	14	0	0.935	1.00	510
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.626 using Equation (Exhibit 13-7)

V_{12} = 2967 pc/h

V_3 or V_{av34} 1471 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4438	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	3928	Exhibit 13-8	6900	No
V_R	510	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2967	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 25.0 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.344 (Exhibit 13-12)

S_R= 53.8 mph (Exhibit 13-12)

S_0= 64.0 mph (Exhibit 13-12)

S = 56.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2130-WB Off to Cosgrove NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 525	V_D = veh/h
	Freeway Volume, V_F: 5481	
	Ramp Volume, V_R: 378	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5481	0.90	Level	7	0	0.966	1.00	6303
Ramp	378	0.90	Level	13	0	0.939	1.00	447
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.582 using Equation (Exhibit 13-7)

V_{12} = 3854 pc/h

V_3 or V_{av34} 2449 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6303	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	5856	Exhibit 13-8	6900	No
V_R	447	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3854	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 32.7 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.338 (Exhibit 13-12)

S_R= 53.9 mph (Exhibit 13-12)

S_0= 60.2 mph (Exhibit 13-12)

S = 56.2 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2135-Cosg NB Off to Cosg NB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3412*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1314*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*21.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2135-Cosg NB Off to Cosg NB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5103*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*7*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1956*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*57.7*	mph	S	mph
D = v_p / S	*33.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-26 WB
Weaving Segment Location	2140 - Cosgrove NB to Cos. SB
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	560ft	Freeway maximum capacity, C_{IFL}	2300
Freeway free-flow speed, FFS	60 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3038	0.90	8	0	1.5	1.2	0.962	1.00	3511
V_{RF}	874	0.90	19	0	1.5	1.2	0.913	1.00	1063
V_{FR}	374	0.90	28	0	1.5	1.2	0.877	1.00	474
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	3511							V =	5048
V_W	1537								
VR	0.304								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1537 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	1712 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	256 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1968 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	197

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5048 pc/h	Weaving intensity factor, W	0.609
Weaving segment capacity, c_w	7354 veh/h	Weaving segment speed, S	42.9 mph
Weaving segment v/c ratio	0.660	Average weaving speed, S_W	43.0 mph
Weaving segment density, D	29.4 pc/mi/ln	Average non-weaving speed, S_{NW}	42.9 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	5632 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-26 WB
Weaving Segment Location	2140 - Cosgrove NB to Cos. SB
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	560ft	Freeway maximum capacity, C_{IFL}	2300
Freeway free-flow speed, FFS	60 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	4248	0.90	7	0	1.5	1.2	0.966	1.00	4885
V_{RF}	790	0.90	18	0	1.5	1.2	0.917	1.00	957
V_{FR}	855	0.90	11	0	1.5	1.2	0.948	1.00	1002
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	4885							V =	6844
V_W	1959								
VR	0.286								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1959 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	2134 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	539 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2673 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	274

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6844 pc/h	Weaving intensity factor, W	0.776
Weaving segment capacity, c_w	7447 veh/h	Weaving segment speed, S	38.4 mph
Weaving segment v/c ratio	0.888	Average weaving speed, S_W	40.3 mph
Weaving segment density, D	44.5 pc/mi/ln	Average non-weaving speed, S_{NW}	37.7 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	5437 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2145-Cosg SB Off to Cosg SB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3912*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1507*	pc/h/ln	Design LOS	
S	*60.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*25.1*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2145-Cosg SB Off to Cosg SB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5038*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*7*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1931*	pc/h/ln	Design LOS	
S	*58.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*33.3*	pc/mi/ln	S	mph
LOS	*D*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2150 - WB On from Cosgrove SB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☑ Off
L_{up} = ft	Acceleration Lane Length, L_A: 425	L_{down} = 2390 ft
V_u = veh/h	Deceleration Lane Length L_D	V_D = 371 veh/h
	Freeway Volume, V_F: 3912	
	Ramp Volume, V_R: 177	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3912	0.90	Level	8	0	0.962	1.00	4521
Ramp	177	0.90	Level	24	0	0.893	1.00	220
UpStream								
DownStream	371	0.90	Level	21	0	0.905	1.00	456

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 2940.51 (Equation 13-6 or 13-7)

P_{FM} = 0.599 using Equation (Exhibit 13-6)

V_{12} = 2707 pc/h

V_3 or V_{av34} 1814 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4741	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2927	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 25.5 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.356 (Exibit 13-11)

S_R= 53.6 mph (Exhibit 13-11)

S_0= 55.3 mph (Exhibit 13-11)

S = 54.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2150 - WB On from Cosgrove SB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A	425	☐ No	☑ Off
L_{up} =	ft	Deceleration Lane Length L_D		L_{down} =	2390 ft
V_u =	veh/h	Freeway Volume, V_F	5038	V_D =	447 veh/h
		Ramp Volume, V_R	361		
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5038	0.90	Level	7	0	0.966	1.00	5794
Ramp	361	0.90	Level	10	0	0.952	1.00	421
UpStream								
DownStream	447	0.90	Level	15	0	0.930	1.00	534

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 3443.50 (Equation 13-6 or 13-7)

P_{FM} = 0.607 using Equation (Exhibit 13-6)

V_{12} = 3519 pc/h

V_3 or V_{av34} 2275 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6215	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3940	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 33.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.483 (Exibit 13-11)

S_R= 51.3 mph (Exhibit 13-11)

S_0= 53.6 mph (Exhibit 13-11)

S = 52.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2160-WB Off to Dorchester
Date Performed	3/20/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{up} = 2390 ft

V_u = 177 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	425
Freeway Volume, V_F	4089
Ramp Volume, V_R	371
Freeway Free-Flow Speed, S_{FF}	60.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4089	0.90	Level	7	0	0.966	1.00	4702
Ramp	371	0.90	Level	21	0	0.905	1.00	456
UpStream	177	0.90	Level	24	0	0.893	1.00	220
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = 1522.60 (Equation 13-12 or 13-13)

P_{FD} = 0.621 using Equation (Exhibit 13-7)

V_{12} = 3095 pc/h

V_3 or V_{av34} 1607 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4702	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	4246	Exhibit 13-8	6900	No
V_R	456	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3095	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 27.0 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.339 (Exhibit 13-12)

S_R= 53.9 mph (Exhibit 13-12)

S_0= 63.5 mph (Exhibit 13-12)

S = 56.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2160-WB Off to Dorchester
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{up} = 2390 ft

V_u = 361 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	425
Freeway Volume, V_F	5399
Ramp Volume, V_R	447
Freeway Free-Flow Speed, S_{FF}	60.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5399	0.90	Level	6	0	0.971	1.00	6179
Ramp	447	0.90	Level	15	0	0.930	1.00	534
UpStream	361	0.90	Level	10	0	0.952	1.00	421
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = 2440.11 (Equation 13-12 or 13-13)

P_{FD} = 0.582 using Equation (Exhibit 13-7)

V_{12} = 3822 pc/h

V_3 or V_{av34} 2357 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6179	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	5645	Exhibit 13-8	6900	No
V_R	534	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3822	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 33.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.346 (Exhibit 13-12)

S_R= 53.8 mph (Exhibit 13-12)

S_0= 60.5 mph (Exhibit 13-12)

S = 56.2 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2165-Dorches Off to Dorches On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3718*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1425*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*60.0*	mph	S	mph
D = v_p / S	*23.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2165-Dorches Off to Dorches On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4952*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1889*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*58.5*	mph	S	mph
D = v_p / S	*32.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2170 - WB On from Dorchester
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 600	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D	V_D = veh/h
	Freeway Volume, V_F: 3718	
	Ramp Volume, V_R: 284	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3718	0.90	Level	7	0	0.966	1.00	4276
Ramp	284	0.90	Level	21	0	0.905	1.00	349
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.594 using Equation (Exhibit 13-6)

V_{12} = 2541 pc/h

V_3 or V_{av34} 1735 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4625	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2890	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 24.1 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.337 (Exibit 13-11)

S_R= 53.9 mph (Exhibit 13-11)

S_0= 55.6 mph (Exhibit 13-11)

S = 54.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2170 - WB On from Dorchester
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 600	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 4952	
	Ramp Volume, V_R: 618	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4952	0.90	Level	6	0	0.971	1.00	5667
Ramp	618	0.90	Level	8	0	0.962	1.00	714
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.594 using Equation (Exhibit 13-6)

V_{12} = 3368 pc/h

V_3 or V_{av34} 2299 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6381	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4082	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 33.2 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.498 (Exibit 13-11)

S_R= 51.0 mph (Exhibit 13-11)

S_0= 53.5 mph (Exhibit 13-11)

S = 51.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2180 - Dorchester to Montague*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4002*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1534*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*25.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2180 - Dorchester to Montague*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5570*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2125*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*55.0*	mph	S	mph
D = v_p / S	*38.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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F-5514

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2190-WB Off to Montague
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	240	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	4002	V_D =	veh/h
		Ramp Volume, V_R	1141		
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4002	0.90	Level	7	0	0.966	1.00	4602
Ramp	1141	0.90	Level	11	0	0.948	1.00	1338
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.583 using Equation (Exhibit 13-7)

V_{12} = 3242 pc/h

V_3 or V_{av34} 1360 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4602	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	3264	Exhibit 13-8	6900	No
V_R	1338	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3242	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.0 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.418 (Exhibit 13-12)

S_R= 52.5 mph (Exhibit 13-12)

S_0= 64.4 mph (Exhibit 13-12)

S = 55.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2190-WB Off to Montague
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 240	V_D = veh/h
	Freeway Volume, V_F: 5570	
	Ramp Volume, V_R: 1156	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5570	0.90	Level	6	0	0.971	1.00	6375
Ramp	1156	0.90	Level	9	0	0.957	1.00	1342
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.539 using Equation (Exhibit 13-7)

V_{12} = 4054 pc/h

V_3 or V_{av34} 2321 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6375	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	5033	Exhibit 13-8	6900	No
V_R	1342	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4054	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 37.0 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.419 (Exhibit 13-12)

S_R= 52.5 mph (Exhibit 13-12)

S_0= 60.7 mph (Exhibit 13-12)

S = 55.2 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2195-Montagu Off to Montagu On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2861*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1102*	pc/h/ln	Design LOS	
S	*60.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*18.4*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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F-5517

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2195-Montagu Off to Montagu On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4414*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1684*	pc/h/ln
S	*59.9*	mph
D = v_p / S	*28.1*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-26 WB
Weaving Segment Location	2200 - Montague to I-526 EB
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1920ft	Freeway maximum capacity, C_{IFL}	2300
Freeway free-flow speed, FFS	60 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	2445	0.90	8	0	1.5	1.2	0.962	1.00	2825
V_{RF}	433	0.90	26	0	1.5	1.2	0.885	1.00	544
V_{FR}	416	0.90	9	0	1.5	1.2	0.957	1.00	483
V_{RR}	74	0.90	26	0	1.5	1.2	0.885	1.00	93
V_{NW}	2918							V =	3945
V_W	1027								
VR	0.260								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1027 lc/h
Interchange density, ID	0.8 int/mi	Weaving lane changes, LC_W	1429 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	871 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2300 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	448

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	3945 pc/h	Weaving intensity factor, W	0.261
Weaving segment capacity, c_w	7892 veh/h	Weaving segment speed, S	48.6 mph
Weaving segment v/c ratio	0.481	Average weaving speed, S_W	50.7 mph
Weaving segment density, D	20.3 pc/mi/ln	Average non-weaving speed, S_{NW}	47.9 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	5162 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-26 WB
Weaving Segment Location	2200 - Montague to I-526 EB
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	1920ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	4079	0.90	6	0	1.5	1.2	0.971	1.00	4668
V_{RF}	1296	0.90	8	0	1.5	1.2	0.962	1.00	1498
V_{FR}	335	0.90	8	0	1.5	1.2	0.962	1.00	387
V_{RR}	106	0.90	8	0	1.5	1.2	0.962	1.00	122
V_{NW}	4790							V =	6675
V_W	1885								
VR	0.282								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1885 lc/h
Interchange density, ID	0.8 int/mi	Weaving lane changes, LC_W	2287 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1257 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	3544 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	736

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6675 pc/h	Weaving intensity factor, W	0.367
Weaving segment capacity, c_w	7899 veh/h	Weaving segment speed, S	40.7 mph
Weaving segment v/c ratio	0.820	Average weaving speed, S_W	47.9 mph
Weaving segment density, D	41.0 pc/mi/ln	Average non-weaving speed, S_{NW}	38.4 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	5396 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2210-WB Off to I-526 WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 830	V_D = veh/h
	Freeway Volume, V_F: 2878	
	Ramp Volume, V_R: 275	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2878	0.90	Level	14	0	0.935	1.00	3422
Ramp	275	0.90	Level	7	0	0.966	1.00	316
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.660 using Equation (Exhibit 13-7)

V_{12} = 2366 pc/h

V_3 or V_{av34} 1056 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3422	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	3106	Exhibit 13-8	6900	No
V_R	316	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2366	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 17.1 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.586 (Exhibit 13-12)

S_R= 49.4 mph (Exhibit 13-12)

S_0= 65.6 mph (Exhibit 13-12)

S = 53.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-26 WB
Agency or Company	Atkins	Junction	2210-WB Off to I-526 WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	830	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	5375	V_D =	veh/h
		Ramp Volume, V_R	338		
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	25.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5375	0.90	Level	11	0	0.948	1.00	6301
Ramp	338	0.90	Level	5	0	0.976	1.00	385
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.585 using Equation (Exhibit 13-7)

V_{12} = 3844 pc/h

V_3 or V_{av34} 2457 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6301	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	5916	Exhibit 13-8	6900	No
V_R	385	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3844	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 29.8 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.593 (Exhibit 13-12)

S_R= 49.3 mph (Exhibit 13-12)

S_0= 60.1 mph (Exhibit 13-12)

S = 53.0 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2215- I-526 WB Off to EB&WB On*
Date Performed	*4/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2603*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*14*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.935*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1032*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*60.0*	mph	S	mph
D = v_p / S	*17.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2215- I-526 WB Off to EB&WB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5037*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1968*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*57.5*	mph	S	mph
D = v_p / S	*34.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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F-5524

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 WB
Analysis Year	2038 Build - Proposed Site	Junction	On from 526 WB & EB
Analysis Time Period:	AM Peak	Segment ID	2218
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	2	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	2,104	3,453	1,349
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	10%	27%	54%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.95	0.88	0.79
Demand Flow Rate, v_p (pc/h/ln)	2,455	2,177	1,904
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,200
v/c ratio	1.12	0.99	0.87
Density, D_{MD} (pc/mi/ln)	43.0	38.1	33.3
LOS	F	E	D

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 WB
Analysis Year	2038 Build - Proposed Site	Junction	On from 526 WB & EB
Analysis Time Period:	PM Peak	Segment ID	2218
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	2	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	2,433	4,057	1,624
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	7%	20%	39%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.91	0.84
Demand Flow Rate, v_p (pc/h/ln)	2,798	2,479	2,156
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,200
v/c ratio	1.27	1.13	0.98
Density, D_{MD} (pc/mi/ln)	49.0	43.4	37.7
LOS	F	F	E

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-26 WB
Weaving Segment Location	2220 - 526 to Rem/Aviation C-D
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	5	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2285ft	Freeway maximum capacity, C_{IFL}	2300
Freeway free-flow speed, FFS	60 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	1972	0.90	14	0	1.5	1.2	0.935	1.00	2344
V_{RF}	2617	0.90	27	0	1.5	1.2	0.881	1.00	3300
V_{FR}	631	0.90	14	0	1.5	1.2	0.935	1.00	750
V_{RR}	836	0.90	27	0	1.5	1.2	0.881	1.00	1054
V_{NW}	3398							V =	7448
V_W	4050								
VR	0.544								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	350

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	7448 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	6015 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.157	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6777 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-26 WB
Weaving Segment Location	2220 - 526 to Rem/Aviation C-D
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	5	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2285ft	Freeway maximum capacity, C_{IFL}	2300
Freeway free-flow speed, FFS	60 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4419	0.90	11	0	1.5	1.2	0.948	1.00	5180
V_{RF}	3560	0.90	20	0	1.5	1.2	0.909	1.00	4351
V_{FR}	618	0.90	11	0	1.5	1.2	0.948	1.00	724
V_{RR}	497	0.90	20	0	1.5	1.2	0.909	1.00	607
V_{NW}	5787							V =	10862
V_W	5075								
VR	0.467								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	10862 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	7101 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.450	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	5880 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2225- Rem/Avia CD Off to CD On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4589*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*16*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.926*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*4*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1377*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*60.0*	mph	S	mph
D = v_p / S	*23.0*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB*
Agency or Company	*Atkins*	From/To	*2225- Rem/Avia CD Off to CD On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7979*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*13*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.939*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2360*	pc/h/ln
S	*49.5*	mph
D = v_p / S	*47.7*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 WB C-D
Analysis Year	2038 Build - Proposed Site	Junction	WB Off to Remount
Analysis Time Period:	AM Peak	Segment ID	2230
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	1	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	1,467	870	597
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	4%	5%	4%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.98	0.98
Demand Flow Rate, v_p (pc/h/ln)	831	991	677
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,100
v/c ratio	0.38	0.45	0.32
Density, D_{MD} (pc/mi/ln)	14.5	17.3	11.8
LOS	B	B	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 WB C-D
Analysis Year	2038 Build - Proposed Site	Junction	WB Off to Remount
Analysis Time Period:	PM Peak	Segment ID	2230
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	1	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	1,115	568	547
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	5%	6%	4%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.97	0.98
Demand Flow Rate, v_p (pc/h/ln)	635	650	620
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,100
v/c ratio	0.29	0.30	0.30
Density, D_{MD} (pc/mi/ln)	11.1	11.4	10.9
LOS	B	B	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB C-D*
Agency or Company	*Atkins*	From/To	*2235-Remount Off to Remount On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1740*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*991*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*18.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB C-D*
Agency or Company	*Atkins*	From/To	*2235-Remount Off to Remount On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1136*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*650*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*11.8*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-26 WB C-D
Weaving Segment Location	2240 - Remount to Aviation
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	2
Weaving segment length, L_S	750ft
Freeway free-flow speed, FFS	55 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{RF}	276	0.90	19	0	1.5	1.2	0.913	1.00	336
V_{FR}	870	0.90	5	0	1.5	1.2	0.976	1.00	991
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	0							V =	1327
V_W	1327								
VR	1.000								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1327 lc/h
Interchange density, ID	0.8 int/mi	Weaving lane changes, LC_W	1380 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	21 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1401 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	0

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	1327 pc/h	Weaving intensity factor, W	0.370
Weaving segment capacity, c_w	2400 veh/h	Weaving segment speed, S	44.2 mph
Weaving segment v/c ratio	0.553	Average weaving speed, S_W	44.2 mph
Weaving segment density, D	15.0 pc/mi/ln	Average non-weaving speed, S_{NW}	42.3 mph
Level of Service, LOS	B	Maximum weaving length, L_{MAX}	14232 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-26 WB C-D
Weaving Segment Location	2240 - Remount to Aviation
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	2
Weaving segment length, L_S	750ft
Freeway free-flow speed, FFS	55 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{RF}	1006	0.90	4	0	1.5	1.2	0.980	1.00	1140
V_{FR}	568	0.90	6	0	1.5	1.2	0.971	1.00	650
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	0							V =	1790
V_W	1790								
VR	1.000								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1790 lc/h
Interchange density, ID	0.8 int/mi	Weaving lane changes, LC_W	1843 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	21 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1864 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	0

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	1790 pc/h	Weaving intensity factor, W	0.464
Weaving segment capacity, c_w	2400 veh/h	Weaving segment speed, S	42.3 mph
Weaving segment v/c ratio	0.746	Average weaving speed, S_W	42.3 mph
Weaving segment density, D	21.1 pc/mi/ln	Average non-weaving speed, S_{NW}	37.8 mph
Level of Service, LOS	B	Maximum weaving length, L_{MAX}	14232 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB C-D*
Agency or Company	*Atkins*	From/To	*2245 - Avia Off to Avia EB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*552*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*19*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.913*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*336*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*55.0*	mph	S	mph
D = v_p / S	*6.1*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*A*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-26 WB C-D*
Agency or Company	*Atkins*	From/To	*2245 - Avia Off to Avia EB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2012*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.980*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1140*	pc/h/ln	Design LOS	
S	*55.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*20.7*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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F-5538

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 WB C-D
Analysis Year	2038 Build - Proposed Site	Junction	WB On from Aviation EB
Analysis Time Period:	AM Peak	Segment ID	2250
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	1	1
Free-Flow Speed, FFS (mph)	55	55	25
Volume, V (veh/h)	276	296	20
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	19%	19%	25%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.91	0.91	0.89
Demand Flow Rate, v_p (pc/h/ln)	336	360	25
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	1,900
v/c ratio	0.15	0.16	0.01
Density, D_{MD} (pc/mi/ln)	5.9	6.3	0.4
LOS	A	A	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 WB C-D
Analysis Year	2038 Build - Proposed Site	Junction	WB On from Aviation EB
Analysis Time Period:	PM Peak	Segment ID	2250
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	1	1
Free-Flow Speed, FFS (mph)	55	55	25
Volume, V (veh/h)	1,006	1,390	384
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	4%	4%	2%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.98	0.99
Demand Flow Rate, v_p (pc/h/ln)	1,140	1,575	431
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	1,900
v/c ratio	0.52	0.72	0.23
Density, D_{MD} (pc/mi/ln)	20.0	27.6	7.5
LOS	B	C	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 WB C-D
Analysis Year	2038 Build - Proposed Site	Junction	WB On from Aviation WB
Analysis Time Period:	AM Peak	Segment ID	2260
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	1	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	296	394	98
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	19%	20%	22%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.91	0.91	0.90
Demand Flow Rate, v_p (pc/h/ln)	360	482	121
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,100
v/c ratio	0.16	0.22	0.06
Density, D_{MD} (pc/mi/ln)	6.3	8.4	2.1
LOS	A	A	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 WB C-D
Analysis Year	2038 Build - Proposed Site	Junction	WB On from Aviation WB
Analysis Time Period:	PM Peak	Segment ID	2260
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	1	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	1,390	1,889	499
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	4%	4%	4%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.98	0.98
Demand Flow Rate, v_p (pc/h/ln)	1,575	2,141	566
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,100
v/c ratio	0.72	0.97	0.27
Density, D_{MD} (pc/mi/ln)	27.6	37.5	9.9
LOS	C	E	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 WB
Analysis Year	2038 Build - Proposed Site	Junction	From Rem/Aviation C-D
Analysis Time Period:	AM Peak	Segment ID	2270
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	4	5	1
Free-Flow Speed, FFS (mph)	60	60	55
Volume, V (veh/h)	4,589	4,983	394
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	16%	16%	20%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.93	0.93	0.91
Demand Flow Rate, v_p (pc/h/ln)	1,377	1,196	482
Capacity Flow Rate, c (pc/h/ln)	2,300	2,300	2,200
v/c ratio	0.60	0.52	0.22
Density, D_{MD} (pc/mi/ln)	24.1	20.9	8.4
LOS	C	C	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-26 WB
Analysis Year	2038 Build - Proposed Site	Junction	From Rem/Aviation C-D
Analysis Time Period:	PM Peak	Segment ID	2270
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	4	5	1
Free-Flow Speed, FFS (mph)	60	60	55
Volume, V (veh/h)	7,979	9,868	1,889
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	13%	12%	4%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.94	0.94	0.98
Demand Flow Rate, v_p (pc/h/ln)	2,360	2,324	2,141
Capacity Flow Rate, c (pc/h/ln)	2,300	2,300	2,200
v/c ratio	1.03	1.01	0.97
Density, D_{MD} (pc/mi/ln)	41.3	40.7	37.5
LOS	F	F	E

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

Appendix E
Traffic Analysis Worksheets

2038 Design Year

Build Proposed Project Alternatives 1-4

Interstate 526

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3010-EB Off to PaulCantrell EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	340	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	2899	V_D =	veh/h
		Ramp Volume, V_R	28		
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2899	0.90	Level	3	0	0.985	1.00	3269
Ramp	28	0.90	Level	36	0	0.847	1.00	37
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3269 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3269	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	3232	Exhibit 13-8	4600	No
V_R	37	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3269	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 29.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.301 (Exhibit 13-12)

S_R= 54.6 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 54.6 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3010-EB Off to PaulCantrell EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	340	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	2639	V_D =	veh/h
		Ramp Volume, V_R	55		
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2639	0.90	Level	3	0	0.985	1.00	2976
Ramp	55	0.90	Level	15	0	0.930	1.00	66
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2976 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2976	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	2910	Exhibit 13-8	4600	No
V_R	66	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2976	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 26.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.304 (Exhibit 13-12)

S_R= 54.5 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 54.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3020-EB Off to PaulCantrell WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	600	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	2871	V_D =	veh/h
		Ramp Volume, V_R	186		
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	25.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2871	0.90	Level	9	0	0.957	1.00	3334
Ramp	186	0.90	Level	7	0	0.966	1.00	214
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3334 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3334	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	3120	Exhibit 13-8	4600	No
V_R	214	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3334	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 27.5 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.577 (Exhibit 13-12)

S_R= 49.6 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.6 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3020-EB Off to PaulCantrell WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	600	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	2584	V_D =	veh/h
		Ramp Volume, V_R	614		
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	25.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2584	0.90	Level	8	0	0.962	1.00	2986
Ramp	614	0.90	Level	2	0	0.990	1.00	689
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2986 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2986	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	2297	Exhibit 13-8	4600	No
V_R	689	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2986	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 24.5 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.620 (Exhibit 13-12)

S_R= 48.8 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 48.8 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3025- PaulC WB Off to PaulC On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2685*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1559*	pc/h/ln	Design LOS	
S	*60.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*26.0*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3025- PaulC WB Off to PaulC On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1970*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1138*	pc/h/ln	Design LOS	
S	*60.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*19.0*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3030-EB On from Paul Cantrell
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 850	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2685	
	Ramp Volume, V_R: 1755	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2685	0.90	Level	9	0	0.957	1.00	3118
Ramp	1755	0.90	Level	18	0	0.917	1.00	2126
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3118 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5244	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5244	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 40.1 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 0.983 (Exibit 13-11)

S_R= 42.3 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 42.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3030-EB On from Paul Cantrell
Date Performed	4/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 850	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1970	
	Ramp Volume, V_R: 1538	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1970	0.90	Level	8	0	0.962	1.00	2276
Ramp	1538	0.90	Level	17	0	0.922	1.00	1854
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2276 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4130	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4130	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 31.5 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.487 (Exibit 13-11)

S_R= 51.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3040 - Paul Cantrell to Leeds*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4440*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*9*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2578*	pc/h/ln	Design LOS	
S	*42.6*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*60.5*	pc/mi/ln	S	mph
LOS	*F*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3040 - Paul Cantrell to Leeds*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3508*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2027*	pc/h/ln
S	*56.7*	mph
D = v_p / S	*35.8*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3050-EB Off to Leeds
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	325
Freeway Volume, V_F	4440
Ramp Volume, V_R	702
Freeway Free-Flow Speed, S_{FF}	60.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4440	0.90	Level	9	0	0.957	1.00	5155
Ramp	702	0.90	Level	8	0	0.962	1.00	811
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 1.000 using Equation (Exhibit 13-7)
V_{12} = 5155 pc/h
V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5155	Exhibit 13-8	4600	Yes
$V_{FO} = V_F - V_R$	4344	Exhibit 13-8	4600	No
V_R	811	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5155	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 45.7 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.371 (Exhibit 13-12)
S_R= 53.3 mph (Exhibit 13-12)
S_0= N/A mph (Exhibit 13-12)
S = 53.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3050-EB Off to Leeds
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	325
Freeway Volume, V_F	3508
Ramp Volume, V_R	331
Freeway Free-Flow Speed, S_{FF}	60.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3508	0.90	Level	8	0	0.962	1.00	4054
Ramp	331	0.90	Level	15	0	0.930	1.00	395
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 1.000 using Equation (Exhibit 13-7)
V_{12} = 4054 pc/h
V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4054	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	3659	Exhibit 13-8	4600	No
V_R	395	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4054	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 36.2 (pc/mi/ln)
LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.334 (Exhibit 13-12)
S_R= 54.0 mph (Exhibit 13-12)
S_0= N/A mph (Exhibit 13-12)
S = 54.0 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3055 - Leeds Off to Leeds On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3738*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2170*	pc/h/ln
S	*54.1*	mph
D = v_p / S	*40.1*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3055 - Leeds Off to Leeds On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3177*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1836*	pc/h/ln	Design LOS	
S	*59.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*31.1*	pc/mi/ln	S	mph
LOS	*D*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 EB
Weaving Segment Location	3060 - Leeds to Dorchester
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	2020ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	3436	0.90	8	0	1.5	1.2	0.962	1.00	3970
V_{RF}	254	0.90	8	0	1.5	1.2	0.962	1.00	294
V_{FR}	302	0.90	12	0	1.5	1.2	0.943	1.00	356
V_{RR}	22	0.90	12	0	1.5	1.2	0.943	1.00	26
V_{NW}	3996							V =	4646
V_W	650								
VR	0.140								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	650 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	903 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1340 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2243 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	807

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4646 pc/h	Weaving intensity factor, W	0.245
Weaving segment capacity, c_w	6213 veh/h	Weaving segment speed, S	48.3 mph
Weaving segment v/c ratio	0.719	Average weaving speed, S_W	51.1 mph
Weaving segment density, D	32.1 pc/mi/ln	Average non-weaving speed, S_{NW}	47.9 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	3931 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 EB
Weaving Segment Location	3060 - Leeds to Dorchester
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	2020ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	2822	0.90	7	0	1.5	1.2	0.966	1.00	3245
V_{RF}	887	0.90	7	0	1.5	1.2	0.966	1.00	1020
V_{FR}	355	0.90	7	0	1.5	1.2	0.966	1.00	408
V_{RR}	111	0.90	7	0	1.5	1.2	0.966	1.00	128
V_{NW}	3373							V =	4801
V_W	1428								
VR	0.297								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1428 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	1681 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1212 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2893 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	681

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4801 pc/h	Weaving intensity factor, W	0.300
Weaving segment capacity, c_w	5881 veh/h	Weaving segment speed, S	44.0 mph
Weaving segment v/c ratio	0.789	Average weaving speed, S_W	49.6 mph
Weaving segment density, D	36.3 pc/mi/ln	Average non-weaving speed, S_{NW}	42.0 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	5556 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3065-Dorches Off to Dorches On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3690*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2142*	pc/h/ln
S	*54.7*	mph
D = v_p / S	*39.2*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3065-Dorches Off to Dorches On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3709*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2143*	pc/h/ln
S	*54.6*	mph
D = v_p / S	*39.2*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 EB
Weaving Segment Location	3070 - Dorchester to Montague
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	1515ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	2957	0.90	9	0	1.5	1.2	0.957	1.00	3433
V_{RF}	604	0.90	18	0	1.5	1.2	0.917	1.00	732
V_{FR}	733	0.90	10	0	1.5	1.2	0.952	1.00	855
V_{RR}	150	0.90	18	0	1.5	1.2	0.917	1.00	182
V_{NW}	3615							V =	5202
V_W	1587								
VR	0.305								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1587 lc/h
Interchange density, ID	0.8 int/mi	Weaving lane changes, LC_W	1783 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	988 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2771 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	438

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5202 pc/h	Weaving intensity factor, W	0.364
Weaving segment capacity, c_w	5699 veh/h	Weaving segment speed, S	42.3 mph
Weaving segment v/c ratio	0.873	Average weaving speed, S_W	48.0 mph
Weaving segment density, D	41.0 pc/mi/ln	Average non-weaving speed, S_{NW}	40.3 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	5638 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 EB
Weaving Segment Location	3070 - Dorchester to Montague
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	1515ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2777	0.90	8	0	1.5	1.2	0.962	1.00	3209
V_{RF}	852	0.90	10	0	1.5	1.2	0.952	1.00	994
V_{FR}	932	0.90	8	0	1.5	1.2	0.962	1.00	1077
V_{RR}	286	0.90	10	0	1.5	1.2	0.952	1.00	334
V_{NW}	3543							V =	5614
V_W	2071								
VR	0.369								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2071 lc/h
Interchange density, ID	0.8 int/mi	Weaving lane changes, LC_W	2267 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	973 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	3240 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	429

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5614 pc/h	Weaving intensity factor, W	0.412
Weaving segment capacity, c_w	5570 veh/h	Weaving segment speed, S	39.5 mph
Weaving segment v/c ratio	0.969	Average weaving speed, S_W	46.9 mph
Weaving segment density, D	47.4 pc/mi/ln	Average non-weaving speed, S_{NW}	36.1 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	6335 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3080-Montague to International*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3561*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2067*	pc/h/ln
S	*56.0*	mph
D = v_p / S	*36.9*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3080-Montague to International*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3629*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2097*	pc/h/ln
S	*55.5*	mph
D = v_p / S	*37.8*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3090-EB Off to InternationalWB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 700	V_D = veh/h
	Freeway Volume, V_F: 3561	
	Ramp Volume, V_R: 893	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3561	0.90	Level	9	0	0.957	1.00	4135
Ramp	893	0.90	Level	8	0	0.962	1.00	1032
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4135 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4135	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	3103	Exhibit 13-8	4600	No
V_R	1032	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4135	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 33.5 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.651 (Exhibit 13-12)

S_R= 48.3 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 48.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3090-EB Off to InternationalWB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 700	V_D = veh/h
	Freeway Volume, V_F: 3629	
	Ramp Volume, V_R: 917	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3629	0.90	Level	8	0	0.962	1.00	4194
Ramp	917	0.90	Level	7	0	0.966	1.00	1055
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4194 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4194	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	3139	Exhibit 13-8	4600	No
V_R	1055	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4194	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 34.0 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.653 (Exhibit 13-12)

S_R= 48.2 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 48.2 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3095- Inter WB Off to Inter On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2668*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1549*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*25.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3095- Inter WB Off to Inter On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2712*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1567*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*26.1*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 EB
Weaving Segment Location	3100 - International to I-26
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	2025ft
Freeway free-flow speed, FFS	55 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	1153	0.90	8	0	1.5	1.2	0.962	1.00	1332
V_{RF}	677	0.90	8	0	1.5	1.2	0.962	1.00	782
V_{FR}	1515	0.90	9	0	1.5	1.2	0.957	1.00	1759
V_{RR}	888	0.90	9	0	1.5	1.2	0.957	1.00	1031
V_{NW}	2363							V =	4904
V_W	2541								
VR	0.518								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	782 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	1036 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1007 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	2043 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	479

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4904 pc/h	Weaving intensity factor, W	0.228
Weaving segment capacity, c_w	5510 veh/h	Weaving segment speed, S	44.5 mph
Weaving segment v/c ratio	0.856	Average weaving speed, S_W	47.6 mph
Weaving segment density, D	36.8 pc/mi/ln	Average non-weaving speed, S_{NW}	41.5 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	6473 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 EB
Weaving Segment Location	3100 - International to I-26
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	2025ft
Freeway free-flow speed, FFS	55 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	1219	0.90	7	0	1.5	1.2	0.966	1.00	1402
V_{RF}	1047	0.90	7	0	1.5	1.2	0.966	1.00	1204
V_{FR}	1493	0.90	7	0	1.5	1.2	0.966	1.00	1717
V_{RR}	1284	0.90	7	0	1.5	1.2	0.966	1.00	1477
V_{NW}	2879							V =	5800
V_W	2921								
VR	0.504								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	573

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5800 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	5574 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.005	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6303 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3105-I-26 Off to I-26 EB CD On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1830*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*17*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.922*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1103*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*20.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3105-I-26 Off to I-26 EB CD On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2266*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*14*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.935*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1347*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*24.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3110-EB On from I-26 EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h		V_D = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	625
Deceleration Lane Length L_D	
Freeway Volume, V_F	1830
Ramp Volume, V_R	1422
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	25.0

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1830	0.90	Level	17	0	0.922	1.00	2206
Ramp	1422	0.90	Level	52	0	0.794	1.00	1991
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2206 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4197	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4197	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 33.4 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.549 (Exibit 13-11)

S_R= 47.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 47.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3110-EB On from I-26 EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 625	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2266	
	Ramp Volume, V_R: 1163	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2266	0.90	Level	14	0	0.935	1.00	2694
Ramp	1163	0.90	Level	55	0	0.784	1.00	1648
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2694 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4342	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4342	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 34.7 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.590 (Exibit 13-11)

S_R= 47.3 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 47.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 EB
Weaving Segment Location	3120 - I-26 WB to Rivers Ave
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	3	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1615ft	Freeway maximum capacity, C_{IFL}	2250
Freeway free-flow speed, FFS	55 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	3033	0.90	17	0	1.5	1.2	0.922	1.00	3656
V_{RF}	457	0.90	17	0	1.5	1.2	0.922	1.00	551
V_{FR}	219	0.90	17	0	1.5	1.2	0.922	1.00	264
V_{RR}	33	0.90	15	0	1.5	1.2	0.930	1.00	39
V_{NW}	3695							V =	4510
V_W	815								
VR	0.181								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	815 lc/h
Interchange density, ID	1.2 int/mi	Weaving lane changes, LC_W	1054 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1059 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2113 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	716

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4510 pc/h	Weaving intensity factor, W	0.279
Weaving segment capacity, c_w	5646 veh/h	Weaving segment speed, S	42.6 mph
Weaving segment v/c ratio	0.736	Average weaving speed, S_W	46.3 mph
Weaving segment density, D	35.3 pc/mi/ln	Average non-weaving speed, S_{NW}	41.9 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	4340 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 EB
Weaving Segment Location	3120 - I-26 WB to Rivers Ave
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	3	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1615ft	Freeway maximum capacity, C_{IFL}	2250
Freeway free-flow speed, FFS	55 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	3088	0.90	14	0	1.5	1.2	0.935	1.00	3671
V_{RF}	397	0.90	14	0	1.5	1.2	0.935	1.00	472
V_{FR}	341	0.90	14	0	1.5	1.2	0.935	1.00	405
V_{RR}	44	0.90	8	0	1.5	1.2	0.962	1.00	51
V_{NW}	3722							V =	4599
V_W	877								
VR	0.191								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	877 lc/h
Interchange density, ID	1.2 int/mi	Weaving lane changes, LC_W	1116 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1064 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2180 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	721

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4599 pc/h	Weaving intensity factor, W	0.286
Weaving segment capacity, c_w	5703 veh/h	Weaving segment speed, S	42.2 mph
Weaving segment v/c ratio	0.754	Average weaving speed, S_W	46.1 mph
Weaving segment density, D	36.4 pc/mi/ln	Average non-weaving speed, S_{NW}	41.3 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	4441 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3130-EB Off to Rivers NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	800	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3490	V_D =	veh/h
		Ramp Volume, V_R	168		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	25.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3490	0.90	Level	17	0	0.922	1.00	4207
Ramp	168	0.90	Level	22	0	0.901	1.00	207
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4207 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4207	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	4000	Exhibit 13-8	4500	No
V_R	207	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4207	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 33.2 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.577 (Exhibit 13-12)

S_R= 47.5 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 47.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3130-EB Off to Rivers NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 800	V_D = veh/h
	Freeway Volume, V_F: 3485	
	Ramp Volume, V_R: 332	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3485	0.90	Level	14	0	0.935	1.00	4143
Ramp	332	0.90	Level	9	0	0.957	1.00	385
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4143 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4143	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	3758	Exhibit 13-8	4500	No
V_R	385	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4143	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 32.7 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.593 (Exhibit 13-12)

S_R= 47.3 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 47.3 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3135-RiversNB Off to Rivers On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3322*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*17*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.922*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2002*	pc/h/ln
S	*54.0*	mph
D = v_p / S	*37.1*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3135-RiversNB Off to Rivers On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3153*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*14*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.935*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1874*	pc/h/ln
S	*54.9*	mph
D = v_p / S	*34.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3140-EB On from Rivers
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 825	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3322	
	Ramp Volume, V_R: 584	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3322	0.90	Level	17	0	0.922	1.00	4005
Ramp	584	0.90	Level	2	0	0.990	1.00	655
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 4005 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4660	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4660	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 36.3 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 0.659 (Exibit 13-11)

S_R= 46.4 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 46.4 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3140-EB On from Rivers
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 825	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3153	
	Ramp Volume, V_R: 527	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3153	0.90	Level	14	0	0.935	1.00	3749
Ramp	527	0.90	Level	2	0	0.990	1.00	591
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3749 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4340	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4340	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 33.9 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.546 (Exibit 13-11)

S_R= 47.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 47.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3150-Rivers to Rhett*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3906*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*15*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.930*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2333*	pc/h/ln
S	*50.2*	mph
D = v_p / S	*46.4*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3150-Rivers to Rhett*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3680*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*14*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.935*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2188*	pc/h/ln
S	*53.7*	mph
D = v_p / S	*40.7*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3160-EB Off to Rhett
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	225	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3906	V_D =	veh/h
		Ramp Volume, V_R	503		
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3906	0.90	Level	15	0	0.930	1.00	4665
Ramp	503	0.90	Level	7	0	0.966	1.00	578
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4665 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4665	Exhibit 13-8	4600	Yes
$V_{FO} = V_F - V_R$	4087	Exhibit 13-8	4600	No
V_R	578	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4665	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 42.3 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.350 (Exhibit 13-12)

S_R= 53.7 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 53.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3160-EB Off to Rhett
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 225	V_D = veh/h
	Freeway Volume, V_F: 3680	
	Ramp Volume, V_R: 720	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3680	0.90	Level	14	0	0.935	1.00	4375
Ramp	720	0.90	Level	4	0	0.980	1.00	816
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4375 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4375	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	3559	Exhibit 13-8	4600	No
V_R	816	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4375	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 39.9 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.371 (Exhibit 13-12)

S_R= 53.3 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 53.3 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3165 - Rhett Off to Rhett On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3403*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*15*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.930*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2032*	pc/h/ln
S	*56.6*	mph
D = v_p / S	*35.9*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3165 - Rhett Off to Rhett On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2960*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*14*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.935*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1760*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*59.5*	mph	S	mph
D = v_p / S	*29.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 EB
Weaving Segment Location	3170 - Rhett to Virginia
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	1090ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2938	0.90	14	0	1.5	1.2	0.935	1.00	3493
V_{RF}	1253	0.90	14	0	1.5	1.2	0.935	1.00	1490
V_{FR}	465	0.90	14	0	1.5	1.2	0.935	1.00	553
V_{RR}	198	0.90	12	0	1.5	1.2	0.943	1.00	233
V_{NW}	3726							V =	5769
V_W	2043								
VR	0.354								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	283

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5769 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	5358 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.006	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6172 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 EB
Weaving Segment Location	3170 - Rhett to Virginia
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	1090ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	2826	0.90	13	0	1.5	1.2	0.939	1.00	3344
V_{RF}	1070	0.90	13	0	1.5	1.2	0.939	1.00	1266
V_{FR}	134	0.90	37	0	1.5	1.2	0.844	1.00	176
V_{RR}	51	0.90	37	0	1.5	1.2	0.844	1.00	67
V_{NW}	3411							V =	4853
V_W	1442								
VR	0.297								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1442 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1593 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	716 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2309 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	260

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4853 pc/h	Weaving intensity factor, W	0.409
Weaving segment capacity, c_w	5518 veh/h	Weaving segment speed, S	43.2 mph
Weaving segment v/c ratio	0.826	Average weaving speed, S_W	46.9 mph
Weaving segment density, D	37.4 pc/mi/ln	Average non-weaving speed, S_{NW}	41.9 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	5553 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3180-Virginia to ClementsFerry*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4191*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*12*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.943*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2468*	pc/h/ln
S	*46.3*	mph
D = v_p / S	*53.3*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3180-Virginia to ClementsFerry*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3896*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2283*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*51.5*	mph	S	mph
D = v_p / S	*44.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3190-EB Off to ClementsFerrySB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	250	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	4191	V_D =	veh/h
		Ramp Volume, V_R	480		
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4191	0.90	Level	12	0	0.943	1.00	4936
Ramp	480	0.90	Level	8	0	0.962	1.00	555
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4936 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4936	Exhibit 13-8	4600	Yes
$V_{FO} = V_F - V_R$	4381	Exhibit 13-8	4600	No
V_R	555	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4936	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 44.5 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.348 (Exhibit 13-12)

S_R= 53.7 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 53.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3190-EB Off to ClementsFerrySB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 250	V_D = veh/h
	Freeway Volume, V_F: 3896	
	Ramp Volume, V_R: 249	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3896	0.90	Level	11	0	0.948	1.00	4567
Ramp	249	0.90	Level	13	0	0.939	1.00	295
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4567 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4567	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	4272	Exhibit 13-8	4600	No
V_R	295	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4567	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 41.3 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.325 (Exhibit 13-12)

S_R= 54.2 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 54.2 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3200-EB Off to ClementsFerryNB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	900	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3711	V_D =	veh/h
		Ramp Volume, V_R	971		
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	25.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3711	0.90	Level	12	0	0.943	1.00	4371
Ramp	971	0.90	Level	20	0	0.909	1.00	1187
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4371 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4371	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	3184	Exhibit 13-8	4600	No
V_R	1187	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4371	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 33.7 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.665 (Exhibit 13-12)

S_R= 48.0 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 48.0 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3200-EB Off to ClementsFerryNB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	900	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3647	V_D =	veh/h
		Ramp Volume, V_R	891		
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	25.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3647	0.90	Level	11	0	0.948	1.00	4275
Ramp	891	0.90	Level	19	0	0.913	1.00	1084
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4275 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4275	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	3191	Exhibit 13-8	4600	No
V_R	1084	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4275	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 32.9 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.656 (Exhibit 13-12)

S_R= 48.2 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 48.2 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3205-ClemFerry NB Off to NB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2740*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*12*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.943*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1614*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*26.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3205-ClemFerry NB Off to NB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2756*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1615*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*26.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3210-EB On from Clements Ferry
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1025	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2740	
	Ramp Volume, V_R: 454	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2740	0.90	Level	12	0	0.943	1.00	3227
Ramp	454	0.90	Level	11	0	0.948	1.00	532
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3227 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3759	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3759	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.1 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.396 (Exibit 13-11)

S_R= 52.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 52.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3210-EB On from Clements Ferry
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1025	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2756	
	Ramp Volume, V_R: 696	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2756	0.90	Level	11	0	0.948	1.00	3231
Ramp	696	0.90	Level	6	0	0.971	1.00	797
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3231 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4028	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4028	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 30.1 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.448 (Exibit 13-11)

S_R= 51.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3220-ClementsFerrytoRiversLand*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3194*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1863*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*58.7*	mph	S	mph
D = v_p / S	*31.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3220-ClementsFerrytoRiversLand*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3452*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*8*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1994*	pc/h/ln
S	*57.2*	mph
D = v_p / S	*34.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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F-5605

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3230-EB Off to River Landing
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	800
Freeway Volume, V_F	3194
Ramp Volume, V_R	808
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3194	0.90	Level	10	0	0.952	1.00	3726
Ramp	808	0.90	Level	4	0	0.980	1.00	916
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 1.000 using Equation (Exhibit 13-7)
V_{12} = 3726 pc/h
V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3726	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	2810	Exhibit 13-8	4700	No
V_R	916	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3726	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 29.1 (pc/mi/ln)
LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.380 (Exhibit 13-12)
S_R= 56.2 mph (Exhibit 13-12)
S_0= N/A mph (Exhibit 13-12)
S = 56.2 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3230-EB Off to River Landing
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	800
Freeway Volume, V_F	3452
Ramp Volume, V_R	836
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3452	0.90	Level	8	0	0.962	1.00	3989
Ramp	836	0.90	Level	3	0	0.985	1.00	943
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 1.000 using Equation (Exhibit 13-7)
V_{12} = 3989 pc/h
V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3989	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	3046	Exhibit 13-8	4700	No
V_R	943	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3989	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 31.4 (pc/mi/ln)
LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.383 (Exhibit 13-12)
S_R= 56.2 mph (Exhibit 13-12)
S_0= N/A mph (Exhibit 13-12)
S = 56.2 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3235-RiverLa Off to RiverLa On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2386*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1398*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*65.0*	mph	S	mph
D = v_p / S	*21.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3235-RiverLa Off to RiverLa On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2616*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1526*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*64.8*	mph	S	mph
D = v_p / S	*23.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3240-EB On from River Landing
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1400	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2386	
	Ramp Volume, V_R: 629	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2386	0.90	Level	11	0	0.948	1.00	2797
Ramp	629	0.90	Level	10	0	0.952	1.00	734
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2797 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3531	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3531	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 23.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.384 (Exibit 13-11)

S_R= 56.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 56.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3240-EB On from River Landing
Date Performed	4/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1400	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2616	
	Ramp Volume, V_R: 518	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2616	0.90	Level	10	0	0.952	1.00	3052
Ramp	518	0.90	Level	10	0	0.952	1.00	604
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3052 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3656	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3656	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 24.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.402 (Exibit 13-11)

S_R= 55.8 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 55.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3250-RiverLanding to LongPoint*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3015*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1767*	pc/h/ln
S	*63.1*	mph
D = v_p / S	*28.0*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3250-RiverLanding to LongPoint*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3134*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1828*	pc/h/ln
S	*62.4*	mph
D = v_p / S	*29.3*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3260-EB Off to Long Point
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 225	V_D = veh/h
	Freeway Volume, V_F: 3015	
	Ramp Volume, V_R: 1122	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3015	0.90	Level	11	0	0.948	1.00	3534
Ramp	1122	0.90	Level	20	0	0.909	1.00	1371
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3534 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3534	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	2163	Exhibit 13-8	4700	No
V_R	1371	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3534	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 32.6 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.421 (Exhibit 13-12)

S_R= 55.3 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 55.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3260-EB Off to Long Point
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 225	V_D = veh/h
	Freeway Volume, V_F: 3134	
	Ramp Volume, V_R: 1203	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3134	0.90	Level	10	0	0.952	1.00	3656
Ramp	1203	0.90	Level	16	0	0.926	1.00	1444
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3656 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3656	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	2212	Exhibit 13-8	4700	No
V_R	1444	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3656	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 33.7 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.428 (Exhibit 13-12)

S_R= 55.2 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 55.2 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3265-LongPt Off to LongPtWB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1893*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*12*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.943*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1115*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*65.0*	mph	S	mph
D = v_p / S	*17.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3265-LongPt Off to LongPtWB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1931*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1126*	pc/h/ln	Design LOS	
S	*65.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*17.3*	pc/mi/ln	S	mph
LOS	*B*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3270-EB On from Long Point WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 925	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1893	
	Ramp Volume, V_R: 591	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1893	0.90	Level	12	0	0.943	1.00	2230
Ramp	591	0.90	Level	11	0	0.948	1.00	693
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2230 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2923	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2923	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 22.2 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.347 (Exibit 13-11)

S_R= 57.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 57.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3270-EB On from Long Point WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	925
Deceleration Lane Length L_D	
Freeway Volume, V_F	1931
Ramp Volume, V_R	591
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	25.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1931	0.90	Level	10	0	0.952	1.00	2253
Ramp	591	0.90	Level	9	0	0.957	1.00	686
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2253 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2939	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2939	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 22.3 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.348 (Exibit 13-11)

S_R= 57.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 57.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3280-EB On from Long Point EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h		V_D = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	625
Deceleration Lane Length L_D	
Freeway Volume, V_F	2484
Ramp Volume, V_R	345
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	45.0

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2484	0.90	Level	12	0	0.943	1.00	2926
Ramp	345	0.90	Level	26	0	0.885	1.00	433
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2926 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3359	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3359	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 27.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.377 (Exibit 13-11)

S_R= 56.3 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 56.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3280-EB On from Long Point EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 625	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2522	
	Ramp Volume, V_R: 667	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2522	0.90	Level	10	0	0.952	1.00	2942
Ramp	667	0.90	Level	12	0	0.943	1.00	786
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2942 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3728	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3728	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 30.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.427 (Exibit 13-11)

S_R= 55.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 55.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3290-LongPt.toUS17/Hungryneck*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2829*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*12*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.943*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1666*	pc/h/ln
S	*64.0*	mph
D = v_p / S	*26.0*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3290-LongPt.toUS17/Hungryneck*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3189*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1851*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*62.1*	mph	S	mph
D = v_p / S	*29.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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F-5623

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3300-EB Off to US17/Hungryneck
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	225	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	2829	V_D =	veh/h
		Ramp Volume, V_R	1203		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2829	0.90	Level	12	0	0.943	1.00	3332
Ramp	1203	0.90	Level	5	0	0.976	1.00	1370
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3332 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3332	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1962	Exhibit 13-8	4500	No
V_R	1370	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3332	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.9 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.421 (Exhibit 13-12)

S_R= 49.5 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3300-EB Off to US17/Hungryneck
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	225	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3189	V_D =	veh/h
		Ramp Volume, V_R	1030		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3189	0.90	Level	9	0	0.957	1.00	3703
Ramp	1030	0.90	Level	5	0	0.976	1.00	1173
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3703 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3703	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	2530	Exhibit 13-8	4500	No
V_R	1173	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3703	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 34.1 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.404 (Exhibit 13-12)

S_R= 49.8 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.8 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3310-US17/Hungryneck to US17*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1626*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*953*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*17.3*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3310-US17/Hungryneck to US17*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2159*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1247*	pc/h/ln	Design LOS	
S	*55.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*22.7*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3320-EB Off to US17 SB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 250	V_D = veh/h
	Freeway Volume, V_F: 1626	
	Ramp Volume, V_R: 1183	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1626	0.90	Level	11	0	0.948	1.00	1906
Ramp	1183	0.90	Level	16	0	0.926	1.00	1420
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1906 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1906	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	486	Exhibit 13-8	4500	No
V_R	1420	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1906	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 18.4 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.426 (Exhibit 13-12)

S_R= 49.5 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3320-EB Off to US17 SB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 250	V_D = veh/h
	Freeway Volume, V_F: 2159	
	Ramp Volume, V_R: 1159	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2159	0.90	Level	8	0	0.962	1.00	2495
Ramp	1159	0.90	Level	14	0	0.935	1.00	1378
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2495 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2495	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1117	Exhibit 13-8	4500	No
V_R	1378	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2495	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 23.5 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.422 (Exhibit 13-12)

S_R= 49.5 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.5 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3325-US17 SB Off to US17 SB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*443*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*260*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*4.7*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 EB*
Agency or Company	*Atkins*	From/To	*3325-US17 SB Off to US17 SB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1000*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*578*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*10.5*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3330-EB On from US17 SB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	725
Deceleration Lane Length L_D	
Freeway Volume, V_F	443
Ramp Volume, V_R	369
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	25.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	443	0.90	Level	11	0	0.948	1.00	519
Ramp	369	0.90	Level	3	0	0.985	1.00	416
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 519 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	935	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	935	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 8.0 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.295 (Exibit 13-11)

S_R= 51.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3330-EB On from US17 SB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 725	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1000	
	Ramp Volume, V_R: 297	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1000	0.90	Level	8	0	0.962	1.00	1156
Ramp	297	0.90	Level	3	0	0.985	1.00	335
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1156 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1491	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1491	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 12.4 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.302 (Exibit 13-11)

S_R= 51.1 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3340-EB On from US17 NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	550
Deceleration Lane Length L_D	
Freeway Volume, V_F	812
Ramp Volume, V_R	24
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	812	0.90	Level	11	0	0.948	1.00	952
Ramp	24	0.90	Level	4	0	0.980	1.00	27
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 952 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	979	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	979	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 9.7 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.282 (Exibit 13-11)

S_R= 51.3 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 EB
Agency or Company	Atkins	Junction	3340-EB On from US17 NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 550	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1297	
	Ramp Volume, V_R: 32	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1297	0.90	Level	8	0	0.962	1.00	1499
Ramp	32	0.90	Level	3	0	0.985	1.00	36
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1499 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1535	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1535	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 14.0 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.290 (Exibit 13-11)

S_R= 51.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4010-WB Off to US17 NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 300	V_D = veh/h
	Freeway Volume, V_F: 1149	
	Ramp Volume, V_R: 341	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1149	0.90	Level	11	0	0.948	1.00	1347
Ramp	341	0.90	Level	12	0	0.943	1.00	402
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1347 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1347	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	945	Exhibit 13-8	4500	No
V_R	402	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1347	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 13.1 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.334 (Exhibit 13-12)

S_R= 50.7 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4010-WB Off to US17 NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	300
Freeway Volume, V_F	1286
Ramp Volume, V_R	487
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1286	0.90	Level	8	0	0.962	1.00	1486
Ramp	487	0.90	Level	7	0	0.966	1.00	560
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1486 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1486	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	926	Exhibit 13-8	4500	No
V_R	560	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1486	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 14.3 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.348 (Exhibit 13-12)

S_R= 50.5 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.5 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4015-US17 NB off to US17 NB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*808*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*474*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*8.6*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4015-US17 NB off to US17 NB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*799*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*462*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*8.4*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4020-WB On from US17 NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h		V_D = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	775
Deceleration Lane Length L_D	
Freeway Volume, V_F	808
Ramp Volume, V_R	1003
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	25.0

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	808	0.90	Level	11	0	0.948	1.00	947
Ramp	1003	0.90	Level	12	0	0.943	1.00	1181
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 947 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2128	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2128	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 16.7 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.315 (Exibit 13-11)

S_R= 50.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 50.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4020-WB On from US17 NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 775	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 799	
	Ramp Volume, V_R: 980	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	799	0.90	Level	8	0	0.962	1.00	923
Ramp	980	0.90	Level	10	0	0.952	1.00	1143
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 923 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2066	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2066	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 16.2 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.313 (Exibit 13-11)

S_R= 50.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 50.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4030-US17 to US17/Hungryneck*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1811*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1061*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*55.0*	mph	S	mph
D = v_p / S	*19.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4030-US17 to US17/Hungryneck*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1779*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1028*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*55.0*	mph	S	mph
D = v_p / S	*18.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4020-WB On from US17/Hungrynec
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h		V_D = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	425
Deceleration Lane Length L_D	
Freeway Volume, V_F	1811
Ramp Volume, V_R	910
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1811	0.90	Level	11	0	0.948	1.00	2123
Ramp	910	0.90	Level	25	0	0.889	1.00	1138
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2123 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3261	Exhibit 13-8		No

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3261	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 27.7 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.384 (Exibit 13-11)

S_R= 50.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 50.0 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4020-WB On from US17/Hungrynec
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h		V_D = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	425
Deceleration Lane Length L_D	
Freeway Volume, V_F	1779
Ramp Volume, V_R	1315
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1779	0.90	Level	8	0	0.962	1.00	2056
Ramp	1315	0.90	Level	15	0	0.930	1.00	1571
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2056 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3627	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3627	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 30.4 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.429 (Exibit 13-11)

S_R= 49.4 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 49.4 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4050-US17/Hungryneck to LongPt*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2721*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*12*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.943*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1602*	pc/h/ln
S	*64.4*	mph
D = v_p / S	*24.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4050-US17/Hungryneck to LongPt*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3094*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1796*	pc/h/ln
S	*62.8*	mph
D = v_p / S	*28.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4060-WB Off to Long Point
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	250	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	2721	V_D =	veh/h
		Ramp Volume, V_R	611		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2721	0.90	Level	12	0	0.943	1.00	3205
Ramp	611	0.90	Level	27	0	0.881	1.00	771
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3205 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3205	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	2434	Exhibit 13-8	4700	No
V_R	771	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3205	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 29.6 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.367 (Exhibit 13-12)

S_R= 56.6 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 56.6 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4060-WB Off to Long Point
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	250
Freeway Volume, V_F	3094
Ramp Volume, V_R	1393
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3094	0.90	Level	9	0	0.957	1.00	3592
Ramp	1393	0.90	Level	10	0	0.952	1.00	1625
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 1.000 using Equation (Exhibit 13-7)
V_{12} = 3592 pc/h
V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3592	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	1967	Exhibit 13-8	4700	No
V_R	1625	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3592	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 32.9 (pc/mi/ln)
LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.444 (Exhibit 13-12)
S_R= 54.8 mph (Exhibit 13-12)
S_0= N/A mph (Exhibit 13-12)
S = 54.8 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4065-LongPt Off to LongPtEB On*
Date Performed	*4/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2110*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*12*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.943*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1243*	pc/h/ln
S	*65.0*	mph
D = v_p / S	*19.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4065-LongPt Off to LongPtEB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1701*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*992*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*65.0*	mph	S	mph
D = v_p / S	*15.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4070-WB On from Long Point EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 950	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2110	
	Ramp Volume, V_R: 609	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2110	0.90	Level	12	0	0.943	1.00	2485
Ramp	609	0.90	Level	20	0	0.909	1.00	744
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2485 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3229	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3229	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 24.4 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.372 (Exibit 13-11)

S_R= 56.4 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 56.4 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4070-WB On from Long Point EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 950	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1701	
	Ramp Volume, V_R: 677	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1701	0.90	Level	10	0	0.952	1.00	1985
Ramp	677	0.90	Level	15	0	0.930	1.00	809
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1985 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2794	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2794	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 20.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.337 (Exibit 13-11)

S_R= 57.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 57.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4080-WB On from Long Point WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1025	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2719	
	Ramp Volume, V_R: 1468	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2719	0.90	Level	12	0	0.943	1.00	3202
Ramp	1468	0.90	Level	5	0	0.976	1.00	1672
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3202 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4874	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4874	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 36.3 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 0.739 (Exibit 13-11)

S_R= 48.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 48.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4080-WB On from Long Point WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1025
Deceleration Lane Length L_D	
Freeway Volume, V_F	2378
Ramp Volume, V_R	1065
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2378	0.90	Level	10	0	0.952	1.00	2774
Ramp	1065	0.90	Level	6	0	0.971	1.00	1219
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2774 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3993	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3993	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 29.6 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.440 (Exibit 13-11)

S_R= 54.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 54.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4090-Long Point to Island Park*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4187*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2454*	pc/h/ln
S	*49.2*	mph
D = v_p / S	*49.8*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4090-Long Point to Island Park*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3443*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2008*	pc/h/ln
S	*59.8*	mph
D = v_p / S	*33.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4100-WB Off to Island Park
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 775	V_D = veh/h
	Freeway Volume, V_F: 4187	
	Ramp Volume, V_R: 1121	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4187	0.90	Level	11	0	0.948	1.00	4908
Ramp	1121	0.90	Level	10	0	0.952	1.00	1308
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4908 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4908	Exhibit 13-8	4700	Yes
$V_{FO} = V_F - V_R$	3600	Exhibit 13-8	4700	No
V_R	1308	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4908	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 39.5 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.676 (Exhibit 13-12)

S_R= 49.5 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 49.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4100-WB Off to Island Park
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 775	V_D = veh/h
	Freeway Volume, V_F: 3443	
	Ramp Volume, V_R: 607	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3443	0.90	Level	10	0	0.952	1.00	4017
Ramp	607	0.90	Level	16	0	0.926	1.00	728
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4017 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4017	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	3289	Exhibit 13-8	4700	No
V_R	728	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4017	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 31.8 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.624 (Exhibit 13-12)

S_R= 50.7 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.7 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4105 - Is. Pk Off to Is. Pk On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3066*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1797*	pc/h/ln	Design LOS	
S	*62.8*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*28.6*	pc/mi/ln	S	mph
LOS	*D*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4105 - Is. Pk Off to Is. Pk On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2836*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*10*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1654*	pc/h/ln
S	*64.1*	mph
D = v_p / S	*25.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4110-WB On from Island Park Dr
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1400	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3066	
	Ramp Volume, V_R: 575	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3066	0.90	Level	11	0	0.948	1.00	3594
Ramp	575	0.90	Level	7	0	0.966	1.00	661
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3594 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4255	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4255	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 29.6 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.470 (Exibit 13-11)

S_R= 54.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 54.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4110-WB On from Island Park Dr
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1400	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2836	
	Ramp Volume, V_R: 667	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2836	0.90	Level	10	0	0.952	1.00	3309
Ramp	667	0.90	Level	5	0	0.976	1.00	760
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3309 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4069	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4069	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.1 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.423 (Exibit 13-11)

S_R= 55.3 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 55.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4120-IslandParktoClementsFerry*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3641*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*10*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.952*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2124*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*57.6*	mph	S	mph
D = v_p / S	*36.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4120-IslandParktoClementsFerry*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3503*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2024*	pc/h/ln
S	*59.5*	mph
D = v_p / S	*34.0*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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F-5665

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4130-WB Off to Clements Ferry
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	240
Freeway Volume, V_F	3641
Ramp Volume, V_R	557
Freeway Free-Flow Speed, S_{FF}	60.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3641	0.90	Level	10	0	0.952	1.00	4248
Ramp	557	0.90	Level	17	0	0.922	1.00	671
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4248 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4248	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	3577	Exhibit 13-8	4600	No
V_R	671	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4248	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 38.6 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.358 (Exhibit 13-12)

S_R= 53.5 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 53.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4130-WB Off to Clements Ferry
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	240
Freeway Volume, V_F	3503
Ramp Volume, V_R	462
Freeway Free-Flow Speed, S_{FF}	60.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3503	0.90	Level	8	0	0.962	1.00	4048
Ramp	462	0.90	Level	17	0	0.922	1.00	557
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 1.000 using Equation (Exhibit 13-7)
V_{12} = 4048 pc/h
V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4048	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	3491	Exhibit 13-8	4600	No
V_R	557	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4048	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 36.9 (pc/mi/ln)
LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.348 (Exhibit 13-12)
S_R= 53.7 mph (Exhibit 13-12)
S_0= N/A mph (Exhibit 13-12)
S = 53.7 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4135-ClFerry Off to ClFerry On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3084*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*12*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.943*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1816*	pc/h/ln
S	*59.2*	mph
D = v_p / S	*30.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4135-ClFerry Off to ClFerry On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3041*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1782*	pc/h/ln	Design LOS	
S	*59.4*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*30.0*	pc/mi/ln	S	mph
LOS	*D*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-526 WB
Analysis Year	2038 Build - Proposed Site	Junction	From Clements Ferry
Analysis Time Period:	AM Peak	Segment ID	4140
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	60	60	45
Volume, V (veh/h)	3,084	4,323	1,239
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	12%	12%	18%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.94	0.94	0.92
Demand Flow Rate, v_p (pc/h/ln)	1,816	1,697	1,501
Capacity Flow Rate, c (pc/h/ln)	2,300	2,300	2,100
v/c ratio	0.79	0.74	0.71
Density, D_{MD} (pc/mi/ln)	31.8	29.7	26.3
LOS	D	D	C

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	I-526 WB
Analysis Year	2038 Build - Proposed Site	Junction	From Clements Ferry
Analysis Time Period:	PM Peak	Segment ID	4140
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	60	60	45
Volume, V (veh/h)	3,041	3,500	459
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	11%	11%	42%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.95	0.95	0.83
Demand Flow Rate, v_p (pc/h/ln)	1,782	1,368	617
Capacity Flow Rate, c (pc/h/ln)	2,300	2,300	2,100
v/c ratio	0.77	0.59	0.29
Density, D_{MD} (pc/mi/ln)	31.2	23.9	10.8
LOS	D	C	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4150-ClementsFerry to Virginia*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4323*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*12*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.943*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2546*	pc/h/ln
S	*43.7*	mph
D = v_p / S	*58.2*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4150-ClementsFerry to Virginia*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3500*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*11*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.948*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2051*	pc/h/ln
S	*56.3*	mph
D = v_p / S	*36.4*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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F-5673

Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4160 - Virginia to Rhett
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	1415ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	3167	0.90	14	0	1.5	1.2	0.935	1.00	3765
V_{RF}	103	0.90	74	0	1.5	1.2	0.730	1.00	157
V_{FR}	1156	0.90	14	0	1.5	1.2	0.935	1.00	1374
V_{RR}	37	0.90	74	0	1.5	1.2	0.730	1.00	56
V_{NW}	3821							V =	5352
V_W	1531								
VR	0.286								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1531 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1710 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	976 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2686 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	378

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5352 pc/h	Weaving intensity factor, W	0.375
Weaving segment capacity, c_w	5585 veh/h	Weaving segment speed, S	42.3 mph
Weaving segment v/c ratio	0.896	Average weaving speed, S_W	47.7 mph
Weaving segment density, D	42.2 pc/mi/ln	Average non-weaving speed, S_{NW}	40.4 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	5435 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4160 - Virginia to Rhett
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	1415ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	2390	0.90	13	0	1.5	1.2	0.939	1.00	2828
V_{RF}	577	0.90	13	0	1.5	1.2	0.939	1.00	683
V_{FR}	1110	0.90	13	0	1.5	1.2	0.939	1.00	1314
V_{RR}	268	0.90	10	0	1.5	1.2	0.952	1.00	313
V_{NW}	3141							V =	5138
V_W	1997								
VR	0.389								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1997 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	2176 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	836 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	3012 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	311

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5138 pc/h	Weaving intensity factor, W	0.410
Weaving segment capacity, c_w	5372 veh/h	Weaving segment speed, S	40.6 mph
Weaving segment v/c ratio	0.898	Average weaving speed, S_W	46.9 mph
Weaving segment density, D	42.2 pc/mi/ln	Average non-weaving speed, S_{NW}	37.4 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	6554 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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F-5675

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4165-Rhett Off to Rhett On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3270*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*15*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.930*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1953*	pc/h/ln	Design LOS		
S	*57.7*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
D = v_p / S	*33.8*	pc/mi/ln	S		mph
LOS	*D*		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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F-5676

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4165-Rhett Off to Rhett On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2967*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*14*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.935*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1764*	pc/h/ln	Design LOS	
S	*59.5*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*29.6*	pc/mi/ln	S	mph
LOS	*D*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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F-5677

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4170-WB On from Rhett
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 625	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3270	
	Ramp Volume, V_R: 768	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3270	0.90	Level	15	0	0.930	1.00	3906
Ramp	768	0.90	Level	6	0	0.971	1.00	879
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3906 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4785	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4785	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 38.5 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 0.732 (Exibit 13-11)

S_R= 46.8 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 46.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4170-WB On from Rhett
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 625	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2967	
	Ramp Volume, V_R: 633	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2967	0.90	Level	14	0	0.935	1.00	3527
Ramp	633	0.90	Level	6	0	0.971	1.00	724
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3527 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4251	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4251	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 34.4 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.538 (Exibit 13-11)

S_R= 50.3 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 50.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4180-Rhett to Rivers*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4038*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*15*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.930*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2412*	pc/h/ln	Design LOS	
S	*45.8*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*52.7*	pc/mi/ln	S	mph
LOS	*F*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4180-Rhett to Rivers*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3600*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*14*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.935*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2140*	pc/h/ln
S	*52.1*	mph
D = v_p / S	*41.0*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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F-5681

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4190-WB Off to Rivers NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	725	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	4038	V_D =	veh/h
		Ramp Volume, V_R	338		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4038	0.90	Level	15	0	0.930	1.00	4823
Ramp	338	0.90	Level	2	0	0.990	1.00	379
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4823 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4823	Exhibit 13-8	4500	Yes
$V_{FO} = V_F - V_R$	4444	Exhibit 13-8	4500	No
V_R	379	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4823	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 39.2 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.332 (Exhibit 13-12)

S_R= 50.7 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4190-WB Off to Rivers NB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 725	V_D = veh/h
	Freeway Volume, V_F: 3600	
	Ramp Volume, V_R: 255	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3600	0.90	Level	14	0	0.935	1.00	4280
Ramp	255	0.90	Level	2	0	0.990	1.00	286
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4280 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4280	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	3994	Exhibit 13-8	4500	No
V_R	286	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4280	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 34.5 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.324 (Exhibit 13-12)

S_R= 50.8 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4200-WB Off to Rivers SB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	700	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3700	V_D =	veh/h
		Ramp Volume, V_R	235		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	25.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3700	0.90	Level	17	0	0.922	1.00	4461
Ramp	235	0.90	Level	6	0	0.971	1.00	269
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4461 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4461	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	4192	Exhibit 13-8	4500	No
V_R	269	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4461	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 36.3 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.582 (Exhibit 13-12)

S_R= 47.4 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 47.4 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4200-WB Off to Rivers SB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 700	V_D = veh/h
	Freeway Volume, V_F: 3345	
	Ramp Volume, V_R: 71	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3345	0.90	Level	14	0	0.935	1.00	3977
Ramp	71	0.90	Level	15	0	0.930	1.00	85
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3977 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3977	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	3892	Exhibit 13-8	4500	No
V_R	85	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3977	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 32.2 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.566 (Exhibit 13-12)

S_R= 47.6 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 47.6 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4205-RiversSB Off to Rivers On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*3465*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*17*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.922*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2089*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*52.9*	mph	S	mph
D = v_p / S	*39.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4205-RiversSB Off to Rivers On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3274*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*14*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.935*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1946*	pc/h/ln	Design LOS	
S	*54.5*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*35.7*	pc/mi/ln	S	mph
LOS	*E*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4210 - Rivers to I-26 WB
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	725ft
Freeway free-flow speed, FFS	55 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	2302	0.90	17	0	1.5	1.2	0.922	1.00	2775
V_{RF}	369	0.90	17	0	1.5	1.2	0.922	1.00	445
V_{FR}	1163	0.90	54	0	1.5	1.2	0.787	1.00	1641
V_{RR}	186	0.90	54	0	1.5	1.2	0.787	1.00	262
V_{NW}	3037							V =	5123
V_W	2086								
VR	0.407								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2086 lc/h
Interchange density, ID	1.2 int/mi	Weaving lane changes, LC_W	2222 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	441 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2663 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	264

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5123 pc/h	Weaving intensity factor, W	0.631
Weaving segment capacity, c_w	4944 veh/h	Weaving segment speed, S	34.5 mph
Weaving segment v/c ratio	0.955	Average weaving speed, S_W	39.5 mph
Weaving segment density, D	49.4 pc/mi/ln	Average non-weaving speed, S_{NW}	31.8 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	6762 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4210 - Rivers to I-26 WB
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	725ft
Freeway free-flow speed, FFS	55 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1867	0.90	14	0	1.5	1.2	0.935	1.00	2220
V_{RF}	289	0.90	14	0	1.5	1.2	0.935	1.00	344
V_{FR}	1407	0.90	39	0	1.5	1.2	0.837	1.00	1868
V_{RR}	217	0.90	39	0	1.5	1.2	0.837	1.00	288
V_{NW}	2508							V =	4720
V_W	2212								
VR	0.469								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2212 lc/h
Interchange density, ID	1.2 int/mi	Weaving lane changes, LC_W	2348 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	332 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2680 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	218

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4720 pc/h	Weaving intensity factor, W	0.634
Weaving segment capacity, c_w	4786 veh/h	Weaving segment speed, S	34.8 mph
Weaving segment v/c ratio	0.922	Average weaving speed, S_W	39.5 mph
Weaving segment density, D	45.2 pc/mi/ln	Average non-weaving speed, S_{NW}	31.5 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	7462 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4215-I-26 WB Off to I-26 WB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2671*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*17*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.922*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1610*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*55.0*	mph	S	mph
D = v_p / S	*29.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4215-I-26 WB Off to I-26 WB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2156*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*14*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.935*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1282*	pc/h/ln	Design LOS	
S	*55.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*23.3*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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F-5691

Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4220 - I-26 WB to I-26 EB C-D
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	3	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	550ft	Freeway maximum capacity, C_{IFL}	2250
Freeway free-flow speed, FFS	55 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	2105	0.90	17	0	1.5	1.2	0.922	1.00	2538
V_{RF}	275	0.90	7	0	1.5	1.2	0.966	1.00	316
V_{FR}	566	0.90	8	0	1.5	1.2	0.962	1.00	654
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	2538							V =	3508
V_W	970								
VR	0.277								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	970 lc/h
Interchange density, ID	1.2 int/mi	Weaving lane changes, LC_W	1074 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	243 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1317 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	168

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	3508 pc/h	Weaving intensity factor, W	0.450
Weaving segment capacity, c_w	5209 veh/h	Weaving segment speed, S	42.5 mph
Weaving segment v/c ratio	0.621	Average weaving speed, S_W	42.6 mph
Weaving segment density, D	27.5 pc/mi/ln	Average non-weaving speed, S_{NW}	42.4 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	5333 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4220 - I-26 WB to I-26 EB C-D
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	3	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	550ft	Freeway maximum capacity, C_{IFL}	2250
Freeway free-flow speed, FFS	55 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1658	0.90	14	0	1.5	1.2	0.935	1.00	1971
V_{RF}	338	0.90	5	0	1.5	1.2	0.976	1.00	385
V_{FR}	498	0.90	7	0	1.5	1.2	0.966	1.00	573
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	1971							V =	2929
V_W	958								
VR	0.327								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	958 lc/h
Interchange density, ID	1.2 int/mi	Weaving lane changes, LC_W	1062 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	126 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1188 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	130

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	2929 pc/h	Weaving intensity factor, W	0.415
Weaving segment capacity, c_w	5167 veh/h	Weaving segment speed, S	43.4 mph
Weaving segment v/c ratio	0.530	Average weaving speed, S_W	43.3 mph
Weaving segment density, D	22.5 pc/mi/ln	Average non-weaving speed, S_{NW}	43.4 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	5876 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4225-I-26 EB CD Off to On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2380*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*17*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.922*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1435*	pc/h/ln	Design LOS		
S	*55.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
D = v_p / S	*26.1*	pc/mi/ln	S		mph
LOS	*D*		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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F-5694

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4225-I-26 EB CD Off to On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1996*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*14*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.935*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1187*	pc/h/ln	Design LOS	
S	*55.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*21.6*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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F-5695

Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4230-I-26EBCD to International
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	3	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	3135ft	Freeway maximum capacity, C_{IFL}	2300
Freeway free-flow speed, FFS	60 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1486	0.90	8	0	1.5	1.2	0.962	1.00	1717
V_{RF}	1565	0.90	16	0	1.5	1.2	0.926	1.00	1878
V_{FR}	894	0.90	9	0	1.5	1.2	0.957	1.00	1038
V_{RR}	943	0.90	16	0	1.5	1.2	0.926	1.00	1132
V_{NW}	2849							V =	5765
V_W	2916								
VR	0.506								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	518

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5765 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	4562 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.215	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	7894 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4230-I-26EBCD to International
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	3	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	3135ft	Freeway maximum capacity, C_{IFL}	2300
Freeway free-flow speed, FFS	60 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	956	0.90	7	0	1.5	1.2	0.966	1.00	1099
V_{RF}	964	0.90	18	0	1.5	1.2	0.917	1.00	1168
V_{FR}	1040	0.90	7	0	1.5	1.2	0.966	1.00	1196
V_{RR}	1048	0.90	18	0	1.5	1.2	0.917	1.00	1269
V_{NW}	2368							V =	4732
V_W	2364								
VR	0.500								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2364 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	2689 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1609 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	4298 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	742

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4732 pc/h	Weaving intensity factor, W	0.290
Weaving segment capacity, c_w	4642 veh/h	Weaving segment speed, S	41.4 mph
Weaving segment v/c ratio	0.985	Average weaving speed, S_W	49.9 mph
Weaving segment density, D	38.1 pc/mi/ln	Average non-weaving speed, S_{NW}	35.4 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	7822 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4235-Interna Off to Interna On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3051*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1771*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*59.5*	mph	S	mph
D = v_p / S	*29.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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F-5698

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4235-Interna Off to Interna On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1920*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1109*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*60.0*	mph	S	mph
D = v_p / S	*18.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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F-5699

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4240-WB On from International
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 875	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3051	
	Ramp Volume, V_R: 614	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3051	0.90	Level	9	0	0.957	1.00	3543
Ramp	614	0.90	Level	17	0	0.922	1.00	740
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3543 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4283	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4283	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 33.1 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.525 (Exibit 13-11)

S_R= 50.6 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 50.6 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4240-WB On from International
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 875	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1920	
	Ramp Volume, V_R: 917	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1920	0.90	Level	8	0	0.962	1.00	2219
Ramp	917	0.90	Level	10	0	0.952	1.00	1070
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2219 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3289	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3289	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 25.2 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.347 (Exibit 13-11)

S_R= 53.8 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 53.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4250-Montague to Dorchester
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	950ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	2853	0.90	9	0	1.5	1.2	0.957	1.00	3313
V_{RF}	543	0.90	9	0	1.5	1.2	0.957	1.00	630
V_{FR}	812	0.90	13	0	1.5	1.2	0.939	1.00	961
V_{RR}	155	0.90	13	0	1.5	1.2	0.939	1.00	183
V_{NW}	3496							V =	5087
V_W	1591								
VR	0.313								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1591 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	1747 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	657 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2404 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	332

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5087 pc/h	Weaving intensity factor, W	0.470
Weaving segment capacity, c_w	5555 veh/h	Weaving segment speed, S	41.9 mph
Weaving segment v/c ratio	0.876	Average weaving speed, S_W	45.6 mph
Weaving segment density, D	40.5 pc/mi/ln	Average non-weaving speed, S_{NW}	40.4 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	5721 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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F-5702

Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4250-Montague to Dorchester
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	950ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2272	0.90	8	0	1.5	1.2	0.962	1.00	2625
V_{RF}	755	0.90	8	0	1.5	1.2	0.962	1.00	872
V_{FR}	565	0.90	15	0	1.5	1.2	0.930	1.00	675
V_{RR}	188	0.90	15	0	1.5	1.2	0.930	1.00	225
V_{NW}	2850							V =	4397
V_W	1547								
VR	0.352								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1547 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	1703 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	524 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2227 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	271

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4397 pc/h	Weaving intensity factor, W	0.443
Weaving segment capacity, c_w	5487 veh/h	Weaving segment speed, S	43.3 mph
Weaving segment v/c ratio	0.771	Average weaving speed, S_W	46.2 mph
Weaving segment density, D	33.9 pc/mi/ln	Average non-weaving speed, S_{NW}	41.8 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	6147 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4255-Dorches Off to Dorches On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3396*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1972*	pc/h/ln
S	*57.5*	mph
D = v_p / S	*34.3*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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F-5704

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4255-Dorches Off to Dorches On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3027*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1749*	pc/h/ln	Design LOS	
S	*59.6*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*29.3*	pc/mi/ln	S	mph
LOS	*D*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4260-Dorchester to Leeds
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	1750ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	2472	0.90	8	0	1.5	1.2	0.962	1.00	2857
V_{RF}	465	0.90	17	0	1.5	1.2	0.922	1.00	561
V_{FR}	924	0.90	17	0	1.5	1.2	0.922	1.00	1114
V_{RR}	174	0.90	17	0	1.5	1.2	0.922	1.00	210
V_{NW}	3067							V =	4742
V_W	1675								
VR	0.353								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1675 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	1908 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1003 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2911 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	537

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4742 pc/h	Weaving intensity factor, W	0.338
Weaving segment capacity, c_w	5660 veh/h	Weaving segment speed, S	42.9 mph
Weaving segment v/c ratio	0.806	Average weaving speed, S_W	48.6 mph
Weaving segment density, D	36.8 pc/mi/ln	Average non-weaving speed, S_{NW}	40.4 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	6162 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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F-5706

Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-526 WB
Weaving Segment Location	4260-Dorchester to Leeds
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	1750ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	2740	0.90	7	0	1.5	1.2	0.966	1.00	3151
V_{RF}	491	0.90	17	0	1.5	1.2	0.922	1.00	592
V_{FR}	287	0.90	14	0	1.5	1.2	0.935	1.00	341
V_{RR}	52	0.90	17	0	1.5	1.2	0.922	1.00	63
V_{NW}	3214							V =	4147
V_W	933								
VR	0.225								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	933 lc/h
Interchange density, ID	1.0 int/mi	Weaving lane changes, LC_W	1166 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1033 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2199 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	562

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4147 pc/h	Weaving intensity factor, W	0.271
Weaving segment capacity, c_w	5991 veh/h	Weaving segment speed, S	47.4 mph
Weaving segment v/c ratio	0.669	Average weaving speed, S_W	50.4 mph
Weaving segment density, D	29.1 pc/mi/ln	Average non-weaving speed, S_{NW}	46.6 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	4793 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4265-Leeds Off to Leeds On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2937*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1705*	pc/h/ln
S	*59.8*	mph
D = v_p / S	*28.5*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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F-5708

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4265-Leeds Off to Leeds On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3231*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*8*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1867*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*58.7*	mph	S	mph
D = v_p / S	*31.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4270-WB On from Leeds
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 825	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2937	
	Ramp Volume, V_R: 222	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2937	0.90	Level	9	0	0.957	1.00	3410
Ramp	222	0.90	Level	19	0	0.913	1.00	270
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3410 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3680	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3680	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.9 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.401 (Exibit 13-11)

S_R= 52.8 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 52.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4270-WB On from Leeds
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 825	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3231	
	Ramp Volume, V_R: 696	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3231	0.90	Level	8	0	0.962	1.00	3734
Ramp	696	0.90	Level	5	0	0.976	1.00	793
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3734 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4527	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4527	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 35.2 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

M_S = 0.607 (Exibit 13-11)

S_R= 49.1 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 49.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4280-Leeds to Paul Cantrell*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3159*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*9*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*60.0*	mph	FFS	*60.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1834*	pc/h/ln	Design LOS	
S	*59.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*31.1*	pc/mi/ln	S	mph
LOS	*D*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4280-Leeds to Paul Cantrell*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3927*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2269*	pc/h/ln
S	*51.9*	mph
D = v_p / S	*43.7*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4290-WB Off to PaulCantrell WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 825	V_D = veh/h
	Freeway Volume, V_F: 3159	
	Ramp Volume, V_R: 1291	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3159	0.90	Level	9	0	0.957	1.00	3668
Ramp	1291	0.90	Level	26	0	0.885	1.00	1621
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 3668 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3668	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	2047	Exhibit 13-8	4600	No
V_R	1621	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3668	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 28.4 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.444 (Exhibit 13-12)

S_R= 52.0 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 52.0 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4290-WB Off to PaulCantrell WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	825
Freeway Volume, V_F	3927
Ramp Volume, V_R	2073
Freeway Free-Flow Speed, S_{FF}	60.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3927	0.90	Level	8	0	0.962	1.00	4538
Ramp	2073	0.90	Level	14	0	0.935	1.00	2465
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 4538 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4538	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	2073	Exhibit 13-8	4600	No
V_R	2465	Exhibit 13-10	2100	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4538	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.9 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.520 (Exhibit 13-12)

S_R= 50.6 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.6 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4300-WB Off to PaulCantrell EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	525	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	1868	V_D =	veh/h
		Ramp Volume, V_R	724		
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	25.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1868	0.90	Level	9	0	0.957	1.00	2169
Ramp	724	0.90	Level	5	0	0.976	1.00	825
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2169 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2169	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	1344	Exhibit 13-8	4600	No
V_R	825	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2169	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 18.2 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.632 (Exhibit 13-12)

S_R= 48.6 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 48.6 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4300-WB Off to PaulCantrell EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 525	V_D = veh/h
	Freeway Volume, V_F: 1854	
	Ramp Volume, V_R: 771	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 25.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1854	0.90	Level	8	0	0.962	1.00	2142
Ramp	771	0.90	Level	4	0	0.980	1.00	874
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2142 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2142	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	1268	Exhibit 13-8	4600	No
V_R	874	Exhibit 13-10	1900	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2142	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 17.9 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.637 (Exhibit 13-12)

S_R= 48.5 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 48.5 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4305-PaulCEB Off to PaulCEB On*
Date Performed	*4/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1144*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*9*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.957*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*664*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*11.1*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*I-526 WB*
Agency or Company	*Atkins*	From/To	*4305-PaulCEB Off to PaulCEB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1083*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*8*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*	
			Up/Down %		

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*60.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*60.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*626*	pc/h/ln
S	*60.0*	mph
D = v_p / S	*10.4*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4310-WB On from PaulCantrellEB
Date Performed	4/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 700	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1144	
	Ramp Volume, V_R: 354	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1144	0.90	Level	9	0	0.957	1.00	1328
Ramp	354	0.90	Level	6	0	0.971	1.00	405
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1328 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1733	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1733	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 14.4 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.280 (Exibit 13-11)

S_R= 55.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 55.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	I-526 WB
Agency or Company	Atkins	Junction	4310-WB On from PaulCantrellEB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 700	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1083	
	Ramp Volume, V_R: 284	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1083	0.90	Level	8	0	0.962	1.00	1251
Ramp	284	0.90	Level	7	0	0.966	1.00	327
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1251 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1578	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1578	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 13.2 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.277 (Exibit 13-11)

S_R= 55.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 55.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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Appendix E
Traffic Analysis Worksheets

2038 Design Year

Build Proposed Project Alternatives 1-4

US Highway 17

MAJOR MERGE SEGMENTS ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US 17 NB
Analysis Year	2038 Build - Proposed Site	Junction	From I-26 EB & WB
Analysis Time Period:	AM Peak	Segment ID	5010
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of On-Ramp	Freeway Downstream of On-Ramp	On-Ramp
Number of Lanes, N	2	4	2
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	2,078	3,531	1,453
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	4%	3%	7%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream of On-Ramp	Freeway Downstream of On-Ramp	On-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.99	0.97
Demand Flow Rate, v_p (pc/h/ln)	1,178	996	835
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,200
v/c ratio	0.52	0.44	0.38
	Below Capacity	Below Capacity	Below Capacity

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

MAJOR MERGE SEGMENTS ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US 17 NB
Analysis Year	2038 Build - Proposed Site	Junction	From I-26 EB & WB
Analysis Time Period:	PM Peak	Segment ID	5010
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of On-Ramp	Freeway Downstream of On-Ramp	On-Ramp
Number of Lanes, N	2	4	2
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	2,256	3,008	752
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	3%	3%	12%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream of On-Ramp	Freeway Downstream of On-Ramp	On-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.99	0.99	0.94
Demand Flow Rate, v_p (pc/h/ln)	1,272	848	443
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,200
v/c ratio	0.57	0.38	0.20
	Below Capacity	Below Capacity	Below Capacity

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 NB
Agency or Company	Atkins	Junction	5020-NB On from Meeting
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1125	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3531	
	Ramp Volume, V_R: 528	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3531	0.90	Level	3	0	0.985	1.00	3982
Ramp	528	0.90	Level	11	0	0.948	1.00	619
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.140 using Equation (Exhibit 13-6)

V_{12} = 559 pc/h

V_3 or V_{av34} 1711 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 1592 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4601	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2211	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 15.4 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.255 (Exibit 13-11)

S_R= 51.7 mph (Exhibit 13-11)

S_0= 52.5 mph (Exhibit 13-11)

S = 52.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 NB
Agency or Company	Atkins	Junction	5020-NB On from Meeting
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1125	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3008	
	Ramp Volume, V_R: 951	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3008	0.90	Level	3	0	0.985	1.00	3392
Ramp	951	0.90	Level	5	0	0.976	1.00	1083
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.082 using Equation (Exhibit 13-6)

V_{12} = 280 pc/h

V_3 or V_{av34} 1556 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 1356 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4475	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2439	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 16.9 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.264 (Exibit 13-11)

S_R= 51.6 mph (Exhibit 13-11)

S_0= 53.1 mph (Exhibit 13-11)

S = 52.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 NB
Agency or Company	Atkins	Junction	5030-NB On from E Bay
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 925	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D	V_D = veh/h
	Freeway Volume, V_F: 4059	
	Ramp Volume, V_R: 346	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4059	0.90	Level	6	0	0.971	1.00	4645
Ramp	346	0.90	Level	15	0	0.930	1.00	413
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.166 using Equation (Exhibit 13-6)

V_{12} = 772 pc/h

V_3 or V_{av34} 1936 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 1858 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5058	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2271	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 17.2 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.276 (Exibit 13-11)

S_R= 51.4 mph (Exhibit 13-11)

S_0= 51.8 mph (Exhibit 13-11)

S = 51.6 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 NB
Agency or Company	Atkins	Junction	5030-NB On from E Bay
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 925	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3959	
	Ramp Volume, V_R: 1210	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3959	0.90	Level	5	0	0.976	1.00	4509
Ramp	1210	0.90	Level	4	0	0.980	1.00	1371
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.046 using Equation (Exhibit 13-6)

V_{12} = 209 pc/h

V_3 or V_{av34} 2150 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☑ Yes ☐ No

If Yes, V_{12a} = 1803 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5880	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3174	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 23.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.331 (Exibit 13-11)

S_R= 50.7 mph (Exhibit 13-11)

S_0= 51.9 mph (Exhibit 13-11)

S = 51.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 NB*
Agency or Company	*Atkins*	From/To	*5040-E Bay to SC-703*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4405*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*6*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1260*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*22.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 NB*
Agency or Company	*Atkins*	From/To	*5040-E Bay to SC-703*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5169*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*5*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*4*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1472*	pc/h/ln	Design LOS		
S	*55.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
D = v_p / S	*26.8*	pc/mi/ln	S		mph
LOS	*D*		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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MAJOR DIVERGE SEGMENTS ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US-17 NB
Analysis Year	2038 Build - Proposed Site	Junction	Off to SC-703
Analysis Time Period:	AM Peak	Segment ID	5050
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Off-Ramp	Freeway Downstream of Off-Ramp	Off-Ramp
Number of Lanes, N	4	2	2
Free-Flow Speed, FFS (mph)	55	45	40
Volume, V (veh/h)	4,405	3,245	1,160
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	6%	5%	8%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.98	0.96
Demand Flow Rate, v_p (pc/h/ln)	1,260	1,848	670
Capacity Flow Rate, c (pc/h/ln)	2,200	2,100	2,000
v/c ratio	0.57	0.88	0.34
Density, D_{MD} (pc/mi/ln)	22.1	32.3	11.7
LOS	C	D	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

MAJOR DIVERGE SEGMENTS ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US-17 NB
Analysis Year	2038 Build - Proposed Site	Junction	Off to SC-703
Analysis Time Period:	PM Peak	Segment ID	5050
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Off-Ramp	Freeway Downstream of Off-Ramp	Off-Ramp
Number of Lanes, N	4	2	2
Free-Flow Speed, FFS (mph)	55	45	40
Volume, V (veh/h)	5,169	3,532	1,637
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	5%	5%	5%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.98	0.98
Demand Flow Rate, v_p (pc/h/ln)	1,472	2,011	932
Capacity Flow Rate, c (pc/h/ln)	2,200	2,100	2,000
v/c ratio	0.67	0.96	0.47
Density, D_{MD} (pc/mi/ln)	25.8	35.2	16.3
LOS	C	E	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US-17 NB
Analysis Year	2038 Build - Proposed Site	Junction	Off to Bowman
Analysis Time Period:	AM Peak	Segment ID	5060
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	3	2	1
Free-Flow Speed, FFS (mph)	45	45	45
Volume, V (veh/h)	2,522	1,838	684
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	6%	8%	2%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.96	0.99
Demand Flow Rate, v_p (pc/h/ln)	962	1,062	768
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	2,100
v/c ratio	0.46	0.51	0.37
Density, D_{MD} (pc/mi/ln)	16.8	18.6	13.4
LOS	B	B	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US-17 NB
Analysis Year	2038 Build - Proposed Site	Junction	Off to Bowman
Analysis Time Period:	PM Peak	Segment ID	5060
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	3	2	1
Free-Flow Speed, FFS (mph)	45	45	45
Volume, V (veh/h)	3,374	2,658	716
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	5%	6%	2%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.97	0.99
Demand Flow Rate, v_p (pc/h/ln)	1,281	1,521	804
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	2,100
v/c ratio	0.61	0.72	0.38
Density, D_{MD} (pc/mi/ln)	22.4	26.6	14.1
LOS	C	C	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 NB*
Agency or Company	*Atkins*	From/To	*5065-Bowman Off to Bowman On*
Date Performed	*4/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1838*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1062*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*19.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 NB*
Agency or Company	*Atkins*	From/To	*5065-Bowman Off to Bowman On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2658*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1521*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*27.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	US-17 NB
Weaving Segment Location	5070-Bowman On to I-526 WB Off
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	825ft
Freeway free-flow speed, FFS	45 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1049	0.90	8	0	1.5	1.2	0.962	1.00	1212
V_{RF}	286	0.90	13	0	1.5	1.2	0.939	1.00	338
V_{FR}	789	0.90	12	0	1.5	1.2	0.943	1.00	929
V_{RR}	214	0.90	13	0	1.5	1.2	0.939	1.00	253
V_{NW}	1465							V =	2732
V_W	1267								
VR	0.464								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1267 lc/h
Interchange density, ID	0.3 int/mi	Weaving lane changes, LC_W	1366 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	171 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1537 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	36

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	2732 pc/h	Weaving intensity factor, W	0.369
Weaving segment capacity, c_w	4976 veh/h	Weaving segment speed, S	33.8 mph
Weaving segment v/c ratio	0.528	Average weaving speed, S_W	36.9 mph
Weaving segment density, D	26.9 pc/mi/ln	Average non-weaving speed, S_{NW}	31.5 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	7406 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	US-17 NB
Weaving Segment Location	5070-Bowman On to I-526 WB Off
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	825ft
Freeway free-flow speed, FFS	45 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1923	0.90	6	0	1.5	1.2	0.971	1.00	2201
V_{RF}	642	0.90	6	0	1.5	1.2	0.971	1.00	735
V_{FR}	735	0.90	10	0	1.5	1.2	0.952	1.00	858
V_{RR}	245	0.90	10	0	1.5	1.2	0.952	1.00	286
V_{NW}	2487							V =	4080
V_W	1593								
VR	0.390								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1593 lc/h
Interchange density, ID	0.3 int/mi	Weaving lane changes, LC_W	1692 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	382 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	2074 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	62

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4080 pc/h	Weaving intensity factor, W	0.468
Weaving segment capacity, c_w	5272 veh/h	Weaving segment speed, S	29.8 mph
Weaving segment v/c ratio	0.751	Average weaving speed, S_W	35.4 mph
Weaving segment density, D	45.7 pc/mi/ln	Average non-weaving speed, S_{NW}	27.0 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	6574 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 NB*
Agency or Company	*Atkins*	From/To	*5075-526 WB Off to 526 WB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1335*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*8*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*771*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*14.0*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 NB*
Agency or Company	*Atkins*	From/To	*5075-526 WB Off to 526 WB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2565*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1468*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*26.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US 17 NB
Analysis Year	2038 Build - Proposed Site	Junction	From I-526 WB
Analysis Time Period:	AM Peak	Segment ID	5080
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	45	45	45
Volume, V (veh/h)	1,335	1,676	341
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	8%	8%	12%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.96	0.96	0.94
Demand Flow Rate, v_p (pc/h/ln)	771	646	402
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	2,100
v/c ratio	0.37	0.31	0.19
Density, D_{MD} (pc/mi/ln)	13.5	11.3	7.0
LOS	B	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US 17 NB
Analysis Year	2038 Build - Proposed Site	Junction	From I-526 WB
Analysis Time Period:	PM Peak	Segment ID	5080
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	45	45	45
Volume, V (veh/h)	2,565	3,052	487
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	6%	6%	7%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.97	0.97
Demand Flow Rate, v_p (pc/h/ln)	1,468	1,164	560
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	2,100
v/c ratio	0.70	0.55	0.27
Density, D_{MD} (pc/mi/ln)	25.7	20.4	9.8
LOS	C	C	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 SB
Agency or Company	Atkins	Junction	6010-Off to I-526 EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	450	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	2537	V_D =	veh/h
		Ramp Volume, V_R	369		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2537	0.90	Level	8	0	0.962	1.00	2932
Ramp	369	0.90	Level	3	0	0.985	1.00	416
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2932 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2932	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	2516	Exhibit 13-8	4500	No
V_R	416	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2932	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 25.4 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.335 (Exhibit 13-12)

S_R= 50.6 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.6 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 SB
Agency or Company	Atkins	Junction	6010-Off to I-526 EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	450
Freeway Volume, V_F	1952
Ramp Volume, V_R	297
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1952	0.90	Level	6	0	0.971	1.00	2234
Ramp	297	0.90	Level	3	0	0.985	1.00	335
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 1.000 using Equation (Exhibit 13-7)
V_{12} = 2234 pc/h
V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2234	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1899	Exhibit 13-8	4500	No
V_R	335	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2234	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 19.4 (pc/mi/ln)
LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.328 (Exhibit 13-12)
S_R= 50.7 mph (Exhibit 13-12)
S_0= N/A mph (Exhibit 13-12)
S = 50.7 mph (Exhibit 13-13)

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US 17 SB*
Agency or Company	*Atkins*	From/To	*6015-526 EB Off to 526 EB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2168*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*8*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1253*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*22.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 SB*
Agency or Company	*Atkins*	From/To	*6015-526 EB Off to 526 EB On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1655*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*947*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*17.2*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	US-17 SB
Weaving Segment Location	6020-I-526 EB On to Bowman Off
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	650ft
Freeway free-flow speed, FFS	45 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1709	0.90	8	0	1.5	1.2	0.962	1.00	1975
V_{RF}	932	0.90	16	0	1.5	1.2	0.926	1.00	1118
V_{FR}	459	0.90	11	0	1.5	1.2	0.948	1.00	538
V_{RR}	251	0.90	16	0	1.5	1.2	0.926	1.00	301
V_{NW}	2276							V =	3932
V_W	1656								
VR	0.421								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc
Interchange density, ID	0.3 int/mi
Minimum RF lane changes, LC_{RF}	1 lc/pc
Minimum FR lane changes, LC_{FR}	0 lc/pc
Minimum RR lane changes, LC_{RR}	lc/pc
Minimum weaving lane changes, LC_{MIN}	1118 lc/h
Weaving lane changes, LC_W	1262 lc/h
Non-weaving lane changes, LC_{NW}	51 lc/h
Total lane changes, LC_{ALL}	1313 lc/h
Non-weaving vehicle index, I_{NW}	44

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	3932 pc/h
Weaving segment capacity, c_w	7269 veh/h
Weaving segment v/c ratio	0.520
Weaving segment density, D	29.0 pc/mi/ln
Level of Service, LOS	C
Weaving intensity factor, W	0.394
Weaving segment speed, S	33.9 mph
Average weaving speed, S_W	36.5 mph
Average non-weaving speed, S_{NW}	32.2 mph
Maximum weaving length, L_{MAX}	5354 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	US-17 SB
Weaving Segment Location	6020-I-526 EB On to Bowman Off
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	650ft
Freeway free-flow speed, FFS	45 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1218	0.90	6	0	1.5	1.2	0.971	1.00	1394
V_{RF}	853	0.90	14	0	1.5	1.2	0.935	1.00	1014
V_{FR}	437	0.90	9	0	1.5	1.2	0.957	1.00	507
V_{RR}	306	0.90	14	0	1.5	1.2	0.935	1.00	364
V_{NW}	1758							V =	3279
V_W	1521								
VR	0.464								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc
Interchange density, ID	0.3 int/mi
Minimum RF lane changes, LC_{RF}	1 lc/pc
Minimum FR lane changes, LC_{FR}	0 lc/pc
Minimum RR lane changes, LC_{RR}	lc/pc
Minimum weaving lane changes, LC_{MIN}	1014 lc/h
Weaving lane changes, LC_W	1158 lc/h
Non-weaving lane changes, LC_{NW}	0 lc/h
Total lane changes, LC_{ALL}	1158 lc/h
Non-weaving vehicle index, I_{NW}	34

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	3279 pc/h
Weaving segment capacity, c_w	7196 veh/h
Weaving segment v/c ratio	0.442
Weaving segment density, D	23.3 pc/mi/ln
Level of Service, LOS	B
Weaving intensity factor, W	0.356
Weaving segment speed, S	35.2 mph
Average weaving speed, S_W	37.1 mph
Average non-weaving speed, S_{NW}	33.8 mph
Maximum weaving length, L_{MAX}	5841 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 SB*
Agency or Company	*Atkins*	From/To	*6025-Bowman Off to Bowman On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2641*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*8*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1526*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*27.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 SB*
Agency or Company	*Atkins*	From/To	*6025-Bowman Off to Bowman On*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2071*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*55.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*55.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1185*	pc/h/ln
S	*55.0*	mph
D = v_p / S	*21.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 SB
Agency or Company	Atkins	Junction	6030-SB On from Bowman
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 900	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2641	
	Ramp Volume, V_R: 722	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2641	0.90	Level	8	0	0.962	1.00	3052
Ramp	722	0.90	Level	2	0	0.990	1.00	810
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 3052 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3862	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3862	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 29.6 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.425 (Exibit 13-11)

S_R= 49.5 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 49.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 SB
Agency or Company	Atkins	Junction	6030-SB On from Bowman
Date Performed	4/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 900	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2071	
	Ramp Volume, V_R: 736	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2071	0.90	Level	6	0	0.971	1.00	2370
Ramp	736	0.90	Level	2	0	0.990	1.00	826
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2370 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3196	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3196	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 24.4 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.335 (Exibit 13-11)

S_R= 50.6 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 50.6 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 SB
Agency or Company	Atkins	Junction	6035-SB On from Wingo Way
Date Performed	4/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 875	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2578	
	Ramp Volume, V_R: 839	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2578	0.90	Level	6	0	0.971	1.00	2950
Ramp	839	0.90	Level	3	0	0.985	1.00	946
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2950 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3896	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3896	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 29.9 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.434 (Exibit 13-11)

S_R= 49.4 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 49.4 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 SB
Agency or Company	Atkins	Junction	6035-SB On from Wingo Way
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 875	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 2464	
	Ramp Volume, V_R: 855	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2464	0.90	Level	5	0	0.976	1.00	2806
Ramp	855	0.90	Level	2	0	0.990	1.00	960
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2806 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3766	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3766	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.9 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.411 (Exibit 13-11)

S_R= 49.7 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 49.7 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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MAJOR MERGE SEGMENTS ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US 17 SB
Analysis Year	2038 Build - Proposed Site	Junction	From SC-703
Analysis Time Period:	AM Peak	Segment ID	6040
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of On-Ramp	Freeway Downstream of On-Ramp	On-Ramp
Number of Lanes, N	2	4	2
Free-Flow Speed, FFS (mph)	55	55	40
Volume, V (veh/h)	3,417	4,877	1,460
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	5%	6%	7%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream of On-Ramp	Freeway Downstream of On-Ramp	On-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.97	0.97
Demand Flow Rate, v_p (pc/h/ln)	1,946	1,395	840
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,000
v/c ratio	0.86	0.62	0.42
	Below Capacity	Below Capacity	Below Capacity

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

MAJOR MERGE SEGMENTS ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US 17 SB
Analysis Year	2038 Build - Proposed Site	Junction	From SC-703
Analysis Time Period:	PM Peak	Segment ID	6040
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of On-Ramp	Freeway Downstream of On-Ramp	On-Ramp
Number of Lanes, N	2	4	2
Free-Flow Speed, FFS (mph)	55	55	40
Volume, V (veh/h)	3,319	4,621	1,302
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	5%	5%	7%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream of On-Ramp	Freeway Downstream of On-Ramp	On-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.98	0.97
Demand Flow Rate, v_p (pc/h/ln)	1,890	1,316	749
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,000
v/c ratio	0.84	0.58	0.37
	Below Capacity	Below Capacity	Below Capacity

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 SB*
Agency or Company	*Atkins*	From/To	*6045-SC-703 to E Bay*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*AM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4877*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*6*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*4*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1395*	pc/h/ln	Design LOS	
S	*55.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*25.4*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*AJR*	Highway/Direction of Travel	*US-17 SB*
Agency or Company	*Atkins*	From/To	*6045-SC-703 to E Bay*
Date Performed	*7/25/2014*	Jurisdiction	
Analysis Time Period	*PM Peak*	Analysis Year	*2038 Build - Proposed Site*

Project Description *Navy Base ICTF*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4621*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*5*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*4*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*55.0*	mph	FFS	*55.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1316*	pc/h/ln	Design LOS		
S	*55.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
D = v_p / S	*23.9*	pc/mi/ln	S		mph
LOS	*C*		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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F-5758

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 SB
Agency or Company	Atkins	Junction	6050-Off to Morrison
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	4
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	200
Freeway Volume, V_F	4877
Ramp Volume, V_R	707
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{down} = 885 ft

V_D = 496 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4877	0.90	Level	6	0	0.971	1.00	5581
Ramp	707	0.90	Level	8	0	0.962	1.00	817
UpStream								
DownStream	496	0.90	Level	9	0	0.957	1.00	576

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 2894 pc/h

V_3 or V_{av34} 1343 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5581	Exhibit 13-8	9000	No
$V_{FO} = V_F - V_R$	4764	Exhibit 13-8	9000	No
V_R	817	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2894	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 27.3 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.372 (Exhibit 13-12)

S_R= 50.2 mph (Exhibit 13-12)

S_0= 59.0 mph (Exhibit 13-12)

S = 54.1 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	US-17 SB
Agency or Company	Atkins	Junction	6050-Off to Morrison
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	4
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	200
Freeway Volume, V_F	4621
Ramp Volume, V_R	601
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{down} = 885 ft

V_D = 359 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4621	0.90	Level	5	0	0.976	1.00	5263
Ramp	601	0.90	Level	8	0	0.962	1.00	694
UpStream								
DownStream	359	0.90	Level	10	0	0.952	1.00	419

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 2686 pc/h

V_3 or V_{av34} 1288 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5263	Exhibit 13-8	9000	No
$V_{FO} = V_F - V_R$	4569	Exhibit 13-8	9000	No
V_R	694	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2686	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 25.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.360 (Exhibit 13-12)

S_R= 50.3 mph (Exhibit 13-12)

S_0= 59.2 mph (Exhibit 13-12)

S = 54.3 mph (Exhibit 13-13)

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FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US-17 SB
Analysis Year	2038 Build - Proposed Site	Junction	Off to Meeting
Analysis Time Period:	AM Peak	Segment ID	6060
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	4	3	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	4,170	3,674	496
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	6%	3%	9%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.99	0.96
Demand Flow Rate, v_p (pc/h/ln)	1,193	1,381	576
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,100
v/c ratio	0.53	0.61	0.27
Density, D_{MD} (pc/mi/ln)	20.9	24.2	10.1
LOS	C	C	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US-17 SB
Analysis Year	2038 Build - Proposed Site	Junction	Off to Meeting
Analysis Time Period:	PM Peak	Segment ID	6060
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	4	3	1
Free-Flow Speed, FFS (mph)	55	55	45
Volume, V (veh/h)	4,020	3,661	359
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	5%	3%	10%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.98	0.99	0.95
Demand Flow Rate, v_p (pc/h/ln)	1,145	1,376	419
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,100
v/c ratio	0.51	0.61	0.20
Density, D_{MD} (pc/mi/ln)	20.0	24.1	7.3
LOS	B	C	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US-17 SB
Analysis Year	2038 Build - Proposed Site	Junction	Off to I-26 WB
Analysis Time Period:	AM Peak	Segment ID	6070
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	3	2	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	3,674	2,432	1,242
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	3%	3%	8%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.99	0.99	0.96
Demand Flow Rate, v_p (pc/h/ln)	1,381	1,371	1,435
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,200
v/c ratio	0.61	0.61	0.65
Density, D_{MD} (pc/mi/ln)	24.2	24.0	25.1
LOS	C	C	C

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

FREEWAY RAMP ADD OR DROP LANE ANALYSIS

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	US-17 SB
Analysis Year	2038 Build - Proposed Site	Junction	Off to I-26 WB
Analysis Time Period:	PM Peak	Segment ID	6070
Project Description:	Navy Base ICTF		

Inputs

	Freeway Upstream of Ramp	Freeway Downstream of Ramp	Ramp
Number of Lanes, N	3	2	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	3,661	2,416	1,245
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	3%	3%	7%
%RVs, P_R	0%	0%	0%

Performance Measures

	Freeway Upstream Ramp	Freeway Downstream Ramp	Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.99	0.99	0.97
Demand Flow Rate, v_p (pc/h/ln)	1,376	1,362	1,432
Capacity Flow Rate, c (pc/h/ln)	2,250	2,250	2,200
v/c ratio	0.61	0.61	0.65
Density, D_{MD} (pc/mi/ln)	24.1	23.8	25.1
LOS	C	C	C

Formulas and Reference Material

$$f_{HV} = \frac{1}{1 + P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Basic Freeway Segments Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
75	2,400
70	2,400
65	2,350
60	2,300
55	2,250

Source: HCM 2010, Exhibit 11-17

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	152	2942	151	76	2512	59	0	0	155	0	0	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0			6.0			6.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.95	1.00			1.00			1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85			0.86			0.86
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00			1.00			1.00
Satd. Flow (prot)	1703	4893	1524	1703	3406	1524			1565			1580
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00			1.00			1.00
Satd. Flow (perm)	1703	4893	1524	1703	3406	1524			1565			1580
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	169	3269	168	84	2791	66	0	0	172	0	0	73
RTOR Reduction (vph)	0	0	19	0	0	10	0	0	16	0	0	50
Lane Group Flow (vph)	169	3269	149	84	2791	56	0	0	156	0	0	24
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	5%	5%	5%	4%	4%	4%
Turn Type	Prot	NA	Perm	Prot	NA	Perm			Over			Over
Protected Phases	5	2		1	6				1			5
Permitted Phases			2			6			1			5
Actuated Green, G (s)	18.0	145.4	145.4	22.6	150.0	150.0			22.6			18.0
Effective Green, g (s)	18.0	145.4	145.4	22.6	150.0	150.0			22.6			18.0
Actuated g/C Ratio	0.10	0.81	0.81	0.13	0.83	0.83			0.13			0.10
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0			6.0			6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0			3.0			3.0
Lane Grp Cap (vph)	170	3952	1231	213	2838	1270			196			158
v/s Ratio Prot	c0.10	0.67		0.05	c0.82				0.10			0.01
v/s Ratio Perm			0.10			0.04						
v/c Ratio	0.99	0.83	0.12	0.39	0.98	0.04			0.80			0.15
Uniform Delay, d1	80.9	10.0	3.7	72.4	13.9	2.6			76.5			74.0
Progression Factor	1.00	1.00	1.00	0.81	2.21	0.04			1.00			1.00
Incremental Delay, d2	67.0	2.1	0.2	0.3	5.6	0.0			19.8			0.4
Delay (s)	147.9	12.1	3.9	58.9	36.2	0.1			96.2			74.4
Level of Service	F	B	A	E	D	A			F			E
Approach Delay (s)		18.1			36.0			96.2			74.4	
Approach LOS		B			D			F			E	

Intersection Summary			
HCM 2000 Control Delay	28.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	122	3255	155	72	2398	40	0	0	155	0	0	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0			6.0			6.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.95	1.00			1.00			1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85			0.86			0.86
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00			1.00			1.00
Satd. Flow (prot)	1719	4940	1538	1719	3438	1538			1580			1580
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00			1.00			1.00
Satd. Flow (perm)	1719	4940	1538	1719	3438	1538			1580			1580
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	136	3617	172	80	2664	44	0	0	172	0	0	73
RTOR Reduction (vph)	0	0	20	0	0	7	0	0	16	0	0	16
Lane Group Flow (vph)	136	3617	152	80	2664	37	0	0	156	0	0	57
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	4%	4%	4%	4%	4%	4%
Turn Type	Prot	NA	Perm	Prot	NA	Perm			Over			Over
Protected Phases	5	2		1	6				1			5
Permitted Phases			2			6			1			5
Actuated Green, G (s)	17.0	147.5	147.5	20.5	151.0	151.0			20.5			17.0
Effective Green, g (s)	17.0	147.5	147.5	20.5	151.0	151.0			20.5			17.0
Actuated g/C Ratio	0.09	0.82	0.82	0.11	0.84	0.84			0.11			0.09
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0			6.0			6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0			3.0			3.0
Lane Grp Cap (vph)	162	4048	1260	195	2884	1290			179			149
v/s Ratio Prot	0.08	0.73		0.05	c0.77				c0.10			0.04
v/s Ratio Perm			0.10			0.02						
v/c Ratio	0.84	0.89	0.12	0.41	0.92	0.03			0.87			0.38
Uniform Delay, d1	80.2	11.0	3.3	74.1	10.4	2.4			78.5			76.6
Progression Factor	1.00	1.00	1.00	0.82	2.30	0.13			1.00			1.00
Incremental Delay, d2	29.9	3.5	0.2	0.6	3.0	0.0			34.1			1.6
Delay (s)	110.1	14.4	3.5	61.6	26.9	0.3			112.5			78.2
Level of Service	F	B	A	E	C	A			F			E
Approach Delay (s)		17.3			27.5			112.5			78.2	
Approach LOS		B			C			F			E	

Intersection Summary			
HCM 2000 Control Delay	24.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	83.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	486	2280	331	341	2395	136	168	261	169	70	289	84
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1792	1792	1792	1792	1792	1792	1863	1863	1863	1845	1845	1845
Adj Flow Rate, veh/h	540	2533	368	379	2661	151	187	290	188	78	321	93
Adj No. of Lanes	2	3	1	2	3	1	1	2	1	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	6	6	6	6	6	6	2	2	2	3	3	3
Cap, veh/h	515	2788	995	413	2637	897	188	433	391	168	312	383
Arrive On Green	0.31	1.00	1.00	0.12	0.54	0.54	0.08	0.12	0.12	0.05	0.09	0.09
Sat Flow, veh/h	3312	4893	1524	3312	4893	1524	1774	3539	1583	1757	3505	1568
Grp Volume(v), veh/h	540	2533	368	379	2661	151	187	290	188	78	321	93
Grp Sat Flow(s),veh/h/ln	1656	1631	1524	1656	1631	1524	1774	1770	1583	1757	1752	1568
Q Serve(g_s), s	28.0	0.0	0.0	20.4	97.0	8.1	15.0	14.1	18.3	7.2	16.0	8.6
Cycle Q Clear(g_c), s	28.0	0.0	0.0	20.4	97.0	8.1	15.0	14.1	18.3	7.2	16.0	8.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	515	2788	995	413	2637	897	188	433	391	168	312	383
V/C Ratio(X)	1.05	0.91	0.37	0.92	1.01	0.17	1.00	0.67	0.48	0.47	1.03	0.24
Avail Cap(c_a), veh/h	515	2788	995	423	2637	897	188	433	391	168	312	383
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.45	0.45	0.45	0.10	0.10	0.10	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	62.0	0.0	0.0	77.9	41.5	16.9	69.8	75.5	57.9	70.0	82.0	54.6
Incr Delay (d2), s/veh	40.3	2.7	0.5	3.6	7.9	0.0	64.3	4.0	0.9	2.0	59.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	15.6	0.7	0.1	9.5	45.4	3.4	5.3	7.2	8.1	3.6	10.3	3.8
LnGrp Delay(d),s/veh	102.3	2.7	0.5	81.5	49.4	16.9	134.1	79.5	58.8	72.0	141.0	54.9
LnGrp LOS	F	A	A	F	F	B	F	E	E	E	F	D
Approach Vol, veh/h		3441			3191			665			492	
Approach Delay, s/veh		18.1			51.7			89.0			113.8	
Approach LOS		B			D			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	28.5	108.5	21.0	22.0	34.0	103.0	15.0	28.0
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	23.0	102.0	15.0	16.0	28.0	97.0	9.0	22.0
Max Q Clear Time (g_c+I1), s	22.4	2.0	17.0	18.0	30.0	99.0	9.2	20.3
Green Ext Time (p_c), s	0.1	98.5	0.0	0.0	0.0	0.0	0.0	0.9

Intersection Summary	
HCM 2010 Ctrl Delay	44.0
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	450	2648	312	325	2102	137	217	269	314	130	234	191
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1810	1810	1810	1810	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	500	2942	347	361	2336	152	241	299	349	144	260	212
Adj No. of Lanes	2	3	1	2	3	1	1	2	1	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	5	5	5	2	2	2	2	2	2
Cap, veh/h	520	2827	1042	334	2552	897	243	452	361	195	315	387
Arrive On Green	0.31	1.00	1.00	0.10	0.52	0.52	0.11	0.13	0.13	0.07	0.09	0.09
Sat Flow, veh/h	3343	4940	1538	3343	4940	1538	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	500	2942	347	361	2336	152	241	299	349	144	260	212
Grp Sat Flow(s),veh/h/ln	1672	1647	1538	1672	1647	1538	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	26.5	0.0	0.0	18.0	78.0	8.2	19.0	14.5	23.0	12.0	13.0	16.0
Cycle Q Clear(g_c), s	26.5	0.0	0.0	18.0	78.0	8.2	19.0	14.5	23.0	12.0	13.0	16.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	520	2827	1042	334	2552	897	243	452	361	195	315	387
V/C Ratio(X)	0.96	1.04	0.33	1.08	0.92	0.17	0.99	0.66	0.97	0.74	0.83	0.55
Avail Cap(c_a), veh/h	520	2827	1042	334	2552	897	243	452	361	195	315	387
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.33	0.33	0.33	0.29	0.29	0.29	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	61.5	0.0	0.0	81.0	39.9	17.3	68.5	74.8	68.8	71.0	80.6	59.3
Incr Delay (d2), s/veh	14.5	22.7	0.3	50.8	2.1	0.1	55.9	3.6	38.7	13.7	16.4	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	13.3	5.9	0.1	10.7	36.0	3.5	6.5	7.3	21.1	1.9	7.1	9.4
LnGrp Delay(d),s/veh	76.0	22.7	0.3	131.8	42.0	17.5	124.4	78.3	107.6	84.7	97.0	60.9
LnGrp LOS	E	F	A	F	D	B	F	E	F	F	F	E
Approach Vol, veh/h		3789			2849			889			616	
Approach Delay, s/veh		27.6			52.1			102.3			81.7	
Approach LOS		C			D			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	24.0	109.0	25.0	22.0	34.0	99.0	18.0	29.0
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	18.0	103.0	19.0	16.0	28.0	93.0	12.0	23.0
Max Q Clear Time (g_c+I1), s	20.0	2.0	21.0	18.0	28.5	80.0	14.0	25.0
Green Ext Time (p_c), s	0.0	99.7	0.0	0.0	0.0	12.9	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	48.4
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	242	2102	175	218	2549	286	126	189	195	199	211	197
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1792	1792	1792	1792	1792	1792	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	269	2336	194	242	2832	318	140	210	217	221	234	219
Adj No. of Lanes	1	3	1	1	3	1	1	1	1	2	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	6	6	6	6	6	6	2	2	2	2	2	2
Cap, veh/h	239	2750	966	257	2746	956	128	228	377	229	217	369
Arrive On Green	0.12	0.56	0.56	0.23	1.00	1.00	0.07	0.12	0.12	0.07	0.12	0.12
Sat Flow, veh/h	1707	4893	1524	1707	4893	1524	1774	1863	1583	3442	1863	1583
Grp Volume(v), veh/h	269	2336	194	242	2832	318	140	210	217	221	234	219
Grp Sat Flow(s),veh/h/ln	1707	1631	1524	1707	1631	1524	1774	1863	1583	1721	1863	1583
Q Serve(g_s), s	21.0	72.0	9.6	18.6	101.0	0.0	13.0	20.1	21.8	11.5	21.0	21.0
Cycle Q Clear(g_c), s	21.0	72.0	9.6	18.6	101.0	0.0	13.0	20.1	21.8	11.5	21.0	21.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	239	2750	966	257	2746	956	128	228	377	229	217	369
V/C Ratio(X)	1.12	0.85	0.20	0.94	1.03	0.33	1.09	0.92	0.58	0.96	1.08	0.59
Avail Cap(c_a), veh/h	239	2750	966	297	2746	956	128	228	377	229	217	369
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.39	0.39	0.39	0.37	0.37	0.37	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	33.0	13.8	50.4	0.0	0.0	83.5	78.2	60.6	83.8	79.5	61.4
Incr Delay (d2), s/veh	75.6	1.4	0.2	17.6	19.9	0.4	106.5	39.0	2.1	48.9	82.9	2.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.9	32.8	4.1	13.0	5.1	0.1	10.2	12.8	9.8	7.1	15.8	9.9
LnGrp Delay(d),s/veh	143.7	34.4	14.0	68.1	19.9	0.4	190.0	117.1	62.7	132.7	162.4	63.9
LnGrp LOS	F	C	B	E	F	A	F	F	E	F	F	E
Approach Vol, veh/h		2799			3392			567			674	
Approach Delay, s/veh		43.5			21.5			114.3			120.7	
Approach LOS		D			C			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	26.8	107.2	19.0	27.0	27.0	107.0	18.0	28.0
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	25.0	97.0	13.0	21.0	21.0	101.0	12.0	22.0
Max Q Clear Time (g_c+I1), s	20.6	74.0	15.0	23.0	23.0	103.0	13.5	23.8
Green Ext Time (p_c), s	0.3	22.9	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	45.9
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	295	2674	123	224	2231	178	99	181	271	219	202	234
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1810	1810	1810	1810	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	328	2971	137	249	2479	198	110	201	301	243	224	260
Adj No. of Lanes	1	3	1	1	3	1	1	1	1	2	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	5	5	5	2	2	2	2	2	2
Cap, veh/h	326	2854	983	231	2607	923	108	197	343	249	217	440
Arrive On Green	0.16	0.58	0.58	0.15	0.70	0.70	0.06	0.11	0.11	0.07	0.12	0.12
Sat Flow, veh/h	1723	4940	1538	1723	4940	1538	1774	1863	1583	3442	1863	1583
Grp Volume(v), veh/h	328	2971	137	249	2479	198	110	201	301	243	224	260
Grp Sat Flow(s),veh/h/ln	1723	1647	1538	1723	1647	1538	1774	1863	1583	1721	1863	1583
Q Serve(g_s), s	29.0	104.0	6.4	20.0	81.0	7.1	11.0	19.0	19.0	12.7	21.0	21.0
Cycle Q Clear(g_c), s	29.0	104.0	6.4	20.0	81.0	7.1	11.0	19.0	19.0	12.7	21.0	21.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	326	2854	983	231	2607	923	108	197	343	249	217	440
V/C Ratio(X)	1.01	1.04	0.14	1.08	0.95	0.21	1.01	1.02	0.88	0.98	1.03	0.59
Avail Cap(c_a), veh/h	326	2854	983	231	2607	923	108	197	343	249	217	440
HCM Platoon Ratio	1.00	1.00	1.00	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.10	0.10	0.10	0.69	0.69	0.69	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	65.2	38.0	12.9	63.7	24.7	10.0	84.5	80.5	68.2	83.4	79.5	56.2
Incr Delay (d2), s/veh	17.3	19.9	0.0	70.9	7.0	0.4	90.4	70.1	21.8	50.6	69.3	2.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.1	0.0
%ile BackOfQ(50%),veh/ln	17.8	52.3	2.7	16.0	37.8	3.0	8.1	13.6	16.5	7.8	15.0	11.5
LnGrp Delay(d),s/veh	82.5	57.9	12.9	134.6	31.8	10.3	175.0	150.8	89.9	134.0	148.9	58.3
LnGrp LOS	F	F	B	F	C	B	F	F	F	F	F	E
Approach Vol, veh/h		3436			2926			612			727	
Approach Delay, s/veh		58.5			39.1			125.2			111.5	
Approach LOS		E			D			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	26.0	110.0	17.0	27.0	35.0	101.0	19.0	25.0
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	20.0	104.0	11.0	21.0	29.0	95.0	13.0	19.0
Max Q Clear Time (g_c+I1), s	22.0	106.0	13.0	23.0	31.0	83.0	14.7	21.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	12.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	61.4
HCM 2010 LOS	E

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	2374	122	136	2967	86	125
Number	2	12	1	6	3	18
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1792	1792	1792	1792	1845	1845
Adj Flow Rate, veh/h	2638	136	151	3297	96	139
Adj No. of Lanes	3	1	1	3	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	6	6	6	6	3	3
Cap, veh/h	2947	1070	268	3752	176	310
Arrive On Green	0.80	0.80	0.13	1.00	0.10	0.10
Sat Flow, veh/h	5055	1524	1707	5055	1757	1568
Grp Volume(v), veh/h	2638	136	151	3297	96	139
Grp Sat Flow(s),veh/h/ln	1631	1524	1707	1631	1757	1568
Q Serve(g_s), s	34.1	1.4	2.4	0.0	4.7	7.0
Cycle Q Clear(g_c), s	34.1	1.4	2.4	0.0	4.7	7.0
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	2947	1070	268	3752	176	310
V/C Ratio(X)	0.90	0.13	0.56	0.88	0.55	0.45
Avail Cap(c_a), veh/h	2947	1070	272	3752	176	310
HCM Platoon Ratio	1.33	1.33	1.33	1.33	1.00	1.00
Upstream Filter(I)	0.41	0.41	0.09	0.09	1.00	1.00
Uniform Delay (d), s/veh	7.0	2.1	19.2	0.0	38.6	31.8
Incr Delay (d2), s/veh	2.1	0.1	0.2	0.3	3.5	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	15.1	0.8	2.3	0.1	2.4	3.1
LnGrp Delay(d),s/veh	9.0	2.2	19.4	0.3	42.1	32.8
LnGrp LOS	A	A	B	A	D	C
Approach Vol, veh/h	2774			3448	235	
Approach Delay, s/veh	8.7			1.1	36.6	
Approach LOS	A			A	D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	14.8	60.2				75.0		15.0
Change Period (Y+Rc), s	6.0	6.0				6.0		6.0
Max Green Setting (Gmax), s	9.0	54.0				69.0		9.0
Max Q Clear Time (g_c+I1), s	4.4	36.1				2.0		9.0
Green Ext Time (p_c), s	0.1	17.9				66.6		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	5.7
HCM 2010 LOS	A

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	3055	109	135	2556	77	156
Number	2	12	1	6	3	18
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1810	1810	1845	1845
Adj Flow Rate, veh/h	3394	121	150	2840	86	173
Adj No. of Lanes	3	1	1	3	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	5	3	3
Cap, veh/h	3853	1302	167	4281	117	188
Arrive On Green	1.00	1.00	0.11	1.00	0.07	0.07
Sat Flow, veh/h	5103	1538	1723	5103	1757	1568
Grp Volume(v), veh/h	3394	121	150	2840	86	173
Grp Sat Flow(s),veh/h/ln	1647	1538	1723	1647	1757	1568
Q Serve(g_s), s	0.0	0.0	7.4	0.0	8.6	12.0
Cycle Q Clear(g_c), s	0.0	0.0	7.4	0.0	8.6	12.0
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	3853	1302	167	4281	117	188
V/C Ratio(X)	0.88	0.09	0.90	0.66	0.73	0.92
Avail Cap(c_a), veh/h	3853	1302	229	4281	117	188
HCM Platoon Ratio	2.00	2.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	0.09	0.09	0.23	0.23	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	47.0	0.0	82.4	78.3
Incr Delay (d2), s/veh	0.3	0.0	8.3	0.2	21.1	43.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	7.6	0.1	4.9	10.8
LnGrp Delay(d),s/veh	0.3	0.0	55.3	0.2	103.5	121.8
LnGrp LOS	A	A	E	A	F	F
Approach Vol, veh/h	3515			2990	259	
Approach Delay, s/veh	0.3			3.0	115.7	
Approach LOS	A			A	F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	15.6	146.4				162.0		18.0
Change Period (Y+Rc), s	6.0	6.0				6.0		6.0
Max Green Setting (Gmax), s	16.0	134.0				156.0		12.0
Max Q Clear Time (g_c+I1), s	9.4	2.0				2.0		14.0
Green Ext Time (p_c), s	0.2	130.5				151.9		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	5.9
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	288	2091	120	193	2753	417	157	94	181	250	107	193
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1792	1792	1792	1792	1792	1792	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	320	2323	133	214	3059	463	174	104	201	278	119	214
Adj No. of Lanes	1	3	1	1	3	1	2	1	1	2	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	6	6	6	6	6	6	2	2	2	2	2	2
Cap, veh/h	258	3027	1078	234	2746	990	315	166	252	315	166	343
Arrive On Green	0.26	1.00	1.00	0.07	0.56	0.56	0.09	0.09	0.09	0.09	0.09	0.09
Sat Flow, veh/h	1707	4893	1524	1707	4893	1524	3548	1863	1583	3548	1863	1583
Grp Volume(v), veh/h	320	2323	133	214	3059	463	174	104	201	278	119	214
Grp Sat Flow(s),veh/h/ln	1707	1631	1524	1707	1631	1524	1774	1863	1583	1774	1863	1583
Q Serve(g_s), s	23.0	0.0	0.0	10.3	101.0	27.5	8.5	9.7	16.0	13.9	11.2	16.0
Cycle Q Clear(g_c), s	23.0	0.0	0.0	10.3	101.0	27.5	8.5	9.7	16.0	13.9	11.2	16.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	258	3027	1078	234	2746	990	315	166	252	315	166	343
V/C Ratio(X)	1.24	0.77	0.12	0.92	1.11	0.47	0.55	0.63	0.80	0.88	0.72	0.62
Avail Cap(c_a), veh/h	258	3027	1078	322	2746	990	315	166	252	315	166	343
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.37	0.37	0.37	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	56.9	0.0	0.0	27.2	39.5	15.8	78.6	79.1	72.9	81.1	79.8	63.9
Incr Delay (d2), s/veh	119.9	0.7	0.1	24.1	57.1	1.6	2.1	7.3	16.3	23.9	14.0	3.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.4	0.2	0.0	12.0	59.8	15.0	4.2	5.3	10.8	7.9	6.4	10.0
LnGrp Delay(d),s/veh	176.8	0.7	0.1	51.3	96.6	17.4	80.6	86.5	89.1	104.9	93.8	67.4
LnGrp LOS	F	A	A	D	F	B	F	F	F	F	F	E
Approach Vol, veh/h		2776			3736			479			611	
Approach Delay, s/veh		21.0			84.2			85.5			89.6	
Approach LOS		C			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	18.7	117.3		22.0	29.0	107.0		22.0
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s	22.0	102.0		16.0	23.0	101.0		16.0
Max Q Clear Time (g_c+I1), s	12.3	2.0		18.0	25.0	103.0		18.0
Green Ext Time (p_c), s	0.4	99.0		0.0	0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	61.6
HCM 2010 LOS	E

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	255	2829	127	201	2340	266	127	98	192	353	172	224
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1810	1810	1810	1810	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	283	3143	141	223	2600	296	141	109	213	392	191	249
Adj No. of Lanes	1	3	1	1	3	1	2	1	1	2	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	5	5	5	2	2	2	2	2	2
Cap, veh/h	271	2854	1025	193	2635	991	315	166	281	394	207	387
Arrive On Green	0.18	0.77	0.77	0.09	0.53	0.53	0.09	0.09	0.09	0.11	0.11	0.11
Sat Flow, veh/h	1723	4940	1538	1723	4940	1538	3548	1863	1583	3548	1863	1583
Grp Volume(v), veh/h	283	3143	141	223	2600	296	141	109	213	392	191	249
Grp Sat Flow(s),veh/h/ln	1723	1647	1538	1723	1647	1538	1774	1863	1583	1774	1863	1583
Q Serve(g_s), s	24.0	104.0	3.4	16.0	93.3	15.3	6.8	10.2	16.0	19.9	18.3	20.0
Cycle Q Clear(g_c), s	24.0	104.0	3.4	16.0	93.3	15.3	6.8	10.2	16.0	19.9	18.3	20.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	271	2854	1025	193	2635	991	315	166	281	394	207	387
V/C Ratio(X)	1.04	1.10	0.14	1.15	0.99	0.30	0.45	0.66	0.76	0.99	0.92	0.64
Avail Cap(c_a), veh/h	271	2854	1025	193	2635	991	315	166	281	394	207	387
HCM Platoon Ratio	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.32	0.32	0.32	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	63.4	20.8	5.8	66.3	41.4	14.1	77.8	79.4	70.3	79.9	79.2	61.0
Incr Delay (d2), s/veh	43.0	47.6	0.1	112.5	14.7	0.8	1.0	9.2	11.2	43.7	41.6	3.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.7	58.7	1.9	15.6	46.0	8.7	3.4	5.7	10.9	12.1	11.8	11.5
LnGrp Delay(d),s/veh	106.4	68.5	5.9	178.7	56.1	14.9	78.8	88.5	81.5	123.7	120.8	64.6
LnGrp LOS	F	F	A	F	E	B	E	F	F	F	F	E
Approach Vol, veh/h		3567			3119			463			832	
Approach Delay, s/veh		69.0			60.9			82.3			105.3	
Approach LOS		E			E			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	22.0	110.0		26.0	30.0	102.0		22.0
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s	16.0	104.0		20.0	24.0	96.0		16.0
Max Q Clear Time (g_c+I1), s	18.0	106.0		22.0	26.0	95.3		18.0
Green Ext Time (p_c), s	0.0	0.0		0.0	0.0	0.7		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	70.4
HCM 2010 LOS	E

Notes

User approved volume balancing among the lanes for turning movement.

Appendix E
Traffic Analysis Worksheets

2038 Design Year

Build Proposed Project Alternative 2

North Charleston Intersections

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	147	0	0	0	0	0	1861	408
Number				7	4	14				5	2	12
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				0	1827	0				0	1810	1810
Adj Flow Rate, veh/h				0	163	0				0	2068	453
Adj No. of Lanes				0	2	0				0	3	1
Peak Hour Factor				0.90	0.90	0.90				0.90	0.90	0.90
Percent Heavy Veh, %				0	4	0				0	5	5
Cap, veh/h				0	449	0				0	3405	1060
Arrive On Green				0.00	0.13	0.00				0.00	0.69	0.69
Sat Flow, veh/h				0	3654	0				0	5103	1538
Grp Volume(v), veh/h				0	163	0				0	2068	453
Grp Sat Flow(s),veh/h/ln				0	1736	0				0	1647	1538
Q Serve(g_s), s				0.0	2.8	0.0				0.0	14.8	8.6
Cycle Q Clear(g_c), s				0.0	2.8	0.0				0.0	14.8	8.6
Prop In Lane				0.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				0	449	0				0	3405	1060
V/C Ratio(X)				0.00	0.36	0.00				0.00	0.61	0.43
Avail Cap(c_a), veh/h				0	682	0				0	4855	1512
HCM Platoon Ratio				1.00	1.00	1.00				1.00	1.00	1.00
Upstream Filter(I)				0.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				0.0	26.3	0.0				0.0	5.5	4.5
Incr Delay (d2), s/veh				0.0	0.5	0.0				0.0	0.2	0.3
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				0.0	1.4	0.0				0.0	6.6	3.6
LnGrp Delay(d),s/veh				0.0	26.8	0.0				0.0	5.7	4.8
LnGrp LOS					C						A	A
Approach Vol, veh/h					163						2521	
Approach Delay, s/veh					26.8						5.5	
Approach LOS					C						A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		51.6		14.5				
Change Period (Y+Rc), s		6.0		6.0				
Max Green Setting (Gmax), s		65.0		13.0				
Max Q Clear Time (g_c+I1), s		16.8		4.8				
Green Ext Time (p_c), s		28.8		0.5				

Intersection Summary	
HCM 2010 Ctrl Delay	6.8
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	219	0	0	0	0	0	1156	287
Number				7	4	14				5	2	12
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				0	1827	0				0	1827	1827
Adj Flow Rate, veh/h				0	243	0				0	1284	319
Adj No. of Lanes				0	2	0				0	3	1
Peak Hour Factor				0.90	0.90	0.90				0.90	0.90	0.90
Percent Heavy Veh, %				0	4	0				0	4	4
Cap, veh/h				0	687	0				0	2609	812
Arrive On Green				0.00	0.20	0.00				0.00	0.52	0.52
Sat Flow, veh/h				0	3654	0				0	5152	1553
Grp Volume(v), veh/h				0	243	0				0	1284	319
Grp Sat Flow(s),veh/h/ln				0	1736	0				0	1663	1553
Q Serve(g_s), s				0.0	2.6	0.0				0.0	7.1	5.3
Cycle Q Clear(g_c), s				0.0	2.6	0.0				0.0	7.1	5.3
Prop In Lane				0.00		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				0	687	0				0	2609	812
V/C Ratio(X)				0.00	0.35	0.00				0.00	0.49	0.39
Avail Cap(c_a), veh/h				0	1776	0				0	6496	2023
HCM Platoon Ratio				1.00	1.00	1.00				1.00	1.00	1.00
Upstream Filter(I)				0.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				0.0	14.9	0.0				0.0	6.6	6.2
Incr Delay (d2), s/veh				0.0	0.3	0.0				0.0	0.1	0.3
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				0.0	1.3	0.0				0.0	3.2	2.3
LnGrp Delay(d),s/veh				0.0	15.2	0.0				0.0	6.7	6.5
LnGrp LOS					B						A	A
Approach Vol, veh/h					243						1603	
Approach Delay, s/veh					15.2						6.7	
Approach LOS					B						A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		28.5		14.5				
Change Period (Y+Rc), s		6.0		6.0				
Max Green Setting (Gmax), s		56.0		22.0				
Max Q Clear Time (g_c+I1), s		9.1		4.6				
Green Ext Time (p_c), s		13.4		1.3				

Intersection Summary	
HCM 2010 Ctrl Delay	7.8
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	440	0	0	0	0	0	925	144	0	0	0
Number	3	8	18				1	6	16			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	0	1827	0				0	1810	1810			
Adj Flow Rate, veh/h	0	489	0				0	1028	160			
Adj No. of Lanes	0	2	0				0	3	1			
Peak Hour Factor	0.90	0.90	0.90				0.90	0.90	0.90			
Percent Heavy Veh, %	0	4	0				0	5	5			
Cap, veh/h	0	880	0				0	2108	656			
Arrive On Green	0.00	0.25	0.00				0.00	0.43	0.43			
Sat Flow, veh/h	0	3654	0				0	5103	1538			
Grp Volume(v), veh/h	0	489	0				0	1028	160			
Grp Sat Flow(s),veh/h/ln	0	1736	0				0	1647	1538			
Q Serve(g_s), s	0.0	4.6	0.0				0.0	5.7	2.5			
Cycle Q Clear(g_c), s	0.0	4.6	0.0				0.0	5.7	2.5			
Prop In Lane	0.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	0	880	0				0	2108	656			
V/C Ratio(X)	0.00	0.56	0.00				0.00	0.49	0.24			
Avail Cap(c_a), veh/h	0	2314	0				0	4347	1353			
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00			
Upstream Filter(I)	0.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	0.0	12.2	0.0				0.0	7.8	6.9			
Incr Delay (d2), s/veh	0.0	0.6	0.0				0.0	0.2	0.2			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	0.0	2.2	0.0				0.0	2.6	1.1			
LnGrp Delay(d),s/veh	0.0	12.7	0.0				0.0	8.0	7.1			
LnGrp LOS		B						A	A			
Approach Vol, veh/h		489						1188				
Approach Delay, s/veh		12.7						7.8				
Approach LOS		B						A				

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						22.0		15.5
Change Period (Y+Rc), s						6.0		6.0
Max Green Setting (Gmax), s						33.0		25.0
Max Q Clear Time (g_c+I1), s						7.7		6.6
Green Ext Time (p_c), s						7.9		3.0

Intersection Summary	
HCM 2010 Ctrl Delay	9.3
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	309	0	0	0	0	0	1603	218	0	0	0
Number	3	8	18				1	6	16			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	0	1827	0				0	1827	1827			
Adj Flow Rate, veh/h	0	343	0				0	1781	242			
Adj No. of Lanes	0	2	0				0	3	1			
Peak Hour Factor	0.90	0.90	0.90				0.90	0.90	0.90			
Percent Heavy Veh, %	0	4	0				0	4	4			
Cap, veh/h	0	608	0				0	2939	915			
Arrive On Green	0.00	0.18	0.00				0.00	0.59	0.59			
Sat Flow, veh/h	0	3654	0				0	5152	1553			
Grp Volume(v), veh/h	0	343	0				0	1781	242			
Grp Sat Flow(s),veh/h/ln	0	1736	0				0	1663	1553			
Q Serve(g_s), s	0.0	4.6	0.0				0.0	11.6	3.9			
Cycle Q Clear(g_c), s	0.0	4.6	0.0				0.0	11.6	3.9			
Prop In Lane	0.00		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	0	608	0				0	2939	915			
V/C Ratio(X)	0.00	0.56	0.00				0.00	0.61	0.26			
Avail Cap(c_a), veh/h	0	1090	0				0	4112	1280			
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00			
Upstream Filter(I)	0.00	1.00	0.00				0.00	1.00	1.00			
Uniform Delay (d), s/veh	0.0	19.2	0.0				0.0	6.7	5.1			
Incr Delay (d2), s/veh	0.0	0.8	0.0				0.0	0.2	0.2			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	0.0	2.3	0.0				0.0	5.3	1.7			
LnGrp Delay(d),s/veh	0.0	20.0	0.0				0.0	6.9	5.2			
LnGrp LOS		C						A	A			
Approach Vol, veh/h		343						2023				
Approach Delay, s/veh		20.0						6.7				
Approach LOS		C						A				

Timer	1	2	3	4	5	6	7	8
Assigned Phs						6		8
Phs Duration (G+Y+Rc), s						36.0		14.9
Change Period (Y+Rc), s						6.0		6.0
Max Green Setting (Gmax), s						42.0		16.0
Max Q Clear Time (g_c+I1), s						13.6		6.6
Green Ext Time (p_c), s						16.4		1.4

Intersection Summary	
HCM 2010 Ctrl Delay	8.6
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	147	55	0	0	0	51	0	0	0	1607	426
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1863	1863	0	1863	0	1792	0	0	0	1810	1810
Adj Flow Rate, veh/h	0	163	61	0	0	0	57	0	0	0	1786	473
Adj No. of Lanes	0	1	1	0	1	0	1	0	0	0	3	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	2	2	0	2	0	6	0	0	0	5	5
Cap, veh/h	0	217	185	0	217	0	113	0	0	0	3521	1096
Arrive On Green	0.00	0.12	0.12	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.71	0.71
Sat Flow, veh/h	0	1863	1583	0	1863	0	1707	57		0	5103	1538
Grp Volume(v), veh/h	0	163	61	0	0	0	57	54.9		0	1786	473
Grp Sat Flow(s),veh/h/ln	0	1863	1583	0	1863	0	1707	D		0	1647	1538
Q Serve(g_s), s	0.0	9.6	4.0	0.0	0.0	0.0	3.7			0.0	18.5	14.5
Cycle Q Clear(g_c), s	0.0	9.6	4.0	0.0	0.0	0.0	3.7			0.0	18.5	14.5
Prop In Lane	0.00		1.00	0.00		0.00	1.00			0.00		1.00
Lane Grp Cap(c), veh/h	0	217	185	0	217	0	113			0	3521	1096
V/C Ratio(X)	0.00	0.75	0.33	0.00	0.00	0.00	0.51			0.00	0.51	0.43
Avail Cap(c_a), veh/h	0	360	306	0	360	0	165			0	3521	1096
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.00	0.00	0.00	1.00			0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	48.7	46.2	0.0	0.0	0.0	51.4			0.0	7.4	6.8
Incr Delay (d2), s/veh	0.0	5.1	1.0	0.0	0.0	0.0	3.5			0.0	0.5	1.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	5.3	1.8	0.0	0.0	0.0	1.9			0.0	8.4	6.4
LnGrp Delay(d),s/veh	0.0	53.8	47.2	0.0	0.0	0.0	54.9			0.0	7.9	8.0
LnGrp LOS		D	D				D				A	A
Approach Vol, veh/h		224			0						2259	
Approach Delay, s/veh		52.0			0.0						7.9	
Approach LOS		D									A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4				8
Phs Duration (G+Y+Rc), s	13.5	87.2		19.3				19.3
Change Period (Y+Rc), s	6.0	6.0		6.0				6.0
Max Green Setting (Gmax), s	11.0	69.0		22.0				22.0
Max Q Clear Time (g_c+I1), s	5.7	20.5		12.6				0.0
Green Ext Time (p_c), s	0.0	23.7		0.7				0.0

Intersection Summary	
HCM 2010 Ctrl Delay	12.9
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	340	65	0	0	0	57	0	0	0	978	219
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1863	1863	0	1863	0	1810	0	0	0	1827	1827
Adj Flow Rate, veh/h	0	378	72	0	0	0	63	0	0	0	1087	243
Adj No. of Lanes	0	1	1	0	1	0	1	0	0	0	3	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	2	2	0	2	0	5	0	0	0	4	4
Cap, veh/h	0	452	384	0	452	0	122	0	0	0	3128	974
Arrive On Green	0.00	0.24	0.24	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.63	0.63
Sat Flow, veh/h	0	1863	1583	0	1863	0	1723	63		0	5152	1553
Grp Volume(v), veh/h	0	378	72	0	0	0	63	52.0		0	1087	243
Grp Sat Flow(s),veh/h/ln	0	1863	1583	0	1863	0	1723	D		0	1663	1553
Q Serve(g_s), s	0.0	20.9	3.9	0.0	0.0	0.0	3.8			0.0	11.3	7.5
Cycle Q Clear(g_c), s	0.0	20.9	3.9	0.0	0.0	0.0	3.8			0.0	11.3	7.5
Prop In Lane	0.00		1.00	0.00		0.00	1.00			0.00		1.00
Lane Grp Cap(c), veh/h	0	452	384	0	452	0	122			0	3128	974
V/C Ratio(X)	0.00	0.84	0.19	0.00	0.00	0.00	0.52			0.00	0.35	0.25
Avail Cap(c_a), veh/h	0	773	657	0	773	0	191			0	3128	974
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.00	0.00	0.00	1.00			0.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	39.0	32.6	0.0	0.0	0.0	48.6			0.0	9.6	8.9
Incr Delay (d2), s/veh	0.0	4.2	0.2	0.0	0.0	0.0	3.4			0.0	0.3	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	11.2	1.7	0.0	0.0	0.0	1.9			0.0	5.2	3.3
LnGrp Delay(d),s/veh	0.0	43.2	32.8	0.0	0.0	0.0	52.0			0.0	10.0	9.6
LnGrp LOS		D	C				D				A	A
Approach Vol, veh/h		450			0						1330	
Approach Delay, s/veh		41.5			0.0						9.9	
Approach LOS		D									A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4				8
Phs Duration (G+Y+Rc), s	13.7	74.0		32.3				32.3
Change Period (Y+Rc), s	6.0	6.0		6.0				6.0
Max Green Setting (Gmax), s	12.0	45.0		45.0				45.0
Max Q Clear Time (g_c+I1), s	5.8	13.3		23.9				0.0
Green Ext Time (p_c), s	0.0	9.4		2.4				0.0

Intersection Summary	
HCM 2010 Ctrl Delay	19.1
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	22	309	0	585	95	136	0	0
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1863	0	0	1863	1863	0	1759	1900	1792	0	0
Adj Flow Rate, veh/h	0	0	0	0	24	343	0	650	106	151	0	0
Adj No. of Lanes	0	1	0	0	1	1	0	3	0	1	0	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	2	0	0	2	2	0	8	8	6	0	0
Cap, veh/h	0	245	0	0	245	1046	0	2208	356	192	0	0
Arrive On Green	0.00	0.00	0.00	0.00	0.13	0.13	0.00	0.53	0.53	0.11	0.00	0.00
Sat Flow, veh/h	0	1863	0	0	1863	1583	0	4329	672	1707	151	
Grp Volume(v), veh/h	0	0	0	0	24	343	0	497	259	151	41.3	
Grp Sat Flow(s),veh/h/ln	0	1863	0	0	1863	1583	0	1601	1641	1707	D	
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.9	7.4	0.0	6.9	7.0	6.8		
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	0.9	7.4	0.0	6.9	7.0	6.8		
Prop In Lane	0.00		0.00	0.00		1.00	0.00		0.41	1.00		
Lane Grp Cap(c), veh/h	0	245	0	0	245	1046	0	1695	869	192		
V/C Ratio(X)	0.00	0.00	0.00	0.00	0.10	0.33	0.00	0.29	0.30	0.79		
Avail Cap(c_a), veh/h	0	446	0	0	446	1217	0	1695	869	882		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	0.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	30.3	5.8	0.0	10.4	10.4	34.3		
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.4	0.9	7.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.0	0.5	7.5	0.0	3.1	3.4	3.6		
LnGrp Delay(d),s/veh	0.0	0.0	0.0	0.0	30.5	6.0	0.0	10.8	11.3	41.3		
LnGrp LOS					C	A		B	B	D		
Approach Vol, veh/h		0			367			756				
Approach Delay, s/veh		0.0			7.6			11.0				
Approach LOS					A			B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4	5	6		8
Phs Duration (G+Y+Rc), s				16.4	14.9	48.0		16.4
Change Period (Y+Rc), s				6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s				19.0	41.0	42.0		19.0
Max Q Clear Time (g_c+I1), s				0.0	8.8	9.0		9.4
Green Ext Time (p_c), s				0.0	0.4	5.0		1.0

Intersection Summary	
HCM 2010 Ctrl Delay	13.6
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	4	378	0	1155	122	80	0	0
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1863	0	0	1863	1863	0	1792	1900	1810	0	0
Adj Flow Rate, veh/h	0	0	0	0	4	420	0	1283	136	89	0	0
Adj No. of Lanes	0	1	0	0	1	1	0	3	0	1	0	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	2	0	0	2	2	0	6	6	5	0	0
Cap, veh/h	0	253	0	0	253	1121	0	2572	273	155	0	0
Arrive On Green	0.00	0.00	0.00	0.00	0.14	0.14	0.00	0.57	0.57	0.09	0.00	0.00
Sat Flow, veh/h	0	1863	0	0	1863	1583	0	4656	476	1723	89	
Grp Volume(v), veh/h	0	0	0	0	4	420	0	931	488	89	42.3	
Grp Sat Flow(s),veh/h/ln	0	1863	0	0	1863	1583	0	1631	1708	1723	D	
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.2	9.4	0.0	15.2	15.2	4.4		
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	0.2	9.4	0.0	15.2	15.2	4.4		
Prop In Lane	0.00		0.00	0.00		1.00	0.00		0.28	1.00		
Lane Grp Cap(c), veh/h	0	253	0	0	253	1121	0	1867	978	155		
V/C Ratio(X)	0.00	0.00	0.00	0.00	0.02	0.37	0.00	0.50	0.50	0.57		
Avail Cap(c_a), veh/h	0	334	0	0	334	1190	0	1867	978	677		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	0.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	33.3	5.2	0.0	11.4	11.4	38.9		
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.2	0.0	1.0	1.8	3.3		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.0	0.1	10.3	0.0	7.1	7.7	2.2		
LnGrp Delay(d),s/veh	0.0	0.0	0.0	0.0	33.4	5.4	0.0	12.4	13.2	42.3		
LnGrp LOS					C	A		B	B	D		
Approach Vol, veh/h		0			424			1419				
Approach Delay, s/veh		0.0			5.6			12.7				
Approach LOS					A			B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4	5	6		8
Phs Duration (G+Y+Rc), s				18.1	14.0	57.0		18.1
Change Period (Y+Rc), s				6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s				16.0	35.0	51.0		16.0
Max Q Clear Time (g_c+I1), s				0.0	6.4	17.2		11.4
Green Ext Time (p_c), s				0.0	0.2	11.4		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	12.5
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	268	69	0	675	92	131	0	0
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1863	0	0	1776	1776	0	1759	1759	1759	0	0
Adj Flow Rate, veh/h	0	0	0	0	298	77	0	750	102	146	0	0
Adj No. of Lanes	0	1	0	0	1	1	0	3	1	1	0	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	2	0	0	7	7	0	8	8	8	0	0
Cap, veh/h	0	394	0	0	376	1002	0	2173	677	184	0	0
Arrive On Green	0.00	0.00	0.00	0.00	0.21	0.21	0.00	0.45	0.45	0.11	0.00	0.00
Sat Flow, veh/h	0	1863	0	0	1776	1509	0	4961	1495	1675	146	
Grp Volume(v), veh/h	0	0	0	0	298	77	0	750	102	146	42.1	
Grp Sat Flow(s),veh/h/ln	0	1863	0	0	1776	1509	0	1601	1495	1675	D	
Q Serve(g_s), s	0.0	0.0	0.0	0.0	12.6	1.4	0.0	8.1	3.2	6.8		
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	12.6	1.4	0.0	8.1	3.2	6.8		
Prop In Lane	0.00		0.00	0.00		1.00	0.00		1.00	1.00		
Lane Grp Cap(c), veh/h	0	394	0	0	376	1002	0	2173	677	184		
V/C Ratio(X)	0.00	0.00	0.00	0.00	0.79	0.08	0.00	0.35	0.15	0.79		
Avail Cap(c_a), veh/h	0	960	0	0	915	1461	0	2173	677	526		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	0.00	0.00	0.00	0.00	0.97	0.97	0.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	29.7	4.7	0.0	14.1	12.8	34.5		
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	3.7	0.0	0.0	0.4	0.5	7.6		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.0	6.6	1.4	0.0	3.6	1.4	3.5		
LnGrp Delay(d),s/veh	0.0	0.0	0.0	0.0	33.4	4.8	0.0	14.6	13.3	42.1		
LnGrp LOS					C	A		B	B	D		
Approach Vol, veh/h		0			375			852				
Approach Delay, s/veh		0.0			27.5			14.4				
Approach LOS					C			B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4	5	6		8
Phs Duration (G+Y+Rc), s				22.8	14.7	42.0		22.8
Change Period (Y+Rc), s				6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s				41.0	25.0	36.0		41.0
Max Q Clear Time (g_c+I1), s				0.0	8.8	10.1		14.6
Green Ext Time (p_c), s				0.0	0.3	5.4		2.2

Intersection Summary	
HCM 2010 Ctrl Delay	20.9
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	187	110	0	1148	156	95	0	0
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1863	0	0	1827	1827	0	1776	1776	1792	0	0
Adj Flow Rate, veh/h	0	0	0	0	208	122	0	1276	173	106	0	0
Adj No. of Lanes	0	1	0	0	1	1	0	3	1	1	0	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	2	0	0	4	4	0	7	7	6	0	0
Cap, veh/h	0	273	0	0	268	1117	0	2777	865	153	0	0
Arrive On Green	0.00	0.00	0.00	0.00	0.15	0.15	0.00	0.57	0.57	0.09	0.00	0.00
Sat Flow, veh/h	0	1863	0	0	1827	1553	0	5007	1509	1707	106	
Grp Volume(v), veh/h	0	0	0	0	208	122	0	1276	173	106	47.2	
Grp Sat Flow(s),veh/h/ln	0	1863	0	0	1827	1553	0	1616	1509	1707	D	
Q Serve(g_s), s	0.0	0.0	0.0	0.0	10.3	2.3	0.0	14.4	5.2	5.7		
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	10.3	2.3	0.0	14.4	5.2	5.7		
Prop In Lane	0.00		0.00	0.00		1.00	0.00		1.00	1.00		
Lane Grp Cap(c), veh/h	0	273	0	0	268	1117	0	2777	865	153		
V/C Ratio(X)	0.00	0.00	0.00	0.00	0.78	0.11	0.00	0.46	0.20	0.69		
Avail Cap(c_a), veh/h	0	573	0	0	562	1367	0	2777	865	344		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	0.00	0.00	0.00	0.00	0.94	0.94	0.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	38.7	4.0	0.0	11.7	9.7	41.7		
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.5	0.5	5.5		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.0	5.5	3.0	0.0	6.5	2.3	2.9		
LnGrp Delay(d),s/veh	0.0	0.0	0.0	0.0	43.3	4.1	0.0	12.2	10.2	47.2		
LnGrp LOS					D	A		B	B	D		
Approach Vol, veh/h		0			330			1449				
Approach Delay, s/veh		0.0			28.8			12.0				
Approach LOS					C			B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4	5	6		8
Phs Duration (G+Y+Rc), s				19.8	14.4	60.0		19.8
Change Period (Y+Rc), s				6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s				29.0	19.0	54.0		29.0
Max Q Clear Time (g_c+I1), s				0.0	7.7	16.4		12.3
Green Ext Time (p_c), s				0.0	0.2	11.7		1.5

Intersection Summary	
HCM 2010 Ctrl Delay	16.9
HCM 2010 LOS	B

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	70	17	47	723	1215	139
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1557	1557	1792	1792	1759	1759
Adj Flow Rate, veh/h	78	19	52	803	1350	154
Adj No. of Lanes	2	1	1	3	3	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	22	22	6	6	8	8
Cap, veh/h	351	161	316	3413	3350	1043
Arrive On Green	0.12	0.12	1.00	1.00	0.70	0.70
Sat Flow, veh/h	2877	1324	334	5055	4961	1495
Grp Volume(v), veh/h	78	19	52	803	1350	154
Grp Sat Flow(s),veh/h/ln	1439	1324	334	1631	1601	1495
Q Serve(g_s), s	1.4	0.7	2.0	0.0	6.9	2.0
Cycle Q Clear(g_c), s	1.4	0.7	8.9	0.0	6.9	2.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	351	161	316	3413	3350	1043
V/C Ratio(X)	0.22	0.12	0.16	0.24	0.40	0.15
Avail Cap(c_a), veh/h	491	226	316	3413	3350	1043
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.89	0.89	1.00	1.00
Uniform Delay (d), s/veh	23.2	22.9	0.8	0.0	3.7	3.0
Incr Delay (d2), s/veh	0.3	0.3	1.0	0.1	0.4	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.3	0.3	0.0	3.1	0.9
LnGrp Delay(d),s/veh	23.5	23.2	1.8	0.1	4.1	3.3
LnGrp LOS	C	C	A	A	A	A
Approach Vol, veh/h	97			855	1504	
Approach Delay, s/veh	23.5			0.2	4.0	
Approach LOS	C			A	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		46.9				46.9		13.1
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		38.0				38.0		10.0
Max Q Clear Time (g_c+I1), s		8.9				10.9		3.4
Green Ext Time (p_c), s		19.8				18.8		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	3.5
HCM 2010 LOS	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	133	50	30	1228	791	88
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1624	1624	1810	1810	1776	1776
Adj Flow Rate, veh/h	148	56	33	1364	879	98
Adj No. of Lanes	2	1	1	3	3	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	17	17	5	5	7	7
Cap, veh/h	446	205	459	3331	3268	1018
Arrive On Green	0.15	0.15	1.00	1.00	0.67	0.67
Sat Flow, veh/h	3000	1380	557	5103	5007	1509
Grp Volume(v), veh/h	148	56	33	1364	879	98
Grp Sat Flow(s),veh/h/ln	1500	1380	557	1647	1616	1509
Q Serve(g_s), s	2.6	2.1	0.4	0.0	4.2	1.3
Cycle Q Clear(g_c), s	2.6	2.1	4.6	0.0	4.2	1.3
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	446	205	459	3331	3268	1018
V/C Ratio(X)	0.33	0.27	0.07	0.41	0.27	0.10
Avail Cap(c_a), veh/h	617	284	459	3331	3268	1018
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.79	0.79	1.00	1.00
Uniform Delay (d), s/veh	22.2	22.0	0.2	0.0	3.8	3.3
Incr Delay (d2), s/veh	0.4	0.7	0.2	0.3	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.8	0.1	0.1	1.9	0.6
LnGrp Delay(d),s/veh	22.7	22.7	0.5	0.3	4.0	3.5
LnGrp LOS	C	C	A	A	A	A
Approach Vol, veh/h	204			1397	977	
Approach Delay, s/veh	22.7			0.3	3.9	
Approach LOS	C			A	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		45.3				45.3		14.7
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		36.0				36.0		12.0
Max Q Clear Time (g_c+I1), s		6.2				6.6		4.6
Green Ext Time (p_c), s		19.9				19.7		0.4

Intersection Summary	
HCM 2010 Ctrl Delay	3.4
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	99	85	7	147	109	144	26	578	220	181	846	215
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1776	1776	1900	1863	1863	1863	1900	1845	1900	1792	1792	1792
Adj Flow Rate, veh/h	110	94	8	163	121	160	29	642	244	201	940	239
Adj No. of Lanes	1	1	0	1	1	1	0	3	0	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	7	7	7	2	2	2	3	3	3	6	6	6
Cap, veh/h	294	461	39	265	292	248	82	1725	641	443	2246	1121
Arrive On Green	0.08	0.29	0.29	0.16	0.16	0.16	0.53	0.53	0.53	0.16	1.00	1.00
Sat Flow, veh/h	1691	1614	137	1287	1863	1583	91	3265	1213	1707	3406	1524
Grp Volume(v), veh/h	110	0	102	163	121	160	319	302	295	201	940	239
Grp Sat Flow(s),veh/h/ln	1691	0	1751	1287	1863	1583	1577	1528	1465	1707	1703	1524
Q Serve(g_s), s	6.0	0.0	5.1	14.0	6.7	10.8	0.0	13.3	13.6	6.0	0.0	0.0
Cycle Q Clear(g_c), s	6.0	0.0	5.1	14.0	6.7	10.8	11.3	13.3	13.6	6.0	0.0	0.0
Prop In Lane	1.00		0.08	1.00		1.00	0.09		0.83	1.00		1.00
Lane Grp Cap(c), veh/h	294	0	500	265	292	248	868	807	774	443	2246	1121
V/C Ratio(X)	0.37	0.00	0.20	0.62	0.41	0.65	0.37	0.37	0.38	0.45	0.42	0.21
Avail Cap(c_a), veh/h	298	0	674	390	473	402	868	807	774	533	2246	1121
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	0.94	0.94
Uniform Delay (d), s/veh	34.7	0.0	31.0	46.6	43.5	45.2	15.4	15.9	15.9	9.8	0.0	0.0
Incr Delay (d2), s/veh	0.8	0.0	0.2	2.3	0.9	2.8	1.2	1.3	1.4	0.7	0.5	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.8	0.0	2.5	5.2	3.5	4.9	6.0	5.9	5.8	2.9	0.2	0.1
LnGrp Delay(d),s/veh	35.5	0.0	31.2	48.9	44.4	48.0	16.6	17.2	17.3	10.5	0.5	0.4
LnGrp LOS	D		C	D	D	D	B	B	B	B	A	A
Approach Vol, veh/h		212			444			915			1380	
Approach Delay, s/veh		33.4			47.4			17.0			2.0	
Approach LOS		C			D			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4	5	6		8
Phs Duration (G+Y+Rc), s		81.4	14.7	23.9	15.0	66.4		38.6
Change Period (Y+Rc), s		6.0	6.0	6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s		64.0	9.0	29.0	15.0	43.0		44.0
Max Q Clear Time (g_c+I1), s		2.0	8.0	16.0	8.0	15.6		7.1
Green Ext Time (p_c), s		23.8	0.0	1.9	0.3	16.4		2.4

Intersection Summary	
HCM 2010 Ctrl Delay	15.7
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	155	150	10	140	72	164	9	912	241	138	577	162
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1792	1792	1900	1863	1863	1863	1900	1845	1900	1810	1810	1810
Adj Flow Rate, veh/h	172	167	11	156	80	182	10	1013	268	153	641	180
Adj No. of Lanes	1	1	0	1	1	1	0	3	0	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	6	6	6	2	2	2	3	3	3	5	5	5
Cap, veh/h	339	493	32	253	296	252	38	1929	507	330	2175	1105
Arrive On Green	0.09	0.30	0.30	0.16	0.16	0.16	0.50	0.50	0.50	0.15	1.00	1.00
Sat Flow, veh/h	1707	1664	110	1201	1863	1583	13	3830	1006	1723	3438	1538
Grp Volume(v), veh/h	172	0	178	156	80	182	485	406	400	153	641	180
Grp Sat Flow(s),veh/h/ln	1707	0	1773	1201	1863	1583	1821	1528	1501	1723	1719	1538
Q Serve(g_s), s	9.6	0.0	9.1	14.6	4.4	12.7	0.0	20.9	21.0	4.6	0.0	0.0
Cycle Q Clear(g_c), s	9.6	0.0	9.1	14.6	4.4	12.7	20.6	20.9	21.0	4.6	0.0	0.0
Prop In Lane	1.00		0.06	1.00		1.00	0.02		0.67	1.00		1.00
Lane Grp Cap(c), veh/h	339	0	526	253	296	252	949	769	756	330	2175	1105
V/C Ratio(X)	0.51	0.00	0.34	0.62	0.27	0.72	0.51	0.53	0.53	0.46	0.29	0.16
Avail Cap(c_a), veh/h	339	0	641	331	417	354	949	769	756	375	2175	1105
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.98	0.98
Uniform Delay (d), s/veh	35.4	0.0	32.0	47.3	43.0	46.5	19.4	19.5	19.5	12.6	0.0	0.0
Incr Delay (d2), s/veh	1.2	0.0	0.4	2.4	0.5	4.3	2.0	2.6	2.6	1.0	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.6	0.0	4.5	5.0	2.3	5.8	11.0	9.4	9.2	2.2	0.1	0.1
LnGrp Delay(d),s/veh	36.6	0.0	32.3	49.7	43.4	50.8	21.4	22.1	22.2	13.6	0.3	0.3
LnGrp LOS	D		C	D	D	D	C	C	C	B	A	A
Approach Vol, veh/h		350			418			1291			974	
Approach Delay, s/veh		34.5			49.0			21.9			2.4	
Approach LOS		C			D			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4	5	6		8
Phs Duration (G+Y+Rc), s		79.5	16.0	24.5	15.0	64.5		40.5
Change Period (Y+Rc), s		6.0	6.0	6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s		66.0	10.0	26.0	12.0	48.0		42.0
Max Q Clear Time (g_c+I1), s		2.0	11.6	16.6	6.6	23.0		11.1
Green Ext Time (p_c), s		23.7	0.0	1.9	0.2	15.4		2.7

Intersection Summary	
HCM 2010 Ctrl Delay	20.8
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	7	16	22	109	15	24	14	797	39	21	968	17
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1827	1900	1827	1827	1900	1845	1845	1900
Adj Flow Rate, veh/h	8	18	24	121	17	27	16	886	43	23	1076	19
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	4	4	4	4	4	4	3	3	3
Cap, veh/h	100	186	202	350	53	59	297	1871	91	351	1956	35
Arrive On Green	0.25	0.25	0.25	0.25	0.25	0.25	0.56	0.56	0.56	0.56	0.56	0.56
Sat Flow, veh/h	130	740	803	993	209	235	503	3370	164	594	3524	62
Grp Volume(v), veh/h	50	0	0	165	0	0	16	456	473	23	535	560
Grp Sat Flow(s),veh/h/ln	1673	0	0	1437	0	0	503	1736	1798	594	1752	1834
Q Serve(g_s), s	0.0	0.0	0.0	4.4	0.0	0.0	1.3	9.8	9.8	1.5	12.1	12.1
Cycle Q Clear(g_c), s	1.4	0.0	0.0	5.8	0.0	0.0	13.4	9.8	9.8	11.4	12.1	12.1
Prop In Lane	0.16		0.48	0.73		0.16	1.00		0.09	1.00		0.03
Lane Grp Cap(c), veh/h	488	0	0	462	0	0	297	963	998	351	973	1018
V/C Ratio(X)	0.10	0.00	0.00	0.36	0.00	0.00	0.05	0.47	0.47	0.07	0.55	0.55
Avail Cap(c_a), veh/h	787	0	0	720	0	0	431	1427	1478	510	1440	1507
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.9	0.0	0.0	19.4	0.0	0.0	13.1	8.3	8.3	11.8	8.8	8.8
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.5	0.0	0.0	0.1	0.4	0.4	0.1	0.5	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	0.0	2.4	0.0	0.0	0.2	4.8	5.0	0.3	5.9	6.2
LnGrp Delay(d),s/veh	18.0	0.0	0.0	19.9	0.0	0.0	13.2	8.7	8.7	11.8	9.3	9.3
LnGrp LOS	B			B			B	A	A	B	A	A
Approach Vol, veh/h		50			165			945			1118	
Approach Delay, s/veh		18.0			19.9			8.8			9.4	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		40.4		21.6		40.4		21.6
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		51.0		27.0		51.0		27.0
Max Q Clear Time (g_c+I1), s		14.1		7.8		15.4		3.4
Green Ext Time (p_c), s		19.4		1.2		19.0		1.3

Intersection Summary	
HCM 2010 Ctrl Delay	10.1
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	6	13	17	63	26	30	29	1065	80	26	722	11
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1845	1900	1845	1845	1900	1845	1845	1900
Adj Flow Rate, veh/h	7	14	19	70	29	33	32	1183	89	29	802	12
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	3	3	3	3	3	3	3	3	3
Cap, veh/h	96	163	178	239	100	86	424	1979	149	266	2117	32
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.60	0.60	0.60	0.60	0.60	0.60
Sat Flow, veh/h	149	725	791	701	443	381	662	3305	248	429	3535	53
Grp Volume(v), veh/h	40	0	0	132	0	0	32	627	645	29	398	416
Grp Sat Flow(s),veh/h/ln	1664	0	0	1525	0	0	662	1752	1801	429	1752	1835
Q Serve(g_s), s	0.0	0.0	0.0	3.0	0.0	0.0	1.8	15.2	15.3	3.1	8.0	8.0
Cycle Q Clear(g_c), s	1.3	0.0	0.0	4.8	0.0	0.0	9.8	15.2	15.3	18.4	8.0	8.0
Prop In Lane	0.17		0.47	0.53		0.25	1.00		0.14	1.00		0.03
Lane Grp Cap(c), veh/h	437	0	0	425	0	0	424	1049	1078	266	1049	1099
V/C Ratio(X)	0.09	0.00	0.00	0.31	0.00	0.00	0.08	0.60	0.60	0.11	0.38	0.38
Avail Cap(c_a), veh/h	594	0	0	569	0	0	570	1438	1477	362	1438	1506
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.0	0.0	0.0	22.2	0.0	0.0	9.7	8.6	8.6	14.3	7.1	7.1
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.4	0.0	0.0	0.1	0.5	0.5	0.2	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	2.1	0.0	0.0	0.3	7.5	7.7	0.4	3.9	4.1
LnGrp Delay(d),s/veh	21.1	0.0	0.0	22.7	0.0	0.0	9.7	9.1	9.1	14.5	7.3	7.3
LnGrp LOS	C			C			A	A	A	B	A	A
Approach Vol, veh/h		40			132			1304			843	
Approach Delay, s/veh		21.1			22.7			9.1			7.6	
Approach LOS		C			C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		46.9		21.4		46.9		21.4
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		56.0		22.0		56.0		22.0
Max Q Clear Time (g_c+I1), s		20.4		6.8		17.3		3.3
Green Ext Time (p_c), s		20.5		0.8		21.4		0.9

Intersection Summary	
HCM 2010 Ctrl Delay	9.5
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	43	61	18	126	87	192	17	655	296	297	891	51
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1792	1900	1900	1810	1810	1845	1845	1845	1827	1827	1827
Adj Flow Rate, veh/h	48	68	20	140	97	213	19	728	329	330	990	57
Adj No. of Lanes	0	2	0	0	1	1	1	2	1	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	6	6	6	5	5	5	3	3	3	4	4	4
Cap, veh/h	136	325	97	240	137	410	319	1704	762	508	2261	1012
Arrive On Green	0.27	0.27	0.27	0.27	0.27	0.27	0.97	0.97	0.97	0.11	0.65	0.65
Sat Flow, veh/h	286	1218	363	717	513	1538	531	3505	1568	1740	3471	1553
Grp Volume(v), veh/h	50	0	86	237	0	213	19	728	329	330	990	57
Grp Sat Flow(s),veh/h/ln	300	0	1567	1230	0	1538	531	1752	1568	1740	1736	1553
Q Serve(g_s), s	5.3	0.0	5.0	17.5	0.0	13.9	0.1	1.1	1.2	10.5	16.4	1.6
Cycle Q Clear(g_c), s	27.8	0.0	5.0	22.5	0.0	13.9	0.2	1.1	1.2	10.5	16.4	1.6
Prop In Lane	0.96		0.23	0.59		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	140	0	418	376	0	410	319	1704	762	508	2261	1012
V/C Ratio(X)	0.36	0.00	0.21	0.63	0.00	0.52	0.06	0.43	0.43	0.65	0.44	0.06
Avail Cap(c_a), veh/h	181	0	479	433	0	471	319	1704	762	723	2261	1012
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.80	0.00	0.80	0.92	0.92	0.92	0.73	0.73	0.73
Uniform Delay (d), s/veh	52.1	0.0	33.5	42.0	0.0	36.7	0.8	0.8	0.8	10.8	10.0	7.4
Incr Delay (d2), s/veh	1.5	0.0	0.2	1.9	0.0	0.8	0.3	0.7	1.6	1.0	0.5	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.0	2.2	7.3	0.0	6.0	0.0	0.6	0.7	5.1	8.0	0.7
LnGrp Delay(d),s/veh	53.7	0.0	33.7	43.9	0.0	37.6	1.2	1.6	2.5	11.8	10.5	7.5
LnGrp LOS	D		C	D		D	A	A	A	B	B	A
Approach Vol, veh/h		136			450			1076			1377	
Approach Delay, s/veh		41.0			40.9			1.8			10.7	
Approach LOS		D			D			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		82.6		37.4	19.4	63.2		37.4
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s		72.0		36.0	28.0	38.0		36.0
Max Q Clear Time (g_c+I1), s		18.4		24.5	12.5	3.2		29.8
Green Ext Time (p_c), s		23.0		2.3	0.9	19.0		1.6

Intersection Summary	
HCM 2010 Ctrl Delay	13.4
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	31	49	33	184	96	333	27	834	181	127	558	44
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1792	1900	1900	1827	1827	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	34	54	37	204	107	370	30	927	201	141	620	49
Adj No. of Lanes	0	2	0	0	1	1	1	2	1	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	6	6	6	4	4	4	3	3	3	3	3	3
Cap, veh/h	115	288	212	308	136	493	439	1768	791	430	2185	978
Arrive On Green	0.32	0.32	0.32	0.32	0.32	0.32	1.00	1.00	1.00	0.07	0.62	0.62
Sat Flow, veh/h	195	906	668	818	429	1553	757	3505	1568	1757	3505	1568
Grp Volume(v), veh/h	41	0	84	311	0	370	30	927	201	141	620	49
Grp Sat Flow(s),veh/h/ln	255	0	1513	1248	0	1553	757	1752	1568	1757	1752	1568
Q Serve(g_s), s	4.3	0.0	5.0	25.3	0.0	26.8	0.0	0.0	0.0	4.5	10.1	1.5
Cycle Q Clear(g_c), s	34.4	0.0	5.0	30.2	0.0	26.8	0.1	0.0	0.0	4.5	10.1	1.5
Prop In Lane	0.83		0.44	0.66		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	134	0	481	444	0	493	439	1768	791	430	2185	978
V/C Ratio(X)	0.31	0.00	0.17	0.70	0.00	0.75	0.07	0.52	0.25	0.33	0.28	0.05
Avail Cap(c_a), veh/h	204	0	591	548	0	607	439	1768	791	473	2185	978
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.67	0.00	0.67	0.86	0.86	0.86	0.94	0.94	0.94
Uniform Delay (d), s/veh	50.6	0.0	30.9	41.8	0.0	38.3	0.0	0.0	0.0	11.4	10.8	9.2
Incr Delay (d2), s/veh	1.3	0.0	0.2	2.0	0.0	2.8	0.3	1.0	0.7	0.4	0.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.4	0.0	2.1	10.2	0.0	11.8	0.0	0.2	0.1	2.2	5.0	0.7
LnGrp Delay(d),s/veh	51.9	0.0	31.1	43.8	0.0	41.1	0.3	1.0	0.7	11.8	11.1	9.3
LnGrp LOS	D		C	D		D	A	A	A	B	B	A
Approach Vol, veh/h		125			681			1158			810	
Approach Delay, s/veh		37.9			42.3			0.9			11.1	
Approach LOS		D			D			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		84.2		45.8	14.9	69.3		45.8
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s		69.0		49.0	12.0	51.0		49.0
Max Q Clear Time (g_c+I1), s		12.1		32.2	6.5	2.1		36.4
Green Ext Time (p_c), s		18.7		3.8	0.2	17.9		3.4

Intersection Summary	
HCM 2010 Ctrl Delay	15.7
HCM 2010 LOS	B

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	204	206	174	634	848	118
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1827	1827	1845	1845
Adj Flow Rate, veh/h	227	229	193	704	942	131
Adj No. of Lanes	1	1	1	2	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	4	4	3	3
Cap, veh/h	294	263	451	2627	2653	1187
Arrive On Green	0.17	0.17	1.00	1.00	1.00	1.00
Sat Flow, veh/h	1723	1538	514	3563	3597	1568
Grp Volume(v), veh/h	227	229	193	704	942	131
Grp Sat Flow(s),veh/h/ln	1723	1538	514	1736	1752	1568
Q Serve(g_s), s	14.6	16.9	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	14.6	16.9	0.0	0.0	0.0	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	294	263	451	2627	2653	1187
V/C Ratio(X)	0.77	0.87	0.43	0.27	0.36	0.11
Avail Cap(c_a), veh/h	400	357	451	2627	2653	1187
HCM Platoon Ratio	1.00	1.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	0.83	0.83	0.74	0.74	0.91	0.91
Uniform Delay (d), s/veh	46.1	47.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	5.3	13.8	2.2	0.2	0.3	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.4	8.2	0.3	0.1	0.1	0.1
LnGrp Delay(d),s/veh	51.4	60.8	2.2	0.2	0.3	0.2
LnGrp LOS	D	E	A	A	A	A
Approach Vol, veh/h	456			897	1073	
Approach Delay, s/veh	56.1			0.6	0.3	
Approach LOS	E			A	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		94.1				94.1		25.9
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		81.0				81.0		27.0
Max Q Clear Time (g_c+I1), s		2.0				2.0		18.9
Green Ext Time (p_c), s		27.5				27.5		1.0

Intersection Summary	
HCM 2010 Ctrl Delay	10.9
HCM 2010 LOS	B

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	194	143	256	924	624	155
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1845	1845	1845	1845
Adj Flow Rate, veh/h	216	159	284	1027	693	172
Adj No. of Lanes	1	1	1	2	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	3	3	3	3
Cap, veh/h	271	242	537	2358	2358	1055
Arrive On Green	0.16	0.16	0.89	0.89	1.00	1.00
Sat Flow, veh/h	1740	1553	631	3597	3597	1568
Grp Volume(v), veh/h	216	159	284	1027	693	172
Grp Sat Flow(s),veh/h/ln	1740	1553	631	1752	1752	1568
Q Serve(g_s), s	7.7	6.2	7.5	3.2	0.0	0.0
Cycle Q Clear(g_c), s	7.7	6.2	7.5	3.2	0.0	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	271	242	537	2358	2358	1055
V/C Ratio(X)	0.80	0.66	0.53	0.44	0.29	0.16
Avail Cap(c_a), veh/h	326	291	537	2358	2358	1055
HCM Platoon Ratio	1.00	1.00	1.33	1.33	2.00	2.00
Upstream Filter(I)	0.94	0.94	0.51	0.51	0.97	0.97
Uniform Delay (d), s/veh	26.0	25.4	1.5	1.3	0.0	0.0
Incr Delay (d2), s/veh	10.4	3.8	1.9	0.3	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.4	2.9	1.4	1.4	0.1	0.1
LnGrp Delay(d),s/veh	36.4	29.2	3.4	1.6	0.3	0.3
LnGrp LOS	D	C	A	A	A	A
Approach Vol, veh/h	375			1311	865	
Approach Delay, s/veh	33.4			2.0	0.3	
Approach LOS	C			A	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		49.0				49.0		16.0
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		41.0				41.0		12.0
Max Q Clear Time (g_c+I1), s		2.0				9.5		9.7
Green Ext Time (p_c), s		23.1				20.2		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	6.0
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	394	872	277	49	438	60	99	409	25	115	657	289
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1900	1810	1810	1900	1792	1792	1900	1827	1827	1827
Adj Flow Rate, veh/h	438	969	308	54	487	67	110	454	28	128	730	321
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	5	5	5	6	6	6	4	4	4
Cap, veh/h	485	1253	396	134	697	95	268	1388	85	328	1045	789
Arrive On Green	0.21	0.49	0.49	0.23	0.23	0.23	0.02	0.14	0.14	0.60	0.60	0.60
Sat Flow, veh/h	1723	2572	813	419	3039	416	1707	3259	200	892	3471	1553
Grp Volume(v), veh/h	438	646	631	54	275	279	110	237	245	128	730	321
Grp Sat Flow(s),veh/h/ln	1723	1719	1666	419	1719	1736	1707	1703	1757	892	1736	1553
Q Serve(g_s), s	22.0	36.5	37.0	14.4	17.3	17.5	5.0	14.8	14.9	9.5	17.1	11.7
Cycle Q Clear(g_c), s	22.0	36.5	37.0	20.9	17.3	17.5	5.0	14.8	14.9	9.7	17.1	11.7
Prop In Lane	1.00		0.49	1.00		0.24	1.00		0.11	1.00		1.00
Lane Grp Cap(c), veh/h	485	837	811	134	394	398	268	725	748	328	1045	789
V/C Ratio(X)	0.90	0.77	0.78	0.40	0.70	0.70	0.41	0.33	0.33	0.39	0.70	0.41
Avail Cap(c_a), veh/h	521	886	859	137	407	411	271	725	748	328	1045	789
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	2.00	2.00	2.00
Upstream Filter(I)	0.57	0.57	0.57	0.93	0.93	0.93	0.99	0.99	0.99	0.92	0.92	0.92
Uniform Delay (d), s/veh	26.6	24.9	25.1	46.3	41.8	41.9	26.7	35.6	35.6	18.4	19.8	9.8
Incr Delay (d2), s/veh	11.7	2.3	2.5	1.8	4.6	4.8	1.0	1.2	1.2	3.2	3.6	1.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.9	17.8	17.6	1.7	8.7	8.9	2.4	7.2	7.5	2.6	8.6	5.0
LnGrp Delay(d),s/veh	38.2	27.3	27.6	48.1	46.4	46.6	27.7	36.7	36.7	21.6	23.4	11.2
LnGrp LOS	D	C	C	D	D	D	C	D	D	C	C	B
Approach Vol, veh/h		1715			608			592			1179	
Approach Delay, s/veh		30.2			46.7			35.1			19.9	
Approach LOS		C			D			D			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6		8
Phs Duration (G+Y+Rc), s	14.8	41.6	30.5	33.1		56.4		63.6
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s	9.0	32.0	27.0	28.0		47.0		61.0
Max Q Clear Time (g_c+I1), s	7.0	19.1	24.0	22.9		16.9		39.0
Green Ext Time (p_c), s	0.0	7.6	0.5	4.2		12.0		13.8

Intersection Summary	
HCM 2010 Ctrl Delay	30.4
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	395	480	133	41	837	120	270	635	64	79	432	308
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1900	1827	1827	1900	1827	1827	1900	1845	1845	1845
Adj Flow Rate, veh/h	439	533	148	46	930	133	300	706	71	88	480	342
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	3	3	3
Cap, veh/h	432	1530	423	284	938	134	279	1078	108	187	674	639
Arrive On Green	0.22	0.57	0.57	0.31	0.31	0.31	0.20	0.68	0.68	0.38	0.38	0.38
Sat Flow, veh/h	1740	2688	743	742	3050	436	1740	3186	320	685	3505	1568
Grp Volume(v), veh/h	439	343	338	46	529	534	300	384	393	88	480	342
Grp Sat Flow(s),veh/h/ln	1740	1736	1696	742	1736	1750	1740	1736	1770	685	1752	1568
Q Serve(g_s), s	28.0	13.8	13.9	5.9	39.5	39.5	13.0	16.7	16.7	13.8	15.1	22.7
Cycle Q Clear(g_c), s	28.0	13.8	13.9	5.9	39.5	39.5	13.0	16.7	16.7	13.8	15.1	22.7
Prop In Lane	1.00		0.44	1.00		0.25	1.00		0.18	1.00		1.00
Lane Grp Cap(c), veh/h	432	988	965	284	534	538	279	587	599	187	674	639
V/C Ratio(X)	1.02	0.35	0.35	0.16	0.99	0.99	1.08	0.65	0.66	0.47	0.71	0.54
Avail Cap(c_a), veh/h	432	988	965	284	534	538	279	587	599	187	674	639
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	0.89	0.89	0.89	0.60	0.60	0.60	0.92	0.92	0.92	0.96	0.96	0.96
Uniform Delay (d), s/veh	41.2	15.0	15.1	33.2	44.8	44.8	39.7	16.6	16.6	36.6	37.0	22.5
Incr Delay (d2), s/veh	45.0	0.2	0.2	0.2	27.8	27.8	73.3	5.2	5.1	7.9	6.0	3.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	20.9	6.6	6.5	1.2	23.1	23.3	9.5	8.5	8.7	3.0	7.8	10.1
LnGrp Delay(d),s/veh	86.2	15.2	15.3	33.4	72.7	72.6	113.0	21.8	21.7	44.5	43.0	25.5
LnGrp LOS	F	B	B	C	E	E	F	C	C	D	D	C
Approach Vol, veh/h		1120			1109			1077			910	
Approach Delay, s/veh		43.0			71.0			47.2			36.6	
Approach LOS		D			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6		8
Phs Duration (G+Y+Rc), s	19.0	31.0	34.0	46.0		50.0		80.0
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s	13.0	25.0	28.0	40.0		44.0		74.0
Max Q Clear Time (g_c+I1), s	15.0	24.7	30.0	41.5		18.7		15.9
Green Ext Time (p_c), s	0.0	0.3	0.0	0.0		11.5		18.4

Intersection Summary	
HCM 2010 Ctrl Delay	50.1
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	16	52	127	20	45	137	30	376	21	109	731	42
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1792	1900	1827	1827	1900	1792	1792	1792
Adj Flow Rate, veh/h	18	58	141	22	50	152	33	418	23	121	812	47
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	6	6	6	4	4	4	6	6	6
Cap, veh/h	50	91	195	53	75	194	461	2278	125	781	2781	1244
Arrive On Green	0.18	0.18	0.18	0.18	0.18	0.18	0.68	0.68	0.68	0.03	0.27	0.27
Sat Flow, veh/h	77	514	1096	93	424	1092	628	3346	184	1707	3406	1524
Grp Volume(v), veh/h	217	0	0	224	0	0	33	216	225	121	812	47
Grp Sat Flow(s),veh/h/ln	1687	0	0	1609	0	0	628	1736	1795	1707	1703	1524
Q Serve(g_s), s	0.0	0.0	0.0	1.2	0.0	0.0	2.2	4.9	5.0	1.8	20.5	2.5
Cycle Q Clear(g_c), s	13.0	0.0	0.0	14.1	0.0	0.0	8.0	4.9	5.0	1.8	20.5	2.5
Prop In Lane	0.08		0.65	0.10		0.68	1.00		0.10	1.00		1.00
Lane Grp Cap(c), veh/h	335	0	0	322	0	0	461	1181	1222	781	2781	1244
V/C Ratio(X)	0.65	0.00	0.00	0.70	0.00	0.00	0.07	0.18	0.18	0.15	0.29	0.04
Avail Cap(c_a), veh/h	670	0	0	640	0	0	461	1181	1222	895	2781	1244
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	0.00	0.00	0.87	0.00	0.00	1.00	1.00	1.00	0.65	0.65	0.65
Uniform Delay (d), s/veh	42.2	0.0	0.0	42.6	0.0	0.0	8.0	6.3	6.3	3.3	14.8	8.2
Incr Delay (d2), s/veh	2.1	0.0	0.0	2.4	0.0	0.0	0.3	0.3	0.3	0.1	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.3	0.0	0.0	6.6	0.0	0.0	0.4	2.5	2.5	0.8	9.8	1.1
LnGrp Delay(d),s/veh	44.3	0.0	0.0	45.0	0.0	0.0	8.3	6.7	6.7	3.3	15.0	8.2
LnGrp LOS	D			D			A	A	A	A	B	A
Approach Vol, veh/h		217			224			474			980	
Approach Delay, s/veh		44.3			45.0			6.8			13.2	
Approach LOS		D			D			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		94.7		25.3	14.8	80.0		25.3
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s		66.0		42.0	16.0	44.0		42.0
Max Q Clear Time (g_c+I1), s		22.5		16.1	3.8	10.0		15.0
Green Ext Time (p_c), s		11.4		3.1	0.2	10.7		3.2

Intersection Summary	
HCM 2010 Ctrl Delay	18.9
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	68	56	58	20	62	163	79	707	35	102	462	52
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1810	1900	1845	1845	1900	1827	1827	1827
Adj Flow Rate, veh/h	76	62	64	22	69	181	88	786	39	113	513	58
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	5	5	5	3	3	3	4	4	4
Cap, veh/h	118	96	81	49	102	237	581	2140	106	521	2608	1167
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.63	0.63	0.63	0.14	1.00	1.00
Sat Flow, veh/h	356	441	370	78	468	1086	829	3399	169	1740	3471	1553
Grp Volume(v), veh/h	202	0	0	272	0	0	88	405	420	113	513	58
Grp Sat Flow(s),veh/h/ln	1167	0	0	1631	0	0	829	1752	1815	1740	1736	1553
Q Serve(g_s), s	2.5	0.0	0.0	0.0	0.0	0.0	5.4	13.6	13.6	2.4	0.0	0.0
Cycle Q Clear(g_c), s	21.4	0.0	0.0	18.9	0.0	0.0	5.4	13.6	13.6	2.4	0.0	0.0
Prop In Lane	0.38		0.32	0.08		0.67	1.00		0.09	1.00		1.00
Lane Grp Cap(c), veh/h	295	0	0	387	0	0	581	1103	1143	521	2608	1167
V/C Ratio(X)	0.69	0.00	0.00	0.70	0.00	0.00	0.15	0.37	0.37	0.22	0.20	0.05
Avail Cap(c_a), veh/h	488	0	0	599	0	0	581	1103	1143	581	2608	1167
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	0.97	0.00	0.00	1.00	1.00	1.00	0.69	0.69	0.69
Uniform Delay (d), s/veh	45.1	0.0	0.0	44.7	0.0	0.0	9.3	10.9	10.9	5.9	0.0	0.0
Incr Delay (d2), s/veh	2.8	0.0	0.0	2.3	0.0	0.0	0.6	0.9	0.9	0.1	0.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.7	0.0	0.0	8.9	0.0	0.0	1.3	6.8	7.1	1.1	0.0	0.0
LnGrp Delay(d),s/veh	47.9	0.0	0.0	47.0	0.0	0.0	9.9	11.8	11.8	6.0	0.1	0.1
LnGrp LOS	D			D			A	B	B	A	A	A
Approach Vol, veh/h		202			272			913			684	
Approach Delay, s/veh		47.9			47.0			11.6			1.1	
Approach LOS		D			D			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		97.5		32.5	14.8	82.7		32.5
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s		75.0		43.0	13.0	56.0		43.0
Max Q Clear Time (g_c+I1), s		2.0		20.9	4.4	15.6		23.4
Green Ext Time (p_c), s		13.4		3.3	0.2	12.4		3.2

Intersection Summary	
HCM 2010 Ctrl Delay	16.3
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	2.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	0	294	179	20	483	428
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	250	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	6	6	2	2	4	4
Mvmt Flow	0	327	199	22	537	476

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1521	111	0	0	221	0
Stage 1	210	-	-	-	-	-
Stage 2	1311	-	-	-	-	-
Critical Hdwy	6.92	7.02	-	-	4.18	-
Critical Hdwy Stg 1	5.92	-	-	-	-	-
Critical Hdwy Stg 2	5.92	-	-	-	-	-
Follow-up Hdwy	3.56	3.36	-	-	2.24	-
Pot Cap-1 Maneuver	105	908	-	-	1331	-
Stage 1	793	-	-	-	-	-
Stage 2	209	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	63	908	-	-	1331	-
Mov Cap-2 Maneuver	110	-	-	-	-	-
Stage 1	793	-	-	-	-	-
Stage 2	125	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.2		
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	908	1331	-
HCM Lane V/C Ratio	-	-	0.36	0.403	-
HCM Control Delay (s)	-	-	11.2	9.5	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	2	2	-

Intersection	
Int Delay, s/veh	5.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	0	431	379	28	292	184
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	250	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	5	5	2	2	3	3
Mvmt Flow	0	479	421	31	324	204

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1188	226	0	0	452	0
Stage 1	437	-	-	-	-	-
Stage 2	751	-	-	-	-	-
Critical Hdwy	6.9	7	-	-	4.16	-
Critical Hdwy Stg 1	5.9	-	-	-	-	-
Critical Hdwy Stg 2	5.9	-	-	-	-	-
Follow-up Hdwy	3.55	3.35	-	-	2.23	-
Pot Cap-1 Maneuver	177	768	-	-	1098	-
Stage 1	610	-	-	-	-	-
Stage 2	419	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	125	768	-	-	1098	-
Mov Cap-2 Maneuver	229	-	-	-	-	-
Stage 1	610	-	-	-	-	-
Stage 2	295	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.1		
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	768	1098	-
HCM Lane V/C Ratio	-	-	0.624	0.295	-
HCM Control Delay (s)	-	-	17.1	9.6	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	4	1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	4	60	5	36	5	27	5	241	8	74	438	5
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1863	1792	1792	1792	1792	1792	1900
Adj Flow Rate, veh/h	4	67	6	40	6	30	6	268	9	82	487	6
Adj No. of Lanes	0	1	0	0	1	1	1	1	1	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	6	6	6	6	6	6
Cap, veh/h	96	517	44	528	69	493	328	736	626	491	726	9
Arrive On Green	0.31	0.31	0.31	0.31	0.31	0.31	0.41	0.41	0.41	0.41	0.41	0.41
Sat Flow, veh/h	25	1661	142	1194	221	1583	866	1792	1524	1056	1767	22
Grp Volume(v), veh/h	77	0	0	46	0	30	6	268	9	82	0	493
Grp Sat Flow(s),veh/h/ln	1828	0	0	1415	0	1583	866	1792	1524	1056	0	1789
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.6	0.2	4.5	0.2	2.5	0.0	9.7
Cycle Q Clear(g_c), s	1.3	0.0	0.0	0.8	0.0	0.6	9.9	4.5	0.2	7.0	0.0	9.7
Prop In Lane	0.05		0.08	0.87		1.00	1.00		1.00	1.00		0.01
Lane Grp Cap(c), veh/h	657	0	0	596	0	493	328	736	626	491	0	735
V/C Ratio(X)	0.12	0.00	0.00	0.08	0.00	0.06	0.02	0.36	0.01	0.17	0.00	0.67
Avail Cap(c_a), veh/h	931	0	0	805	0	733	935	1992	1693	1231	0	1988
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.7	0.0	0.0	10.5	0.0	10.4	14.4	8.8	7.5	11.2	0.0	10.3
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.3	0.0	0.2	0.0	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	0.0	0.4	0.0	0.3	0.1	2.2	0.1	0.8	0.0	4.9
LnGrp Delay(d),s/veh	10.8	0.0	0.0	10.6	0.0	10.5	14.4	9.1	7.6	11.4	0.0	11.4
LnGrp LOS	B			B		B	B	A	A	B		B
Approach Vol, veh/h		77			76			283			575	
Approach Delay, s/veh		10.8			10.5			9.2			11.4	
Approach LOS		B			B			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		23.7		19.4		23.7		19.4
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		48.0		20.0		48.0		20.0
Max Q Clear Time (g_c+I1), s		11.7		2.8		11.9		3.3
Green Ext Time (p_c), s		5.8		0.7		5.8		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	10.7
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	4	9	4	12	31	57	4	404	26	33	280	4
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1863	1810	1810	1810	1810	1810	1900
Adj Flow Rate, veh/h	4	10	4	13	34	63	4	449	29	37	311	4
Adj No. of Lanes	0	1	0	0	1	1	1	1	1	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	5	5	5	5	5	5
Cap, veh/h	166	335	113	200	436	471	471	747	635	368	735	9
Arrive On Green	0.30	0.30	0.30	0.30	0.30	0.30	0.41	0.41	0.41	0.41	0.41	0.41
Sat Flow, veh/h	201	1127	379	299	1464	1583	1030	1810	1538	887	1783	23
Grp Volume(v), veh/h	18	0	0	47	0	63	4	449	29	37	0	315
Grp Sat Flow(s),veh/h/ln	1707	0	0	1762	0	1583	1030	1810	1538	887	0	1805
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	1.2	0.1	8.0	0.5	1.4	0.0	5.1
Cycle Q Clear(g_c), s	0.3	0.0	0.0	0.8	0.0	1.2	5.3	8.0	0.5	9.4	0.0	5.1
Prop In Lane	0.22		0.22	0.28		1.00	1.00		1.00	1.00		0.01
Lane Grp Cap(c), veh/h	614	0	0	636	0	471	471	747	635	368	0	745
V/C Ratio(X)	0.03	0.00	0.00	0.07	0.00	0.13	0.01	0.60	0.05	0.10	0.00	0.42
Avail Cap(c_a), veh/h	918	0	0	951	0	765	1240	2097	1782	1029	0	2092
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.3	0.0	0.0	10.5	0.0	10.6	10.5	9.5	7.3	13.2	0.0	8.7
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.8	0.0	0.1	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0	0.4	0.0	0.5	0.0	4.2	0.2	0.4	0.0	2.6
LnGrp Delay(d),s/veh	10.3	0.0	0.0	10.5	0.0	10.8	10.5	10.3	7.3	13.3	0.0	9.0
LnGrp LOS	B			B		B	B	B	A	B		A
Approach Vol, veh/h		18			110			482			352	
Approach Delay, s/veh		10.3			10.7			10.1			9.5	
Approach LOS		B			B			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		23.1		18.3		23.1		18.3
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		48.0		20.0		48.0		20.0
Max Q Clear Time (g_c+I1), s		11.4		3.2		10.0		2.3
Green Ext Time (p_c), s		5.6		0.4		5.7		0.4

Intersection Summary	
HCM 2010 Ctrl Delay	10.0
HCM 2010 LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	9	9	249	6	12	459
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1681	1681	1810	1900	1792	1792
Adj Flow Rate, veh/h	10	10	277	7	13	510
Adj No. of Lanes	2	1	2	0	1	2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	13	13	5	5	6	6
Cap, veh/h	143	66	1868	47	775	1856
Arrive On Green	0.05	0.05	0.55	0.55	0.55	0.55
Sat Flow, veh/h	3107	1429	3517	86	1050	3495
Grp Volume(v), veh/h	10	10	139	145	13	510
Grp Sat Flow(s),veh/h/ln	1553	1429	1719	1794	1050	1703
Q Serve(g_s), s	0.1	0.2	1.2	1.2	0.2	2.4
Cycle Q Clear(g_c), s	0.1	0.2	1.2	1.2	1.4	2.4
Prop In Lane	1.00	1.00		0.05	1.00	
Lane Grp Cap(c), veh/h	143	66	937	978	775	1856
V/C Ratio(X)	0.07	0.15	0.15	0.15	0.02	0.27
Avail Cap(c_a), veh/h	1482	682	1991	2078	1419	3945
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	13.4	13.4	3.3	3.3	3.6	3.6
Incr Delay (d2), s/veh	0.2	1.1	0.1	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.1	0.6	0.6	0.1	1.1
LnGrp Delay(d),s/veh	13.6	14.5	3.4	3.4	3.7	3.7
LnGrp LOS	B	B	A	A	A	A
Approach Vol, veh/h	20		284			523
Approach Delay, s/veh	14.1		3.4			3.7
Approach LOS	B		A			A

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		22.0				22.0		7.4
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		34.0				34.0		14.0
Max Q Clear Time (g_c+I1), s		3.2				4.4		2.2
Green Ext Time (p_c), s		5.6				5.5		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	3.8
HCM 2010 LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	6	7	436	13	10	282
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1727	1727	1827	1900	1810	1810
Adj Flow Rate, veh/h	7	8	484	14	11	313
Adj No. of Lanes	2	1	2	0	1	2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	10	10	4	4	5	5
Cap, veh/h	113	52	1899	55	664	1895
Arrive On Green	0.04	0.04	0.55	0.55	0.55	0.55
Sat Flow, veh/h	3191	1468	3537	100	870	3529
Grp Volume(v), veh/h	7	8	244	254	11	313
Grp Sat Flow(s),veh/h/ln	1596	1468	1736	1809	870	1719
Q Serve(g_s), s	0.1	0.2	2.1	2.1	0.2	1.3
Cycle Q Clear(g_c), s	0.1	0.2	2.1	2.1	2.3	1.3
Prop In Lane	1.00	1.00		0.06	1.00	
Lane Grp Cap(c), veh/h	113	52	957	997	664	1895
V/C Ratio(X)	0.06	0.15	0.25	0.26	0.02	0.17
Avail Cap(c_a), veh/h	1649	759	1973	2057	1174	3909
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	13.5	13.6	3.4	3.4	4.0	3.2
Incr Delay (d2), s/veh	0.2	1.4	0.1	0.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.1	1.1	1.1	0.0	0.6
LnGrp Delay(d),s/veh	13.8	14.9	3.5	3.5	4.0	3.3
LnGrp LOS	B	B	A	A	A	A
Approach Vol, veh/h	15		498			324
Approach Delay, s/veh	14.4		3.5			3.3
Approach LOS	B		A			A

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		22.0				22.0		7.0
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		33.0				33.0		15.0
Max Q Clear Time (g_c+I1), s		4.1				4.3		2.2
Green Ext Time (p_c), s		5.4				5.4		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	3.6
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	7	164	254	92	99	13	108	62	172	14	129	14
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1810	1810	1900	1681	1681	1900	1863	1863	1900
Adj Flow Rate, veh/h	8	182	282	102	110	14	120	69	191	16	143	16
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	5	5	5	13	13	13	2	2	2
Cap, veh/h	547	227	351	402	881	112	312	99	275	217	414	46
Arrive On Green	0.35	0.35	0.35	0.12	0.56	0.56	0.25	0.25	0.25	0.25	0.25	0.25
Sat Flow, veh/h	1250	653	1013	1723	1574	200	1103	395	1093	1115	1646	184
Grp Volume(v), veh/h	8	0	464	102	0	124	120	0	260	16	0	159
Grp Sat Flow(s),veh/h/ln	1250	0	1666	1723	0	1774	1103	0	1488	1115	0	1830
Q Serve(g_s), s	0.3	0.0	16.0	2.0	0.0	2.1	6.4	0.0	10.1	0.8	0.0	4.5
Cycle Q Clear(g_c), s	0.3	0.0	16.0	2.0	0.0	2.1	10.9	0.0	10.1	10.9	0.0	4.5
Prop In Lane	1.00		0.61	1.00		0.11	1.00		0.73	1.00		0.10
Lane Grp Cap(c), veh/h	547	0	578	402	0	993	312	0	375	217	0	461
V/C Ratio(X)	0.01	0.00	0.80	0.25	0.00	0.12	0.38	0.00	0.69	0.07	0.00	0.35
Avail Cap(c_a), veh/h	900	0	1048	442	0	1535	434	0	539	340	0	662
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.6	0.0	18.8	11.4	0.0	6.6	23.9	0.0	21.6	26.5	0.0	19.5
Incr Delay (d2), s/veh	0.0	0.0	2.7	0.3	0.0	0.1	0.8	0.0	2.3	0.1	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	7.8	1.0	0.0	1.0	2.0	0.0	4.4	0.3	0.0	2.4
LnGrp Delay(d),s/veh	13.7	0.0	21.5	11.8	0.0	6.7	24.7	0.0	23.9	26.6	0.0	19.9
LnGrp LOS	B		C	B		A	C		C	C		B
Approach Vol, veh/h		472			226			380			175	
Approach Delay, s/veh		21.3			9.0			24.1			20.5	
Approach LOS		C			A			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	13.5	28.0		22.0		41.6		22.0
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s	9.0	40.0		23.0		55.0		23.0
Max Q Clear Time (g_c+I1), s	4.0	18.0		12.9		4.1		12.9
Green Ext Time (p_c), s	0.1	4.0		2.3		4.6		2.3

Intersection Summary	
HCM 2010 Ctrl Delay	19.8
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	14	98	147	120	174	24	189	127	128	14	50	14
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1827	1827	1900	1696	1696	1900	1863	1863	1900
Adj Flow Rate, veh/h	16	109	163	133	193	27	210	141	142	16	56	16
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	4	4	4	12	12	12	2	2	2
Cap, veh/h	440	185	276	509	811	113	420	214	216	250	385	110
Arrive On Green	0.28	0.28	0.28	0.14	0.52	0.52	0.28	0.28	0.28	0.28	0.28	0.28
Sat Flow, veh/h	1145	669	1000	1740	1569	219	1205	776	782	1092	1394	398
Grp Volume(v), veh/h	16	0	272	133	0	220	210	0	283	16	0	72
Grp Sat Flow(s),veh/h/ln	1145	0	1668	1740	0	1788	1205	0	1558	1092	0	1792
Q Serve(g_s), s	0.6	0.0	8.2	2.6	0.0	3.9	9.2	0.0	9.3	0.8	0.0	1.8
Cycle Q Clear(g_c), s	0.6	0.0	8.2	2.6	0.0	3.9	11.0	0.0	9.3	10.1	0.0	1.8
Prop In Lane	1.00		0.60	1.00		0.12	1.00		0.50	1.00		0.22
Lane Grp Cap(c), veh/h	440	0	461	509	0	924	420	0	430	250	0	495
V/C Ratio(X)	0.04	0.00	0.59	0.26	0.00	0.24	0.50	0.00	0.66	0.06	0.00	0.15
Avail Cap(c_a), veh/h	697	0	835	601	0	1420	753	0	861	552	0	990
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.4	0.0	18.1	10.6	0.0	7.7	20.0	0.0	18.5	23.0	0.0	15.8
Incr Delay (d2), s/veh	0.0	0.0	1.2	0.3	0.0	0.1	0.9	0.0	1.7	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	3.9	1.3	0.0	1.9	3.1	0.0	4.2	0.2	0.0	0.9
LnGrp Delay(d),s/veh	15.4	0.0	19.3	10.9	0.0	7.8	20.9	0.0	20.3	23.1	0.0	15.9
LnGrp LOS	B		B	B		A	C		C	C		B
Approach Vol, veh/h		288			353			493			88	
Approach Delay, s/veh		19.1			9.0			20.5			17.2	
Approach LOS		B			A			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	13.9	22.0		22.0		35.9		22.0
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s	11.0	29.0		32.0		46.0		32.0
Max Q Clear Time (g_c+I1), s	4.6	10.2		12.1		5.9		13.0
Green Ext Time (p_c), s	0.2	3.0		3.0		3.5		3.0

Intersection Summary	
HCM 2010 Ctrl Delay	16.6
HCM 2010 LOS	B

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	195	374	190	403	636	156
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1667	1667	1667	1667
Adj Flow Rate, veh/h	217	416	211	448	707	173
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	14	14	14	14
Cap, veh/h	402	359	284	1056	1056	897
Arrive On Green	0.23	0.23	0.63	0.63	0.63	0.63
Sat Flow, veh/h	1723	1538	562	1667	1667	1417
Grp Volume(v), veh/h	217	416	211	448	707	173
Grp Sat Flow(s),veh/h/ln	1723	1538	562	1667	1667	1417
Q Serve(g_s), s	9.9	21.0	32.7	12.1	24.3	4.6
Cycle Q Clear(g_c), s	9.9	21.0	57.0	12.1	24.3	4.6
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	402	359	284	1056	1056	897
V/C Ratio(X)	0.54	1.16	0.74	0.42	0.67	0.19
Avail Cap(c_a), veh/h	402	359	284	1056	1056	897
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.3	34.5	29.2	8.3	10.5	6.9
Incr Delay (d2), s/veh	1.4	98.2	10.0	0.3	1.6	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.9	18.7	6.0	5.6	11.5	1.8
LnGrp Delay(d),s/veh	31.7	132.7	39.2	8.5	12.2	7.0
LnGrp LOS	C	F	D	A	B	A
Approach Vol, veh/h	633			659	880	
Approach Delay, s/veh	98.1			18.4	11.1	
Approach LOS	F			B	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		63.0				63.0		27.0
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		57.0				57.0		21.0
Max Q Clear Time (g_c+I1), s		26.3				59.0		23.0
Green Ext Time (p_c), s		13.0				0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	38.7
HCM 2010 LOS	D

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	187	216	423	720	458	221
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1712	1712	1712	1712
Adj Flow Rate, veh/h	208	240	470	800	509	246
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	11	11	11	11
Cap, veh/h	251	224	472	1236	1236	1051
Arrive On Green	0.14	0.14	0.72	0.72	0.72	0.72
Sat Flow, veh/h	1740	1553	649	1712	1712	1455
Grp Volume(v), veh/h	208	240	470	800	509	246
Grp Sat Flow(s),veh/h/ln	1740	1553	649	1712	1712	1455
Q Serve(g_s), s	10.5	13.0	54.4	21.9	10.6	5.1
Cycle Q Clear(g_c), s	10.5	13.0	65.0	21.9	10.6	5.1
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	251	224	472	1236	1236	1051
V/C Ratio(X)	0.83	1.07	1.00	0.65	0.41	0.23
Avail Cap(c_a), veh/h	251	224	472	1236	1236	1051
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.4	38.5	22.3	6.5	4.9	4.2
Incr Delay (d2), s/veh	20.0	79.9	40.1	1.2	0.2	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.4	10.5	16.9	10.6	5.0	2.0
LnGrp Delay(d),s/veh	57.4	118.4	62.4	7.7	5.2	4.3
LnGrp LOS	E	F	E	A	A	A
Approach Vol, veh/h	448			1270	755	
Approach Delay, s/veh	90.0			27.9	4.9	
Approach LOS	F			C	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		71.0				71.0		19.0
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		65.0				65.0		13.0
Max Q Clear Time (g_c+I1), s		12.6				67.0		15.0
Green Ext Time (p_c), s		24.4				0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	32.2
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	162	859	86	80	387	120	47	391	61	115	746	154
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1900	1696	1696	1696	1827	1827	1900	1667	1667	1667
Adj Flow Rate, veh/h	180	954	96	89	430	133	52	434	68	128	829	171
Adj No. of Lanes	1	2	0	1	2	1	1	1	0	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	12	12	12	4	4	4	14	14	14
Cap, veh/h	311	776	78	178	712	319	170	622	97	316	693	589
Arrive On Green	0.10	0.25	0.25	0.07	0.22	0.22	0.06	0.40	0.40	0.08	0.42	0.42
Sat Flow, veh/h	1723	3155	317	1616	3223	1442	1740	1543	242	1587	1667	1417
Grp Volume(v), veh/h	180	520	530	89	430	133	52	0	502	128	829	171
Grp Sat Flow(s),veh/h/ln	1723	1719	1754	1616	1612	1442	1740	0	1784	1587	1667	1417
Q Serve(g_s), s	9.4	29.0	29.0	4.9	14.1	9.3	1.9	0.0	27.6	5.4	49.0	9.5
Cycle Q Clear(g_c), s	9.4	29.0	29.0	4.9	14.1	9.3	1.9	0.0	27.6	5.4	49.0	9.5
Prop In Lane	1.00		0.18	1.00		1.00	1.00		0.14	1.00		1.00
Lane Grp Cap(c), veh/h	311	423	431	178	712	319	170	0	719	316	693	589
V/C Ratio(X)	0.58	1.23	1.23	0.50	0.60	0.42	0.31	0.00	0.70	0.41	1.20	0.29
Avail Cap(c_a), veh/h	349	423	431	184	712	319	194	0	742	317	693	589
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	31.7	44.4	44.4	34.0	41.3	39.4	26.9	0.0	29.2	21.3	34.4	22.9
Incr Delay (d2), s/veh	1.9	122.2	122.0	2.2	1.4	0.9	1.0	0.0	2.8	0.8	102.1	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.6	28.0	28.5	2.3	6.4	3.8	1.0	0.0	14.1	2.4	42.0	3.7
LnGrp Delay(d),s/veh	33.6	166.7	166.5	36.2	42.7	40.3	27.9	0.0	32.0	22.1	136.6	23.2
LnGrp LOS	C	F	F	D	D	D	C		C	C	F	C
Approach Vol, veh/h		1230			652			554			1128	
Approach Delay, s/veh		147.1			41.3			31.6			106.4	
Approach LOS		F			D			C			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.4	55.0	17.5	32.1	14.9	53.5	14.5	35.0
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	9.0	49.0	14.0	24.0	9.0	49.0	9.0	29.0
Max Q Clear Time (g_c+I1), s	3.9	51.0	11.4	16.1	7.4	29.6	6.9	31.0
Green Ext Time (p_c), s	0.0	0.0	0.1	5.4	0.0	9.6	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	96.9
HCM 2010 LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	229	385	45	165	760	111	115	670	96	142	273	208
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1900	1727	1727	1727	1827	1827	1900	1712	1712	1712
Adj Flow Rate, veh/h	254	428	50	183	844	123	128	744	107	158	303	231
Adj No. of Lanes	1	2	0	1	2	1	1	1	0	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	10	10	10	4	4	4	11	11	11
Cap, veh/h	205	679	79	275	711	318	446	664	96	182	729	620
Arrive On Green	0.08	0.22	0.22	0.08	0.22	0.22	0.07	0.43	0.43	0.07	0.43	0.43
Sat Flow, veh/h	1740	3134	364	1645	3282	1468	1740	1563	225	1630	1712	1455
Grp Volume(v), veh/h	254	236	242	183	844	123	128	0	851	158	303	231
Grp Sat Flow(s),veh/h/ln	1740	1736	1763	1645	1641	1468	1740	0	1787	1630	1712	1455
Q Serve(g_s), s	10.0	14.8	15.0	10.0	26.0	8.6	4.8	0.0	51.0	7.0	14.8	13.0
Cycle Q Clear(g_c), s	10.0	14.8	15.0	10.0	26.0	8.6	4.8	0.0	51.0	7.0	14.8	13.0
Prop In Lane	1.00		0.21	1.00		1.00	1.00		0.13	1.00		1.00
Lane Grp Cap(c), veh/h	205	376	382	275	711	318	446	0	760	182	729	620
V/C Ratio(X)	1.24	0.63	0.63	0.67	1.19	0.39	0.29	0.00	1.12	0.87	0.42	0.37
Avail Cap(c_a), veh/h	205	376	382	275	711	318	448	0	760	182	729	620
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	38.1	42.6	42.7	34.9	47.0	40.2	17.3	0.0	34.5	30.5	24.0	23.5
Incr Delay (d2), s/veh	141.9	3.3	3.4	5.9	97.8	0.8	0.4	0.0	70.9	33.1	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.1	7.4	7.6	1.6	21.4	3.6	2.3	0.0	40.1	6.8	7.1	5.3
LnGrp Delay(d),s/veh	180.0	45.9	46.1	40.9	144.8	40.9	17.7	0.0	105.4	63.6	24.4	23.9
LnGrp LOS	F	D	D	D	F	D	B		F	E	C	C
Approach Vol, veh/h		732			1150			979			692	
Approach Delay, s/veh		92.5			117.2			93.9			33.2	
Approach LOS		F			F			F			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.9	57.1	16.0	32.0	15.0	57.0	16.0	32.0
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	9.0	51.0	10.0	26.0	9.0	51.0	10.0	26.0
Max Q Clear Time (g_c+I1), s	6.8	16.8	12.0	28.0	9.0	53.0	12.0	17.0
Green Ext Time (p_c), s	0.1	10.9	0.0	0.0	0.0	0.0	0.0	5.6

Intersection Summary	
HCM 2010 Ctrl Delay	89.3
HCM 2010 LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	51	35	103	5	32	7	79	395	6	7	746	122
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1792	1900	1810	1810	1900	1827	1827	1900	1827	1827	1900
Adj Flow Rate, veh/h	57	39	114	6	36	8	88	439	7	8	829	136
Adj No. of Lanes	0	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	6	6	6	5	5	5	4	4	4	4	4	4
Cap, veh/h	114	74	158	264	273	61	241	1195	19	600	1020	167
Arrive On Green	0.19	0.19	0.19	0.19	0.19	0.19	0.67	0.67	0.67	0.67	0.67	0.67
Sat Flow, veh/h	312	387	830	1194	1434	319	569	1793	29	922	1531	251
Grp Volume(v), veh/h	210	0	0	6	0	44	88	0	446	8	0	965
Grp Sat Flow(s),veh/h/ln	1530	0	0	1194	0	1753	569	0	1822	922	0	1783
Q Serve(g_s), s	6.9	0.0	0.0	0.0	0.0	1.7	11.2	0.0	9.1	0.3	0.0	33.0
Cycle Q Clear(g_c), s	10.7	0.0	0.0	0.5	0.0	1.7	44.2	0.0	9.1	9.4	0.0	33.0
Prop In Lane	0.27		0.54	1.00		0.18	1.00		0.02	1.00		0.14
Lane Grp Cap(c), veh/h	346	0	0	264	0	334	241	0	1214	600	0	1187
V/C Ratio(X)	0.61	0.00	0.00	0.02	0.00	0.13	0.37	0.00	0.37	0.01	0.00	0.81
Avail Cap(c_a), veh/h	347	0	0	265	0	335	283	0	1349	669	0	1320
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	31.6	0.0	0.0	27.6	0.0	28.1	26.3	0.0	6.2	8.3	0.0	10.2
Incr Delay (d2), s/veh	3.0	0.0	0.0	0.0	0.0	0.2	0.9	0.0	0.2	0.0	0.0	3.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.8	0.0	0.0	0.1	0.0	0.9	1.8	0.0	4.5	0.1	0.0	17.0
LnGrp Delay(d),s/veh	34.6	0.0	0.0	27.7	0.0	28.3	27.2	0.0	6.4	8.3	0.0	13.8
LnGrp LOS	C			C		C	C		A	A		B
Approach Vol, veh/h		210			50			534			973	
Approach Delay, s/veh		34.6			28.2			9.8			13.8	
Approach LOS		C			C			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		61.8		22.0		61.8		22.0
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		62.0		16.0		62.0		16.0
Max Q Clear Time (g_c+I1), s		35.0		3.7		46.2		12.7
Green Ext Time (p_c), s		13.3		1.2		9.6		0.4

Intersection Summary	
HCM 2010 Ctrl Delay	15.5
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	67	33	94	15	36	14	131	761	14	11	360	85
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1810	1900	1827	1827	1900	1845	1845	1900	1827	1827	1900
Adj Flow Rate, veh/h	74	37	104	17	40	16	146	846	16	12	400	94
Adj No. of Lanes	0	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	4	4	4	3	3	3	4	4	4
Cap, veh/h	164	90	172	362	289	116	492	1068	20	251	847	199
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.59	0.59	0.59	0.59	0.59	0.59
Sat Flow, veh/h	399	388	737	1219	1242	497	891	1805	34	626	1431	336
Grp Volume(v), veh/h	215	0	0	17	0	56	146	0	862	12	0	494
Grp Sat Flow(s),veh/h/ln	1525	0	0	1219	0	1739	891	0	1839	626	0	1768
Q Serve(g_s), s	4.9	0.0	0.0	0.0	0.0	1.7	7.6	0.0	24.7	1.0	0.0	10.8
Cycle Q Clear(g_c), s	8.4	0.0	0.0	0.9	0.0	1.7	18.4	0.0	24.7	25.7	0.0	10.8
Prop In Lane	0.34		0.48	1.00		0.29	1.00		0.02	1.00		0.19
Lane Grp Cap(c), veh/h	425	0	0	362	0	405	492	0	1089	251	0	1047
V/C Ratio(X)	0.51	0.00	0.00	0.05	0.00	0.14	0.30	0.00	0.79	0.05	0.00	0.47
Avail Cap(c_a), veh/h	535	0	0	453	0	533	706	0	1530	401	0	1471
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	23.3	0.0	0.0	20.5	0.0	20.8	13.1	0.0	10.7	20.6	0.0	7.9
Incr Delay (d2), s/veh	0.9	0.0	0.0	0.1	0.0	0.2	0.3	0.0	1.9	0.1	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	0.0	0.0	0.3	0.0	0.9	1.9	0.0	12.8	0.2	0.0	5.3
LnGrp Delay(d),s/veh	24.2	0.0	0.0	20.6	0.0	21.0	13.5	0.0	12.7	20.7	0.0	8.2
LnGrp LOS	C			C		C	B		B	C		A
Approach Vol, veh/h		215			73			1008			506	
Approach Delay, s/veh		24.2			20.9			12.8			8.5	
Approach LOS		C			C			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		46.5		21.9		46.5		21.9
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		57.0		21.0		57.0		21.0
Max Q Clear Time (g_c+I1), s		27.7		3.7		26.7		10.4
Green Ext Time (p_c), s		12.9		1.5		13.1		1.2

Intersection Summary	
HCM 2010 Ctrl Delay	13.3
HCM 2010 LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	55	0	460	92	0	776
Number	7	14	6	16	5	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1743	1743	1810	1810	0	1827
Adj Flow Rate, veh/h	61	0	511	0	0	862
Adj No. of Lanes	1	1	1	1	0	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	9	9	5	5	0	4
Cap, veh/h	174	155	1161	987	0	1172
Arrive On Green	0.10	0.00	0.64	0.00	0.00	0.64
Sat Flow, veh/h	1660	1482	1810	1538	0	1827
Grp Volume(v), veh/h	61	0	511	0	0	862
Grp Sat Flow(s),veh/h/ln	1660	1482	1810	1538	0	1827
Q Serve(g_s), s	1.6	0.0	6.7	0.0	0.0	15.2
Cycle Q Clear(g_c), s	1.6	0.0	6.7	0.0	0.0	15.2
Prop In Lane	1.00	1.00		1.00	0.00	
Lane Grp Cap(c), veh/h	174	155	1161	987	0	1172
V/C Ratio(X)	0.35	0.00	0.44	0.00	0.00	0.74
Avail Cap(c_a), veh/h	316	282	2257	1918	0	2278
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	19.7	0.0	4.2	0.0	0.0	5.8
Incr Delay (d2), s/veh	1.2	0.0	0.3	0.0	0.0	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	3.3	0.0	0.0	7.7
LnGrp Delay(d),s/veh	20.9	0.0	4.5	0.0	0.0	6.7
LnGrp LOS	C		A			A
Approach Vol, veh/h	61		511			862
Approach Delay, s/veh	20.9		4.5			6.7
Approach LOS	C		A			A

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		36.3		11.0		36.3		
Change Period (Y+Rc), s		6.0		6.0		6.0		
Max Green Setting (Gmax), s		59.0		9.0		59.0		
Max Q Clear Time (g_c+I1), s		17.2		3.6		8.7		
Green Ext Time (p_c), s		13.2		0.0		13.7		

Intersection Summary	
HCM 2010 Ctrl Delay	6.5
HCM 2010 LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	72	0	854	84	0	482
Number	7	14	6	16	5	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1776	1776	1827	1827	0	1845
Adj Flow Rate, veh/h	80	0	949	0	0	536
Adj No. of Lanes	1	1	1	1	0	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	7	7	4	4	0	3
Cap, veh/h	195	174	1217	1034	0	1228
Arrive On Green	0.12	0.00	0.67	0.00	0.00	0.67
Sat Flow, veh/h	1691	1509	1827	1553	0	1845
Grp Volume(v), veh/h	80	0	949	0	0	536
Grp Sat Flow(s),veh/h/ln	1691	1509	1827	1553	0	1845
Q Serve(g_s), s	2.4	0.0	19.8	0.0	0.0	7.5
Cycle Q Clear(g_c), s	2.4	0.0	19.8	0.0	0.0	7.5
Prop In Lane	1.00	1.00		1.00	0.00	
Lane Grp Cap(c), veh/h	195	174	1217	1034	0	1228
V/C Ratio(X)	0.41	0.00	0.78	0.00	0.00	0.44
Avail Cap(c_a), veh/h	277	247	1963	1668	0	1982
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	22.5	0.0	6.4	0.0	0.0	4.3
Incr Delay (d2), s/veh	1.4	0.0	1.1	0.0	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	10.1	0.0	0.0	3.8
LnGrp Delay(d),s/veh	23.9	0.0	7.5	0.0	0.0	4.6
LnGrp LOS	C		A			A
Approach Vol, veh/h	80		949			536
Approach Delay, s/veh	23.9		7.5			4.6
Approach LOS	C		A			A

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		42.6		12.3		42.6		
Change Period (Y+Rc), s		6.0		6.0		6.0		
Max Green Setting (Gmax), s		59.0		9.0		59.0		
Max Q Clear Time (g_c+I1), s		9.5		4.4		21.8		
Green Ext Time (p_c), s		16.1		0.1		14.7		

Intersection Summary	
HCM 2010 Ctrl Delay	7.3
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	67	4	64	4	4	4	37	528	4	4	713	82
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1900	1863	1900	1810	1810	1900	1810	1810	1900
Adj Flow Rate, veh/h	74	4	71	4	4	4	41	587	4	4	792	91
Adj No. of Lanes	1	1	0	0	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	5	5	5	5	5	5
Cap, veh/h	394	18	317	147	143	112	255	1125	8	454	999	115
Arrive On Green	0.21	0.21	0.21	0.21	0.21	0.21	0.63	0.63	0.63	0.63	0.63	0.63
Sat Flow, veh/h	1402	85	1511	390	681	536	608	1795	12	799	1594	183
Grp Volume(v), veh/h	74	0	75	12	0	0	41	0	591	4	0	883
Grp Sat Flow(s),veh/h/ln	1402	0	1596	1607	0	0	608	0	1807	799	0	1777
Q Serve(g_s), s	2.7	0.0	2.9	0.0	0.0	0.0	3.9	0.0	13.3	0.2	0.0	27.1
Cycle Q Clear(g_c), s	3.1	0.0	2.9	0.4	0.0	0.0	31.0	0.0	13.3	13.5	0.0	27.1
Prop In Lane	1.00		0.95	0.33		0.33	1.00		0.01	1.00		0.10
Lane Grp Cap(c), veh/h	394	0	335	403	0	0	255	0	1133	454	0	1114
V/C Ratio(X)	0.19	0.00	0.22	0.03	0.00	0.00	0.16	0.00	0.52	0.01	0.00	0.79
Avail Cap(c_a), veh/h	406	0	348	415	0	0	388	0	1526	628	0	1501
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.1	0.0	24.1	23.1	0.0	0.0	21.7	0.0	7.6	11.3	0.0	10.2
Incr Delay (d2), s/veh	0.2	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.4	0.0	0.0	2.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	0.0	1.3	0.2	0.0	0.0	0.7	0.0	6.7	0.0	0.0	13.7
LnGrp Delay(d),s/veh	24.3	0.0	24.4	23.1	0.0	0.0	21.9	0.0	8.0	11.4	0.0	12.3
LnGrp LOS	C		C	C			C		A	B		B
Approach Vol, veh/h		149			12			632			887	
Approach Delay, s/veh		24.4			23.1			8.9			12.3	
Approach LOS		C			C			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		52.0		21.4		52.0		21.4
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		62.0		16.0		62.0		16.0
Max Q Clear Time (g_c+I1), s		29.1		2.4		33.0		5.1
Green Ext Time (p_c), s		13.7		0.5		13.0		0.5

Intersection Summary	
HCM 2010 Ctrl Delay	12.2
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	61	4	46	4	4	4	65	800	4	4	590	67
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1900	1863	1900	1827	1827	1900	1827	1827	1900
Adj Flow Rate, veh/h	68	4	51	4	4	4	72	889	4	4	656	74
Adj No. of Lanes	1	1	0	0	1	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	4	4	4	4	4	4
Cap, veh/h	396	24	311	149	144	113	359	1131	5	260	1004	113
Arrive On Green	0.21	0.21	0.21	0.21	0.21	0.21	0.62	0.62	0.62	0.62	0.62	0.62
Sat Flow, veh/h	1402	116	1484	389	689	539	709	1817	8	609	1613	182
Grp Volume(v), veh/h	68	0	55	12	0	0	72	0	893	4	0	730
Grp Sat Flow(s),veh/h/ln	1402	0	1601	1617	0	0	709	0	1825	609	0	1795
Q Serve(g_s), s	2.4	0.0	2.0	0.0	0.0	0.0	5.1	0.0	25.8	0.3	0.0	18.4
Cycle Q Clear(g_c), s	2.8	0.0	2.0	0.4	0.0	0.0	23.6	0.0	25.8	26.1	0.0	18.4
Prop In Lane	1.00		0.93	0.33		0.33	1.00		0.00	1.00		0.10
Lane Grp Cap(c), veh/h	396	0	335	406	0	0	359	0	1136	260	0	1117
V/C Ratio(X)	0.17	0.00	0.16	0.03	0.00	0.00	0.20	0.00	0.79	0.02	0.00	0.65
Avail Cap(c_a), veh/h	418	0	360	430	0	0	535	0	1590	411	0	1563
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	23.3	0.0	23.0	22.4	0.0	0.0	16.1	0.0	9.9	19.6	0.0	8.6
Incr Delay (d2), s/veh	0.2	0.0	0.2	0.0	0.0	0.0	0.3	0.0	1.8	0.0	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	0.9	0.2	0.0	0.0	1.0	0.0	13.2	0.1	0.0	9.1
LnGrp Delay(d),s/veh	23.5	0.0	23.3	22.4	0.0	0.0	16.3	0.0	11.7	19.6	0.0	9.2
LnGrp LOS	C		C	C			B		B	B		A
Approach Vol, veh/h		123			12			965			734	
Approach Delay, s/veh		23.4			22.4			12.1			9.3	
Approach LOS		C			C			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		50.3		20.9		50.3		20.9
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		62.0		16.0		62.0		16.0
Max Q Clear Time (g_c+I1), s		28.1		2.4		27.8		4.8
Green Ext Time (p_c), s		16.2		0.4		16.3		0.4

Intersection Summary	
HCM 2010 Ctrl Delay	11.8
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	14	4	4	7	10	99	4	523	23	189	508	24
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1681	1681	1900	1727	1727	1900	1759	1759	1900	1810	1810	1900
Adj Flow Rate, veh/h	16	4	4	8	11	110	4	581	26	210	564	27
Adj No. of Lanes	1	2	0	1	2	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	13	13	13	10	10	10	8	8	8	5	5	5
Cap, veh/h	279	354	304	382	356	319	429	1021	46	421	1047	50
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.61	0.61	0.61	0.61	0.61	0.61
Sat Flow, veh/h	1142	1631	1400	1300	1641	1468	777	1671	75	787	1713	82
Grp Volume(v), veh/h	16	4	4	8	11	110	4	0	607	210	0	591
Grp Sat Flow(s),veh/h/ln	1142	1597	1434	1300	1641	1468	777	0	1746	787	0	1795
Q Serve(g_s), s	0.8	0.1	0.2	0.3	0.4	4.4	0.2	0.0	14.5	15.2	0.0	13.3
Cycle Q Clear(g_c), s	5.3	0.1	0.2	0.5	0.4	4.4	13.6	0.0	14.5	29.6	0.0	13.3
Prop In Lane	1.00		0.98	1.00		1.00	1.00		0.04	1.00		0.05
Lane Grp Cap(c), veh/h	279	347	312	382	356	319	429	0	1067	421	0	1097
V/C Ratio(X)	0.06	0.01	0.01	0.02	0.03	0.34	0.01	0.00	0.57	0.50	0.00	0.54
Avail Cap(c_a), veh/h	308	389	349	416	399	357	633	0	1524	627	0	1567
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	25.4	21.5	21.5	21.7	21.6	23.1	11.8	0.0	8.1	16.9	0.0	7.9
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.5	0.9	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.1	0.1	0.1	0.2	1.9	0.0	0.0	7.1	3.4	0.0	6.7
LnGrp Delay(d),s/veh	25.5	21.5	21.5	21.7	21.6	23.8	11.8	0.0	8.6	17.9	0.0	8.3
LnGrp LOS	C	C	C	C	C	C	B		A	B		A
Approach Vol, veh/h		24			129			611			801	
Approach Delay, s/veh		24.1			23.5			8.6			10.8	
Approach LOS		C			C			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		48.7		21.2		48.7		21.2
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		61.0		17.0		61.0		17.0
Max Q Clear Time (g_c+I1), s		16.5		7.3		31.6		6.4
Green Ext Time (p_c), s		12.5		0.5		11.1		0.5

Intersection Summary	
HCM 2010 Ctrl Delay	11.2
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	32	9	4	13	4	196	4	559	10	95	501	9
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1727	1727	1900	1743	1743	1900	1792	1792	1900	1827	1827	1900
Adj Flow Rate, veh/h	36	10	4	14	4	218	4	621	11	106	557	10
Adj No. of Lanes	1	2	0	1	2	0	1	1	0	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	10	10	10	9	9	9	6	6	6	4	4	4
Cap, veh/h	249	593	223	442	421	376	400	973	17	356	991	18
Arrive On Green	0.25	0.25	0.25	0.25	0.25	0.25	0.55	0.55	0.55	0.55	0.55	0.55
Sat Flow, veh/h	1070	2336	877	1305	1656	1482	809	1756	31	776	1789	32
Grp Volume(v), veh/h	36	7	7	14	4	218	4	0	632	106	0	567
Grp Sat Flow(s),veh/h/ln	1070	1641	1572	1305	1656	1482	809	0	1787	776	0	1821
Q Serve(g_s), s	1.9	0.2	0.2	0.5	0.1	8.0	0.2	0.0	15.3	6.8	0.0	12.6
Cycle Q Clear(g_c), s	10.0	0.2	0.2	0.7	0.1	8.0	12.8	0.0	15.3	22.1	0.0	12.6
Prop In Lane	1.00		0.56	1.00		1.00	1.00		0.02	1.00		0.02
Lane Grp Cap(c), veh/h	249	417	399	442	421	376	400	0	990	356	0	1009
V/C Ratio(X)	0.14	0.02	0.02	0.03	0.01	0.58	0.01	0.00	0.64	0.30	0.00	0.56
Avail Cap(c_a), veh/h	285	472	453	486	477	426	728	0	1714	670	0	1747
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.8	17.5	17.5	17.8	17.4	20.4	13.2	0.0	9.6	17.2	0.0	9.0
Incr Delay (d2), s/veh	0.3	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.7	0.5	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.1	0.1	0.2	0.1	3.4	0.0	0.0	7.6	1.5	0.0	6.4
LnGrp Delay(d),s/veh	25.0	17.5	17.5	17.8	17.5	21.9	13.2	0.0	10.3	17.7	0.0	9.5
LnGrp LOS	C	B	B	B	B	C	B		B	B		A
Approach Vol, veh/h		50			236			636			673	
Approach Delay, s/veh		22.9			21.6			10.3			10.8	
Approach LOS		C			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		40.7		21.9		40.7		21.9
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		60.0		18.0		60.0		18.0
Max Q Clear Time (g_c+I1), s		17.3		12.0		24.1		10.0
Green Ext Time (p_c), s		11.0		0.8		10.6		1.0

Intersection Summary	
HCM 2010 Ctrl Delay	12.6
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	8.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	17	188	7	8	129	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	5	5	2	2
Mvmt Flow	19	209	8	9	143	6

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	304	12	0	0	17	0
Stage 1	12	-	-	-	-	-
Stage 2	292	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	688	1069	-	-	1600	-
Stage 1	1011	-	-	-	-	-
Stage 2	758	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	626	1069	-	-	1600	-
Mov Cap-2 Maneuver	626	-	-	-	-	-
Stage 1	1011	-	-	-	-	-
Stage 2	690	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.6		7.2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	1010	1600	-
HCM Lane V/C Ratio	-	-	0.226	0.09	-
HCM Control Delay (s)	-	-	9.6	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	1	0	-

Intersection	
Int Delay, s/veh	7.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	16	124	6	16	199	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	4	4	2	2
Mvmt Flow	18	138	7	18	221	9

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	467	16	0	0	24	0
Stage 1	16	-	-	-	-	-
Stage 2	451	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	554	1063	-	-	1591	-
Stage 1	1007	-	-	-	-	-
Stage 2	642	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	476	1063	-	-	1591	-
Mov Cap-2 Maneuver	476	-	-	-	-	-
Stage 1	1007	-	-	-	-	-
Stage 2	552	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.6		7.3
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	932	1591	-
HCM Lane V/C Ratio	-	-	0.167	0.139	-
HCM Control Delay (s)	-	-	9.6	7.6	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	1	0	-

Intersection	
Int Delay, s/veh	16.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	501	534	237	28	47	350
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	0	-	-	0	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	12	12	19	19	5	5
Mvmt Flow	557	593	263	31	52	389

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	263	0	-	0	1970	-
Stage 1	-	-	-	-	263	-
Stage 2	-	-	-	-	1707	-
Critical Hdwy	4.22	-	-	-	6.45	-
Critical Hdwy Stg 1	-	-	-	-	5.45	-
Critical Hdwy Stg 2	-	-	-	-	5.45	-
Follow-up Hdwy	2.308	-	-	-	3.545	-
Pot Cap-1 Maneuver	1245	-	-	-	67	0
Stage 1	-	-	-	-	774	0
Stage 2	-	-	-	-	158	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1245	-	-	-	~ 37	-
Mov Cap-2 Maneuver	-	-	-	-	~ 37	-
Stage 1	-	-	-	-	774	-
Stage 2	-	-	-	-	87	-

Approach	EB	WB	SB
HCM Control Delay, s			$ 460.1
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1245	-	-	-	37	-
HCM Lane V/C Ratio	0.447	-	-	-	1.411	-
HCM Control Delay (s)	10.2	-	-	-	$ 460.1	0
HCM Lane LOS	B	-	-	-	F	A
HCM 95th %tile Q(veh)	2	-	-	-	5	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Int Delay, s/veh	7.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	397	226	494	43	44	542
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	0	-	-	0	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	10	10	17	17	3	3
Mvmt Flow	441	251	549	48	49	602

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	549	0	-	0	1682	-
Stage 1	-	-	-	-	549	-
Stage 2	-	-	-	-	1133	-
Critical Hdwy	4.2	-	-	-	6.43	-
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.29	-	-	-	3.527	-
Pot Cap-1 Maneuver	982	-	-	-	103	0
Stage 1	-	-	-	-	577	0
Stage 2	-	-	-	-	306	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	982	-	-	-	57	-
Mov Cap-2 Maneuver	-	-	-	-	57	-
Stage 1	-	-	-	-	577	-
Stage 2	-	-	-	-	169	-

Approach	EB	WB	SB
HCM Control Delay, s			195.5
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	982	-	-	-	57	-
HCM Lane V/C Ratio	0.449	-	-	-	0.858	-
HCM Control Delay (s)	11.6	-	-	-	195.5	0
HCM Lane LOS	B	-	-	-	F	A
HCM 95th %tile Q(veh)	2	-	-	-	4	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	172	17	392	4	7	4	150	22	4	5	135	108
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1597	1597	1597	1900	1863	1900	1545	1545	1900	1900	1845	1900
Adj Flow Rate, veh/h	191	0	449	4	8	4	167	24	4	6	150	120
Adj No. of Lanes	1	0	2	0	1	0	1	1	0	0	2	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	19	19	19	2	2	2	23	23	23	3	3	3
Cap, veh/h	459	0	820	16	31	16	372	416	69	77	608	442
Arrive On Green	0.30	0.00	0.30	0.04	0.04	0.04	0.32	0.32	0.32	0.32	0.32	0.32
Sat Flow, veh/h	1521	0	2714	441	881	441	916	1291	215	19	1886	1370
Grp Volume(v), veh/h	191	0	449	16	0	0	167	0	28	150	0	126
Grp Sat Flow(s),veh/h/ln	1521	0	1357	1763	0	0	916	0	1507	1838	0	1437
Q Serve(g_s), s	5.3	0.0	7.3	0.5	0.0	0.0	8.8	0.0	0.7	0.0	0.0	3.4
Cycle Q Clear(g_c), s	5.3	0.0	7.3	0.5	0.0	0.0	12.2	0.0	0.7	3.2	0.0	3.4
Prop In Lane	1.00		1.00	0.25		0.25	1.00		0.14	0.04		0.95
Lane Grp Cap(c), veh/h	459	0	820	63	0	0	372	0	486	663	0	463
V/C Ratio(X)	0.42	0.00	0.55	0.25	0.00	0.00	0.45	0.00	0.06	0.23	0.00	0.27
Avail Cap(c_a), veh/h	718	0	1281	300	0	0	734	0	1081	1382	0	1031
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.7	0.0	15.5	24.8	0.0	0.0	17.9	0.0	12.4	13.2	0.0	13.3
Incr Delay (d2), s/veh	0.6	0.0	0.6	2.1	0.0	0.0	0.9	0.0	0.0	0.2	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.3	0.0	2.8	0.3	0.0	0.0	2.3	0.0	0.3	1.6	0.0	1.4
LnGrp Delay(d),s/veh	15.3	0.0	16.0	27.0	0.0	0.0	18.7	0.0	12.4	13.4	0.0	13.6
LnGrp LOS	B		B	C			B		B	B		B
Approach Vol, veh/h		640			16			195			276	
Approach Delay, s/veh		15.8			27.0			17.8			13.5	
Approach LOS		B			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		23.1		22.0		23.1		7.9
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		38.0		25.0		38.0		9.0
Max Q Clear Time (g_c+I1), s		14.2		9.3		5.4		2.5
Green Ext Time (p_c), s		2.9		2.3		3.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	15.8
HCM 2010 LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	93	7	170	4	6	5	352	134	4	5	32	179
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1624	1624	1624	1900	1863	1900	1583	1583	1900	1900	1863	1900
Adj Flow Rate, veh/h	103	0	194	4	7	6	391	149	4	6	36	199
Adj No. of Lanes	1	0	2	0	1	0	1	1	0	0	2	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	17	17	17	2	2	2	20	20	20	2	2	2
Cap, veh/h	322	0	574	15	25	22	526	801	22	146	833	752
Arrive On Green	0.21	0.00	0.21	0.04	0.04	0.04	0.52	0.52	0.52	0.52	0.52	0.52
Sat Flow, veh/h	1547	0	2761	408	714	612	970	1535	41	177	1594	1441
Grp Volume(v), veh/h	103	0	194	17	0	0	391	0	153	42	0	199
Grp Sat Flow(s),veh/h/ln	1547	0	1380	1734	0	0	970	0	1576	1771	0	1441
Q Serve(g_s), s	4.3	0.0	4.6	0.7	0.0	0.0	28.8	0.0	3.9	0.0	0.0	5.9
Cycle Q Clear(g_c), s	4.3	0.0	4.6	0.7	0.0	0.0	34.7	0.0	3.9	0.8	0.0	5.9
Prop In Lane	1.00		1.00	0.24		0.35	1.00		0.03	0.14		1.00
Lane Grp Cap(c), veh/h	322	0	574	62	0	0	526	0	823	979	0	752
V/C Ratio(X)	0.32	0.00	0.34	0.28	0.00	0.00	0.74	0.00	0.19	0.04	0.00	0.26
Avail Cap(c_a), veh/h	322	0	575	203	0	0	613	0	964	1134	0	881
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	25.8	0.0	25.9	36.1	0.0	0.0	19.8	0.0	9.7	9.0	0.0	10.2
Incr Delay (d2), s/veh	0.6	0.0	0.3	2.4	0.0	0.0	4.2	0.0	0.1	0.0	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	0.0	1.8	0.4	0.0	0.0	8.2	0.0	1.7	0.4	0.0	2.4
LnGrp Delay(d),s/veh	26.4	0.0	26.3	38.4	0.0	0.0	23.9	0.0	9.8	9.0	0.0	10.4
LnGrp LOS	C		C	D			C		A	A		B
Approach Vol, veh/h		297			17			544			241	
Approach Delay, s/veh		26.3			38.4			20.0			10.1	
Approach LOS		C			D			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		46.1		22.0		46.1		8.7
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		47.0		16.0		47.0		9.0
Max Q Clear Time (g_c+I1), s		36.7		6.6		7.9		2.7
Green Ext Time (p_c), s		3.5		0.7		5.4		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	19.8
HCM 2010 LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

Intersection	
Intersection Delay, s/veh	42
Intersection LOS	E

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	19	9	107	0	48	6	47	0	185	225	58
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	5	5	5
Mvmt Flow	0	21	10	119	0	53	7	52	0	206	250	64
Number of Lanes	0	0	1	0	0	0	1	1	0	0	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	2	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	2	1	2
HCM Control Delay	14	11.9	32.8
HCM LOS	B	B	D

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2	SBLn1
Vol Left, %	45%	0%	14%	89%	0%	38%
Vol Thru, %	55%	0%	7%	11%	0%	53%
Vol Right, %	0%	100%	79%	0%	100%	9%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	410	58	135	54	47	505
LT Vol	225	0	9	6	0	270
Through Vol	0	58	107	0	47	44
RT Vol	185	0	19	48	0	191
Lane Flow Rate	456	64	150	60	52	561
Geometry Grp	7	7	6	7	7	6
Degree of Util (X)	0.847	0.103	0.316	0.143	0.107	1
Departure Headway (Hd)	6.697	5.752	7.583	8.569	7.385	6.599
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	542	624	477	422	487	556
Service Time	4.406	3.48	5.574	6.244	5.101	4.599
HCM Lane V/C Ratio	0.841	0.103	0.314	0.142	0.107	1.009
HCM Control Delay	36.1	9.1	14	12.7	11	64.1
HCM Lane LOS	E	A	B	B	B	F
HCM 95th-tile Q	8.9	0.3	1.3	0.5	0.4	14.3

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	191	270	44
Peak Hour Factor	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	3	3	3
Mvmt Flow	0	212	300	49
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	2
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	64.1
HCM LOS	F

Lane

Intersection	
Intersection Delay, s/veh	41.4
Intersection LOS	E

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	35	10	203	0	55	7	222	0	121	284	60
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	3	3	3
Mvmt Flow	0	39	11	226	0	61	8	247	0	134	316	67
Number of Lanes	0	0	1	0	0	0	1	1	0	0	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	2	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	2	1	2
HCM Control Delay	25.5	18.6	64
HCM LOS	D	C	F

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2	SBLn1
Vol Left, %	30%	0%	14%	89%	0%	13%
Vol Thru, %	70%	0%	4%	11%	0%	81%
Vol Right, %	0%	100%	82%	0%	100%	6%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	405	60	248	62	222	323
LT Vol	284	0	10	7	0	262
Through Vol	0	60	203	0	222	20
RT Vol	121	0	35	55	0	41
Lane Flow Rate	450	67	276	69	247	359
Geometry Grp	7	7	6	7	7	6
Degree of Util (X)	1	0.136	0.645	0.175	0.547	0.832
Departure Headway (Hd)	8.228	7.35	8.43	9.165	7.977	8.35
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	446	491	430	394	454	434
Service Time	5.928	5.05	6.445	6.857	5.712	6.381
HCM Lane V/C Ratio	1.009	0.136	0.642	0.175	0.544	0.827
HCM Control Delay	71.8	11.2	25.5	13.8	20	41.2
HCM Lane LOS	F	B	D	B	C	E
HCM 95th-tile Q	12.8	0.5	4.4	0.6	3.2	7.9

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	41	262	20
Peak Hour Factor	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	46	291	22
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	2
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	41.2
HCM LOS	E

Lane

Intersection	
Int Delay, s/veh	1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	7	20	245	7	62	513
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	16	16	3	3	4	4
Mvmt Flow	8	22	272	8	69	570

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	984	276	0	0	280	0
Stage 1	276	-	-	-	-	-
Stage 2	708	-	-	-	-	-
Critical Hdwy	6.56	6.36	-	-	4.14	-
Critical Hdwy Stg 1	5.56	-	-	-	-	-
Critical Hdwy Stg 2	5.56	-	-	-	-	-
Follow-up Hdwy	3.644	3.444	-	-	2.236	-
Pot Cap-1 Maneuver	260	730	-	-	1271	-
Stage 1	739	-	-	-	-	-
Stage 2	464	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	239	730	-	-	1271	-
Mov Cap-2 Maneuver	239	-	-	-	-	-
Stage 1	739	-	-	-	-	-
Stage 2	427	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.1		0.9
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	476	1271	-
HCM Lane V/C Ratio	-	-	0.063	0.054	-
HCM Control Delay (s)	-	-	13.1	8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	1.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	17	78	550	8	22	274
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	10	10	2	2	3	3
Mvmt Flow	19	87	611	9	24	304

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	969	616	0	0	620	0
Stage 1	616	-	-	-	-	-
Stage 2	353	-	-	-	-	-
Critical Hdwy	6.5	6.3	-	-	4.13	-
Critical Hdwy Stg 1	5.5	-	-	-	-	-
Critical Hdwy Stg 2	5.5	-	-	-	-	-
Follow-up Hdwy	3.59	3.39	-	-	2.227	-
Pot Cap-1 Maneuver	272	476	-	-	956	-
Stage 1	524	-	-	-	-	-
Stage 2	694	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	264	476	-	-	956	-
Mov Cap-2 Maneuver	264	-	-	-	-	-
Stage 1	524	-	-	-	-	-
Stage 2	673	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.6		0.7
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	416	956	-
HCM Lane V/C Ratio	-	-	0.254	0.026	-
HCM Control Delay (s)	-	-	16.6	8.9	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	1	0	-

Intersection	
Int Delay, s/veh	3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	24	281	133	101	577	90
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	0	100	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	4	4	26	26	13	13
Mvmt Flow	27	312	148	112	641	100

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1586	-	0	0	260	0
Stage 1	204	-	-	-	-	-
Stage 2	1382	-	-	-	-	-
Critical Hdwy	6.44	-	-	-	4.23	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	-	-	-	2.317	-
Pot Cap-1 Maneuver	118	0	-	-	1243	-
Stage 1	825	0	-	-	-	-
Stage 2	231	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	57	-	-	-	1243	-
Mov Cap-2 Maneuver	57	-	-	-	-	-
Stage 1	825	-	-	-	-	-
Stage 2	112	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	114.7		
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	57	-	1243	-
HCM Lane V/C Ratio	-	-	0.468	-	0.516	-
HCM Control Delay (s)	-	-	114.7	0	10.9	-
HCM Lane LOS	-	-	F	A	B	-
HCM 95th %tile Q(veh)	-	-	2	-	3	-

Intersection	
Int Delay, s/veh	1.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	44	653	71	50	219	122
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	None
Storage Length	0	100	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	3	3	26	26	11	11
Mvmt Flow	49	726	79	56	243	136

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	729	-	0	0	134	0
Stage 1	107	-	-	-	-	-
Stage 2	622	-	-	-	-	-
Critical Hdwy	6.43	-	-	-	4.21	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	-	-	-	2.299	-
Pot Cap-1 Maneuver	388	0	-	-	1397	-
Stage 1	915	0	-	-	-	-
Stage 2	533	0	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	321	-	-	-	1397	-
Mov Cap-2 Maneuver	321	-	-	-	-	-
Stage 1	915	-	-	-	-	-
Stage 2	440	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	18.2		
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	321	-	1397	-
HCM Lane V/C Ratio	-	-	0.152	-	0.174	-
HCM Control Delay (s)	-	-	18.2	0	8.1	-
HCM Lane LOS	-	-	C	A	A	-
HCM 95th %tile Q(veh)	-	-	1	-	1	-

Intersection	
Int Delay, s/veh	3.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	63	123	75	311	498	32
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	13	13	18	18
Mvmt Flow	70	137	83	346	553	36

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	910	294	589	0	-	0
Stage 1	571	-	-	-	-	-
Stage 2	339	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.36	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.33	-	-	-
Pot Cap-1 Maneuver	274	702	911	-	-	-
Stage 1	529	-	-	-	-	-
Stage 2	693	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	249	702	911	-	-	-
Mov Cap-2 Maneuver	249	-	-	-	-	-
Stage 1	529	-	-	-	-	-
Stage 2	630	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	20.6		
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	911	-	434	-	-
HCM Lane V/C Ratio	0.091	-	0.476	-	-
HCM Control Delay (s)	9.3	-	20.6	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0	-	3	-	-

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	56	70	136	599	241	73
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	11	11	16	16
Mvmt Flow	62	78	151	666	268	81

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	943	174	349	0	-	0
Stage 1	308	-	-	-	-	-
Stage 2	635	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.32	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.31	-	-	-
Pot Cap-1 Maneuver	261	839	1144	-	-	-
Stage 1	719	-	-	-	-	-
Stage 2	490	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	227	839	1144	-	-	-
Mov Cap-2 Maneuver	227	-	-	-	-	-
Stage 1	719	-	-	-	-	-
Stage 2	425	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	19.8		
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1144	-	382	-	-
HCM Lane V/C Ratio	0.132	-	0.366	-	-
HCM Control Delay (s)	8.6	-	19.8	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0	-	2	-	-

Intersection	
Int Delay, s/veh	21.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	397	266	0	432	265	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	350	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	12	12	18	18	18	18
Mvmt Flow	441	296	0	480	294	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	534	147	294	0	-	0
Stage 1	294	-	-	-	-	-
Stage 2	240	-	-	-	-	-
Critical Hdwy	7.04	7.14	4.46	-	-	-
Critical Hdwy Stg 1	6.04	-	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-	-	-
Follow-up Hdwy	3.62	3.42	2.38	-	-	-
Pot Cap-1 Maneuver	452	843	1156	-	-	-
Stage 1	701	-	-	-	-	-
Stage 2	748	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	452	843	1156	-	-	-
Mov Cap-2 Maneuver	452	-	-	-	-	-
Stage 1	701	-	-	-	-	-
Stage 2	748	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	44.7		
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1156	-	452	843	-	-
HCM Lane V/C Ratio	-	-	0.976	0.351	-	-
HCM Control Delay (s)	0	-	66.9	11.6	-	-
HCM Lane LOS	A	-	F	B	-	-
HCM 95th %tile Q(veh)	0	-	12	2	-	-

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	95	90	0	603	191	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	350	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	37	37	16	16	19	19
Mvmt Flow	106	100	0	670	212	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	547	106	212	0	-	0
Stage 1	212	-	-	-	-	-
Stage 2	335	-	-	-	-	-
Critical Hdwy	7.54	7.64	4.42	-	-	-
Critical Hdwy Stg 1	6.54	-	-	-	-	-
Critical Hdwy Stg 2	6.54	-	-	-	-	-
Follow-up Hdwy	3.87	3.67	2.36	-	-	-
Pot Cap-1 Maneuver	391	826	1259	-	-	-
Stage 1	708	-	-	-	-	-
Stage 2	603	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	391	826	1259	-	-	-
Mov Cap-2 Maneuver	391	-	-	-	-	-
Stage 1	708	-	-	-	-	-
Stage 2	603	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	13.9		
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1259	-	391	826	-	-
HCM Lane V/C Ratio	-	-	0.27	0.121	-	-
HCM Control Delay (s)	0	-	17.6	10	-	-
HCM Lane LOS	A	-	C	B	-	-
HCM 95th %tile Q(veh)	0	-	1	0	-	-

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	0	80	749	265	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	225	-	-	325
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	18	18	25	25
Mvmt Flow	0	0	89	832	294	67

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	888	147	294	0	-	0
Stage 1	294	-	-	-	-	-
Stage 2	594	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.46	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.38	-	-	-
Pot Cap-1 Maneuver	283	873	1156	-	-	-
Stage 1	730	-	-	-	-	-
Stage 2	514	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	261	873	1156	-	-	-
Mov Cap-2 Maneuver	261	-	-	-	-	-
Stage 1	730	-	-	-	-	-
Stage 2	474	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0		
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1156	-	-	-	-
HCM Lane V/C Ratio	0.077	-	-	-	-
HCM Control Delay (s)	8.4	-	0	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	0	308	390	191	537
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	225	-	-	325
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	19	19	21	21
Mvmt Flow	0	0	342	433	212	597

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1113	106	212	0	-	0
Stage 1	212	-	-	-	-	-
Stage 2	901	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.48	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.39	-	-	-
Pot Cap-1 Maneuver	203	928	1240	-	-	-
Stage 1	803	-	-	-	-	-
Stage 2	357	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	147	928	1240	-	-	-
Mov Cap-2 Maneuver	147	-	-	-	-	-
Stage 1	803	-	-	-	-	-
Stage 2	259	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0		
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1240	-	-	-	-
HCM Lane V/C Ratio	0.276	-	-	-	-
HCM Control Delay (s)	9	-	0	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	1	-	-	-	-

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	435	68	189	669	1229	967
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1776	1900	1810	1810	1810	1810
Adj Flow Rate, veh/h	554	0	210	743	1366	1074
Adj No. of Lanes	2	1	1	2	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	7	0	5	5	5	5
Cap, veh/h	571	273	147	2600	2600	1163
Arrive On Green	0.17	0.00	0.76	0.76	1.00	1.00
Sat Flow, veh/h	3382	1615	135	3529	3529	1538
Grp Volume(v), veh/h	554	0	210	743	1366	1074
Grp Sat Flow(s),veh/h/ln	1691	1615	135	1719	1719	1538
Q Serve(g_s), s	26.1	0.0	121.0	10.8	0.0	0.0
Cycle Q Clear(g_c), s	26.1	0.0	121.0	10.8	0.0	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	571	273	147	2600	2600	1163
V/C Ratio(X)	0.97	0.00	1.43	0.29	0.53	0.92
Avail Cap(c_a), veh/h	571	273	147	2600	2600	1163
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.09	0.09
Uniform Delay (d), s/veh	66.1	0.0	38.0	6.1	0.0	0.0
Incr Delay (d2), s/veh	30.2	0.0	227.6	0.3	0.1	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.6	0.0	15.8	5.2	0.0	0.5
LnGrp Delay(d),s/veh	96.3	0.0	265.7	6.3	0.1	1.6
LnGrp LOS	F		F	A	A	A
Approach Vol, veh/h	554			953	2440	
Approach Delay, s/veh	96.3			63.5	0.7	
Approach LOS	F			E	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		127.0				127.0		33.0
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		121.0				121.0		27.0
Max Q Clear Time (g_c+I1), s		2.0				123.0		28.1
Green Ext Time (p_c), s		103.5				0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	29.3
HCM 2010 LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	589	131	189	900	938	620
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1900	1827	1827	1827	1827
Adj Flow Rate, veh/h	790	0	210	1000	1042	689
Adj No. of Lanes	2	1	1	2	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	0	4	4	4	4
Cap, veh/h	855	397	243	2256	2256	1009
Arrive On Green	0.25	0.00	0.65	0.65	1.00	1.00
Sat Flow, veh/h	3480	1615	273	3563	3563	1553
Grp Volume(v), veh/h	790	0	210	1000	1042	689
Grp Sat Flow(s),veh/h/ln	1740	1615	273	1736	1736	1553
Q Serve(g_s), s	24.2	0.0	71.1	15.5	0.0	0.0
Cycle Q Clear(g_c), s	24.2	0.0	71.1	15.5	0.0	0.0
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	855	397	243	2256	2256	1009
V/C Ratio(X)	0.92	0.00	0.86	0.44	0.46	0.68
Avail Cap(c_a), veh/h	890	413	243	2256	2256	1009
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.20	0.20
Uniform Delay (d), s/veh	40.3	0.0	24.6	9.4	0.0	0.0
Incr Delay (d2), s/veh	14.8	0.0	30.9	0.6	0.1	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	13.4	0.0	8.4	7.6	0.0	0.2
LnGrp Delay(d),s/veh	55.1	0.0	55.6	10.1	0.1	0.8
LnGrp LOS	E		E	B	A	A
Approach Vol, veh/h	790			1210	1731	
Approach Delay, s/veh	55.1			18.0	0.4	
Approach LOS	E			B	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		77.1				77.1		32.9
Change Period (Y+Rc), s		6.0				6.0		6.0
Max Green Setting (Gmax), s		70.0				70.0		28.0
Max Q Clear Time (g_c+I1), s		2.0				73.1		26.2
Green Ext Time (p_c), s		49.5				0.0		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	17.7
HCM 2010 LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	564	334	126	978	1862	642
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1696	1900	1810	1810	1810	1810
Adj Flow Rate, veh/h	627	0	140	1087	2069	713
Adj No. of Lanes	2	1	1	2	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	12	0	5	5	5	5
Cap, veh/h	696	348	157	2550	2216	991
Arrive On Green	0.22	0.00	0.12	1.00	0.64	0.64
Sat Flow, veh/h	3231	1615	1723	3529	3529	1538
Grp Volume(v), veh/h	627	0	140	1087	2069	713
Grp Sat Flow(s),veh/h/ln	1616	1615	1723	1719	1719	1538
Q Serve(g_s), s	29.2	0.0	7.2	0.0	83.1	47.5
Cycle Q Clear(g_c), s	29.2	0.0	7.2	0.0	83.1	47.5
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	696	348	157	2550	2216	991
V/C Ratio(X)	0.90	0.00	0.89	0.43	0.93	0.72
Avail Cap(c_a), veh/h	919	459	157	2550	2216	991
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.77	0.77	1.00	1.00
Uniform Delay (d), s/veh	59.1	0.0	47.6	0.0	24.5	18.2
Incr Delay (d2), s/veh	9.7	0.0	35.0	0.4	8.8	4.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.0	0.0	7.3	0.1	41.8	21.2
LnGrp Delay(d),s/veh	68.7	0.0	82.6	0.4	33.4	22.7
LnGrp LOS	E		F	A	C	C
Approach Vol, veh/h	627			1227	2782	
Approach Delay, s/veh	68.7			9.8	30.6	
Approach LOS	E			A	C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	15.0	105.7				120.7		39.3
Change Period (Y+Rc), s	6.0	6.0				6.0		6.0
Max Green Setting (Gmax), s	9.0	89.0				104.0		44.0
Max Q Clear Time (g_c+I1), s	9.2	85.1				2.0		31.2
Green Ext Time (p_c), s	0.0	3.9				83.8		2.1

Intersection Summary	
HCM 2010 Ctrl Delay	30.3
HCM 2010 LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	795	271	78	1411	1287	555
Number	3	18	1	6	2	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1743	1900	1827	1827	1810	1810
Adj Flow Rate, veh/h	883	0	87	1568	1430	617
Adj No. of Lanes	2	1	1	2	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	9	0	4	4	5	5
Cap, veh/h	988	480	236	2150	1647	737
Arrive On Green	0.30	0.00	0.11	0.82	0.48	0.48
Sat Flow, veh/h	3320	1615	1740	3563	3529	1538
Grp Volume(v), veh/h	883	0	87	1568	1430	617
Grp Sat Flow(s),veh/h/ln	1660	1615	1740	1736	1719	1538
Q Serve(g_s), s	27.2	0.0	2.3	21.3	39.7	37.3
Cycle Q Clear(g_c), s	27.2	0.0	2.3	21.3	39.7	37.3
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	988	480	236	2150	1647	737
V/C Ratio(X)	0.89	0.00	0.37	0.73	0.87	0.84
Avail Cap(c_a), veh/h	1180	574	236	2150	1647	737
HCM Platoon Ratio	1.00	1.00	1.33	1.33	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.69	0.69	1.00	1.00
Uniform Delay (d), s/veh	35.9	0.0	20.9	5.5	24.8	24.2
Incr Delay (d2), s/veh	8.0	0.0	0.7	1.5	6.5	10.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	13.6	0.0	1.3	10.2	20.2	18.0
LnGrp Delay(d),s/veh	43.9	0.0	21.6	7.0	31.3	35.2
LnGrp LOS	D		C	A	C	D
Approach Vol, veh/h	883			1655	2047	
Approach Delay, s/veh	43.9			7.8	32.5	
Approach LOS	D			A	C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	15.0	57.2				72.2		37.8
Change Period (Y+Rc), s	6.0	6.0				6.0		6.0
Max Green Setting (Gmax), s	9.0	45.0				60.0		38.0
Max Q Clear Time (g_c+I1), s	4.3	41.7				23.3		29.2
Green Ext Time (p_c), s	0.1	3.3				32.7		2.6

Intersection Summary	
HCM 2010 Ctrl Delay	25.8
HCM 2010 LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	45	1048	323	38	898	305	123	14	123	15	14	83
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1900	1827	1827	1827	1900	1776	1776	1863	1863	1900
Adj Flow Rate, veh/h	50	1164	359	42	998	339	137	16	137	17	16	92
Adj No. of Lanes	1	2	0	1	2	1	0	1	1	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	4	4	4	7	7	7	2	2	2
Cap, veh/h	283	1626	493	200	2170	971	271	27	326	156	52	298
Arrive On Green	0.63	0.63	0.63	0.63	0.63	0.63	0.22	0.22	0.22	0.22	0.22	0.22
Sat Flow, veh/h	396	2600	789	334	3471	1553	837	123	1509	1229	240	1379
Grp Volume(v), veh/h	50	763	760	42	998	339	153	0	137	17	0	108
Grp Sat Flow(s),veh/h/ln	396	1719	1670	334	1736	1553	960	0	1509	1229	0	1619
Q Serve(g_s), s	5.8	22.6	23.7	7.5	11.4	7.9	8.4	0.0	5.9	1.0	0.0	4.2
Cycle Q Clear(g_c), s	17.2	22.6	23.7	31.1	11.4	7.9	12.6	0.0	5.9	13.6	0.0	4.2
Prop In Lane	1.00		0.47	1.00		1.00	0.90		1.00	1.00		0.85
Lane Grp Cap(c), veh/h	283	1075	1044	200	2170	971	298	0	326	156	0	350
V/C Ratio(X)	0.18	0.71	0.73	0.21	0.46	0.35	0.51	0.00	0.42	0.11	0.00	0.31
Avail Cap(c_a), veh/h	292	1114	1082	207	2249	1006	342	0	379	199	0	407
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.0	9.6	9.7	20.5	7.5	6.8	29.9	0.0	25.6	34.7	0.0	24.9
Incr Delay (d2), s/veh	0.3	2.0	2.4	0.5	0.2	0.2	1.4	0.0	0.9	0.3	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	11.2	11.5	0.7	5.5	3.4	3.1	0.0	2.6	0.4	0.0	1.9
LnGrp Delay(d),s/veh	12.3	11.6	12.2	21.0	7.6	7.0	31.3	0.0	26.4	35.0	0.0	25.4
LnGrp LOS	B	B	B	C	A	A	C		C	C		C
Approach Vol, veh/h		1573			1379			290			125	
Approach Delay, s/veh		11.9			7.9			29.0			26.7	
Approach LOS		B			A			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		53.3		22.3		53.3		22.3
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		49.0		19.0		49.0		19.0
Max Q Clear Time (g_c+I1), s		33.1		14.6		25.7		15.6
Green Ext Time (p_c), s		14.1		0.9		20.0		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	12.3
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	90	1038	287	56	844	345	179	14	138	25	14	48
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1900	1827	1827	1827	1900	1827	1827	1863	1863	1900
Adj Flow Rate, veh/h	100	1153	319	62	938	383	199	16	153	28	16	53
Adj No. of Lanes	1	2	0	1	2	1	0	1	1	1	1	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	4	4	4	4	4	4	2	2	2
Cap, veh/h	277	1620	443	197	2086	933	349	21	378	163	93	307
Arrive On Green	0.60	0.60	0.60	0.60	0.60	0.60	0.24	0.24	0.24	0.24	0.24	0.24
Sat Flow, veh/h	406	2696	737	351	3471	1553	1063	85	1553	1211	380	1260
Grp Volume(v), veh/h	100	737	735	62	938	383	215	0	153	28	0	69
Grp Sat Flow(s),veh/h/ln	406	1736	1697	351	1736	1553	1148	0	1553	1211	0	1640
Q Serve(g_s), s	13.8	22.7	23.5	11.6	11.4	10.1	11.7	0.0	6.4	1.7	0.0	2.6
Cycle Q Clear(g_c), s	25.2	22.7	23.5	35.1	11.4	10.1	14.3	0.0	6.4	16.0	0.0	2.6
Prop In Lane	1.00		0.43	1.00		1.00	0.93		1.00	1.00		0.77
Lane Grp Cap(c), veh/h	277	1043	1020	197	2086	933	369	0	378	163	0	399
V/C Ratio(X)	0.36	0.71	0.72	0.31	0.45	0.41	0.58	0.00	0.40	0.17	0.00	0.17
Avail Cap(c_a), veh/h	281	1059	1036	201	2118	948	408	0	423	199	0	447
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.3	10.7	10.8	23.2	8.4	8.1	28.7	0.0	24.5	35.0	0.0	23.0
Incr Delay (d2), s/veh	0.8	2.1	2.4	0.9	0.2	0.3	1.7	0.0	0.7	0.5	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	11.3	11.5	1.2	5.4	4.3	4.5	0.0	2.8	0.6	0.0	1.2
LnGrp Delay(d),s/veh	16.1	12.8	13.2	24.1	8.6	8.4	30.4	0.0	25.2	35.5	0.0	23.2
LnGrp LOS	B	B	B	C	A	A	C		C	D		C
Approach Vol, veh/h		1572			1383			368			97	
Approach Delay, s/veh		13.2			9.2			28.2			26.8	
Approach LOS		B			A			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		52.3		24.7		52.3		24.7
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		47.0		21.0		47.0		21.0
Max Q Clear Time (g_c+I1), s		37.1		16.3		27.2		18.0
Green Ext Time (p_c), s		9.2		1.1		17.4		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	13.6
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	24	24	230	88	14	11	511	1381	180	31	1227	55
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1827	1624	1624	1900	1810	1810	1900	1810	1810	1810
Adj Flow Rate, veh/h	27	27	256	98	16	12	568	1534	200	34	1363	61
Adj No. of Lanes	1	1	1	1	1	0	2	3	0	1	3	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	17	17	17	5	5	5	5	5	5
Cap, veh/h	322	348	296	255	164	123	674	2374	309	101	1945	605
Arrive On Green	0.19	0.19	0.19	0.19	0.19	0.19	0.20	0.54	0.54	0.06	0.39	0.39
Sat Flow, veh/h	1350	1827	1553	952	863	647	3343	4425	576	1723	4940	1538
Grp Volume(v), veh/h	27	27	256	98	0	28	568	1141	593	34	1363	61
Grp Sat Flow(s),veh/h/ln	1350	1827	1553	952	0	1510	1672	1647	1708	1723	1647	1538
Q Serve(g_s), s	1.4	1.0	13.4	7.9	0.0	1.3	13.7	20.6	20.7	1.6	19.4	2.1
Cycle Q Clear(g_c), s	2.7	1.0	13.4	8.9	0.0	1.3	13.7	20.6	20.7	1.6	19.4	2.1
Prop In Lane	1.00		1.00	1.00		0.43	1.00		0.34	1.00		1.00
Lane Grp Cap(c), veh/h	322	348	296	255	0	288	674	1767	916	101	1945	605
V/C Ratio(X)	0.08	0.08	0.87	0.38	0.00	0.10	0.84	0.65	0.65	0.34	0.70	0.10
Avail Cap(c_a), veh/h	322	348	296	255	0	288	876	1843	956	185	2000	623
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	29.1	27.9	32.9	31.6	0.0	28.0	32.3	13.8	13.8	38.0	21.3	16.1
Incr Delay (d2), s/veh	0.1	0.1	22.5	0.9	0.0	0.1	5.9	0.7	1.4	1.9	1.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.5	7.6	2.1	0.0	0.5	6.9	9.5	10.1	0.8	9.0	0.9
LnGrp Delay(d),s/veh	29.3	28.0	55.4	32.5	0.0	28.2	38.2	14.6	15.3	39.9	22.4	16.1
LnGrp LOS	C	C	E	C		C	D	B	B	D	C	B
Approach Vol, veh/h		310			126			2302			1458	
Approach Delay, s/veh		50.8			31.6			20.6			22.5	
Approach LOS		D			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	22.9	39.1		22.0	10.9	51.1		22.0
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s	22.0	34.0		16.0	9.0	47.0		16.0
Max Q Clear Time (g_c+I1), s	15.7	21.4		10.9	3.6	22.7		15.4
Green Ext Time (p_c), s	1.2	11.7		0.8	0.0	21.3		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	23.8
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	56	4	464	192	20	11	276	1348	74	7	1221	34
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1638	1638	1900	1827	1827	1900	1827	1827	1827
Adj Flow Rate, veh/h	62	4	516	213	22	12	307	1498	82	8	1357	38
Adj No. of Lanes	1	1	1	1	1	0	2	3	0	1	3	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	16	16	16	4	4	4	4	4	4
Cap, veh/h	515	614	522	338	329	179	385	2132	117	32	1719	535
Arrive On Green	0.33	0.33	0.33	0.33	0.33	0.33	0.11	0.44	0.44	0.02	0.34	0.34
Sat Flow, veh/h	1369	1863	1583	772	998	544	3375	4840	265	1740	4988	1553
Grp Volume(v), veh/h	62	4	516	213	0	34	307	1029	551	8	1357	38
Grp Sat Flow(s),veh/h/ln	1369	1863	1583	772	0	1542	1688	1663	1780	1740	1663	1553
Q Serve(g_s), s	2.8	0.1	27.6	21.8	0.0	1.3	7.5	21.3	21.3	0.4	20.8	1.4
Cycle Q Clear(g_c), s	4.0	0.1	27.6	21.9	0.0	1.3	7.5	21.3	21.3	0.4	20.8	1.4
Prop In Lane	1.00		1.00	1.00		0.35	1.00		0.15	1.00		1.00
Lane Grp Cap(c), veh/h	515	614	522	338	0	508	385	1465	784	32	1719	535
V/C Ratio(X)	0.12	0.01	0.99	0.63	0.00	0.07	0.80	0.70	0.70	0.25	0.79	0.07
Avail Cap(c_a), veh/h	515	614	522	338	0	508	437	1465	784	184	1937	603
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.9	19.1	28.3	26.5	0.0	19.5	36.7	19.3	19.3	41.1	25.1	18.7
Incr Delay (d2), s/veh	0.1	0.0	36.5	3.7	0.0	0.1	8.9	1.5	2.8	4.1	2.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.1	17.3	5.0	0.0	0.6	4.0	10.0	11.0	0.2	9.9	0.6
LnGrp Delay(d),s/veh	21.0	19.2	64.9	30.2	0.0	19.6	45.6	20.8	22.1	45.2	27.1	18.8
LnGrp LOS	C	B	E	C		B	D	C	C	D	C	B
Approach Vol, veh/h		582			247			1887			1403	
Approach Delay, s/veh		59.9			28.8			25.2			27.0	
Approach LOS		E			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	15.7	35.3		34.0	7.5	43.4		34.0
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s	11.0	33.0		28.0	9.0	35.0		28.0
Max Q Clear Time (g_c+I1), s	9.5	22.8		23.9	2.4	23.3		29.6
Green Ext Time (p_c), s	0.2	6.5		1.6	0.0	10.6		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	30.9
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	606	0	315	291	1757	0	0	1375	170
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1712	0	1712	1759	1759	0	0	1810	1810
Adj Flow Rate, veh/h				673	0	350	323	1952	0	0	1528	189
Adj No. of Lanes				2	0	1	2	3	0	0	3	1
Peak Hour Factor				0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %				11	0	11	8	8	0	0	5	5
Cap, veh/h				867	0	399	391	2919	0	0	2117	659
Arrive On Green				0.27	0.00	0.27	0.12	0.61	0.00	0.00	0.43	0.43
Sat Flow, veh/h				3163	0	1455	3250	4961	0	0	5103	1538
Grp Volume(v), veh/h				673	0	350	323	1952	0	0	1528	189
Grp Sat Flow(s),veh/h/ln				1581	0	1455	1625	1601	0	0	1647	1538
Q Serve(g_s), s				19.9	0.0	23.4	9.9	27.3	0.0	0.0	26.0	8.1
Cycle Q Clear(g_c), s				19.9	0.0	23.4	9.9	27.3	0.0	0.0	26.0	8.1
Prop In Lane				1.00		1.00	1.00		0.00	0.00		1.00
Lane Grp Cap(c), veh/h				867	0	399	391	2919	0	0	2117	659
V/C Ratio(X)				0.78	0.00	0.88	0.83	0.67	0.00	0.00	0.72	0.29
Avail Cap(c_a), veh/h				1027	0	472	480	3071	0	0	2138	666
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				34.0	0.0	35.3	43.7	13.2	0.0	0.0	24.0	18.9
Incr Delay (d2), s/veh				3.2	0.0	15.1	9.6	0.5	0.0	0.0	1.2	0.2
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				9.1	0.0	11.0	5.0	12.1	0.0	0.0	12.0	3.5
LnGrp Delay(d),s/veh				37.2	0.0	50.3	53.2	13.7	0.0	0.0	25.2	19.2
LnGrp LOS				D		D	D	B			C	B
Approach Vol, veh/h					1023			2275			1717	
Approach Delay, s/veh					41.7			19.3			24.6	
Approach LOS					D			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		67.8			18.2	49.6		33.9
Change Period (Y+Rc), s		6.0			6.0	6.0		6.0
Max Green Setting (Gmax), s		65.0			15.0	44.0		33.0
Max Q Clear Time (g_c+I1), s		29.3			11.9	28.0		25.4
Green Ext Time (p_c), s		32.5			0.4	15.3		2.5

Intersection Summary	
HCM 2010 Ctrl Delay	25.7
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	772	0	253	687	1445	0	0	1624	253
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1743	0	1743	1792	1792	0	0	1827	1827
Adj Flow Rate, veh/h				858	0	281	763	1606	0	0	1804	281
Adj No. of Lanes				2	0	1	2	3	0	0	3	1
Peak Hour Factor				0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %				9	0	9	6	6	0	0	4	4
Cap, veh/h				820	0	377	753	3114	0	0	1768	551
Arrive On Green				0.25	0.00	0.25	0.23	0.64	0.00	0.00	0.35	0.35
Sat Flow, veh/h				3221	0	1482	3312	5055	0	0	5152	1553
Grp Volume(v), veh/h				858	0	281	763	1606	0	0	1804	281
Grp Sat Flow(s),veh/h/ln				1610	0	1482	1656	1631	0	0	1663	1553
Q Serve(g_s), s				28.0	0.0	19.2	25.0	19.5	0.0	0.0	39.0	15.7
Cycle Q Clear(g_c), s				28.0	0.0	19.2	25.0	19.5	0.0	0.0	39.0	15.7
Prop In Lane				1.00		1.00	1.00		0.00	0.00		1.00
Lane Grp Cap(c), veh/h				820	0	377	753	3114	0	0	1768	551
V/C Ratio(X)				1.05	0.00	0.75	1.01	0.52	0.00	0.00	1.02	0.51
Avail Cap(c_a), veh/h				820	0	377	753	3114	0	0	1768	551
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				41.0	0.0	37.7	42.5	10.8	0.0	0.0	35.5	28.0
Incr Delay (d2), s/veh				44.3	0.0	7.8	36.3	0.1	0.0	0.0	26.6	0.8
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				17.5	0.0	8.6	15.2	8.8	0.0	0.0	22.2	6.8
LnGrp Delay(d),s/veh				85.3	0.0	45.6	78.8	11.0	0.0	0.0	62.1	28.8
LnGrp LOS				F		D	F	B			F	C
Approach Vol, veh/h					1139			2369			2085	
Approach Delay, s/veh					75.5			32.8			57.6	
Approach LOS					E			C			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		76.0			31.0	45.0		34.0
Change Period (Y+Rc), s		6.0			6.0	6.0		6.0
Max Green Setting (Gmax), s		70.0			25.0	39.0		28.0
Max Q Clear Time (g_c+I1), s		21.5			27.0	41.0		30.0
Green Ext Time (p_c), s		42.5			0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	50.8
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	12	94	344	104	55	16	256	409	203	5	214	34
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1827	1827	1863	1863	1900	1792	1792	1792	1900	1810	1900
Adj Flow Rate, veh/h	13	104	382	116	61	18	284	454	226	6	238	38
Adj No. of Lanes	0	1	1	1	1	0	1	1	1	0	2	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	2	2	2	6	6	6	5	5	5
Cap, veh/h	70	406	614	443	576	170	493	776	660	51	576	90
Arrive On Green	0.24	0.24	0.24	0.10	0.42	0.42	0.16	0.43	0.43	0.20	0.20	0.20
Sat Flow, veh/h	84	1708	1553	1774	1383	408	1707	1792	1524	21	2876	448
Grp Volume(v), veh/h	117	0	382	116	0	79	284	454	226	149	0	133
Grp Sat Flow(s),veh/h/ln	1792	0	1553	1774	0	1791	1707	1792	1524	1778	0	1568
Q Serve(g_s), s	0.0	0.0	15.8	3.5	0.0	2.2	9.8	15.4	7.9	0.0	0.0	5.9
Cycle Q Clear(g_c), s	4.2	0.0	15.8	3.5	0.0	2.2	9.8	15.4	7.9	5.7	0.0	5.9
Prop In Lane	0.11		1.00	1.00		0.23	1.00		1.00	0.04		0.29
Lane Grp Cap(c), veh/h	476	0	614	443	0	746	493	776	660	403	0	314
V/C Ratio(X)	0.25	0.00	0.62	0.26	0.00	0.11	0.58	0.58	0.34	0.37	0.00	0.42
Avail Cap(c_a), veh/h	564	0	692	547	0	941	907	1481	1259	660	0	549
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.8	0.0	19.4	17.4	0.0	14.2	18.8	17.2	15.1	27.8	0.0	27.9
Incr Delay (d2), s/veh	0.3	0.0	1.4	0.3	0.0	0.1	1.1	0.7	0.3	0.6	0.0	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	0.0	7.0	1.7	0.0	1.1	4.6	7.7	3.3	2.9	0.0	2.6
LnGrp Delay(d),s/veh	25.1	0.0	20.8	17.7	0.0	14.3	19.8	17.9	15.4	28.4	0.0	28.8
LnGrp LOS	C		C	B		B	B	B	B	C		C
Approach Vol, veh/h		499			195			964			282	
Approach Delay, s/veh		21.8			16.3			17.9			28.6	
Approach LOS		C			B			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4	5	6		8
Phs Duration (G+Y+Rc), s		40.6	14.3	25.0	18.6	22.0		39.3
Change Period (Y+Rc), s		6.0	6.0	6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s		66.0	13.0	23.0	32.0	28.0		42.0
Max Q Clear Time (g_c+I1), s		17.4	5.5	17.8	11.8	7.9		4.2
Green Ext Time (p_c), s		6.1	0.1	1.2	0.8	5.2		2.6

Intersection Summary	
HCM 2010 Ctrl Delay	20.3
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	15	65	393	176	86	8	268	305	157	5	351	34
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1845	1863	1863	1900	1810	1810	1810	1900	1827	1900
Adj Flow Rate, veh/h	17	72	437	196	96	9	298	339	174	6	390	38
Adj No. of Lanes	0	1	1	1	1	0	1	1	1	0	2	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	2	2	2	5	5	5	4	4	4
Cap, veh/h	97	350	605	449	686	64	452	799	679	49	638	61
Arrive On Green	0.22	0.22	0.22	0.11	0.41	0.41	0.16	0.44	0.44	0.21	0.21	0.21
Sat Flow, veh/h	194	1563	1568	1774	1678	157	1723	1810	1538	14	3107	299
Grp Volume(v), veh/h	89	0	437	196	0	105	298	339	174	229	0	205
Grp Sat Flow(s),veh/h/ln	1757	0	1568	1774	0	1835	1723	1810	1538	1811	0	1610
Q Serve(g_s), s	0.0	0.0	18.0	6.4	0.0	2.9	10.2	10.3	5.7	0.0	0.0	9.3
Cycle Q Clear(g_c), s	3.2	0.0	18.0	6.4	0.0	2.9	10.2	10.3	5.7	9.2	0.0	9.3
Prop In Lane	0.19		1.00	1.00		0.09	1.00		1.00	0.03		0.19
Lane Grp Cap(c), veh/h	447	0	605	449	0	751	452	799	679	418	0	330
V/C Ratio(X)	0.20	0.00	0.72	0.44	0.00	0.14	0.66	0.42	0.26	0.55	0.00	0.62
Avail Cap(c_a), veh/h	447	0	605	606	0	913	816	1530	1301	760	0	641
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	25.4	0.0	21.0	18.8	0.0	14.9	19.1	15.4	14.1	29.0	0.0	29.1
Incr Delay (d2), s/veh	0.2	0.0	4.2	0.7	0.0	0.1	1.7	0.4	0.2	1.1	0.0	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.0	8.9	3.1	0.0	1.5	5.0	5.3	2.4	4.7	0.0	4.3
LnGrp Delay(d),s/veh	25.7	0.0	25.3	19.4	0.0	15.0	20.8	15.8	14.3	30.2	0.0	31.0
LnGrp LOS	C		C	B		B	C	B	B	C		C
Approach Vol, veh/h		526			301			811			434	
Approach Delay, s/veh		25.3			17.9			17.3			30.5	
Approach LOS		C			B			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4	5	6		8
Phs Duration (G+Y+Rc), s		41.5	14.9	24.0	19.0	22.5		38.9
Change Period (Y+Rc), s		6.0	6.0	6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s		68.0	16.0	18.0	30.0	32.0		40.0
Max Q Clear Time (g_c+I1), s		12.3	8.4	20.0	12.2	11.3		4.9
Green Ext Time (p_c), s		6.0	0.3	0.0	0.8	5.2		2.8

Intersection Summary	
HCM 2010 Ctrl Delay	22.2
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	131	942	0	0	494	153	311	0	60	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0		6.0		6.0			
Lane Util. Factor	1.00	0.95			0.95		0.97		1.00			
Frt	1.00	1.00			0.96		1.00		0.85			
Flt Protected	0.95	1.00			1.00		0.95		1.00			
Satd. Flow (prot)	1671	3343			3285		2894		1335			
Flt Permitted	0.28	1.00			1.00		0.95		1.00			
Satd. Flow (perm)	488	3343			3285		2894		1335			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	146	1047	0	0	549	170	346	0	67	0	0	0
RTOR Reduction (vph)	0	0	0	0	25	0	0	0	52	0	0	0
Lane Group Flow (vph)	146	1047	0	0	694	0	346	0	15	0	0	0
Heavy Vehicles (%)	8%	8%	8%	6%	6%	6%	21%	21%	21%	2%	2%	2%
Turn Type	custom	NA			NA		Prot		Prot			
Protected Phases	5 8	2 5 8			6		7		7			
Permitted Phases	2						7		7			
Actuated Green, G (s)	72.0	72.0			44.0		25.9		25.9			
Effective Green, g (s)	72.0	72.0			44.0		25.9		25.9			
Actuated g/C Ratio	0.61	0.61			0.37		0.22		0.22			
Clearance Time (s)					6.0		6.0		6.0			
Vehicle Extension (s)					3.0		3.0		3.0			
Lane Grp Cap (vph)	603	2024			1215		630		290			
v/s Ratio Prot	0.06	c0.31			c0.21		c0.12		0.01			
v/s Ratio Perm	0.08											
v/c Ratio	0.24	0.52			0.57		0.55		0.05			
Uniform Delay, d1	10.8	13.5			29.9		41.3		36.8			
Progression Factor	1.67	0.83			1.00		1.00		1.00			
Incremental Delay, d2	0.2	0.2			0.7		1.0		0.1			
Delay (s)	18.1	11.3			30.6		42.3		36.8			
Level of Service	B	B			C		D		D			
Approach Delay (s)		12.2			30.6			41.4			0.0	
Approach LOS		B			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	23.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	118.9	Sum of lost time (s)	24.0
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	294	631	0	0	823	324	333	0	114	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0		6.0		6.0			
Lane Util. Factor	1.00	0.95			0.95		0.97		1.00			
Frt	1.00	1.00			0.96		1.00		0.85			
Flt Protected	0.95	1.00			1.00		0.95		1.00			
Satd. Flow (prot)	1703	3406			3292		3045		1404			
Flt Permitted	0.10	1.00			1.00		0.95		1.00			
Satd. Flow (perm)	172	3406			3292		3045		1404			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	327	701	0	0	914	360	370	0	127	0	0	0
RTOR Reduction (vph)	0	0	0	0	34	0	0	0	108	0	0	0
Lane Group Flow (vph)	327	701	0	0	1240	0	370	0	19	0	0	0
Heavy Vehicles (%)	6%	6%	6%	5%	5%	5%	15%	15%	15%	2%	2%	2%
Turn Type	custom	NA			NA		Prot		Prot			
Protected Phases	5 8	2 5 8			6		7		7			
Permitted Phases	2						7		7			
Actuated Green, G (s)	74.0	74.0			51.2		17.5		17.5			
Effective Green, g (s)	74.0	74.0			51.2		17.5		17.5			
Actuated g/C Ratio	0.62	0.62			0.43		0.15		0.15			
Clearance Time (s)					6.0		6.0		6.0			
Vehicle Extension (s)					3.0		3.0		3.0			
Lane Grp Cap (vph)	523	2116			1415		447		206			
v/s Ratio Prot	c0.17	0.21			c0.38		c0.12		0.01			
v/s Ratio Perm	0.22											
v/c Ratio	0.63	0.33			0.88		0.83		0.09			
Uniform Delay, d1	25.9	10.8			31.1		49.3		43.9			
Progression Factor	1.84	0.76			1.00		1.00		1.00			
Incremental Delay, d2	1.7	0.1			6.4		11.9		0.2			
Delay (s)	49.4	8.3			37.4		61.3		44.1			
Level of Service	D	A			D		E		D			
Approach Delay (s)		21.3			37.4			56.9			0.0	
Approach LOS		C			D			E			A	

Intersection Summary			
HCM 2000 Control Delay	35.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	119.1	Sum of lost time (s)	24.0
Intersection Capacity Utilization	73.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	698	632	77	728	0	0	0	0	375	0	233
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0					6.0		6.0
Lane Util. Factor		0.95	1.00	1.00	0.95					1.00		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		3282	1468	1671	3343					1626		1455
Flt Permitted		1.00	1.00	0.20	1.00					0.95		1.00
Satd. Flow (perm)		3282	1468	345	3343					1626		1455
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	776	702	86	809	0	0	0	0	417	0	259
RTOR Reduction (vph)	0	0	117	0	0	0	0	0	0	0	0	66
Lane Group Flow (vph)	0	776	585	86	809	0	0	0	0	417	0	193
Heavy Vehicles (%)	10%	10%	10%	8%	8%	8%	2%	2%	2%	11%	11%	11%
Turn Type		NA	custom	custom	NA					custom		custom
Protected Phases		2		1	1 6					7 8		7 8
Permitted Phases			2 7 8	6						7 8		7 8
Actuated Green, G (s)		41.0	94.9	56.0	56.0					47.9		47.9
Effective Green, g (s)		41.0	94.9	56.0	56.0					47.9		47.9
Actuated g/C Ratio		0.34	0.80	0.47	0.47					0.40		0.40
Clearance Time (s)		6.0		6.0								
Vehicle Extension (s)		3.0		3.0								
Lane Grp Cap (vph)		1131	1171	296	1574					655		586
v/s Ratio Prot		c0.24		0.03	c0.24					c0.26		0.13
v/s Ratio Perm			0.40	0.11								
v/c Ratio		0.69	0.50	0.29	0.51					0.64		0.33
Uniform Delay, d1		33.4	4.0	19.5	22.0					28.5		24.4
Progression Factor		1.00	1.00	0.75	1.06					1.00		1.00
Incremental Delay, d2		1.7	0.3	0.4	0.2					2.0		0.3
Delay (s)		35.2	4.4	15.0	23.6					30.5		24.8
Level of Service		D	A	B	C					C		C
Approach Delay (s)		20.5			22.7			0.0			28.3	
Approach LOS		C			C			A			C	

Intersection Summary			
HCM 2000 Control Delay	22.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	118.9	Sum of lost time (s)	24.0
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	731	406	120	1036	0	0	0	0	194	0	216
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0					6.0		6.0
Lane Util. Factor		0.95	1.00	1.00	0.95					1.00		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		3343	1495	1703	3406					1583		1417
Flt Permitted		1.00	1.00	0.17	1.00					0.95		1.00
Satd. Flow (perm)		3343	1495	305	3406					1583		1417
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	812	451	133	1151	0	0	0	0	216	0	240
RTOR Reduction (vph)	0	0	121	0	0	0	0	0	0	0	0	91
Lane Group Flow (vph)	0	812	330	133	1151	0	0	0	0	216	0	149
Heavy Vehicles (%)	8%	8%	8%	6%	6%	6%	2%	2%	2%	14%	14%	14%
Turn Type		NA	custom	custom	NA					custom		custom
Protected Phases		2		1	1 6					7 8		7 8
Permitted Phases			2 7 8	6						7 8		7 8
Actuated Green, G (s)		41.6	87.1	67.6	67.6					39.5		39.5
Effective Green, g (s)		41.6	87.1	67.6	67.6					39.5		39.5
Actuated g/C Ratio		0.35	0.73	0.57	0.57					0.33		0.33
Clearance Time (s)		6.0		6.0								
Vehicle Extension (s)		3.0		3.0								
Lane Grp Cap (vph)		1167	1093	407	1933					525		469
v/s Ratio Prot		c0.24		0.05	c0.34					c0.14		0.11
v/s Ratio Perm			0.22	0.13								
v/c Ratio		0.70	0.30	0.33	0.60					0.41		0.32
Uniform Delay, d1		33.3	5.5	15.2	16.8					30.8		29.7
Progression Factor		1.00	1.00	1.49	0.95					1.00		1.00
Incremental Delay, d2		1.8	0.2	0.2	0.2					0.5		0.4
Delay (s)		35.1	5.7	22.8	16.3					31.3		30.1
Level of Service		D	A	C	B					C		C
Approach Delay (s)		24.6			17.0			0.0			30.7	
Approach LOS		C			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	22.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	119.1	Sum of lost time (s)	24.0
Intersection Capacity Utilization	73.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	204	256	323	178	132	67	556	1262	282	40	655	113
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1776	1776	1776	1792	1792	1900	1810	1810	1810	1810	1810	1810
Adj Flow Rate, veh/h	227	284	359	198	147	74	618	1402	313	44	728	126
Adj No. of Lanes	1	2	1	1	2	0	1	2	1	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	7	7	7	6	6	6	5	5	5	5	5	5
Cap, veh/h	280	675	755	283	726	348	588	1977	884	122	774	346
Arrive On Green	0.20	0.20	0.20	0.08	0.33	0.33	0.30	0.57	0.57	0.22	0.22	0.22
Sat Flow, veh/h	1101	3374	1509	1707	2235	1071	1723	3438	1538	275	3438	1538
Grp Volume(v), veh/h	227	284	359	198	110	111	618	1402	313	44	728	126
Grp Sat Flow(s),veh/h/ln	1101	1687	1509	1707	1703	1603	1723	1719	1538	275	1719	1538
Q Serve(g_s), s	24.0	8.8	18.7	9.0	5.6	6.0	36.0	35.1	13.0	17.7	25.0	8.3
Cycle Q Clear(g_c), s	24.0	8.8	18.7	9.0	5.6	6.0	36.0	35.1	13.0	17.7	25.0	8.3
Prop In Lane	1.00		1.00	1.00		0.67	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	280	675	755	283	553	521	588	1977	884	122	774	346
V/C Ratio(X)	0.81	0.42	0.48	0.70	0.20	0.21	1.05	0.71	0.35	0.36	0.94	0.36
Avail Cap(c_a), veh/h	280	675	755	283	553	521	588	1977	884	122	774	346
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	48.4	41.9	19.7	37.0	29.2	29.4	33.2	18.3	13.6	42.9	45.7	39.3
Incr Delay (d2), s/veh	16.2	0.4	0.5	7.4	0.2	0.2	51.5	1.2	0.2	1.8	19.5	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.8	4.1	7.9	2.6	2.7	2.7	27.8	16.9	5.5	1.4	13.9	3.6
LnGrp Delay(d),s/veh	64.5	42.3	20.1	44.3	29.4	29.6	84.7	19.5	13.8	44.7	65.2	39.9
LnGrp LOS	E	D	C	D	C	C	F	B	B	D	E	D
Approach Vol, veh/h		870			419			2333			898	
Approach Delay, s/veh		39.0			36.5			36.0			60.6	
Approach LOS		D			D			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6	7	8
Phs Duration (G+Y+Rc), s	42.0	33.0		45.0		75.0	15.0	30.0
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0	6.0	6.0
Max Green Setting (Gmax), s	36.0	27.0		39.0		69.0	9.0	24.0
Max Q Clear Time (g_c+I1), s	38.0	27.0		8.0		37.1	11.0	26.0
Green Ext Time (p_c), s	0.0	0.0		6.0		23.8	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	41.5
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	96	150	535	259	311	60	344	786	158	28	1208	145
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1792	1792	1792	1810	1810	1900	1827	1827	1827	1827	1827	1827
Adj Flow Rate, veh/h	107	167	594	288	346	67	382	873	176	31	1342	161
Adj No. of Lanes	1	2	1	1	2	0	1	2	1	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	6	6	6	5	5	5	4	4	4	4	4	4
Cap, veh/h	184	454	495	264	768	147	396	2198	983	266	1360	608
Arrive On Green	0.13	0.13	0.13	0.08	0.27	0.27	0.19	0.63	0.63	0.39	0.39	0.39
Sat Flow, veh/h	932	3406	1524	1723	2880	552	1740	3471	1553	525	3471	1553
Grp Volume(v), veh/h	107	167	594	288	205	208	382	873	176	31	1342	161
Grp Sat Flow(s),veh/h/ln	932	1703	1524	1723	1719	1712	1740	1736	1553	525	1736	1553
Q Serve(g_s), s	13.5	5.4	16.0	10.0	11.9	12.2	21.7	14.8	5.6	4.6	46.0	8.4
Cycle Q Clear(g_c), s	13.5	5.4	16.0	10.0	11.9	12.2	21.7	14.8	5.6	4.6	46.0	8.4
Prop In Lane	1.00		1.00	1.00		0.32	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	184	454	495	264	458	457	396	2198	983	266	1360	608
V/C Ratio(X)	0.58	0.37	1.20	1.09	0.45	0.46	0.96	0.40	0.18	0.12	0.99	0.26
Avail Cap(c_a), veh/h	184	454	495	264	458	457	396	2198	983	266	1360	608
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	50.9	47.4	40.5	46.3	36.6	36.7	38.3	10.8	9.1	23.6	36.2	24.8
Incr Delay (d2), s/veh	4.5	0.5	108.0	81.7	0.7	0.7	35.8	0.1	0.1	0.2	21.3	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	2.6	31.2	6.0	5.7	5.9	16.5	7.1	2.4	0.7	26.0	3.7
LnGrp Delay(d),s/veh	55.4	47.9	148.5	128.0	37.3	37.4	74.1	10.9	9.2	23.8	57.5	25.0
LnGrp LOS	E	D	F	F	D	D	E	B	A	C	E	C
Approach Vol, veh/h		868			701			1431			1534	
Approach Delay, s/veh		117.7			74.6			27.5			53.4	
Approach LOS		F			E			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6	7	8
Phs Duration (G+Y+Rc), s	29.0	53.0		38.0		82.0	16.0	22.0
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0	6.0	6.0
Max Green Setting (Gmax), s	23.0	47.0		32.0		76.0	10.0	16.0
Max Q Clear Time (g_c+I1), s	23.7	48.0		14.2		16.8	12.0	18.0
Green Ext Time (p_c), s	0.0	0.0		6.3		34.7	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	60.8
HCM 2010 LOS	E

Intersection	
Int Delay, s/veh	1.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	37	31	291	45	52	418
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	170	0	-	100	220	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	56	56	19	19	28	28
Mvmt Flow	41	34	323	50	58	464

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	903	323	0	0	323	0
Stage 1	323	-	-	-	-	-
Stage 2	580	-	-	-	-	-
Critical Hdwy	6.96	6.76	-	-	4.38	-
Critical Hdwy Stg 1	5.96	-	-	-	-	-
Critical Hdwy Stg 2	5.96	-	-	-	-	-
Follow-up Hdwy	4.004	3.804	-	-	2.452	-
Pot Cap-1 Maneuver	249	609	-	-	1104	-
Stage 1	627	-	-	-	-	-
Stage 2	467	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	236	609	-	-	1104	-
Mov Cap-2 Maneuver	236	-	-	-	-	-
Stage 1	627	-	-	-	-	-
Stage 2	442	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.9		
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	236	609	1104	-
HCM Lane V/C Ratio	-	-	0.174	0.057	0.052	-
HCM Control Delay (s)	-	-	23.4	11.3	8.4	-
HCM Lane LOS	-	-	C	B	A	-
HCM 95th %tile Q(veh)	-	-	1	0	0	-

Intersection	
Int Delay, s/veh	1.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	31	37	390	52	45	296
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	170	0	-	100	220	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	48	48	17	17	25	25
Mvmt Flow	34	41	433	58	50	329

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	862	433	0	0	433	0
Stage 1	433	-	-	-	-	-
Stage 2	429	-	-	-	-	-
Critical Hdwy	6.88	6.68	-	-	4.35	-
Critical Hdwy Stg 1	5.88	-	-	-	-	-
Critical Hdwy Stg 2	5.88	-	-	-	-	-
Follow-up Hdwy	3.932	3.732	-	-	2.425	-
Pot Cap-1 Maneuver	272	536	-	-	1014	-
Stage 1	566	-	-	-	-	-
Stage 2	569	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	259	536	-	-	1014	-
Mov Cap-2 Maneuver	259	-	-	-	-	-
Stage 1	566	-	-	-	-	-
Stage 2	541	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.3		
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	259	536	1014	-
HCM Lane V/C Ratio	-	-	0.133	0.077	0.049	-
HCM Control Delay (s)	-	-	21	12.3	8.7	-
HCM Lane LOS	-	-	C	B	A	-
HCM 95th %tile Q(veh)	-	-	0	0	0	-

Intersection	
Int Delay, s/veh	42.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	181	174	162	393	362	93
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	Free	-	None
Storage Length	0	0	-	0	175	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	11	11	18	18	19	19
Mvmt Flow	201	193	180	437	402	103

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1036	180	0	-	180	0
Stage 1	180	-	-	-	-	-
Stage 2	856	-	-	-	-	-
Critical Hdwy	6.765	6.365	-	-	4.29	-
Critical Hdwy Stg 1	5.565	-	-	-	-	-
Critical Hdwy Stg 2	5.965	-	-	-	-	-
Follow-up Hdwy	3.6045	3.4045	-	-	2.371	-
Pot Cap-1 Maneuver	229	837	-	0	1299	-
Stage 1	826	-	-	0	-	-
Stage 2	360	-	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	~ 158	837	-	-	1299	-
Mov Cap-2 Maneuver	~ 158	-	-	-	-	-
Stage 1	826	-	-	-	-	-
Stage 2	249	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	116.8		
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	158	837	1299	-
HCM Lane V/C Ratio	-	1.273	0.231	0.31	-
HCM Control Delay (s)	-	218.9	10.6	9	-
HCM Lane LOS	-	F	B	A	-
HCM 95th %tile Q(veh)	-	12	1	1	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Int Delay, s/veh	36.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	364	329	113	162	173	154
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	Free	-	None
Storage Length	0	0	-	0	175	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	10	10	16	16	17	17
Mvmt Flow	404	366	126	180	192	171

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	596	126	0	-	126	0
Stage 1	126	-	-	-	-	-
Stage 2	470	-	-	-	-	-
Critical Hdwy	6.75	6.35	-	-	4.27	-
Critical Hdwy Stg 1	5.55	-	-	-	-	-
Critical Hdwy Stg 2	5.95	-	-	-	-	-
Follow-up Hdwy	3.595	3.395	-	-	2.353	-
Pot Cap-1 Maneuver	435	901	-	0	1373	-
Stage 1	878	-	-	0	-	-
Stage 2	577	-	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	~ 374	901	-	-	1373	-
Mov Cap-2 Maneuver	~ 374	-	-	-	-	-
Stage 1	878	-	-	-	-	-
Stage 2	496	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	60.1		
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	374	901	1373	-
HCM Lane V/C Ratio	-	1.081	0.406	0.14	-
HCM Control Delay (s)	-	103.8	11.7	8	-
HCM Lane LOS	-	F	B	A	-
HCM 95th %tile Q(veh)	-	14	2	0	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	199	17	19	356	177	97
Number	7	14	5	2	6	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1727	1727	1583	1583	1610	1900
Adj Flow Rate, veh/h	221	19	21	396	197	108
Adj No. of Lanes	2	1	1	2	2	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	10	10	20	20	18	18
Cap, veh/h	446	205	818	2330	1503	790
Arrive On Green	0.14	0.14	0.77	0.77	1.00	1.00
Sat Flow, veh/h	3191	1468	909	3088	2021	1020
Grp Volume(v), veh/h	221	19	21	396	153	152
Grp Sat Flow(s),veh/h/ln	1596	1468	909	1504	1530	1430
Q Serve(g_s), s	4.1	0.7	0.3	2.2	0.0	0.0
Cycle Q Clear(g_c), s	4.1	0.7	0.3	2.2	0.0	0.0
Prop In Lane	1.00	1.00	1.00			0.71
Lane Grp Cap(c), veh/h	446	205	818	2330	1185	1108
V/C Ratio(X)	0.50	0.09	0.03	0.17	0.13	0.14
Avail Cap(c_a), veh/h	1107	509	818	2330	1185	1108
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00
Upstream Filter(I)	0.82	0.82	1.00	1.00	0.78	0.78
Uniform Delay (d), s/veh	25.2	23.8	1.7	1.9	0.0	0.0
Incr Delay (d2), s/veh	0.7	0.2	0.1	0.2	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	0.3	0.1	0.9	0.1	0.1
LnGrp Delay(d),s/veh	25.9	23.9	1.7	2.0	0.2	0.2
LnGrp LOS	C	C	A	A	A	A
Approach Vol, veh/h	240			417	305	
Approach Delay, s/veh	25.8			2.0	0.2	
Approach LOS	C			A	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		55.1		14.9		55.1		
Change Period (Y+Rc), s		6.0		6.0		6.0		
Max Green Setting (Gmax), s		36.0		22.0		36.0		
Max Q Clear Time (g_c+I1), s		4.2		6.1		2.0		
Green Ext Time (p_c), s		5.0		0.7		5.1		

Intersection Summary	
HCM 2010 Ctrl Delay	7.4
HCM 2010 LOS	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	98	16	16	177	321	197
Number	7	14	5	2	6	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1743	1743	1597	1597	1638	1900
Adj Flow Rate, veh/h	109	18	18	197	357	219
Adj No. of Lanes	2	1	1	2	2	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	9	9	19	19	16	16
Cap, veh/h	444	204	638	2165	1333	804
Arrive On Green	0.14	0.14	0.71	0.71	1.00	1.00
Sat Flow, veh/h	3221	1482	715	3113	1950	1127
Grp Volume(v), veh/h	109	18	18	197	296	280
Grp Sat Flow(s),veh/h/ln	1610	1482	715	1517	1556	1439
Q Serve(g_s), s	1.7	0.6	0.4	1.1	0.0	0.0
Cycle Q Clear(g_c), s	1.7	0.6	0.4	1.1	0.0	0.0
Prop In Lane	1.00	1.00	1.00			0.78
Lane Grp Cap(c), veh/h	444	204	638	2165	1110	1027
V/C Ratio(X)	0.25	0.09	0.03	0.09	0.27	0.27
Avail Cap(c_a), veh/h	857	394	638	2165	1110	1027
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00
Upstream Filter(I)	0.90	0.90	1.00	1.00	0.81	0.81
Uniform Delay (d), s/veh	21.7	21.2	2.4	2.5	0.0	0.0
Incr Delay (d2), s/veh	0.3	0.2	0.1	0.1	0.5	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.3	0.1	0.5	0.1	0.2
LnGrp Delay(d),s/veh	22.0	21.4	2.5	2.6	0.5	0.5
LnGrp LOS	C	C	A	A	A	A
Approach Vol, veh/h	127			215	576	
Approach Delay, s/veh	21.9			2.5	0.5	
Approach LOS	C			A	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		46.2		13.8		46.2		
Change Period (Y+Rc), s		6.0		6.0		6.0		
Max Green Setting (Gmax), s		33.0		15.0		33.0		
Max Q Clear Time (g_c+I1), s		3.1		3.7		2.0		
Green Ext Time (p_c), s		5.5		0.3		5.6		

Intersection Summary	
HCM 2010 Ctrl Delay	3.9
HCM 2010 LOS	A

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	0	4	375	28	166
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	14	14	20	20
Mvmt Flow	0	0	4	417	31	184

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	340	108	216	0	-	0
Stage 1	123	-	-	-	-	-
Stage 2	217	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.38	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.34	-	-	-
Pot Cap-1 Maneuver	630	925	1268	-	-	-
Stage 1	889	-	-	-	-	-
Stage 2	798	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	627	925	1268	-	-	-
Mov Cap-2 Maneuver	627	-	-	-	-	-
Stage 1	889	-	-	-	-	-
Stage 2	795	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	0.1	
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1268	-	-	-	-
HCM Lane V/C Ratio	0.004	-	-	-	-
HCM Control Delay (s)	7.8	0	0	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	0	4	193	14	323
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	24	24	19	19
Mvmt Flow	0	0	4	214	16	359

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	311	187	374	0	-	0
Stage 1	195	-	-	-	-	-
Stage 2	116	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.58	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.44	-	-	-
Pot Cap-1 Maneuver	657	823	1038	-	-	-
Stage 1	819	-	-	-	-	-
Stage 2	896	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	654	823	1038	-	-	-
Mov Cap-2 Maneuver	654	-	-	-	-	-
Stage 1	819	-	-	-	-	-
Stage 2	892	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	0.2	
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1038	-	-	-	-
HCM Lane V/C Ratio	0.004	-	-	-	-
HCM Control Delay (s)	8.5	0	0	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Int Delay, s/veh	11.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	371	4	4	4	0	4	0	4	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	16	16	16	2	2	2	2	2	2
Mvmt Flow	412	4	4	4	0	4	0	4	4

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	56	56	16	58	54	7	16	0	0
Stage 1	47	47	-	7	7	-	-	-	-
Stage 2	9	9	-	51	47	-	-	-	-
Critical Hdwy	7.26	6.66	6.36	7.12	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	6.26	5.66	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	6.26	5.66	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	3.644	4.144	3.444	3.518	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	908	809	1024	939	837	1075	1602	-	-
Stage 1	932	829	-	1015	890	-	-	-	-
Stage 2	977	861	-	962	856	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	897	801	1024	924	828	1075	1602	-	-
Mov Cap-2 Maneuver	897	801	-	924	828	-	-	-	-
Stage 1	932	820	-	1015	890	-	-	-	-
Stage 2	973	861	-	943	847	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	12.5	8.7	
HCM LOS	B	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1602	-	-	897	994	1536	-	-
HCM Lane V/C Ratio	-	-	-	0.469	0.009	0.01	-	-
HCM Control Delay (s)	0	-	-	12.5	8.7	7.4	-	-
HCM Lane LOS	A	-	-	B	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	3	0	0	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	14	14	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	0	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	90	90	90
Heavy Vehicles, %	14	14	14
Mvmt Flow	16	16	0

Major/Minor	Major2		
Conflicting Flow All	9	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.24	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.326	-	-
Pot Cap-1 Maneuver	1536	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1536	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	9.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	187	4	4	4	0	4	0	6	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	26	26	26	2	2	2	2	2	2
Mvmt Flow	208	4	4	4	0	4	0	7	4

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	34	34	8	37	32	9	8	0	0
Stage 1	23	23	-	9	9	-	-	-	-
Stage 2	11	11	-	28	23	-	-	-	-
Critical Hdwy	7.36	6.76	6.46	7.12	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	6.36	5.76	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	6.36	5.76	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	3.734	4.234	3.534	3.518	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	915	814	1008	968	861	1073	1612	-	-
Stage 1	937	831	-	1012	888	-	-	-	-
Stage 2	951	841	-	989	876	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	907	810	1008	956	856	1073	1612	-	-
Mov Cap-2 Maneuver	907	810	-	956	856	-	-	-	-
Stage 1	937	826	-	1012	888	-	-	-	-
Stage 2	947	841	-	974	871	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	10.2	8.6	
HCM LOS	B	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1612	-	-	907	1011	1476	-	-
HCM Lane V/C Ratio	-	-	-	0.239	0.009	0.005	-	-
HCM Control Delay (s)	0	-	-	10.2	8.6	7.5	-	-
HCM Lane LOS	A	-	-	B	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	1	0	0	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	7	7	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	0	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	90	90	90
Heavy Vehicles, %	24	24	24
Mvmt Flow	8	8	0

Major/Minor	Major2		
Conflicting Flow All	11	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.34	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.416	-	-
Pot Cap-1 Maneuver	1476	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1476	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	4.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	31	53	103	185	358	59
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	100	100	100	28	26	100
Mvmt Flow	34	59	114	206	398	66

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	763	232	463	0	-	0
Stage 1	431	-	-	-	-	-
Stage 2	332	-	-	-	-	-
Critical Hdwy	8.8	8.9	6.1	-	-	-
Critical Hdwy Stg 1	7.8	-	-	-	-	-
Critical Hdwy Stg 2	7.8	-	-	-	-	-
Follow-up Hdwy	4.5	4.3	3.2	-	-	-
Pot Cap-1 Maneuver	192	540	626	-	-	-
Stage 1	407	-	-	-	-	-
Stage 2	476	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	152	540	626	-	-	-
Mov Cap-2 Maneuver	152	-	-	-	-	-
Stage 1	407	-	-	-	-	-
Stage 2	378	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	24.4	4.7	
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	626	-	278	-	-
HCM Lane V/C Ratio	0.183	-	0.336	-	-
HCM Control Delay (s)	12	0.6	24.4	-	-
HCM Lane LOS	B	A	C	-	-
HCM 95th %tile Q(veh)	1	-	1	-	-

Intersection	
Int Delay, s/veh	4.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	62	104	51	355	198	28
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	100	100	100	25	22	100
Mvmt Flow	69	116	57	394	220	31

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	547	126	251	0	-	0
Stage 1	236	-	-	-	-	-
Stage 2	311	-	-	-	-	-
Critical Hdwy	8.8	8.9	6.1	-	-	-
Critical Hdwy Stg 1	7.8	-	-	-	-	-
Critical Hdwy Stg 2	7.8	-	-	-	-	-
Follow-up Hdwy	4.5	4.3	3.2	-	-	-
Pot Cap-1 Maneuver	290	660	820	-	-	-
Stage 1	554	-	-	-	-	-
Stage 2	492	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	264	660	820	-	-	-
Mov Cap-2 Maneuver	264	-	-	-	-	-
Stage 1	554	-	-	-	-	-
Stage 2	448	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	19.9	1.5	
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	820	-	423	-	-
HCM Lane V/C Ratio	0.069	-	0.436	-	-
HCM Control Delay (s)	9.7	0.3	19.9	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	2	-	-

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	26	12	21	195	405	44
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	26	26	23	23
Mvmt Flow	29	13	23	217	450	49

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	629	249	499	0	-	0
Stage 1	474	-	-	-	-	-
Stage 2	155	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.62	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.46	-	-	-
Pot Cap-1 Maneuver	414	751	910	-	-	-
Stage 1	592	-	-	-	-	-
Stage 2	857	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	402	751	910	-	-	-
Mov Cap-2 Maneuver	402	-	-	-	-	-
Stage 1	592	-	-	-	-	-
Stage 2	832	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	13.4	1	
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	910	-	471	-	-
HCM Lane V/C Ratio	0.026	-	0.09	-	-
HCM Control Delay (s)	9.1	0.1	13.4	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	44	24	14	403	202	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	22	22	20	20
Mvmt Flow	49	27	16	448	224	28

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	493	126	252	0	-	0
Stage 1	238	-	-	-	-	-
Stage 2	255	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.54	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.42	-	-	-
Pot Cap-1 Maneuver	505	901	1177	-	-	-
Stage 1	779	-	-	-	-	-
Stage 2	764	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	496	901	1177	-	-	-
Mov Cap-2 Maneuver	496	-	-	-	-	-
Stage 1	779	-	-	-	-	-
Stage 2	750	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12	0.4	
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1177	-	590	-	-
HCM Lane V/C Ratio	0.013	-	0.128	-	-
HCM Control Delay (s)	8.1	0.1	12	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Cosgrove NB
Agency or Company	Atkins	Junction	7010 - Off to I-26 EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	125	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3107	V_D =	veh/h
		Ramp Volume, V_R	870		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3107	0.90	Level	12	0	0.943	1.00	3659
Ramp	870	0.90	Level	17	0	0.922	1.00	1049
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.620 using Equation (Exhibit 13-7)

V_{12} = 2668 pc/h

V_3 or V_{av34} 991 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3659	Exhibit 13-8	6750	No
$V_{FO} = V_F - V_R$	2610	Exhibit 13-8	6750	No
V_R	1049	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2668	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 26.1 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.392 (Exhibit 13-12)

S_R= 49.9 mph (Exhibit 13-12)

S_0= 60.3 mph (Exhibit 13-12)

S = 52.4 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Cosgrove NB
Agency or Company	Atkins	Junction	7010 - Off to I-26 EB
Date Performed	3/20/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	125
Freeway Volume, V_F	2024
Ramp Volume, V_R	472
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2024	0.90	Level	10	0	0.952	1.00	2361
Ramp	472	0.90	Level	27	0	0.881	1.00	595
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.674 using Equation (Exhibit 13-7)
V_{12} = 1785 pc/h
V_3 or V_{av34} 576 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2361	Exhibit 13-8	6750	No
$V_{FO} = V_F - V_R$	1766	Exhibit 13-8	6750	No
V_R	595	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1785	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 18.5 (pc/mi/ln)
LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.352 (Exhibit 13-12)
S_R= 50.4 mph (Exhibit 13-12)
S_0= 60.3 mph (Exhibit 13-12)
S = 52.5 mph (Exhibit 13-13)

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	Cosgrove NB
Weaving Segment Location	7020-I-26 EB On to I-26 WB Off
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	450ft
Freeway free-flow speed, FFS	45 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1363	0.90	10	0	1.5	1.2	0.952	1.00	1590
V_{RF}	308	0.90	10	0	1.5	1.2	0.952	1.00	359
V_{FR}	874	0.90	19	0	1.5	1.2	0.913	1.00	1063
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	1590							V =	3012
V_W	1422								
VR	0.472								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1422 lc/h
Interchange density, ID	0.2 int/mi	Weaving lane changes, LC_W	1510 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	0 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1510 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	14

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	3012 pc/h	Weaving intensity factor, W	0.587
Weaving segment capacity, c_w	4841 veh/h	Weaving segment speed, S	32.4 mph
Weaving segment v/c ratio	0.593	Average weaving speed, S_W	33.9 mph
Weaving segment density, D	23.2 pc/mi/ln	Average non-weaving speed, S_{NW}	31.1 mph
Level of Service, LOS	B	Maximum weaving length, L_{MAX}	7502 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	Cosgrove NB
Weaving Segment Location	7020-I-26 EB On to I-26 WB Off
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	450ft
Freeway free-flow speed, FFS	45 mph
Segment type	C-D Roadway/ Multilane Highways
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2250
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	762	0.90	8	0	1.5	1.2	0.962	1.00	881
V_{RF}	148	0.90	14	0	1.5	1.2	0.935	1.00	176
V_{FR}	790	0.90	18	0	1.5	1.2	0.917	1.00	957
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	881							V =	2014
V_W	1133								
VR	0.563								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1133 lc/h
Interchange density, ID	0.2 int/mi	Weaving lane changes, LC_W	1221 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	0 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1221 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	8

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	2014 pc/h	Weaving intensity factor, W	0.497
Weaving segment capacity, c_w	4102 veh/h	Weaving segment speed, S	34.8 mph
Weaving segment v/c ratio	0.472	Average weaving speed, S_W	35.0 mph
Weaving segment density, D	14.5 pc/mi/ln	Average non-weaving speed, S_{NW}	34.4 mph
Level of Service, LOS	B	Maximum weaving length, L_{MAX}	8567 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Cosgrove NB
Agency or Company	Atkins	Junction	7030 - NB On from I-26 WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 200	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1671	
	Ramp Volume, V_R: 429	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1671	0.90	Level	10	0	0.952	1.00	1950
Ramp	429	0.90	Level	14	0	0.935	1.00	510
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.583 using Equation (Exhibit 13-6)

V_{12} = 1137 pc/h

V_3 or V_{av34} 813 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2460	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1647	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 16.8 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.323 (Exibit 13-11)

S_R= 50.8 mph (Exhibit 13-11)

S_0= 53.9 mph (Exhibit 13-11)

S = 51.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Cosgrove NB
Agency or Company	Atkins	Junction	7030 - NB On from I-26 WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 200	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D	V_D = veh/h
	Freeway Volume, V_F: 910	
	Ramp Volume, V_R: 378	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	910	0.90	Level	8	0	0.962	1.00	1052
Ramp	378	0.90	Level	13	0	0.939	1.00	447
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.583 using Equation (Exhibit 13-6)

V_{12} = 613 pc/h

V_3 or V_{av34} 439 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1499	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1060	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 12.3 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.314 (Exibit 13-11)

S_R= 50.9 mph (Exhibit 13-11)

S_0= 55.0 mph (Exhibit 13-11)

S = 52.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Cosgrove SB
Agency or Company	Atkins	Junction	7040 - Off to I-26 WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	225	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	1156	V_D =	veh/h
		Ramp Volume, V_R	177		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1156	0.90	Level	5	0	0.976	1.00	1317
Ramp	177	0.90	Level	24	0	0.893	1.00	220
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1317 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1317	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1097	Exhibit 13-8	4500	No
V_R	220	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1317	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 13.6 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.318 (Exhibit 13-12)

S_R= 50.9 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.9 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Cosgrove SB
Agency or Company	Atkins	Junction	7040 - Off to I-26 WB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	225
Freeway Volume, V_F	2002
Ramp Volume, V_R	361
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2002	0.90	Level	4	0	0.980	1.00	2269
Ramp	361	0.90	Level	10	0	0.952	1.00	421
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 1.000 using Equation (Exhibit 13-7)
V_{12} = 2269 pc/h
V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2269	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1848	Exhibit 13-8	4500	No
V_R	421	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2269	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 21.7 (pc/mi/ln)
LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.336 (Exhibit 13-12)
S_R= 50.6 mph (Exhibit 13-12)
S_0= N/A mph (Exhibit 13-12)
S = 50.6 mph (Exhibit 13-13)

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	Cosgrove SB
Weaving Segment Location	7050-I-26 WB On to I-26 EB Off
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	C-D Roadway/ Multilane Highways
Weaving number of lanes, N	3	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	475ft	Freeway maximum capacity, C_{IFL}	2250
Freeway free-flow speed, FFS	45 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	556	0.90	10	0	1.5	1.2	0.952	1.00	649
V_{RF}	374	0.90	28	0	1.5	1.2	0.877	1.00	474
V_{FR}	423	0.90	10	0	1.5	1.2	0.952	1.00	494
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	649							V =	1617
V_W	968								
VR	0.599								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	968 lc/h
Interchange density, ID	0.2 int/mi	Weaving lane changes, LC_W	1022 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	0 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1022 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	6

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	1617 pc/h	Weaving intensity factor, W	0.414
Weaving segment capacity, c_w	3818 veh/h	Weaving segment speed, S	35.9 mph
Weaving segment v/c ratio	0.403	Average weaving speed, S_W	36.2 mph
Weaving segment density, D	15.0 pc/mi/ln	Average non-weaving speed, S_{NW}	35.4 mph
Level of Service, LOS	B	Maximum weaving length, L_{MAX}	9002 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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Navy Base ICTF

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AJR
Agency/Company	Atkins
Date Performed	7/25/2014
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	Cosgrove SB
Weaving Segment Location	7050-I-26 WB On to I-26 EB Off
Analysis Year	2038 Build - Proposed Site

Project Description *Navy Base ICTF*

Inputs

Weaving configuration	One-Sided	Segment type	C-D Roadway/ Multilane Highways
Weaving number of lanes, N	3	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	475ft	Freeway maximum capacity, C_{IFL}	2250
Freeway free-flow speed, FFS	45 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1201	0.90	8	0	1.5	1.2	0.962	1.00	1388
V_{RF}	855	0.90	11	0	1.5	1.2	0.948	1.00	1002
V_{FR}	440	0.90	8	0	1.5	1.2	0.962	1.00	508
V_{RR}	0	0.90	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	1388							V =	2898
V_W	1510								
VR	0.521								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1510 lc/h
Interchange density, ID	0.2 int/mi	Weaving lane changes, LC_W	1564 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	0 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	1564 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	13

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	2898 pc/h	Weaving intensity factor, W	0.579
Weaving segment capacity, c_w	4429 veh/h	Weaving segment speed, S	31.7 mph
Weaving segment v/c ratio	0.629	Average weaving speed, S_W	34.0 mph
Weaving segment density, D	30.5 pc/mi/ln	Average non-weaving speed, S_{NW}	29.5 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	8074 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	Cosgrove SB
Analysis Year	2038 Build - Proposed Site	Junction	From I-26 EB
Analysis Time Period:	AM Peak	Segment ID	7060
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	45	45	45
Volume, V (veh/h)	930	1,795	865
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	12%	12%	12%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.94	0.94	0.94
Demand Flow Rate, v_p (pc/h/ln)	548	705	1,019
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	2,100
v/c ratio	0.26	0.34	0.49
Density, D_{MD} (pc/mi/ln)	9.6	12.3	17.8
LOS	A	B	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	Cosgrove SB
Analysis Year	2038 Build - Proposed Site	Junction	From I-26 EB
Analysis Time Period:	PM Peak	Segment ID	7060
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	45	45	45
Volume, V (veh/h)	2,056	3,299	1,243
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	10%	10%	7%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.95	0.95	0.97
Demand Flow Rate, v_p (pc/h/ln)	1,199	1,283	1,429
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	2,100
v/c ratio	0.57	0.61	0.68
Density, D_{MD} (pc/mi/ln)	21.0	22.5	25.0
LOS	C	C	C

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Montague NB
Agency or Company	Atkins	Junction	8010 - Off to I-26 EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	350
Freeway Volume, V_F	2254
Ramp Volume, V_R	735
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2254	0.90	Level	11	0	0.948	1.00	2642
Ramp	735	0.90	Level	8	0	0.962	1.00	849
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2642 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2642	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	1793	Exhibit 13-8	4500	No
V_R	849	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2642	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 23.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.374 (Exhibit 13-12)

S_R= 50.1 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.1 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Montague NB
Agency or Company	Atkins	Junction	8010 - Off to I-26 EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	350
Freeway Volume, V_F	2651
Ramp Volume, V_R	797
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2651	0.90	Level	8	0	0.962	1.00	3063
Ramp	797	0.90	Level	6	0	0.971	1.00	912
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 1.000 using Equation (Exhibit 13-7)
V_{12} = 3063 pc/h
V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3063	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	2151	Exhibit 13-8	4500	No
V_R	912	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3063	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 27.4 (pc/mi/ln)
LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.380 (Exhibit 13-12)
S_R= 50.1 mph (Exhibit 13-12)
S_0= N/A mph (Exhibit 13-12)
S = 50.1 mph (Exhibit 13-13)

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	Montague NB
Analysis Year	2038 Build - Proposed Site	Junction	From I-26 EB
Analysis Time Period:	AM Peak	Segment ID	8020
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	45	45	25
Volume, V (veh/h)	1,519	2,048	529
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	11%	8%	6%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.95	0.96	0.97
Demand Flow Rate, v_p (pc/h/ln)	890	789	605
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	1,900
v/c ratio	0.42	0.38	0.32
Density, D_{MD} (pc/mi/ln)	15.6	13.8	10.6
LOS	B	B	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	Montague NB
Analysis Year	2038 Build - Proposed Site	Junction	From I-26 EB
Analysis Time Period:	PM Peak	Segment ID	8020
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	3	1
Free-Flow Speed, FFS (mph)	45	45	25
Volume, V (veh/h)	1,854	2,132	278
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	8%	6%	10%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.96	0.97	0.95
Demand Flow Rate, v_p (pc/h/ln)	1,071	813	324
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	1,900
v/c ratio	0.51	0.39	0.17
Density, D_{MD} (pc/mi/ln)	18.7	14.2	5.7
LOS	B	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	Montague SB
Analysis Year	2038 Build - Proposed Site	Junction	Off to I-26 EB
Analysis Time Period:	AM Peak	Segment ID	8030
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	3	2	1
Free-Flow Speed, FFS (mph)	45	45	25
Volume, V (veh/h)	1,981	1,567	414
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	8%	11%	9%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.96	0.95	0.96
Demand Flow Rate, v_p (pc/h/ln)	763	918	481
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	1,900
v/c ratio	0.36	0.44	0.25
Density, D_{MD} (pc/mi/ln)	13.4	16.1	8.4
LOS	B	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	Montague SB
Analysis Year	2038 Build - Proposed Site	Junction	Off to I-26 EB
Analysis Time Period:	PM Peak	Segment ID	8030
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	3	2	1
Free-Flow Speed, FFS (mph)	45	45	25
Volume, V (veh/h)	2,396	1,871	525
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	6%	8%	6%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.97	0.96	0.97
Demand Flow Rate, v_p (pc/h/ln)	914	1,081	601
Capacity Flow Rate, c (pc/h/ln)	2,100	2,100	1,900
v/c ratio	0.44	0.51	0.32
Density, D_{MD} (pc/mi/ln)	16.0	18.9	10.5
LOS	B	B	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Montague SB
Agency or Company	Atkins	Junction	8040 - On from I-26 EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 550	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1567	
	Ramp Volume, V_R: 504	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1567	0.90	Level	11	0	0.948	1.00	1837
Ramp	504	0.90	Level	16	0	0.926	1.00	605
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1837 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2442	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2442	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 20.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.316 (Exibit 13-11)

S_R= 50.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 50.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	Montague SB
Agency or Company	Atkins	Junction	8040 - On from I-26 EB
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build - Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	550
Deceleration Lane Length L_D	
Freeway Volume, V_F	1871
Ramp Volume, V_R	303
Freeway Free-Flow Speed, S_{FF}	55.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1871	0.90	Level	8	0	0.962	1.00	2162
Ramp	303	0.90	Level	9	0	0.957	1.00	352
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 2162 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2514	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2514	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 21.5 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.320 (Exibit 13-11)

S_R= 50.8 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 50.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	PAR NB
Analysis Year	2038 Build-Proposed Site	Junction	Merge from 26 EB & WB
Analysis Time Period:	AM Peak	Segment ID	9010
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	2	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	305	962	657
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	45%	45%	45%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.82	0.82	0.82
Demand Flow Rate, v_p (pc/h/ln)	415	655	894
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,200
v/c ratio	0.19	0.30	0.41
Density, D_{MD} (pc/mi/ln)	7.3	11.5	15.6
LOS	A	B	B

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	PAR NB
Analysis Year	2038 Build-Proposed Site	Junction	Merge from 26 EB & WB
Analysis Time Period:	PM Peak	Segment ID	9010
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	1	2	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	111	454	343
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	39%	39%	39%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.84	0.84	0.84
Demand Flow Rate, v_p (pc/h/ln)	147	301	455
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,200
v/c ratio	0.07	0.14	0.21
Density, D_{MD} (pc/mi/ln)	2.6	5.3	8.0
LOS	A	A	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	PAR NB
Agency or Company	Atkins	Junction	9020 - Off to Local Access Rd
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build-Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	950	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	962	V_D =	veh/h
		Ramp Volume, V_R	379		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	962	0.90	Level	45	0	0.816	1.00	1309
Ramp	379	0.90	Level	16	0	0.926	1.00	455
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1309 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1309	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	854	Exhibit 13-8	4500	No
V_R	455	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1309	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 7.0 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.339 (Exhibit 13-12)

S_R= 50.6 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.6 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	PAR NB
Agency or Company	Atkins	Junction	9020 - Off to Local Access Rd
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build-Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	950	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	454	V_D =	veh/h
		Ramp Volume, V_R	195		
		Freeway Free-Flow Speed, S_{FF}	55.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	454	0.90	Level	39	0	0.837	1.00	603
Ramp	195	0.90	Level	26	0	0.885	1.00	245
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 603 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	603	Exhibit 13-8	4500	No
$V_{FO} = V_F - V_R$	358	Exhibit 13-8	4500	No
V_R	245	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	603	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 0.9 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.320 (Exhibit 13-12)

S_R= 50.8 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 50.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	PAR SB
Agency or Company	Atkins	Junction	9030 - On from Local Access Rd
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	2038 Build-Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1000	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 268	
	Ramp Volume, V_R: 170	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	268	0.90	Level	60	0	0.769	1.00	387
Ramp	170	0.90	Level	34	0	0.855	1.00	221
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 387 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	608	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	608	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 3.8 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.238 (Exibit 13-11)

S_R= 51.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	AJR	Freeway/Dir of Travel	PAR SB
Agency or Company	Atkins	Junction	9030 - On from Local Access Rd
Date Performed	7/25/2014	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	2038 Build-Proposed Site

Project Description Navy Base ICTF

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1000	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 591	
	Ramp Volume, V_R: 327	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	591	0.90	Level	51	0	0.797	1.00	824
Ramp	327	0.90	Level	15	0	0.930	1.00	391
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 824 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1215	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1215	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 8.5 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.244 (Exibit 13-11)

S_R= 51.8 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 51.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	PAR SB
Analysis Year	2038 Build-Proposed Site	Junction	Split to 26 EB & WB
Analysis Time Period:	AM Peak	Segment ID	9040
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	1	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	438	339	99
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	45%	45%	44%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.82	0.82	0.82
Demand Flow Rate, v_p (pc/h/ln)	298	461	134
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,200
v/c ratio	0.14	0.21	0.06
Density, D_{MD} (pc/mi/ln)	5.2	8.1	2.3
LOS	A	A	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

RAMP ADD OR DROP LANE ANALYSIS (MAINLINE <55 MPH)

ATKINS

General Information

Date Performed:	7/25/2014	Freeway/Direction	PAR SB
Analysis Year	2038 Build-Proposed Site	Junction	Split to 26 EB & WB
Analysis Time Period:	PM Peak	Segment ID	9040
Project Description:	Navy Base ICTF		

Inputs

	Mainline Upstream Ramp	Mainline Downstream Ramp	Ramp
Number of Lanes, N	2	1	1
Free-Flow Speed, FFS (mph)	55	55	55
Volume, V (veh/h)	918	636	282
Driver Population, f_P	1	1	1
General Terrain	Level	Level	Level
Peak Hour Factor, PHF	0.90	0.90	0.90
%Trucks and Buses, P_T	39%	39%	39%
%RVs, P_R	0%	0%	0%

Performance Measures

	Upstream of Off-Ramp	Downstream of Off-Ramp	Off-Ramp
Heavy Vehicle Adjustment Factor, f_{HV}	0.84	0.84	0.84
Demand Flow Rate, v_p (pc/h/ln)	609	844	374
Capacity Flow Rate, c (pc/h/ln)	2,200	2,200	2,200
v/c ratio	0.28	0.38	0.17
Density, D_{MD} (pc/mi/ln)	10.7	14.8	6.5
LOS	B	B	A

Formulas and Reference Material

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ HCM 2010, Equation 11-3

$$V_p = \frac{V}{PHF*N*f_{HV}*f_P}$$ HCM 2010, Equation 11-2

$$D_{MD} = \frac{0.0175*v_f}{N}$$ HCM 2010, Equation 13-26

Ramp Roadways Max Service Flow Rates

FFS (mi/h)	Capacity (pc/h/ln)
> 50	2,200
>40-50	2,100
>30-40	2,000
≥20-30	1,900
<20	1,800

Source: HCM 2010, Exhibit 13-10

Diverge LOS Thresholds

LOS	Density (pc/mi/ln)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	v/c > 1

Source: HCM 2010, Exhibit 13-2

Arterial Level of Service: NB #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Driveway	II	40	28.5	8.8	37.3	0.26	25.0	C
Carolina Ave	II	35	43.3	4.5	47.8	0.41	31.1	B
Reynolds Ave	II	35	44.7	8.2	52.9	0.43	29.2	B
Cosgrove Ave	II	40	30.5	33.3	63.8	0.30	16.9	E
McMillan Ave	II	40	15.4	10.2	25.6	0.13	18.8	D
Total	II		162.4	65.0	227.4	1.53	24.3	C

Arterial Level of Service: SB #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Cosgrove Ave	II	40	15.4	42.0	57.4	0.13	8.4	F
Reynolds Ave	II	40	30.5	22.6	53.1	0.30	20.3	D
Carolina Ave	II	35	44.7	7.1	51.8	0.43	29.9	B
Burton Ln	II	40	39.6	13.6	53.2	0.41	27.9	C
Stromboli Ave	II	40	28.5	11.9	40.4	0.26	23.1	C
Total	II		158.7	97.2	255.9	1.53	21.6	D

Arterial Level of Service: NB #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Driveway	II	40	28.5	13.1	41.6	0.26	22.4	C
Carolina Ave	II	35	43.3	9.7	53.0	0.41	28.0	B
Reynolds Ave	II	35	44.7	20.6	65.3	0.43	23.7	C
Cosgrove Ave	II	40	30.5	54.7	85.2	0.30	12.7	F
McMillan Ave	II	40	15.4	10.8	26.2	0.13	18.3	D
Total	II		162.4	108.9	271.3	1.53	20.4	D

Arterial Level of Service: SB #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Cosgrove Ave	II	40	15.4	33.2	48.6	0.13	9.9	F
Reynolds Ave	II	40	30.5	10.0	40.5	0.30	26.6	C
Carolina Ave	II	35	44.7	5.2	49.9	0.43	31.0	B
Burton Ln	II	40	39.6	10.1	49.7	0.41	29.9	B
Stromboli Ave	II	40	28.5	15.4	43.9	0.26	21.2	D
Total	II		158.7	73.9	232.6	1.53	23.7	C

Arterial Level of Service: NB #2

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Burton Ln	III	34	35.4	8.3	43.7	0.29	24.3	B
Reynolds Ave	III	35	50.6	10.6	61.2	0.42	24.8	B
Cosgrove Ave	III	35	27.9	24.7	52.6	0.23	15.9	D
Dorchester Rd	III	35	18.7	5.1	23.8	0.15	22.1	C
McMillan Ave	III	35	24.5	13.3	37.8	0.20	19.4	C
Total	III		157.1	62.0	219.1	1.30	21.3	C

Arterial Level of Service: SB #2

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Dorchester Rd	II	35	25.5	5.7	31.2	0.20	23.6	C
Cosgrove Ave	II	35	18.3	31.2	49.5	0.15	10.6	F
Reynolds Ave	II	35	27.6	1.9	29.5	0.23	28.3	B
Burton Ln	II	35	44.6	10.0	54.6	0.43	28.3	B
Stromboli Ave	II	37	32.4	2.1	34.5	0.29	30.8	B
Total	II		148.4	50.9	199.3	1.31	23.6	C

Arterial Level of Service: NB #2

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Burton Ln	III	34	35.4	11.8	47.2	0.29	22.5	C
Reynolds Ave	III	35	50.6	15.6	66.2	0.42	22.9	C
Cosgrove Ave	III	35	27.9	30.3	58.2	0.23	14.4	D
Dorchester Rd	III	35	18.7	3.9	22.6	0.15	23.3	C
McMillan Ave	III	35	24.5	20.8	45.3	0.20	16.2	D
Total	III		157.1	82.4	239.5	1.30	19.5	C

Arterial Level of Service: SB #2

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Dorchester Rd	II	35	25.5	5.3	30.8	0.20	23.9	C
Cosgrove Ave	II	35	18.3	44.1	62.4	0.15	8.4	F
Reynolds Ave	II	35	27.6	6.6	34.2	0.23	24.4	C
Burton Ln	II	35	44.6	10.3	54.9	0.43	28.1	B
Stromboli Ave	II	37	32.4	1.7	34.1	0.29	31.1	B
Total	II		148.4	68.0	216.4	1.31	21.7	D

Intersection: 10: Rivers Ave SB & I-526 WB Ramps

Movement	WB	WB	SB	SB	SB
Directions Served	T	T	T	T	T
Maximum Queue (ft)	108	115	189	152	103
Average Queue (ft)	49	49	107	54	43
95th Queue (ft)	95	89	169	110	89
Link Distance (ft)	136	136	1224	1224	1224
Upstream Blk Time (%)	0	0			
Queuing Penalty (veh)	0	0			
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 11: Rivers Ave NB/Rivers Ave & I-526 WB Ramps

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 20: Rivers Ave NB & I-526 EB Ramps

Movement	EB	EB	NB	NB	NB	NB
Directions Served	T	T	T	T	T	R
Maximum Queue (ft)	158	163	141	122	132	50
Average Queue (ft)	73	87	59	50	54	3
95th Queue (ft)	127	141	113	103	106	24
Link Distance (ft)	157	157	1619	1619	1619	
Upstream Blk Time (%)	0	0				
Queuing Penalty (veh)	1	1				
Storage Bay Dist (ft)						350
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 21: Rivers Ave SB & I-526 EB Ramps

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 30: Rivers Ave SB & Mall Dr

Movement	EB	EB	NB	SB	SB	SB	SB
Directions Served	T	R	L	T	T	T	R
Maximum Queue (ft)	207	105	112	253	242	255	222
Average Queue (ft)	104	28	48	137	121	103	69
95th Queue (ft)	179	70	95	232	212	201	148
Link Distance (ft)	1458		122	2788	2788	2788	
Upstream Blk Time (%)			0				
Queuing Penalty (veh)			0				
Storage Bay Dist (ft)		125					140
Storage Blk Time (%)	8	0				3	0
Queuing Penalty (veh)	5	0				12	2

Intersection: 31: Rivers Ave NB & Mall Dr Left

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 32: Rivers Ave NB & Rivers Ave NB Left

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 33: Rivers Ave SB

Movement	SB	SB	SB
Directions Served	T	T	T
Maximum Queue (ft)	9	20	3
Average Queue (ft)	0	1	0
95th Queue (ft)	5	10	3
Link Distance (ft)	122	122	122
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 40: Rivers Ave NB & WB Montague Ramps

Movement	WB	WB	NB	NB	NB	SB
Directions Served	T	R	T	T	TR	L
Maximum Queue (ft)	68	151	68	80	119	147
Average Queue (ft)	19	69	7	11	25	88
95th Queue (ft)	54	120	38	45	74	147
Link Distance (ft)	470		346	346	346	76
Upstream Blk Time (%)						13
Queuing Penalty (veh)						17
Storage Bay Dist (ft)		380				
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 41: Rivers Ave SB & WB Montague Ramps

Movement	SB
Directions Served	L
Maximum Queue (ft)	6
Average Queue (ft)	0
95th Queue (ft)	7
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	200
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 42: Rivers Ave NB

Movement	EB	NB	NB
Directions Served	R	T	T
Maximum Queue (ft)	91	2	6
Average Queue (ft)	9	0	0
95th Queue (ft)	49	2	6
Link Distance (ft)	109	76	76
Upstream Blk Time (%)	0		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 43: Rivers Ave SB & Montague Ramp Left

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 50: Rivers Ave NB & Morningside Dr

Movement	WB	WB	NB	NB	NB	NB	SB
Directions Served	T	R	T	T	T	R	L
Maximum Queue (ft)	326	74	164	201	237	181	134
Average Queue (ft)	180	22	79	90	110	31	89
95th Queue (ft)	285	53	146	171	205	102	135
Link Distance (ft)	701		666	666	666		61
Upstream Blk Time (%)							30
Queuing Penalty (veh)							40
Storage Bay Dist (ft)		425				120	
Storage Blk Time (%)	0				6	0	
Queuing Penalty (veh)	0				6	0	

Intersection: 51: Rivers Ave SB & Morningside Dr

Movement	SB	SB
Directions Served	L	T
Maximum Queue (ft)	47	2
Average Queue (ft)	2	0
95th Queue (ft)	24	2
Link Distance (ft)	186	186
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 52: Rivers Ave NB

Movement	EB	NB
Directions Served	R	T
Maximum Queue (ft)	123	2
Average Queue (ft)	25	0
95th Queue (ft)	85	2
Link Distance (ft)	60	61
Upstream Blk Time (%)	4	
Queuing Penalty (veh)	6	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 53: Rivers Ave SB & Morningside Dr Left

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 55: Rivers Ave/Rivers Ave SB & Rivers Ave NB

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	39	40
Average Queue (ft)	2	3
95th Queue (ft)	18	22
Link Distance (ft)	560	560
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 60: Rivers Ave & Piggly Wiggly Dr

Movement	EB	EB	EB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	L	T	T	T	T	T	T	R
Maximum Queue (ft)	46	128	29	92	100	96	120	148	167	143	72
Average Queue (ft)	4	49	1	32	27	22	44	45	66	50	18
95th Queue (ft)	23	104	21	74	72	65	101	120	147	121	53
Link Distance (ft)		468			2162	2162	2162	716	716	716	
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)	75		50	125							425
Storage Blk Time (%)	0	17		0	0						
Queuing Penalty (veh)	0	9		0	0						

Intersection: 70: Rivers Ave & Meeting St/Durant Ave

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	TR	L	T	R	LT	T	TR	L	T	T	R
Maximum Queue (ft)	135	155	207	192	113	150	152	223	189	192	208	64
Average Queue (ft)	63	63	97	80	31	64	67	100	73	61	79	22
95th Queue (ft)	116	128	169	159	73	127	127	186	143	151	167	57
Link Distance (ft)		460		552		673	673			2162	2162	2162
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	50		125		150			300	725			
Storage Blk Time (%)	26	12	8	2								
Queuing Penalty (veh)	24	12	20	7								

Intersection: 80: Rivers Ave & Helm Ave

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	TR	L	T	TR
Maximum Queue (ft)	54	128	45	193	223	49	205	216
Average Queue (ft)	18	55	7	76	104	11	98	108
95th Queue (ft)	46	104	29	158	190	36	179	188
Link Distance (ft)	737	713		3153	3153		2604	2604
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			225			200		
Storage Blk Time (%)				0			0	
Queuing Penalty (veh)				0			0	

Intersection: 90: Rivers Ave #2/Rivers Ave & McMillan Ave

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	LT	TR	LT	R	L	T	T	R	L	T	T	R
Maximum Queue (ft)	98	71	264	115	27	212	228	160	262	362	351	77
Average Queue (ft)	26	12	120	35	2	83	98	66	123	151	168	15
95th Queue (ft)	70	46	217	88	11	177	216	158	250	455	432	52
Link Distance (ft)	1091	1091	1516	1516		982	982			3153	3153	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)					200			200	200			200
Storage Blk Time (%)						0	1	3	7	1	2	
Queuing Penalty (veh)						0	2	10	30	2	1	

Intersection: 100: Rivers Ave #2 & Dorchester Rd

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	R	L	T	T	T	T	R
Maximum Queue (ft)	420	200	186	110	118	170	171	54
Average Queue (ft)	170	117	90	32	49	57	57	15
95th Queue (ft)	307	215	159	80	104	124	127	42
Link Distance (ft)	1350			656	656	982	982	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		100	185					200
Storage Blk Time (%)	28	6	0	0			0	
Queuing Penalty (veh)	57	13	1	0			0	

Intersection: 110: Rivers Ave #2 & Cosgrove Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	T	TR	L	T	T
Maximum Queue (ft)	381	399	426	154	268	307	150	193	214	228	278	266
Average Queue (ft)	189	200	229	41	148	180	62	108	125	66	146	130
95th Queue (ft)	314	342	376	96	252	286	122	174	200	153	245	222
Link Distance (ft)		3181	3181		1388	1388		1140	1140		656	656
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	450			165			200			200		
Storage Blk Time (%)	0	0		0	9			0		0	3	14
Queuing Penalty (veh)	0	0		0	4			0		1	3	40

Intersection: 110: Rivers Ave #2 & Cosgrove Ave

Movement	SB
Directions Served	R
Maximum Queue (ft)	205
Average Queue (ft)	48
95th Queue (ft)	126
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	125
Storage Blk Time (%)	0
Queuing Penalty (veh)	1

Intersection: 120: Rivers Ave #2 & Reynolds Ave

Movement	EB	WB	NB	NB	NB	SB	SB	SB	SB
Directions Served	LTR	LTR	L	T	TR	L	T	T	R
Maximum Queue (ft)	235	272	62	142	142	116	227	173	81
Average Queue (ft)	97	107	15	55	57	35	61	44	8
95th Queue (ft)	192	208	44	116	116	81	154	122	40
Link Distance (ft)	666	1494		1257	1257		1140	1140	
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)			200			200			50
Storage Blk Time (%)							0	5	0
Queuing Penalty (veh)							0	2	0

Intersection: 123: Bend

Movement	SB	SB	SB
Directions Served	T	T	
Maximum Queue (ft)	169	179	50
Average Queue (ft)	10	11	2
95th Queue (ft)	118	124	51
Link Distance (ft)	422	422	422
Upstream Blk Time (%)	0	0	0
Queuing Penalty (veh)	0	1	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 130: Rivers Ave/Rivers Ave #2 & Carner Ave #2

Movement	WB	NB	NB	SB	SB
Directions Served	R	T	TR	L	T
Maximum Queue (ft)	138	9	52	302	170
Average Queue (ft)	70	0	16	121	9
95th Queue (ft)	112	5	47	240	112
Link Distance (ft)	2094	773	773		1257
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				250	
Storage Blk Time (%)				2	
Queuing Penalty (veh)				4	

Intersection: 140: Carner Ave #2 & Burton Ln

Movement	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	T	R	L	TR
Maximum Queue (ft)	66	59	38	29	133	34	77	204
Average Queue (ft)	33	21	11	4	56	3	29	96
95th Queue (ft)	61	50	33	20	112	18	64	176
Link Distance (ft)	572	1428			222			2094
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			190	120		50	170	
Storage Blk Time (%)					9	0		1
Queuing Penalty (veh)					1	0		1

Intersection: 150: Carner Ave/Carner Ave #2 & Stromboli Ave

Movement	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	L	R	T	TR	L	T	T
Maximum Queue (ft)	3	34	55	74	15	41	89	88
Average Queue (ft)	0	6	10	12	1	5	13	10
95th Queue (ft)	3	26	38	49	8	24	52	48
Link Distance (ft)		1754	1754	1034	1034		671	671
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	300					250		
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 160: Spruill Ave & Montague Ave

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	35	259	95	106	154	190	46	144
Average Queue (ft)	6	118	40	38	65	83	10	57
95th Queue (ft)	26	207	76	85	125	152	36	112
Link Distance (ft)		450		1923		680		573
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	125		75		275		90	
Storage Blk Time (%)		6	1	1		0		2
Queuing Penalty (veh)		0	2	1		0		0

Intersection: 170: Spruill Ave #1/Spruill Ave & McMillan Ave

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	730	1127	406	590	1411	300
Average Queue (ft)	274	635	272	268	694	176
95th Queue (ft)	909	1409	466	646	1516	396
Link Distance (ft)	1516	1516		621	1560	
Upstream Blk Time (%)	0	4		9	8	
Queuing Penalty (veh)	0	13		62	0	
Storage Bay Dist (ft)			310			200
Storage Blk Time (%)			34	3	41	
Queuing Penalty (veh)			136	5	64	

Intersection: 180: Spruill Ave #1 & Cosgrove Ave

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	T	R	L	TR	L	T	R
Maximum Queue (ft)	325	681	694	149	250	266	178	278	838	240	638	380
Average Queue (ft)	187	385	390	61	132	143	60	64	401	132	579	208
95th Queue (ft)	382	750	738	119	216	244	151	230	993	279	750	489
Link Distance (ft)		1388	1388		2051	2051			1488		621	
Upstream Blk Time (%)									2		11	
Queuing Penalty (veh)									7		111	
Storage Bay Dist (ft)	225			200			150	260		140		280
Storage Blk Time (%)	14	30		0	1	8	4		23	4	47	0
Queuing Penalty (veh)	61	49		0	1	10	7		11	31	126	0

Intersection: 190: Spruill Ave #1 & Reynolds Ave

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	L	TR	L	TR	L	TR
Maximum Queue (ft)	235	33	77	153	326	26	345
Average Queue (ft)	101	4	27	61	115	3	172
95th Queue (ft)	196	19	63	136	403	17	324
Link Distance (ft)	1494		716		2143		1488
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		200		185		180	
Storage Blk Time (%)					3		6
Queuing Penalty (veh)					2		0

Intersection: 200: Spruill Ave #1 & Carolina Ave

Movement	WB	NB	NB	SB
Directions Served	L	T	R	T
Maximum Queue (ft)	95	204	102	238
Average Queue (ft)	37	64	6	95
95th Queue (ft)	76	152	54	207
Link Distance (ft)	573	2105		2143
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			50	
Storage Blk Time (%)		7		
Queuing Penalty (veh)		6		

Intersection: 210: Spruill Ave #1 & Burton Ln/Driveway

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	L	TR	LTR	L	TR	L	TR
Maximum Queue (ft)	87	76	46	95	233	26	331
Average Queue (ft)	40	31	9	30	101	3	159
95th Queue (ft)	75	64	34	73	197	15	290
Link Distance (ft)		1428	473		1289		2105
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	250			150		170	
Storage Blk Time (%)					2		5
Queuing Penalty (veh)					1		0

Intersection: 220: Spruill Ave/Spruill Ave #1 & Stromboli Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	54	40	48	40	21	102	26	260	204	256
Average Queue (ft)	9	3	5	5	2	37	2	118	89	107
95th Queue (ft)	35	20	26	25	11	78	13	215	164	219
Link Distance (ft)		1754	1754		1627	1627		518		1289
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	250			250			250		250	
Storage Blk Time (%)								0	0	0
Queuing Penalty (veh)								0	2	0

Intersection: 230: St Johns Ave & Turnbull Ave

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	84	30
Average Queue (ft)	48	2
95th Queue (ft)	73	16
Link Distance (ft)	1959	1038
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 240: Cosgrove Ave/McMillan Ave & Noisette Blvd

Movement	EB	WB	WB	SB	SB
Directions Served	L	T	R	L	R
Maximum Queue (ft)	241	17	22	92	10
Average Queue (ft)	86	1	1	30	1
95th Queue (ft)	178	12	18	69	12
Link Distance (ft)	2051	312	312	1290	1290
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 250: Hobson Ave & McMillan Ave

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	L	TR	LT	R
Maximum Queue (ft)	148	29	41	162	69	96	65
Average Queue (ft)	61	2	9	74	15	38	29
95th Queue (ft)	119	26	33	135	49	81	57
Link Distance (ft)		312	727	446	446	583	583
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	60						
Storage Blk Time (%)	6						
Queuing Penalty (veh)	25						

Intersection: 260: Noisette Blvd & Turnbull Ave

Movement	EB	WB	WB	NB	NB	SB
Directions Served	LTR	LT	R	LT	R	LTR
Maximum Queue (ft)	76	52	50	188	59	207
Average Queue (ft)	41	24	21	90	26	98
95th Queue (ft)	67	46	41	147	51	162
Link Distance (ft)	1959	315		1290	1290	2516
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)			75			
Storage Blk Time (%)		0	0			
Queuing Penalty (veh)		0	0			

Intersection: 270: Noisette Blvd & Avenue B

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	63	1	99
Average Queue (ft)	22	0	19
95th Queue (ft)	56	1	68
Link Distance (ft)	564	1116	593
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 280: Virginia Ave & Avenue B

Movement	WB	NB	SB
Directions Served	L	TR	L
Maximum Queue (ft)	75	56	233
Average Queue (ft)	21	9	98
95th Queue (ft)	56	36	184
Link Distance (ft)	593	466	1266
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)	0		
Queuing Penalty (veh)	0		

Intersection: 290: Virginia Ave & Montague Ave

Movement	EB	NB	SB
Directions Served	LR	L	TR
Maximum Queue (ft)	109	77	7
Average Queue (ft)	54	23	0
95th Queue (ft)	93	57	5
Link Distance (ft)	1923		394
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		150	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 300: Virginia Ave & I-526 EB Off-Ramp

Movement	EB	EB	NB
Directions Served	L	R	T
Maximum Queue (ft)	448	861	6
Average Queue (ft)	305	293	0
95th Queue (ft)	530	919	6
Link Distance (ft)		1232	1357
Upstream Blk Time (%)		4	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)	350		
Storage Blk Time (%)	35	0	
Queuing Penalty (veh)	94	0	

Intersection: 310: Virginia Ave & I-526 WB On-Ramp

Movement	NB	SB
Directions Served	L	R
Maximum Queue (ft)	79	15
Average Queue (ft)	23	1
95th Queue (ft)	61	8
Link Distance (ft)		
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	225	325
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 320: Rhett Ave & I-526 EB Ramps

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	LR	L	T	T	T	T	R
Maximum Queue (ft)	375	669	248	486	390	131	542	720
Average Queue (ft)	346	558	147	168	98	59	86	363
95th Queue (ft)	437	799	252	411	322	122	318	606
Link Distance (ft)		639		684	684	803	803	803
Upstream Blk Time (%)		39		1	0		0	0
Queuing Penalty (veh)		0		0	0		1	1
Storage Bay Dist (ft)	275		150					
Storage Blk Time (%)	39	70	25	1				
Queuing Penalty (veh)	110	151	85	2				

Intersection: 330: Rhett Ave & I-526 WB Ramps

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	LR	L	T	T	T	T	R
Maximum Queue (ft)	575	796	222	237	261	636	670	425
Average Queue (ft)	566	759	112	111	143	466	623	346
95th Queue (ft)	614	834	194	203	243	710	716	580
Link Distance (ft)		735		803	803	612	612	
Upstream Blk Time (%)		54				2	27	
Queuing Penalty (veh)		0				0	0	
Storage Bay Dist (ft)	475		270					325
Storage Blk Time (%)	11	65	1	0			29	0
Queuing Penalty (veh)	69	182	3	0			184	4

Intersection: 340: Morningside Dr/Piedmont Ave & Montague Ave

Movement	EB	EB	EB	B38	B39	B39	B39	WB	WB	WB	WB	NB
Directions Served	L	T	TR	T	T	T		L	T	T	R	LT
Maximum Queue (ft)	112	300	330	8	107	228	56	89	177	164	168	260
Average Queue (ft)	36	132	160	0	5	15	4	34	98	81	75	88
95th Queue (ft)	83	251	285	6	91	166	80	72	156	148	142	190
Link Distance (ft)		370	370	1986	538	538	538		724	724		701
Upstream Blk Time (%)		0	0			0	0					
Queuing Penalty (veh)		0	1			0	0					
Storage Bay Dist (ft)	150							175			150	
Storage Blk Time (%)	0	5							0	0	0	23
Queuing Penalty (veh)	1	2							0	1	2	28

Intersection: 340: Morningside Dr/Piedmont Ave & Montague Ave

Movement	NB	SB	SB
Directions Served	R	L	TR
Maximum Queue (ft)	150	48	93
Average Queue (ft)	24	12	36
95th Queue (ft)	111	38	70
Link Distance (ft)			459
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	50	135	
Storage Blk Time (%)	0		0
Queuing Penalty (veh)	0		0

Intersection: 350: Montague Ave & Mall Dr/Goer Dr

Movement	EB	EB	EB	WB	WB	NB	NB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	L	T	T	TR	L	T
Maximum Queue (ft)	56	69	161	163	91	269	308	420	431	339	75	235
Average Queue (ft)	16	19	67	67	20	138	161	179	203	129	27	142
95th Queue (ft)	44	52	133	134	70	225	253	340	367	286	62	217
Link Distance (ft)		415	415		476			516	516	516		538
Upstream Blk Time (%)								0	0			
Queuing Penalty (veh)								0	0			
Storage Bay Dist (ft)	185			170		275	275				175	
Storage Blk Time (%)				0		0	0	1				3
Queuing Penalty (veh)				0		0	2	8				1

Intersection: 350: Montague Ave & Mall Dr/Goer Dr

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	264	298
Average Queue (ft)	162	160
95th Queue (ft)	245	259
Link Distance (ft)	538	538
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		0
Queuing Penalty (veh)		0

Intersection: 360: Montague Ave & I-26 WB Ramps

Movement	WB	WB	WB	NB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	L	L	T	T	T	T	T	T	R
Maximum Queue (ft)	344	401	219	177	197	394	351	303	345	397	352	79
Average Queue (ft)	197	253	53	88	110	246	216	150	194	218	205	3
95th Queue (ft)	310	364	152	157	174	362	322	259	317	351	335	41
Link Distance (ft)		573				845	845	845	516	516	516	
Upstream Blk Time (%)										0		
Queuing Penalty (veh)										0		
Storage Bay Dist (ft)	375		375	550	550							350
Storage Blk Time (%)	0	0									0	
Queuing Penalty (veh)	0	2									1	

Intersection: 370: Montague Ave & I-26 EB Ramps

Movement	B123	SB
Directions Served	T	T
Maximum Queue (ft)	38	74
Average Queue (ft)	1	4
95th Queue (ft)	39	46
Link Distance (ft)	369	845
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 380: Dorchester Rd & Meeting St

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	L	T	R	LT	TR
Maximum Queue (ft)	173	142	108	83	219	318	112	143	138
Average Queue (ft)	66	65	45	24	105	133	47	66	58
95th Queue (ft)	127	112	88	61	187	248	96	118	109
Link Distance (ft)	457			469		1842	1842	1350	
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)		100	125		125				125
Storage Blk Time (%)	3	1	0	0	3	8		1	1
Queuing Penalty (veh)	11	1	0	0	14	21		1	1

Intersection: 390: I-26 WB Ramps & Dorchester Rd

Movement	EB	EB	EB	WB	WB	NB	NB
Directions Served	L	T	T	T	TR	L	L
Maximum Queue (ft)	150	234	216	264	290	262	318
Average Queue (ft)	68	139	111	145	165	134	194
95th Queue (ft)	129	209	191	225	249	254	285
Link Distance (ft)	304	304	304	1842	1842		
Upstream Blk Time (%)		0	0				
Queuing Penalty (veh)		0	0				
Storage Bay Dist (ft)						530	530
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 400: I-26 EB Ramps & Dorchester Rd

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	T	T	R	L	T	T	L	R
Maximum Queue (ft)	448	388	220	111	233	249	379	212
Average Queue (ft)	270	211	22	40	138	152	212	21
95th Queue (ft)	391	346	138	89	213	234	343	132
Link Distance (ft)	560	560		304	304	304	445	
Upstream Blk Time (%)						0	0	
Queuing Penalty (veh)						0	0	
Storage Bay Dist (ft)			425					300
Storage Blk Time (%)		0	0				2	
Queuing Penalty (veh)		0	0				5	

Intersection: 410: Cosgrove Ave & Azalea Dr

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	TR	L	T	T	R	L
Maximum Queue (ft)	229	381	307	198	239	188	102	346	496	505	253	264
Average Queue (ft)	147	142	90	88	110	55	19	224	205	199	51	47
95th Queue (ft)	240	306	229	170	207	129	64	349	377	368	153	162
Link Distance (ft)		892	892			767			661	661	661	
Upstream Blk Time (%)									0	0	0	
Queuing Penalty (veh)									0	1	0	
Storage Bay Dist (ft)	130			400	230		600	250				200
Storage Blk Time (%)	27	5	0		1	0		9	1			0
Queuing Penalty (veh)	35	11	0		2	0		55	5			1

Intersection: 410: Cosgrove Ave & Azalea Dr

Movement	SB	SB	SB
Directions Served	T	T	R
Maximum Queue (ft)	505	585	300
Average Queue (ft)	247	320	121
95th Queue (ft)	458	546	337
Link Distance (ft)	3181	3181	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			200
Storage Blk Time (%)	19	38	
Queuing Penalty (veh)	8	43	

Intersection: 421: Cosgrove Ave & I-26 WB Ramps

Movement	WB	NB	NB	NB	NB
Directions Served	R	T	T	T	R
Maximum Queue (ft)	113	17	16	8	2
Average Queue (ft)	6	1	1	0	0
95th Queue (ft)	61	17	18	9	2
Link Distance (ft)	473	950	950	950	950
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 422: Cosgrove Ave & I-26 EB Ramps

Movement	NB	NB	NB	SB
Directions Served	T	T	TR	T
Maximum Queue (ft)	911	942	944	17
Average Queue (ft)	349	912	920	1
95th Queue (ft)	1051	936	942	17
Link Distance (ft)	882	882	882	950
Upstream Blk Time (%)	1	42	76	
Queuing Penalty (veh)	0	0	0	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 450: Local Access Rd & Hobson Ave

Movement	WB	WB	NB	NB	SB
Directions Served	L	R	T	R	L
Maximum Queue (ft)	98	83	5	6	71
Average Queue (ft)	36	29	0	0	21
95th Queue (ft)	83	70	4	5	59
Link Distance (ft)		930	1160		
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	170			100	220
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 460: Magrath Darby Blvd & US 17

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	SB
Directions Served	L	T	T	T	R	L	T	T	R	R	R
Maximum Queue (ft)	384	725	708	630	224	289	1309	1354	1142	336	126
Average Queue (ft)	253	376	339	294	28	76	602	650	68	143	46
95th Queue (ft)	473	1014	966	891	161	196	1268	1330	518	310	101
Link Distance (ft)		1105	1105	1105			1292	1292	1292	516	538
Upstream Blk Time (%)		7	3	2			0	0	0	3	
Queuing Penalty (veh)		0	0	0			2	4	0	0	
Storage Bay Dist (ft)	375				175	205					
Storage Blk Time (%)	8	8		6			10				
Queuing Penalty (veh)	82	13		9			7				

Intersection: 470: Houston Northcutt Blvd/Mathis Ferry Rd & US 17

Movement	EB	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB
Directions Served	L	L	T	T	T	R	L	L	T	T	T	R
Maximum Queue (ft)	465	514	1064	1134	1007	315	311	450	2290	2357	2151	230
Average Queue (ft)	409	447	674	646	556	155	188	370	1328	1372	1290	52
95th Queue (ft)	533	593	1339	1315	1188	371	304	576	2166	2204	2115	194
Link Distance (ft)			1292	1292	1292				4040	4040	4040	
Upstream Blk Time (%)			4	1	0					0		
Queuing Penalty (veh)			44	7	3					0		
Storage Bay Dist (ft)	415	415				215	350	350				130
Storage Blk Time (%)	21	41	2		23		0	1	45		30	
Queuing Penalty (veh)	163	315	10		76		3	9	154		41	

Intersection: 470: Houston Northcutt Blvd/Mathis Ferry Rd & US 17

Movement	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	T	T	R	L	T	T	R
Maximum Queue (ft)	214	335	294	244	433	537	532	342
Average Queue (ft)	150	175	124	102	159	407	378	179
95th Queue (ft)	231	284	231	195	467	635	630	467
Link Distance (ft)		543	543	543	536	536	536	
Upstream Blk Time (%)					8	23	22	
Queuing Penalty (veh)					0	0	0	
Storage Bay Dist (ft)	115							300
Storage Blk Time (%)	30	27					48	
Queuing Penalty (veh)	40	45					40	

Intersection: 480: Shelmore Blvd & US 17

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	R	L	T	T	T	R	L	T
Maximum Queue (ft)	478	947	870	436	261	484	607	618	636	300	259	251
Average Queue (ft)	320	260	255	233	38	183	393	419	441	187	219	159
95th Queue (ft)	501	780	753	521	165	351	540	569	595	405	299	297
Link Distance (ft)		4040	4040	4040			2558	2558	2558		231	231
Upstream Blk Time (%)											55	16
Queuing Penalty (veh)											0	0
Storage Bay Dist (ft)	400				210	400				200		
Storage Blk Time (%)	17	0		6		0	7		34			51
Queuing Penalty (veh)	119	1		10		0	15		97			100

Intersection: 480: Shelmore Blvd & US 17

Movement	NB	SB	SB	SB	SB
Directions Served	R	L	L	T	R
Maximum Queue (ft)	190	175	365	367	211
Average Queue (ft)	92	150	266	255	83
95th Queue (ft)	223	222	409	430	192
Link Distance (ft)			333	333	333
Upstream Blk Time (%)			31	29	0
Queuing Penalty (veh)			0	0	0
Storage Bay Dist (ft)	90	75			
Storage Blk Time (%)	11	68	87		
Queuing Penalty (veh)	20	68	87		

Intersection: 490: Dragoon Dr & US 17

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB
Directions Served	T	T	T	R	L	T	T	T	L	R
Maximum Queue (ft)	386	391	396	300	145	1118	1292	700	126	151
Average Queue (ft)	189	200	219	58	69	137	165	140	55	64
95th Queue (ft)	331	345	363	229	122	601	669	446	105	123
Link Distance (ft)	2558	2558	2558			1813	1813	1813		228
Upstream Blk Time (%)						0	0	0		0
Queuing Penalty (veh)						0	0	0		0
Storage Bay Dist (ft)				200	200				125	
Storage Blk Time (%)			9			0			1	1
Queuing Penalty (veh)			11			0			1	1

Intersection: 500: Anna Knapp Blvd & US 17

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	R	L	T	T	T	R	L	LT
Maximum Queue (ft)	463	615	604	542	275	470	1526	1522	1521	300	198	195
Average Queue (ft)	347	291	274	248	61	311	1438	1431	1435	241	115	112
95th Queue (ft)	519	644	562	461	226	590	1714	1717	1729	424	188	187
Link Distance (ft)		1813	1813	1813			1466	1466	1466		325	325
Upstream Blk Time (%)							32	25	38			
Queuing Penalty (veh)							0	0	0			
Storage Bay Dist (ft)	365				175	370				200		
Storage Blk Time (%)	29	1		16		0	40		41			
Queuing Penalty (veh)	202	1		19		0	77		172			

Intersection: 500: Anna Knapp Blvd & US 17

Movement	NB	NB	SB	SB	SB	SB
Directions Served	T	R	L	LT	T	R
Maximum Queue (ft)	192	195	175	295	254	236
Average Queue (ft)	44	91	168	268	148	97
95th Queue (ft)	150	164	186	307	260	193
Link Distance (ft)	325			260	260	260
Upstream Blk Time (%)				66	3	0
Queuing Penalty (veh)				0	0	0
Storage Bay Dist (ft)		140	75			
Storage Blk Time (%)	1	3	81	93		
Queuing Penalty (veh)	2	2	145	116		

Intersection: 510: Local Access Rd & Bainbridge Ave

Movement	WB	WB	NB	NB	SB
Directions Served	L	R	T	R	L
Maximum Queue (ft)	280	101	12	22	150
Average Queue (ft)	120	49	0	1	62
95th Queue (ft)	279	79	7	20	128
Link Distance (ft)	842	842	1386	1386	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					175
Storage Blk Time (%)					0
Queuing Penalty (veh)					0

Intersection: 520: Local Access Rd & Stromboli Ave

Movement	EB	EB	EB	NB	NB	NB	SB	SB
Directions Served	L	L	R	L	T	T	T	TR
Maximum Queue (ft)	122	142	59	55	92	107	56	100
Average Queue (ft)	44	66	12	11	33	38	10	39
95th Queue (ft)	94	114	40	39	78	84	39	82
Link Distance (ft)		1627	1627		1428	1428	1386	1386
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	200			200				
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 530: Local Access Rd & PAR SB Ramp

Movement	SB	SB
Directions Served	T	TR
Maximum Queue (ft)	8	7
Average Queue (ft)	0	0
95th Queue (ft)	8	7
Link Distance (ft)	1428	1428
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 540: PAR NB Ramp/Tidewater Rd & Local Access Rd

Movement	EB	WB	SB
Directions Served	LTR	LTR	L
Maximum Queue (ft)	157	27	3
Average Queue (ft)	73	6	0
95th Queue (ft)	118	24	3
Link Distance (ft)	615	871	211
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 550: Hobson Ave & ICTF Truck Dwy

Movement	EB	NB	SB	SB
Directions Served	LR	L	T	R
Maximum Queue (ft)	171	152	35	24
Average Queue (ft)	68	60	3	1
95th Queue (ft)	130	125	18	14
Link Distance (ft)	896		1098	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		500		500
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 560: Hobson Ave & ICTF Employee Dwy

Movement	EB	NB	SB	SB
Directions Served	LR	LT	T	TR
Maximum Queue (ft)	73	67	6	24
Average Queue (ft)	27	10	0	1
95th Queue (ft)	59	42	6	13
Link Distance (ft)	439	152	446	446
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 4557

Intersection: 10: Rivers Ave SB & I-526 WB Ramps

Movement	WB	WB	SB	SB	SB
Directions Served	T	T	T	T	T
Maximum Queue (ft)	113	120	181	116	85
Average Queue (ft)	56	60	94	41	27
95th Queue (ft)	100	101	150	87	63
Link Distance (ft)	136	136	1224	1224	1224
Upstream Blk Time (%)	0	0			
Queuing Penalty (veh)	0	0			
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 11: Rivers Ave NB/Rivers Ave & I-526 WB Ramps

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 20: Rivers Ave NB & I-526 EB Ramps

Movement	EB	EB	NB	NB	NB	NB	B27
Directions Served	T	T	T	T	T	R	T
Maximum Queue (ft)	137	158	160	151	160	60	69
Average Queue (ft)	60	76	67	66	75	6	2
95th Queue (ft)	112	128	126	122	135	36	70
Link Distance (ft)	157	157	1619	1619	1619		751
Upstream Blk Time (%)	0	0					
Queuing Penalty (veh)	0	0					
Storage Bay Dist (ft)						350	
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 21: Rivers Ave SB & I-526 EB Ramps

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 30: Rivers Ave SB & Mall Dr

Movement	EB	EB	NB	SB	SB	SB	SB
Directions Served	T	R	L	T	T	T	R
Maximum Queue (ft)	390	225	110	236	230	214	144
Average Queue (ft)	227	63	41	131	117	95	44
95th Queue (ft)	342	195	89	212	201	178	95
Link Distance (ft)	1458		122	2788	2788	2788	
Upstream Blk Time (%)			0				
Queuing Penalty (veh)			0				
Storage Bay Dist (ft)		125					140
Storage Blk Time (%)	31	0				2	0
Queuing Penalty (veh)	20	0				5	0

Intersection: 31: Rivers Ave NB & Mall Dr Left

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 32: Rivers Ave NB & Rivers Ave NB Left

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 33: Rivers Ave SB

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	6	3
Average Queue (ft)	0	0
95th Queue (ft)	6	4
Link Distance (ft)	122	122
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 40: Rivers Ave NB & WB Montague Ramps

Movement	WB	WB	NB	NB	NB	SB
Directions Served	T	R	T	T	TR	L
Maximum Queue (ft)	29	249	121	146	165	133
Average Queue (ft)	3	105	22	35	49	52
95th Queue (ft)	18	190	75	96	112	110
Link Distance (ft)	470		346	346	346	76
Upstream Blk Time (%)						6
Queuing Penalty (veh)						5
Storage Bay Dist (ft)		380				
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 41: Rivers Ave SB & WB Montague Ramps

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 42: Rivers Ave NB

Movement	EB	NB	NB
Directions Served	R	T	T
Maximum Queue (ft)	25	4	5
Average Queue (ft)	1	0	0
95th Queue (ft)	10	4	5
Link Distance (ft)	109	76	76
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 43: Rivers Ave SB & Montague Ramp Left

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 50: Rivers Ave NB & Morningside Dr

Movement	WB	WB	NB	NB	NB	NB	SB
Directions Served	T	R	T	T	T	R	L
Maximum Queue (ft)	257	96	184	178	246	134	116
Average Queue (ft)	129	34	51	62	75	25	62
95th Queue (ft)	219	69	125	130	168	79	116
Link Distance (ft)	701		666	666	666		61
Upstream Blk Time (%)							20
Queuing Penalty (veh)							19
Storage Bay Dist (ft)		425				120	
Storage Blk Time (%)					2	0	
Queuing Penalty (veh)					3	0	

Intersection: 51: Rivers Ave SB & Morningside Dr

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 52: Rivers Ave NB

Movement	EB	NB
Directions Served	R	T
Maximum Queue (ft)	70	8
Average Queue (ft)	5	0
95th Queue (ft)	32	6
Link Distance (ft)	60	61
Upstream Blk Time (%)	1	
Queuing Penalty (veh)	1	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 53: Rivers Ave SB & Morningside Dr Left

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 55: Rivers Ave/Rivers Ave SB & Rivers Ave NB

Movement	SB	SB	SB
Directions Served	T	T	T
Maximum Queue (ft)	55	2	12
Average Queue (ft)	2	0	0
95th Queue (ft)	56	3	7
Link Distance (ft)	560	560	560
Upstream Blk Time (%)	0		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 60: Rivers Ave & Piggly Wiggly Dr

Movement	EB	EB	EB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	L	T	T	T	T	T	T	R
Maximum Queue (ft)	69	168	44	62	132	134	163	122	153	127	68
Average Queue (ft)	7	77	2	20	37	42	67	35	56	46	18
95th Queue (ft)	38	134	31	51	93	102	136	96	128	107	49
Link Distance (ft)		468			2162	2162	2162	716	716	716	
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)	75		50	125							425
Storage Blk Time (%)	0	27			0						
Queuing Penalty (veh)	0	31			0						

Intersection: 70: Rivers Ave & Meeting St/Durant Ave

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	TR	L	T	R	LT	T	TR	L	T	T	R
Maximum Queue (ft)	149	279	186	154	111	248	255	329	135	159	162	73
Average Queue (ft)	87	114	98	56	35	127	138	184	61	56	66	25
95th Queue (ft)	153	219	166	126	80	224	236	300	115	125	133	60
Link Distance (ft)		460		552		673	673			2162	2162	2162
Upstream Blk Time (%)		0										
Queuing Penalty (veh)		0										
Storage Bay Dist (ft)	50		125		150			300	725			
Storage Blk Time (%)	34	24	7	1	0		0	1				
Queuing Penalty (veh)	55	37	18	2	0		0	2				

Intersection: 80: Rivers Ave & Helm Ave

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	TR	L	T	TR
Maximum Queue (ft)	60	110	53	248	262	64	165	198
Average Queue (ft)	16	49	12	101	128	17	76	90
95th Queue (ft)	41	93	37	197	223	48	149	164
Link Distance (ft)	737	713		3153	3153		2604	2604
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			225			200		
Storage Blk Time (%)				0			0	
Queuing Penalty (veh)				0			0	

Intersection: 90: Rivers Ave #2/Rivers Ave & McMillan Ave

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	LT	TR	LT	R	L	T	T	R	L	T	T	R
Maximum Queue (ft)	93	75	314	204	33	265	268	105	118	167	212	69
Average Queue (ft)	20	7	154	77	3	143	155	39	30	46	83	10
95th Queue (ft)	62	36	261	164	17	243	253	79	81	121	174	45
Link Distance (ft)	1091	1091	1516	1516		982	982			3153	3153	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)					200			200	200			200
Storage Blk Time (%)						3	4		0	0	1	
Queuing Penalty (veh)						1	7		0	0	0	

Intersection: 100: Rivers Ave #2 & Dorchester Rd

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	R	L	T	T	T	T	R
Maximum Queue (ft)	234	193	238	176	113	132	155	62
Average Queue (ft)	110	67	109	34	49	51	67	26
95th Queue (ft)	198	142	202	108	94	110	140	56
Link Distance (ft)	1350			656	656	982	982	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		100	185					200
Storage Blk Time (%)	12	1	2	0			0	
Queuing Penalty (veh)	18	2	12	0			1	

Intersection: 110: Rivers Ave #2 & Cosgrove Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	T	TR	L	T	T
Maximum Queue (ft)	519	509	404	264	655	696	300	603	543	267	372	336
Average Queue (ft)	315	173	147	64	393	422	215	277	213	152	194	162
95th Queue (ft)	523	502	353	219	685	712	336	586	427	290	426	395
Link Distance (ft)		3181	3181		1388	1388		1140	1140		656	656
Upstream Blk Time (%)											1	1
Queuing Penalty (veh)											5	4
Storage Bay Dist (ft)	450			165			200			200		
Storage Blk Time (%)	8	0		0	48		37	4		24	4	14
Queuing Penalty (veh)	20	1		0	19		118	12		51	3	42

Intersection: 110: Rivers Ave #2 & Cosgrove Ave

Movement	SB
Directions Served	R
Maximum Queue (ft)	216
Average Queue (ft)	84
95th Queue (ft)	176
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	125
Storage Blk Time (%)	3
Queuing Penalty (veh)	7

Intersection: 120: Rivers Ave #2 & Reynolds Ave

Movement	EB	WB	NB	NB	NB	SB	SB	SB	SB
Directions Served	LTR	LTR	L	T	TR	L	T	T	R
Maximum Queue (ft)	260	286	132	271	241	135	200	179	123
Average Queue (ft)	117	132	35	141	129	59	103	75	24
95th Queue (ft)	216	246	85	232	210	107	181	154	76
Link Distance (ft)	666	1494		1257	1257		1140	1140	
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)			200			200			50
Storage Blk Time (%)			0	2			0	16	1
Queuing Penalty (veh)			0	2			0	9	2

Intersection: 123: Bend

Movement	SB
Directions Served	T
Maximum Queue (ft)	41
Average Queue (ft)	1
95th Queue (ft)	42
Link Distance (ft)	422
Upstream Blk Time (%)	0
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 130: Rivers Ave/Rivers Ave #2 & Carner Ave #2

Movement	WB	NB	NB	SB	SB
Directions Served	R	T	TR	L	T
Maximum Queue (ft)	241	25	64	260	23
Average Queue (ft)	114	2	17	113	1
95th Queue (ft)	199	13	53	211	23
Link Distance (ft)	2094	773	773		1257
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				250	
Storage Blk Time (%)				1	
Queuing Penalty (veh)				1	

Intersection: 140: Carner Ave #2 & Burton Ln

Movement	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	T	R	L	TR
Maximum Queue (ft)	34	61	55	28	189	62	55	165
Average Queue (ft)	10	21	22	2	82	10	16	58
95th Queue (ft)	33	51	48	16	154	39	44	131
Link Distance (ft)	572	1428			222			2094
Upstream Blk Time (%)					0			
Queuing Penalty (veh)					0			
Storage Bay Dist (ft)			190	120		50	170	
Storage Blk Time (%)					14	0		0
Queuing Penalty (veh)					4	1		0

Intersection: 150: Carner Ave/Carner Ave #2 & Stromboli Ave

Movement	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	R	T	TR	L	T	T
Maximum Queue (ft)	36	53	99	29	37	55	53
Average Queue (ft)	5	8	19	1	4	7	5
95th Queue (ft)	24	34	69	12	22	33	28
Link Distance (ft)	1754	1754	1034	1034		671	671
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)					250		
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 160: Spruill Ave & Montague Ave

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	45	182	110	135	210	214	45	78
Average Queue (ft)	12	80	48	63	88	88	12	27
95th Queue (ft)	38	147	89	113	163	167	38	63
Link Distance (ft)		450		1923		680		573
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	125		75		275		90	
Storage Blk Time (%)		2	2	5	0	0		0
Queuing Penalty (veh)		0	5	6	0	0		0

Intersection: 170: Spruill Ave #1/Spruill Ave & McMillan Ave

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	262	138	410	631	186	85
Average Queue (ft)	112	46	281	259	86	39
95th Queue (ft)	228	105	453	611	162	75
Link Distance (ft)	1516	1516		621	1560	
Upstream Blk Time (%)				3		
Queuing Penalty (veh)				35		
Storage Bay Dist (ft)			310			200
Storage Blk Time (%)			27	3	0	
Queuing Penalty (veh)			192	14	0	

Intersection: 180: Spruill Ave #1 & Cosgrove Ave

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	T	R	L	TR	L	T	R
Maximum Queue (ft)	325	1193	1186	350	1250	1247	300	360	1498	239	447	246
Average Queue (ft)	307	772	509	256	765	775	207	207	1327	129	168	73
95th Queue (ft)	382	1512	1282	453	1466	1481	408	464	1756	238	357	193
Link Distance (ft)		1388	1388		2051	2051			1488		621	
Upstream Blk Time (%)		6	1		1	1			9		0	
Queuing Penalty (veh)		18	2		4	6			78		2	
Storage Bay Dist (ft)	225			200			150	260		140		280
Storage Blk Time (%)	86	0		8	65	74	1		63	23	7	
Queuing Penalty (veh)	165	1		32	108	82	4		72	115	26	

Intersection: 190: Spruill Ave #1 & Reynolds Ave

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	L	TR	L	TR	L	TR
Maximum Queue (ft)	265	50	98	274	1676	34	231
Average Queue (ft)	107	10	34	150	903	7	90
95th Queue (ft)	215	35	78	343	2288	25	178
Link Distance (ft)	1494		716		2143		1488
Upstream Blk Time (%)					2		
Queuing Penalty (veh)					17		
Storage Bay Dist (ft)		200		185		180	
Storage Blk Time (%)				0	42		1
Queuing Penalty (veh)				0	54		0

Intersection: 200: Spruill Ave #1 & Carolina Ave

Movement	WB	NB	NB	SB
Directions Served	L	T	R	T
Maximum Queue (ft)	109	948	150	169
Average Queue (ft)	47	342	37	62
95th Queue (ft)	94	1220	143	139
Link Distance (ft)	573	2106		2143
Upstream Blk Time (%)		1		
Queuing Penalty (veh)		5		
Storage Bay Dist (ft)			50	
Storage Blk Time (%)		24		
Queuing Penalty (veh)		20		

Intersection: 210: Spruill Ave #1 & Burton Ln/Driveway

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	L	TR	LTR	L	TR	L	TR
Maximum Queue (ft)	100	74	42	190	496	29	290
Average Queue (ft)	43	27	8	49	196	3	123
95th Queue (ft)	85	57	29	136	553	18	228
Link Distance (ft)		1428	473		1287		2106
Upstream Blk Time (%)					0		
Queuing Penalty (veh)					1		
Storage Bay Dist (ft)	250			150		170	
Storage Blk Time (%)				0	9		2
Queuing Penalty (veh)				0	6		0

Intersection: 220: Spruill Ave/Spruill Ave #1 & Stromboli Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	75	40	37	50	21	150	27	241	119	243
Average Queue (ft)	23	5	4	7	2	61	2	121	55	102
95th Queue (ft)	57	25	21	29	11	117	15	209	102	201
Link Distance (ft)		1754	1754		1627	1627		518		1287
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	250			250			250		250	
Storage Blk Time (%)								0		0
Queuing Penalty (veh)								0		0

Intersection: 230: St Johns Ave & Turnbull Ave

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	76	49
Average Queue (ft)	40	6
95th Queue (ft)	65	31
Link Distance (ft)	1959	1038
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 240: Cosgrove Ave/McMillan Ave & Noisette Blvd

Movement	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	R	L	R
Maximum Queue (ft)	257	8	77	42	90	36
Average Queue (ft)	114	0	11	5	31	5
95th Queue (ft)	212	8	98	68	69	48
Link Distance (ft)	2051	2051	312	312	1290	1290
Upstream Blk Time (%)			1	0		
Queuing Penalty (veh)			2	0		
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 250: Hobson Ave & McMillan Ave

Movement	EB	WB	NB	NB	SB	SB
Directions Served	LT	LTR	L	TR	LT	R
Maximum Queue (ft)	105	39	268	140	46	70
Average Queue (ft)	37	10	124	41	10	33
95th Queue (ft)	79	35	227	101	34	62
Link Distance (ft)		727	446	446	583	583
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	60					
Storage Blk Time (%)	2					
Queuing Penalty (veh)	4					

Intersection: 260: Noisette Blvd & Turnbull Ave

Movement	EB	WB	WB	NB	NB	SB
Directions Served	LTR	LT	R	LT	R	LTR
Maximum Queue (ft)	114	55	88	189	58	130
Average Queue (ft)	59	26	43	90	27	63
95th Queue (ft)	91	47	75	153	49	105
Link Distance (ft)	1959	315		1290	1290	2516
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)			75			
Storage Blk Time (%)		0	1			
Queuing Penalty (veh)		0	1			

Intersection: 270: Noisette Blvd & Avenue B

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	101	80
Average Queue (ft)	48	12
95th Queue (ft)	86	47
Link Distance (ft)	564	593
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 280: Virginia Ave & Avenue B

Movement	WB	NB	SB
Directions Served	L	TR	L
Maximum Queue (ft)	58	17	88
Average Queue (ft)	21	1	24
95th Queue (ft)	45	8	64
Link Distance (ft)	593	466	1266
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 290: Virginia Ave & Montague Ave

Movement	EB	NB	SB
Directions Served	LR	L	TR
Maximum Queue (ft)	99	69	15
Average Queue (ft)	44	26	1
95th Queue (ft)	79	61	8
Link Distance (ft)	1923		394
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		150	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 300: Virginia Ave & I-526 EB Off-Ramp

Movement	EB	EB	NB	NB
Directions Served	L	R	T	T
Maximum Queue (ft)	263	347	221	139
Average Queue (ft)	112	122	42	20
95th Queue (ft)	315	591	231	136
Link Distance (ft)		1232	1357	1357
Upstream Blk Time (%)		4		
Queuing Penalty (veh)		0		
Storage Bay Dist (ft)	350			
Storage Blk Time (%)	9	0		
Queuing Penalty (veh)	8	0		

Intersection: 310: Virginia Ave & I-526 WB On-Ramp

Movement	NB	NB	NB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	324	569	471	7	133
Average Queue (ft)	208	185	117	0	40
95th Queue (ft)	374	605	486	4	92
Link Distance (ft)		593	593	492	
Upstream Blk Time (%)		6	0		
Queuing Penalty (veh)		21	2		
Storage Bay Dist (ft)	225				325
Storage Blk Time (%)	32	0			
Queuing Penalty (veh)	65	0			

Intersection: 320: Rhett Ave & I-526 EB Ramps

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	LR	L	T	T	T	T	R
Maximum Queue (ft)	375	634	246	614	539	171	354	573
Average Queue (ft)	315	415	166	277	216	86	95	237
95th Queue (ft)	417	595	283	631	558	148	219	455
Link Distance (ft)		639		684	684	803	803	803
Upstream Blk Time (%)		2		6	1		0	
Queuing Penalty (veh)		0		0	0		0	
Storage Bay Dist (ft)	275		150					
Storage Blk Time (%)	5	40	38	4				
Queuing Penalty (veh)	21	118	172	7				

Intersection: 330: Rhett Ave & I-526 WB Ramps

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	LR	L	T	T	T	T	R
Maximum Queue (ft)	575	791	127	294	296	606	652	425
Average Queue (ft)	555	734	49	151	160	328	442	268
95th Queue (ft)	630	862	98	246	248	570	708	532
Link Distance (ft)		735		803	803	612	612	
Upstream Blk Time (%)		33				1	9	
Queuing Penalty (veh)		0				0	0	
Storage Bay Dist (ft)	475		270					325
Storage Blk Time (%)	4	48		0			17	2
Queuing Penalty (veh)	24	190		0			96	15

Intersection: 340: Morningside Dr/Piedmont Ave & Montague Ave

Movement	EB	EB	EB	B39	B39	B39	WB	WB	WB	WB	NB	NB
Directions Served	L	T	TR	T	T		L	T	T	R	LT	R
Maximum Queue (ft)	171	311	342	162	117	56	108	181	179	192	239	149
Average Queue (ft)	64	145	170	6	4	2	47	96	86	89	99	21
95th Queue (ft)	132	271	309	98	86	57	94	159	154	159	178	102
Link Distance (ft)		370	370	538	538	538		724	724		701	
Upstream Blk Time (%)		0	0	0	0	0						
Queuing Penalty (veh)		0	0	0	0	0						
Storage Bay Dist (ft)	150						175			150		50
Storage Blk Time (%)	1	5						0	1	1	33	0
Queuing Penalty (veh)	7	5						0	2	4	45	0

Intersection: 340: Morningside Dr/Piedmont Ave & Montague Ave

Movement	SB	SB
Directions Served	L	TR
Maximum Queue (ft)	65	82
Average Queue (ft)	19	29
95th Queue (ft)	50	63
Link Distance (ft)		459
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	135	
Storage Blk Time (%)		0
Queuing Penalty (veh)		0

Intersection: 350: Montague Ave & Mall Dr/Goer Dr

Movement	EB	EB	EB	WB	WB	NB	NB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	L	T	T	TR	L	T
Maximum Queue (ft)	112	446	460	206	80	160	232	394	477	399	36	251
Average Queue (ft)	34	298	378	99	19	81	107	187	212	137	7	147
95th Queue (ft)	81	623	560	173	58	141	174	338	369	295	26	224
Link Distance (ft)		415	415		476			516	516	516		538
Upstream Blk Time (%)		37	69					0	0	0		
Queuing Penalty (veh)		0	0					0	0	0		
Storage Bay Dist (ft)	185			170		275	275				175	
Storage Blk Time (%)	0			1				1				4
Queuing Penalty (veh)	0			0				4				0

Intersection: 350: Montague Ave & Mall Dr/Goer Dr

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	257	304
Average Queue (ft)	166	169
95th Queue (ft)	247	261
Link Distance (ft)	538	538
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		0
Queuing Penalty (veh)		0

Intersection: 360: Montague Ave & I-26 WB Ramps

Movement	WB	WB	WB	NB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	L	L	T	T	T	T	T	T	R
Maximum Queue (ft)	475	623	475	381	391	263	226	193	426	446	443	296
Average Queue (ft)	380	485	232	229	248	161	145	94	272	299	291	29
95th Queue (ft)	528	688	611	347	367	235	211	172	389	409	406	161
Link Distance (ft)		573				845	845	845	516	516	516	
Upstream Blk Time (%)		16								0	0	
Queuing Penalty (veh)		0								0	1	
Storage Bay Dist (ft)	375		375	550	550							350
Storage Blk Time (%)	5	30		0	0						2	
Queuing Penalty (veh)	30	196		0	0						6	

Intersection: 370: Montague Ave & I-26 EB Ramps

Movement	B123	B123	SB	SB
Directions Served	T	T	T	T
Maximum Queue (ft)	85	38	65	132
Average Queue (ft)	4	1	2	5
95th Queue (ft)	74	39	42	92
Link Distance (ft)	369	369	845	845
Upstream Blk Time (%)	0	0		
Queuing Penalty (veh)	0	0		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 380: Dorchester Rd & Meeting St

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	L	T	R	LT	TR
Maximum Queue (ft)	167	179	154	122	212	244	94	210	180
Average Queue (ft)	58	83	75	38	107	100	39	100	92
95th Queue (ft)	120	146	130	91	184	190	77	170	150
Link Distance (ft)	457			469		1842	1842	1350	
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)		100	125		125				125
Storage Blk Time (%)	1	4	2	0	5	4		4	2
Queuing Penalty (veh)	5	4	2	0	16	10		8	4

Intersection: 390: I-26 WB Ramps & Dorchester Rd

Movement	EB	EB	EB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	TR	L	L	R
Maximum Queue (ft)	318	155	122	400	447	339	378	33
Average Queue (ft)	202	78	44	239	270	175	228	1
95th Queue (ft)	314	132	97	360	402	293	331	20
Link Distance (ft)	304	304	304	1842	1842			561
Upstream Blk Time (%)	1							
Queuing Penalty (veh)	3							
Storage Bay Dist (ft)						530	530	
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 400: I-26 EB Ramps & Dorchester Rd

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	T	T	R	L	T	T	L	R
Maximum Queue (ft)	521	454	109	172	239	254	247	179
Average Queue (ft)	316	228	7	64	150	160	120	20
95th Queue (ft)	465	388	61	131	223	240	211	104
Link Distance (ft)	560	560		304	304	304	445	
Upstream Blk Time (%)	0	0				0		
Queuing Penalty (veh)	0	0				0		
Storage Bay Dist (ft)			425					300
Storage Blk Time (%)		0					0	
Queuing Penalty (veh)		0					0	

Intersection: 410: Cosgrove Ave & Azalea Dr

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	TR	L	T	T	R	L
Maximum Queue (ft)	205	909	942	500	330	747	650	334	394	307	201	299
Average Queue (ft)	112	356	647	456	294	480	375	191	146	127	36	44
95th Queue (ft)	208	939	1248	610	398	906	826	325	336	288	133	189
Link Distance (ft)		892	892			767			661	661	661	
Upstream Blk Time (%)		2	39			22			0	0	0	
Queuing Penalty (veh)		0	0			0			1	0	0	
Storage Bay Dist (ft)	130			400	230		600	250				200
Storage Blk Time (%)	24	3	0	68	69	0	1	8	0			
Queuing Penalty (veh)	18	3	1	51	257	1	3	33	0			

Intersection: 410: Cosgrove Ave & Azalea Dr

Movement	SB	SB	SB
Directions Served	T	T	R
Maximum Queue (ft)	665	737	300
Average Queue (ft)	379	430	156
95th Queue (ft)	657	706	380
Link Distance (ft)	3181	3181	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			200
Storage Blk Time (%)	33	43	0
Queuing Penalty (veh)	9	62	1

Intersection: 421: Cosgrove Ave & I-26 WB Ramps

Movement	WB	NB	NB
Directions Served	R	T	T
Maximum Queue (ft)	16	15	3
Average Queue (ft)	1	1	0
95th Queue (ft)	16	17	3
Link Distance (ft)	473	950	950
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 422: Cosgrove Ave & I-26 EB Ramps

Movement	NB	NB	NB	SB	SB	SB
Directions Served	T	T	TR	T	T	R
Maximum Queue (ft)	713	927	934	61	314	174
Average Queue (ft)	58	315	422	2	16	11
95th Queue (ft)	413	1014	1098	62	182	165
Link Distance (ft)	882	882	882	950	950	950
Upstream Blk Time (%)	0	10	22			
Queuing Penalty (veh)	0	0	0			
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 450: Local Access Rd & Hobson Ave

Movement	WB	WB	NB	NB	SB
Directions Served	L	R	T	R	L
Maximum Queue (ft)	95	84	6	9	75
Average Queue (ft)	31	29	0	0	21
95th Queue (ft)	77	70	5	5	60
Link Distance (ft)		930	1160		
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	170			100	220
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 460: Magrath Darby Blvd & US 17

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	SB
Directions Served	L	T	T	T	R	L	T	T	R	R	R
Maximum Queue (ft)	413	849	816	766	252	281	1312	1338	1000	299	137
Average Queue (ft)	187	433	384	347	53	80	576	654	48	148	47
95th Queue (ft)	406	986	933	863	229	189	1259	1369	427	268	103
Link Distance (ft)		1105	1105	1105			1292	1292	1292	516	538
Upstream Blk Time (%)		3	2	2			0	0	0		
Queuing Penalty (veh)		0	0	0			1	4	0		
Storage Bay Dist (ft)	375				175	205					
Storage Blk Time (%)	0	12		13		0	9				
Queuing Penalty (veh)	0	14		20		1	7				

Intersection: 470: Houston Northcutt Blvd/Mathis Ferry Rd & US 17

Movement	EB	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB
Directions Served	L	L	T	T	T	R	L	L	T	T	T	R
Maximum Queue (ft)	452	515	1280	1287	1276	315	400	450	1805	1833	1772	230
Average Queue (ft)	378	439	826	835	826	168	329	404	1111	1133	1058	54
95th Queue (ft)	531	611	1495	1501	1503	401	465	543	1916	1934	1900	196
Link Distance (ft)			1292	1292	1292				4040	4040	4040	
Upstream Blk Time (%)			1	1	1							
Queuing Penalty (veh)			15	12	10							
Storage Bay Dist (ft)	415	415				215	350	350				130
Storage Blk Time (%)	17	30	15		32		25	41	31		26	
Queuing Penalty (veh)	152	264	67		100		178	289	102		36	

Intersection: 470: Houston Northcutt Blvd/Mathis Ferry Rd & US 17

Movement	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	T	T	R	L	T	T	R
Maximum Queue (ft)	214	473	391	426	325	346	328	252
Average Queue (ft)	186	248	164	239	146	239	209	126
95th Queue (ft)	245	450	347	378	298	431	414	277
Link Distance (ft)		543	543	543	536	536	536	
Upstream Blk Time (%)		0		0	1	4	5	
Queuing Penalty (veh)		0		0	0	0	0	
Storage Bay Dist (ft)	115							300
Storage Blk Time (%)	49	22					11	0
Queuing Penalty (veh)	66	49					20	0

Intersection: 480: Shelmore Blvd & US 17

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	R	L	T	T	T	R	L	T
Maximum Queue (ft)	486	1611	1304	592	310	480	624	649	645	300	254	268
Average Queue (ft)	314	414	443	417	105	308	370	390	386	140	196	198
95th Queue (ft)	471	1041	1077	579	329	489	652	655	606	363	297	328
Link Distance (ft)		4040	4040	4040			2558	2558	2558		231	231
Upstream Blk Time (%)			0								41	40
Queuing Penalty (veh)			0								0	0
Storage Bay Dist (ft)	400				210	400				200		
Storage Blk Time (%)	6	7		35		12	5		33			64
Queuing Penalty (veh)	51	19		43		87	10		58			174

Intersection: 480: Shelmore Blvd & US 17

Movement	NB	SB	SB	SB	SB
Directions Served	R	L	L	T	R
Maximum Queue (ft)	190	175	363	346	220
Average Queue (ft)	141	155	290	229	73
95th Queue (ft)	261	206	413	393	176
Link Distance (ft)			333	333	333
Upstream Blk Time (%)			41	21	0
Queuing Penalty (veh)			0	0	0
Storage Bay Dist (ft)	90	75			
Storage Blk Time (%)	31	77	91		
Queuing Penalty (veh)	55	84	99		

Intersection: 490: Dragoon Dr & US 17

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB
Directions Served	T	T	T	R	L	T	T	T	L	R
Maximum Queue (ft)	442	656	229	45	228	854	885	264	222	247
Average Queue (ft)	84	116	105	7	114	128	142	133	103	149
95th Queue (ft)	347	455	230	30	199	436	453	280	194	243
Link Distance (ft)	2558	2558	2558			1813	1813	1813		228
Upstream Blk Time (%)						0	0		0	3
Queuing Penalty (veh)						0	0		0	0
Storage Bay Dist (ft)				200	200				125	
Storage Blk Time (%)			1		2	0			15	18
Queuing Penalty (veh)			1		14	1			23	14

Intersection: 500: Anna Knapp Blvd & US 17

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	R	L	T	T	T	R	L	LT
Maximum Queue (ft)	427	542	582	576	275	470	1434	1394	1322	300	188	184
Average Queue (ft)	261	299	342	368	96	382	855	813	738	175	110	112
95th Queue (ft)	415	567	577	581	294	573	1439	1370	1254	402	176	177
Link Distance (ft)		1813	1813	1813			1466	1466	1466		325	325
Upstream Blk Time (%)							3	1	0			
Queuing Penalty (veh)							0	0	0			
Storage Bay Dist (ft)	365				175	370				200		
Storage Blk Time (%)	4	3		25		29	26		34			
Queuing Penalty (veh)	41	7		32		217	52		91			

Intersection: 500: Anna Knapp Blvd & US 17

Movement	NB	NB	SB	SB	SB	SB
Directions Served	T	R	L	LT	T	R
Maximum Queue (ft)	247	232	175	306	264	233
Average Queue (ft)	74	130	171	279	167	91
95th Queue (ft)	210	219	186	294	265	183
Link Distance (ft)	325			260	260	260
Upstream Blk Time (%)	0			89	2	0
Queuing Penalty (veh)	0			0	0	0
Storage Bay Dist (ft)		140	75			
Storage Blk Time (%)	3	11	71	91		
Queuing Penalty (veh)	5	6	187	160		

Intersection: 510: Local Access Rd & Bainbridge Ave

Movement	WB	WB	SB
Directions Served	L	R	L
Maximum Queue (ft)	368	172	81
Average Queue (ft)	158	72	23
95th Queue (ft)	328	138	63
Link Distance (ft)	842	842	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			175
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 520: Local Access Rd & Stromboli Ave

Movement	EB	EB	EB	NB	NB	NB	SB	SB
Directions Served	L	L	R	L	T	T	T	TR
Maximum Queue (ft)	80	97	48	64	75	72	74	143
Average Queue (ft)	25	38	10	10	15	17	16	59
95th Queue (ft)	61	74	35	39	50	52	52	115
Link Distance (ft)		1627	1627		1428	1428	1386	1386
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	200			200				
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 530: Local Access Rd & PAR SB Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 540: PAR NB Ramp/Tidewater Rd & Local Access Rd

Movement	EB	WB
Directions Served	LTR	LTR
Maximum Queue (ft)	105	27
Average Queue (ft)	56	7
95th Queue (ft)	87	25
Link Distance (ft)	615	871
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 550: Hobson Ave & ICTF Truck Dwy

Movement	EB	NB	SB	SB
Directions Served	LR	L	T	R
Maximum Queue (ft)	277	100	9	12
Average Queue (ft)	110	23	0	0
95th Queue (ft)	206	76	6	9
Link Distance (ft)	896		1098	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		500		500
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 560: Hobson Ave & ICTF Employee Dwy

Movement	EB	NB	NB
Directions Served	LR	LT	T
Maximum Queue (ft)	67	73	24
Average Queue (ft)	33	6	1
95th Queue (ft)	58	35	18
Link Distance (ft)	439	152	152
Upstream Blk Time (%)		0	0
Queuing Penalty (veh)		0	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 6087

Appendix E

Traffic Analysis Worksheets

2038 Design Year

Build Proposed Project Alternatives 1, 3 & 4

North Charleston Intersections

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	195	19	355	64	16	5	174	403	148	5	636	156
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1810	1810	1810	1810	1667	1667	1900	1667	1667	1667
Adj Flow Rate, veh/h	217	21	394	71	18	6	193	448	164	6	707	173
Adj No. of Lanes	1	1	1	1	1	1	1	1	0	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	5	5	5	14	14	14	14	14	14
Cap, veh/h	383	423	359	291	423	359	284	737	270	371	1055	897
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.63	0.63	0.63	0.63	0.63	0.63
Sat Flow, veh/h	1342	1810	1538	940	1810	1538	562	1165	426	722	1667	1417
Grp Volume(v), veh/h	217	21	394	71	18	6	193	0	612	6	707	173
Grp Sat Flow(s),veh/h/ln	1342	1810	1538	940	1810	1538	562	0	1591	722	1667	1417
Q Serve(g_s), s	13.4	0.8	21.0	5.7	0.7	0.3	30.0	0.0	20.6	0.4	24.3	4.6
Cycle Q Clear(g_c), s	14.1	0.8	21.0	6.5	0.7	0.3	54.3	0.0	20.6	21.1	24.3	4.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.27	1.00		1.00
Lane Grp Cap(c), veh/h	383	423	359	291	423	359	284	0	1007	371	1055	897
V/C Ratio(X)	0.57	0.05	1.10	0.24	0.04	0.02	0.68	0.00	0.61	0.02	0.67	0.19
Avail Cap(c_a), veh/h	383	423	359	291	423	359	284	0	1009	372	1057	898
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	32.1	26.7	34.4	29.2	26.7	26.5	27.8	0.0	9.8	16.1	10.5	6.9
Incr Delay (d2), s/veh	1.9	0.0	76.0	0.4	0.0	0.0	6.4	0.0	1.1	0.0	1.7	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.1	0.4	16.4	1.5	0.3	0.1	5.1	0.0	9.1	0.1	11.5	1.8
LnGrp Delay(d),s/veh	34.1	26.8	110.4	29.7	26.7	26.5	34.2	0.0	10.9	16.1	12.2	7.0
LnGrp LOS	C	C	F	C	C	C	C		B	B	B	A
Approach Vol, veh/h		632			95			805			886	
Approach Delay, s/veh		81.4			28.9			16.5			11.2	
Approach LOS		F			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		62.9		27.0		62.9		27.0
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		57.0		21.0		57.0		21.0
Max Q Clear Time (g_c+I1), s		26.3		23.0		56.3		8.5
Green Ext Time (p_c), s		14.8		0.0		0.6		2.4

Intersection Summary	
HCM 2010 Ctrl Delay	32.0
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	187	22	194	154	18	5	405	720	73	5	458	221
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1827	1827	1827	1827	1712	1712	1900	1712	1712	1712
Adj Flow Rate, veh/h	208	24	216	171	20	6	450	800	81	6	509	246
Adj No. of Lanes	1	1	1	1	1	1	1	1	0	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	4	4	4	11	11	11	11	11	11
Cap, veh/h	308	325	276	266	325	276	441	1054	107	280	1179	1002
Arrive On Green	0.18	0.18	0.18	0.18	0.18	0.18	0.69	0.69	0.69	0.69	0.69	0.69
Sat Flow, veh/h	1352	1827	1553	1114	1827	1553	649	1530	155	577	1712	1455
Grp Volume(v), veh/h	208	24	216	171	20	6	450	0	881	6	509	246
Grp Sat Flow(s),veh/h/ln	1352	1827	1553	1114	1827	1553	649	0	1684	577	1712	1455
Q Serve(g_s), s	13.6	1.0	12.0	13.6	0.8	0.3	50.2	0.0	30.7	0.6	11.8	5.7
Cycle Q Clear(g_c), s	14.4	1.0	12.0	14.6	0.8	0.3	62.0	0.0	30.7	31.3	11.8	5.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.09	1.00		1.00
Lane Grp Cap(c), veh/h	308	325	276	266	325	276	441	0	1160	280	1179	1002
V/C Ratio(X)	0.68	0.07	0.78	0.64	0.06	0.02	1.02	0.00	0.76	0.02	0.43	0.25
Avail Cap(c_a), veh/h	308	325	276	266	325	276	441	0	1160	280	1179	1002
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	36.8	30.8	35.3	36.9	30.8	30.5	24.5	0.0	9.1	19.3	6.2	5.2
Incr Delay (d2), s/veh	5.7	0.1	13.6	5.2	0.1	0.0	47.8	0.0	3.0	0.0	0.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.6	0.5	6.1	4.6	0.4	0.1	16.8	0.0	14.9	0.1	5.6	2.3
LnGrp Delay(d),s/veh	42.5	30.9	48.9	42.1	30.8	30.6	72.3	0.0	12.1	19.4	6.4	5.4
LnGrp LOS	D	C	D	D	C	C	F		B	B	A	A
Approach Vol, veh/h		448			197			1331			761	
Approach Delay, s/veh		45.0			40.6			32.4			6.2	
Approach LOS		D			D			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		68.0		22.0		68.0		22.0
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		62.0		16.0		62.0		16.0
Max Q Clear Time (g_c+I1), s		33.3		16.4		64.0		16.6
Green Ext Time (p_c), s		18.6		0.0		0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	27.8
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	300	721	86	69	334	104	47	401	51	96	757	207
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1900	1696	1696	1696	1827	1827	1900	1667	1667	1667
Adj Flow Rate, veh/h	333	801	96	77	371	116	52	446	57	107	841	230
Adj No. of Lanes	1	2	0	1	2	1	1	1	0	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	12	12	12	4	4	4	14	14	14
Cap, veh/h	342	684	82	175	473	212	170	684	87	345	737	626
Arrive On Green	0.14	0.22	0.22	0.07	0.15	0.15	0.06	0.43	0.43	0.07	0.44	0.44
Sat Flow, veh/h	1723	3093	371	1616	3223	1442	1740	1588	203	1587	1667	1417
Grp Volume(v), veh/h	333	445	452	77	371	116	52	0	503	107	841	230
Grp Sat Flow(s),veh/h/ln	1723	1719	1744	1616	1612	1442	1740	0	1791	1587	1667	1417
Q Serve(g_s), s	17.0	26.0	26.0	4.6	13.1	8.8	1.8	0.0	26.2	4.2	52.0	12.7
Cycle Q Clear(g_c), s	17.0	26.0	26.0	4.6	13.1	8.8	1.8	0.0	26.2	4.2	52.0	12.7
Prop In Lane	1.00		0.21	1.00		1.00	1.00		0.11	1.00		1.00
Lane Grp Cap(c), veh/h	342	380	386	175	473	212	170	0	771	345	737	626
V/C Ratio(X)	0.97	1.17	1.17	0.44	0.78	0.55	0.31	0.00	0.65	0.31	1.14	0.37
Avail Cap(c_a), veh/h	342	380	386	185	493	221	194	0	792	349	737	626
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.8	45.8	45.8	39.1	48.4	46.6	26.5	0.0	26.5	18.8	32.8	21.9
Incr Delay (d2), s/veh	41.6	101.8	101.6	1.7	7.8	2.6	1.0	0.0	1.9	0.5	79.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.7	23.0	23.3	2.1	6.3	3.6	0.9	0.0	13.3	1.9	40.0	5.0
LnGrp Delay(d),s/veh	79.5	147.6	147.4	40.9	56.2	49.2	27.5	0.0	28.4	19.3	112.3	22.2
LnGrp LOS	E	F	F	D	E	D	C		C	B	F	C
Approach Vol, veh/h		1230			564			555			1178	
Approach Delay, s/veh		129.1			52.6			28.3			86.2	
Approach LOS		F			D			C			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.4	58.0	23.0	23.3	14.7	56.6	14.3	32.0
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	9.0	52.0	17.0	18.0	9.0	52.0	9.0	26.0
Max Q Clear Time (g_c+I1), s	3.8	54.0	19.0	15.1	6.2	28.2	6.6	28.0
Green Ext Time (p_c), s	0.0	0.0	0.0	2.1	0.1	11.1	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	86.7
HCM 2010 LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	287	327	45	138	633	93	115	685	81	120	300	335
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1900	1727	1727	1727	1827	1827	1900	1712	1712	1712
Adj Flow Rate, veh/h	319	363	50	153	703	103	128	761	90	133	333	372
Adj No. of Lanes	1	2	0	1	2	1	1	1	0	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	10	10	10	4	4	4	11	11	11
Cap, veh/h	263	644	88	301	602	269	397	682	81	181	728	619
Arrive On Green	0.12	0.21	0.21	0.09	0.18	0.18	0.07	0.43	0.43	0.07	0.43	0.43
Sat Flow, veh/h	1740	3069	420	1645	3282	1468	1740	1604	190	1630	1712	1455
Grp Volume(v), veh/h	319	204	209	153	703	103	128	0	851	133	333	372
Grp Sat Flow(s),veh/h/ln	1740	1736	1753	1645	1641	1468	1740	0	1793	1630	1712	1455
Q Serve(g_s), s	14.0	12.6	12.8	8.9	22.0	7.4	4.8	0.0	51.0	5.3	16.6	23.7
Cycle Q Clear(g_c), s	14.0	12.6	12.8	8.9	22.0	7.4	4.8	0.0	51.0	5.3	16.6	23.7
Prop In Lane	1.00		0.24	1.00		1.00	1.00		0.11	1.00		1.00
Lane Grp Cap(c), veh/h	263	364	368	301	602	269	397	0	763	181	728	619
V/C Ratio(X)	1.21	0.56	0.57	0.51	1.17	0.38	0.32	0.00	1.12	0.73	0.46	0.60
Avail Cap(c_a), veh/h	263	364	368	303	602	269	399	0	763	182	728	619
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.6	42.4	42.5	35.3	48.9	43.0	17.6	0.0	34.4	27.2	24.6	26.6
Incr Delay (d2), s/veh	125.1	1.9	2.1	1.4	92.3	0.9	0.5	0.0	69.1	14.2	0.4	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.2	6.3	6.4	4.1	17.6	3.1	2.3	0.0	39.7	3.1	8.0	9.8
LnGrp Delay(d),s/veh	162.7	44.4	44.6	36.7	141.3	43.9	18.1	0.0	103.6	41.4	25.0	28.2
LnGrp LOS	F	D	D	D	F	D	B		F	D	C	C
Approach Vol, veh/h		732			959			979			838	
Approach Delay, s/veh		96.0			114.1			92.4			29.0	
Approach LOS		F			F			F			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.9	57.0	20.0	28.0	14.9	57.0	16.9	31.1
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	9.0	51.0	14.0	22.0	9.0	51.0	11.0	25.0
Max Q Clear Time (g_c+I1), s	6.8	25.7	16.0	24.0	7.3	53.0	10.9	14.8
Green Ext Time (p_c), s	0.1	10.8	0.0	0.0	0.0	0.0	0.0	5.2

Intersection Summary	
HCM 2010 Ctrl Delay	83.9
HCM 2010 LOS	F

Intersection	
Int Delay, s/veh	4.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	334	534	237	28	47	270
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	0	-	-	0	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	12	12	19	19	5	5
Mvmt Flow	371	593	263	31	52	300

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	263	0	-	0	1599	-
Stage 1	-	-	-	-	263	-
Stage 2	-	-	-	-	1336	-
Critical Hdwy	4.22	-	-	-	6.45	-
Critical Hdwy Stg 1	-	-	-	-	5.45	-
Critical Hdwy Stg 2	-	-	-	-	5.45	-
Follow-up Hdwy	2.308	-	-	-	3.545	-
Pot Cap-1 Maneuver	1245	-	-	-	115	0
Stage 1	-	-	-	-	774	0
Stage 2	-	-	-	-	242	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1245	-	-	-	81	-
Mov Cap-2 Maneuver	-	-	-	-	81	-
Stage 1	-	-	-	-	774	-
Stage 2	-	-	-	-	170	-

Approach	EB	WB	SB
HCM Control Delay, s			108.4
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1245	-	-	-	81	-
HCM Lane V/C Ratio	0.298	-	-	-	0.645	-
HCM Control Delay (s)	9.1	-	-	-	108.4	0
HCM Lane LOS	A	-	-	-	F	A
HCM 95th %tile Q(veh)	1	-	-	-	3	-

Intersection	
Int Delay, s/veh	3.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	302	226	494	43	44	370
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	0	-	-	0	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	10	10	17	17	3	3
Mvmt Flow	336	251	549	48	49	411

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	549	0	-	0	1471	-
Stage 1	-	-	-	-	549	-
Stage 2	-	-	-	-	922	-
Critical Hdwy	4.2	-	-	-	6.43	-
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.29	-	-	-	3.527	-
Pot Cap-1 Maneuver	982	-	-	-	139	0
Stage 1	-	-	-	-	577	0
Stage 2	-	-	-	-	386	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	982	-	-	-	91	-
Mov Cap-2 Maneuver	-	-	-	-	91	-
Stage 1	-	-	-	-	577	-
Stage 2	-	-	-	-	254	-

Approach	EB	WB	SB
HCM Control Delay, s			83.3
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	982	-	-	-	91	-
HCM Lane V/C Ratio	0.342	-	-	-	0.537	-
HCM Control Delay (s)	10.6	-	-	-	83.3	0
HCM Lane LOS	B	-	-	-	F	A
HCM 95th %tile Q(veh)	2	-	-	-	2	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	172	17	392	4	7	4	150	22	4	5	135	108
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1597	1597	1900	1863	1900	1545	1545	1900	1900	1845	1845
Adj Flow Rate, veh/h	191	19	0	4	8	4	167	24	4	6	150	120
Adj No. of Lanes	0	1	1	0	1	0	1	1	0	0	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	19	19	19	2	2	2	23	23	23	3	3	3
Cap, veh/h	543	45	472	198	351	148	456	481	80	94	679	585
Arrive On Green	0.35	0.35	0.00	0.35	0.35	0.35	0.37	0.37	0.37	0.37	0.37	0.37
Sat Flow, veh/h	1100	131	1357	267	1009	426	916	1291	215	17	1821	1568
Grp Volume(v), veh/h	210	0	0	16	0	0	167	0	28	156	0	120
Grp Sat Flow(s),veh/h/ln	1231	0	1357	1702	0	0	916	0	1507	1838	0	1568
Q Serve(g_s), s	5.5	0.0	0.0	0.0	0.0	0.0	6.6	0.0	0.5	0.0	0.0	2.2
Cycle Q Clear(g_c), s	5.7	0.0	0.0	0.3	0.0	0.0	9.0	0.0	0.5	2.5	0.0	2.2
Prop In Lane	0.91		1.00	0.25		0.25	1.00		0.14	0.04		1.00
Lane Grp Cap(c), veh/h	588	0	472	697	0	0	456	0	562	772	0	585
V/C Ratio(X)	0.36	0.00	0.00	0.02	0.00	0.00	0.37	0.00	0.05	0.20	0.00	0.21
Avail Cap(c_a), veh/h	847	0	759	1045	0	0	627	0	843	1112	0	877
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.0	0.0	0.0	9.2	0.0	0.0	12.3	0.0	8.6	9.2	0.0	9.1
Incr Delay (d2), s/veh	0.4	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.1	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	0.0	0.0	0.1	0.0	0.0	1.7	0.0	0.2	1.3	0.0	1.0
LnGrp Delay(d),s/veh	11.3	0.0	0.0	9.2	0.0	0.0	12.8	0.0	8.6	9.3	0.0	9.3
LnGrp LOS	B			A			B		A	A		A
Approach Vol, veh/h		210			16			195			276	
Approach Delay, s/veh		11.3			9.2			12.2			9.3	
Approach LOS		B			A			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		22.0		20.9		22.0		20.9
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		24.0		24.0		24.0		24.0
Max Q Clear Time (g_c+I1), s		11.0		7.7		4.5		2.3
Green Ext Time (p_c), s		2.0		1.1		2.3		1.3

Intersection Summary	
HCM 2010 Ctrl Delay	10.7
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	93	7	170	4	6	5	352	134	4	5	32	179
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1624	1624	1900	1863	1900	1583	1583	1900	1900	1863	1863
Adj Flow Rate, veh/h	103	8	0	4	7	6	391	149	4	6	36	199
Adj No. of Lanes	0	1	1	0	1	0	1	1	0	0	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	17	17	17	2	2	2	20	20	20	2	2	2
Cap, veh/h	453	29	375	153	234	161	603	738	20	153	792	761
Arrive On Green	0.27	0.27	0.00	0.27	0.27	0.27	0.48	0.48	0.48	0.48	0.48	0.48
Sat Flow, veh/h	1140	108	1380	227	862	594	970	1535	41	141	1649	1583
Grp Volume(v), veh/h	111	0	0	17	0	0	391	0	153	42	0	199
Grp Sat Flow(s),veh/h/ln	1248	0	1380	1683	0	0	970	0	1576	1790	0	1583
Q Serve(g_s), s	3.0	0.0	0.0	0.0	0.0	0.0	17.4	0.0	2.7	0.0	0.0	3.6
Cycle Q Clear(g_c), s	3.4	0.0	0.0	0.3	0.0	0.0	18.0	0.0	2.7	0.6	0.0	3.6
Prop In Lane	0.93		1.00	0.24		0.35	1.00		0.03	0.14		1.00
Lane Grp Cap(c), veh/h	482	0	375	549	0	0	603	0	758	945	0	761
V/C Ratio(X)	0.23	0.00	0.00	0.03	0.00	0.00	0.65	0.00	0.20	0.04	0.00	0.26
Avail Cap(c_a), veh/h	555	0	456	645	0	0	778	0	1042	1258	0	1047
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.0	0.0	0.0	13.0	0.0	0.0	11.4	0.0	7.2	6.7	0.0	7.5
Incr Delay (d2), s/veh	0.2	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.1	0.0	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	0.0	0.2	0.0	0.0	4.8	0.0	1.2	0.3	0.0	1.6
LnGrp Delay(d),s/veh	14.3	0.0	0.0	13.0	0.0	0.0	12.7	0.0	7.4	6.7	0.0	7.6
LnGrp LOS	B			B			B		A	A		A
Approach Vol, veh/h		111			17			544			241	
Approach Delay, s/veh		14.3			13.0			11.2			7.5	
Approach LOS		B			B			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		29.3		19.1		29.3		19.1
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		32.0		16.0		32.0		16.0
Max Q Clear Time (g_c+I1), s		20.0		5.4		5.6		2.3
Green Ext Time (p_c), s		3.3		0.4		4.3		0.5

Intersection Summary	
HCM 2010 Ctrl Delay	10.6
HCM 2010 LOS	B

Intersection	
Intersection Delay, s/veh	45.3
Intersection LOS	E

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	35	8	104	0	48	6	47	0	206	225	58
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	5	5	5
Mvmt Flow	0	39	9	116	0	53	7	52	0	229	250	64
Number of Lanes	0	0	1	0	0	0	1	1	0	0	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	2	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	2	1	2
HCM Control Delay	14.8	12	39.8
HCM LOS	B	B	E

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2	SBLn1
Vol Left, %	48%	0%	24%	89%	0%	35%
Vol Thru, %	52%	0%	5%	11%	0%	49%
Vol Right, %	0%	100%	71%	0%	100%	16%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	431	58	147	54	47	549
LT Vol	225	0	8	6	0	270
Through Vol	0	58	104	0	47	88
RT Vol	206	0	35	48	0	191
Lane Flow Rate	479	64	163	60	52	610
Geometry Grp	7	7	6	7	7	6
Degree of Util (X)	0.899	0.104	0.348	0.144	0.108	1
Departure Headway (Hd)	6.758	5.819	7.661	8.615	7.471	6.608
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	536	615	469	416	478	549
Service Time	4.503	3.564	5.72	6.379	5.235	4.684
HCM Lane V/C Ratio	0.894	0.104	0.348	0.144	0.109	1.111
HCM Control Delay	43.9	9.2	14.8	12.8	11.1	64.5
HCM Lane LOS	E	A	B	B	B	F
HCM 95th-tile Q	10.4	0.3	1.5	0.5	0.4	14.2

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	191	270	88
Peak Hour Factor	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	3	3	3
Mvmt Flow	0	212	300	98
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	2
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	64.5
HCM LOS	F

Lane

Intersection	
Intersection Delay, s/veh	46.6
Intersection LOS	E

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	59	12	201	0	55	9	222	0	145	284	60
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	3	3	3
Mvmt Flow	0	66	13	223	0	61	10	247	0	161	316	67
Number of Lanes	0	0	1	0	0	0	1	1	0	0	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	2	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	2	1	2
HCM Control Delay	31.4	19.7	65.8
HCM LOS	D	C	F

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2	SBLn1
Vol Left, %	34%	0%	22%	86%	0%	12%
Vol Thru, %	66%	0%	4%	14%	0%	76%
Vol Right, %	0%	100%	74%	0%	100%	12%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	429	60	272	64	222	345
LT Vol	284	0	12	9	0	262
Through Vol	0	60	201	0	222	42
RT Vol	145	0	59	55	0	41
Lane Flow Rate	477	67	302	71	247	383
Geometry Grp	7	7	6	7	7	6
Degree of Util (X)	1	0.142	0.724	0.185	0.564	0.907
Departure Headway (Hd)	8.586	7.685	8.628	9.359	8.227	8.514
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	424	469	417	383	437	426
Service Time	6.286	5.385	6.71	7.133	6.002	6.588
HCM Lane V/C Ratio	1.125	0.143	0.724	0.185	0.565	0.899
HCM Control Delay	73.4	11.7	31.4	14.3	21.2	53.5
HCM Lane LOS	F	B	D	B	C	F
HCM 95th-tile Q	12.5	0.5	5.6	0.7	3.4	9.8

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	41	262	42
Peak Hour Factor	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	46	291	47
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	2
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	53.5
HCM LOS	F

Lane

Intersection	
Int Delay, s/veh	1.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	37	31	291	45	52	418
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	170	0	-	100	220	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	56	56	19	19	28	28
Mvmt Flow	41	34	323	50	58	464

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	903	323	0	0	323	0
Stage 1	323	-	-	-	-	-
Stage 2	580	-	-	-	-	-
Critical Hdwy	6.96	6.76	-	-	4.38	-
Critical Hdwy Stg 1	5.96	-	-	-	-	-
Critical Hdwy Stg 2	5.96	-	-	-	-	-
Follow-up Hdwy	4.004	3.804	-	-	2.452	-
Pot Cap-1 Maneuver	249	609	-	-	1104	-
Stage 1	627	-	-	-	-	-
Stage 2	467	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	236	609	-	-	1104	-
Mov Cap-2 Maneuver	236	-	-	-	-	-
Stage 1	627	-	-	-	-	-
Stage 2	442	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.9		
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	236	609	1104	-
HCM Lane V/C Ratio	-	-	0.174	0.057	0.052	-
HCM Control Delay (s)	-	-	23.4	11.3	8.4	-
HCM Lane LOS	-	-	C	B	A	-
HCM 95th %tile Q(veh)	-	-	1	0	0	-

Intersection	
Int Delay, s/veh	1.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	31	37	390	52	45	296
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	170	0	-	100	220	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	48	48	17	17	25	25
Mvmt Flow	34	41	433	58	50	329

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	862	433	0	0	433	0
Stage 1	433	-	-	-	-	-
Stage 2	429	-	-	-	-	-
Critical Hdwy	6.88	6.68	-	-	4.35	-
Critical Hdwy Stg 1	5.88	-	-	-	-	-
Critical Hdwy Stg 2	5.88	-	-	-	-	-
Follow-up Hdwy	3.932	3.732	-	-	2.425	-
Pot Cap-1 Maneuver	272	536	-	-	1014	-
Stage 1	566	-	-	-	-	-
Stage 2	569	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	259	536	-	-	1014	-
Mov Cap-2 Maneuver	259	-	-	-	-	-
Stage 1	566	-	-	-	-	-
Stage 2	541	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.3		
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	259	536	1014	-
HCM Lane V/C Ratio	-	-	0.133	0.077	0.049	-
HCM Control Delay (s)	-	-	21	12.3	8.7	-
HCM Lane LOS	-	-	C	B	A	-
HCM 95th %tile Q(veh)	-	-	0	0	0	-

Intersection	
Int Delay, s/veh	42.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	181	174	162	393	362	93
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	Free	-	None
Storage Length	0	0	-	0	175	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	11	11	18	18	19	19
Mvmt Flow	201	193	180	437	402	103

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1036	180	0	-	180	0
Stage 1	180	-	-	-	-	-
Stage 2	856	-	-	-	-	-
Critical Hdwy	6.765	6.365	-	-	4.29	-
Critical Hdwy Stg 1	5.565	-	-	-	-	-
Critical Hdwy Stg 2	5.965	-	-	-	-	-
Follow-up Hdwy	3.6045	3.4045	-	-	2.371	-
Pot Cap-1 Maneuver	229	837	-	0	1299	-
Stage 1	826	-	-	0	-	-
Stage 2	360	-	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	~ 158	837	-	-	1299	-
Mov Cap-2 Maneuver	~ 158	-	-	-	-	-
Stage 1	826	-	-	-	-	-
Stage 2	249	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	116.8		
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	158	837	1299	-
HCM Lane V/C Ratio	-	1.273	0.231	0.31	-
HCM Control Delay (s)	-	218.9	10.6	9	-
HCM Lane LOS	-	F	B	A	-
HCM 95th %tile Q(veh)	-	12	1	1	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Int Delay, s/veh	36.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	364	329	113	162	173	154
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	Free	-	None
Storage Length	0	0	-	0	175	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	10	10	16	16	17	17
Mvmt Flow	404	366	126	180	192	171

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	596	126	0	-	126	0
Stage 1	126	-	-	-	-	-
Stage 2	470	-	-	-	-	-
Critical Hdwy	6.75	6.35	-	-	4.27	-
Critical Hdwy Stg 1	5.55	-	-	-	-	-
Critical Hdwy Stg 2	5.95	-	-	-	-	-
Follow-up Hdwy	3.595	3.395	-	-	2.353	-
Pot Cap-1 Maneuver	435	901	-	0	1373	-
Stage 1	878	-	-	0	-	-
Stage 2	577	-	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	~ 374	901	-	-	1373	-
Mov Cap-2 Maneuver	~ 374	-	-	-	-	-
Stage 1	878	-	-	-	-	-
Stage 2	496	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	60.1		
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	374	901	1373	-
HCM Lane V/C Ratio	-	1.081	0.406	0.14	-
HCM Control Delay (s)	-	103.8	11.7	8	-
HCM Lane LOS	-	F	B	A	-
HCM 95th %tile Q(veh)	-	14	2	0	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Int Delay, s/veh	2.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	31	53	103	185	358	59
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	500	-	-	500
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	100	100	100	28	26	100
Mvmt Flow	34	59	114	206	398	66

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	832	398	398	0	-	0
Stage 1	398	-	-	-	-	-
Stage 2	434	-	-	-	-	-
Critical Hdwy	7.4	7.2	5.1	-	-	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	4.4	4.2	3.1	-	-	-
Pot Cap-1 Maneuver	236	483	780	-	-	-
Stage 1	509	-	-	-	-	-
Stage 2	487	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	202	483	780	-	-	-
Mov Cap-2 Maneuver	202	-	-	-	-	-
Stage 1	509	-	-	-	-	-
Stage 2	416	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	20.9		
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	780	-	319	-	-
HCM Lane V/C Ratio	0.147	-	0.293	-	-
HCM Control Delay (s)	10.4	-	20.9	-	-
HCM Lane LOS	B	-	C	-	-
HCM 95th %tile Q(veh)	1	-	1	-	-

Intersection	
Int Delay, s/veh	4.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	62	104	51	355	198	28
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	500	-	-	500
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	100	100	100	25	22	100
Mvmt Flow	69	116	57	394	220	31

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	728	220	220	0	-	0
Stage 1	220	-	-	-	-	-
Stage 2	508	-	-	-	-	-
Critical Hdwy	7.4	7.2	5.1	-	-	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	4.4	4.2	3.1	-	-	-
Pot Cap-1 Maneuver	277	626	933	-	-	-
Stage 1	631	-	-	-	-	-
Stage 2	445	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	260	626	933	-	-	-
Mov Cap-2 Maneuver	260	-	-	-	-	-
Stage 1	631	-	-	-	-	-
Stage 2	418	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	20.8		
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	933	-	410	-	-
HCM Lane V/C Ratio	0.061	-	0.45	-	-
HCM Control Delay (s)	9.1	-	20.8	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0	-	2	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	26	12	21	195	405	44
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	26	26	23	23
Mvmt Flow	29	13	23	217	450	49

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	629	249	499	0	-	0
Stage 1	474	-	-	-	-	-
Stage 2	155	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.62	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.46	-	-	-
Pot Cap-1 Maneuver	414	751	910	-	-	-
Stage 1	592	-	-	-	-	-
Stage 2	857	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	402	751	910	-	-	-
Mov Cap-2 Maneuver	592	-	-	-	-	-
Stage 1	592	-	-	-	-	-
Stage 2	832	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	11.1	1	
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	910	-	634	-	-
HCM Lane V/C Ratio	0.026	-	0.067	-	-
HCM Control Delay (s)	9.1	0.1	11.1	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	44	24	14	403	202	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	22	22	20	20
Mvmt Flow	49	27	16	448	224	28

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	493	126	252	0	-	0
Stage 1	238	-	-	-	-	-
Stage 2	255	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.54	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.42	-	-	-
Pot Cap-1 Maneuver	505	901	1177	-	-	-
Stage 1	779	-	-	-	-	-
Stage 2	764	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	496	901	1177	-	-	-
Mov Cap-2 Maneuver	496	-	-	-	-	-
Stage 1	779	-	-	-	-	-
Stage 2	750	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12	0.4	
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1177	-	590	-	-
HCM Lane V/C Ratio	0.013	-	0.128	-	-
HCM Control Delay (s)	8.1	0.1	12	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Arterial Level of Service: NB #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Driveway	II	40	28.5	8.8	37.3	0.26	25.0	C
Carolina Ave	II	35	43.3	4.5	47.8	0.41	31.1	B
Reynolds Ave	II	35	44.7	8.2	52.9	0.43	29.2	B
Cosgrove Ave	II	40	30.5	30.4	60.9	0.30	17.7	D
St Johns Ave	II	40	15.4	15.4	30.8	0.13	15.6	E
Total	II		162.4	67.3	229.7	1.53	24.0	C

Arterial Level of Service: SB #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Cosgrove Ave	II	40	15.4	42.1	57.5	0.13	8.4	F
Reynolds Ave	II	40	30.5	22.6	53.1	0.30	20.3	D
Carolina Ave	II	35	44.7	7.1	51.8	0.43	29.9	B
Burton Ln	II	40	39.6	13.6	53.2	0.41	27.9	C
Stromboli Ave	II	40	28.5	11.9	40.4	0.26	23.1	C
Total	II		158.7	97.3	256.0	1.53	21.6	D

Arterial Level of Service: NB #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Driveway	II	40	28.5	13.1	41.6	0.26	22.4	C
Carolina Ave	II	35	43.3	9.7	53.0	0.41	28.0	B
Reynolds Ave	II	35	44.7	20.6	65.3	0.43	23.7	C
Cosgrove Ave	II	40	30.5	48.0	78.5	0.30	13.7	E
St Johns Ave	II	40	15.4	16.3	31.7	0.13	15.2	E
Total	II		162.4	107.7	270.1	1.53	20.4	D

Arterial Level of Service: SB #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Cosgrove Ave	II	40	15.4	32.9	48.3	0.13	10.0	F
Reynolds Ave	II	40	30.5	10.0	40.5	0.30	26.6	C
Carolina Ave	II	35	44.7	5.2	49.9	0.43	31.0	B
Burton Ln	II	40	39.6	10.1	49.7	0.41	29.9	B
Stromboli Ave	II	40	28.5	15.4	43.9	0.26	21.2	D
Total	II		158.7	73.6	232.3	1.53	23.8	C

Arterial Level of Service: NB #2

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Burton Ln	III	34	35.4	8.3	43.7	0.29	24.3	B
Reynolds Ave	III	35	50.6	10.6	61.2	0.42	24.8	B
Cosgrove Ave	III	35	27.9	24.7	52.6	0.23	15.9	D
Dorchester Rd	III	35	18.7	5.1	23.8	0.15	22.1	C
McMillan Ave	III	35	24.5	13.3	37.8	0.20	19.4	C
Total	III		157.1	62.0	219.1	1.30	21.3	C

Arterial Level of Service: SB #2

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Dorchester Rd	II	35	25.5	5.7	31.2	0.20	23.6	C
Cosgrove Ave	II	35	18.3	31.2	49.5	0.15	10.6	F
Reynolds Ave	II	35	27.6	1.9	29.5	0.23	28.3	B
Burton Ln	II	35	44.6	10.0	54.6	0.43	28.3	B
Stromboli Ave	II	37	32.4	2.1	34.5	0.29	30.8	B
Total	II		148.4	50.9	199.3	1.31	23.6	C

Arterial Level of Service: NB #2

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Burton Ln	III	34	35.4	11.8	47.2	0.29	22.5	C
Reynolds Ave	III	35	50.6	15.6	66.2	0.42	22.9	C
Cosgrove Ave	III	35	27.9	30.3	58.2	0.23	14.4	D
Dorchester Rd	III	35	18.7	3.9	22.6	0.15	23.3	C
McMillan Ave	III	35	24.5	20.8	45.3	0.20	16.2	D
Total	III		157.1	82.4	239.5	1.30	19.5	C

Arterial Level of Service: SB #2

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Dorchester Rd	II	35	25.5	5.3	30.8	0.20	23.9	C
Cosgrove Ave	II	35	18.3	44.1	62.4	0.15	8.4	F
Reynolds Ave	II	35	27.6	6.6	34.2	0.23	24.4	C
Burton Ln	II	35	44.6	10.3	54.9	0.43	28.1	B
Stromboli Ave	II	37	32.4	1.7	34.1	0.29	31.1	B
Total	II		148.4	68.0	216.4	1.31	21.7	D

Intersection: 10: Rivers Ave SB & I-526 WB Ramps

Movement	WB	WB	SB	SB	SB
Directions Served	T	T	T	T	T
Maximum Queue (ft)	104	109	193	156	236
Average Queue (ft)	48	49	107	58	51
95th Queue (ft)	90	87	172	122	176
Link Distance (ft)	136	136	1224	1224	1224
Upstream Blk Time (%)	0	0			
Queuing Penalty (veh)	0	0			
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 11: Rivers Ave NB/Rivers Ave & I-526 WB Ramps

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 20: Rivers Ave NB & I-526 EB Ramps

Movement	EB	EB	NB	NB	NB	NB
Directions Served	T	T	T	T	T	R
Maximum Queue (ft)	146	162	135	117	136	60
Average Queue (ft)	70	85	58	47	55	4
95th Queue (ft)	123	132	108	95	104	26
Link Distance (ft)	157	157	1619	1619	1619	
Upstream Blk Time (%)	0	0				
Queuing Penalty (veh)	0	0				
Storage Bay Dist (ft)						350
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 21: Rivers Ave SB & I-526 EB Ramps

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 30: Rivers Ave SB & Mall Dr

Movement	EB	EB	NB	SB	SB	SB	SB
Directions Served	T	R	L	T	T	T	R
Maximum Queue (ft)	224	134	117	294	262	260	219
Average Queue (ft)	101	30	45	138	124	103	65
95th Queue (ft)	182	84	94	240	224	203	136
Link Distance (ft)	1458		122	2788	2788	2788	
Upstream Blk Time (%)			1				
Queuing Penalty (veh)			0				
Storage Bay Dist (ft)		125					140
Storage Blk Time (%)	8	0				3	0
Queuing Penalty (veh)	4	0				12	1

Intersection: 31: Rivers Ave NB & Mall Dr Left

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 32: Rivers Ave NB & Rivers Ave NB Left

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 33: Rivers Ave SB

Movement	SB	SB	SB
Directions Served	T	T	T
Maximum Queue (ft)	11	4	16
Average Queue (ft)	0	0	1
95th Queue (ft)	7	4	16
Link Distance (ft)	122	122	122
Upstream Blk Time (%)			0
Queuing Penalty (veh)			0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 40: Rivers Ave NB & WB Montague Ramps

Movement	WB	WB	NB	NB	NB	SB
Directions Served	T	R	T	T	TR	L
Maximum Queue (ft)	70	136	61	70	91	145
Average Queue (ft)	19	68	6	10	22	87
95th Queue (ft)	54	116	34	40	64	145
Link Distance (ft)	470		346	346	346	76
Upstream Blk Time (%)						12
Queuing Penalty (veh)						16
Storage Bay Dist (ft)		380				
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 41: Rivers Ave SB & WB Montague Ramps

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 42: Rivers Ave NB

Movement	EB	NB
Directions Served	R	T
Maximum Queue (ft)	89	6
Average Queue (ft)	8	0
95th Queue (ft)	46	6
Link Distance (ft)	109	76
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 43: Rivers Ave SB & Montague Ramp Left

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 50: Rivers Ave NB & Morningside Dr

Movement	WB	WB	NB	NB	NB	NB	SB
Directions Served	T	R	T	T	T	R	L
Maximum Queue (ft)	332	65	173	177	214	133	132
Average Queue (ft)	189	21	73	82	104	24	86
95th Queue (ft)	308	48	149	162	198	72	135
Link Distance (ft)	701		666	666	666		61
Upstream Blk Time (%)							28
Queuing Penalty (veh)							37
Storage Bay Dist (ft)		425				120	
Storage Blk Time (%)					5		
Queuing Penalty (veh)					5		

Intersection: 51: Rivers Ave SB & Morningside Dr

Movement	SB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	24	17	10	3
Average Queue (ft)	1	0	0	0
95th Queue (ft)	14	10	9	3
Link Distance (ft)	186	186	186	186
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 52: Rivers Ave NB

Movement	EB
Directions Served	R
Maximum Queue (ft)	107
Average Queue (ft)	19
95th Queue (ft)	71
Link Distance (ft)	60
Upstream Blk Time (%)	3
Queuing Penalty (veh)	3
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 53: Rivers Ave SB & Morningside Dr Left

Movement	SB
Directions Served	T
Maximum Queue (ft)	5
Average Queue (ft)	0
95th Queue (ft)	5
Link Distance (ft)	243
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 55: Rivers Ave/Rivers Ave SB & Rivers Ave NB

Movement	SB	SB	SB
Directions Served	T	T	T
Maximum Queue (ft)	59	36	43
Average Queue (ft)	2	2	3
95th Queue (ft)	60	19	21
Link Distance (ft)	560	560	560
Upstream Blk Time (%)	0		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 60: Rivers Ave & Piggly Wiggly Dr

Movement	EB	EB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	L	T	T	T	T	T	T	R
Maximum Queue (ft)	45	126	79	81	85	119	139	151	147	70
Average Queue (ft)	4	49	30	25	23	45	51	67	51	17
95th Queue (ft)	22	99	68	65	67	100	129	148	123	51
Link Distance (ft)		468		2162	2162	2162	716	716	716	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	75		125							425
Storage Blk Time (%)	0	16								
Queuing Penalty (veh)	0	8								

Intersection: 70: Rivers Ave & Meeting St/Durant Ave

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	TR	L	T	R	LT	T	TR	L	T	T	R
Maximum Queue (ft)	143	181	196	177	83	151	175	246	196	190	209	86
Average Queue (ft)	62	64	97	71	27	57	63	92	83	63	81	24
95th Queue (ft)	119	130	168	144	61	114	126	182	156	151	167	66
Link Distance (ft)		460		552		673	673			2162	2162	2162
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	50		125		150			300	725			
Storage Blk Time (%)	25	12	7	2				0				
Queuing Penalty (veh)	23	12	18	5				0				

Intersection: 80: Rivers Ave & Helm Ave

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	TR	L	T	TR
Maximum Queue (ft)	72	142	38	214	231	46	219	230
Average Queue (ft)	19	55	7	79	105	9	99	111
95th Queue (ft)	49	110	26	164	188	32	174	191
Link Distance (ft)	737	713		3153	3153		2604	2604
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			225			200		
Storage Blk Time (%)				0			0	
Queuing Penalty (veh)				0			0	

Intersection: 90: Rivers Ave #2/Rivers Ave & McMillan Ave

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	LT	TR	LT	R	L	T	T	R	L	T	T	R
Maximum Queue (ft)	98	57	258	122	25	180	191	137	243	262	279	119
Average Queue (ft)	28	8	121	31	2	75	85	55	110	107	134	15
95th Queue (ft)	71	34	215	80	12	150	162	109	211	220	241	69
Link Distance (ft)	1091	1091	1517	1517		981	981			3153	3153	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)					200			200	200			200
Storage Blk Time (%)						0	0	0	1	1	2	
Queuing Penalty (veh)						0	1	0	5	2	1	

Intersection: 100: Rivers Ave #2 & Dorchester Rd

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	R	L	T	T	T	T	R
Maximum Queue (ft)	396	200	210	113	141	160	168	53
Average Queue (ft)	168	112	91	32	53	59	58	15
95th Queue (ft)	305	212	168	84	112	128	130	42
Link Distance (ft)	1350			656	656	981	981	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		100	185					200
Storage Blk Time (%)	28	6	1	0			0	
Queuing Penalty (veh)	58	11	3	0			0	

Intersection: 110: Rivers Ave #2 & Cosgrove Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	T	TR	L	T	T
Maximum Queue (ft)	367	372	403	102	258	307	134	208	219	163	273	266
Average Queue (ft)	193	204	231	42	148	179	61	110	125	67	140	125
95th Queue (ft)	321	349	376	86	240	274	115	182	199	140	233	217
Link Distance (ft)		3181	3181		1388	1388		1140	1140		656	656
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	450			165			200			200		
Storage Blk Time (%)	0	0			8			0		0	3	12
Queuing Penalty (veh)	0	0			4			0		1	3	35

Intersection: 110: Rivers Ave #2 & Cosgrove Ave

Movement	SB
Directions Served	R
Maximum Queue (ft)	213
Average Queue (ft)	55
95th Queue (ft)	143
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	125
Storage Blk Time (%)	0
Queuing Penalty (veh)	1

Intersection: 120: Rivers Ave #2 & Reynolds Ave

Movement	EB	WB	NB	NB	NB	SB	SB	SB	SB
Directions Served	LTR	LTR	L	T	TR	L	T	T	R
Maximum Queue (ft)	228	222	56	136	140	111	232	206	106
Average Queue (ft)	96	102	16	55	56	35	65	48	10
95th Queue (ft)	188	185	43	112	112	82	161	132	52
Link Distance (ft)	666	1494		1257	1257		1140	1140	
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)			200			200			50
Storage Blk Time (%)							0	5	0
Queuing Penalty (veh)							0	2	0

Intersection: 123: Bend

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	123	128
Average Queue (ft)	4	5
95th Queue (ft)	74	77
Link Distance (ft)	422	422
Upstream Blk Time (%)	0	0
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 130: Rivers Ave/Rivers Ave #2 & Carner Ave #2

Movement	WB	NB	NB	SB	SB
Directions Served	R	T	TR	L	T
Maximum Queue (ft)	143	6	52	311	118
Average Queue (ft)	72	0	13	128	4
95th Queue (ft)	117	4	44	250	71
Link Distance (ft)	2094	773	773		1257
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				250	
Storage Blk Time (%)				1	
Queuing Penalty (veh)				2	

Intersection: 140: Carner Ave #2 & Burton Ln

Movement	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	T	R	L	TR
Maximum Queue (ft)	80	68	42	24	162	56	73	226
Average Queue (ft)	33	22	12	3	60	4	30	101
95th Queue (ft)	66	53	34	17	120	30	65	189
Link Distance (ft)	572	1428			222			2094
Upstream Blk Time (%)					0			
Queuing Penalty (veh)					0			
Storage Bay Dist (ft)			190	120		50	170	
Storage Blk Time (%)					9	0		1
Queuing Penalty (veh)					1	0		1

Intersection: 150: Carner Ave/Carner Ave #2 & Stromboli Ave

Movement	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	L	R	T	TR	L	T	T
Maximum Queue (ft)	3	44	54	90	35	40	83	92
Average Queue (ft)	0	8	11	15	2	5	16	14
95th Queue (ft)	3	32	38	58	18	25	57	58
Link Distance (ft)		1754	1754	1034	1034		671	671
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	300					250		
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 160: Spruill Ave & Montague Ave

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	54	284	88	93	143	219	44	132
Average Queue (ft)	6	126	42	36	63	80	12	59
95th Queue (ft)	35	221	74	77	121	153	38	110
Link Distance (ft)		450		1923		680		573
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	125		75		275		90	
Storage Blk Time (%)		7	1	1		0		3
Queuing Penalty (veh)		0	2	1		0		0

Intersection: 170: Spruill Ave #1/Spruill Ave & McMillan Ave/St Johns Ave

Movement	EB	EB	EB	WB	WB	WB	B6	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	T	L	TR	L	T	R
Maximum Queue (ft)	271	278	912	298	54	10	651	405	574	161	1205	300
Average Queue (ft)	105	46	411	200	6	1	233	254	266	5	443	124
95th Queue (ft)	203	279	951	365	30	4	778	448	579	69	1075	333
Link Distance (ft)		1517	1517	222	222	222	1411		598		1558	
Upstream Blk Time (%)				54					4		2	
Queuing Penalty (veh)				0					30		0	
Storage Bay Dist (ft)	225							310		275		200
Storage Blk Time (%)	1							29	4		28	
Queuing Penalty (veh)	0							158	6		46	

Intersection: 180: Spruill Ave #1 & Cosgrove Ave

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	T	R	L	TR	L	T	R
Maximum Queue (ft)	325	682	671	125	235	232	126	192	483	240	621	380
Average Queue (ft)	217	295	294	49	124	129	48	40	234	101	539	226
95th Queue (ft)	364	563	524	99	209	212	104	131	417	249	729	499
Link Distance (ft)		1388	1388		2051	2051			1488		598	
Upstream Blk Time (%)											9	
Queuing Penalty (veh)											99	
Storage Bay Dist (ft)	225			200			150	260		140		280
Storage Blk Time (%)	16	17			2	9	1		8	1	42	0
Queuing Penalty (veh)	58	53			1	9	1		4	7	128	0

Intersection: 190: Spruill Ave #1 & Reynolds Ave

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	L	TR	L	TR	L	TR
Maximum Queue (ft)	210	27	83	138	227	23	387
Average Queue (ft)	96	5	25	57	77	3	181
95th Queue (ft)	178	20	65	109	169	15	353
Link Distance (ft)	1494		716		2143		1488
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		200		185		180	
Storage Blk Time (%)				0	1		6
Queuing Penalty (veh)				0	0		0

Intersection: 200: Spruill Ave #1 & Carolina Ave

Movement	WB	NB	NB	SB
Directions Served	L	T	R	T
Maximum Queue (ft)	90	190	29	235
Average Queue (ft)	36	56	2	98
95th Queue (ft)	74	138	26	213
Link Distance (ft)	573	2105		2143
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			50	
Storage Blk Time (%)		6		
Queuing Penalty (veh)		5		

Intersection: 210: Spruill Ave #1 & Burton Ln/Driveway

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	L	TR	LTR	L	TR	L	TR
Maximum Queue (ft)	93	86	35	101	233	50	344
Average Queue (ft)	39	33	7	29	99	3	165
95th Queue (ft)	75	68	28	72	193	15	295
Link Distance (ft)		1428	473		1289		2105
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	250			150		170	
Storage Blk Time (%)					2		6
Queuing Penalty (veh)					1		0

Intersection: 220: Spruill Ave/Spruill Ave #1 & Stromboli Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	54	46	49	41	23	108	31	241	186	253
Average Queue (ft)	13	4	5	4	2	35	3	108	90	106
95th Queue (ft)	44	23	27	23	13	75	17	196	162	209
Link Distance (ft)		1754	1754		1627	1627		518		1289
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	250			250			250		250	
Storage Blk Time (%)								0		0
Queuing Penalty (veh)								0		0

Intersection: 240: Cosgrove Ave/McMillan Ave & Noisette Blvd

Movement	EB	WB	WB	SB	SB
Directions Served	L	T	R	L	R
Maximum Queue (ft)	187	6	2	74	12
Average Queue (ft)	62	0	0	26	0
95th Queue (ft)	137	4	2	57	8
Link Distance (ft)	2051	312	312	1290	1290
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 250: Hobson Ave & McMillan Ave

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	L	TR	LT	R
Maximum Queue (ft)	156	43	35	179	57	99	68
Average Queue (ft)	62	2	9	71	11	36	27
95th Queue (ft)	123	27	31	137	40	77	56
Link Distance (ft)		312	727	446	446	583	583
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	60						
Storage Blk Time (%)	7						
Queuing Penalty (veh)	27						

Intersection: 260: Noisette Blvd & Turnbull Ave

Movement	EB	WB	WB	NB	NB	SB
Directions Served	LTR	LT	R	LT	R	LTR
Maximum Queue (ft)	78	53	51	204	54	255
Average Queue (ft)	41	25	20	99	26	119
95th Queue (ft)	67	46	40	168	49	205
Link Distance (ft)	1870	315		1290	1290	2516
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)			75			
Storage Blk Time (%)		0	0			
Queuing Penalty (veh)		0	0			

Intersection: 270: Noisette Blvd & Avenue B

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	66	102
Average Queue (ft)	21	18
95th Queue (ft)	54	62
Link Distance (ft)	564	593
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 280: Virginia Ave & Avenue B

Movement	WB	NB	SB
Directions Served	L	TR	L
Maximum Queue (ft)	80	57	288
Average Queue (ft)	22	9	106
95th Queue (ft)	61	37	212
Link Distance (ft)	593	466	1266
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)	0		
Queuing Penalty (veh)	1		

Intersection: 290: Virginia Ave & Montague Ave

Movement	EB	NB	SB	SB
Directions Served	LR	L	T	TR
Maximum Queue (ft)	126	73	5	16
Average Queue (ft)	58	24	0	0
95th Queue (ft)	102	58	2	7
Link Distance (ft)	1923		394	394
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		150		
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 300: Virginia Ave & I-526 EB Off-Ramp

Movement	EB	EB	NB	SB	SB
Directions Served	L	R	T	T	T
Maximum Queue (ft)	427	782	6	8	2
Average Queue (ft)	331	322	0	0	0
95th Queue (ft)	557	894	6	5	2
Link Distance (ft)		1232	1357	593	593
Upstream Blk Time (%)		1			
Queuing Penalty (veh)		0			
Storage Bay Dist (ft)	350				
Storage Blk Time (%)	46	0			
Queuing Penalty (veh)	123	1			

Intersection: 310: Virginia Ave & I-526 WB On-Ramp

Movement	NB	SB	SB
Directions Served	L	T	R
Maximum Queue (ft)	74	2	13
Average Queue (ft)	22	0	1
95th Queue (ft)	57	0	8
Link Distance (ft)		492	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	225		325
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 320: Rhett Ave & I-526 EB Ramps

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	LR	L	T	T	T	T	R
Maximum Queue (ft)	375	680	247	641	607	226	637	748
Average Queue (ft)	360	584	178	281	194	62	93	371
95th Queue (ft)	413	776	293	661	555	164	360	621
Link Distance (ft)		639		684	684	803	803	803
Upstream Blk Time (%)		41		7	0		0	0
Queuing Penalty (veh)		0		0	0		2	1
Storage Bay Dist (ft)	275		150					
Storage Blk Time (%)	42	77	45	2				
Queuing Penalty (veh)	120	167	153	3				

Intersection: 330: Rhett Ave & I-526 WB Ramps

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	LR	L	T	T	T	T	R
Maximum Queue (ft)	575	794	228	268	304	641	668	425
Average Queue (ft)	564	755	114	114	147	472	616	340
95th Queue (ft)	631	857	213	237	271	723	734	586
Link Distance (ft)		735		803	803	612	612	
Upstream Blk Time (%)		52				3	26	
Queuing Penalty (veh)		0				0	0	
Storage Bay Dist (ft)	475		270					325
Storage Blk Time (%)	12	63	1	0			29	0
Queuing Penalty (veh)	72	177	6	0			185	1

Intersection: 340: Morningside Dr/Piedmont Ave & Montague Ave

Movement	EB	EB	EB	B38	B39	B39	WB	WB	WB	WB	NB	NB
Directions Served	L	T	TR	T	T	T	L	T	T	R	LT	R
Maximum Queue (ft)	179	306	332	9	209	283	91	183	186	172	233	150
Average Queue (ft)	37	142	172	0	11	10	31	98	83	72	87	19
95th Queue (ft)	106	264	299	6	136	134	71	164	155	136	175	100
Link Distance (ft)		370	370	1986	538	538		724	724		701	
Upstream Blk Time (%)		0	0		0	0						
Queuing Penalty (veh)		0	0		0	0						
Storage Bay Dist (ft)	150						175			150		50
Storage Blk Time (%)	0	5						0	1	0	21	0
Queuing Penalty (veh)	0	2						0	2	2	26	0

Intersection: 340: Morningside Dr/Piedmont Ave & Montague Ave

Movement	SB	SB
Directions Served	L	TR
Maximum Queue (ft)	55	80
Average Queue (ft)	13	35
95th Queue (ft)	41	67
Link Distance (ft)		459
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	135	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 350: Montague Ave & Mall Dr/Goer Dr

Movement	EB	EB	EB	WB	WB	NB	NB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	L	T	T	TR	L	T
Maximum Queue (ft)	61	64	171	144	70	246	296	470	498	440	85	251
Average Queue (ft)	16	17	66	63	20	136	161	178	210	135	28	145
95th Queue (ft)	47	49	139	121	55	220	246	349	386	306	67	221
Link Distance (ft)		415	415		476			516	516	516		538
Upstream Blk Time (%)								0	0	0		
Queuing Penalty (veh)								0	1	0		
Storage Bay Dist (ft)	185			170		275	275				175	
Storage Blk Time (%)				0		0	0	1				3
Queuing Penalty (veh)				0		0	1	5				1

Intersection: 350: Montague Ave & Mall Dr/Goer Dr

Movement	SB	SB	SB
Directions Served	T	T	R
Maximum Queue (ft)	273	285	8
Average Queue (ft)	159	157	0
95th Queue (ft)	244	252	8
Link Distance (ft)	538	538	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			360
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 360: Montague Ave & I-26 WB Ramps

Movement	WB	WB	WB	NB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	L	L	T	T	T	T	T	T	R
Maximum Queue (ft)	388	474	337	168	187	397	360	290	336	346	329	52
Average Queue (ft)	213	272	58	85	109	244	213	147	190	212	199	2
95th Queue (ft)	342	411	193	149	166	351	318	246	311	326	318	28
Link Distance (ft)		573				845	845	845	516	516	516	
Upstream Blk Time (%)		0										
Queuing Penalty (veh)		0										
Storage Bay Dist (ft)	375		375	550	550							350
Storage Blk Time (%)	0	1									0	
Queuing Penalty (veh)	0	7									0	

Intersection: 370: Montague Ave & I-26 EB Ramps

Movement	B123	SB	SB
Directions Served	T	T	T
Maximum Queue (ft)	38	18	134
Average Queue (ft)	1	1	5
95th Queue (ft)	39	11	91
Link Distance (ft)	369	845	845
Upstream Blk Time (%)	0		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 380: Dorchester Rd & Meeting St

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	L	T	R	LT	TR
Maximum Queue (ft)	123	142	105	72	224	304	115	126	123
Average Queue (ft)	60	66	43	21	103	137	45	60	56
95th Queue (ft)	107	109	82	54	194	254	89	105	103
Link Distance (ft)	457			469		1842	1842	1350	
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)		100	125		125				125
Storage Blk Time (%)	2	1	0		4	8		0	0
Queuing Penalty (veh)	7	1	0		15	20		0	1

Intersection: 390: I-26 WB Ramps & Dorchester Rd

Movement	EB	EB	EB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	TR	L	L	R
Maximum Queue (ft)	163	223	233	258	278	317	370	9
Average Queue (ft)	64	141	121	138	159	148	208	0
95th Queue (ft)	130	210	196	221	245	284	311	9
Link Distance (ft)	304	304	304	1842	1842			561
Upstream Blk Time (%)			0					
Queuing Penalty (veh)			0					
Storage Bay Dist (ft)						530	530	
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 400: I-26 EB Ramps & Dorchester Rd

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	T	T	R	L	T	T	L	R
Maximum Queue (ft)	472	388	301	108	259	272	409	299
Average Queue (ft)	269	206	38	41	139	153	209	17
95th Queue (ft)	398	328	185	90	218	241	342	130
Link Distance (ft)	560	560		304	304	304	445	
Upstream Blk Time (%)	0				0	0	0	
Queuing Penalty (veh)	0				0	0	0	
Storage Bay Dist (ft)			425					300
Storage Blk Time (%)		0					2	
Queuing Penalty (veh)		0					5	

Intersection: 410: Cosgrove Ave & Azalea Dr

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	TR	L	T	T	R	L
Maximum Queue (ft)	227	387	332	189	241	181	103	348	468	477	166	241
Average Queue (ft)	150	146	94	83	115	58	21	223	199	191	47	50
95th Queue (ft)	243	331	258	169	221	130	68	347	365	343	112	166
Link Distance (ft)		892	892			767			661	661	661	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	130			400	230		600	250				200
Storage Blk Time (%)	28	5	0		2	0		7	2			0
Queuing Penalty (veh)	36	10	0		5	0		44	9			0

Intersection: 410: Cosgrove Ave & Azalea Dr

Movement	SB	SB	SB
Directions Served	T	T	R
Maximum Queue (ft)	574	645	300
Average Queue (ft)	261	335	121
95th Queue (ft)	503	580	340
Link Distance (ft)	3181	3181	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			200
Storage Blk Time (%)	19	40	
Queuing Penalty (veh)	8	45	

Intersection: 421: Cosgrove Ave & I-26 WB Ramps

Movement	WB	NB	NB	NB	NB
Directions Served	R	T	T	T	R
Maximum Queue (ft)	220	14	12	65	8
Average Queue (ft)	14	1	0	2	0
95th Queue (ft)	118	16	13	66	8
Link Distance (ft)	473	950	950	950	950
Upstream Blk Time (%)	0				
Queuing Penalty (veh)	0				
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 422: Cosgrove Ave & I-26 EB Ramps

Movement	NB	NB	NB	SB	SB
Directions Served	T	T	TR	T	R
Maximum Queue (ft)	912	941	943	3	8
Average Queue (ft)	396	911	922	0	0
95th Queue (ft)	1109	933	943	3	6
Link Distance (ft)	882	882	882	950	950
Upstream Blk Time (%)	1	40	75		
Queuing Penalty (veh)	0	0	0		
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 450: Local Access Rd & Hobson Ave

Movement	WB	WB	NB	NB	SB
Directions Served	L	R	T	R	L
Maximum Queue (ft)	108	85	11	6	73
Average Queue (ft)	38	28	0	0	18
95th Queue (ft)	85	67	5	4	56
Link Distance (ft)		930	1160		
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	170			100	220
Storage Blk Time (%)	0				
Queuing Penalty (veh)	0				

Intersection: 460: Magrath Darby Blvd & US 17

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	SB
Directions Served	L	T	T	T	R	L	T	T	R	R	R
Maximum Queue (ft)	461	1016	940	909	275	303	1314	1337	1009	403	106
Average Queue (ft)	254	494	451	378	53	77	629	685	51	177	40
95th Queue (ft)	492	1126	1086	966	228	209	1337	1411	438	372	86
Link Distance (ft)		1105	1105	1105			1292	1292	1292	516	538
Upstream Blk Time (%)		8	3	2			0	0	0	5	
Queuing Penalty (veh)		0	0	0			2	4	1	0	
Storage Bay Dist (ft)	375				175	205					
Storage Blk Time (%)	0	22		11		0	10				
Queuing Penalty (veh)	2	32		16		0	7				

Intersection: 470: Houston Northcutt Blvd/Mathis Ferry Rd & US 17

Movement	EB	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB
Directions Served	L	L	T	T	T	R	L	L	T	T	T	R
Maximum Queue (ft)	465	515	1317	1347	1332	315	276	450	2436	2652	2424	230
Average Queue (ft)	433	477	936	886	738	168	165	365	1514	1558	1488	50
95th Queue (ft)	536	604	1639	1595	1444	385	261	576	2499	2558	2485	190
Link Distance (ft)			1292	1292	1292				4040	4040	4040	
Upstream Blk Time (%)			15	2	0							
Queuing Penalty (veh)			149	16	5							
Storage Bay Dist (ft)	415	415				215	350	350				130
Storage Blk Time (%)	38	60	2		24	0		0	45		30	
Queuing Penalty (veh)	291	455	10		79	0		0	155		40	

Intersection: 470: Houston Northcutt Blvd/Mathis Ferry Rd & US 17

Movement	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	T	T	R	L	T	T	R
Maximum Queue (ft)	214	340	267	214	349	508	491	311
Average Queue (ft)	150	166	121	100	103	383	351	134
95th Queue (ft)	232	281	223	188	312	594	576	397
Link Distance (ft)		543	543	543	536	536	536	
Upstream Blk Time (%)					1	13	10	
Queuing Penalty (veh)					0	0	0	
Storage Bay Dist (ft)	115							300
Storage Blk Time (%)	30	27					38	
Queuing Penalty (veh)	39	45					32	

Intersection: 480: Shelmore Blvd & US 17

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	R	L	T	T	T	R	L	T
Maximum Queue (ft)	460	842	1530	452	256	497	610	769	636	300	258	261
Average Queue (ft)	283	230	240	208	35	185	401	439	459	199	223	167
95th Queue (ft)	466	701	823	403	156	368	562	670	613	416	297	307
Link Distance (ft)		4040	4040	4040			2558	2558	2558		231	231
Upstream Blk Time (%)											60	23
Queuing Penalty (veh)											0	0
Storage Bay Dist (ft)	400				210	400				200		
Storage Blk Time (%)	12	0		5			9		35			52
Queuing Penalty (veh)	86	0		9			19		100			102

Intersection: 480: Shelmore Blvd & US 17

Movement	NB	SB	SB	SB	SB
Directions Served	R	L	L	T	R
Maximum Queue (ft)	190	175	357	360	262
Average Queue (ft)	91	150	257	277	93
95th Queue (ft)	227	216	400	423	210
Link Distance (ft)			333	333	333
Upstream Blk Time (%)			24	29	0
Queuing Penalty (veh)			0	0	0
Storage Bay Dist (ft)	90	75			
Storage Blk Time (%)	10	62	85		
Queuing Penalty (veh)	19	62	85		

Intersection: 490: Dragoon Dr & US 17

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB
Directions Served	T	T	T	R	L	T	T	T	L	R
Maximum Queue (ft)	386	395	419	300	150	689	1015	369	130	162
Average Queue (ft)	191	205	216	57	71	105	153	136	56	68
95th Queue (ft)	335	345	361	221	129	351	548	321	110	132
Link Distance (ft)	2558	2558	2558			1813	1813	1813		228
Upstream Blk Time (%)							0		0	0
Queuing Penalty (veh)							0		0	0
Storage Bay Dist (ft)				200	200				125	
Storage Blk Time (%)			9		0	0			1	1
Queuing Penalty (veh)			11		1	0			1	1

Intersection: 500: Anna Knapp Blvd & US 17

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	R	L	T	T	T	R	L	LT
Maximum Queue (ft)	461	864	840	746	275	470	1523	1520	1522	300	229	211
Average Queue (ft)	379	467	425	286	62	289	1443	1435	1436	232	127	126
95th Queue (ft)	546	1092	1013	658	231	576	1684	1692	1718	423	204	201
Link Distance (ft)		1813	1813	1813			1466	1466	1466		325	325
Upstream Blk Time (%)							33	26	38			
Queuing Penalty (veh)							0	0	0			
Storage Bay Dist (ft)	365				175	370				200		
Storage Blk Time (%)	44	1		17	0	0	40		42			
Queuing Penalty (veh)	305	2		20	0	0	77		175			

Intersection: 500: Anna Knapp Blvd & US 17

Movement	NB	NB	SB	SB	SB	SB
Directions Served	T	R	L	LT	T	R
Maximum Queue (ft)	231	222	175	301	261	218
Average Queue (ft)	61	96	170	276	154	94
95th Queue (ft)	186	181	183	297	263	183
Link Distance (ft)	325			260	260	260
Upstream Blk Time (%)				82	1	0
Queuing Penalty (veh)				0	0	0
Storage Bay Dist (ft)		140	75			
Storage Blk Time (%)	1	5	83	94		
Queuing Penalty (veh)	3	3	147	117		

Intersection: 510: Local Access Rd & Bainbridge Ave

Movement	WB	WB	NB	NB	SB	SB
Directions Served	L	R	T	R	L	T
Maximum Queue (ft)	297	119	10	31	146	2
Average Queue (ft)	103	52	0	1	56	0
95th Queue (ft)	235	89	9	18	120	2
Link Distance (ft)	842	842	1386	1386		1160
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)					175	
Storage Blk Time (%)					0	
Queuing Penalty (veh)					0	

Intersection: 520: Local Access Rd & Stromboli Ave

Movement	EB	EB	EB	NB	NB	NB	SB	SB
Directions Served	L	L	R	L	T	T	T	TR
Maximum Queue (ft)	108	126	60	55	93	114	68	116
Average Queue (ft)	44	67	13	9	35	38	13	40
95th Queue (ft)	89	111	43	35	78	84	48	91
Link Distance (ft)		1627	1627		1428	1428	1386	1386
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	200			200				
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 530: Local Access Rd & PAR SB Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 540: PAR NB Ramp/Tidewater Rd & Local Access Rd

Movement	EB	WB
Directions Served	LTR	LTR
Maximum Queue (ft)	136	27
Average Queue (ft)	75	7
95th Queue (ft)	120	25
Link Distance (ft)	615	871
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 550: Hobson Ave & ICTF Truck Dwy

Movement	EB	NB	SB	SB
Directions Served	LR	L	T	R
Maximum Queue (ft)	175	143	41	30
Average Queue (ft)	68	58	2	1
95th Queue (ft)	132	125	17	15
Link Distance (ft)	896		1098	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		500		500
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 560: Hobson Ave & ICTF Employee Dwy

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (ft)	64	81	10
Average Queue (ft)	25	12	0
95th Queue (ft)	53	51	9
Link Distance (ft)	439	152	446
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 4910

Intersection: 10: Rivers Ave SB & I-526 WB Ramps

Movement	WB	WB	SB	SB	SB
Directions Served	T	T	T	T	T
Maximum Queue (ft)	120	127	155	102	79
Average Queue (ft)	56	59	88	37	23
95th Queue (ft)	101	102	140	81	59
Link Distance (ft)	136	136	1224	1224	1224
Upstream Blk Time (%)	0	0			
Queuing Penalty (veh)	0	0			
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 11: Rivers Ave NB/Rivers Ave & I-526 WB Ramps

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 20: Rivers Ave NB & I-526 EB Ramps

Movement	EB	EB	NB	NB	NB	NB
Directions Served	T	T	T	T	T	R
Maximum Queue (ft)	137	150	146	147	166	56
Average Queue (ft)	63	78	65	63	72	6
95th Queue (ft)	117	126	123	125	137	34
Link Distance (ft)	157	157	1619	1619	1619	
Upstream Blk Time (%)	0	0				
Queuing Penalty (veh)	0	0				
Storage Bay Dist (ft)						350
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 21: Rivers Ave SB & I-526 EB Ramps

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 30: Rivers Ave SB & Mall Dr

Movement	EB	EB	NB	SB	SB	SB	SB
Directions Served	T	R	L	T	T	T	R
Maximum Queue (ft)	430	224	130	268	226	187	111
Average Queue (ft)	215	54	51	140	116	90	44
95th Queue (ft)	349	174	105	229	199	169	86
Link Distance (ft)	1458		122	2788	2788	2788	
Upstream Blk Time (%)			1				
Queuing Penalty (veh)			1				
Storage Bay Dist (ft)		125					140
Storage Blk Time (%)	29					2	0
Queuing Penalty (veh)	19					4	0

Intersection: 31: Rivers Ave NB & Mall Dr Left

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 32: Rivers Ave NB & Rivers Ave NB Left

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 33: Rivers Ave SB

Movement	WB	SB	SB
Directions Served	R	T	T
Maximum Queue (ft)	10	2	3
Average Queue (ft)	0	0	0
95th Queue (ft)	8	2	3
Link Distance (ft)	73	122	122
Upstream Blk Time (%)	0		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 40: Rivers Ave NB & WB Montague Ramps

Movement	WB	WB	NB	NB	NB	SB
Directions Served	T	R	T	T	TR	L
Maximum Queue (ft)	32	254	124	128	154	124
Average Queue (ft)	4	109	20	30	43	49
95th Queue (ft)	20	194	76	85	104	102
Link Distance (ft)	470		346	346	346	76
Upstream Blk Time (%)						4
Queuing Penalty (veh)						3
Storage Bay Dist (ft)		380				
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 41: Rivers Ave SB & WB Montague Ramps

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 42: Rivers Ave NB

Movement	EB
Directions Served	R
Maximum Queue (ft)	20
Average Queue (ft)	1
95th Queue (ft)	14
Link Distance (ft)	109
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 43: Rivers Ave SB & Montague Ramp Left

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 50: Rivers Ave NB & Morningside Dr

Movement	WB	WB	NB	NB	NB	NB	SB
Directions Served	T	R	T	T	T	R	L
Maximum Queue (ft)	280	87	168	184	220	129	122
Average Queue (ft)	137	34	54	64	75	27	67
95th Queue (ft)	237	69	124	139	161	82	125
Link Distance (ft)	701		666	666	666		61
Upstream Blk Time (%)							24
Queuing Penalty (veh)							23
Storage Bay Dist (ft)		425				120	
Storage Blk Time (%)					2		
Queuing Penalty (veh)					3		

Intersection: 51: Rivers Ave SB & Morningside Dr

Movement	SB
Directions Served	L
Maximum Queue (ft)	13
Average Queue (ft)	1
95th Queue (ft)	8
Link Distance (ft)	186
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 52: Rivers Ave NB

Movement	EB	NB
Directions Served	R	T
Maximum Queue (ft)	100	2
Average Queue (ft)	11	0
95th Queue (ft)	54	3
Link Distance (ft)	60	61
Upstream Blk Time (%)	3	
Queuing Penalty (veh)	3	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 53: Rivers Ave SB & Morningside Dr Left

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 55: Rivers Ave/Rivers Ave SB & Rivers Ave NB

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	2	2
Average Queue (ft)	0	0
95th Queue (ft)	2	2
Link Distance (ft)	560	560
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 60: Rivers Ave & Piggly Wiggly Dr

Movement	EB	EB	EB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	L	T	T	T	T	T	T	R
Maximum Queue (ft)	93	176	88	65	119	136	174	141	158	142	64
Average Queue (ft)	10	76	3	19	36	41	70	39	56	42	18
95th Queue (ft)	51	138	38	51	92	100	140	106	127	104	49
Link Distance (ft)		468			2162	2162	2162	716	716	716	
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)	75		50	125							425
Storage Blk Time (%)	0	25			0						
Queuing Penalty (veh)	0	30			0						

Intersection: 70: Rivers Ave & Meeting St/Durant Ave

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	TR	L	T	R	LT	T	TR	L	T	T	R
Maximum Queue (ft)	149	262	192	176	100	270	273	324	186	158	179	63
Average Queue (ft)	90	114	98	50	34	128	140	184	66	58	68	24
95th Queue (ft)	155	212	170	124	74	225	238	296	132	128	142	56
Link Distance (ft)		460		552		673	673			2162	2162	2162
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	50		125		150			300	725			
Storage Blk Time (%)	34	24	9	0			0	0				
Queuing Penalty (veh)	55	37	21	0			0	1				

Intersection: 80: Rivers Ave & Helm Ave

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	TR	L	T	TR
Maximum Queue (ft)	56	115	52	251	280	57	191	202
Average Queue (ft)	17	48	12	105	131	14	77	91
95th Queue (ft)	42	93	36	202	227	41	150	162
Link Distance (ft)	737	713		3153	3153		2604	2604
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			225			200		
Storage Blk Time (%)				0			0	
Queuing Penalty (veh)				0			0	

Intersection: 90: Rivers Ave #2/Rivers Ave & McMillan Ave

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	LT	TR	LT	R	L	T	T	R	L	T	T	R
Maximum Queue (ft)	88	59	316	200	26	240	254	147	136	189	219	45
Average Queue (ft)	21	8	150	75	3	136	150	40	35	59	89	9
95th Queue (ft)	62	33	265	160	15	221	239	94	91	151	187	32
Link Distance (ft)	1091	1091	1517	1517		981	981			3153	3153	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)					200			200	200			200
Storage Blk Time (%)						2	3			0	1	
Queuing Penalty (veh)						0	5			0	0	

Intersection: 100: Rivers Ave #2 & Dorchester Rd

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	R	L	T	T	T	T	R
Maximum Queue (ft)	286	170	255	201	121	233	264	114
Average Queue (ft)	113	63	114	38	47	82	100	36
95th Queue (ft)	244	133	215	134	96	340	372	121
Link Distance (ft)	1350			656	656	981	981	
Upstream Blk Time (%)						0	2	
Queuing Penalty (veh)						1	6	
Storage Bay Dist (ft)		100	185					200
Storage Blk Time (%)	11	4	5	0			4	
Queuing Penalty (veh)	16	8	22	0			6	

Intersection: 110: Rivers Ave #2 & Cosgrove Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	T	TR	L	T	T
Maximum Queue (ft)	494	659	526	243	436	462	296	560	488	259	399	404
Average Queue (ft)	294	228	206	46	289	320	218	232	192	142	216	190
95th Queue (ft)	493	920	818	168	417	449	334	485	392	294	496	479
Link Distance (ft)		3181	3181		1388	1388		1140	1140		656	656
Upstream Blk Time (%)											4	3
Queuing Penalty (veh)											16	10
Storage Bay Dist (ft)	450			165			200			200		
Storage Blk Time (%)	3	6			34		36	5		23	7	16
Queuing Penalty (veh)	9	21			14		113	13		50	6	48

Intersection: 110: Rivers Ave #2 & Cosgrove Ave

Movement	SB
Directions Served	R
Maximum Queue (ft)	216
Average Queue (ft)	91
95th Queue (ft)	192
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	125
Storage Blk Time (%)	3
Queuing Penalty (veh)	6

Intersection: 120: Rivers Ave #2 & Reynolds Ave

Movement	EB	WB	NB	NB	NB	SB	SB	SB	SB
Directions Served	LTR	LTR	L	T	TR	L	T	T	R
Maximum Queue (ft)	239	295	115	260	245	126	206	162	87
Average Queue (ft)	112	122	38	140	130	59	96	65	22
95th Queue (ft)	208	240	86	230	219	114	171	132	62
Link Distance (ft)	666	1494		1257	1257		1140	1140	
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)			200			200			50
Storage Blk Time (%)				2			0	15	1
Queuing Penalty (veh)				1			0	8	2

Intersection: 123: Bend

Movement	SB
Directions Served	T
Maximum Queue (ft)	42
Average Queue (ft)	2
95th Queue (ft)	43
Link Distance (ft)	422
Upstream Blk Time (%)	0
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 130: Rivers Ave/Rivers Ave #2 & Carner Ave #2

Movement	WB	NB	NB	SB	SB
Directions Served	R	T	TR	L	T
Maximum Queue (ft)	294	27	71	238	46
Average Queue (ft)	125	1	18	110	2
95th Queue (ft)	233	13	55	204	44
Link Distance (ft)	2094	773	773		1257
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				250	
Storage Blk Time (%)				1	
Queuing Penalty (veh)				1	

Intersection: 140: Carner Ave #2 & Burton Ln

Movement	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	T	R	L	TR
Maximum Queue (ft)	35	58	58	27	215	111	57	142
Average Queue (ft)	12	21	23	2	91	11	17	59
95th Queue (ft)	37	51	50	14	171	58	46	119
Link Distance (ft)	572	1428			222			2094
Upstream Blk Time (%)					0			
Queuing Penalty (veh)					1			
Storage Bay Dist (ft)			190	120		50	170	
Storage Blk Time (%)					15	0		0
Queuing Penalty (veh)					5	0		0

Intersection: 150: Carner Ave/Carner Ave #2 & Stromboli Ave

Movement	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	R	T	TR	L	T	T
Maximum Queue (ft)	37	57	99	37	39	64	61
Average Queue (ft)	4	8	17	3	6	6	5
95th Queue (ft)	22	36	66	19	27	32	29
Link Distance (ft)	1754	1754	1034	1034		671	671
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)					250		
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 160: Spruill Ave & Montague Ave

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	61	181	115	140	209	183	45	81
Average Queue (ft)	10	84	50	66	92	86	9	28
95th Queue (ft)	42	150	91	118	161	154	34	64
Link Distance (ft)		450		1923		680		573
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	125		75		275		90	
Storage Blk Time (%)		2	3	5		0		0
Queuing Penalty (veh)		0	5	6		0		0

Intersection: 170: Spruill Ave #1/Spruill Ave & McMillan Ave/St Johns Ave

Movement	EB	EB	EB	WB	WB	WB	B6	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	T	L	TR	L	T	R
Maximum Queue (ft)	223	70	123	264	45	12	52	410	614	17	185	95
Average Queue (ft)	115	7	39	134	8	1	18	319	368	1	84	36
95th Queue (ft)	202	40	95	263	29	7	124	487	708	10	160	72
Link Distance (ft)		1517	1517	222	222	222	1411		598		1558	
Upstream Blk Time (%)				10					7			
Queuing Penalty (veh)				0					79			
Storage Bay Dist (ft)	225							310		275		200
Storage Blk Time (%)	1	0						40	7		0	
Queuing Penalty (veh)	0	0						325	29		0	

Intersection: 180: Spruill Ave #1 & Cosgrove Ave

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	T	R	L	TR	L	T	R
Maximum Queue (ft)	325	1035	964	350	1676	1678	300	360	1503	226	388	268
Average Queue (ft)	297	584	360	254	1072	1086	215	218	1330	99	161	96
95th Queue (ft)	393	1252	999	465	2152	2161	417	478	1821	194	322	211
Link Distance (ft)		1388	1388		2051	2051			1488		598	
Upstream Blk Time (%)		6	2		6	7			13		0	
Queuing Penalty (veh)		20	5		25	28			114		2	
Storage Bay Dist (ft)	225			200			150	260		140		280
Storage Blk Time (%)	74	0		4	78	83	1		64	7	9	0
Queuing Penalty (veh)	120	1		13	108	78	3		74	44	40	0

Intersection: 190: Spruill Ave #1 & Reynolds Ave

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	L	TR	L	TR	L	TR
Maximum Queue (ft)	309	41	88	285	2049	37	236
Average Queue (ft)	121	9	32	182	1227	7	90
95th Queue (ft)	261	31	69	380	2653	26	188
Link Distance (ft)	1494		716		2143		1488
Upstream Blk Time (%)					4		
Queuing Penalty (veh)					31		
Storage Bay Dist (ft)		200		185		180	
Storage Blk Time (%)				0	53		1
Queuing Penalty (veh)				0	70		0

Intersection: 200: Spruill Ave #1 & Carolina Ave

Movement	WB	NB	NB	SB
Directions Served	L	T	R	T
Maximum Queue (ft)	104	1246	150	156
Average Queue (ft)	48	505	48	62
95th Queue (ft)	90	1610	162	139
Link Distance (ft)	573	2106		2143
Upstream Blk Time (%)		2		
Queuing Penalty (veh)		15		
Storage Bay Dist (ft)			50	
Storage Blk Time (%)		32		
Queuing Penalty (veh)		26		

Intersection: 210: Spruill Ave #1 & Burton Ln/Driveway

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	L	TR	LTR	L	TR	L	TR
Maximum Queue (ft)	92	64	42	231	640	27	271
Average Queue (ft)	40	25	9	58	259	2	121
95th Queue (ft)	80	54	33	168	759	12	229
Link Distance (ft)		1428	473		1287		2106
Upstream Blk Time (%)					1		
Queuing Penalty (veh)					7		
Storage Bay Dist (ft)	250			150		170	
Storage Blk Time (%)				0	14		2
Queuing Penalty (veh)				0	9		0

Intersection: 220: Spruill Ave/Spruill Ave #1 & Stromboli Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	88	53	37	40	16	174	29	331	134	238
Average Queue (ft)	27	7	5	8	1	67	3	134	56	105
95th Queue (ft)	69	33	24	30	9	136	16	271	106	211
Link Distance (ft)		1754	1754		1627	1627		518		1287
Upstream Blk Time (%)								1		
Queuing Penalty (veh)								0		
Storage Bay Dist (ft)	250			250			250		250	
Storage Blk Time (%)								2		0
Queuing Penalty (veh)								0		0

Intersection: 240: Cosgrove Ave/McMillan Ave & Noisette Blvd

Movement	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	R	L	R
Maximum Queue (ft)	226	46	177	157	82	96
Average Queue (ft)	89	2	43	21	27	12
95th Queue (ft)	174	27	214	152	61	77
Link Distance (ft)	2051	2051	312	312	1290	1290
Upstream Blk Time (%)			5	2		
Queuing Penalty (veh)			13	5		
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 250: Hobson Ave & McMillan Ave

Movement	EB	WB	NB	NB	SB	SB
Directions Served	LT	LTR	L	TR	LT	R
Maximum Queue (ft)	109	37	317	173	48	116
Average Queue (ft)	36	11	146	49	11	40
95th Queue (ft)	78	35	296	141	37	85
Link Distance (ft)		727	446	446	583	583
Upstream Blk Time (%)			3			
Queuing Penalty (veh)			6			
Storage Bay Dist (ft)	60					
Storage Blk Time (%)	3					
Queuing Penalty (veh)	5					

Intersection: 260: Noisette Blvd & Turnbull Ave

Movement	EB	WB	WB	NB	NB	SB
Directions Served	LTR	LT	R	LT	R	LTR
Maximum Queue (ft)	112	58	99	204	58	163
Average Queue (ft)	60	27	45	94	26	68
95th Queue (ft)	94	51	78	164	49	123
Link Distance (ft)	1873	315		1290	1290	2516
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)			75			
Storage Blk Time (%)		0	1			
Queuing Penalty (veh)		0	1			

Intersection: 270: Noisette Blvd & Avenue B

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	97	79
Average Queue (ft)	44	13
95th Queue (ft)	78	51
Link Distance (ft)	564	593
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 280: Virginia Ave & Avenue B

Movement	WB	NB	SB
Directions Served	L	TR	L
Maximum Queue (ft)	57	19	80
Average Queue (ft)	21	1	25
95th Queue (ft)	43	12	63
Link Distance (ft)	593	466	1266
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 290: Virginia Ave & Montague Ave

Movement	EB	NB	SB	SB
Directions Served	LR	L	T	TR
Maximum Queue (ft)	104	69	2	29
Average Queue (ft)	44	27	0	1
95th Queue (ft)	78	59	0	10
Link Distance (ft)	1923		394	394
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		150		
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 300: Virginia Ave & I-526 EB Off-Ramp

Movement	EB	EB	NB	NB
Directions Served	L	R	T	T
Maximum Queue (ft)	222	244	148	48
Average Queue (ft)	85	75	22	9
95th Queue (ft)	244	359	163	96
Link Distance (ft)		1232	1357	1357
Upstream Blk Time (%)		0		
Queuing Penalty (veh)		0		
Storage Bay Dist (ft)	350			
Storage Blk Time (%)	5			
Queuing Penalty (veh)	4			

Intersection: 310: Virginia Ave & I-526 WB On-Ramp

Movement	NB	NB	NB	SB	SB	SB
Directions Served	L	T	T	T	T	R
Maximum Queue (ft)	323	528	441	8	4	142
Average Queue (ft)	200	124	62	0	0	41
95th Queue (ft)	357	481	340	6	3	100
Link Distance (ft)		593	593	492	492	
Upstream Blk Time (%)		3	0			
Queuing Penalty (veh)		11	1			
Storage Bay Dist (ft)	225					325
Storage Blk Time (%)	24	0				
Queuing Penalty (veh)	48	0				

Intersection: 320: Rhett Ave & I-526 EB Ramps

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	LR	L	T	T	T	T	R
Maximum Queue (ft)	375	636	245	535	486	194	327	486
Average Queue (ft)	325	444	163	242	184	86	93	218
95th Queue (ft)	427	659	273	518	453	143	208	424
Link Distance (ft)		639		684	684	803	803	803
Upstream Blk Time (%)		6		0	0		0	0
Queuing Penalty (veh)		0		0	0		0	0
Storage Bay Dist (ft)	275		150					
Storage Blk Time (%)	8	43	33	6				
Queuing Penalty (veh)	37	128	152	11				

Intersection: 330: Rhett Ave & I-526 WB Ramps

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	LR	L	T	T	T	T	R
Maximum Queue (ft)	575	793	133	300	306	629	659	425
Average Queue (ft)	543	715	50	153	164	366	483	300
95th Queue (ft)	646	876	97	250	259	632	760	554
Link Distance (ft)		735		803	803	612	612	
Upstream Blk Time (%)		29				1	15	
Queuing Penalty (veh)		0				0	0	
Storage Bay Dist (ft)	475		270					325
Storage Blk Time (%)	4	45		1			20	5
Queuing Penalty (veh)	26	179		1			115	35

Intersection: 340: Morningside Dr/Piedmont Ave & Montague Ave

Movement	EB	EB	EB	B38	B39	B39	B39	WB	WB	WB	WB	NB
Directions Served	L	T	TR	T	T	T		L	T	T	R	LT
Maximum Queue (ft)	206	312	347	3	312	426	56	125	177	184	196	275
Average Queue (ft)	73	141	164	0	16	23	2	50	96	81	88	108
95th Queue (ft)	163	276	308	4	165	198	53	106	157	148	159	205
Link Distance (ft)		370	370	1986	538	538	538		724	724		701
Upstream Blk Time (%)		0	0		0	0						
Queuing Penalty (veh)		0	1		0	0						
Storage Bay Dist (ft)	150							175			150	
Storage Blk Time (%)	5	5						0	0	0	1	32
Queuing Penalty (veh)	26	5						1	0	1	5	45

Intersection: 340: Morningside Dr/Piedmont Ave & Montague Ave

Movement	NB	SB	SB
Directions Served	R	L	TR
Maximum Queue (ft)	150	52	71
Average Queue (ft)	22	17	27
95th Queue (ft)	108	46	60
Link Distance (ft)			459
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	50	135	
Storage Blk Time (%)	0		
Queuing Penalty (veh)	0		

Intersection: 350: Montague Ave & Mall Dr/Goer Dr

Movement	EB	EB	EB	WB	WB	NB	NB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	L	T	T	TR	L	T
Maximum Queue (ft)	114	450	463	221	140	156	264	422	424	418	63	254
Average Queue (ft)	34	324	398	106	22	76	108	207	228	160	9	150
95th Queue (ft)	83	625	534	192	85	131	195	368	382	339	42	231
Link Distance (ft)		415	415		476			516	516	516		538
Upstream Blk Time (%)		42	73					0	0	0		
Queuing Penalty (veh)		0	0					1	1	1		
Storage Bay Dist (ft)	185			170		275	275				175	
Storage Blk Time (%)				2	0		0	2				4
Queuing Penalty (veh)				1	0		0	7				0

Intersection: 350: Montague Ave & Mall Dr/Goer Dr

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	284	295
Average Queue (ft)	168	175
95th Queue (ft)	251	270
Link Distance (ft)	538	538
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		0
Queuing Penalty (veh)		0

Intersection: 360: Montague Ave & I-26 WB Ramps

Movement	WB	WB	WB	NB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	L	L	T	T	T	T	T	T	R
Maximum Queue (ft)	474	622	475	386	399	306	244	191	443	464	510	357
Average Queue (ft)	381	478	217	228	250	164	148	93	290	314	320	45
95th Queue (ft)	513	672	590	350	375	250	219	168	416	436	473	225
Link Distance (ft)		573				845	845	845	516	516	516	
Upstream Blk Time (%)		15							0	0	1	
Queuing Penalty (veh)		0							0	0	4	
Storage Bay Dist (ft)	375		375	550	550							350
Storage Blk Time (%)	5	29		0	0						4	
Queuing Penalty (veh)	31	186		0	0						11	

Intersection: 370: Montague Ave & I-26 EB Ramps

Movement	B123	SB	SB
Directions Served	T	T	T
Maximum Queue (ft)	114	33	47
Average Queue (ft)	4	1	2
95th Queue (ft)	69	34	34
Link Distance (ft)	369	845	845
Upstream Blk Time (%)	0		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 380: Dorchester Rd & Meeting St

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	LT	R	L	TR	L	T	R	LT	TR
Maximum Queue (ft)	140	181	137	110	206	233	90	181	174
Average Queue (ft)	58	84	71	32	99	90	37	93	85
95th Queue (ft)	114	145	121	80	171	180	77	153	142
Link Distance (ft)	457			469		1842	1842	1350	
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)		100	125		125				125
Storage Blk Time (%)	2	5	1	0	4	3		2	1
Queuing Penalty (veh)	8	4	1	0	12	8		4	2

Intersection: 390: I-26 WB Ramps & Dorchester Rd

Movement	EB	EB	EB	WB	WB	NB	NB
Directions Served	L	T	T	T	TR	L	L
Maximum Queue (ft)	323	148	116	403	425	308	362
Average Queue (ft)	207	75	47	242	271	175	226
95th Queue (ft)	329	125	97	368	398	287	328
Link Distance (ft)	304	304	304	1842	1842		
Upstream Blk Time (%)	2						
Queuing Penalty (veh)	7						
Storage Bay Dist (ft)						530	530
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 400: I-26 EB Ramps & Dorchester Rd

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	T	T	R	L	T	T	L	R
Maximum Queue (ft)	520	457	135	167	227	240	230	176
Average Queue (ft)	318	236	7	71	149	160	118	25
95th Queue (ft)	481	410	77	139	215	230	206	123
Link Distance (ft)	560	560		304	304	304	445	
Upstream Blk Time (%)	1	0				0		
Queuing Penalty (veh)	0	0				0		
Storage Bay Dist (ft)			425					300
Storage Blk Time (%)		0					0	0
Queuing Penalty (veh)		0					0	0

Intersection: 410: Cosgrove Ave & Azalea Dr

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	TR	L	T	T	R	L
Maximum Queue (ft)	208	832	894	500	330	782	678	329	444	309	230	275
Average Queue (ft)	103	286	567	450	303	544	440	200	158	135	45	31
95th Queue (ft)	205	819	1188	604	394	972	888	334	369	314	220	153
Link Distance (ft)		892	892			767			661	661	661	
Upstream Blk Time (%)		1	32			28			0	0	0	
Queuing Penalty (veh)		0	0			0			2	1	2	
Storage Bay Dist (ft)	130			400	230		600	250				200
Storage Blk Time (%)	24	2	0	62	76	0	1	10	0			
Queuing Penalty (veh)	17	2	0	47	281	1	4	38	0			

Intersection: 410: Cosgrove Ave & Azalea Dr

Movement	SB	SB	SB
Directions Served	T	T	R
Maximum Queue (ft)	637	694	300
Average Queue (ft)	366	421	157
95th Queue (ft)	641	709	380
Link Distance (ft)	3181	3181	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			200
Storage Blk Time (%)	30	39	0
Queuing Penalty (veh)	8	57	0

Intersection: 421: Cosgrove Ave & I-26 WB Ramps

Movement	NB	NB	NB	NB
Directions Served	T	T	T	R
Maximum Queue (ft)	36	27	5	5
Average Queue (ft)	2	1	0	0
95th Queue (ft)	33	26	5	5
Link Distance (ft)	950	950	950	950
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 422: Cosgrove Ave & I-26 EB Ramps

Movement	NB	NB	NB	SB	SB
Directions Served	T	T	TR	T	T
Maximum Queue (ft)	623	918	929	20	23
Average Queue (ft)	44	284	408	1	1
95th Queue (ft)	351	958	1084	20	22
Link Distance (ft)	882	882	882	950	950
Upstream Blk Time (%)	0	7	18		
Queuing Penalty (veh)	0	0	0		
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 450: Local Access Rd & Hobson Ave

Movement	WB	WB	NB	NB	SB
Directions Served	L	R	T	R	L
Maximum Queue (ft)	95	72	4	2	85
Average Queue (ft)	31	28	0	0	22
95th Queue (ft)	76	67	4	2	63
Link Distance (ft)		930	1160		
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	170			100	220
Storage Blk Time (%)	0				
Queuing Penalty (veh)	0				

Intersection: 460: Magrath Darby Blvd & US 17

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	SB
Directions Served	L	T	T	T	R	L	T	T	R	R	R
Maximum Queue (ft)	414	816	751	694	252	304	1304	1355	908	285	110
Average Queue (ft)	185	397	371	327	60	90	546	629	49	152	43
95th Queue (ft)	393	897	879	824	243	226	1201	1320	443	259	89
Link Distance (ft)		1105	1105	1105			1292	1292	1292	516	538
Upstream Blk Time (%)		3	1	2			0	1	0		
Queuing Penalty (veh)		0	0	0			2	5	0		
Storage Bay Dist (ft)	375				175	205					
Storage Blk Time (%)		8		12		0	9				
Queuing Penalty (veh)		9		19		2	7				

Intersection: 470: Houston Northcutt Blvd/Mathis Ferry Rd & US 17

Movement	EB	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB
Directions Served	L	L	T	T	T	R	L	L	T	T	T	R
Maximum Queue (ft)	446	515	1274	1308	1291	315	400	450	1798	1919	1833	230
Average Queue (ft)	345	432	844	868	850	174	301	398	1082	1114	1028	55
95th Queue (ft)	520	622	1456	1468	1468	409	456	546	1961	1979	1958	199
Link Distance (ft)			1292	1292	1292				4040	4040	4040	
Upstream Blk Time (%)			0	0	0							
Queuing Penalty (veh)			4	5	5							
Storage Bay Dist (ft)	415	415				215	350	350				130
Storage Blk Time (%)	13	23	20		34		15	29	33		25	
Queuing Penalty (veh)	110	198	88		106		100	198	109		34	

Intersection: 470: Houston Northcutt Blvd/Mathis Ferry Rd & US 17

Movement	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	T	T	R	L	T	T	R
Maximum Queue (ft)	214	428	366	424	255	342	310	242
Average Queue (ft)	180	226	151	229	128	214	178	101
95th Queue (ft)	245	398	301	369	228	339	314	205
Link Distance (ft)		543	543	543	536	536	536	
Upstream Blk Time (%)		0		0		0		
Queuing Penalty (veh)		0		0		0		
Storage Bay Dist (ft)	115							300
Storage Blk Time (%)	43	24					3	0
Queuing Penalty (veh)	58	53					5	0

Intersection: 480: Shelmore Blvd & US 17

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	R	L	T	T	T	R	L	T
Maximum Queue (ft)	492	1311	1309	1023	310	492	720	742	742	300	263	262
Average Queue (ft)	310	440	480	468	107	303	390	394	394	126	222	169
95th Queue (ft)	467	968	1112	864	332	505	847	839	810	345	285	316
Link Distance (ft)		4040	4040	4040			2558	2558	2558		231	231
Upstream Blk Time (%)			0	0							60	25
Queuing Penalty (veh)			0	0							0	0
Storage Bay Dist (ft)	400				210	400				200		
Storage Blk Time (%)	4	10		36		15	3		28			56
Queuing Penalty (veh)	34	30		45		109	8		50			152

Intersection: 480: Shelmore Blvd & US 17

Movement	NB	SB	SB	SB	SB
Directions Served	R	L	L	T	R
Maximum Queue (ft)	190	175	346	354	282
Average Queue (ft)	120	150	270	232	107
95th Queue (ft)	258	211	404	387	236
Link Distance (ft)			333	333	333
Upstream Blk Time (%)			29	14	0
Queuing Penalty (veh)			0	0	0
Storage Bay Dist (ft)	90	75			
Storage Blk Time (%)	24	67	88		
Queuing Penalty (veh)	43	73	95		

Intersection: 490: Dragoon Dr & US 17

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB
Directions Served	T	T	T	R	L	T	T	T	L	R
Maximum Queue (ft)	886	1133	473	47	237	1030	1320	260	224	244
Average Queue (ft)	116	144	122	9	117	145	176	135	102	150
95th Queue (ft)	591	638	394	33	214	560	673	284	198	246
Link Distance (ft)	2558	2558	2558			1813	1813	1813		228
Upstream Blk Time (%)	0	0	0			0	0		1	3
Queuing Penalty (veh)	0	0	0			0	0		0	0
Storage Bay Dist (ft)				200	200				125	
Storage Blk Time (%)			1		2	0			13	21
Queuing Penalty (veh)			2		21	1			20	16

Intersection: 500: Anna Knapp Blvd & US 17

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB
Directions Served	L	T	T	T	R	L	T	T	T	R	L	LT
Maximum Queue (ft)	439	547	599	608	275	470	1374	1329	1300	300	191	198
Average Queue (ft)	253	300	352	384	88	419	932	898	823	170	111	113
95th Queue (ft)	400	552	582	600	281	575	1564	1539	1461	395	178	180
Link Distance (ft)		1813	1813	1813			1466	1466	1466		325	325
Upstream Blk Time (%)							16	7	5			
Queuing Penalty (veh)							0	0	0			
Storage Bay Dist (ft)	365				175	370				200		
Storage Blk Time (%)	2	3		26		53	22		33			
Queuing Penalty (veh)	21	9		33		411	44		87			

Intersection: 500: Anna Knapp Blvd & US 17

Movement	NB	NB	SB	SB	SB	SB
Directions Served	T	R	L	LT	T	R
Maximum Queue (ft)	257	235	175	309	270	213
Average Queue (ft)	65	128	172	279	168	89
95th Queue (ft)	205	216	180	293	268	177
Link Distance (ft)	325			260	260	260
Upstream Blk Time (%)	0			88	5	0
Queuing Penalty (veh)	0			0	0	0
Storage Bay Dist (ft)		140	75			
Storage Blk Time (%)	2	11	70	91		
Queuing Penalty (veh)	5	6	183	160		

Intersection: 510: Local Access Rd & Bainbridge Ave

Movement	WB	WB	SB
Directions Served	L	R	L
Maximum Queue (ft)	477	199	85
Average Queue (ft)	196	72	25
95th Queue (ft)	402	140	68
Link Distance (ft)	842	842	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			175
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 520: Local Access Rd & Stromboli Ave

Movement	EB	EB	EB	NB	NB	NB	SB	SB
Directions Served	L	L	R	L	T	T	T	TR
Maximum Queue (ft)	74	91	51	54	67	82	90	158
Average Queue (ft)	25	40	12	11	15	15	17	58
95th Queue (ft)	60	79	39	41	49	52	58	123
Link Distance (ft)		1627	1627		1428	1428	1386	1386
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	200			200				
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 530: Local Access Rd & PAR SB Ramp

Movement	SB	SB
Directions Served	T	TR
Maximum Queue (ft)	8	24
Average Queue (ft)	0	1
95th Queue (ft)	8	18
Link Distance (ft)	1428	1428
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 540: PAR NB Ramp/Tidewater Rd & Local Access Rd

Movement	EB	WB	SB
Directions Served	LTR	LTR	L
Maximum Queue (ft)	105	27	9
Average Queue (ft)	57	7	0
95th Queue (ft)	89	27	7
Link Distance (ft)	615	871	211
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 550: Hobson Ave & ICTF Truck Dwy

Movement	EB	NB	SB	SB
Directions Served	LR	L	T	R
Maximum Queue (ft)	209	105	13	4
Average Queue (ft)	99	23	1	0
95th Queue (ft)	176	73	7	4
Link Distance (ft)	896		1098	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		500		500
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 560: Hobson Ave & ICTF Employee Dwy

Movement	EB	NB	NB	B17	SB
Directions Served	LR	LT	T	T	TR
Maximum Queue (ft)	84	97	38	47	9
Average Queue (ft)	33	13	3	4	0
95th Queue (ft)	62	74	32	67	8
Link Distance (ft)	439	152	152	432	446
Upstream Blk Time (%)		2	0	0	
Queuing Penalty (veh)		0	0	0	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 6251