APPENDIX G
ENVIRONMENTAL NOISE ASSESSMENT

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PREFACE TO APPENDIX G, ENVIRONMENTAL NOISE ASSESSMENT

Noise modeling was conducted in 2012 to determine the location and magnitude of noise that would be generated by the training operations in comparison to existing conditions (baseline). The Proposed Action of this Supplemental Draft EIS includes the same noise producing operations that were analyzed in the 2012 Draft EIS. The locations of the Driving Tracks, Explosives Training, and Firearms Training venues are the same as 2012 Build Alternative 2. Build Alternative 3 would not have any substantive change in noise impacts when compared with 2012 Build Alternative 2. All noise producing operations presented for Build Alternative 3 are generally the same types, numbers, and frequency as those originally modeled. One change in the firearms training range is the consolidation of firing ranges and a slight shift in some of the buildings. Because this analysis was conducted using peak sound levels, this shift will not alter the noise footprint. Another change is a correction in the proposed use of simulators at the Anti-Terrorism Driving Course (D02), which is addressed in the Addendum to the Environmental Noise Assessment on the next page. Therefore, the 2012 noise analysis and the Addendum to the Environmental Noise Assessment represent the noise effects from Build Alternative 3.

ADDENDUM TO THE ENVIRONMENTAL NOISE ASSESSMENT

This Addendum to the Environmental Noise Assessment updates the 2012 noise analysis to address a correction in the proposed use of simulators at the High Speed Anti-Terrorism Driving Course (D02) for Build Alternative 3.

4.3 Predicted Peak Noise Levels for Simulators

Simulators (flash bangs) are an explosive proposed for use in certain FASTC driver training and mock urban environment exercises. It is proposed that approximately 400 simulator events would occur on an annual basis at the Explosives Simulation Alley (E04) and 600 simulator events would occur at the High Speed Anti-Terrorism Driving Course (D02). The standard method to analyze these simulators is to compute the peak noise levels and determine the distances for risks of complaints. E04 is located in the southeast part of LRA Parcel 9 and D02 is located in the southwest and south central part of LRA Parcel 9. BNOISE2 was used to compute peak noise levels to evaluate the risk of complaints from these events.

Simulator noise levels would vary depending on the type (artillery, ground burst and grenade) but the variation is limited to a few decibels[1]. Table 17 provides an estimate of the distances from the source of a simulator event to the peak noise contours used to define the Moderate (115 to 130 dBP) and High (130 to 140 dBP) complaint risk areas for both unfavorable (PK15(met)) and average (PK50(met)) weather conditions. These guidelines for impulsive noise were indicated previously in Table 16.

Table 17. Predicted Peak Noise Levels for Simulators

Metric	Weather Conditions	Noise Guideline (dBP)	Complaint Risk	Distance from Source (feet)
PK15(met)	Unfavorable	115 to 130	Moderate	2577 feet to 115 dBP
PK15(met)	Unfavorable	130 to 140	High	656 feet to 130 dBP
PK50(met)	Average	115 to 130	Moderate	1462 feet to 115 dBP
PK50(met)	Average	130 to 140	High	520 feet to 130 dBP

The peak levels and complaint risk areas used to describe simulator noise are analogous to those used for demolition and large caliber operations (Figures 12 through 17). Simulator activity is assessed here, in terms of peak levels, for the Baseline and Proposed Action conditions.

<u>Baseline</u>

For the Baseline condition, Figures 12 and 15 respectively indicate moderate to low complaint risk in the area proposed for E04 and D02 due to Fort Pickett demolition and large caliber weapons operations. Currently, no simulator activity occurs in the areas planned for E04 or D02.

<u>Proposed Action</u>

For Proposed Action Alternative 1, range E04 is located in the northeast part of LRA Parcel 9, and D02 is located in the southwest and south central (see Figure 3). Simulator activity at E04 and D02 is expected to generate peak noise levels above 130 dB within 656 feet from the source for unfavorable weather conditions (PK15(met)) and within 520 feet from the source for average weather conditions (PK50(met)). These levels, which correspond to high complaint risk, are not expected to extend beyond

the eastern boundary of LRA Parcel 9 and therefore existing VAARNG buildings located near this boundary would be in a Moderate Complaint Risk Area when simulators are used.

Peak levels above 130 dB from simulators at E02 and D02 may extend beyond the northern boundary of LRA Parcel 9, depending on simulator location, but are not expected to impact existing buildings located more than 660 feet from the simulators.

For Proposed Action Alternative 2, E04 is located in the southeast part of LRA Parcel 9, with D02 in the same location as for Alternative 1 (see Figure 4). In this case, simulator peak levels above 130 dB from operations at E04 would not generally extend beyond the LRA Parcel 9 boundary unless simulators were used in the most southeastern part of E04 (within about 660 feet of the existing VAARNG MEDCOM or classroom buildings). Therefore operating simulators more than 660 feet away from these buildings would ensure they were located in a Moderate Complaint Risk Area, rather than in a High Complaint Risk Area. The Officer's Club, another prominent existing building located just south of D02 is expected to be located in a Low to Moderate Complaint Risk Area when simulators are used for both Alternative 1 and Alternative 2, provided simulator activity takes place more than 660 feet from this building.

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Executive Summary

The United States (U.S.) General Services Administration (GSA) is proposing to acquire land and develop a U.S. Department of State (DOS), Bureau of Diplomatic Security (DS) Foreign Affairs Security Training Center (FASTC) in Nottoway County, Virginia. The proposed location is near the town of Blackstone within and adjacent to the Army National Guard Maneuver Training Center Fort Pickett (Fort Pickett), which is operated by the Virginia Army National Guard (VAARNG). FASTC would be used to provide training for DS law enforcement and security personnel. Training would be conducted in the use of small caliber weapons, demolition, and evasive and tactical driving at planned facilities. These facilities, which would be fully operational in the year 2020, are expected to generate a mixture of continuous and impulsive noise.

The purpose of this study was to predict the noise environment that would result from implementing the Proposed Action, the development of FASTC in Nottoway County. This study also determines whether there would be a change in the existing noise environment that may adversely impact the community.

Noise results are provided for the three main types of FASTC activities: drive tracks and courses, demolition, and small caliber weapons training. Where applicable, these results are then compared and combined with the Baseline noise environment, defined as existing noise generated by Fort Pickett operations. The results are combined because under the proposed project the resulting noise environment would be both FASTC and Fort Pickett operations occurring simultaneously. Fort Pickett operations are mainly due to demolition and large caliber weapons. Weapons are classified as large caliber if the associated rounds are greater than .50 caliber; otherwise they are classified as small caliber. This analysis was accomplished using training operations data provided by the DS and standardized computer models and methods of assessment.

The study results show that, overall, the proposed FASTC training operations are predicted to generate limited additional noise exposure in the surrounding residential communities beyond the existing noise due to Fort Pickett. However, Blackstone residents are still likely to notice several changes to their noise environment if FASTC is implemented. First, there would be additional demolition operations, increasing the overall number of explosive events heard. But of these additional events, mainly the higher yield FASTC demolition operations (2 to 3 pound charges) would be noticed; the 3 pound demolition charges are expected to occur a total of 6 times per year during the daytime (and likewise the 2.23 pound charges are expected to occur 36 times per year during the daytime). These are much lower in number on an annual basis then existing Fort Pickett operations. For example, existing 105mm Howitzer firings occur 565 times per year during the daytime and 63 times per year during nighttime hours at just one gun site. Overall, Fort Pickett conducts a much larger number of firings by multiple high-caliber weapons. The higher yield FASTC demolition operations (2 to 3 pound charges) add up to 42 additional events per year. While the frequency of these proposed events is unknown, if they were spread out

evenly throughout the year, over a fifty week period, for example, then this would mean that Blackstone residents would be expected to hear about 1.2 additional demolition events per week with the Proposed Action.

The second noticeable difference is that peak noise levels would increase in the immediate vicinity of the northwest boundary of Fort Pickett as a result of these FASTC demolition charges. This is predicted to occur because the FASTC demolition pads would be located closer to the western boundary of Fort Pickett than the existing operations, even though the FASTC operations have a lower acoustic output compared to most of the high caliber Fort Pickett weapons. Despite this increase in peak levels, the infrequency of these events would result in a low risk that residents in the surrounding communities would complain.

Drive tracks and road courses

Drive tracks and road courses were assessed in terms of hourly average sound levels and maximum sound levels. Noise criteria were determined from a review of the noise ordinances of several local jurisdictions as well as from the Noise Abatement Criteria (NAC) of the Federal Highway Administration (FHWA). The FHWA criteria, which was used for average sound levels, are that a noise impact occurs when the hourly average A-weighted sound level is 66 decibels (dBA) or higher. The study results show there would no noise impact beyond 70 feet from the centerline of the loudest track as well as from the skid pad locations where skid pad and car ramming exercises would occur.

The local criteria used for maximum sound levels are that noise impacts occur when the maximum A-weighted sound level (L_{Amax}) is 65 dB or higher during the daytime or 55 dB or higher at night. The study results show there would be no noise impact beyond approximately 1,000 feet from the loudest track during the daytime, and 500 feet from the loudest track at night. Similarly for skid pad and car impact exercises, the study results show there would be no noise impact beyond 800 feet from the skid pads.

Because of the distances to the nearest residential community of Blackstone, about one mile northwest of the drive tracks, none of the driving exercises would generate noise levels in residential areas that exceed either criteria.

Demolition noise

Demolition noise was evaluated two ways: first from a land use planning perspective with regard to compatibility with residential, commercial, or other types of development; and second, to identify where noise complaints are likely to occur. The main observations, comparing the Proposed Action noise levels with the Baseline Fort Pickett levels (U.S. Army Public Health Command 2011)[1], are that (1) noise exposure from FASTC proposed operations is concentrated in the northwest part of Fort Pickett, including the 21/20 Parcel (where the demolition pads are located), LRA Parcels 9 and 10, Grid Parcel, and the Blackstone Army Airfield and (2) this additional FASTC noise exposure only increases the combined noise environment (Baseline + Proposed Action) above the Baseline in this one area. Examining the noise exposure outside Fort Pickett in terms of compatible land use, the only noticeable

difference, between the Baseline and the combined action (Baseline + Proposed Action) occurs for the 57 dB noise contour. In this analysis, average noise level contours define noise zones used to assess land use compatibility. The proposed addition of FASTC activities would generate a 57 dB contour that would extend just beyond the Fort Pickett boundary, directly north of the airfield, by approximately 650 feet. This would result in an extension of the Land Use Planning Zone (LUPZ) and Zone I, which are acceptable for noise sensitive land uses (e.g., housing, schools, and medical facilities). In addition, the area affected is mostly limited to the industrial zone, such that minimal additional incompatibilities in land use are expected to result with the introduction of FASTC operations. Noise exposure within Fort Pickett is also expected to increase with the most notable result being an increase in Noise Zone II (62-70 dB) extending over parts of Pickett Park, the 21/20 Parcel, Grid Parcel and the eastern part of LRA Parcel 9. There are a number of VAARNG buildings located east of Pickett Park and near the southern boundaries of LRA Parcel 9 and the Grid Parcel that would be located in Noise Zone II with the Proposed Action.

Peak noise levels would also increase with the addition of FASTC demolition activity, but the complaint risk areas determined indicate that there is still expected to be a low risk of complaints from residents in the surrounding communities. Blackstone would still be well outside of the Moderate Complaint Risk area. However, this complaint risk area would extend to include several commercial and residential properties located north of the airfield; these include the Virginia Polytechnic Institute Agricultural Research and Extension campus and a single residence located on Virginia Tech property. Still, these properties would be located in a Moderate Complaint Risk area. For locations within Fort Pickett, there would be an expansion of the Moderate Complaint Risk areas associated with LRA Parcels 9 and 10 and the Blackstone Army Airfield and an expansion of the High Complaint Risk areas associated with LRA Parcel 9 and the Grid Parcel. Although there are VAARNG buildings located east of LRA Parcel 9 and south of the Grid Parcel, these areas are typically used by base personnel therefore complaint risk is expected to be lower than it would be for the general population. Likewise, simulator activity in LRA Parcel 9 is expected to have a low risk of complaints associated with these same VAARNG buildings.

Small Caliber Weapons

Small caliber weapons noise was evaluated for outdoor and indoor ranges separately using peak sound levels. The single outdoor firing range (R05) is an existing range currently used by Fort Pickett. It is expected that FASTC training would use a similar mix of weapons as are currently being used by Fort Pickett; therefore, peak noise levels are not expected to change from the existing Baseline conditions. The indoor firing ranges include several different types of structures but design plans for these structures have not been finalized. For this analysis, a generic case was analyzed which assumed that the building construction of each indoor range is of the brick and mortar type, with a corresponding noise level reduction (NLR) value of 25 dB provided on the exterior of the building. For the proposed FASTC gun types, estimates were made of the exterior peak sound levels for two representative distances (328 feet and 656 feet) and three azimuths (0°, 90° and 180°) from the firing position. Per AR 200-1 (U.S. Army 2007)[2], small arms operations were analyzed using noise zone definitions, which define acceptable land uses. Estimates of the exterior peak sound levels (dBP) associated with the indoor ranges indicate

that all Zone II (87-104 dBP) and Zone III levels (> 104 dBP) are expected to remain within Fort Pickett. Additionally, the Zone III noise contour (> 104 dBP) is expected to remain relatively localized and within 328 feet of the weapon position for all types of weapons, whereas the Zone II contours (87-104 dBP) extend farther out from the weapon position (approximately 656 feet).

Occupational Noise Exposure

Noise levels within Fort Pickett are not expected to change much in areas where there are existing operations; however, levels would increase in areas where new facilities are planned, especially in areas located away from existing operational sites. A concern for personnel working or training at these new facilities is that certain noise events may be of high enough intensity to damage unprotected hearing. To address this concern, an assessment of occupational noise exposure was conducted for all FASTC facilities to identify areas where personnel would potentially be at risk. The Federal Occupational Safety and Health Administration (OSHA) (U.S. Department of Labor 1981)[3] has established decibel (dB) levels for hearing protection that include limits on "continuous" and "impulsive" noise exposure. For continuous noise, the 8-hour, time-weighted average level of 85 dBA was used, which corresponds to the limit for establishing a hearing conservation program. For impulsive noise, the OSHA criterion for unprotected occupational noise exposure is an unweighted peak level of 140 dB. OSHA noise evaluation of the driving exercises (which are treated as continuous sources) indicates that while the noise levels for individual car passes, skid pad exercises, and car ramming exercises would exceed 85 dBA at locations close to the tracks, because of the low number of proposed daily operations, the OSHA 8-hour TWA, in the vicinity of all tracks and courses, would be significantly less than the OSHA limit. Demolition training and small arms training (which are impulsive sound sources) are expected to generate peak noise levels that exceed the OSHA criteria of 140 dBP at certain distances from each demolition or firing event. This is also true for simulators and other smaller explosives. Predicted distances to the 140 dB peak contour for each weapon are specified in the report, thus estimating the extent of the hazardous noise zone. A single unprotected exposure to loud gunfire can result in temporary hearing loss; repeated exposure to impulsive firearm noise can result in permanent noise-induced hearing loss. To be in compliance with OSHA 1910.95[3], it is expected that operators of the FASTC demolition ranges and firing ranges would provide hearing protection to personnel working and training at these sites during live operations.

List of Acronyms and Abbreviations

ACUB	Army Compatible Use Buffer
AMSL	Above Mean Sea Level
AR	Army Regulation
AVG	Average
BNOISE2	Large Arms Noise Assessment Model
CDNL	C-Weighted Day-Night Average Sound Level
dB	Decibel
dBA	A-Weighted Sound Pressure Level
dBP	Peak Sound Pressure Level
DGAC	Dense-Graded Asphaltic Concrete
DNL	Day-Night Average Sound Level
DOD	Department Of Defense
DOS	Department of State
DS	Bureau of Diplomatic Security
FASTC	Foreign Affairs Security Training Center
FHWA	Federal Highway Administration
GSA	General Services Administration
HCA	Hearing Conservation Amendment
Hz	Hertz
IED	Improvised Explosive Device
LAeq1h	Hourly Average A-Weighted Sound Level
L_{AFMAX}	Maximum A-Weighted Fast-Response Sound Level
L_{Amax}	Maximum A-Weighted Sound Level
LUPZ	Land Use Planning Zone
MAX	Maximum
MIN	Minimum
mm	Millimeter
MPH	Miles per Hour
NAC	Noise Abatement Criteria
NEW	Net Explosive Weight
NLR	Noise Level Reduction
OGAC	Open-Graded Asphaltic Concrete
OSHA	Occupational Safety and Health Administration
PCC	Portland Cement Concrete
PEL	Permissible Exposure Limit
PK15	Peak Sound Level Exceeded 15 Percent of the Time
PK50	Peak Sound Level Exceeded 50 Percent of the Time
REMEL	Reference Energy Mean Emission Level
SARNAM	Small Arms Range Noise Assessment Model
SI	International System of Units
TNM	Federal Highway Administration's Traffic Noise Model
TWA	Time Weighted Average
USAPHC	U.S. Army Public Health Command
VAARNG	Virginia Army National Guard

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1 Introduction

1.1 Purpose

This noise analysis is one of the environmental studies being conducted to support the U.S. General Services Administration, Environmental Impact Statement for the Department of State, Bureau of Diplomatic Security (DS), Foreign Affairs Security Training Center (FASTC). The United States (U.S.) General Services Administration (GSA) is proposing to acquire land and develop a U.S. Department of State (DOS), Bureau of Diplomatic Security (DS) Foreign Affairs Security Training Center (FASTC) in Nottoway County, Virginia. The proposed location is near the town of Blackstone within and adjacent to the Army National Guard Maneuver Training Center Fort Pickett (Fort Pickett), which is operated by the Virginia Army National Guard (VAARNG). FASTC would be used to provide training for DS law enforcement and security personnel. This would involve training in the use of small arms weapons and demolition as well as driver training on paved tracks and off-road courses. The purpose of this study is to estimate the noise levels associated with these training activities to determine if the proposed siting of FASTC would adversely impact the communities surrounding Fort Pickett or personnel working or training at Fort Pickett.

FASTC training includes a variety of exercises and operational events which would combine to form a complex noise environment. For instance, driver training exercises on paved tracks would include multiple cars travelling at speeds of up to 100 mph on certain parts of the track. Other related driving exercises would involve controlled skidding and car ramming. On one of the urban drive tracks, flash bangs would be used to create an environment where simulated improvised explosive devices (IED) are used. These noise sources related to driver training have different characteristics; whereas the flash bangs are impulsive, high-amplitude events, car driving on the paved tracks is better classified as continuous noise, and car skidding and ramming tests are short duration events (i.e., neither impulsive nor continuous). Added to these driving exercises would be small arms training at both indoor and outdoor facilities and demolition training, which are impulsive, high-amplitude operations. All of these operations are expected to generate a varied and complex noise environment.

Because there is no single noise assessment methodology which combines impulsive and continuous noise sources, the various FASTC training exercises were modeled separately depending on whether the noise from these exercises is normally characterized as impulsive, high-amplitude (such as gun fire or demolition operations) or as continuous (car driving). Industry standard computer noise models were used to predict the noise exposure due to all FASTC training operations. Where applicable, the noise from FASTC operations were compared (and integrated) with the existing Fort Pickett Baseline noise environment recently estimated by the U.S. Army Public Health Command (USAPHC) (USAPHC 2011)[1]. The results are combined because under the proposed project the resulting noise environment would be both FASTC and Fort Pickett operations occurring simultaneously. To compare both results and determine the overall noise environment for the Proposed Action (Fort Pickett Baseline + proposed FASTC), the FASTC analysis uses noise assessment methodologies identical to those used by the USAPHC.

This report contains the following sections: a description of the noise metrics and models used (section 1), FASTC training facilities and operations (section 2), and noise evaluation for the drive tracks, demolition, and small caliber weapons operations (in sections 3-5, respectively). Section 6 provides an occupational noise exposure assessment for personnel who would be working or training at FASTC facilities.

1.2 Noise Environment and Metrics

Noise represents one of the most prominent environmental issues associated with military training operations. The noise environment at military installations, such as Fort Pickett, includes different types of noise sources that can either be classified as continuous noise (e.g., on-base vehicular traffic and aircraft operations), or impulsive noise (e.g., weapons firing or detonation of explosives). Not all of these noise sources are directly associated with military training, such as civilian vehicular traffic or building HVAC system noise. However, the noise environment on military bases is typically dominated by military training operations.

The noise environment at Fort Pickett is dominated by impulsive noise events ranging from demolition testing, large-caliber weapons firing, and small arms firing and, to a lesser extent, by continuous noise including vehicular traffic. Some of the loudest munitions used by Fort Pickett include mortars (up to 120 mm high explosive) and Howitzer firings (up to 155 mm high explosive). The proposed FASTC training facilities at Fort Pickett would also include demolition testing and small arms firing as well as driving exercises. The loudest FASTC training events would be 3 pound demolition charges which, in comparison to the loudest VAARNG operations, have a smaller net explosive weight (NEW) and acoustic output. The proposed FASTC demolition operations are also expected to be significantly lower in number than the existing VAARNG demolition and large caliber weapon operations.

Humans perceive and react differently to impulsive and continuous noise events depending on the level as measured in decibels (dB), frequency, and duration of the event. Also, the threshold of hearing damage for unprotected personnel is different for impulsive noise than it is for continuous noise. Because of the difference in human response to these types of noise events, military operational noise is assessed using several different noise metrics. The two most commonly used metrics are the Day-Night Average Sound Level (DNL) and the Peak Sound Pressure Level (dBP).

The DNL is a federally-recommended noise measure used for assessing cumulative sound levels that account for the exposure of all noise events in a 24-hour period. DNL is an average sound level, expressed in dB. DNL is related to compatible/incompatible land uses and does not directly relate to any singular sound event a person may hear; it includes a 10 dB penalty for nighttime noise events. Daytime is defined as the period from 7:00 a.m. to 10:00 p.m., and nighttime is the period from 10:00 p.m. to 7:00 a.m. the following morning. The 10 dB penalty accounts for the generally lower background sound levels and greater community sensitivity to noise during nighttime hours.

To accurately assess the impacts on humans to these different types of noise events, the DNL metric is used along with different weighting factors that emphasize certain parts of the audio frequency spectrum. The normal human ear detects sounds in the range from 20 hertz (Hz) to 20,000 Hz, but is most sensitive to sounds in the 1,000 to 4,000 Hz range; the hertz is the International System of Units (SI) unit of frequency defined as the number of cycles per second of a periodic phenomenon. Community noise is often assessed using a filter called an "A-weighting" filter that approximates the frequency response of the human ear, adjusting low and high frequencies to match the sensitivity of the ear. This "A-weighting" filter is used to assess most community noise sources, including vehicular traffic and aircraft noise. However, for community sounds that are impulsive and contain significant low frequency energy, such as large-caliber weapon firings or explosive detonations, a weighting filter called "C-weighting" is used, which includes more low frequency noise than does the A-weighting filter.

The dBP is the highest instantaneous, unweighted sound level over any given time period. It is also used to quantify impulsive, short duration events such as a large-caliber and small arms weapon firing and explosive detonation. High peak sound levels can generate complaints from people in the local community. Peak sound levels can vary significantly due to varying weather conditions. Therefore, computer models used to predict peak levels account for this variation by using the PK15 metric. PK15 is the peak sound level, factoring in the statistical variations caused by weather, that is likely to be exceeded only 15 percent of the time (i.e., 85 percent certainty that the sound would be within this range). For average weather conditions, without significant variations, the PK50 metric can be used. This metric is the peak sound level that is likely to be exceeded 50 percent of the time.

In this analysis, and to be compatible with USAPHC's recent Baseline noise analysis for Fort Pickett[1], range noise was assessed using the Department of Defense (DoD) recommended noise metrics for Army Installations. Small arms noise was assessed using the peak sound level PK15. Large caliber weapon (Fort Pickett Baseline) and demolition noise, which includes low frequency noise components, was assessed using the C-weighted DNL (CDNL) as well as the PK15 and PK50 metrics. Besides the small arms weapon firing and demolition activity, FASTC would generate community noise from the various driving exercises. These were evaluated using hourly average and maximum sound levels, expressed in dBA, along with acceptable criteria for residential land use.

1.3 Computerized Noise Exposure Models

BNOISE2 (U.S. Army Construction Engineering Research Laboratories 2009)[5] is the standard DoD model used in this analysis to compute the PK15, PK50 and CDNL metrics for large caliber weapons and demolition operations. Primary inputs to BNOISE2 are the range firing and target point coordinates, munitions type, and number of daytime and nighttime rounds or operations. BNOISE2 accounts for weather and the effects of any land-water boundaries.

The DoD standard model for assessing noise from small arms range operations is SARNAM (U.S. Army Construction Engineering Research Laboratories 2003)[6]. SARNAM was used in this analysis to compute

the peak sound level (PK15) based on the range design (geographic location, number of targets, and direction of fire), weapons and ammunition used.

The Federal Highway Administration's (FHWA) Traffic Noise Model (TNM) (Federal Highway Administration 2004)[4] and associated Reference Energy Mean Emission Level (REMEL) data were used to predict the sound levels for the driving exercises. Average and maximum A-weighted sound levels were estimated for the proposed car operations on each of the drive tracks and courses.

Based on the FASTC operations data obtained from study team members, these models were exercised to develop noise exposure contours for the metrics identified above. CDNL contours define noise zones used to assess land use compatibility; peak level contours similarly define noise zones used to assess complaint risk. These noise contours are shown in sections 3-5 of this report.

2 FASTC Training Facilities and Proposed Operations

This section provides a description of the proposed FASTC training facilities and operations that are the focus of this noise study, including an overview of the entire training complex and details about each facility such as its primary use and proposed operations. FASTC would become fully operational by the year 2020.

To model the noise environment for the FASTC training exercises, operations data were collected for each of the exercises, including: demolition training, munitions utilization at small arms ranges, and several types of driving exercises. Driver training would include high-speed driving on paved tracks and driving at lower speeds on urban and off-road courses. Driving exercises on the paved tracks would also include car skid and car impact (ramming) events. Urban driving at Explosives Simulation Alley would include simulators used at various points along the course.

All operations data were collected from project team members during the first few months of the study. These data were organized in a Data Validation Package (Blue Ridge Research and Consulting 2012)[7], which was reviewed by project team members and finalized prior to starting the noise analysis.

The following sections provide a description of the study area and the FASTC training operations that are expected to occur when each facility is fully operational.

2.1 FASTC Site Plans

The proposed site of the FASTC training complex is located on the Fort Pickett, Virginia Army National Guard Maneuver Training Center (Fort Pickett) and on Pickett Park, in Nottoway County, Virginia, approximately 60 miles southwest of Richmond. Figure 1 depicts the Fort Pickett installation and surrounding areas, which consist primarily of rural land. The town of Blackstone, Virginia is the closest population center, located less than two miles west of Fort Pickett (Figure 2). All figures indicate the Fort Pickett boundary using either a grey border (as in Figure 1) or a blue border (Figure 2). The Proposed Action would locate the FASTC training facilities on four parcels of land (Figure 1), LRA 9 & 10, Grid Parcel, and 21/20 (EIS Alternatives 1 and 2 2012)[8]. Facilities are located in these parcels such that a buffer is provided between the expected noisiest training activities, occurring in the 21/20 Parcel, and the nearby town of Blackstone.

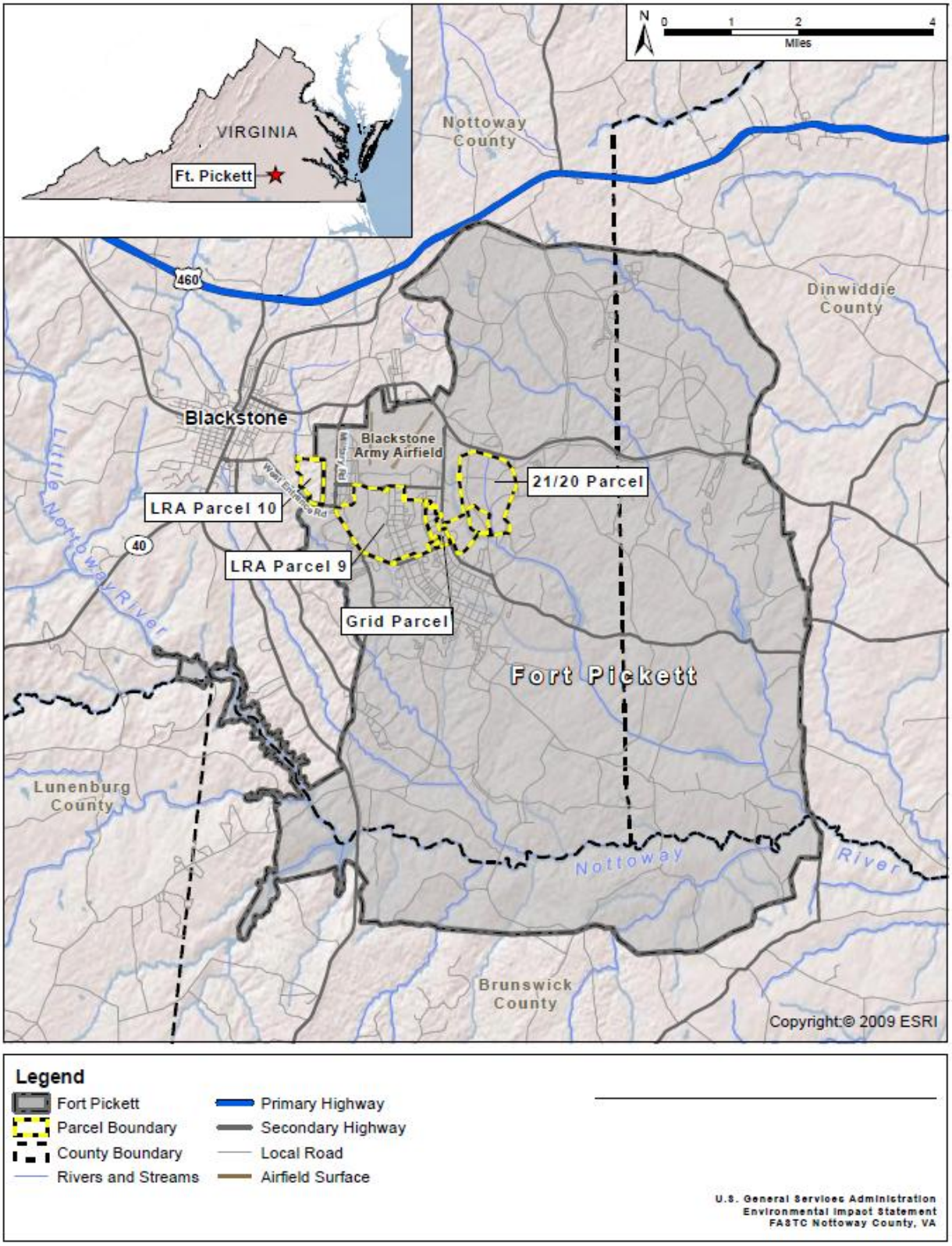

Figure 1. Fort Pickett Site Map with Proposed FASTC Land Parcels.

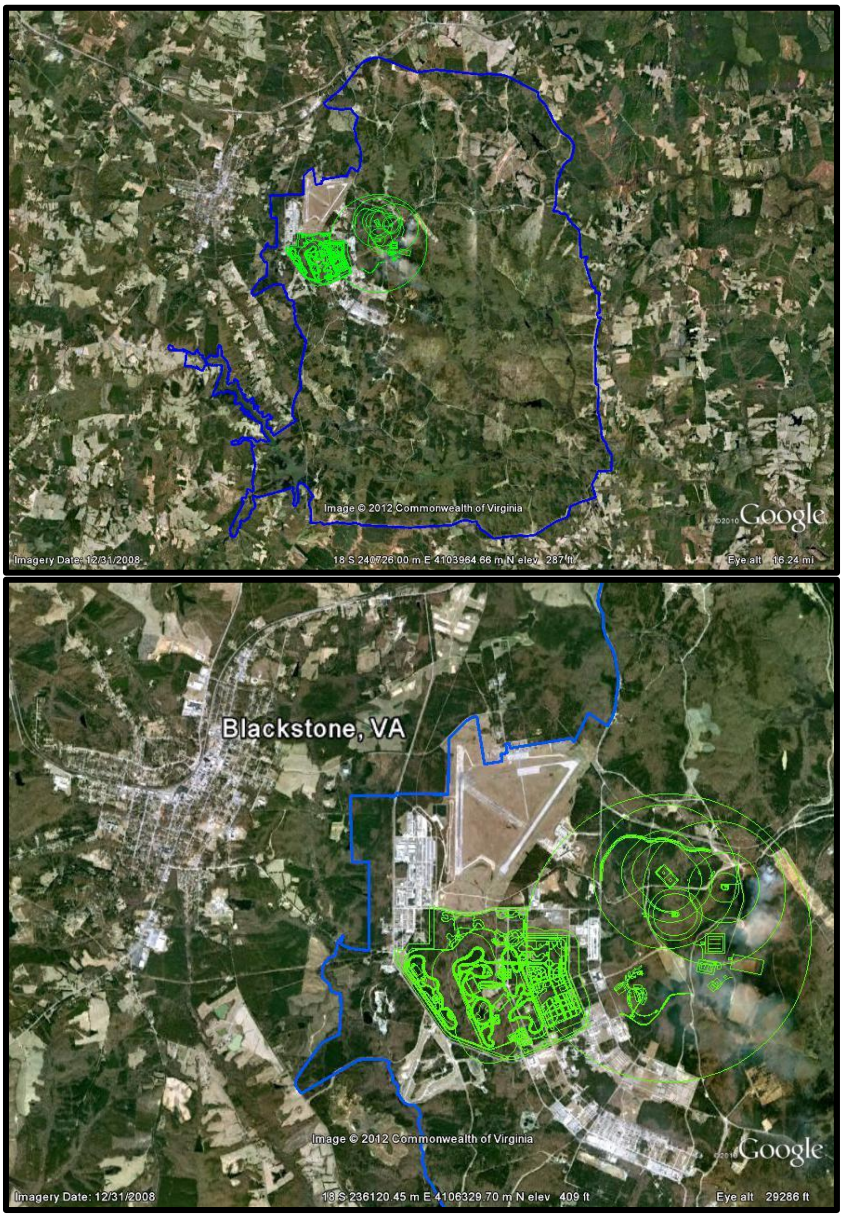

Figure 2. Proposed FASTC and Town of Blackstone, Virginia.

This analysis considers two build alternatives for the FASTC complex, referred to as Alternative 1 and Alternative 2. Build Alternative 1 is shown in Figure 3 with the different types of facilities identified using colored labels; blue (drive tracks and courses), red (demolition areas) and orange (firing ranges). Build Alternative 2 is similar to Alternative 1 with the exception that demolition facilities E02, E04, E05b and E05c/d and driving facilities D03 and T02 are relocated as indicated in Figure 4; this change in the range layout is the only major difference between the two alternatives' noise source locations. Facility operations, which are described in the following sections, are identical for both alternatives.

Figure 3. FASTC Build Alternative 1 Facility locations.

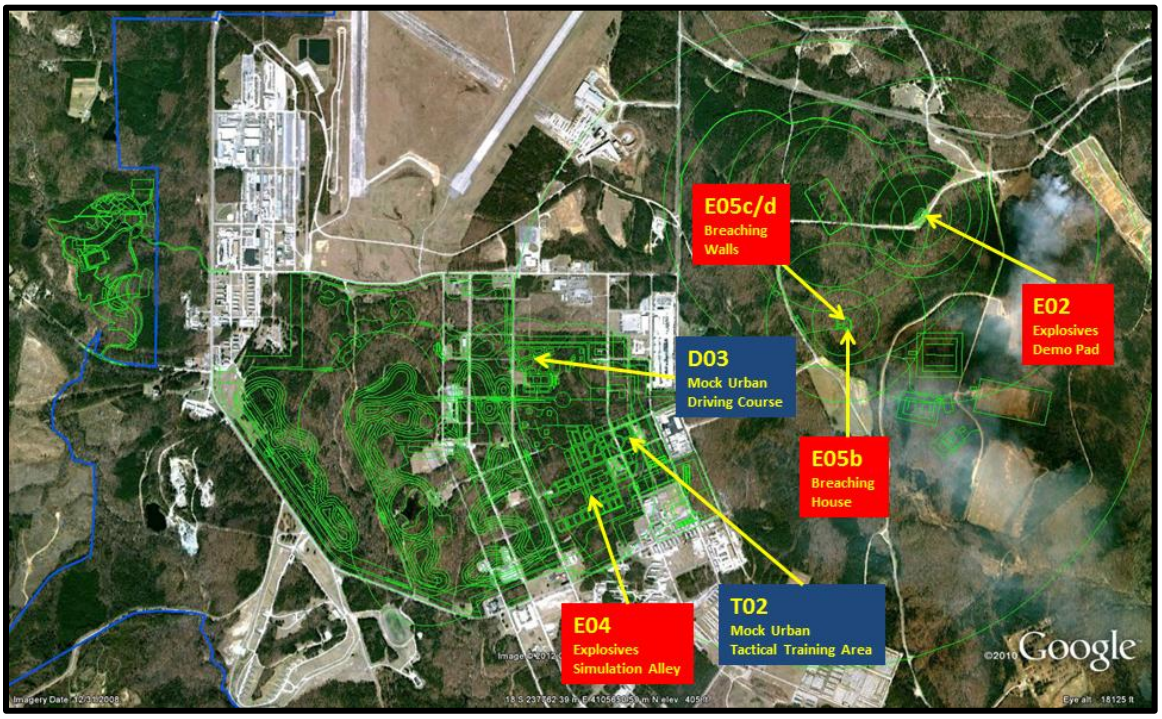

Figure 4. FASTC Build Alternative 2 (same as Alternative 1 but with E02, E04, E05b, E05c/d, D03 and T02 relocated).

2.2 Drive Tracks

2.2.1 High-Speed Driving Exercises

There are three High-Speed Anti-Terrorism Drive tracks as indicated in Figure 3. For training purposes, each track is divided into several sections where individual maneuvers are performed. The vehicle counts provided for each track in Table 1 are indicative of the number of trips around the track necessary to impart skills for protective security driving, attacks on principal, etc. The maximum number of cars on any track at one time is 9 and each car is estimated to make 30 trips around the track on the average day; this is a total of 270 trips around each track (or vehicle passes) per day[7]. Vehicle speeds would vary but can be up to 100 mph. No nighttime activities are proposed.

Table 1. High-Speed Driving Exercises

Driver Training Exercise	Vehicle Location	Speed (mph)			Average Daily Vehicle Count	
		Avg	Min	Max	Day (0700-2200)	Night (2200-0700)
D02 High-Speed Anti-Terrorism Driving (Track 1)	Continuous around track	50	25	100	270	0
D02 High-Speed Anti-Terrorism Driving (Track 2)	Continuous around track	50	25	100	270	0
D02 High-Speed Anti-Terrorism Driving (Track 3)	Continuous around track	50	25	100	270	0

Three other types of training events occur as part of the high-speed driving exercises; artillery simulator (flash bang) detonations, controlled car skids and car impacts or ramming of other cars. The proposed annual operations for these events are shown in Table 2 through Table 4, along with the event locations near each track, and the daytime and nighttime percentage of operations.

Table 2. Flash Bang (Artillery Simulator) Events

Flash Bang Events	Flash Bang Locations		Explosive Type	Total Events Forecast Year	Daytime % 0700-2200	Nighttime % 2200-0700
	Latitude (° N)	Longitude (° W)				
D02 (Track 1) Western	37.05477	77.96599	CTS 7290 Mini-Bang Pyrotechnic	200	100	0
D02 (Track 2) Center	37.05248	77.95759	CTS 7290 Mini-Bang Pyrotechnic	200	100	0
D02 (Track 3) Eastern	37.05751	77.95597	CTS 7290 Mini-Bang Pyrotechnic	200	100	0

Table 3. Skid Pad Exercises (controlled car skids)

Skid Pad Exercises	Skid Pad Location			Total Events Forecast Year	Daytime % 0700-2200	Nighttime % 2200-0700
	Latitude (° N)	Longitude (° W)				
D02 Skid Pad (Track 1)	37.05681	77.96789		300	100	0
D02 Skid Pad (Track 2)	37.05758	77.95868		300	100	0
D02 Skid Pad (Track 3)	37.05739	77.95744		300	100	0

Table 4. Car Impact Exercises

Car Impact Events	Car Impact Locations			Total Events Forecast Year	Daytime % 0700-2200	Nighttime % 2200-0700
	Latitude (° N)	Longitude (° W)				
D02 (Track 1) Skid Pad	37.05681	77.96789		150	100	0
D02 (Track 2) Skid Pad	37.05758	77.95867		150	100	0
D02 (Track 3) Skid Pad	37.05740	77.95744		150	100	0

All of the operations listed in Table 1 through Table 4 are associated with the high-speed drive tracks and therefore were grouped together. But these operations do not all generate similar types of noise and their assessment requires the use of different metrics. For example, noise from high-speed cars were treated as steady state and assessed using A-weighted levels (maximum and average), whereas simulator noise, which is impulsive, was assessed using peak levels. Sections 3-5 describe the methods of noise assessment used for each type of training exercise.

2.2.2 Mock Urban Tactical Training

Several types of car driving exercises are conducted in simulated urban areas. Table 5 shows the operations associated with Mock Urban Drive Tracks (T02 and D03 in Figure 3) and the Simulation Alley Drive Track (E04 Urban); operations are also indicated for the nearby Rural Drive Course (E04 Rural). Average daily operations for tracks T02 and D03 are based on 6 cars per exercise, each traveling through the course, and estimating a maximum of 6 exercises per day (36 total)[7]. For both the Simulation Alley Track (E04 Urban) and the rural course (E04 Rural), there would be an estimated two exercises per day, each with 6 cars traveling through the course. For all of these tracks, vehicle speeds are estimated to range from 15 to 50 mph[7]. No nighttime activities are proposed.

Table 5. Mock Urban and Rural Drive Course Exercises

Driver Training Exercise	Vehicle Location	Speed (mph)			Average Daily Vehicle Count	
		Avg	Min	Max	Day (0700-2200)	Night (2200-0700)
T02 Mock Urban Tactical Training Area (Driving)	Continuous around track	35	20	50	36	0
D03 Mock Urban Driving Track	Continuous around track	35	20	50	36	0
E04 Urban Driving Track	Continuous around track	25	15	40	12	0
E04 Rural Drive Course	Continuous around track	35	20	50	12	0

2.2.3 Off-Road and Unimproved Road Driving Exercises

Table 6 shows the operations associated with the off-road (DO5) and unimproved road (DO4) courses. Vehicle speeds are estimated to range from 20 to 50 mph. Twenty-five percent of the total daily operations on these courses are nighttime operations[7].

Table 6. Off-road and Unimproved Road Driving Exercises

Driver Training Exercise	Vehicle Location	Speed (mph)			Average Daily Vehicle Count	
		Avg	Min	Max	Day (0700-2200)	Night (2200-0700)
D05 Off-Road Driving Course	Continuous around track	35	20	50	12	4
D04 Unimproved Road Driving Course	Continuous around track	35	20	50	12	4

2.3 Demolition Facilities

Five demolition training facilities are proposed, including the Explosives Demo Range (E02), Post Blast Training Range (E03), Explosives Simulation Alley (E04), Explosives Breaching House (E05b) and Explosives Breaching Walls (E05c/d). These facilities accommodate explosives ranging in size from flash bangs (4.5 grams) up to 3 pound charges[7]. The primary modeling parameters are the number of operations by type of munitions and the geographic location of each facility, shown in Tables 7 and 8.

For each explosives range, Table 7 lists the explosive type, number of annual rounds and the percentage of daytime and nighttime operations. The higher-weight explosives (1-3 pound charges) would be used on ranges E03 and E05c/d, whereas the lower-weight explosives (less than 1 pound charge) would be used on ranges E02, E04, and E05b. Table 8 shows the demolition range locations in Latitude and Longitude coordinates. Explosives Simulation Alley (E04) has three locations defined where flash bangs would be used. Ranges E02, E03 and E04 would have explosives detonated on a pad, at ground level, whereas the detonation points for the Explosive Breaching House and Walls (E05b and E05c/d) are expected to be located on building elements (i.e., doors or walls) at a height estimated at 3.3 feet (1 meter) above ground. Sites E02, E05b and E05c/d would be relocated for Alternative 2.

Table 7. Demolition Operations

Type of Explosives	Total Annual FASTC Rounds	Daytime 0700-2200 %	Nightime 0700-2200 %	Total Annual Rounds Distributed By Explosives Training Area				
				EO2	EO3	EO4	EO5b	EO5c/d
Black Powder, 2 oz	312	100	0	312	0	0	0	0
C4 / C2 Detasheet, 1 / 10 lb	156	100	0	156	0	0	0	0
C4 / C2 Detasheet, 1 / 8 lb	433	100	0	433	0	0	0	0
C4 / C2 Detasheet, 1 / 7 lb	156	100	0	156	0	0	0	0
C4 / C2 Detasheet, 1 / 5 lb	18	100	0	18	0	0	0	0
C4 / C2 Detasheet, 1 / 4 lb	424	100	0	424	0	0	0	0
C4 / C2 Detasheet, 1 / 3 lb	238	100	0	238	0	0	0	0
Cast Booster, 1 / 2 lb	493	100	0	493	0	0	0	0
C4 / C2 Detasheet, 1 lb	54	100	0	0	54	0	0	0
C4 / C2 Detasheet, 1 1 / 4 lb	30	100	0	0	30	0	0	0
C4 / C2 Detasheet, 1 1 / 2 lb	9	100	0	0	3	0	0	6
C4 / C2 Detasheet, 3 lb	6	100	0	0	6	0	0	0
C6 (0.25 in), 2.23 lb	36	100	0	0	0	0	0	36
C6 (0.25 in), total of 0.62 lb	60	100	0	0	0	0	60	0
Flash Bangs (4.5 grams)	400	100	0	0	0	400	0	0
FASTC Annual Total	2825							

Table 8. Demolition Range Geographic Coordinates

Explosives Range	Alternative	Description	Range Coordinates		
			Latitude (° N)	Longitude (° W)	Height (feet)
EO2	1	Explosives Demo Range	37.06403	77.93287	0
EO3	1 & 2	Post Blast Training Range.	37.06773	77.93399	0
EO4	1 & 2	Explosives Simulation Alley	37.06012	77.95224	0
	1 & 2		37.06027	77.95454	0
	1 & 2		37.06028	77.95060	0
EO5b	1	Explosives Breaching House	37.06709	77.92608	3.3
EO5c/d	1	Explosives Breaching Walls	37.06686	77.92608	3.3
EO2	2	Explosives Demo Range	37.06758	77.92853	0
EO5b	2	Explosives Breaching House	37.06232	77.93330	3.3
EO5c/d	2	Explosives Breaching Walls	37.06256	77.93329	3.3

2.4 Firing Ranges

There are five small arms ranges proposed which include one existing outdoor range (R05) and four indoor ranges (R02, R03a, R03b and R04). These ranges accommodate small-caliber weapons such as shotguns, rifles, and pistols. Table 9 indicates the daytime operations by gun type that would occur on each range; no nighttime operations are proposed[7].

Table 9. Firing Range Operations

	SMALL ARMS (Munitions Utilization)				
Range/Facility	Weapon Type		Total Annual Rounds	Daytime 0700-2200 %	Nighttime 2200-0700 %
R02 - Indoor Firing Ranges	Handgun	.357 magnum	190,000	100	0
	Handgun	9 mm	190,000	100	0
	Handgun	.40 cal	190,000	100	0
	Rifle	5.56 mm	190,000	100	0
	Sub-machine gun	9 mm	190,000	100	0
	Sub-machine gun	.40 cal	190,000	100	0
	Sub-machine gun	.45 cal	190,000	100	0
	Shotgun	12 gauge	190,000	100	0
R03a - Live Fire Shoot House (1 story)	Handgun	.357 magnum	190,000	100	0
	Handgun	9 mm	190,000	100	0
	Handgun	.40 cal	190,000	100	0
	Rifle	5.56 mm	190000	100	0
R03b - Live Fire Shoot House (2 story)	Handgun	.357 magnum	190,000	100	0
	Handgun	9 mm	190,000	100	0
	Handgun	.40 cal	190,000	100	0
	Rifle	5.56 mm	190000	100	0
R04 - Baffled Indoor Tactical Combat Range	Handgun	.357 magnum	190,000	100	0
	Handgun	9 mm	190,000	100	0
	Handgun	.40 cal	190,000	100	0
	Rifle	5.56 mm	190,000	100	0
	Sub-machine gun	9 mm	190,000	100	0
	Sub-machine gun	.40 cal	190,000	100	0
	Sub-machine gun	.45 cal	190,000	100	0
	Shotgun	12 gauge	190,000	100	0
R05 - Existing Outdoor Rifle Range	Handgun	.357 magnum	190,000	100	0
	Handgun	9 mm	190,000	100	0
	Handgun	.40 cal	190,000	100	0
	Rifle	5.56 mm	190,000	100	0
	Sub-machine gun	9 mm	190,000	100	0
	Sub-machine gun	.40 cal	190,000	100	0
	Sub-machine gun	.45 cal	190,000	100	0
	Shotgun	12 gauge	190,000	100	0

The small arms range-modeling parameters, used to define the range's geographic location, dimensions, and orientation, are shown in Table 10. Included for each range are the firing location (latitude, longitude and height above ground), azimuth from the first firing point to the target point, distance between firing and target points, number of firing lanes, and lane spacing.

Table 10. Firing Range Modeling Parameters

	SMALL ARMS (Range Coordinates/Parameters)						
Range/Facility	Firing Location (leftmost firing point)			Azimuth from 1st Firing Point to 1st Target Point (° clockwise from North)	Distance Firing Point to Target Point (feet)	Firing Lanes #	Lane Spacing (feet)
	Latitude (° N)	Longitude (° W)	Height (feet)				
R02 - Indoor Firing Range (4 Ranges Total)	37.05818	77.92956	3.3	10.9	164	100	1.6
R03a - Live Fire Shoot House (1 story)	37.05598	77.92779	3.3	360	82	6	16
R03b - Live Fire Shoot House (2 story)	37.05639	77.92727	3.3	360	98	9	16
R04 - Baffled Indoor Tactical Combat Range (3 Ranges Total)	37.06159	77.92832	3.3	90	492	90	1.6
R05 - Existing Outdoor Rifle Range	37.05920	77.92457	3.3	101	985	33	16

The munitions operations and range modeling parameters in Tables 9 and 10 are part of the noise model inputs for SARNAM. In Section 5, small arms noise is assessed using different methodologies for outdoor and indoor ranges. SARNAM is normally used to model outdoor ranges. For indoor ranges, estimates were made of the exterior noise levels using common structural noise reduction values and the methodology recommended by the USAPHC.

3 Drive Track Noise Evaluation

This section describes the noise analysis conducted for automobile operations on the FASTC drive tracks and road courses. The modeling parameters for these tracks and courses were defined in detail in section 2. To summarize, this project has nine separate tracks and courses including three High-Speed Anti-Terrorism Driving Tracks (DO2 tracks 1, 2, and 3), Mock Urban Tactical Training Area Drive Track (T02), Mock Urban Driving Track (D03), Urban Driving Track (E04), Rural Driving Track (E04), Unimproved Road Course (D04) and Off-Road Course (D05). Only common street automobiles would use each track and course. This analysis follows guidelines recommended by FHWA and uses noise criteria from local jurisdictions. Maximum and hourly average sound levels are estimated for all driving exercises.

3.1 Noise Level Criteria

The project is located near the town of Blackstone, Virginia. Although there is a noise ordinance in this jurisdiction, that ordinance is what is commonly referred to as a "nuisance" ordinance in that it does not provide numerical noise level limits. In order to provide reference points for commonly-accepted criteria in environmental noise, a survey of nearby ordinances was undertaken. The following nearby jurisdictions also have nuisance-type ordinances:

- Altavista
- Amherst County
- Bedford County
- Blackstone
- Brunswick County
- Chesterfield County
- Franklin
- Lawrenceville
- South Boston
- South Hill
- Suffolk

The following is a summary of the noise level limits for many jurisdictions near Blackstone which have numerical limits. All of these limits are in terms of the maximum A-weighted sound level, although the response time might vary between slow and fast, depending on specific conditions listed in the ordinance. The land near Fort Pickett appears to be mostly agriculturally zoned with some residential areas. Some of the noise ordinances only have requirements for residential zones, while others have the same requirements for both residential and agricultural zones. Most of the ordinances limit noise levels anywhere on residential zones while some limit noise levels inside residences as well. Each ordinance that lists different requirements for different zoning classifications has the strictest limit for residential zones.

For brevity, only the residential limit is presented.

	Daytime definition	Daytime (nighttime) residential limit
Accomack County	7:01 am to 9:00 pm	65 dB outdoors (55 at night)
Emporia	7 am to 10 pm	65 dB indoors (55 at night)
Franklin County	7 am to 11:30 pm	67 dB outdoors (62 at night)
Petersburg	7 am to 10 pm	65 dB outdoors (55 at night)
	(am Weekends and Holidays) to 10 pm	65 dB outdoors (55 at night)
Richmond	7 am to 11 pm	65 dB indoors, 75 dB outdoors (55 indoors & 65 outdoors at night)

The strictest of the daytime noise ordinance limits in residential zones are maximum A-weighted sound levels of 65 dB during the day and 55 dB at night outdoors. These criteria were used in the analysis of maximum sound levels.

Another common set of criteria for automobile noise are the Noise Abatement Criteria (NAC) of the FHWA (Federal Highway Administration 1982)[9]. While these criteria are not binding for this project, they form a useful reference. The criterion for residential land uses is that when the hourly average A-weighted sound level (LAeq1h) approaches or exceeds 67 dB a noise impact occurs. State departments of transportation implement the criteria and most states define "approach or exceed" to mean that a noise impact exists when the hourly average A-weighted sound level is 66 dB or higher. This criterion was used in the analysis of hourly average sound levels.

3.2 Drive Track Operations Summary

Operations on the nine tracks and courses used for noise modeling purposes are summarized in Table 11. The speeds listed below are the minimum, average, and maximum speeds estimated for the tracks and courses.

Table 11. Summary of Drive Track and Course Operations

Track / Course	Cars / day (0700-2200)	Max Cars / Hr	Cars at a time	Speeds (mph)
D02 Track 1	270	72	9	25,50,100
D02 Track 2	270	72	9	25,50,100
D02 Track 3	270	72	9	25,50,100
T02	36	12	6	20,35,50
D03	36	12	6	20,35,50
E04 Urban	12	6	6	15,25,40
E04 Rural	12	6	6	20,35,50
D05 Off-Road	12 (plus 4 night)	6 day, 4 night	9 (4 at night)	20,35,50
D04 Unimproved	12 (plus 4 night)	6 day, 4 night	9 (4 at night)	20,35,50

3.3 Analysis Methodology

The FHWA developed TNM[4] over many years. This is a computerized noise model which predicts average sound levels due to roadway traffic. During the development of this model, vehicle noise levels were measured at a distance of 50 feet from the centerline of the lane of travel. From these data, the Reference Energy Mean Emission Levels (REMEL) (Federal Highway Administration 1995)[10] were developed. The REMEL values can be taken as the maximum sound levels which would be measured as a vehicle passes by with a sound level meter set on fast response (eight samples per second integration rate). This sound level meter setting produces slightly higher sound levels than does the slow response (one sample per second integration rate). Although not all noise ordinances specify the fast response setting, it is conservative to use this setting, and it is straightforward to use the REMEL data in calculations.

The FHWA document which describes the development of the REMEL data[10] provides equations to determine REMELs as a function of vehicle type, pavement type, vehicle speed, and sound frequency using one-third octave frequency bands. Since automobiles would predominantly be used on the FASTC tracks and courses, as opposed to other vehicle types, the REMEL data for automobiles were used in this analysis. The pavement types included in the REMEL data are Portland Cement Concrete (PCC), Dense-Graded Asphaltic Concrete (DGAC), an average of PCC and DGAC, and Open-Graded Asphaltic Concrete (OGAC). It was assumed that the paved roads for this project would have asphaltic concrete. Since data are not available for dirt roads, the most common form of asphaltic concrete pavement, DGAC pavement, was used in the analysis for unimproved and off road tracks. To provide supplemental information, sound levels were also calculated for PCC pavement. Each of the speeds listed in Table 11 were considered in the analysis. In the calculation of maximum sound levels, it was assumed that all of the cars operating at once would be approximately in the same location. This assumption is the maximum scenario because in reality not all cars would be the same distance from the evaluation point. Also, it was assumed that sounds from other tracks, which might be in use at that instant, are negligible. The REMELs were calculated for each one-third octave frequency band. Based on these values, octave band sound levels were determined.

When modeling sound propagation it is useful to know the height at which the noise is generated. Based on the REMEL document[10], for modeling sound propagation from automobiles the sound can be assumed to be radiating from a combination of 0 and 1.5 meters (5 feet) above the ground. The ratio of the sound energy at each of these heights is a function of vehicle type and speed. To be conservative, and for simplicity, it was assumed in this analysis that all sound is generated 5 feet above the ground.

In order to predict sound levels in the community the Sound Propagation Model for Outdoor Sources (Power Acoustics 2002) SPM9613 Version 2.0 was used. This computer program takes octave band sound power levels as the input and outputs the octave band and A-weighted sound pressure levels. The sound power level is the total amount of sound energy emitted by a sound source in all directions, and the sound pressure level is simply the sound level at a specific location. Sound power levels were inferred from the REMEL data. This computer model is directly based on the standard: ISO 9613-2:1996

"Acoustics – Attenuation of sound during propagation outdoors – Part 2: General Method of Calculation (International Standards Organization 1996)[12]." The procedures contained in this standard are the most widely used method for predicting sound propagation outdoors in computer models. ISO 9613 predicts the long-term average downwind sound level during conditions favorable to sound propagation, including mild temperature inversions. In this way, the noise model is somewhat conservative with respect to atmospheric conditions. This model also factors in whether the ground is acoustically reflective (hard) or sound-absorptive (soft). For this analysis, the ground at the automobile (pavement) was modeled as hard, while the ground at all community locations (grass or field) was modeled as soft. Also, topography was not modeled in this analysis (i.e., the ground was assumed to be flat); the ground elevation in the study area was examined and the changes in elevation indicate that this is a reasonable assumption. Neither do these estimates include the potential moderating effects of vegetation on sound propagation.

3.4 Driving Exercise Hourly Average Noise Levels

In this section hourly average noise levels are computed for the drive track, skid pad and car impact operations. In section 3.5, maximum A-weighted noise levels are computed for these same operations.

<u>Drive Track Hourly Average Noise Levels</u>

The tracks and courses would not have many cars traveling each hour. As such, the analysis methodology for average sound levels was simplified. As indicated in Table 11, the worst conceivable (though quite unlikely to occur) case is when the following car operations occur during the same hour:

- 72 cars traveling 100 mph on each of the D02 tracks (1-3)
- 12 cars traveling 50 mph on tracks T02 and D03
- 6 cars traveling 50 mph on D04, D05 and the E04 rural course
- 6 cars traveling 40 mph on the E04 urban course

To illustrate what the average sound level would be from all of these operations occurring at once, on tracks located side-by-side, a simple case was created using the FHWA TNM model[4]. Three roads were created, one with 216 cars traveling 100 mph, one with 42 cars traveling 50 mph, and one with 6 cars traveling 40 mph. To simplify the analysis, each road was 500 feet long, with centerlines just 20 feet apart. Each road was 12-feet wide with DGAC pavement. Receivers were set up along a row extending out from the midpoint of the roads (i.e., 250 feet from one end), spaced 10 feet apart. The road with cars traveling 100 mph was closest to the receivers, while the other roads were parallel to that road on the side opposite the receivers. The receiver height was 5 feet. The default ground type was lawn. The result was that the hourly average sound level was 66 dBA at a distance of 70 feet from the road for this unlikely worst case condition. No noise impact is expected to occur outside the Fort Pickett boundary.

Skid Pad and Car Impact Hourly Average Noise Levels

Hourly average sound levels for the skid pad and car impact exercises were not computed because of the low number of expected operations. Hourly average sound levels for these exercises would be lower than the levels estimated above for the worst case drive track operations (66 dBA at a distance of 70 feet from the source).

Summary of Hourly Average Noise Levels for All Car Exercises

Figure 5 shows the hourly average A-weighted sound levels (LAeq1h) estimated for all driving operations for Alternative 1; contours for the car ramming and skid pad exercises are conservatively shown using the same LAeq1h value as was determined for the drive tracks (66 dBA at 70 feet); although it was mentioned that the LAeq1h value for these exercises is expected to be much lower. In Figure 5, the 66 dBA hourly average sound level contour is shown extending around the perimeter of all drive tracks and courses approximately 70 feet outward from each track or course. Three circular contours representing the car ramming and skid pad exercises are shown extending 70 feet from the center of each skid pad. Figure 6 shows the 66 dBA hourly average sound level contour estimated for all driving operations for Alternative 2; the primary difference for Alternative 2 being that the 66 dBA contour extends about 150 feet further south and 550 feet further east than does the same contour for Alternative 1, reflecting the differences in the site layouts. This analysis of hourly average sound levels indicates that noise due to FASTC driver training exercises would be contained entirely within the Fort Pickett boundary and would not exceed the FHWA NAC levels for residential land use. No impacts are expected outside LRA Parcel 9.

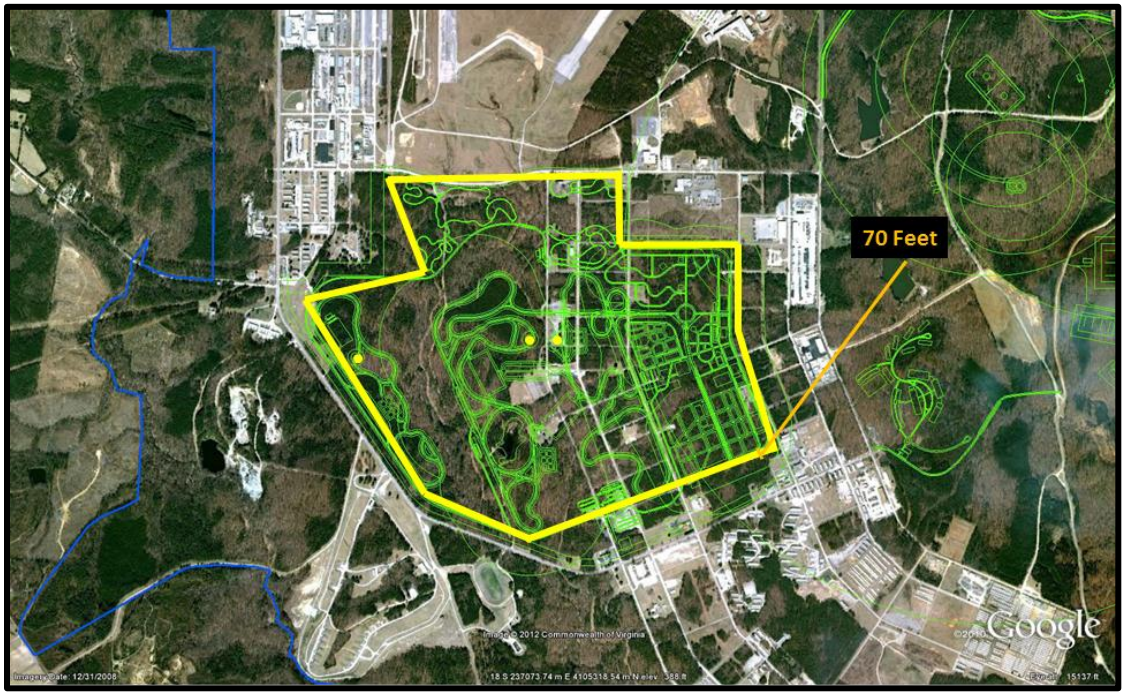

Figure 5. Drive Track Noise Level Envelope for Alternative 1 (66 dBA Hourly Average Sound Level).

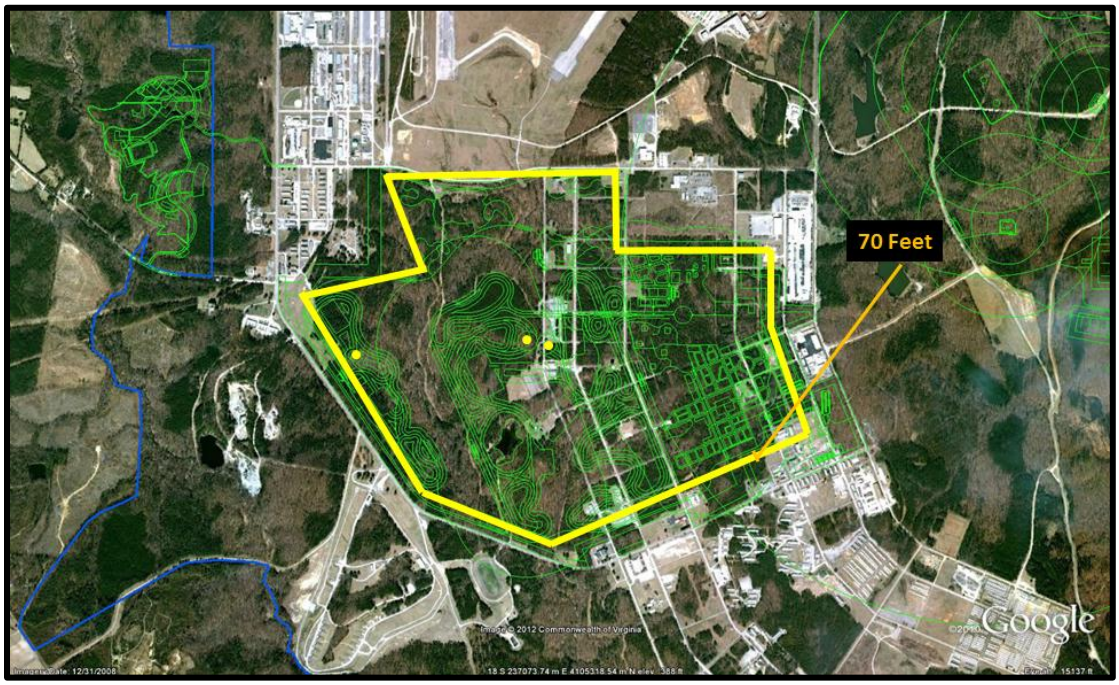

Figure 6. Drive Track Noise Level Envelope for Alternative 2 (66 dBA Hourly Average Sound Level).

3.5 Driving Exercise Maximum Noise Levels

<u>Drive Track Maximum Noise Levels</u>

The first step in this analysis was to extrapolate sound power levels based on the octave band sound pressure levels for each vehicle speed. Next, evaluation locations were set up at varying distances from the vehicle. These locations were used to determine where the maximum A-weighted sound level reaches 55 dB at night and 65 dB during the day.

Based on the REMEL data as outlined above, the maximum A-weighted fast-response sound levels (L_{AFMAX}) at a distance of 50 feet, due to a single car traveling on DGAC pavement, are shown in Table 12; for reference, the levels are also shown for PCC pavement. Unless noted otherwise in this report, the pavement was assumed to be DGAC.

Table 12. Car Pass Maximum A-Weighted Sound Levels

Car Speed (mph)	L_{AFMAX} (dBA)	
	DGAC Pavement	PCC Pavement
15	51.8	54.4
20	55.0	58.4
25	58.4	62.2
35	64.1	68.3
40	66.5	70.8
50	70.6	75.0
60	74.0	78.5
80	79.4	84.2
100	83.7	88.7

During the course of this project, sound level measurements were made (Shen Milsom & Wilke 2011)[13] of car passes at various speeds. Because these measurements were made available for use on this project, a comparison was made with the REMEL data. The following are the maximum fast-response A-weighted sound levels measured for cars on smooth, wet, asphaltic concrete pavement: an average of 81.5 dB for two events at a distance of 35 feet with a speed of 60 mph, and an average of 86.8 dB for four events at a distance of 22 feet and a speed of 80 mph. In order to compare these data to the REMEL data presented above, these sound levels were extrapolated for distance. For simplicity, the car was treated as a point source of sound, and assumed that sound levels drop off at a rate of 6 dB per doubling of distance. Using this simple relationship, the maximum A-weighted sound levels at 50 feet are 80.4 dB at 60 mph and 79.7 at 80 mph. These compare reasonably well to the REMEL data sound levels presented above for DGAC pavement. For the remainder of this analysis, to evaluate other FASTC vehicle speeds, A-weighted sound levels determined from the REMEL data were used.

For each of the FASTC tracks and modeled operations, Table 13 shows the distances from the centerline of the track or course at which the maximum A-weighted sound level is 65 dB. Similarly, the distances at which the sound level is 55 dB (for nighttime assessment) are presented in Table 14.

Table 13. Distances from Track or Course to 65 dB Contour - Daytime

Track / Course	Cars at a time	Min Speed	Avg Speed	Max Speed
D02 Tracks 1-3	9	68 feet at 25 mph	256 feet at 50 mph	994 feet at 100 mph
T02, D03, E04 Rural	6	39 feet at 20 mph	106 feet at 35 mph	213 feet at 50 mph
E04 Urban	6	26 feet at 15 mph	56 feet at 25 mph	136 feet at 40 mph
D05, D04	9	48 feet at 20 mph	128 feet at 35 mph	256 feet at 50 mph

Table 14. Distances from Track or Course to 55 dB Contour - Nighttime

Track / Course	Cars at a time	Min Speed	Avg Speed	Max Speed
D05, D04	4	103 feet at 20 mph	256 feet at 35 mph	505 feet at 50 mph

For daytime operations the data in Table 13 indicate that the 65 dB maximum A-weighted contour would extend out as far as approximately 1,000 feet (994 feet) from the high-speed drive tracks for the straightaway track segments where vehicle speeds approach 100 mph. On the high-speed track turn sections, and on all other courses, vehicle speeds are expected to be lower (50 mph or less); therefore the 65 dB contour would extend outward from the track approximately 250 feet or less. For nighttime operations on the unimproved road course (D04) and the off-road course (D05) the 55 dB maximum A-weighted contour would extend outward from each course as much as approximately 500 feet.

Skid Pad and Car Impact Maximum Noise Levels

Controlled car skids and car ramming exercises are expected to be conducted on the skid pads associated with each high-speed drive track. To assess the noise from these operations, measurement data (Shen Milsom & Wilke 2011)[14] were used in this analysis. Shen, Milsom & Wilke had previously conducted field measurements of various Department of State driver training exercises. The measurements included recordings of car ramming events and tire squeal events (due to acceleration burnout rather than from hard braking).

Based on the data provided, the maximum A-weighted sound levels for these two types of events were compared with the 65 dB criteria for daytime events; proposed operations indicate that neither of these exercises would be conducted at night. A summary of the measured data is provided:

- Tire Squeal, 5 events measured at a distance of 10-15 feet, L_{Amax}(dBA) = 100.2 (maximum), 98.8 (minimum) and 99.4 (average),
- Car Ramming, 23 events measured at location 1 at a distance of 35-50 feet, L_{Amax}(dBA) = 99.2 (maximum) , 84.6 (minimum) and 89.3 (average) and
- Car Ramming, 23 events measured at location 2 at a distance of 20-30 feet, L_{Amax}(dBA) = 98.0 (maximum), 83.5 (minimum) and 92.3 (average).

The tire squeal measurements are highly consistent whereas the car impact measurements show a wide variation in measured levels. This variation seen for the impact events is likely due to these exercises being conducted with different drivers and different car orientations when the impacts occurred.

To simplify the noise assessment for FASTC, a representative maximum A-weighted sound level of 100 dBA was used to represent the tire squeal events at a reference distance of 15 feet; likewise, a maximum A-weighted sound level of 89 dBA was used to represent the car ramming events at a reference distance of 50 feet. These reference levels are close to the average levels determined from the measurement data. By propagating these levels outward from the source, taking into account spherical spreading (i.e., sound levels drop off at a rate of 6 dB per doubling of distance) and atmospheric absorption, computed for 15-degrees Celsius and 70% relative humidity, both representative sources generate 65 dBA at a distance of approximately 800 feet from their source locations.

Summary of Maximum Noise Levels for All Car Exercises

Figure 7 shows the maximum A-weighted noise levels (L_{Amax}) estimated for all driving operations for Alternative 1 including the car ramming and skid pad exercises. The 65 dBA maximum sound level contour is shown extending around the perimeter of all drive tracks and courses; approximately 1,000 feet from the most western high-speed track straightaway and 250 feet, from the nearest drive track or course, around the remaining parts of the complex. These distances were determined from the data provided in Table 13. Generally, the distance to the 65 dBA contour was computed using the maximum speed indicated for each track or course. In the case of the high-speed tracks, this methodology was used only for the long straight segment associated with the most western track (where vehicle speeds can be up to 100 mph); speeds on the turn segments, such as those which occur at the south end of the complex, were estimated to be 50 mph (Table 13 indicates that the distance to the 65 dBA contour is about 250 feet in this case). The 65 dBA maximum sound level contours are also shown for the skid pad and car impact exercises, indicated by the three circles which extend outward approximately 800 feet from the center of each skid pad. For all driving exercises considered, the 65 dBA contour does not extend outside the Fort Pickett boundary and, therefore, would not impact any of the surrounding residential communities. For the limited nighttime driving expected to occur on the unimproved road (D04) and off-road (D05) courses, the 55 dB maximum A-weighted noise contour would be located approximately 505 feet from these two courses. This contour is not shown in Figure 7, however it is entirely within the Fort Pickett boundary; no impact of residential properties is expected. Further, there are expected to be low numbers of vehicle operations per day (4 each) on D04 and D05.

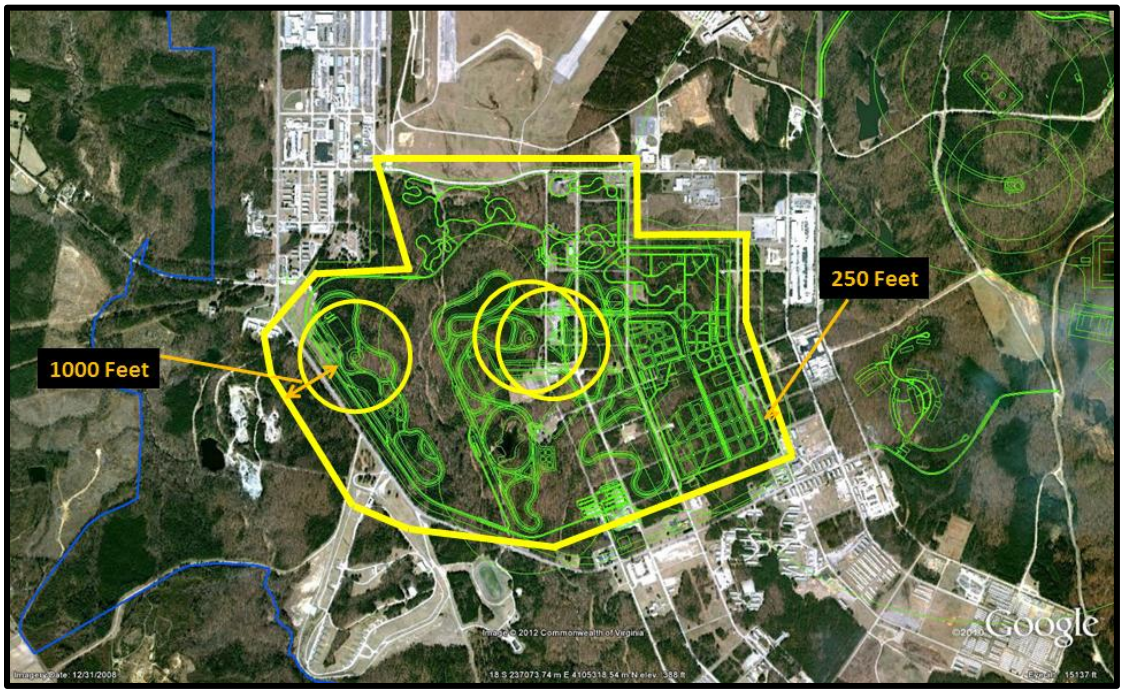

Figure 7. Drive Track Noise Level Envelope for Alternative 1 (65 dB Maximum A-weighted Sound Level).

Figure 8 shows the maximum A-weighted noise levels (L_{Amax}) estimated for all driving operations for Alternative 2. The 65 dBA maximum sound level contour extends around the perimeter of all drive tracks and courses at the same distances from the drive tracks that were estimated for Alternative 1; approximately 1,000 feet from the most western high-speed track straightaway and 250 feet, from the nearest drive track or course, around the remaining parts of the complex. Comparing this Alternative 2 result with Alternative 1, the main difference is that the 65 dBA contour extends approximately 200 feet further south and 750 feet further east than does the same contour for Alternative 1.

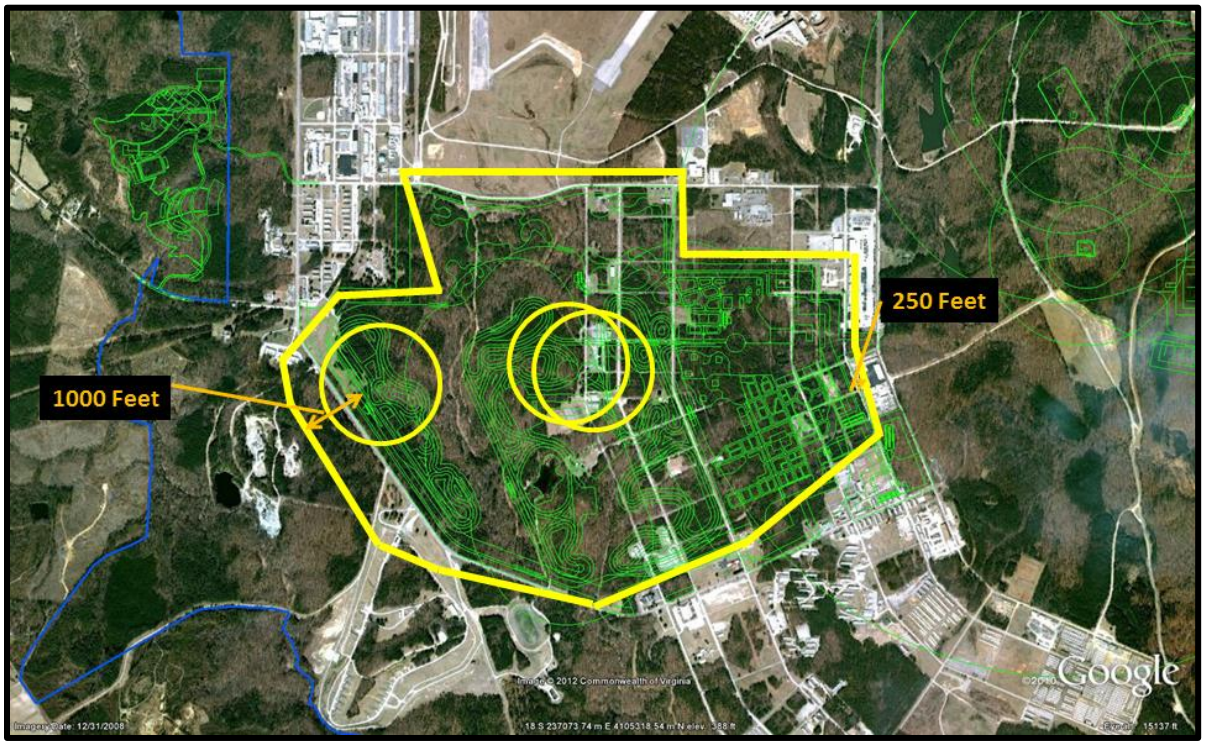

Figure 8. Drive Track Noise Level Envelope for Alternative 2 (65 dB Maximum A-weighted Sound Level).

4 Demolition Noise Evaluation

There are five demolition training ranges planned for FASTC which include the Explosives Demo Range (E02), Post Blast Training Range (E03), Explosives Simulation Alley (E04), Explosives Breaching House (E05b) and Explosives Breaching Walls (E05c/d). These ranges, which were shown on the site map in Figure 3, are all located in the northeast section of the FASTC complex, except the Explosives Simulation Alley, which is more centrally located near the Urban Drive Course. All of these ranges are within the Fort Pickett boundary, and their noise contribution would be additive to the existing Fort Pickett noise exposure. To properly compare the FASTC demolition noise with the existing Fort Pickett demolition and large caliber weapons noise, the same metrics that were used in the Fort Pickett Baseline study[1] were used in this analysis for FASTC. The use of similar metrics is also required to determine the noise exposure for both activities combined. It should be noted that while the Fort Pickett Baseline operations and noise contours were finalized at the end of 2011, the proposed FASTC activity is not expected to be fully operational until 2020. Phase I, which includes most hard skills (explosive ranges etc.), is operational in 2017.

The Proposed Action and the Baseline were evaluated two ways: the first method examines the noise exposure from a land use planning perspective to identify areas, in specific noise zones, which are compatible with residential, commercial or other types of development; second, noise exposure is evaluated in terms of complaint risk areas to identify where noise complaints are likely to occur due to these operations. The next two sections cover these methods of analysis. Lastly, noise levels are evaluated separately for simulators (flash bangs) because these devices have significantly lower net explosive weight (NEW), compared with the other explosives and weapons analyzed.

4.1 Land Use Planning

<u>Noise Zones</u>

Army Regulation (AR) 200-1[2] lists housing, schools, and medical facilities as examples of noise-sensitive land uses. The AR defines four noise zones that are used to evaluate land use compatibility which were used in this analysis to determine the significance of noise impacts associated with the Proposed Action:

- Noise-sensitive land uses are not recommended in Zone III.
- Although local conditions such as availability of developable land or cost may require noise-sensitive land uses in Zone II, this type of land use is strongly discouraged on the installation and in surrounding communities. All viable alternatives should be considered to limit development in Zone II to non-sensitive activities such as industry, manufacturing, transportation, and agriculture.
- Noise-sensitive land uses are generally acceptable within Zone I. However, though an area may only receive Zone I levels, military operations may be loud enough to be heard or even judged

loud on occasion. Zone I is not one of the contours shown on the map; rather it is the entire area outside of the Zone II contour.

- The *Land Use Planning Zone (LUPZ)* is a subdivision of Zone I. The LUPZ is 5 decibels (dB) lower than the Zone II. Within this area, noise-sensitive land uses are generally acceptable. However, communities and individuals often have different views regarding what level of noise is acceptable or desirable. To address this, some local governments have implemented land use planning measures out beyond the Zone II limits. Additionally, implementing planning controls within the LUPZ can develop a buffer to avert the possibility of future noise conflicts.

Table 15 describes the noise zones in relation to the CDNL noise contours provided in this document.

Table 15. Noise Zone Definitions

Noise Zone	Noise Limits, (dB)	
	Large Caliber, Demolitions, Etc. (CDNL)	Small Arms PK15(met)
LUPZ	57 to 62	
Zone I	<62	<87
Zone II	62 to 70	87 to 104
Zone III	>70	>104

LUPZ is a land-use planning zone
PK15(met) is the peak sound level exceeded 15 percent of the time (unfavorable weather conditions)

Three C-weighted Day-Night average sound Level (CDNL) contour results are presented in Figures 9 through 11 to evaluate land use compatibility for demolition and large caliber weapon operations. The assessment period used to create the CDNL contours was 104 days, reflecting the number of National Guard operating days per year and for consistency with the Fort Pickett Baseline analysis. In order, the scenarios are the Fort Pickett Baseline, Baseline plus Proposed Action Alternative 1, and the Baseline plus Proposed Action Alternative 2. The legend in each figure identifies the CDNL contour levels described in Table 15, shown overlaid on a map of Fort Pickett and vicinity. Of note in the figures are the Fort Pickett boundary and Army Compatible Use Buffer (ACUB) which serves as a land use planning buffer zone between base operations and the surrounding communities.

<u>Baseline</u>

The Fort Pickett Baseline was taken from USAPHC, "Operational Noise Consultation No. 52-EN-0FNT-12 Operational Noise Contours Fort Pickett, Virginia, 28 November 2011[1]. The Baseline CDNL noise contours are shown in Figure 9. The Baseline LUPZ (57 dB CDNL) extends beyond the base boundary in most directions but generally does not extend beyond the ACUB. The Zone II (62 dB CDNL) extends beyond the western and southern boundaries 1,000 and 2,300 feet respectively and it extends beyond the eastern boundary up to 5,250 feet. The Zone III (70 dB CDNL) extends beyond the boundary less than 1,300 feet from the activity at firing point series 33 and 53[1]. Based on available imagery, the Zone II

and III areas extending outside the Fort Pickett boundaries are primarily undeveloped rural land. There are several rural residential properties located in Zone II.

Proposed Action

Comparing the FASTC Proposed Action cases (Alternative 1 in Figure 10 and Alternative 2 in Figure 11) with the Baseline case, two of the main observations are that (1) noise exposure from FASTC proposed operations is concentrated in the northwest part of Fort Pickett, including the 21/20 Parcel (where the demolition pads are located), LRA Parcels 9 and 10, Grid Parcel and the Blackstone Army Airfield and (2) this additional FASTC noise exposure only increases the combined noise environment (Baseline + Proposed Action) above the Baseline in this one area.

Comparing existing and proposed noise exposure, the only noticeable difference between the Baseline and the combined contours (Baseline + Proposed Action) occurs for the 57 dB CDNL contour which, due to the addition of FASTC, would extend beyond the Fort Pickett boundary, directly north of the airfield, by approximately 650 feet. This would result in an extension of the LUPZ and Zone I which are acceptable for noise sensitive land uses. In addition, the area affected is mostly within the industrial zone, such that no additional incompatibilities in land use are expected to result due to the introduction of FASTC operations.

Noise exposure within Fort Pickett is expected to increase, with the Proposed Action, in areas directly east and south-east of Blackstone Army Airfield. These areas include parts of Nottoway County Pickett Park, the 21/20 Parcel and the eastern part of LRA Parcel 9. As shown in Figures 10 and 11, while the Proposed Action LUPZ extends further north, primarily over the airfield, Noise Zone II (62-70 CDNL) extends over these areas mentioned. In general, land use within Noise Zone II should be limited to non-sensitive activities such as industry, manufacturing, etc. There are a number of VAARNG buildings located near the eastern airfield boundary, eastern boundary of Pickett Park and the southern boundary of the Grid Parcel which would be located within Noise Zone II with the Proposed Action. Noise Zone III would expand to cover the northern half of the 21/20 Parcel; this is where the demolition pads are located, primarily in an undeveloped area suitable for demolition operations.

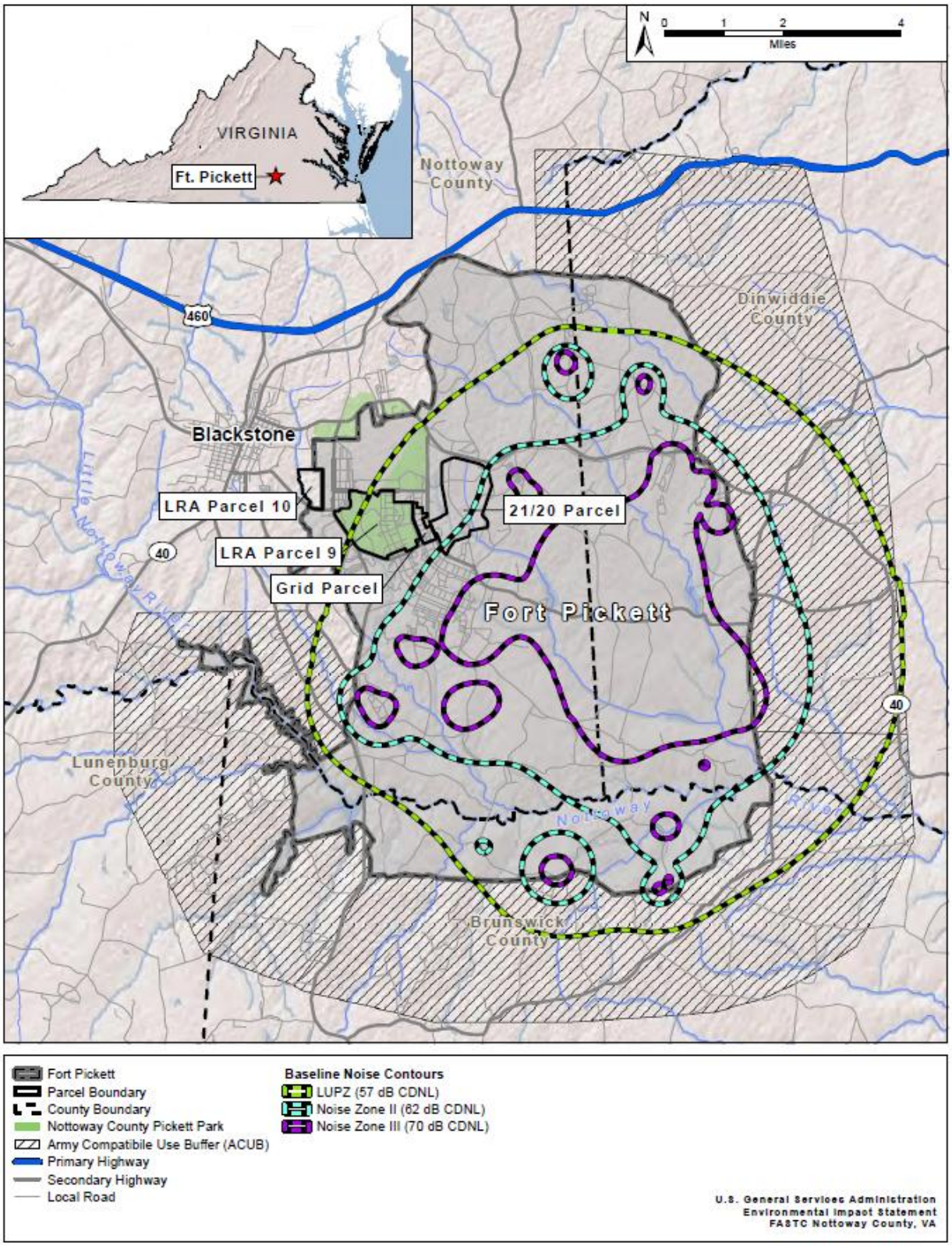

Figure 9. Demolition and Large Caliber Operations Noise Contours (Fort Pickett Baseline).

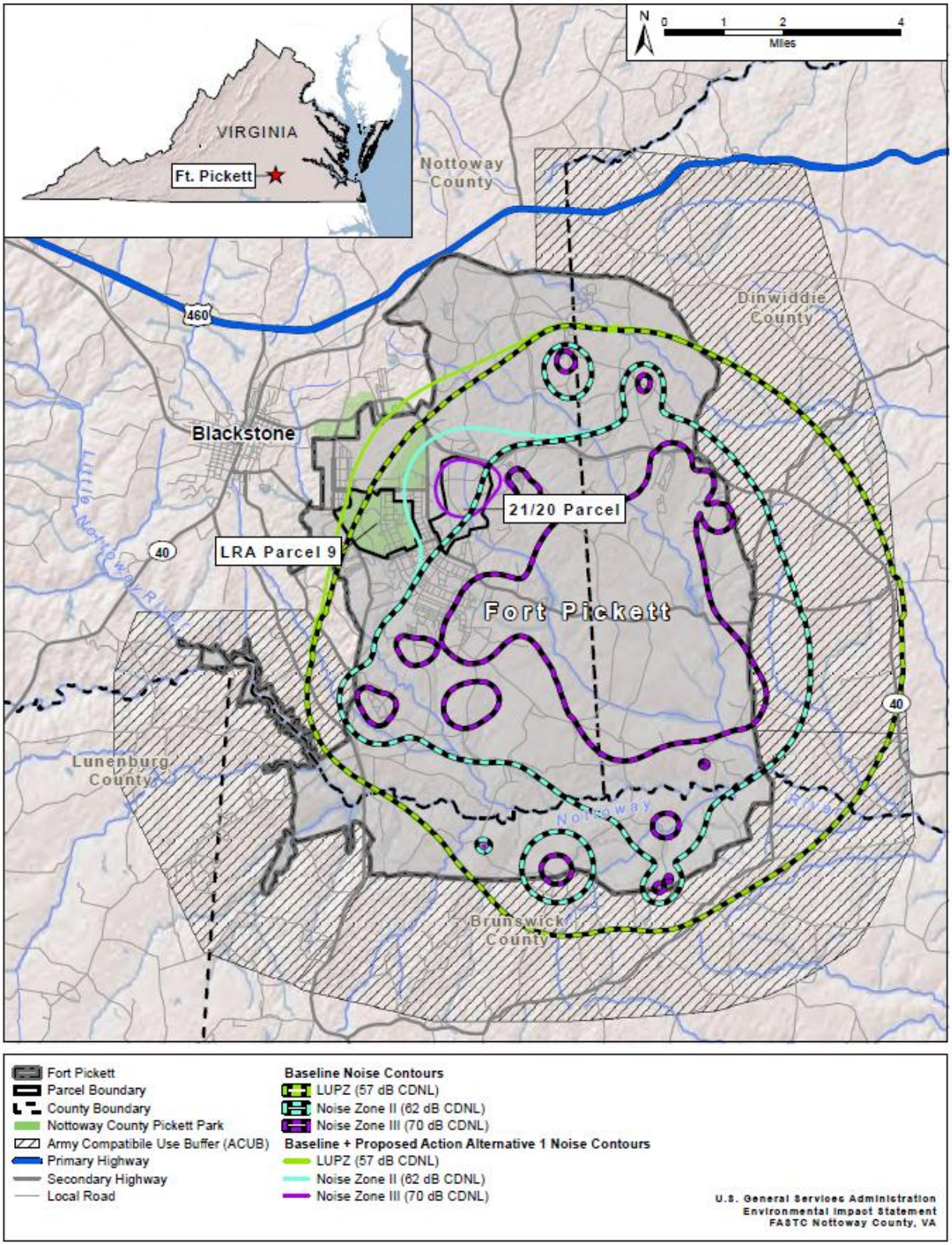

Figure 10. Demolition and Large Caliber Operations Noise Contours (Baseline + Alternative 1).

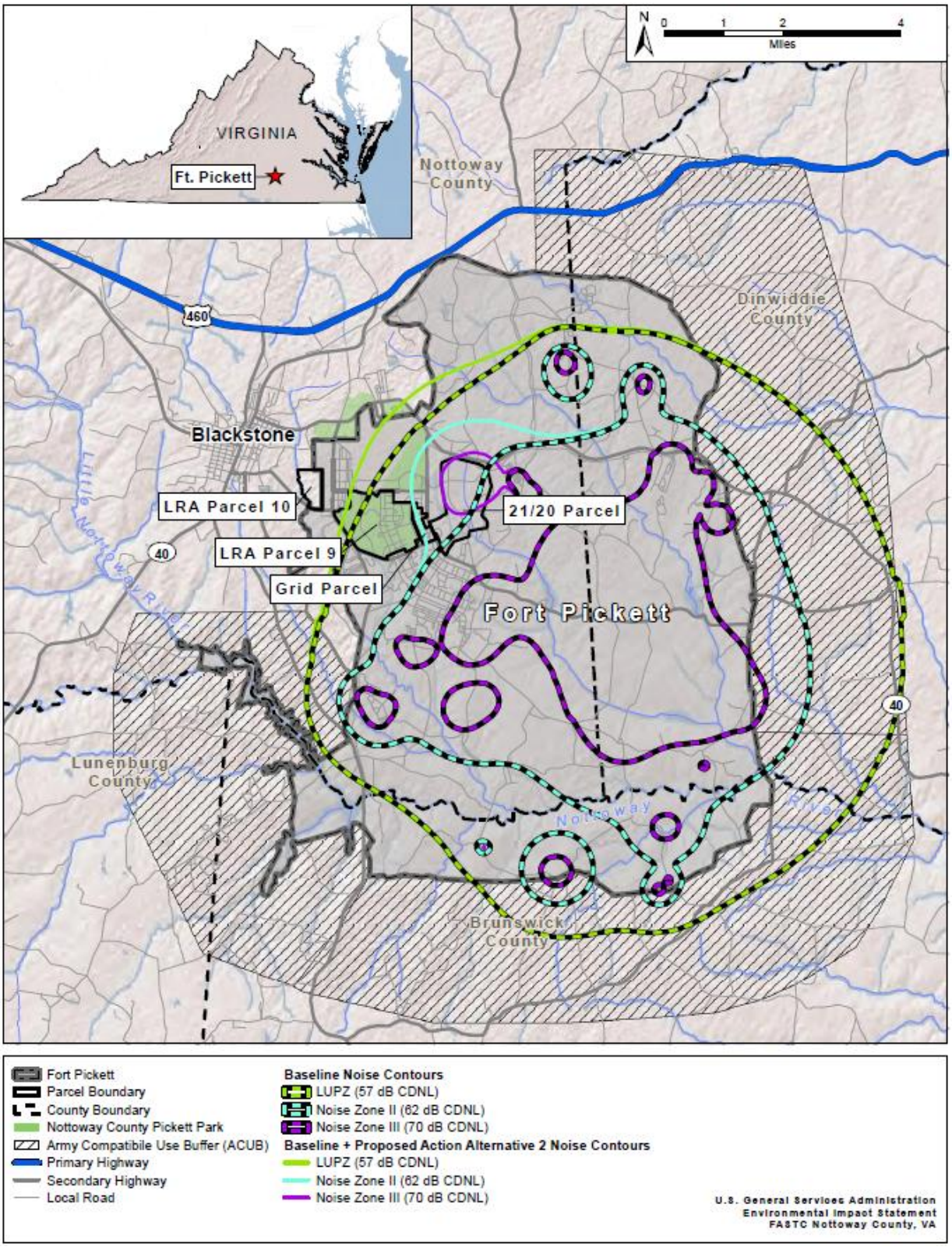

Figure 11. Demolition and Large Caliber Operations Noise Contours (Baseline + Alternative 2).

4.2 Complaint Risk Areas

Annual average noise levels (i.e., CDNL) were evaluated to determine the significance of the noise impacts. However, complaints are more attributed to single specific events rather than annual average noise levels. Peak levels are appropriate for estimating the risk of receiving a noise complaint because they correlate with the receiver's perception of the single event noise level. Table 16 indicates the risk of receiving noise complaints with increasing levels of impulsive noise from large weapons and demolition.

Table 16. Complaint Risk Guidelines for Impulsive Noise

Perceptability	Large Weapon Noise Limit (dB) PK 15(met)	Risk of Receiving Noise Complaints
Audible	<115	Low
Noticeable, Distinct	115 to 130	Moderate
Loud, May Startle	130 to 140	High
Intense, at or above Threshold of Pain and Discomfort	>140	Risk of Physiological damage to unprotected human ears and structural damage claims

The risk of receiving noise complaints due to demolition and large caliber weapons was evaluated for three scenarios, including the Fort Pickett Baseline and the Baseline combined with each of the two Proposed Action alternatives. This was conducted using BNOISE2 to generate peak noise contours (representing the loudest single event at each range or firing location). But because peak noise levels can vary significantly with different atmospheric conditions, two sets of contours were computed:

- Unfavorable Weather Conditions: The PK15(met) is the peak sound pressure level, factoring in statistical variations caused by weather, that is likely to be exceeded only 15 percent of the time. The PK15(met) levels would occur under conditions that enhance sound propagation such as a temperature inversion; that is, warmer air above colder ground surfaces.
- Neutral Weather Conditions: The PK50(met) is the peak sound pressure level that would be expected 50 percent of the time and under neutral weather conditions.

<u>Baseline</u>

The complaint risk areas for demolition and large caliber weapons operations are shown using PK15(met) contours in Figure 12 for the Baseline condition, as provided by USAPHC. Figure 15 shows the results for the PK50(met) contours. The following results were determined for demolition and large caliber weapons operations in the Fort Pickett Baseline Study[1]:

Under enhanced propagation conditions (Figure 12), the High Complaint Risk area (130 to 140 dB PK15(met)) extends beyond the boundary less than 2,950 feet (0.6 miles) at Ranges 15 and 16 and from the artillery firing points near the boundary. The Moderate Complaint Risk area (115 to 130 dB PK15(met)) extends beyond the boundary in most directions up to 7,220 feet (1.4 miles).

Under neutral propagation conditions (Figure 15), the High Complaint Risk area (130 to 140 dB PK50(met)) remains within Fort Pickett except for small areas near Ranges 15 and 16 and from the artillery firing points near the boundary. The Moderate Complaint Risk area (115 to 130 dB PK50(met)) extends beyond the boundary less than 4,250 feet (0.8 miles). Though the complaint risk guidelines would indicate a moderate to high risk of complaints, these areas are primarily undeveloped and as such the risk of complaints would be low for the Baseline scenario. Although these Baseline contours do extend outside Fort Pickett in certain areas they do not extend beyond the ACUB.

Proposed Action

In comparison to the Baseline scenario, the primary difference in the peak contours representing the Baseline plus Proposed Action cases occurs in the northwest area containing the 21/20 Parcel, LRA Parcels 9 and 10, Grid Parcel and the Blackstone Army Airfield. Under enhanced propagation conditions, PK15(met), Figure 13 shows the Complaint Risk areas for the combined activities Baseline plus Proposed Action Alternative 1 and Figure 14 shows the same areas for the combined activity with Alternative 2. The result of adding the FASTC activity is to expand the complaint risk areas to the northwest, over the proposed FASTC complex. The Moderate Complaint Risk area (115 to 130 dB PK15(met)) would extend outside Fort Pickett in the area directly north of the airfield; this projected new area includes commercial buildings associated with the Virginia Polytechnic Institute and at least one residence, located north of the Virginia Tech campus. The High Complaint Risk area (130 to 140 dB PK15(met)) would be further extended to the northwest, but still remain entirely within Fort Pickett; although some existing VAARNG buildings, which are now located in a Moderate Complaint Risk area, would then be located in a High Complaint Risk area.

The Proposed Action Alternatives under neutral propagation (Figures 16 and 17) show a similar change where the complaint risk areas are identical to the Baseline case except for their expansion to the northwest. For neutral propagation, the High Complaint Risk area (130 to 140 dB PK50(met)) to the northwest is larger than it is for the Baseline case, but it remains entirely within Fort Pickett and mainly within the 21/20 Parcel; the Moderate Complaint Risk area (115 to 130 dB PK50(met)) also extends further to the northwest but not outside Fort Pickett. Under neutral propagation parts of the Blackstone Army Airfield, LRA Parcel 9 and the Grid Parcel would now be in a Moderate Complaint Risk area with the Proposed Action.

The purpose of this peak level analysis was to determine how the Complaint Risk areas change from the existing Fort Pickett Baseline case to the combined cases which include proposed FASTC operations. Under enhanced sound propagation conditions, there would be an increase in Moderate Complaint Risk for the area outside Fort Pickett north of the airfield; several commercial buildings including those belonging to Virginia Polytechnic Institute and at least one residence would potentially be at a higher complaint risk. For locations within Fort Pickett, there would be an increase in the Moderate and High Complaint Risk areas associated with Pickett Park and the 21/20 Parcel. These areas are typically used by base personnel therefore complaint risk is expected to be lower than if the affected areas were in the surrounding community.

Blackstone residents are likely to notice a couple of changes to their noise environment if FASTC is implemented.

First, there would be additional demolition operations, increasing the overall number of explosive events heard. But of these additional events, mainly the higher yield FASTC demolition operations (2 to 3 pound charges) would be noticed. There are expected to be only six 3 pound charges and thirty-six 2.23 pound charges detonated annually under the Proposed Action. These are much lower in number on an annual basis then existing VAARNG operations which include thousands of rounds fired (many by 105mm and 155mm Howitzers and 120mm Tank guns). The higher yield FASTC demolition operations (2 to 3 pound charges) add up to 42 additional events per year. While the frequency of these proposed events is unknown, if they were spread out evenly throughout the year, over a fifty week period, for example, then this would mean that Blackstone residents would be expected to hear about 1.2 additional demolition events per week due to the Proposed Action.

Second, peak noise levels would increase as a result of these FASTC demolition charges. This is projected to occur because the FASTC demolition events would be located closer to Blackstone, even though they have lower acoustic output compared to most of the high caliber VAARNG operations. However, the projected Complaint Risk Areas indicate that there is still expected to be a low risk of complaints from Blackstone residents, i.e., Blackstone is still located well outside of the moderate complaint risk area.

On post, in addition to the higher yield FASTC demolition charges, some of the lower yield charges may also be noticed, depending on the observer's location with respect to the demolition pads. Considering the FASTC demolition operations, there is expected to be a much higher annual number of these lower yield charges including black powder 2 ounces (312), flash bangs 4.5 grams (400) and C2/C4 Detasheet ¼ pound (424). These may be noticed at times by personnel within Fort Pickett, but these are considered minor events compared with the greater number of higher yield Fort Pickett demolition and high caliber weapons operations.

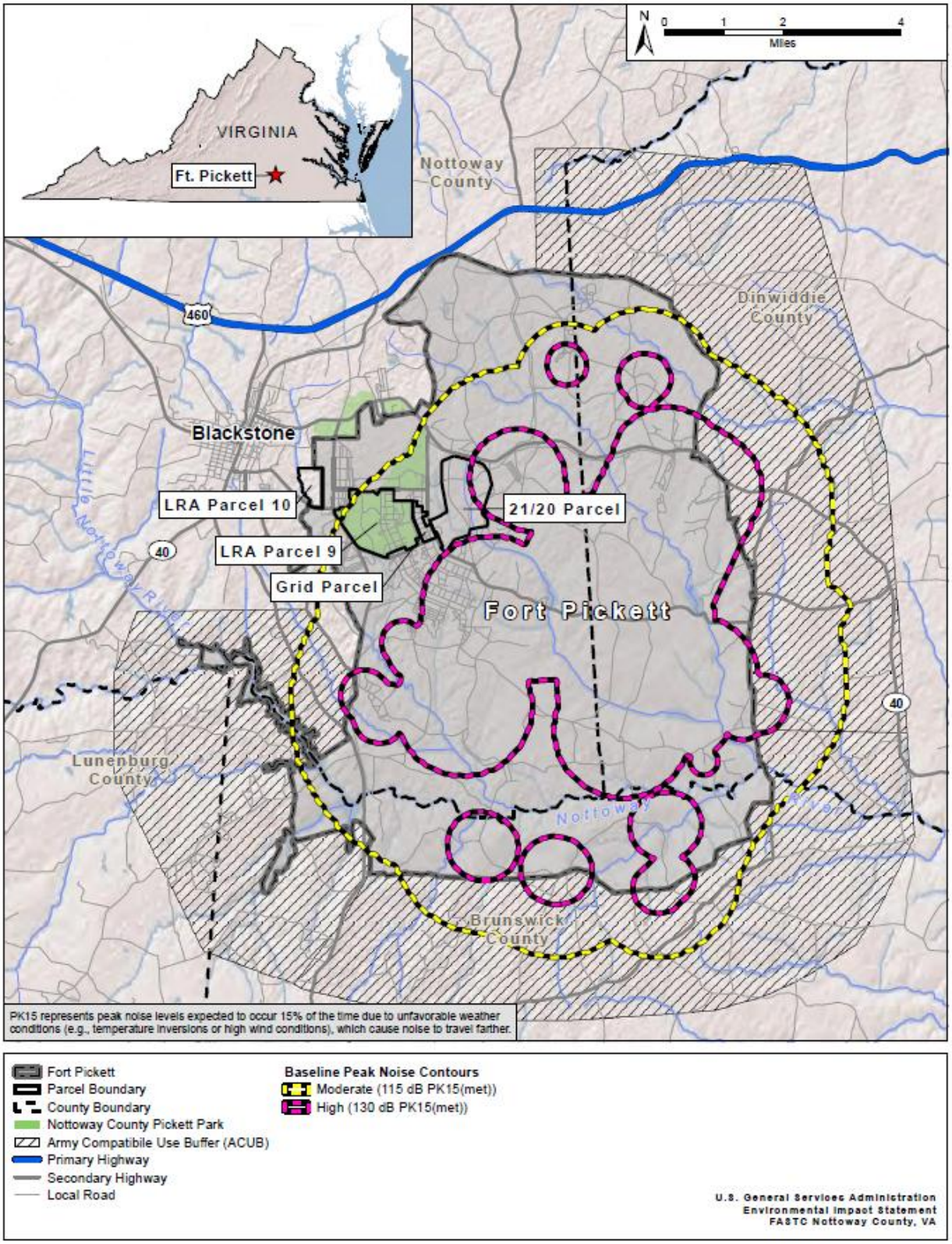

Figure 12. Demolition and Large Caliber Operations Complaint Risk Areas, PK15(met), (Fort Pickett Baseline).

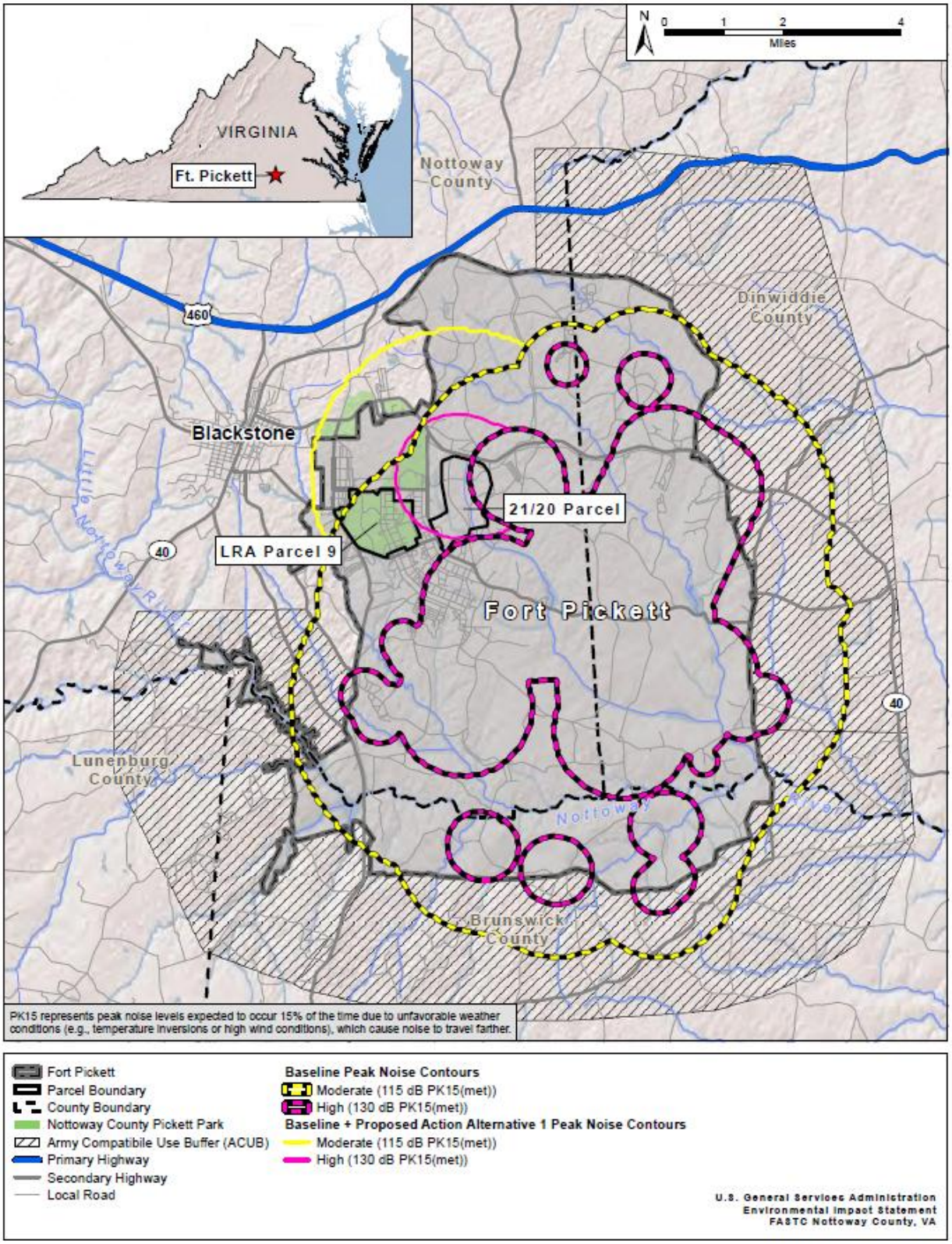

Figure 13. Demolition and Large Caliber Operations Complaint Risk Areas, PK15(met), (Baseline + Alternative 1).

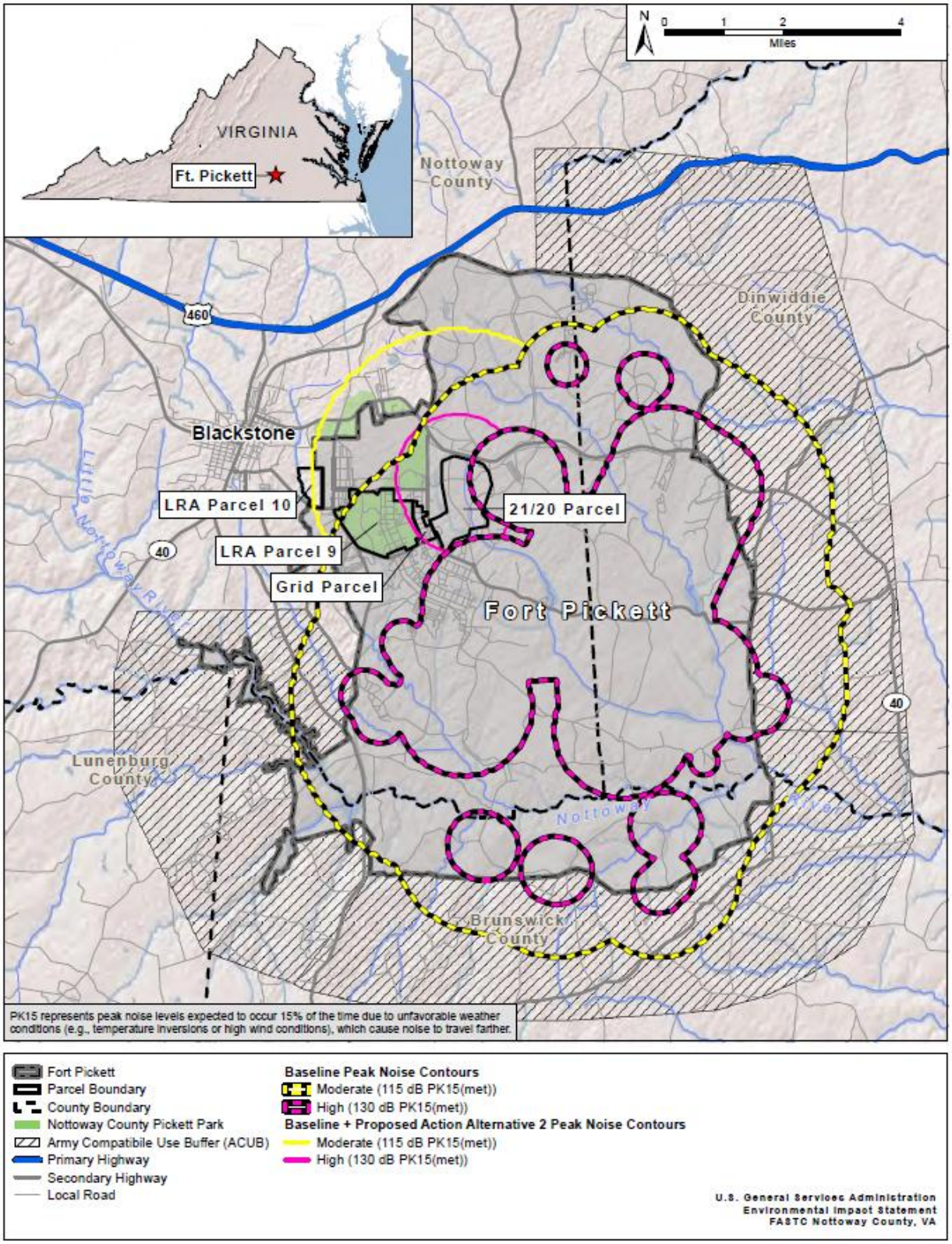

Figure 14. Demolition and Large Caliber Operations Complaint Risk Areas, PK15(met), (Baseline + Alternative 2).

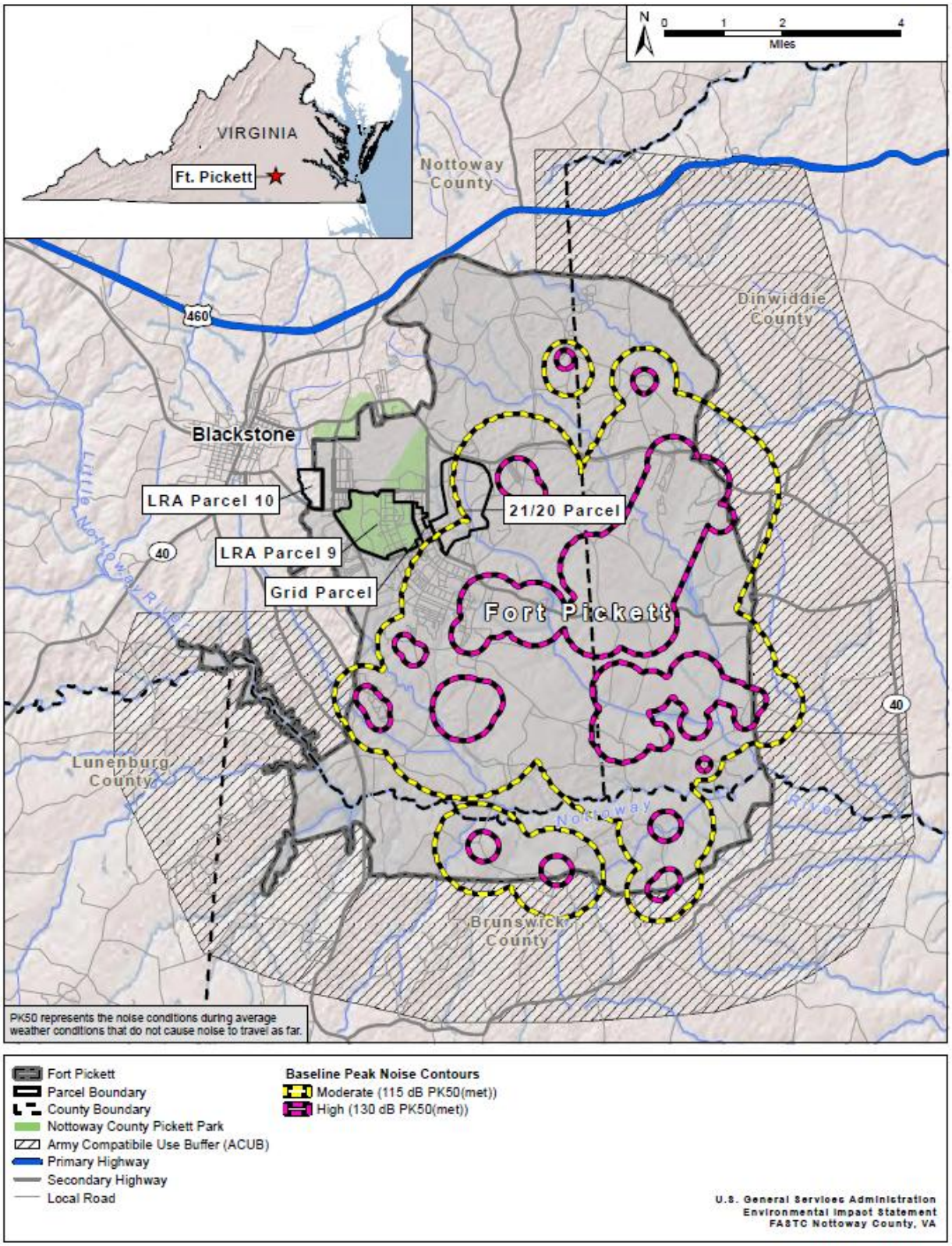

Figure 15. Demolition and Large Caliber Operations Complaint Risk Areas, PK50(met), (Fort Pickett Baseline).

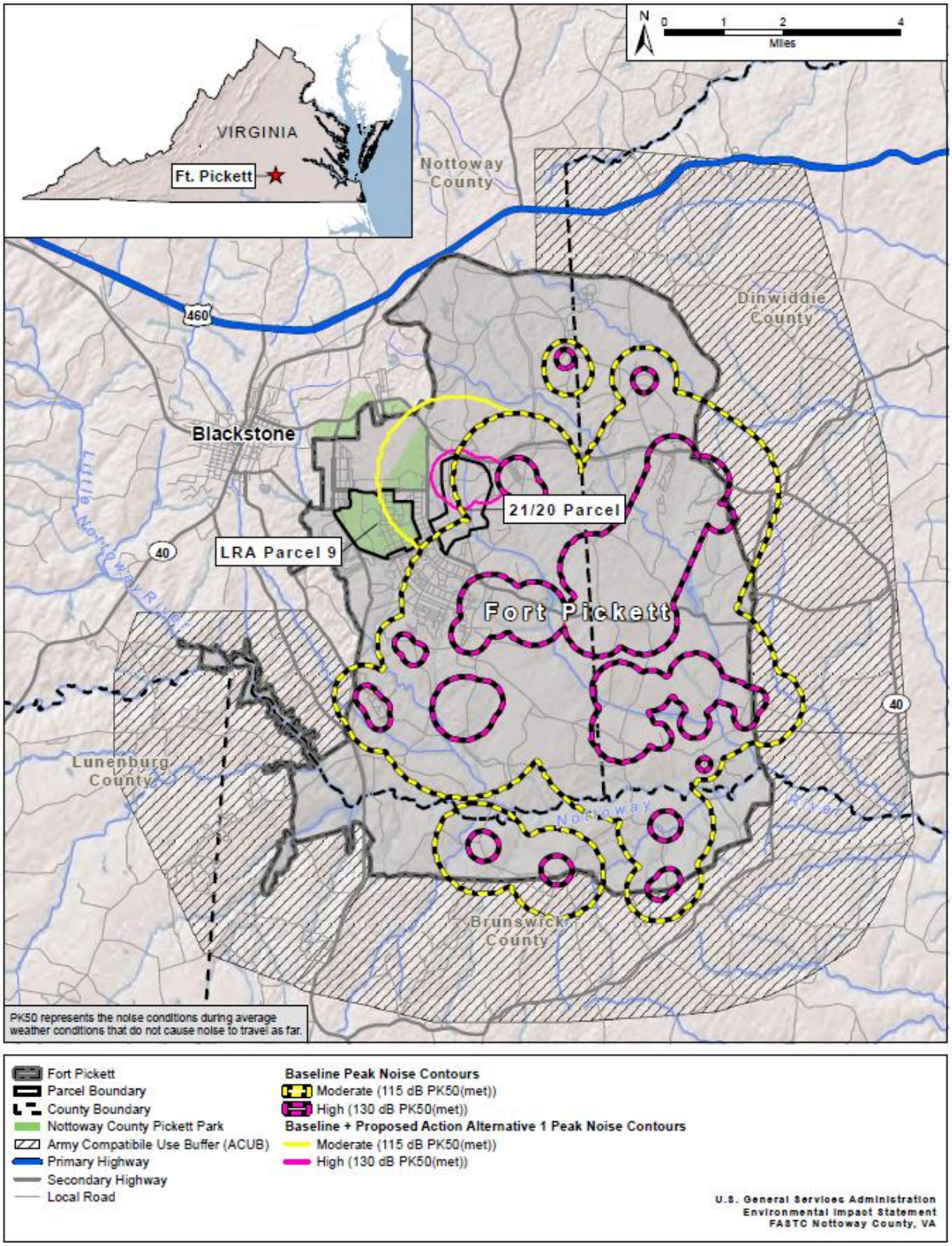

Figure 16. Demolition and Large Caliber Operations Complaint Risk Areas, PK50(met), (Baseline + Alternative 1).

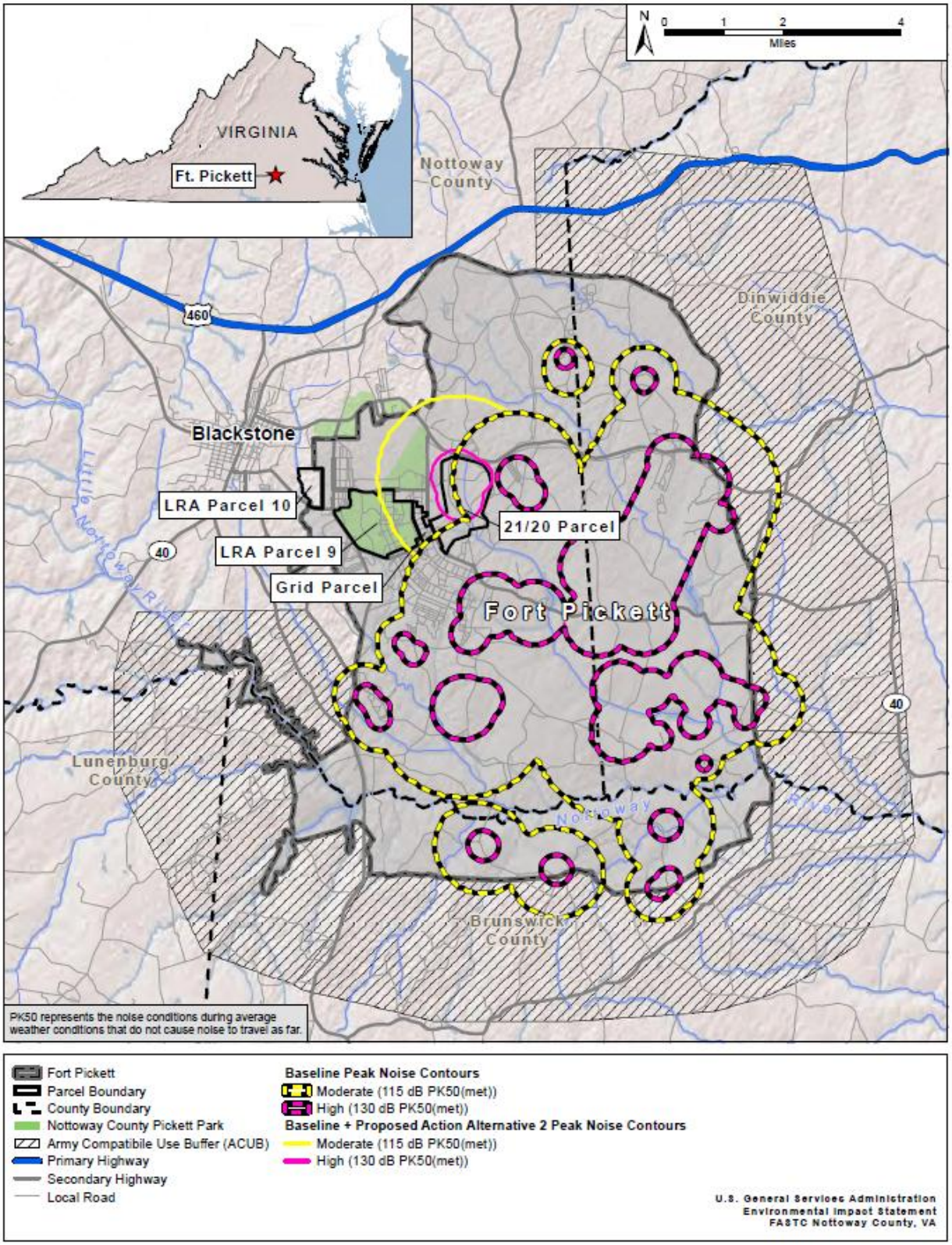

Figure 17. Demolition and Large Caliber Operations Complaint Risk Areas, PK50(met), (Baseline + Alternative 2).

4.3 Predicted Peak Noise Levels for Simulators

Simulators (flash bangs) are an explosive proposed for use in certain FASTC driver training exercises. Part of the Urban Drive Course (E04) is the Explosives Simulation Alley where it is proposed that approximately 400 simulator events would occur on an annual basis. This number of simulators is below the threshold used in BNOISE2 to compute annual average noise levels. However, BNOISE2 was used to compute peak noise levels to evaluate the risk of complaints from these events.

Simulator noise levels would vary depending on the type (artillery, ground burst and grenade) but the variation is limited to a few decibels[1]. Table 17 provides an estimate of the distances from the source of a simulator event to the peak noise contours used to define the Moderate (115 to 130 dBP) and High (130 to 140 dBP) complaint risk areas for both unfavorable (PK15(met)) and average (PK50(met)) weather conditions. These guidelines for impulsive noise were indicated previously in Table 16.

Table 17. Predicted Peak Noise Levels for Simulators

Metric	Weather Conditions	Noise Guideline (dBP)	Complaint Risk	Distance from Source (feet)
PK15(met)	Unfavorable	115 to 130	Moderate	2577 feet to 115 dBP
PK15(met)	Unfavorable	130 to 140	High	656 feet to 130 dBP
PK50(met)	Average	115 to 130	Moderate	1462 feet to 115 dBP
PK50(met)	Average	130 to 140	High	520 feet to 130 dBP

The peak levels and complaint risk areas used to describe simulator noise are analogous to those used for demolition and large caliber operations (Figures 12 through 17). Simulator activity is assessed here, in terms of peak levels, for the Baseline and Proposed Action conditions.

Baseline

For the Baseline condition, Figures 12 and 15 respectively indicate moderate to low complaint risk in the area proposed for E04 due to Fort Pickett demolition and large caliber weapons operations. Currently, no simulator activity occurs in this area planned for E04.

Proposed Action

For Proposed Action Alternative 1, range E04 is located in the northeast part of LRA Parcel 9 (see Figure 3). Simulator activity at E04 is expected to generate peak noise levels above 130 dB within 656 feet from the source for unfavorable weather conditions (PK15(met)) and within 520 feet from the source for average weather conditions (PK50(met)). These levels, which correspond to high complaint risk, are not expected to extend beyond the eastern boundary of LRA Parcel 9 and therefore existing VAARNG buildings located near this boundary would be in a Moderate Complaint Risk Area when simulators are used. Peak levels above 130 dB may extend beyond the northern boundary of LRA Parcel 9, depending on simulator location, but are not expected to impact existing buildings which are located more than 650 feet from this northern boundary.

For Proposed Action Alternative 2, E04 is located in the southeast part of LRA Parcel 9 (see Figure 4). In this case, simulator peak levels above 130 dB generally would not extend beyond the LRA Parcel 9 boundary unless simulators were used in the most south-eastern part of E04 (within about 650 feet from the existing VAARNG MEDCOM or classroom buildings). Therefore operating simulators more than 650 feet away from these buildings would ensure they were located in a Moderate Complaint Risk Area, rather than in a High Complaint Risk Area. The Officer's Club, another prominent existing building located approximately 1,500 feet southwest of E04, is expected to be located in a Low to Moderate Complaint Risk Area when simulators are used.

5 Small Caliber Weapon Noise Evaluation

Five firing ranges are to be used by FASTC personnel for small arms weapons training, including the Indoor Firing Range (R02), Live fire Shoot House, 1-Story (R03a), Live fire Shoot House, 2-Story (R03b), Baffled Indoor Tactical Combat Range (R04) and the Existing Outdoor Rifle Range (R05). The first four are planned indoor ranges whereas the outdoor range is currently being used by Fort Pickett for training.

In this analysis, the same methods were used to assess small arms noise for FASTC operations as were used by the USAPHC to assess the Fort Pickett Baseline operations[1]. The FASTC operations data used were identified in section 2.4. It is important to note that the small arms noise assessment was conducted using different methods for outdoor and indoor ranges. The SARNAM model was used for all outdoor ranges, including those in the Baseline assessment, where the primary output is peak sound level contours. But for indoor ranges, there is no model that takes into account all of the structural and acoustical characteristics of an enclosed range, such as interior sound field characteristics or detailed building noise reduction. To assess indoor ranges, the USAPHC estimates the exterior peak levels using common structural noise reduction values and limits these estimates to several distances and azimuths from each weapon being analyzed. The following sections describe both types of noise analysis conducted for outdoor and indoor ranges.

5.1 Outdoor Firing Ranges

Baseline

Per AR 200-1 (U.S. Army 2007)[2], small arms operations for the Baseline case were analyzed using PK15(met). The noise zone definitions were provided in Table 15.

Since the contours are based on peak levels rather than a cumulative or average level, the size of the contours would not change if the number of rounds fired increases or decreases.

The small caliber weapons noise contours for the Fort Pickett Baseline case, which were developed by the USAPHC[1], are shown in Figure 18. Along the eastern boundary, Zone II [87 dB PK15(met)] extends less than 5,900 feet (1.1 miles) into the community and Zone III [104 dB PK15(met)] extends less than 820 feet into the community. Based on available imagery, the Zone II and III areas outside Fort Pickett are primarily undeveloped. There may be scattered residential properties within Zone II.

These contours were generated using SARNAM which requires specific firing point and target point locations entered into the model. At several of Fort Pickett training areas and ranges, there are no set firing points or target point locations and firing can occur at multiple locations and in multiple directions. The USAPHC addressed this by estimating the peak levels for specific types of munitions and determining at what distances noise levels would approach Zone II limits [PK15(met) 87 decibels (dB)]. Although the USAPHC did this for several types of munitions, the loudest in the group is the .50 caliber blank activity for which Zone II levels would extend out approximately 2,625 feet. For the .50 caliber and all other munitions analyzed, noise levels approaching Zone II limits [PK15(met) 87 dB] would either be

contained within the small caliber noise zones shown in Figure 18 or would not extend beyond the Fort Pickett boundary.

Proposed Action

The preceding analysis of small caliber weapons noise refers to the Fort Pickett Baseline operations conducted at existing outdoor ranges. The only outdoor firing range associated with the proposed FASTC operations is R05 which has the same activity and layout as existing Range 8, used by Fort Pickett. Because this analysis was conducted using peak sound levels, the additional activity associated with R05 would not change the Baseline peak sound level contours (or noise zones) depicted in Figure 18.

The remaining four FASTC firing ranges are indoor ranges. The noise assessment for these ranges is presented in the following section.

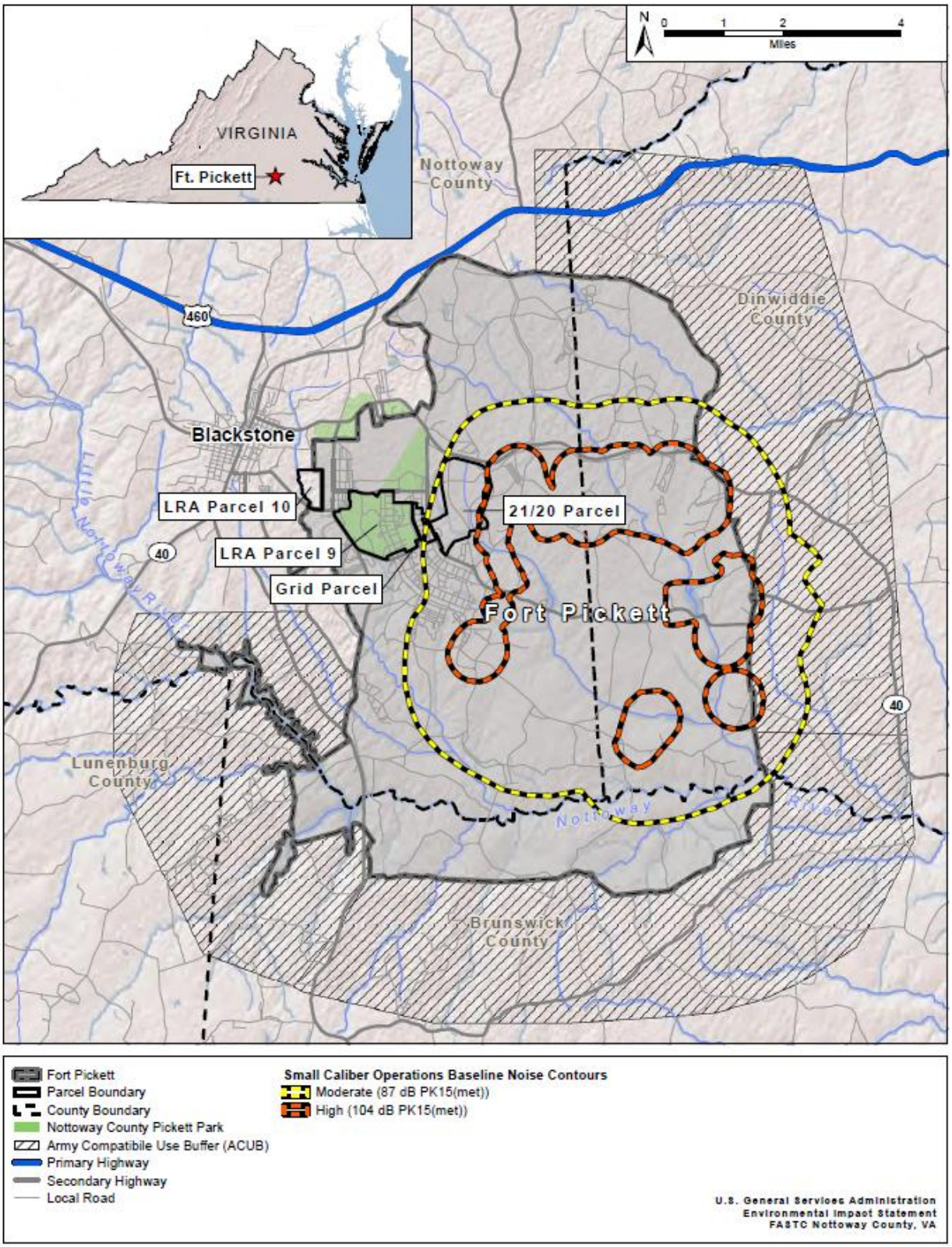

Figure 18. Small Caliber Operations Noise Contours (Fort Pickett Baseline).

5.2 Indoor Firing Ranges

Baseline

All firing ranges at Fort Pickett are outdoor ranges; therefore, the Fort Pickett Baseline does not include indoor firing ranges.

Proposed Action

The proposed FASTC indoor ranges include the Indoor Firing Range (R02), One-Story Live Fire Shoot House (R03a), Two-Story Live Fire Shoot House (R03b) and the Baffled Indoor Tactical Combat Range (R04). Weapons to be fired in these ranges include handguns (.357 magnum, 9mm, and .40 caliber), M16 Rifle (5.56mm), Shotgun (12 gauge), and Machine Guns (9mm, 0.40 caliber, and 0.45 caliber), with operations distributed on each range as indicated in Table 9.

Modeling the activity for indoor ranges was done making some assumptions about the building type because the designs for these ranges are not final. The indoor ranges are expected to be fully enclosed, however no firing range noise model currently available can account for a full or partial structure. Preliminary plans for these indoor ranges have indicated different types of structures, some with interior sound absorption to make the facility as 'sound proof' as possible. Generally, the exterior noise level of an enclosed small arms range is of little concern due to the attenuation effects of the structure itself.

To estimate the exterior noise levels for an indoor range, the building construction Noise Level Reduction (NLR) is used. For example, if the building construction of the indoor ranges was the common brick and mortar type, a typical NLR value of 25 dB would be used to represent this type of construction. If the brick and mortar structure also had interior sound absorption or other noise mitigation, the NLR would be expected to be higher (30 dB or more). Or, If the construction was wood exterior, the NLR would be expected to be lower (15 dB).

Since there are several different types of structures proposed for the indoor ranges, and the design plans for these structures have not been finalized, a generic case is presented here. In this example, it is assumed that the building construction of each indoor range is the brick and mortar type, with a corresponding NLR value of 25 dB provided on the exterior of the building.

Using the SARNAM[6] noise model program, combined with the building NLR value of 25 dB, an estimate of the exterior peak sound levels can be made for a generic indoor range utilizing the proposed FASTC operations. Table 18 shows the results of this exercise where the exterior peak sound levels are estimated for each FASTC weapon type and live round for two representative distances (328 feet and 656 feet) and three azimuths (0°, 90° and 180°) from the firing position. In this case, 0° is directly in front of the weapon and 180° is directly behind the weapon.

Table 18 shows a range of peak noise levels for each distance and azimuth from the firing position. For each range of levels, the lower number represents the level exceeded 85 percent of the time (mean-1σ)

and the higher number represents the level exceeded 15 percent of the time (mean +1σ). This bounds the range of exterior peak noise levels accounting for statistical variation in meteorological conditions.

Table 18. Predicted Exterior Peak Sound Levels for Indoor Range Operations

Weapon Type and Round		Predicted Exterior Peak Sound Level, dBP					
		Distance = 328 feet			Distance = 656 feet		
		Azimuth			Azimuth		
		0°	90°	180°	0°	90°	180°
Handgun	.357 magnum	93-103	87-97	86-96	86-96	80-90	78-88
Handgun	9 mm	83-93	78-88	74-84	77-87	71-81	68-78
Handgun	.40 cal	83-93	80-90	80-90	77-87	73-83	73-83
Rifle	5.56 mm	93-103	86-96	76-86	86-96	79-89	69-79
Sub-machine gun	9 mm	83-93	78-88	74-84	77-87	71-81	68-78
Sub-machine gun	.40 cal	83-93	80-90	80-90	77-87	73-83	73-83
Sub-machine gun	.45 cal	83-93	80-90	80-90	77-87	73-83	73-83
Shotgun	12 guage	92-102	80-90	81-91	85-95	73-93	75-85

Notes: the 0° is directly in front of the weapon and the 180° azimuth is directly behind the weapon.
NLR estimated at 25 dB.

For example, the Shotgun (12 gauge) is one of the loudest weapons where the exterior peak levels, at 328 feet (100 meters) from the firing position, are predicted to be within a range of 92-102 dBP in front of the weapon or in the firing direction. To the side of the weapon, the exterior peak levels are predicted to be within a range of 80-90 dBP and behind the weapon, 81-91 dBP.

With brick and mortar construction and estimated building attenuation of 25 dB, the Zone III noise contour (> 104 dBP) is expected to remain relatively localized and within 328 feet to the front of the weapon position for all weapons indicated in Table 18. In comparison, the Zone II contours (87-104 dBP) extend further covering a larger area around the firing range. Noise approaching or within Zone II levels (87-104 dBP) would extend out approximately 656 feet in front of the weapon position for all weapons indicated in the table. Due to noise directivity, levels to the side and behind the weapon are reduced when compared to levels in front; this is normally true for a weapon fired in open space. Depending on the structure and interior acoustics of an indoor range, this directivity pattern can potentially change. Therefore, the levels presented in Table 18 are estimates which use the noise directivity patterns of each weapon, without accounting for any filtering of the range structure.

Zone II noise levels estimated for all FASTC firing range operations are expected to remain within the Fort Pickett boundary. The noise levels in Table 18 can be used to estimate the location of the Zone II and Zone III contours for a building NLR of 25 decibels. The results for using a different building NLR value can be determined by adding (or subtracting) decibels to the levels in Table 18. For example, if the NLR was 15 dB, 10 dB would be added to the levels in Table 18 whereas if the NLR was 30 dB, 5 dB would be subtracted from the levels in the table. It is expected that firing range buildings would be designed to ensure noise levels at adjacent facilities are within acceptable levels.

6 Occupational Noise Exposure

The proposed FASTC training operations are estimated to have limited additional noise exposure on the surrounding residential communities beyond the existing Baseline noise at Fort Pickett. However, FASTC training operations are expected to increase noise levels within Fort Pickett where new facilities are to be located. One concern for personnel working or training at these facilities is that some noise events may be of high enough intensity to damage unprotected hearing.

The various training events are expected to generate different types of noise ranging from the continuous sound of cars on the drive tracks to impulsive sounds of gun fire and demolition activity on the ranges. A person's cumulative noise exposure to continuous noise is determined from the constantly varying noise levels and the duration of exposure to each level. The evaluation of continuous noise uses the A-weighting filter adjustment which corresponds well to human hearing sensitivity, reducing the contribution of lower frequency noises. A person's exposure to impulsive noise is typically quantified using the unweighted peak noise metric since the unweighted or 'flat' response better approximates human hearing sensitivity to loud sounds.

The federal Occupational Safety and Health Administration (OSHA)[3] has established decibel (dB) levels for hearing protection that include limits on "continuous" and "impulsive" noise exposure. For continuous noise, the OSHA criterion level or permissible exposure limit (PEL) is 90 decibels (A-weighted), as an 8-hour, time-weighted average level (TWA). This standard specifies a 5 dB exchange rate and slow response measurement. Using this criterion, individuals may be exposed to a noise level of 90 dBA for no longer than 8 hours before a temporary threshold shift is expected. Higher levels are permitted for shorter durations. For example, a TWA level of 95 dBA reduces the time for an individual to receive a maximum dose from 8 hours to 4 hours. Similarly, for a TWA level of 85 dBA, the permissible exposure time is increased by a factor of two. The OSHA hearing protection criterion limits the maximum A-weighted sound level (for unprotected personnel) to 115 dBA (for 15 minutes); the threshold level for dose computations is 80 dBA.

Although the permissible noise exposure limit is defined as 90 dBA for 8 hours, OSHA also published a hearing conservation amendment (HCA) which specifies that employers must administer a continuing, effective hearing conservation program whenever employee noise exposures are at or above an 8-hour TWA of 85 dBA. For evaluation of continuous noise at the FASTC facilities, the 85 dBA level was used to identify areas where personnel could potentially be at risk.

For impulsive noise, the OSHA criterion for unprotected occupational noise exposure is an unweighted peak level of 140 dB. The OSHA procedure for determining occupational noise exposure is to evaluate both continuous and impulsive noise separately using their respective criteria. If, in either case, noise levels exceed the stated criteria then OSHA requires a reduction in noise exposure via implementing a hearing conservation program.

For each of the FASTC facilities, the proposed operations and associated noise levels determined previously were evaluated using the appropriate OSHA criterion. Table 19 identifies the FASTC training

facility operations and indicates whether either of the OSHA criteria, for peak sound pressure level or the 8-hour TWA level, are expected to be exceeded at the facility. It should be noted that each type of facility and operations are evaluated using only one of the two OSHA criteria, depending on whether the noise source is considered impulsive or continuous.

Table 19. OSHA Occupational Noise Exposure Evaluation for FASTC Facilities

FASTC Training Facilities/Operations	OSHA Occupational Noise Exposure Standard 1910.95	
	Impulsive Sound	Continuous Sound
	Peak SPL Exceeds 140 dBP	8-hr TWA Exceeds 90 dBA
High-Speed Anti-Terrorism Driving, D02 (Tracks 1-3)	N/A	No
Skid Pad Exercises at D02 (Tracks 1-3)	N/A	No
Car Impact Events at D02 (Tracks 1-3)	N/A	No
Mock Urban and Rural Drive Courses T02, D03 and E04	N/A	No
Off-Road (D05) and Unimproved Road (D04) Drive Courses	N/A	No
Indoor Firing Ranges (R02, R03a, R03b and R04)	Range Interior Locations	N/A
Outdoor Firing Range R05	Range Interior Locations	N/A
Demolition Ranges (E02, E03, E04, E05b and E05c/d)		
C4/C2 Detasheet, 1/10 LB	< 492 feet	N/A
C4/C2 Detasheet, 1/3 LB	< 656 feet	N/A
C4/C2 Detasheet, 1 LB	< 984 feet	N/A
C4/C2 Detasheet, 3 LB	< 1148 feet	N/A
Simulators (flash bangs) at D02 and E04	< 328 feet	N/A

The driving operations (high-speed tracks, urban, rural and off-road/unimproved courses) are more accurately characterized as continuous noise sources, rather than impulsive, although noise generated at these tracks would be intermittent because cars would be dispersed on the tracks. Based on model predictions and measured data[14], none of the individual car passes (with speeds of up to 100 mph) or group of cars would exceed 85 dB(A) at distances greater than about 100 feet from the track. Since there are a limited number of operations per day on each track (far lower than would be considered continuous for eight hours) the OSHA 8-hour TWA for each track would be significantly less than the 85 dBA criteria.

The skid pad exercises and the car impact events were also evaluated using the criteria for continuous noise, although these events are of short duration. Measurements conducted for the skid pad and car impact exercises[14] show that the maximum A-weighted levels recorded for each did not exceed 100 dBA at distances of approximately 15 feet from the test track. Considering the proposed number of events per day, it is estimated that the skid pad exercises and car impact events would not exceed the OSHA 8-hour TWA criteria of 85 dBA at any locations in the vicinity of the drive tracks.

While the car operations on the drive tracks and courses are not expected to exceed the TWA limits for continuous noise, operations associated with firing ranges, demolition ranges and simulators are expected to exceed the peak sound level criteria at certain distances from the source, depending on the type of munitions used. These high-intensity, impulsive noise sources are expected to create a hazardous noise environment for people working and training at these facilities.

For this analysis, all of these operations are considered short duration, impulsive noise sources; although, at firing ranges, in cases where shooters on the firing line are exposed to noise from multiple guns being fired, then this could, at times, be considered a continuous noise source.

It is well known that high-powered guns generate peak noise levels that often exceed the OSHA 140 dB peak limit, for unprotected personnel, at the shooter's location. The area where peak levels are 140 dB or higher would potentially extend farther from the shooter's location, depending on the design of the range (i.e., size, type of enclosure and interior acoustic characteristics). A single unprotected exposure to loud gunfire can result in a temporary hearing loss. However, repeated exposure to impulsive firearm noise can result in permanent noise-induced hearing loss.

Due to both the high intensity of firearm noise and the preliminary nature of the FASTC range designs, all indoor and outdoor firing ranges are identified in Table 19 as areas where the OSHA 140 dB limit would likely be exceeded; and potentially at large areas surrounding the firing line. This is a typical result since all firing ranges generate these types of impulsive sound levels, requiring anyone located within the range to wear hearing protection. To be in compliance with the OSHA Occupational Noise Exposure Standard 1910.95[3], operators of the FASTC firing ranges are expected to provide hearing protection to personnel working and training inside these ranges during shooting practice.

FASTC demolition training would use explosives with higher power than ordinary firearms, yet lower power than some of the high explosive munitions used by Fort Pickett. Originally shown in Table 7, these explosives range in weight from 2 ounces black powder up to 3 pounds of C4/C2 Detasheet. In Table 19 several explosive weights, within this range, were evaluated for noise exposure, including C4/C2 Detasheet (1/10, 1/3, 1 and 3 pounds). BNOISE2 was used to determine the approximate distance to the 140 dBP contour (measured along an azimuth of 0° from the blast location). Table 19 indicates the estimated distances from each demolition event where the peak levels would be equal to or higher than 140 dBP; locations within these distances are considered to be in a hazardous noise zone during live operations. For safety purposes, fragmentation guidelines are expected to be more stringent than the noise distance guidelines shown in Table 19. In any case, hearing protection would be required to be used by personnel working or training in any of the FASTC demolition ranges during live operations.

Simulators are expected to be used at several locations near drive tracks 1-3 (D02) and Explosives Simulation Alley (E04). Peak noise levels for simulators were reported in section 4.3 to be 134-136 dBP at a distance of 328 feet from the blast. In Table 19, 328 feet is listed conservatively as the distance within which the OSHA 140 dBP limit would be exceeded.

OSHA criteria were evaluated above for noise associated only with the proposed FASTC facilities. However, noise from Fort Pickett operations, especially peak levels from demolition and large caliber weapon operations, should also be a concern to any personnel on base. Since Fort Pickett operations are well established, it is expected that hearing protection is already used by personnel in the vicinity of the Fort Pickett demolition ranges and large caliber operations.

7 References

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Appendix A: Project Assumptions

1. Noise analysis was conducted to predict the noise environment that would result from implementing the development of FASTC at Fort Pickett, Virginia.

2. The locations of the facilities for Build Alternatives 1 and 2 were based on FASTC Master Plan concepts dated May 15, 2012 (Alternative 1) and July 27, 2012 (Alternative 2).

3. Operations data for all FASTC driving exercises, small arms range activity and demolition exercises were initially obtained from the previous Shen, Milsom & Wilke report (SM&W #09250) on the proposed FASTC site in St. Mary's County, Maryland. These data were assembled by BRRC into a data validation package for approval by GSA/DOS. The operations data used in this analysis were from the data validation package dated May 2012.

4. FASTC noise analysis was conducted for three main types of exercises; car driving exercises, small arms range activity and demolition exercises. Where applicable these exercises were combined with similar existing Fort Pickett exercises; primarily this meant combining FASTC demolition operations with Fort Pickett demolition and large caliber operations.

5. Industry standard noise models were used for all FASTC noise analysis except to predict noise levels from car ramming and tire squeal exercises. Large arms modeling was conducted using the BNOISE2 Large Arms Noise Assessment Model (version 1.3 2003 -07-03), small arms modeling was conducted using the SARNAM2 Small Arms Range Noise Assessment Model (version 2.6 2003-06-06), and drive track/course noise levels were determined using the Federal Highway Administration's Traffic Noise Model (FHWA TNM) version 2.5, February 2004 and associated reference noise (REMEL) data.

6. Noise metrics and reporting methodology, for the large and small arms noise analysis, were the same as those used by the Army PHC (USAPHC) in their recent (2011) Baseline noise analysis for Fort Pickett. This allowed a direct comparison with the Fort Pickett Baseline, and because the metrics and methodology used by the USAPHC are considered to be the industry standard.

7. Noise measurements for several FASTC driving activities had previously been recorded by Shen, Milsom & Wilke and these were considered for use on this project. The measurements found suitable for use in this analysis were for tire squeal and car ramming exercises; these measured data were used in this analysis to predict noise levels for these two exercises. Noise levels for all other driving exercises were estimated using TNM and the associated REMEL data.

8. Several modeling assumptions are noted: (1) the 3 pound demolition charge, which is the highest yield charge proposed for FASTC use, was modeled in BNOISE2 using the 3.5 pound surrogate because data for a 3 pound charge is not available. Contours generated by the available options (3.5 pound and 2.6 pound) indicated that there was not much of a difference between these two; therefore, modeling the 3.5 pound charge in the study was appropriate (i.e., using the 2.6 pound charge would not have affected the results significantly.; (2) the unimproved road and off-road courses were modeled using pavement as the road surface rather

than dirt; this was done because there is no noise data available for car driving on dirt roads. With reasonable approximation, pavement can be considered as 'best available' data. It should also be noted that the driving operations on the unimproved road and off-road courses are significantly less than those on the other FASTC high speed driving tracks and therefore noise levels generated by these courses are lower than the noise levels generated by the other tracks.

9. For the demolition and large caliber noise analysis, the metrics used were CDNL to assess land use compatibility and PK15 and PK50 to assess complaint risk. PK15 represents the peak noise level that is exceeded only 15 percent of the time, based on unfavorable weather conditions; this is a commonly used metric for this type of analysis but it does assume that these unfavorable weather conditions occur 15 percent of the time. Actual Fort Pickett weather data may indicate something different.

10. Detailed architectural designs for the FASTC small arms ranges were not available at the time of this noise analysis; therefore, to estimate exterior noise levels a general case was presented assuming a common brick and mortar structure. This analysis of exterior noise levels was presented in such a way that, once detailed estimates of building noise reductions become available, these noise reductions could be used to recalculate the exterior noise levels, using a simple procedure, if desired.

11. The analysis of simulators was based on project layouts for Alternative 1 dated May 15, 2012 and Alternative 2 dated July 27, 2012 and operations listed in the Data Validation Package dated May 2012. The Master Plan will continue to evolve and the location and operations of simulator detonations may change from that analyzed in this report. Any potentially significant change to the future noise environment presented in this report would be monitored and additional impact analysis performed if required.

Appendix H

Traffic Impact Analysis

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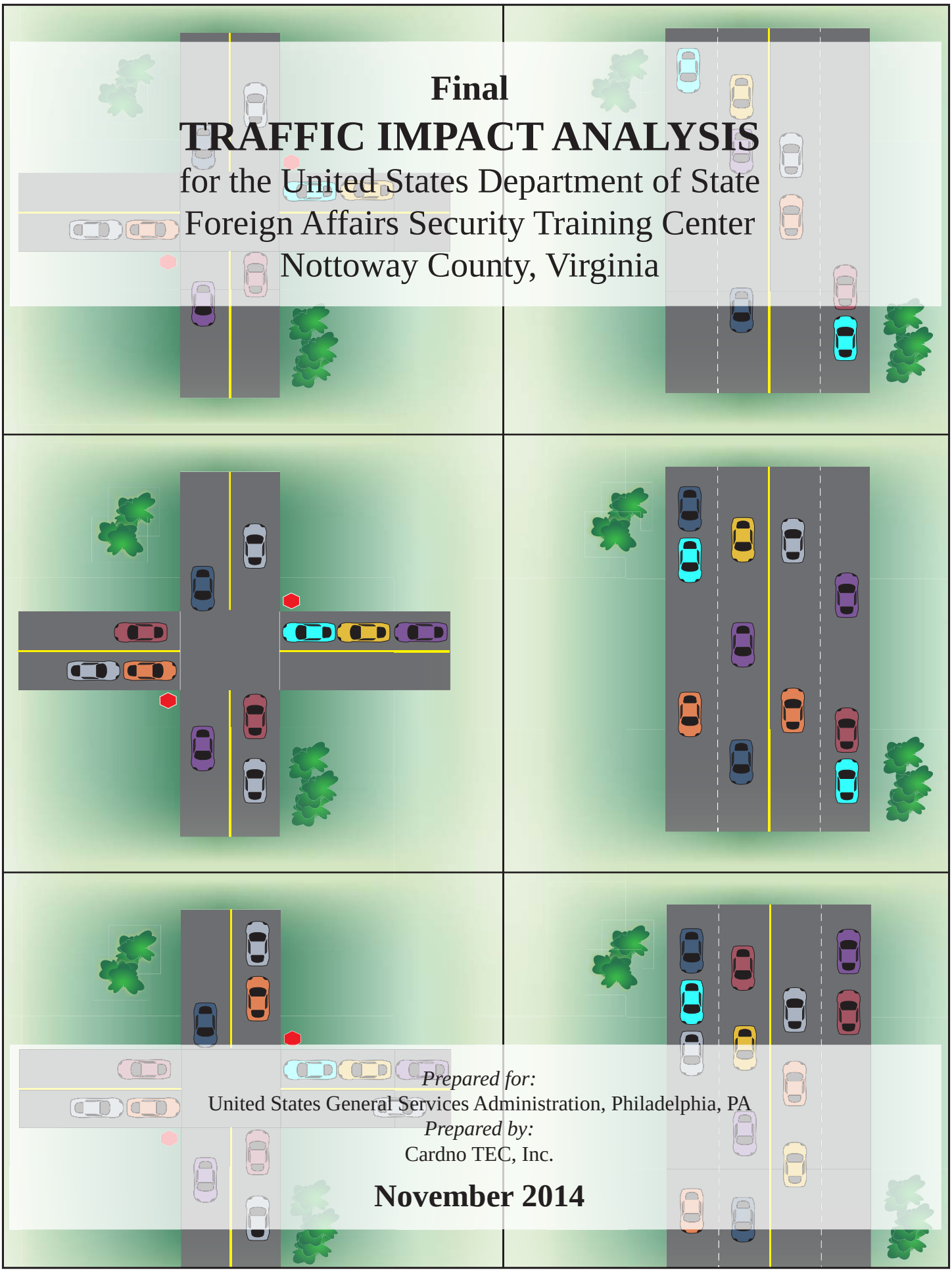

Final
TRAFFIC IMPACT ANALYSIS
for the United States Department of State
Foreign Affairs Security Training Center
Nottoway County, Virginia

Prepared for:
United States General Services Administration, Philadelphia, PA
Prepared by:
Cardno TEC, Inc.

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ACRONYMS AND ABBREVIATIONS

ARNG	Army National Guard
DOS	U.S. Department of State
FASTC	Foreign Affairs Security Training Center
Fort Pickett	ARNG Maneuver Training Center Fort Pickett
GSA	U.S. General Services Administration
HCM	Highway Capacity Manual
ITE	Institute of Transportation Engineers
LOS	Level of Service
LRA	Local Redevelopment Authority
MUTCD	Manual on Uniform Traffic Control Devices
ROI	region of influence
SDEIS	Supplemental Draft Environmental Impact Statement
SR	Secondary Road
TIA	Traffic Impact Analysis
TRB	Transportation Research Board
U.S.	United States
VA Route	Virginia Route
VDOT	Virginia Department of Transportation
vph	vehicles per hour
vphpl	vehicles per hour per lane

EXECUTIVE SUMMARY

This Traffic Impact Analysis (TIA) has been prepared to analyze the traffic-related effects of the proposed United States (U.S.) Department of State (DOS) Bureau of Diplomatic Security Foreign Affairs Security Training Center (FASTC) (the Proposed Action), a training facility for U.S. government security personnel to be established at the Army National Guard Maneuver Training Center Fort Pickett (Fort Pickett) and Local Redevelopment Authority land in Nottoway County, Virginia. The Proposed Action would consolidate hard skills training functions currently taking place at various leased and contracted facilities into one state-of-the-art center. This TIA considers planning year 2018 operational conditions because 90 percent of the training program would be operational by 2018. By 2020, 100 percent of training would be operational. This TIA evaluates the full buildout of the Proposed Action by the year 2018. The Proposed Action's year 2018 traffic generation is increased by 10 percent to capture 100 percent of project traffic.

This TIA is a supplement to an earlier TIA prepared by the U.S. General Services Administration (GSA) and DOS in 2012 (GSA/DOS 2012). The earlier TIA is referred to throughout this document as the "2012 TIA." This TIA incorporates many of the key assumptions, counts and methods used in the preceding document. However, various changes have been incorporated into the Proposed Action since the completion of the 2012 TIA, including revisions to the project footprint, site access, and on-site land uses. Because these changes would substantially alter the Proposed Action's traffic generation and trip distribution, this TIA includes updated analyses and new findings and recommendations.

Two access options are analyzed. Under Option A, access for project-related traffic to FASTC would be provided at the existing Fort Pickett Main Gate (i.e., on Military Road south of Darvills Road) and the existing Fort Pickett West Gate (i.e., on West Entrance Road west of Military Road). The existing closed gate across Dearing Avenue north of W. 10th Street would remain closed under this option. Under Option B, the main access to FASTC would be at an additional access point that would be established on Dearing Avenue, north of W. 10th Street (i.e., the existing closed gate would be replaced by an operating controlled access). This TIA assumes Fort Pickett traffic would continue to access through the Main Gate and the West Gate, and a limited amount of FASTC traffic would also access through these existing gates. The majority of all FASTC trips (i.e., approximately 80 percent), including all bus and minivan trips, would be directed to the proposed Dearing Avenue gate under Option B.

Access to and from the FASTC facility would be concentrated along Dearing Avenue between Military Road and W. 10th Street. A one-way loop circulation road (or "Entry Loop") would be constructed to the west of Dearing Avenue, and would form two intersections with this roadway. The one-way traffic flow would be from north to south. The Entry Loop would provide access to and from the FASTC Core Area. The Core Area would accommodate the majority of trips accessing the facility. These trips include passenger cars driven by instructors and staff, buses transporting students from area hotels, and minivans transporting students from the Core Area to training venues within FASTC.

The following analyses were performed under year 2018 conditions for both options.

- Peak hour (i.e., 6:30 to 7:30 a.m. and 4:00 to 5:00 p.m.) capacity analysis at 15 intersections;

- Turn lane storage and taper requirements at four intersections on designated Virginia Department of Transportation (VDOT)-maintained facilities; and
- Peak hour traffic volumes and staffing requirements at Fort Pickett access gates.

This TIA also addresses traffic signal warrants and provides a qualitative assessment of site access and internal circulation. The key findings and conclusions of these analyses are described below.

- *Capacity Analysis*: Most traffic movements at all intersections would be characterized by Level of Service (LOS) A or B with several movements having LOS C or better conditions during both peak hours for both options. Because the Proposed Action would not cause any movement to exceed the minimum performance standard of LOS D, its traffic impacts would be less than significant and no avoidance, minimization or mitigation measures are recommended.
- *Turning Lane Analysis*: Although there are no direct traffic impacts, a turning lane analysis was performed with projected year 2018 traffic volumes using VDOT design criteria for Access Management (VDOT 2005). These criteria address turning lane needs and design features to ensure safe and efficient traffic movements.
    - Under the No Action Alternative without the proposed project, the turning lane analysis determined that 2018 traffic volumes would result in the existing turning lane storage being less than VDOT design standards at two intersections, and that the following turning lane improvements may be warranted:
        1. New exclusive westbound left turn lane, including storage and taper, at the Cox Road/Military Road intersection.
        2. Extend the existing eastbound right turn lane storage and taper at the Darvills Road/Military Road intersection.
    - Under Build Alternative 3 for Option A and B, although there are no significant direct traffic impacts from the proposed project, the turning lane analysis determined that additional project-related traffic would result in the existing turning lane storage being less than VDOT design standards at three intersections. One movement of the U.S. Route 460/Cox Road intersection would be less than standard under Option A or B. Under Option B only, one movement at the Darvills Road/Military Road intersection and one movement at the Darvills Road/Dearing Avenue intersection would be less than standard. To address VDOT policy for turning lane storage criteria, the following turning lane improvements may be warranted at these three additional intersections:
        1. Extend the existing westbound left turn lane storage and taper at the U.S. Route 460/Cox Road intersection (Option A and B).
        2. New exclusive westbound right turn lane, including storage and taper, at the Darvills Road/Military Road intersection (Option B only).
        3. Extend the existing eastbound right turn lane storage and taper at the Darvills Road/Dearing Avenue intersection (Option B only).
- *Fort Pickett Gate Analysis*: Neither option would increase traffic levels at either the Main Gate or the West Gate so as to necessitate additional guards to process inbound trips. Under Option B, the projected future inbound volume at the proposed access gate on Dearing Avenue would be 148 vehicles during the morning peak hour. This is substantially below the minimum threshold of 375

vehicles per hour established by Virginia Army National Guard for two guards per lane. Therefore, based on Virginia Army National Guard criteria, a single guard would suffice at this location. However, the actual number of guards at this gate would be determined by DOS based upon a review of their doctrine and practice for access control.

- *Internal Circulation*: The Core Area would accommodate a mixture of vehicles, including personal vehicles, buses, and minivans. Also, there would be substantial pedestrian activity at the Core Area, as students would transfer from buses to minivans at this location. The following traffic circulation measure would avoid potential transportation-related effects:
    1. It is recommended that the Entry Loop be designed to accommodate and efficiently process vehicles approaching the Core Area. As feasible, passenger cars traveling to and from the surface parking lot should be separated from buses, minivans, and pedestrians. Where queues may form, sufficient storage should be provided to avoid blocking adjacent lanes and to prevent vehicles from stacking onto Dearing Avenue. To facilitate the transfer of students, minivans should be scheduled to arrive and park before buses in the morning, while buses should be in place before the arrival of minivans in the afternoon. Signage, pavement markings, pedestrian islands and other design elements should be considered to accommodate safe and efficient pedestrian movement at the Core Area.

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Chapter 1 INTRODUCTION

1.1 PROJECT LOCATION

This Traffic Impact Analysis (TIA) evaluates the potential traffic-related effects caused by the proposed construction and operation of a consolidated United States (U.S.) Department of State (DOS) Bureau of Diplomatic Security Foreign Affairs Security Training Center (FASTC) at Army National Guard (ARNG) Maneuver Training Center Fort Pickett (Fort Pickett) and Local Redevelopment Authority (LRA) land in Nottoway County, Virginia. This TIA supports National Environmental Policy Act analysis of the Proposed Action, and substantiates the analysis of transportation impacts documented in the Supplemental Draft Environmental Impact Statement (SDEIS) for FASTC Nottoway County, Virginia (referred to from here forward as the "FASTC SDEIS"). The proposed project site is located in south central Virginia, near the town of Blackstone in Nottoway County, approximately 60 miles southwest of Richmond and 40 miles west of Petersburg. The project site is within the Fort Pickett boundary, which contains portions of Nottoway, Dinwiddie, Brunswick, and Lunenburg Counties (**Figure 1-1**).

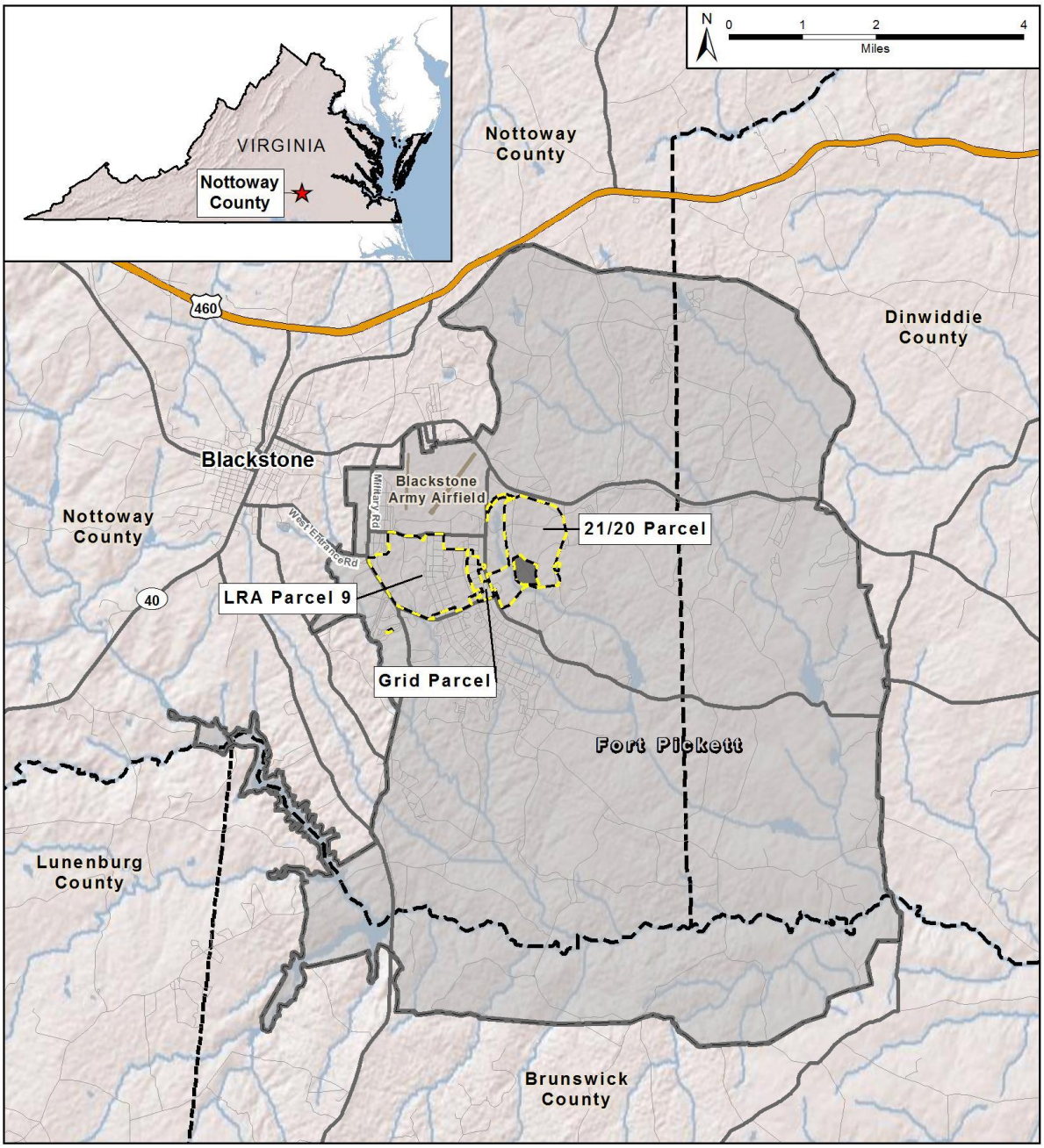
1.2 PROJECT BACKGROUND

1.2.1 Overview of the Proposed Action

The Proposed Action is the acquisition of land and the development of a consolidated DOS FASTC at Fort Pickett and LRA land in Nottoway County, Virginia. The Proposed Action would consolidate hard skills[1] training functions currently taking place at various leased and contracted facilities into one state-of-the-art center. These facilities would no longer be leased or contracted by DOS after full implementation of the Proposed Action.

After completion of construction, FASTC would be a consolidated hard skills training center for a rotating student population of 8,000–10,000 annually. FASTC would offer state-of-the-art instruction in hard skills, as well as support functions including administration and emergency medical technicians. Normal operating hours would be 7:30 a.m. to 5:00 p.m., Monday through Friday, 50 weeks a year. However, should operational needs so require, FASTC would have the capability to operate 24 hours a day, seven days a week, year round. An average of 600 students would be on-site on an average training day. Training would range from 5 days to 6 months in length, with an average student stay of 14 days.

[1] Tactical skills such as driving, weapons/explosives training, simulation, and other types of training.



Legend

- Fort Pickett
- Parcel Boundary
- County Boundary
- Primary Highway
- Secondary Highway
- Local Road
- Airfield Surface

Source: ESRI (2014)

Figure 1-1. Project Location

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FASTC staff would be anticipated to arrive at the facility between 6:30 a.m. and 8:00 a.m. and depart at 5:00 p.m., Monday through Friday. A small night crew would remain on-site for possible service calls. Similar hours are anticipated for occasional weekend training sessions. Limited night training sessions would require some FASTC staff to leave the facility between 7:00 p.m. and midnight. FASTC staff employees are anticipated to commute daily to the facility in personally operated vehicles, although a small portion may utilize van pools, if available.

Due to the substantial size of the entire project, FASTC would be constructed over a five-year period. Construction would begin in the fall of 2015 and would be completed by 2020. Training venues would begin to operate in 2016 with approximately 10 percent of training operations underway. By 2018, all training venues fundamental to the FASTC training program would be in place, and 90 percent of the training program would be operational. By 2020, 100 percent of training would be operational. Phasing schedules continue to evolve and would ultimately depend on timeframes for design and appropriated funding from Congress, but they are estimated in the FASTC SDEIS for the purposes of analysis.

1.2.2 Previous Studies

The U.S. General Services Administration (GSA) and DOS prepared a Draft Environmental Impact Statement for the FASTC project in 2012. As part of this effort, a TIA was prepared to assess the project's traffic-related effects. That document, referred to hereafter as the "2012 TIA," addressed the project's impacts on intersection capacity, turn bay storage, gate operations, and other topics (GSA/DOS 2012). This TIA is a supplement to the 2012 TIA and incorporates many of the key assumptions, counts and methods used in the preceding document. Since the completion of 2012 TIA, a draft Master Plan Update has been prepared (GSA/DOS 2014a). The Master Plan Update incorporates the following changes to the project description that are pertinent to traffic impacts:

- LRA Parcel 10, a development area located along the western boundary of Fort Pickett, is no longer a part of the Proposed Action;
- Lodging facilities have been removed from the Proposed Action. Instead, students would be housed in area hotels and would be transported to and from FASTC by bus;
- The Proposed Action may establish an access gate on Dearing Avenue to the north of W. 10th Street. (The traffic impacts associated with this access option are addressed in this TIA as Option B.); and
- As documented in the Master Plan Update, access to and from FASTC would be focused along Dearing Avenue. A Core Area would be established within the Grid Parcel, to the west of Dearing Avenue. A one-way Entry Loop circulation road would be built to connect the Core Area to Dearing Avenue. Instructors, staff and students would enter FASTC via the Entry Loop. Instructors and staff would park their personal vehicles in a surface lot, while students would be transported from the Core Area to FASTC training venues by minivans, which would be positioned at the Core Area before the students arrive by bus.

Because these changes would substantially change the number and directional distribution of project-vehicle trips, this TIA includes additional traffic data collection and updated traffic analyses.

1.3 ACCESS OPTIONS

The FASTC SDEIS evaluates one action alternative: Build Alternative 3. This TIA analyzes the traffic impacts associated with the Fort Pickett access options described below (**Figure 1-2**).

1.3.1 Option A

Under Option A, access to and from the project area would be provided via the existing Fort Pickett gates (i.e., the Main Gate and West Gate), which are located to the west of the proposed FASTC development. Project traffic would approach the Core Area entrance on Dearing Avenue primarily via W. 10th Street and Military Road. The existing gate across Dearing Avenue, to the north of W. 10th Street, would remain closed under this option.

1.3.2 Option B

Under Option B, a new Fort Pickett access gate would be established on Dearing Avenue, to the north of W. 10th Street. This TIA assumes Fort Pickett traffic would continue to access through the Main Gate and the West Gate, and a limited amount of FASTC traffic would also access through these existing gates. Project traffic would be able to approach FASTC via Darvills Road and Dearing Avenue. This proposed gate would accommodate the majority of FASTC trips, including all bus and minivan trips. To provide a conservative analysis, this TIA also assumes that the proposed new access gate could also be used by Fort Pickett personnel. As a result, some existing traffic accessing the installation via the Main Gate would shift to the proposed Dearing Avenue Gate.

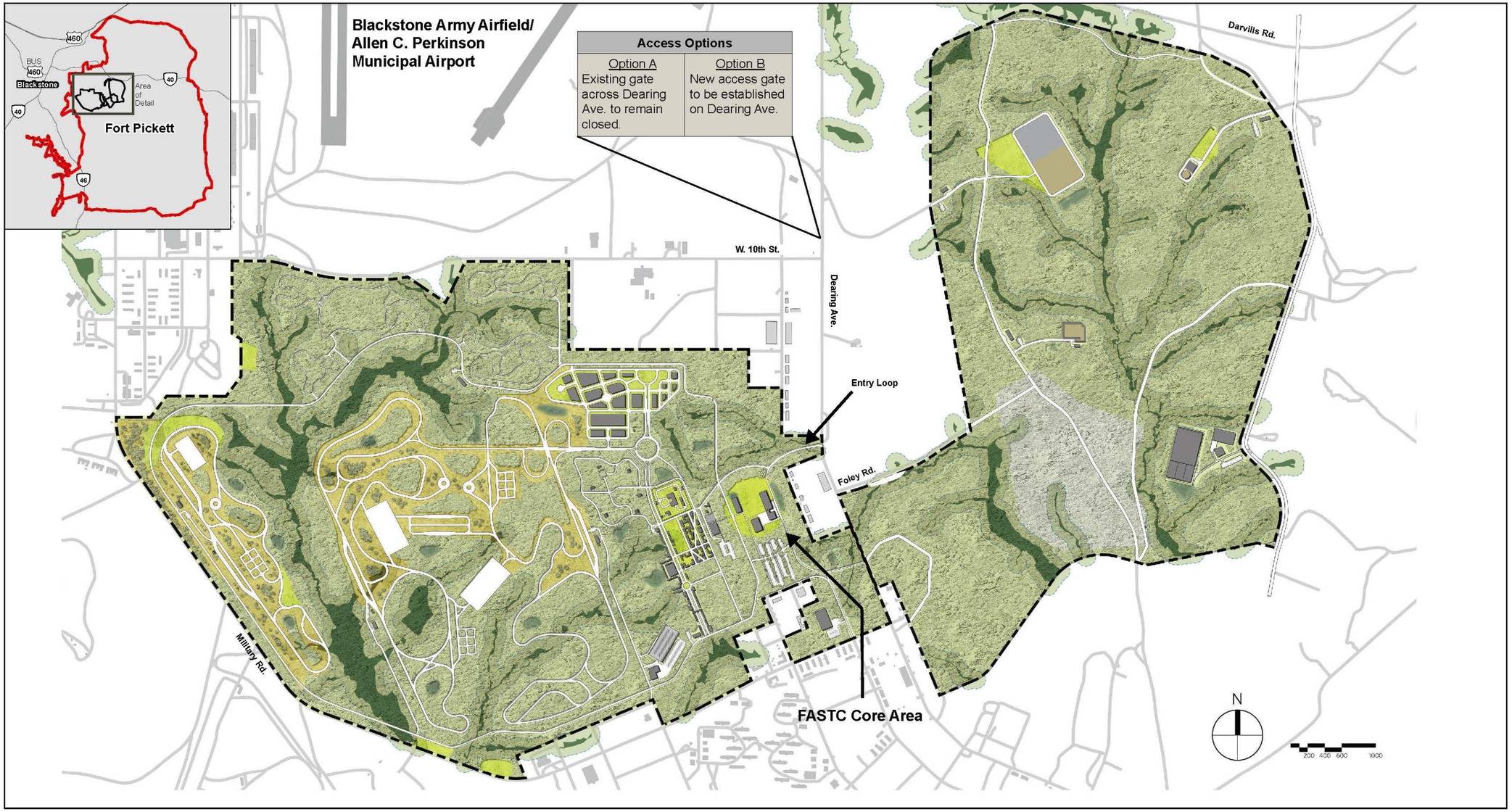

Figure 1-2. Build Alternative 3, Access Options A and B

Source: GSA/DOS 2014a

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Chapter 2 ANALYSIS METHODS

Because of the generally dispersed nature of land use development in the project area, and the absence of pedestrian, bicycle, and transit facilities and services adjacent to the FASTC site (GSA/DOS 2014a), the Proposed Action's transportation impacts would be caused by an increase in traffic (i.e., passenger cars, buses, and minivans) on the existing street network. Methods used to determine the significance of the Proposed Action's traffic impacts are described in the following paragraphs.

2.1 CAPACITY ANALYSIS PROCEDURES

Roadway and intersection operating conditions and the adequacy of existing roadway systems to accommodate projected future traffic are described in terms of Level of Service (LOS) ratings. LOS is a method used to rate the performance of streets, intersections, and other highway facilities. Developed by the Transportation Research Board (TRB), and documented since 1965 in various editions of the Highway Capacity Manual (HCM), LOS rates performance on a scale of A to F, with LOS A reflecting free flowing conditions and LOS F representing heavily congested conditions (TRB 2010). **Table 2-1** summarizes the general traffic conditions associated with each LOS rating.

Table 2-1. Traffic Conditions Associated with LOS Ratings

LOS Rating	Description of Traffic Conditions
A	Traffic flows freely, with little or no restrictions to vehicle maneuvers within the traffic stream.
B	Reasonably free-flowing conditions, with slight restrictions to vehicle maneuvers within the traffic stream.
C	Traffic speed approaches free-flowing conditions, but freedom to maneuver within the traffic stream noticeably restricted.
D	Traffic speed begins to be reduced, and freedom to maneuver is seriously limited due to a high concentration of traffic.
E	Unpredictable traffic flow, with virtually no usable gaps in the traffic stream to accommodate vehicle maneuvers.
F	Unstable traffic flow resulting in delays and the formation of queues in locations where traffic demand exceeds roadway capacity.

Source: TRB 2010.

2.1.1 Intersection LOS

Intersection capacity analysis was conducted in accordance with procedures contained in Chapter 18 (signalized intersections) and Chapter 19 (unsignalized intersections with stop signs on one or two intersection legs) of the HCM (TRB 2010). Data used in intersection analysis include peak-hour[2] turning movement traffic volumes, the number of lanes, the timing and phasing of the traffic signal, and other factors. Analysis was performed using the Synchro 8 software (published by Trafficware), which incorporates the current HCM analysis procedures (TRB 2010). LOS for signalized and unsignalized

[2] Typically the single hour having the highest concentration of traffic that occurs during traditional morning and afternoon commuting periods (i.e., 6:00 to 9:00 a.m. and 3:30 to 6:30 p.m.).

intersections is measured in terms of delay in seconds per vehicle. **Table 2-2** presents the delay values associated with each LOS grade for both signalized and unsignalized intersections.

Table 2-2. Intersection LOS Delay Thresholds

LOS Rating	Delay (seconds per vehicle)	
	Signalized Intersections	One-Way Stop-Controlled Intersections
A	≤10.0	≤10.0
B	>10.0 and ≤25.0	>10.0 and ≤15.0
C	>20.0 and ≤35.0	>15.0 and ≤25.0
D	>35.0 and ≤55.0	>25.0 and ≤35.0
E	>55.0 and ≤80.0	>35.0 and ≤50.0
F	>80.0	>50.0

Source: TRB 2010.

2.1.2 Target LOS and Significance Criteria

For the purposes of this TIA, the target LOS for intersections in the project area is LOS C. Accordingly, LOS A, B, and C are considered to be acceptable LOS, while LOS D, E, and F are considered to be unacceptable. Where a project has a significant impact on an intersection that does not meet the target LOS of C, mitigation measures may be identified to minimize or avoid the project's effect on traffic.

Based on typical industry standards, a project is considered to have a *significant impact* on the operations of an intersection when the addition of project traffic results in a LOS dropping from LOS C or better to LOS D, E or F. In addition, a project may contribute toward a substantial cumulative effect if its traffic, when taken together with traffic from past, present and reasonably foreseeable future projects, causes intersection LOS to decline from LOS A through C to LOS D through F.

2.2 Other Traffic Analyses

2.2.1 Turn Lane Analysis

An increase in the number of vehicles making left or right turns at an intersection may necessitate establishing or expanding turn lanes to improve traffic flow. Consistent with Virginia Department of Transportation's (VDOT) Road Design Manual. Appendix F (VDOT 2005), a turn lane analysis was performed for left and right turn movements at unsignalized intersections along state highways that are designated as principal arterials, collectors, and local streets. Designated routes in the traffic Region of Influence (ROI) include U.S. Route 460 and Darvills Road (VA Route 40) (VDOT 2007). Therefore, four intersections (i.e., intersections 1-3 and intersection 13) were evaluated. Turn lane requirements were analyzed per VDOT criteria, which provides guidelines for establishing turn lanes on two- and four-lane highways (VDOT 2005).

2.2.2 Fort Pickett Access Gate Analysis

At present, access to Fort Pickett is controlled by two access gates. The Main Gate is located on Military Road south of the intersection of Darvills Road. The West Gate is located on West Entrance Road west of the intersection of Military Road. The need for additional personnel at each access gate was evaluated based on peak hour traffic volumes and staffing thresholds established by the Virginia Army National

Guard. Specifically, the number of guards at each gate is determined based on the number of vehicles per hour per lane (vphpl) as follows:

1. < 375 vphpl: one guard
2. ≥ 375 and < 675 vphpl: two guards
3. ≥ 675 vphpl: three guards

The No Action Alternative and Option A analyzed the two access gates included in the 2012 TIA. The proposed Dearing Avenue access gate in Option B is expected to provide minimal traffic redistribution of both project related trips and Fort Pickett personnel, as discussed in Section 1.3.2.

2.2.3 Intersection Control Warrants

Changes in traffic patterns may necessitate modification of existing forms of traffic control, such as stop signs and traffic signals. The Manual on Uniform Traffic Control Devices (MUTCD) (Federal Highway Administration 2012) provides various thresholds that may be used to assess whether or not installation of a specific traffic control device is justified to better regulate traffic. Chapter 4C of the MUTCD includes a series of nine separate warrants that may be used to evaluate traffic signal installation. Consistent with the 2012 TIA, traffic signal warrant analysis is performed only at intersections with traffic movements characterized by LOS E or LOS F (GSA/DOS 2012).

2.3 Other Considerations

VDOT has established guidelines for the scope and content of a traffic impact analysis, which are described in the VDOT Traffic Impact Regulations (henceforth referred to as Chapter 527). A VDOT TIA is not required for this project since the FASTC site will generate less than 5,000 vehicles per day, which is the minimum threshold for a Chapter 527 study. Nevertheless, the 2012 TIA was developed in consultation with VDOT staff and completed in accordance with Chapter 527 (GSA/DOS 2012). The current TIA incorporates the same methods as the 2012 TIA and therefore also complies with Chapter 527. Consistent with direction from VDOT staff in the preparation of 2012 TIA, this TIA does not include a speed survey, an assessment of collision history, or an evaluation of intersection sight distance.

2.4 Traffic Region of Influence

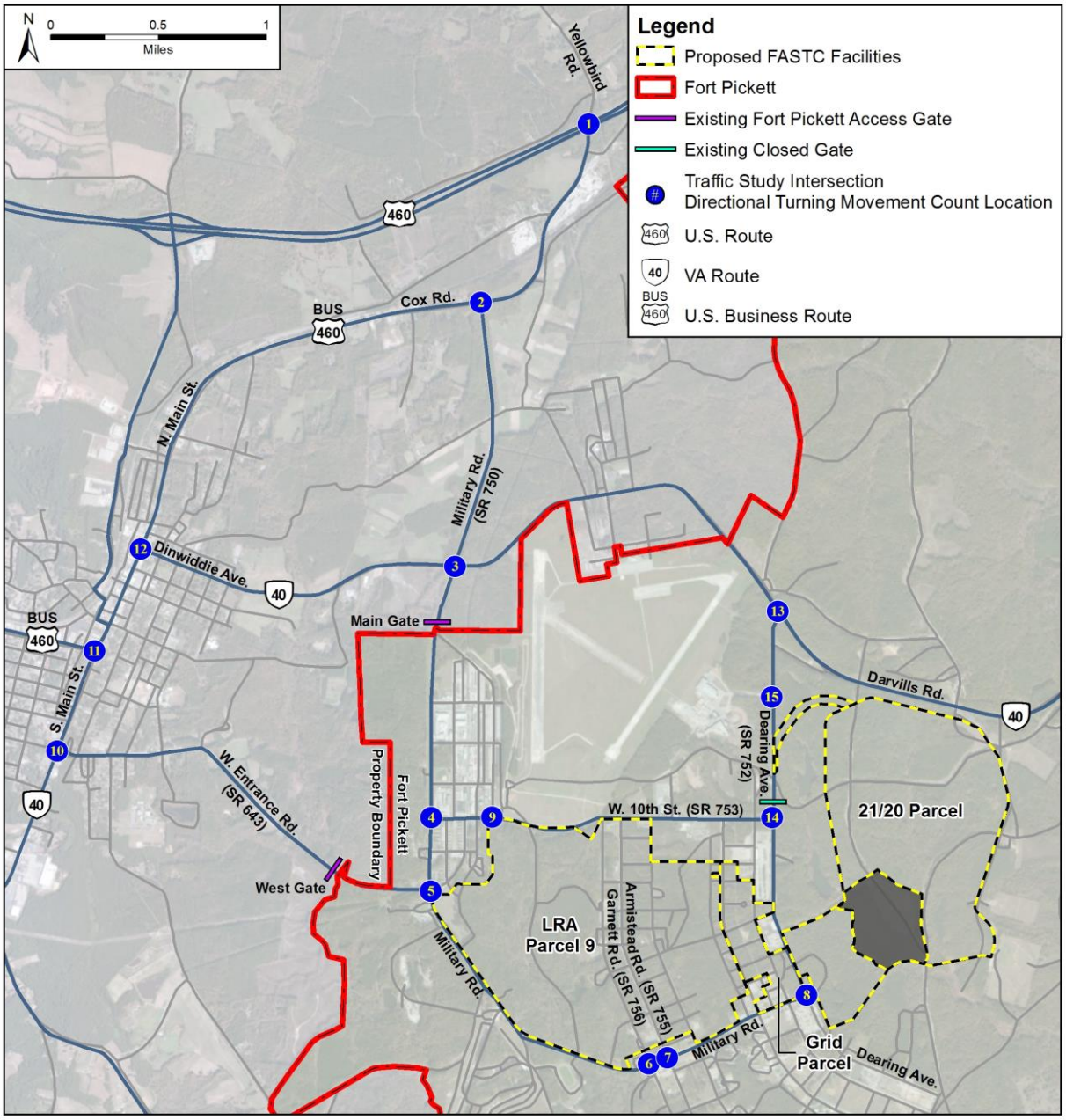
For the purposes of this TIA, the ROI consists of those intersections expected to accommodate the greatest concentration of project-related traffic. These intersections lie along likely routes between the trip origins (i.e., residences for instructors and staff and area hotels for students). The ROI consists of 15 intersections (**Figure 2-2**)[3]. **Table 2-3** lists the ROI intersections and type of existing traffic control provided at each location.

[3] Figure 2-2 and Table 2-3 include the VDOT route designations for roadways that are part of the state-maintained highway system (i.e., U.S. Route, Virginia Route, and Secondary Road). For ease of reference, these roadways are referred to by their street name (rather than route number) throughout the remainder of this TIA.

Table 2-3. ROI Intersections

Intersection*	Traffic Control
1. U.S. Route 460 (W Colonial Trail Highway)/Cox Road/Yellowbird Road SR 609)	Two-Way Stop
2. Cox Road (U.S. Route 460 Business)/Military Road (SR 750)	One-Way Stop
3. Military Road (SR 750)/Darvills Road (VA Route 40)	Two-Way Stop
4. Military Road/W. 10th Street	Two-Way Stop
5. Military Road/ West Entrance Road	One-Way Stop
6. Military Road/Garnett Avenue (SR 756)	Two-Way Stop
7. Military Road/Armistead Avenue (SR 755)	Two-Way Stop
8. Military Road/Dearing Avenue	Two-Way Stop
9. W. 10th Street (SR 753)/Warehouse Street	One-Way Stop
10. West Entrance Road (SR 643)/8th Street/S. Main Street (VA Route 40/U.S. Route 460 Business)	Signal
11. Church Street (U.S. Route 460 Business)/S. Main Street (VA Route 40/U.S. Route 460 Business)	Signal
12. Dinwiddie Avenue (VA Route 40)/N. Main Street (VA Route 40/U.S. Route 460 Business)	Signal
13. Darvills Road (VA Route 40)/Dearing Avenue (SR 752)	One-Way Stop
14. W. 10th Street (SR 753)/Dearing Avenue (SR 752)	One-Way Stop
15. Business Driveway/Dearing Avenue (SR 752)	One-Way Stop

Notes:
*Figure 2-2 depicts the intersection numbers. SR = Secondary Road; VA Route = Virginia Route.



Source: ESRI 2014

Directional Turning Movement Count Locations:

1. US Route 460 (W. Colonial Trial Hwy.)/Cox Rd. (US Route 460 Business)/Yellowbird Rd. (SR 609)
2. Cox Rd. (US Route 460 Business) at Military Rd. (SR 750)
3. Military Rd. (SR 750)/Darvills Rd. (VA Route 40)
4. Military Rd./W. 10th St.
5. Military Rd./ W. Entrance Rd.
6. Military Rd./Garnett Ave. (SR 756)
7. Military Rd./Armistead Ave. (SR 755)
8. Military Rd./Dearing Ave.
9. W. 10th St. (SR 753)/Warehouse St.
10. W. Entrance Rd. (SR 643)/8th St./S. Main St. (VA Route 40/US Route 460 Business)
11. Church St. (US Route 460 Business)/S. Main St. (VA Route 40/US Route 460 Business)
12. Dinwiddie Ave. (VA Route 40)/N. Main St. (VA Route 40/US Route 460 Business)
13. Darvills Rd. (VA Route 40)/Dearing Ave. (SR 752)
14. W. 10th St. (SR 753)/Dearing Ave. (SR 752)
15. Business Driveway/Dearing Ave. (SR 752)

Figure 2-2. Intersections in the ROI

Chapter 3 EXISTING CONDITIONS

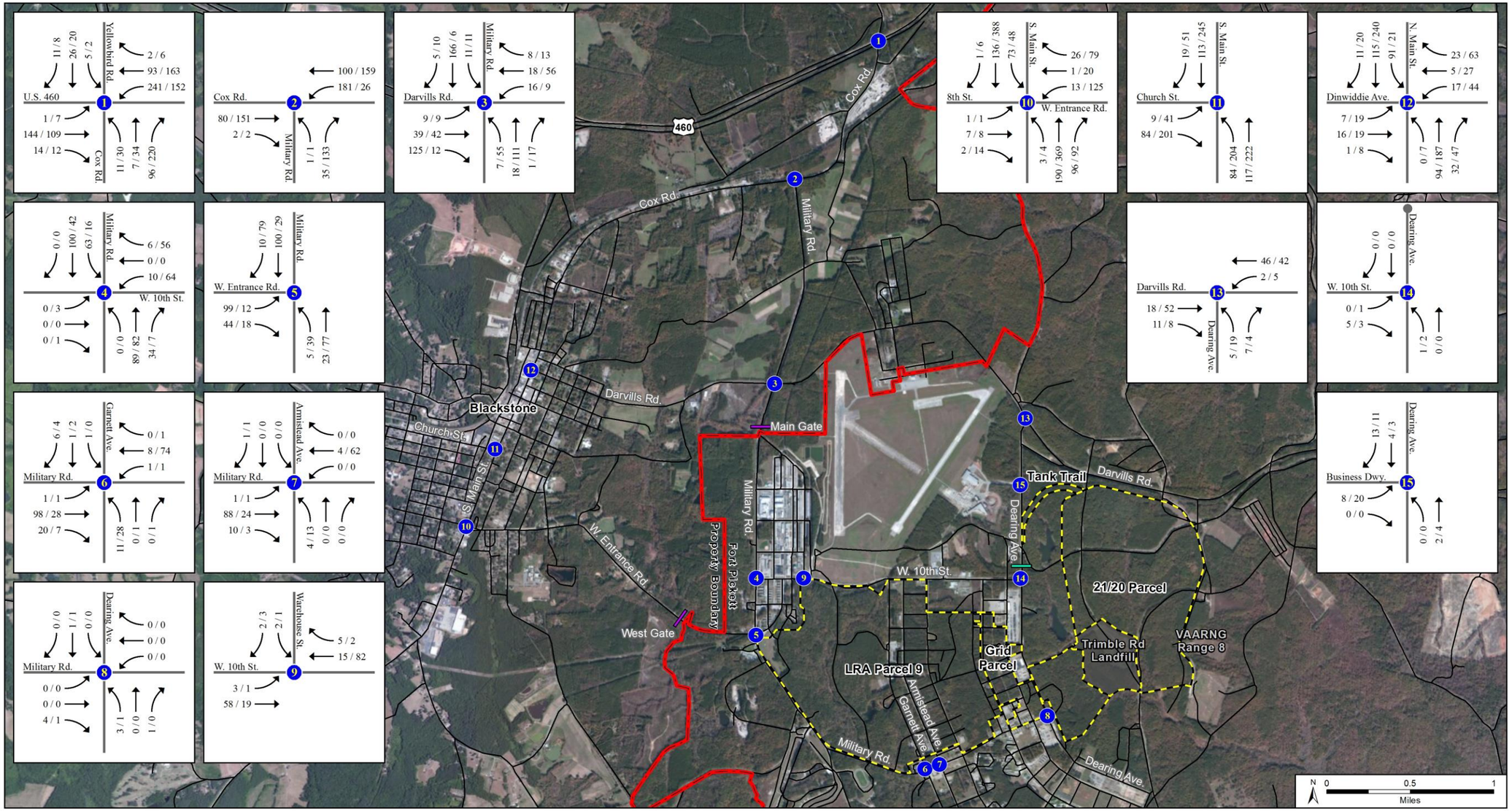
The Proposed Action would be developed within Fort Pickett, a military installation that contains several developed areas that are surrounded by undeveloped land. Access to Fort Pickett is controlled by two gates. The Main Gate is located on Military Road to the south of Darvills Road. The West Gate is located on West Entrance Road to the west of Military Road. Runways and related aviation facilities are located within the Blackstone Army Airfield/Allen C. Perkinson Municipal Airport, in the northwestern area of the installation. The Town of Blackstone is located along the western boundary of the installation. Other areas surrounding Fort Pickett to the north and east are characterized by undeveloped land, highways, and dispersed areas of low-intensity development.

3.1 EXISTING TRAFFIC COUNTS

Peak hour traffic data for intersections 1 through 12, as described in Table 2-2, was collected in support of the 2012 TIA in April 2012. Counts at intersections 13 through 15 were completed in August 2014. A compounded annual growth rate of one percent per year (GSA/DOS 2012) was applied uniformly to all movements in the 2012 counts to provide a consistent basis for evaluating existing traffic conditions. Therefore, the analysis presented in this Chapter is for the year 2014. The peak hours are 6:30 to 7:30 a.m. and 4:00 to 5:00 p.m. (GSA/DOS 2012). **Figure 3-1** depicts existing peak hour turning movement/traffic volume counts in the ROI. Attachment A contains copies of the 2014 traffic count summaries for intersections 13 through 15.

3.2 EXISTING TRANSPORTATION NETWORK

Existing lane geometry and traffic control for all ROI intersections is presented in **Figure 3-2**. Attachment B contains excerpts from the 2012 TIA that describes posted speed limits, functional roadway classifications in the Town of Blackstone, VDOT Secondary Roads (SR) proximate to the project site, programmed transportation improvements, and the Blackstone Area Bus System. Since the publication of the 2012 TIA, new information has become available regarding programmed transportation improvements and bus route alignment and schedule. The applicable exhibits in Attachment B have been revised to include the updated information. As applicable, data contained in Attachment B has been incorporated into the analysis summarized in this and subsequent chapters, consistent with the 2012 TIA. Specifically, posted speed limit data has been incorporated into the turn lane analysis that was performed at intersections 1 through 3 (refer to Section 3.4.1).



Legend

- Fort Pickett
- Parcel Boundary
- Intersection
- Road
- Intersection Turning Movement
- XXX / YYY Peak Hour Volume (am/pm)
- Existing Fort Pickett Access Gate
- Existing Closed Gate

Notes: Dearing Ave. is closed to through traffic north of W. 10th St.
Movements shown with a volume of zero are considered to accomodate a nominal amount of traffic.

Source: ESRI 2014

Figure 3-1. Existing (Year 2014) Peak Hour Traffic Volumes

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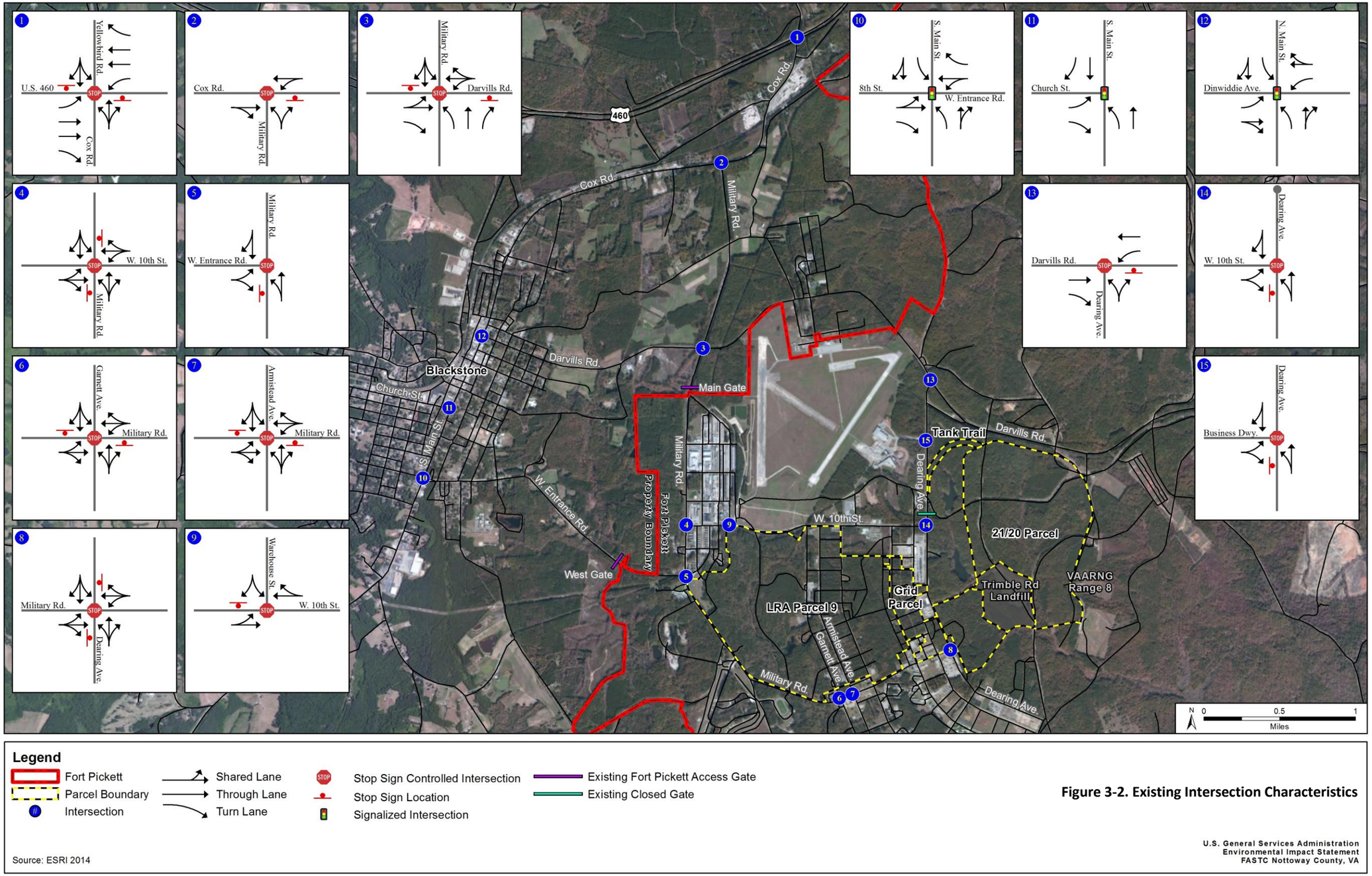

Legend

- Fort Pickett
- Parcel Boundary
- Intersection
- Shared Lane
- Through Lane
- Turn Lane
- Stop Sign Controlled Intersection
- Stop Sign Location
- Signalized Intersection
- Existing Fort Pickett Access Gate
- Existing Closed Gate

Source: ESRI 2014

Figure 3-2. Existing Intersection Characteristics

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3.3 INTERSECTION LOS

Existing traffic conditions within the ROI were evaluated using the methods described above in Chapter 2, and using the peak hour traffic volumes and intersection characteristics shown in Figures 3-1 and 3-2, respectively. Analysis worksheets for these intersections are provided in Attachment C. As shown in **Table 3-1**, most intersection movements are characterized by LOS A or B, and several have LOS C conditions during both peak hours.

Table 3-1. Summary of Intersection LOS – Existing Conditions (Year 2014)

Intersection		Traffic Control	Traffic Movement[a]	A.M. Peak Hour		P.M. Peak Hour	
				Delay[b]	LOS[c]	Delay[b]	LOS[c]
1	U.S. Route 460 (W Colonial Trail Hwy)/ Cox Rd/Yellowbird Rd	TWSC	NB Left/Through/Right	11.0	B	12.7	B
			EB Left	8.6	A	7.5	A
			WB Left	8.2	A	7.5	A
			SB Left/Through/Right	14.6	B	12.6	B
2	Cox Rd (U.S. Route 460 Bus)/Military Rd	OWSC	NB Left/Right	9.2	A	10.0	B
			WB Left	7.7	A	7.9	A
3	Darvills Rd (VA Route 40)/Military Rd	TWSC	NB Left	11.1	B	10.0	B
			NB Through	10.0	B	11.0	B
			NB Right	8.5	A	8.6	A
			EB Left	7.3	A	7.4	A
			WB Left	7.3	A	7.5	A
			SB Left/Right	11.3	B	10.5	B
4	W 10th St/Military Rd	TWSC	WB Left/Through/Right	10.6	B	10.0	B
			EB Left/Through/Right	0.0	A	9.7	A
			SB Left	7.6	A	7.6	A
5	West Entrance Rd/Military Rd	OWSC	NB Left	7.4	A	7.5	A
			EB Left/Right	10.1	B	9.4	A
6	Military Rd/Garnett Ave	TWSC	NB Left/Through/Right	9.6	A	9.4	A
			EB Left	7.2	A	7.6	A
			WB Left	7.5	A	7.3	A
			SB Left/Through/Right	8.8	A	9.1	A
7	Military Rd/Armistead Ave	TWSC	NB Left/Through/Right	9.3	A	9.1	A
			EB Left	7.2	A	7.6	A
			SB Left/Through/Right	8.3	A	8.7	A
8	Military Rd/Dearing Ave	TWSC	NB Left	7.2	A	7.2	A
			EB Left/Through/Right	8.3	A	0.0	A
9	W 10th St/Warehouse St	OWSC	EB Left	7.9	A	7.4	A
			SB Left/Right	8.7	A	8.9	A
10	8th St/West Entrance Rd/S Main St	Signal	Overall (all movements)	14.8	B	17.9	B
			EB Left/Through/Right	21.6	C	28.8	C
			WB Left/Through/Right	20.0	C	28.5	C
			NB Left/Through/Right	17.8	B	19.1	B
			SB Left/Right	9.5	A	10.5	B
11	Church St (U.S. Route 460 Bus)/S Main St (U.S. 460 Bus/VA Route 40)	Signal	Overall (all movements)	8.3	A	10.7	B
			EB Left/Right	12.1	B	12.6	B
			NB Left/Through	5.3	A	7.3	A
			SB Through/Right	10.1	B	14.1	B

Intersection		Traffic Control	Traffic Movement[a]	A.M. Peak Hour		P.M. Peak Hour	
				Delay[b]	LOS[c]	Delay[b]	LOS[c]
12	Dinwiddie Ave (VA Route 40)/N Main St (U.S. Route 460/VA Route 40)	Signal	Overall (all movements)	17.1	B	15.8	B
			EB Left/Through/Right	21.8	C	22.2	C
			WB Left/Through/Right	25.5	C	23.7	C
			NB Left/Through/Right	20.7	C	16.7	B
			SB Left/Through/Right	12.7	B	10.3	B
13	Darvills Rd (VA Route 40)/Dearing Ave	OWSC	NB Left/Right	8.6	A	9.1	A
			WB Left	7.3	A	7.3	A
14	W 10th St/Dearing Ave	OWSC	(d)	(d)	(d)	(d)	(d)
15	Business Driveway/ Dearing Ave	OWSC	EB Left/Right	8.6	A	8.7	A

Notes:
Bus = Business Route; EB = eastbound; LOS = TRB; NB = northbound; OWSC = one-way stop control; SB = southbound; TWSC = two-way stop control; WB = Westbound.
[a] LOS is provided only for movements that would experience delay during one or both peak hours.
[b] Delay is measured in seconds per vehicle.
[c] LOS calculations are based on HCM (TRB 2010) methods, and were performed using Synchro 8.
[d] W 10th St/Dearing Ave (intersection 14) was not analyzed because it has no conflicting movements.

3.4 Other Traffic Analyses

3.4.1 Turn Lane Analysis

Existing turn lane treatments are summarized below in **Table 3-2** (GSA/DOS 2012).

Table 3-2. Summary of Turn Lane Treatments – Existing Conditions (Year 2014)

Intersection and Movement	Existing Turn Lane Treatment
U.S. Route 460 at Cox Rd (intersection 1)	
Eastbound Left	125-foot Left Turn Lane with 75-foot Taper
Eastbound Right	50-foot Right Turn Lane with 125-foot Taper
Westbound Left	100-foot Left Turn Lane with 150-footTaper
Westbound Right	100-foot Right Turn Lane with 50-foot Taper
Cox Rd and Military Rd (Intersection 2)	
Eastbound Right	None
Westbound Left	None
Darvills Rd and Military Rd (intersection 3)	
Eastbound Left	None
Eastbound Right	50-foot Right Turn Lane with 50-foot Taper
Westbound Left	None
Westbound Right	None
Northbound Left	150-foot Left Turn Lane with 50-foot Taper
Northbound Right	25-foot Right Turn Lane with 50-foot Taper
Southbound Left	None
Southbound Right	None

Intersection and Movement	Existing Turn Lane Treatment
Darvills Rd at Dearing Ave (intersection 13)	
Eastbound Right	110-foot Right Turn Lane with 135-foot Taper
Westbound Left	165-foot Left Turn Lane with 110-foot Taper

3.4.2 Fort Pickett Access Gate Analysis

The Main Gate has two inbound lanes with one guard each. As shown in **Table 3-3**, the Main Gate's existing volumes are below the 375 vphpl threshold that would necessitate more than one guard per lane, for both the morning and afternoon peak-hour. The West Gate also has two inbound lanes with one guard per lane. The morning and afternoon peak-hour volumes were also below the 375 vphpl threshold for the West Gate.

Table 3-3. Summary of Gate Analysis – Existing Conditions (Year 2014)

Main Gate (Military Road)				West Gate (West Entrance Road)			
A.M. Peak-hour (6:30-7:30 a.m.)		P.M. Peak-hour (4:00-5:00 p.m.)		A.M. Peak-hour (6:30-7:30 a.m.)		P.M. Peak-hour (4:00-5:00 p.m.)	
Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
vph	vph	vph	vph	vph	vph	vph	vph
188	123	15	14	64	79	14	14
Guards	Guards	Guards	Guards	Guards	Guards	Guards	Guards
1	1	1	1	1	1	1	1

Note:
vph = vehicles per hour.

3.4.3 Intersection Control Warrants

Because none of the traffic movements at any of the intersections are characterized by LOS E or LOS F, no traffic signal warrant analysis was performed. All unsignalized intersections operate at LOS A or B during both peak hours; therefore, traffic signal installation is not needed to address existing intersection delay.

Chapter 4 NO ACTION ALTERNATIVE (YEAR 2018)

The Proposed Action would be 90 percent operational in 2018 and 100 percent operational by 2020. This TIA evaluates the full buildout of the Proposed Action by 2018. The following paragraphs describe future traffic conditions in planning year 2018 without the Proposed Action.

4.1 PROJECTED TRAFFIC GROWTH

Consistent with the 2012 TIA, a compounded annual growth rate of one percent per year was applied to existing morning and afternoon peak hour volumes at all ROI intersections. This results in a growth factor of 1.0406 over the four-year period from 2014 to 2018. **Figure 4-1** shows the peak hour turning movement volumes of the No Action Alternative.

4.2 INTERSECTION LOS

Under the No Action Alternative, all intersections in the ROI are expected to have the same intersection lane geometry and traffic control as under existing conditions. **Table 4-1** displays the LOS analysis results for ROI intersections under the No Action Alternative. As shown in the table, most intersection movements within the ROI would operate at LOS A or B, and several would operate at LOS C conditions during both peak hours. Refer to Attachment C for intersection capacity worksheets.

Table 4-1. Summary of Intersection LOS – No Action Alternative (Year 2018)

Intersection		Traffic Control	Traffic Movement[a]	A.M. Peak Hour		P.M. Peak Hour	
				Delay[b]	LOS[c]	Delay[b]	LOS[c]
1	U.S. Route 460 (W Colonial Trail Hwy)/ Cox Rd/Yellowbird Rd	TWSC	NB Left/Through/Right	11.1	B	13.0	B
			EB Left	8.7	A	7.6	A
			WB Left	8.3	A	7.9	A
			SB Left/Through/Right	15.1	C	12.9	B
2	Cox Rd (U.S. Route 460 Bus)/Military Rd	OWSC	NB Left/Right	9.3	A	10.1	B
			WB Left	7.8	A	7.9	A
3	Darvills Rd (VA Route 40)/Military Rd	TWSC	NB Left	11.2	B	10.0	B
			NB Through	10.1	B	11.1	B
			NB Right	8.5	A	8.6	A
			EB Left	7.3	A	7.4	A
			WB Left	7.3	A	7.5	A
			SB Left/Right	11.5	B	10.6	B
4	W 10th St/Military Rd	TWSC	WB Left/Through/Right	10.8	B	10.1	B
			EB Left/Through/Right	0.0	A	9.8	A
			SB Left	7.6	A	7.6	A
5	West Entrance Rd/Military Rd	OWSC	NB Left	7.5	A	7.5	A
			EB Left/Right	10.1	B	9.4	A
6	Military Rd/Garnett Ave	TWSC	NB Left/Through/Right	9.6	A	9.5	A
			EB Left	7.2	A	7.6	A
			WB Left	7.5	A	7.3	A
			SB Left/Through/Right	8.8	A	9.1	A

Intersection		Traffic Control	Traffic Movement[a]	A.M. Peak Hour		P.M. Peak Hour	
				Delay[b]	LOS[c]	Delay[b]	LOS[c]
7	Military Rd/Armistead Ave	TWSC	NB Left/Through/Right	9.4	A	9.2	A
			EB Left	7.2	A	7.6	A
			SB Left/Through/Right	8.3	A	8.7	A
8	Military Rd/Dearing Ave	TWSC	NB Left	7.2	A	7.2	A
			EB Left/Through/Right	8.3	A	0.0	A
9	W 10th St/Warehouse St	OWSC	EB Left	7.9	A	7.4	A
			SB Left/Right	8.7	A	8.9	A
10	8th St/West Entrance Rd/S Main St	Signal	Overall (all movements)	15.1	B	18.2	B
			EB Left/Through/Right	21.7	C	29.8	C
			WB Left/Through/Right	20.1	C	29.3	C
			NB Left/Through/Right	18.2	B	19.4	B
			SB Left/Right	9.6	A	10.6	B
11	Church St (U.S. Route 460 Bus)/S Main St (U.S. Route 460 Bus/VA Route 40)	Signal	Overall (all movements)	8.3	A	11.0	B
			EB Left/Right	12.1	B	12.8	B
			NB Left/Through	5.3	A	7.5	A
			SB Through/Right	10.2	B	14.5	B
12	Dinwiddie Ave (VA Route 40)/N Main St (U.S. Route 460/VA 40)	Signal	Overall (all movements)	17.3	B	16.1	B
			EB Left/Through/Right	22.0	C	22.3	C
			WB Left/Through/Right	25.4	C	23.9	C
			NB Left/Through/Right	21.1	C	17.0	C
			SB Left/Through/Right	12.9	B	10.5	B
13	Darvills Rd (VA Route 40)/Dearing Ave	OWSC	NB Left/Right	8.7	A	9.1	A
			WB Left	7.3	A	7.3	A
14	W 10th St/Dearing Ave	OWSC	(d)	(d)	(d)	(d)	(d)
15	Business Driveway/ Dearing Ave	OWSC	EB Left/Right	8.6	A	8.7	A

Notes:

Bus = Business Route; EB = eastbound; LOS = Level of Service; NB = northbound; OWSC = one-way stop control; SB = southbound; TWSC = two-way stop control; WB = Westbound.

[a] LOS is provided only for movements that would experience delay during one or both peak hours.

[b] Delay is measured in seconds per vehicle.

[c] LOS calculations are based on HCM (TRB 2010) methods, and were performed using Synchro 8.

[d] W 10th St/Dearing Ave (intersection 14) was not analyzed because it has no conflicting movements.

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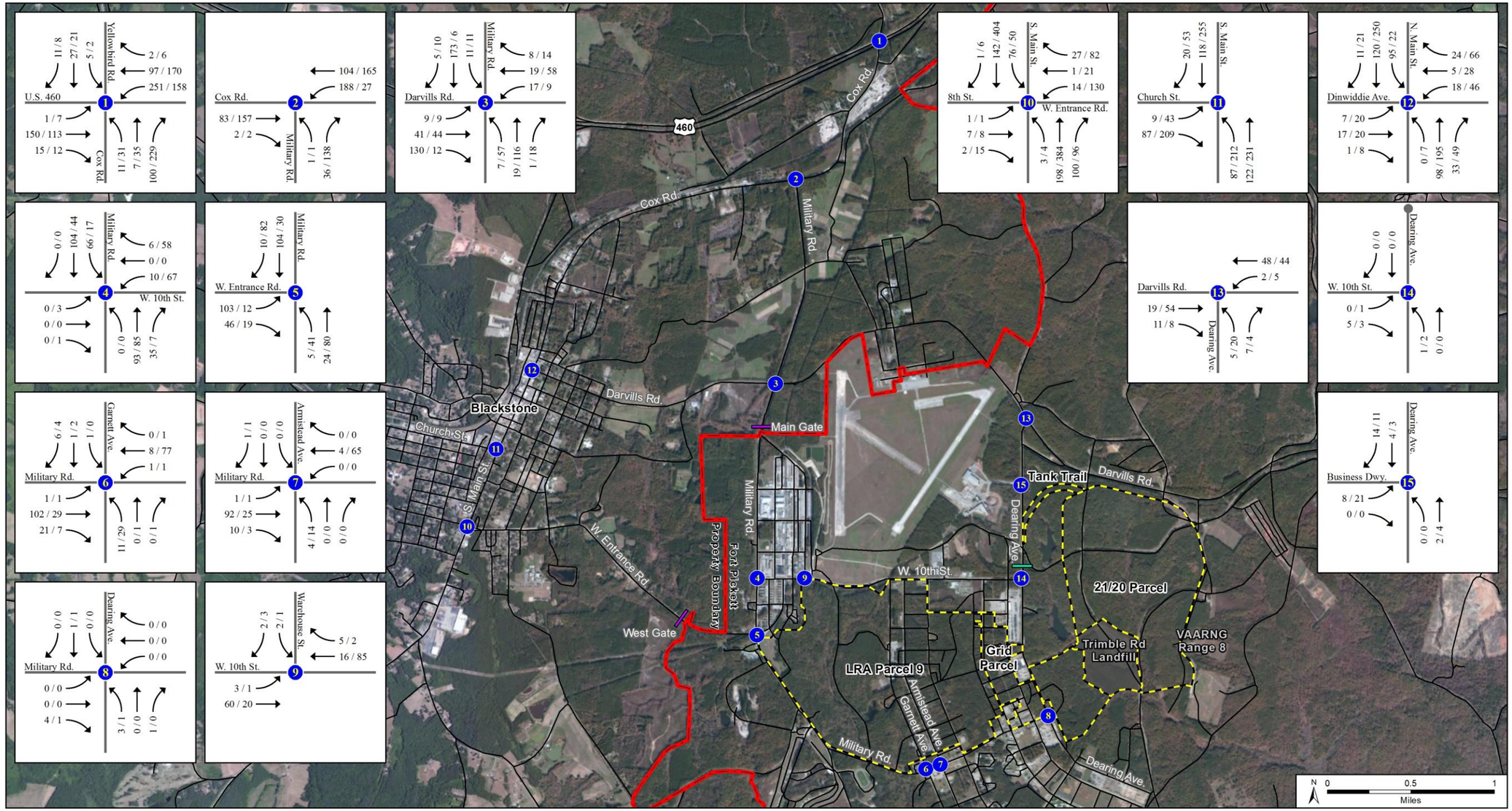

Legend

- Fort Pickett
- Parcel Boundary
- Intersection
- Road
- Intersection Turning Movement
- XXX / YYY Peak Hour Volume (am/pm)
- Existing Fort Pickett Access Gate
- Existing Closed Gate

Notes: Dearing Ave. is closed to through traffic north of W. 10th St.
Movements shown with a volume of zero are considered to accomodate a nominal amount of traffic.

Source: ESRI 2014

Figure 4-1. No Action (Year 2018) Peak Hour Traffic Volumes

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4.3 Other Traffic Analyses

4.3.1 Turn Lane Analysis

A turn lane analysis for the No Action Alternative was performed using the methods described in Chapter 2. The results of the analysis are summarized in **Table 4-2** below. The data tables and charts used in the determination of turn lane warrants are provided in Attachment D. According to this, VDOT policy would require additional turn lane treatments for the following intersections and movements:

- Cox Road westbound left at Military Road (intersection 2), and
- Darvills Road eastbound right at Military Road (intersection 3)

Table 4-2. Summary of Turn Lane Analyses - No Action Alternative (Year 2018)

Intersection and Movement	Existing Turn Lane Treatment	Turn Lane Treatment Required per VDOT Policy	Additional Treatment Required?
U.S. Route 460 at Cox Rd (intersection 1)			
Eastbound Left	125-foot Left Turn Lane with 75-foot Taper	No Left Turn Lane Required	NO
Eastbound Right	50-foot Right Turn Lane with 125-foot Taper	No Right Turn Lane Required	NO
Westbound Left	150-foot Left Turn Lane with 150-footTaper	No Left Turn Lane Required	NO
Westbound Right	100-foot Right Turn Lane with 50-foot Taper	No Right Turn Lane Required	NO
Cox Rd at Military Rd (intersection 2)			
Eastbound Right	None	No Right Turn Lane Required	NO
Westbound Left	None	Minimum 200-foot Left Turn Lane with Minimum 200-foot Taper	**YES**
Darvills Rd at Military Rd (intersection 3)			
Eastbound Left	None	No Left Turn Lane Required	NO
Eastbound Right	50-foot Right Turn Lane with 50-foot Taper	Minimum 200-foot Right Turn Lane with Minimum 200-foot Taper	**YES**
Westbound Left	None	No Left Turn Lane Required	NO
Westbound Right	None	No Right Turn Lane Required	NO
Northbound Left	150-foot Left Turn Lane with 50-foot Taper	No Left Turn Lane Required	NO
Northbound Right	25-foot Right Turn Lane with 50-foot Taper	No Right Turn Lane Required	NO
Southbound Left	None	No Left Turn Lane Required	NO
Southbound Right	None	No Right Turn Lane Required	NO
Darvills Rd at Dearing Ave (intersection 13)			
Eastbound Right	110-foot Right Turn Lane with 135 foot Taper	No Right Turn Lane Required	NO
Westbound Left	165-foot Left Turn Lane with 135-foot Taper	No Left Turn Lane Required	NO

4.3.2 Fort Pickett Access Gate Analysis

Access to Fort Pickett would continue to be controlled by two gates in the No Action Alternative. The one percent per year compounded growth rate was applied to the existing counts for both lanes, using the lane distribution shown in the existing volumes. Under the No Action Alternative in 2018, both the Main Gate and the West Gate would accommodate morning and afternoon peak-hour volumes below the 375 vphpl threshold that would necessitate more than one guard per lane.

Table 4-3. Summary of Gate Analysis – No Action Alternative (Year 2018)

Main Gate (Military Road)				West Gate (West Entrance Road)			
A.M. Peak-hour (6:30-7:30 a.m.)		P.M. Peak-hour (4:00-5:00 p.m.)		A.M. Peak-hour (6:30-7:30 a.m.)		P.M. Peak-hour (4:00-5:00 p.m.)	
Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
vph	vph	vph	vph	vph	vph	vph	vph
192	123	15	14	64	79	14	14
Guards	Guards	Guards	Guards	Guards	Guards	Guards	Guards
1	1	1	1	1	1	1	1

Note:
vph = vehicles per hour.

4.3.3 Intersection Control Warrants

Because none of the traffic movements at any of the intersections are characterized by LOS E or LOS F, no traffic signal warrant analysis was performed. As was shown in Table 4-1, all unsignalized intersections would operate at LOS C or better during both peak hours in 2018; therefore, traffic signal installation would not be needed to address any projected future intersection delay under the No Action Alternative.

Chapter 5 PROJECT TRAFFIC

The following paragraphs describe future traffic conditions that are expected to occur at the time the Proposed Action is built and operating. As discussed in Section 1.2, all training venues fundamental to the FASTC training program would be in place, and 90 percent of the training program would be operational by the year 2018. By 2020, 100 percent of training would be operational. This TIA evaluates the full buildout of the Proposed Action by the year 2018. This approach increases the Proposed Action's year 2018 traffic generation by 10 percent to capture the 100 percent of project traffic. The Proposed Action's traffic impacts were determined based on the incremental effect of each option relative to the No Action Alternative.

This section describes the key assumptions and methods used to estimate the traffic generation, trip distribution, and traffic assignment of the two access options. The Proposed Action would affect traffic patterns in the following ways:

1. Additional passenger car and bus trips would be added to intersections throughout the ROI as the result of commuting trips by instructors and staff and the transport of students to and from area hotels;
2. Minivans would be driven from various locations to the Core Area in order to transport students to training venues;
3. As discussed in Section 1.2, a one-way Entry Loop would be constructed to the west of Dearing Avenue to provide a connection to the Core Area;
4. Additional minivan trips would be added to project access points along Dearing Avenue (only) as students are transported from the Core Area to training venues; and
5. For Option B (only), establishing a new access gate on Dearing Avenue is expected to cause the redistribution of existing trips from the Main Gate to the proposed Dearing Avenue gate.

The Entry Loop would form two intersections with Dearing Avenue, which are referred to in Chapter 6 as Entry Loop (North) and Entry Loop (South). These intersections are numbered 16 and 17 in the figures that follow. A third intersection, Foley Road/Dearing Avenue, would provide access to and from proposed training venues in the 21/20 Parcel (see text below). This location is labeled as intersection 18 in the figures that follow.

5.1 TRAFFIC GENERATION

The Proposed Action's traffic generation was estimated based on information provided by the GSA and DOS (GSA/DOS 2014a, 2014b) and using trip generation rates published by the Institute of Transportation Engineers (ITE) (ITE 2012). **Table 5-1** presents the traffic generation data, assumptions and calculations. In order to provide a conservative estimate, the bus and minivan trips estimated in the Master Plan Update were increased by approximately 9 percent to reflect the possibility that not all buses and minivans would be fully occupied by students during each trip. As shown in Table 5-1, the Proposed Action would add 240 trips (182 inbound and 58 outbound) to ROI intersections during the morning peak hour, and 233 (65 inbound and 168 outbound) in the afternoon peak hour. Minivan trips between the Core Area and FASTC training venues are summarized in the row labelled "Internal Shuttle Trips" in Table 5-1. Minivan trips would include 24 outbound trips from the Core Area in the morning

peak hour, and 24 inbound trips to the Core Area in the afternoon peak hour. As discussed below in Section 5.2, only a portion of these trips would occur outside of the FASTC facility, and these trips would be limited to project access points on Dearing Avenue.

5.2 TRIP DISTRIBUTION

Project traffic was distributed throughout the ROI based on the distribution pattern provided in the 2012 TIA and supplemental information provided by GSA/DOS (2014b). The regional distribution project traffic is as follows:

- 75 percent to/from the northeast via U.S. Route 460 (Richmond and Washington DC);
- 2 percent to/from the east via Darvills Road;
- 2 percent to/from the south via Brunswick Road (VA Route 46);
- 2 percent to/from the southwest via Kenbridge Road (VA Route 40);
- 14 percent to/from the west and northwest via US Route 460 (i.e., the towns of Farmville, Burkeville, and Crewe); and
- 5 percent to/from within the Town of Blackstone.

Under Option A, all project trips would enter Fort Pickett via the Main Gate and the West Gate. Based on the origins and destinations of project traffic, it is assumed that approximately 90 percent of project trips would enter the installation at the Main Gate, while approximately 10 percent would enter via the West Gate. Under Option B, only a limited amount of project traffic would enter Fort Pickett using these two existing gates. It is assumed that approximately 80 percent of trips under Option B, including all bus and minivan trips, would enter Fort Pickett using the proposed Dearing Avenue gate. The remaining 20 percent, consisting of passenger vehicles, would be evenly split between the Main Gate and the West Gate (i.e., approximately 10 percent entering at each of these two gates).

Internal shuttle trips between the Core Area and training venues would be split between LRA Parcel 9 and the 21/20 Parcel. Based on the number of venues within each parcel, it is assumed that 55 percent of internal shuttle trips would be between the Core Area and LRA Parcel 9. These trips would be entirely within the FASTC boundary. The remaining 45 percent of internal shuttle trips would travel between the Core Area and the 21/20 Parcel. Outbound trips destined for the 21/20 Parcel would exit the Entry Loop at Dearing Avenue, and proceed to the north on Dearing Avenue for a short distance before turning right onto Foley Road to enter the 21/20 Parcel. These external trips are accounted for in the Proposed Action's traffic assignment.

Table 5-1. Traffic Generation Summary

Trip Category	Amount	Daily Trip Rate [a]	Daily Trips	A.M. Peak Hour			P.M. Peak Hour		
				In	Out	Total	In	Out	Total
External Trips to and from FASTC									
Commuting Trips for Instructors and Staff	339 employees	3.3 / employee	1,125	143	20	163	27	129	156
Transport of Students from Area Hotels (buses) [b]	600 students	0.09 / student	60	15	15	30	15	15	30
Movement of Minivans to and from FASTC [c]	24 minivans	4 / minivan	96	24	24	48	24	24	48
Total:			**1,281**	**182**	**58**	**240**	**65**	**168**	**233**
Internal Shuttle Trips [d]									
Transport of Students from the Core Area (minivans) [e]	600 students	0.07 / student	48	0	24	24	24	0	24

Notes:

[a] Trip generation rates and directional splits for Instructors and Staff taken from Institute of Transportation Engineers' Trip Generation (ITE 2012) for Land Use Code 710. Trip rates for transporting students provided by GSA/DOS (2014a). External bus and minivan trips increased by 8.6 percent to reflect potential seat vacancies.

[b] Transport of students between area hotels and FASTC Core Area to be provided by buses having a maximum capacity of 47 students per bus (GSA/DOS 2014a).

[c] Minivans would be positioned at the Core Area to transport students after they arrive by bus, and to return the students to the Core Area after training each day.

[d] Internal shuttle trips would travel between the Core Area and training venues on the in LRA Parcel 9. Trips to and from the 21/20 Parcel would traverse the Dearing Avenue intersections with the internal Entry Loop and Foley Road. Trips to and from LRA Parcel would occur entirely within the FASTC boundary.

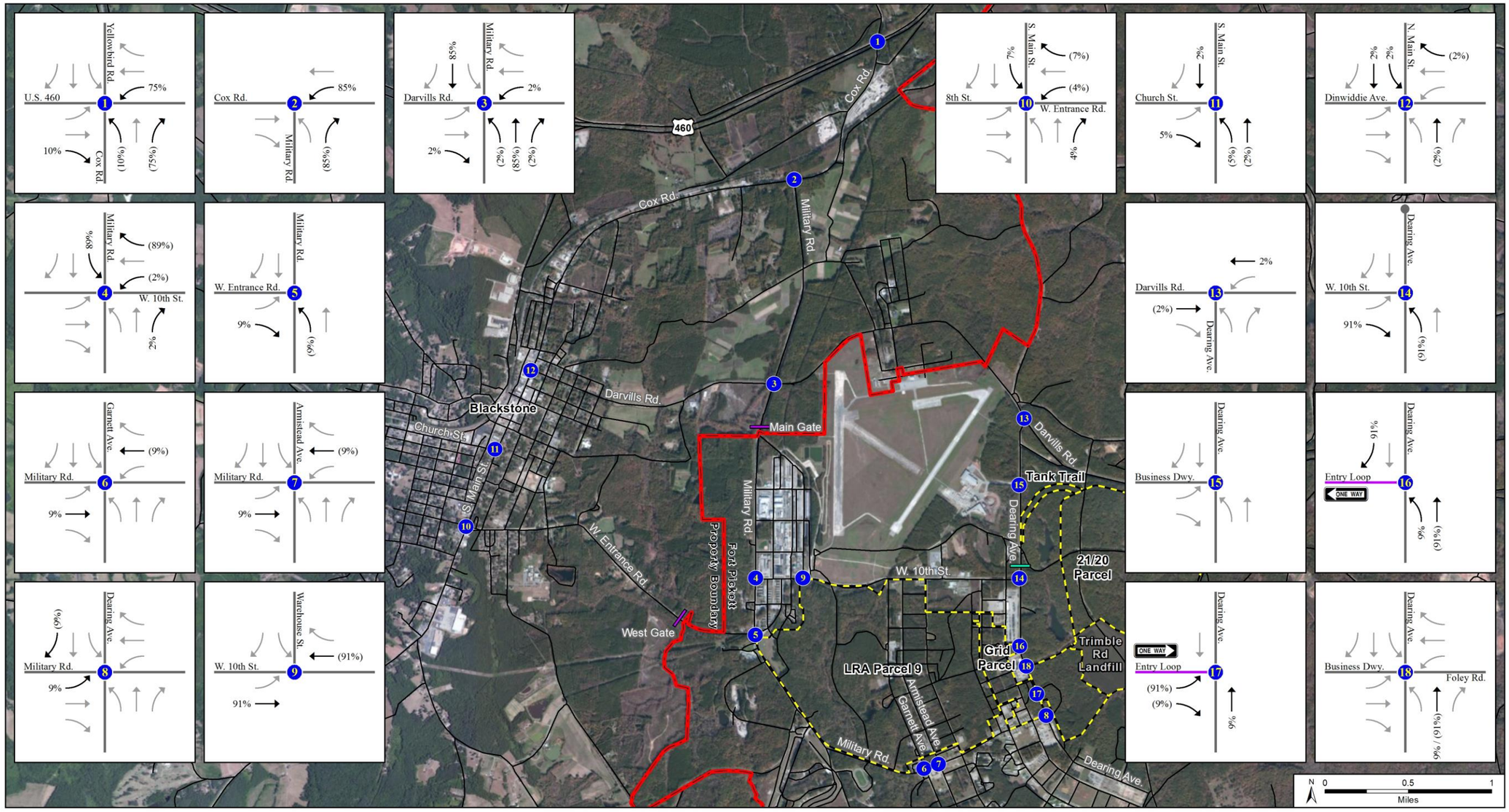
[e] Transport of students between the FASTC Core Area and training venues to be provided by minivans having a maximum capacity of 29 students per minivan (GSA/DOS 2014a).

5.3 OPTION A TRAFFIC VOLUMES

Figure 5-1 presents the trip distribution pattern for Option A. **Figure 5-2** depicts the assignment of project-related trips under this scenario. The trips shown in Figure 5-2 include both external trips to and from FASTC (i.e., commuting trips by instructors and staff, transport of students to and from area hotels, and the movement of minivans to and from the Core Area) and internal shuttle trips between the Core Area and training venues. The addition of trips from Option A to No Action Alternative volumes is shown in **Figure 5-3**.

5.4 OPTION B TRAFFIC VOLUMES

Figure 5-4 illustrates Option B's trip distribution pattern, while **Figure 5-5** presents Option B's traffic assignment. In addition to external trips to and from FASTC and internal shuttle trips, Figure 5-5 also includes the redistribution of existing trips that would be expected due to the establishment of a new access gate on Dearing Avenue. **Figure 5-6** shows the combination of Option B trips and No Action Alternative trips.



Legend

- Fort Pickett
- Parcel Boundary
- Intersection
- Road
- Future Road
- Intersection Turning Movement
- Intersection Turning Movement with Trip Distribution
- XX% /(YY%) Inbound (Outbound) Trip Distribution Percentage
- Existing Fort Pickett Access Gate
- Existing Closed Gate

Note: Dearing Ave. is closed to through traffic north of W. 10th St.

Source: ESRI 2014

Figure 5-1. Option A Trip Distribution

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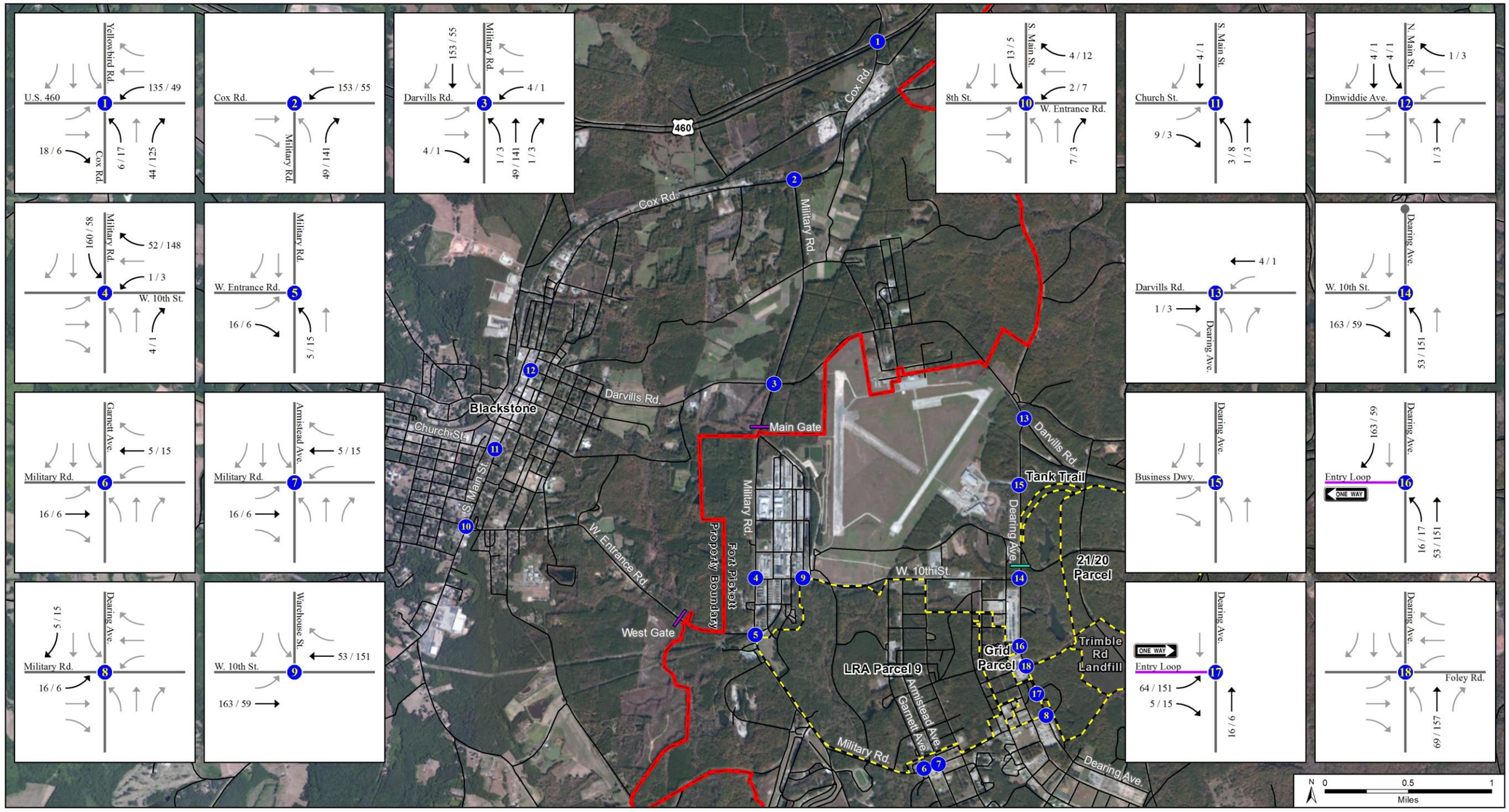

Legend

- Fort Pickett
- Parcel Boundary
- Intersection
- Road
- Future Road
- Intersection Turning Movement
- Intersection Turning Movement with Traffic Assignment
- XXX / YYY Peak Hour Traffic Assignment (am/pm)
- Existing Fort Pickett Access Gate
- Existing Closed Gate

Note: Dearing Ave. is closed to through traffic north of W. 10th St.

Source: ESRI 2014

Figure 5-2. Option A Traffic Assignment

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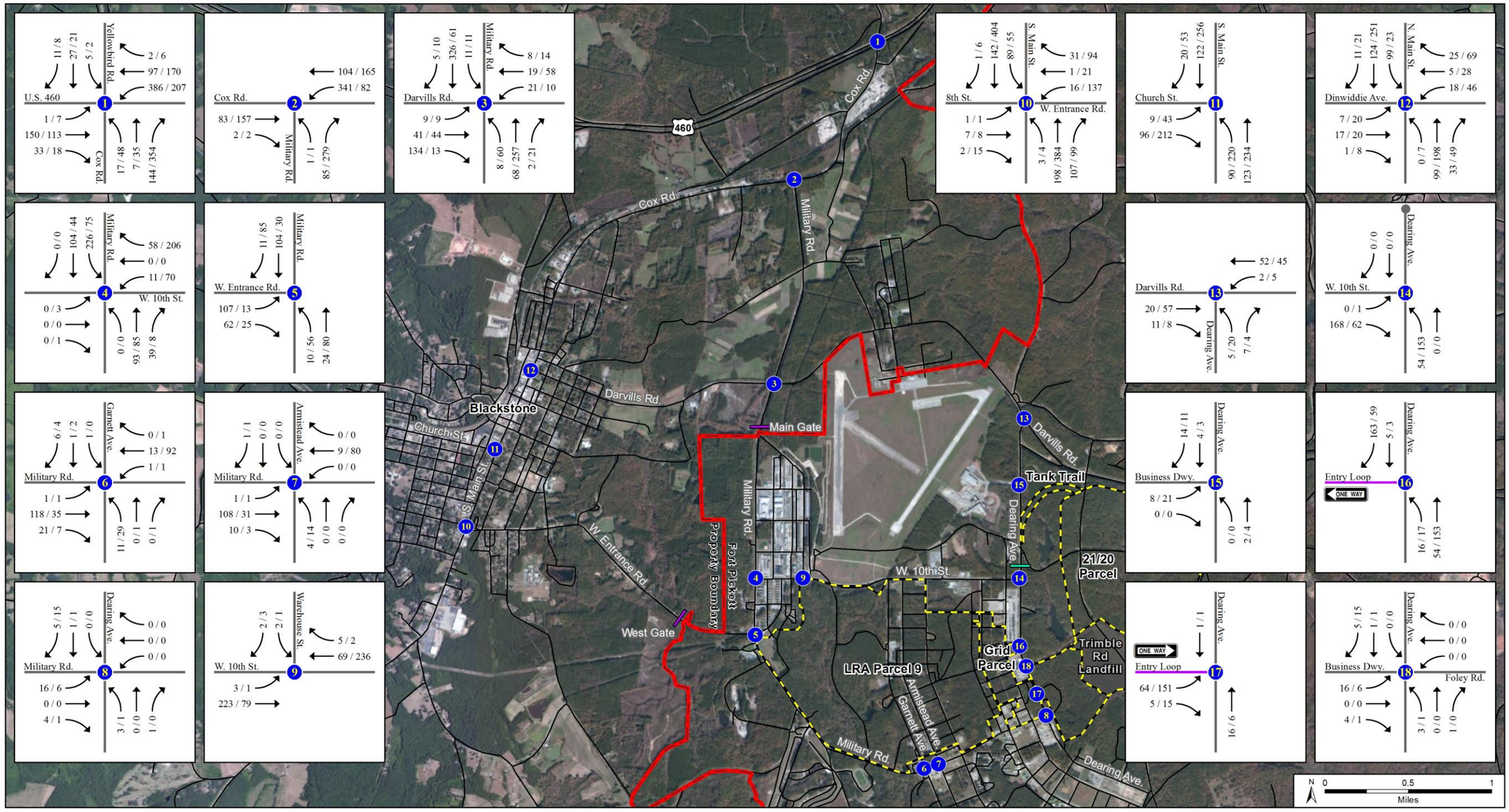

Legend

- Fort Pickett
- Parcel Boundary
- Intersection
- Road
- Intersection Turning Movement
- XXX / YYY Peak Hour Volume (am/pm)

Notes: Dearing Ave. is closed to through traffic north of W. 10th St.
Movements shown with a volume of zero are considered to accomodate a nominal amount of traffic.

Source: ESRI 2014

Figure 5-3. Option A (Year 2018) Peak Hour Traffic Volumes

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Environmental Impact Statement
FASTC Nottoway County, VA

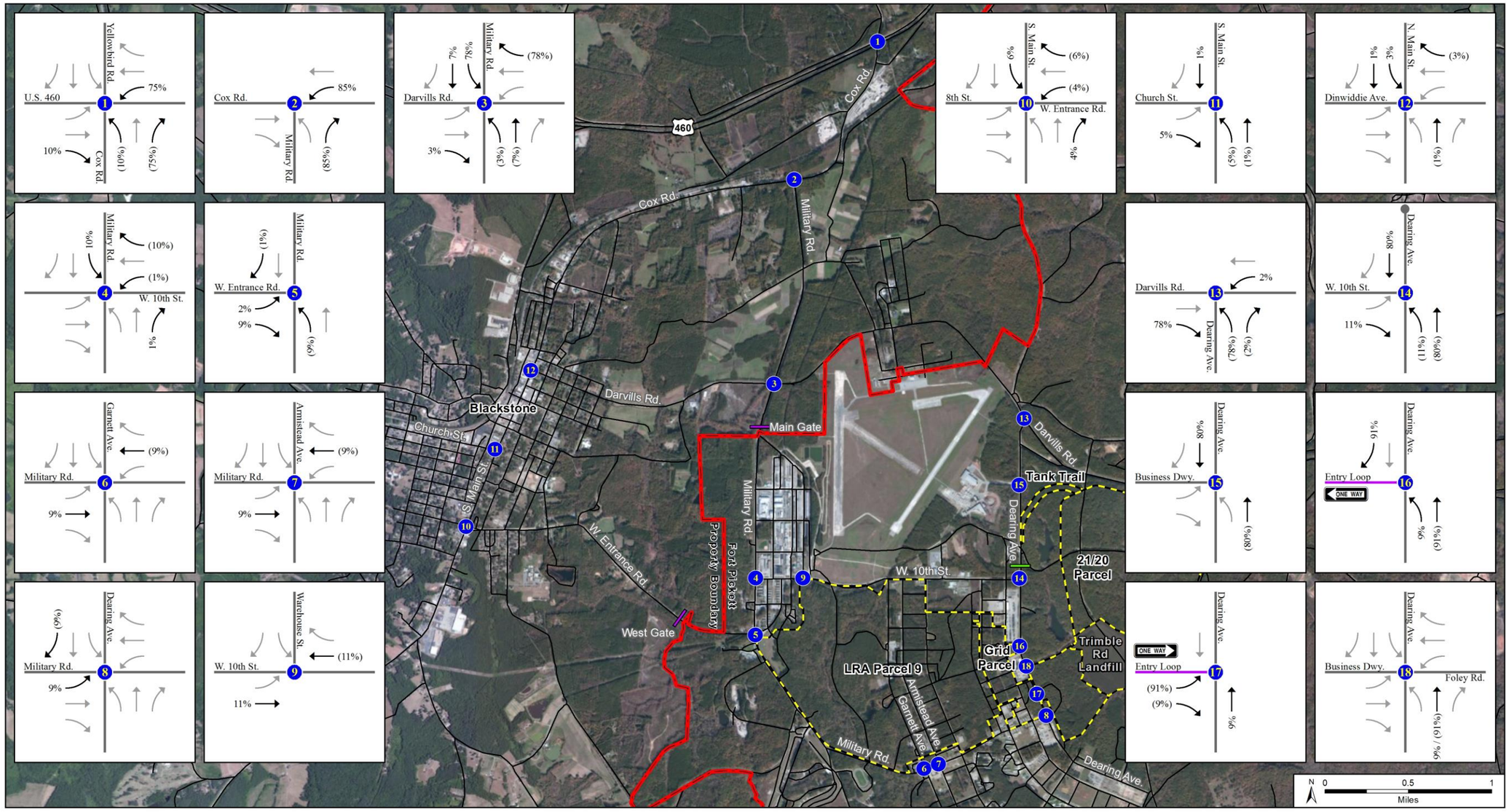
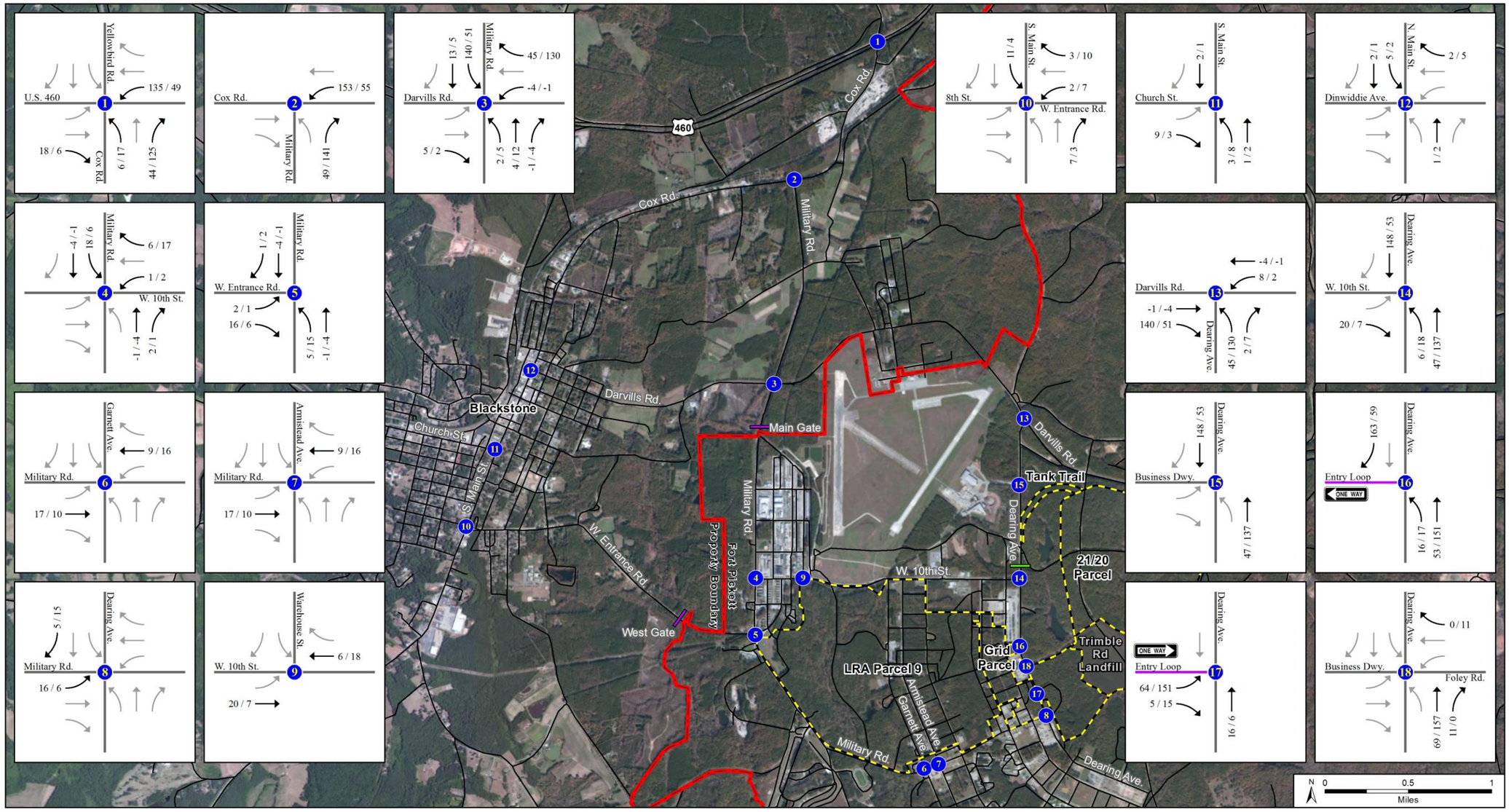


Figure 5-4. Option B Trip Distribution

U.S. General Services Administration
Environmental Impact Statement
FASTC Nottoway County, VA



Legend

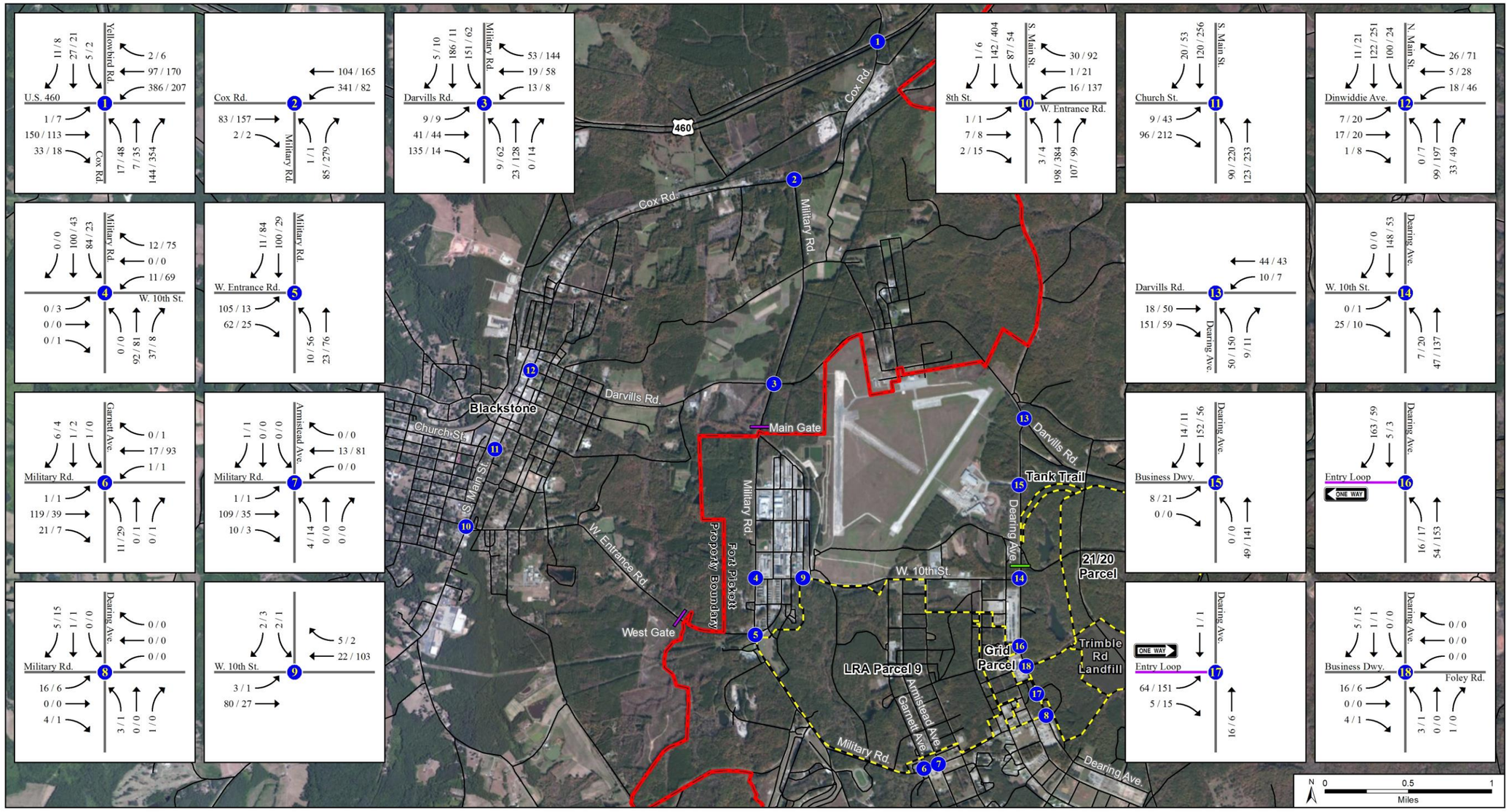
- Fort Pickett
- Parcel Boundary
- Intersection
- Road
- Future Road
- Intersection Turning Movement
- Intersection Turning Movement with Traffic Assignment
- XXX / YYY Peak Hour Traffic Assignment (am/pm)
- Existing Fort Pickett Access Gate
- Proposed Dearing Ave. Access Gate

Note: Negative volumes refelct the diversion of existing trips from the Main Gate to the proposed gate on Dearing Ave.

Source: ESRI 2014

Figure 5-5. Option B Traffic Assignment

U.S. General Services Administration
Environmental Impact Statement
FASTC Nottoway County, VA



Legend

- Fort Pickett
- Parcel Boundary
- Intersection
- Road
- Intersection Turning Movement
- XXX / YYY Peak Hour Volume (am/pm)
- Existing Fort Pickett Access Gate
- Proposed Dearing Ave. Access Gate

Note: Movements shown with a volume of zero are considered to accomodate a nominal amount of traffic.

Source: ESRI 2014

Figure 5-6. Option B (Year 2018) Peak Hour Traffic Volumes

U.S. General Services Administration
Environmental Impact Statement
FASTC Nottoway County, VA

Chapter 6 PROJECT IMPACTS

6.1 BUILD ALTERNATIVE 3, ACCESS OPTION A

6.1.1 Intersection LOS

As shown in **Table 6-1**, with the addition of project-related traffic (i.e., instructor and staff commuting trips, transport of students from area hotels, movement of minivans to and from the Core Area, and internal shuttle trips), all intersections would be characterized by LOS C or better conditions during both peak hours. Because the Proposed Action would not cause any traffic movement to deteriorate from LOS C or better to LOS D or worse, Option A would not result in any significant traffic impact. Refer to Attachment C for intersection worksheets.

Table 6-1. Summary of Intersection LOS – Build Alternative 3, Option A (Year 2018)

Intersection		Traffic Control	Traffic Movement[a]	A.M. Peak Hour		P.M. Peak Hour	
				Delay[b]	LOS[c]	Delay[b]	LOS[c]
1	U.S. Route 460 (W Colonial Trail Hwy)/ Cox Rd/Yellowbird Rd	TWSC	NB Left/Through/Right	14.5	B	17.9	C
			EB Left	8.7	A	7.6	A
			WB Left	8.8	A	8.0	A
			SB Left/Through/Right	21.5	C	14.2	B
2	Cox Rd (U.S. Route 460 Bus)/Military Rd	OWSC	NB Left/Right	9.6	A	11.5	B
			WB Left	8.2	A	8.1	A
3	Darvills Rd (VA Route 40)/Military Rd	TWSC	NB Left	14.6	B	10.8	B
			NB Through	10.7	B	13.3	B
			NB Right	8.6	A	8.6	A
			EB Left	7.3	A	7.4	A
			WB Left	7.3	A	7.5	A
			SB Left/Right	14.6	B	11.6	B
4	W 10th St/Military Rd	TWSC	WB Left/Through/Right	11.2	B	11.7	B
			EB Left/Through/Right	0.0	A	12.7	B
			SB Left	8.0	A	7.8	A
5	West Entrance Rd/Military Rd	OWSC	NB Left	7.6	A	7.6	A
			EB Left/Right	10.4	B	9.5	A
6	Military Rd/Garnett Ave	TWSC	NB Left/Through/Right	9.8	A	9.6	A
			EB Left	7.3	A	7.7	A
			WB Left	7.5	A	7.3	A
			SB Left/Through/Right	8.9	A	9.2	A
7	Military Rd/Armistead Ave	TWSC	NB Left/Through/Right	9.3	A	9.3	A
			EB Left	7.3	A	7.6	A
			SB Left/Through/Right	8.6	A	8.8	A
8	Military Rd/Dearing Ave	TWSC	NB Left	7.2	A	7.2	A
			EB Left/Through/Right	8.6	A	0.0	A
9	W 10th St/Warehouse St	OWSC	EB Left	8.0	A	7.7	A
			SB Left/Right	9.6	A	9.9	A

Intersection		Traffic Control	Traffic Movement[a]	A.M. Peak Hour		P.M. Peak Hour	
				Delay[b]	LOS[c]	Delay[b]	LOS[c]
10	8th St/West Entrance Rd/S Main St	Signal	Overall (all movements)	15.3	B	18.7	B
			EB Left/Through/Right	21.8	C	30.4	C
			WB Left/Through/Right	20.1	C	29.5	C
			NB Left/Through/Right	18.6	B	19.8	B
			SB Left/Right	9.7	A	10.8	B
11	Church St (U.S. Route 460 Bus)/S Main St (U.S. 460 Bus/VA Route 40)	Signal	Overall (all movements)	8.5	A	11.0	B
			EB Left/Right	12.1	B	12.8	B
			NB Left/Through	5.5	A	7.5	A
			SB Through/Right	10.4	B	14.7	B
12	Dinwiddie Ave (VA Route 40)/N Main St (U.S. Route 460/VA 40)	Signal	Overall (all movements)	17.3	B	16.2	B
			EB Left/Through/Right	22.1	C	22.4	C
			WB Left/Through/Right	25.4	C	24.1	C
			NB Left/Through/Right	21.2	C	17.1	B
			SB Left/Through/Right	13.0	B	10.5	B
13	Darvills Rd (VA Route 40)/Dearing Ave	OWSC	NB Left/Right	8.7	A	9.2	A
			WB Left	7.3	A	7.3	A
14	W 10th St/Dearing Ave	OWSC	(d)	(d)	(d)	(d)	(d)
15	Business Driveway/ Dearing Ave	OWSC	EB Left/Right	8.6	A	8.7	A
16	Entry Loop (North)/Dearing Ave	None	(d)	(d)	(d)	(d)	(d)
17	Entry Loop (South)/Dearing Ave	OWSC	EB Left/Right	8.9	A	9.3	A
18	Foley Rd/Dearing Ave	TWSC	EB Left/Through/Right	8.7	A	9.2	A
			WB Left/Through/Right	0.0	A	9.2	A

Notes:
Bus = Business Route; EB = eastbound; LOS = Level of Service; NB = northbound; OWSC = one-way stop control; SB = southbound; TWSC = two-way stop control; WB = Westbound.
[a] LOS is provided only for movements that would experience delay during one or both peak hours.
[b] Delay is measured in seconds per vehicle.
[c] LOS calculations are based on HCM (TRB 2010) methods, and were performed using Synchro 8.
[d] W 10th St/Dearing Ave (intersection 14) and Entry Loop (North)/Dearing Ave (intersection 16) were not analyzed because they have no conflicting movements.

6.1.2 Other Traffic Analyses

6.1.2.1 Turn Lane Analysis

A turn lane analysis for projected conditions under Option A was performed using the methods described in Chapter 2. The results of the analysis are summarized in **Table 6-2**. The data tables and charts used to determine turn lane warrants are provided in Attachment D. Based on this analysis, the existing turning lane storage would be less than VDOT design standards and turning lane improvements may be warranted at the following intersection:

- U.S. Route 460 westbound left at Cox Road (intersection 1).

The turn lane treatment at U.S. Route 460/Cox Road would be triggered by the addition of project-related traffic. However, the turn lane improvements at Cox Road/Military Road and Darvills

Road/Military Road listed in Table 6-2 would be necessary under the No Action Alternative, and are not triggered by the Proposed Action.

Table 6-2. Summary of Turn Lane Analyses – Build Alternative 3, Option A (Year 2018)

Intersection and Movement	Existing Turn Lane Treatment	Turn Lane Treatment Required per VDOT Policy	Additional Treatment Required?
U.S. Route 460 at Cox Rd (intersection 1)			
Eastbound Left	125-foot Left Turn Lane with 75-foot Taper	No Left Turn Lane Required	NO
Eastbound Right	50-foot Right Turn Lane with 125-foot Taper	No Right Turn Lane Required	NO
Westbound Left	150-foot Left Turn Lane with 150-footTaper	Minimum 250-foot Left Turn Lane with Minimum 200-foot Taper	**YES**
Westbound Right	100-foot Right Turn Lane with 50-foot Taper	No Right Turn Lane Required	NO
Cox Rd at Military Rd (intersection 2)			
Eastbound Right	None	No Right Turn Lane Required	NO
Westbound Left	None	Minimum 200-foot Left Turn Lane with Minimum 200-foot Taper	**YES** [(a)]
Darvills Rd at Military Rd (intersection 3)			
Eastbound Left	None	No Left Turn Lane Required	NO
Eastbound Right	50-foot Right Turn Lane with 50-foot Taper	Minimum 200-foot Right Turn Lane with Minimum 200-foot Taper	**YES** [(a)]
Westbound Left	None	No Left Turn Lane Required	NO
Westbound Right	None	No Right Turn Lane Required	NO
Northbound Left	150-foot Left Turn Lane with 50-foot Taper	No Left Turn Lane Required	NO
Northbound Right	25-foot Right Turn Lane with 50-foot Taper	No Right Turn Lane Required	NO
Southbound Left	None	No Left Turn Lane Required	NO
Southbound Right	None	No Right Turn Lane Required	NO

Note:
[(a)] Additional turn lane treatment is warranted under the No Action Alternative, and is not caused by the addition of Option A traffic.

6.1.2.2 Fort Pickett Access Gate Analysis

Under Option A, access to Fort Pickett would continue to be controlled by two gates, the Main Gate and the West Gate. Each gate has two inbound lanes and one guard per lane. **Table 6-3** summarizes traffic volumes and staffing requirements at both gates under Option A. As shown in this table, both the Main Gate and the West Gate would have peak hour volumes per lane below the 375 vphpl threshold that would necessitate more than one guard per lane under Option A. Therefore, no additional personnel would be required at either gate.

Table 6-3. Summary of Gate Analysis – Build Alternative 3, Option A (Year 2018)

Main Gate (Military Road)				West Gate (West Entrance Road)			
A.M. Peak-hour (6:30-7:30 a.m.)		P.M. Peak-hour (4:00-5:00 p.m.)		A.M. Peak-hour (6:30-7:30 a.m.)		P.M. Peak-hour (4:00-5:00 p.m.)	
Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
vph	vph	vph	vph	vph	vph	vph	vph
290	188	44	42	74	92	18	17
Guards	Guards	Guards	Guards	Guards	Guards	Guards	Guards
1	1	1	1	1	1	1	1

Note:
vph = vehicles per hour.

6.1.2.3 Intersection Control Warrants

Because none of the traffic movements at any of the intersections are characterized by LOS E or F under Option A, no traffic signal warrant analysis was performed. As shown above in Table 6-1, all intersection traffic movements operate at LOS C or better during both peak hours; therefore, traffic signal installation is not needed to address any projected future intersection delay caused by project-related traffic or background traffic growth.

6.1.2.4 Site Access and Internal Circulation

As discussed in Section 1.2, access to and from the site would be provided primarily via Dearing Avenue, and a one-way loop circulation road (i.e., Entry Loop) would be constructed to the west of Dearing Avenue to provide a connection to the Core Area. Traffic on the Entry Loop would flow from north to south. The Core Area would function as an intermodal transfer facility, and the Entry Loop would accommodate a mixture of vehicles, including personal vehicles, buses, and minivans. Also, there would be substantial pedestrian activity at the Core Area, as students would transfer from buses to minivans at this location. The following traffic circulation measures would avoid potential transportation-related effects:

1. It is recommended that the Entry Loop be designed to accommodate and efficiently process vehicles approaching the Core Area. As feasible, passenger cars traveling to and from the surface parking lot should be separated from buses, minivans, and pedestrians. Where queues may form, sufficient storage should be provided to avoid blocking adjacent lanes and to prevent vehicles from stacking onto Dearing Avenue. To facilitate the transfer of students, it is recommended that minivans be scheduled to arrive and park before buses in the morning, while buses should be in place before the arrival of minivans in the afternoon. Signage, pavement markings, pedestrian islands and other design elements should be considered to accommodate safe and efficient pedestrian movement at the Core Area.

6.2 BUILD ALTERNATIVE 3, ACCESS OPTION B

6.2.1 Intersection LOS

Table 6-4 summarizes intersection LOS with the addition of project-related traffic associated with Option B. This includes externally-oriented trips (i.e., commuting trips by instructors and staff, transport of students from area hotels, and movement of minivans to and from the Core Area), internal shuttle trips, and the redistribution of existing trips from the Main Gate to the proposed Dearing Avenue gate. As shown in this table, most traffic movements would operate at LOS A or B, and several movements would operate at LOS C conditions during both peak hours. Because the Proposed Action would not cause LOS to drop from LOS C or better to LOS D or worse, Option B would have no significant traffic impact. Refer to Attachment C for intersection worksheets.

Table 6-4. Summary of Intersection LOS – Build Alternative 3, Option B (Year 2018)

Intersection		Traffic Control	Traffic Movement[a]	A.M. Peak Hour		P.M. Peak Hour	
				Delay[b]	LOS[c]	Delay[b]	LOS[c]
1	U.S. Route 460 (W Colonial Trail Hwy)/ Cox Rd/Yellowbird Rd	TWSC	NB Left/Through/Right	14.5	B	17.9	C
			EB Left	8.7	A	7.6	A
			WB Left	8.8	A	8.0	A
			SB Left/Through/Right	21.5	C	14.2	B
2	Cox Rd (U.S. Route 460 Bus)/Military Rd	OWSC	NB Left/Right	9.6	B	11.5	B
			WB Left	8.2	A	8.1	A
3	Darvills Rd (VA Route 40)/Military Rd	TWSC	NB Left	11.8	B	10.8	B
			NB Through	10.5	B	12.9	B
			NB Right	0.0	A	8.6	A
			EB Left	7.4	A	7.7	A
			WB Left	7.3	A	7.5	A
			SB Left/Right	14.5	B	14.0	B
4	W 10th St/Military Rd	TWSC	WB Left/Through/Right	10.7	B	10.2	B
			EB Left/Through/Right	0.0	A	10.1	B
			SB Left	7.7	A	7.7	A
5	West Entrance Rd/Military Rd	OWSC	NB Left	7.5	A	7.6	A
			EB Left/Right	10.3	B	9.4	A
6	Military Rd/Garnett Ave	TWSC	NB Left/Through/Right	9.8	A	9.7	A
			EB Left	7.3	A	7.4	A
			WB Left	7.5	A	7.3	A
			SB Left/Through/Right	8.8	A	9.2	A
7	Military Rd/Armistead Ave	TWSC	NB Left/Through/Right	9.4	A	9.4	A
			EB Left	7.2	A	7.4	A
			SB Left/Through/Right	8.4	A	8.7	A
8	Military Rd/Dearing Ave	TWSC	NB Left	7.2	A	7.2	A
			EB Left/Through/Right	8.6	A	8.8	A
9	W 10th St/Warehouse St	OWSC	EB Left	7.9	A	7.4	A
			SB Left/Right	8.8	A	9.0	A

Intersection		Traffic Control	Traffic Movement[a]	A.M. Peak Hour		P.M. Peak Hour	
				Delay[b]	LOS[c]	Delay[b]	LOS[c]
10	8th St/West Entrance Rd/S Main St	Signal	Overall (all movements)	15.3	B	18.6	B
			EB Left/Through/Right	21.8	C	30.4	C
			WB Left/Through/Right	20.1	C	29.5	C
			NB Left/Through/Right	18.6	B	19.8	B
			SB Left/Right	9.7	A	10.7	B
11	Church St (U.S. Route 460 Bus)/S Main St (U.S. Route 460 Bus/VA Route 40)	Signal	Overall (all movements)	8.5	A	11.0	B
			EB Left/Right	12.1	B	12.8	B
			NB Left/Through	5.4	A	7.5	A
			SB Through/Right	10.4	B	14.7	B
12	Dinwiddie Ave (VA Route 40)/N Main St (U.S. Route 460/VA Route 40)	Signal	Overall (all movements)	17.4	B	16.2	B
			EB Left/Through/Right	22.2	C	22.4	C
			WB Left/Through/Right	25.4	C	24.3	C
			NB Left/Through/Right	21.3	C	17.2	B
			SB Left/Through/Right	13.0	B	10.5	B
13	Darvills Rd (VA Route 40)/Dearing Ave	OWSC	NB Left/Right	9.2	A	10.1	B
			WB Left	7.3	A	7.3	A
14	W 10th St/Dearing Ave	OWSC	EB Left/Right	7.6	A	7.4	A
			NB Left	9.2	A	8.7	A
15	Business Driveway/ Dearing Ave	OWSC	EB Left/Right	9.8	A	9.8	A
16	Entry Loop (North)/Dearing Ave	None	(d)	(d)	(d)	(d)	(d)
17	Entry Loop (South)/Dearing Ave	OWSC	EB Left/Right	8.9	A	9.3	A
18	Foley Rd/Dearing Ave	TWSC	EB Left/Through/Right	8.7	A	9.2	A
			WB Left/Through/Right	0.0	A	9.2	A

Notes:
Bus = Business Route; EB = eastbound; LOS = Level of Service; NB = northbound; OWSC = one-way stop control; SB = southbound; TWSC = two-way stop control; WB = Westbound.
[a] LOS is provided only for movements that would experience delay during one or both peak hours.
[b] Delay is measured in seconds per vehicle.
[c] LOS calculations are based on HCM (TRB 2010) methods, and were performed using Synchro 8.
[d] Entry Loop (North)/Dearing Ave (intersection 16) was not analyzed because it has no conflicting movements.

6.2.2 Other Traffic Analyses

6.2.2.1 Turn Lane Analysis

A turn lane analysis for projected conditions under Option B was performed using the methods described in Chapter 2. The results of the analysis are summarized in **Table 6-5**. Refer to Attachment D for the data tables and charts used in this analysis. Based on this analysis, the existing turning lane storage would be less than VDOT design standards and turning lane improvements may be warranted at the following three intersections:

- U.S. Route 460 westbound left at Cox Road (intersection 1);
- Darvills Road westbound right at Military Road (intersection 3); and
- Darvills Road eastbound right at Dearing Avenue (intersection 13).

The turn lane treatment at U.S. Route 460/Cox Road (westbound left), the westbound right turn treatment at Darvills Road/Military Road, and the eastbound right turn treatment at Darvills Road/Dearing Avenue would be triggered by the addition of project-related traffic. However, the turn lane improvements listed in Table 6-5 at Cox Road/Military Road (westbound left) and the eastbound right at Darvills Road/Military Road would be necessary under the No Action Alternative, and are not triggered by the Proposed Action.

Table 6-5. Summary of Turn Lane Analyses – Build Alternative 3, Option B (Year 2018)

Intersection and Movement	Existing Turn Lane Treatment	Turn Lane Treatment Required per VDOT Policy	Additional Treatment Required?
U.S. Route 460 at Cox Rd (intersection 1)			
Eastbound Left	125-foot Left Turn Lane with 75-foot Taper	No Left Turn Lane Required	NO
Eastbound Right	50-foot Right Turn Lane with 125-foot Taper	No Right Turn Lane Required	NO
Westbound Left	150-foot Left Turn Lane with 150-footTaper	Minimum 250-foot Left Turn Lane with Minimum 200-foot Taper	**YES**
Westbound Right	100-foot Right Turn Lane with 50-foot Taper	No Right Turn Lane Required	NO
Cox Rd at Military Rd (intersection 2)			
Eastbound Right	None	No Right Turn Lane Required	NO
Westbound Left	None	Minimum 200-foot Left Turn Lane with Minimum 200-foot Taper	**YES** [(a)]
Darvills Rd at Military Rd (intersection 3)			
Eastbound Left	None	No Left Turn Lane Required	NO
Eastbound Right	50-foot Right Turn Lane with 50-foot Taper	Minimum 200-foot Right Turn Lane with Minimum 200-foot Taper	**YES** [(a)]
Westbound Left	None	No Left Turn Lane Required	NO
Westbound Right	None	Minimum 100-foot Right Turn Lane with Minimum 200-foot Taper	**YES**
Northbound Left	150-foot Left Turn Lane with 50-foot Taper	No Left Turn Lane Required	NO
Northbound Right	25-foot Right Turn Lane with 50-foot Taper	No Right Turn Lane Required	NO
Southbound Left	None	No Left Turn Lane Required	NO
Southbound Right	None	No Right Turn Lane Required	NO
Darvills Rd at Dearing Ave (intersection 13)			
Eastbound Right	110-foot Right Turn Lane and 135-foot Taper	Minimum 200-foot Right Turn Lane with Minimum 200-foot Taper	**YES**
Westbound Left	165-foot Left Turn Lane with 135-foot Taper	No Left Turn Lane Required	NO

Note:
[(a)] Additional turn lane treatment is warranted under the No Action Alternative, and is not caused by the addition of Option B traffic.

6.2.2.2 Fort Pickett Access Gate Analysis

Under Option B, a new access gate would be established on Dearing Avenue, to the north of W. 10th Street. As previously discussed, this analysis assumes some existing vehicles that currently enter Fort Pickett at the Main Gate would divert to the proposed Dearing Avenue gate. **Table 6-6** summarizes traffic volumes and staffing requirements at all three gates under Option B. As shown in this table, Option B would not increase traffic levels so as to necessitate additional guards to process inbound trips at either the Main Gate or the West Gate. As shown below, the projected future inbound volume at the proposed access gate on Dearing Avenue would be 148 vehicles during the morning peak hour. This is substantially below the minimum threshold of 375 vehicles per hour per lane established by Virginia Army National Guard for two guards per land. Therefore, based on Virginia Army National Guard criteria, a single guard would suffice at this location. However, the actual number of guards at this gate would be determined by DOS based upon current doctrine and practice for access control.

Table 6-6. Summary of Gate Analysis – Build Alternative 3, Option B (Year 2018)

Main Gate (Military Road)				West Gate (West Entrance Road)				Proposed Dearing Gate (Dearing Ave)	
A.M. Peak-hour (6:30-7:30 a.m.)		P.M. Peak-hour (4:00-5:00 p.m.)		A.M. Peak-hour (6:30-7:30 a.m.)		P.M. Peak-hour (4:00-5:00 p.m.)		A.M. Peak-hour (6:30-7:30 a.m.)	P.M. Peak-hour (4:00-5:00 p.m.)
Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 1
vph	vph	vph	vph	vph	vph	vph	vph	vph	vph
200	131	18	17	73	91	18	17	148	53
Guards	Guards	Guards	Guards	Guards	Guards	Guards	Guards	Guards	Guards
1	1	1	1	1	1	1	1	1	1

Note:
vph = vehicles per hour.

6.2.2.3 Intersection Control Warrants

Because none of the traffic movements at any of the intersections are characterized by LOS E or LOS F under Option B, no traffic signal warrant analysis was performed. As shown in Table 6-4, all intersection traffic movements operate at LOS C or better during both peak hours; therefore, traffic signal installation is not needed to address any projected future intersection delay caused by project-related traffic or background traffic growth.

6.2.2.4 Site Access and Internal Circulation

Option B would have the same access configuration as Option A. Therefore, the following traffic circulation measure is also recommended for Option B:

It is recommended that the Entry Loop be designed to accommodate and efficiently process vehicles approaching the Core Area. As feasible, passenger cars traveling to and from the surface parking lot

should be separated from buses, minivans, and pedestrians. Where queues may form, sufficient storage should be provided to avoid blocking adjacent lanes and to prevent vehicles from stacking onto Dearing Avenue. To facilitate the transfer of students, it is recommended that minivans be scheduled to arrive and park before buses in the morning, while buses should be in place before the arrival of minivans in the afternoon. Signage, pavement markings, pedestrian islands and other design elements should be considered to accommodate safe and efficient pedestrian movement at the Core Area.

6.3 CONSTRUCTION IMPACTS

Implementation of any action alternative would involve temporary traffic impacts resulting from demolition and construction activities. The following types of additional trips are expected be added to the highway network:

- Construction worker commuting trips;
- Trips involving the delivery and removal of construction equipment and materials; and
- Trips involving the removal of demolition debris and excess fill material.

These trips would be temporary, and would not occur after the completion of project construction. Whereas construction worker commuter trips are expected to be concentrated during the traditional peak commuting periods, other trips would likely be dispersed throughout the typical working day. Regardless of the access option selected, construction traffic would approach the project site via Dearing Avenue, and would not enter Fort Pickett at either the Main Gate or the West Gate. The existing barrier across Dearing Avenue to the north of W. 10th Street would be temporarily opened to construction traffic until construction activities are completed. GSA and DOS would cooperate with Fort Pickett to ensure that appropriate security protocols are observed for construction traffic entering the installation. Given the temporary nature of construction traffic, and considering that all traffic movements are characterized by LOS C or better conditions under the No Action Alternative, the addition of construction related trips is not expected to result in a significant traffic-related impact.

6.4 CUMULATIVE IMPACTS

Although the Proposed Action would not have a significant direct traffic impact, its impacts, when considered together with other past, present and reasonably foreseeable future projects, are evaluated for potential cumulative effect. The traffic impacts of past projects (e.g., additional traffic from new development, changes in capacity, and circulation patterns due to transportation improvements) are reflected in the existing traffic conditions described in Chapter 3. Although no present or reasonably foreseeable future projects have been specifically identified and analyzed in this TIA, projected future traffic growth (i.e., one percent compounded annually) included in the No Action Alternative accounts for future projects that may add trips to the ROI. Reasonably foreseeable future projects that have not undergone environmental reviews under the National Environmental Policy Act and other state and local regulations would ensure that traffic impacts are avoided, minimized, and/or mitigated for to the extent practicable. The Proposed Action's contribution to cumulative traffic impacts would be relatively minor, consisting of additional passenger car, bus and minivan trips. The volume of traffic to be added, particularly during the peak hours, would be comparatively small. Accordingly, the Proposed Action would not result in any significant cumulative impacts relative to traffic and circulation.

Chapter 7 FINDINGS AND RECOMMENDATIONS

Two proposed FASTC access options are analyzed. Under Option A, access for project-related traffic to Fort Pickett would be provided at the existing Main Gate (i.e., on Military Road south of Darvills Road) and the existing West Gate (i.e., on West Entrance Road west of Military Road). The existing closed gate across Dearing Avenue north of W. 10th Street would remain closed under this option. Under Option B, the main access to FASTC would be at an additional access point that would be established on Dearing Avenue, north of W. 10th Street (i.e., the existing closed gate would be replaced by an operating controlled access). Access for Fort Pickett traffic would continue to be provided at the Main Gate and at the West Gate, and this analysis assumes that a limited amount of FASTC traffic would use the existing gates. The majority of all FASTC trips (i.e., approximately 80 percent), including all bus and minivan trips, would be directed to the proposed Dearing Avenue gate under Option B.

Access to and from the FASTC facility would be concentrated along Dearing Avenue between Military Road and W. 10th Street. A one-way loop circulation road (or "Entry Loop") would be constructed to the west of Dearing Avenue, and would form two intersections with this roadway. The one-way traffic flow would be from north to south. The Entry Loop would provide access to and from the FASTC Core Area. The Core Area would accommodate the majority of trips accessing the facility. These trips include passenger cars driven by instructors and staff, buses transporting students from area hotels, and minivans transporting students from the Core Area to training venues within FASTC.

The following analyses were performed under year 2018 conditions for both options.

- Peak hour (i.e., 6:30 to 7:30 a.m. and 4:00 to 5:00 p.m.) capacity analysis at 15 intersections;
- Turn lane storage and taper requirements at four intersections on designated VDOT-maintained facilities; and
- Peak hour traffic volumes and staffing requirements at Fort Pickett access gates.

This TIA also addresses traffic signal warrants and provides a qualitative assessment of site access and internal circulation. The key findings and conclusions of these analyses are described below.

- *Capacity Analysis*: All traffic movements at all intersections would be characterized by LOS C or better conditions during both peak hours for both options. Because the Proposed Action would not cause any movement to exceed the minimum performance standard of LOS D, its traffic impacts would be less than significant and no avoidance, minimization, or mitigation measures are recommended.
- *Turning Lane Analysis*: Although there are no direct traffic impacts, a turning lane analysis was performed with projected year 2018 traffic volumes using VDOT design criteria for Access Management (VDOT 2005). These criteria address turning lane needs and design features to ensure safe and efficient traffic movements.
    - Under the No Action Alternative without the proposed project, the turning lane analysis determined that 2018 traffic volumes will result in the existing turning lane storage being less than VDOT design standards at two intersections, and that the following turning lane improvements may be warranted:

1. New exclusive westbound left turn lane, including storage and taper, at the Cox Road/Military Road intersection.
2. Extend the existing eastbound right turn lane storage and taper at the Darvills Road/Military Road intersection.

- Under Build Alternative 3 for Option A and B, although there are no significant direct traffic impacts from the proposed project, the turning lane analysis determined that additional project-related traffic would result in the existing turning lane storage being less than VDOT design standards at three intersections. One movement of the U.S. Route 460/Cox Road intersection would be less than standard under Option A or B. Under Option B only, one movement at the Darvills Road/Military Road intersection and one movement at the Darvills Road/Dearing Avenue intersection would be less than standard. To address VDOT policy for turning lane storage criteria, the following turning lane improvements may be warranted at these three additional intersections:
    1. Extend the existing westbound left turn lane storage and taper at the U.S. Route 460/Cox Road intersection (Option A and B).
    2. New exclusive westbound right turn lane, including storage and taper, at the Darvills Road/Military Road intersection (Option B only).
    3. Extend the existing eastbound right turn lane storage and taper at the Darvills Road/Dearing Avenue intersection (Option B only).

- *Fort Pickett Gate Analysis*: Neither option would increase traffic levels at either the Main Gate or the West Gate so as to necessitate additional guards to process inbound trips. Under Option B, the projected future inbound volume at the proposed access gate on Dearing Avenue would be 148 vehicles during the morning peak hour. This is substantially below the minimum threshold of 375 vehicles per hour established by Virginia Army National Guard for two guards per lane. Therefore, based on Virginia Army National Guard criteria, as single guard would suffice at this location. However, the actual number of guards at this gate would be determined by DOS based upon a review of their doctrine and practice for access control.
- *Internal Circulation*: The Core Area would accommodate a mixture of vehicles, including personal vehicles, buses, and minivans. Also, there would be substantial pedestrian activity at the Core Area, as students would transfer from buses to minivans at this location. The following traffic circulation measure would avoid potential transportation-related effects:
    1. It is recommended that the Entry Loop be designed to accommodate and efficiently process vehicles approaching the Core Area. As feasible, passenger cars traveling to and from the surface parking lot should be separated from buses, minivans, and pedestrians. Where queues may form, sufficient storage should be provided to avoid blocking adjacent lanes and to prevent vehicles from stacking onto Dearing Avenue. To facilitate the transfer of students, minivans should be scheduled to arrive and park before buses in the morning, while buses should be in place before the arrival of minivans in the afternoon. Signage, pavement markings, pedestrian islands and other design elements should be considered to accommodate safe and efficient pedestrian movement at the Core Area.

Chapter 8 **REFERENCES**

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- **Attachment A**

2014 Traffic Counts

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(888) 247-8602

File Name : TM 1-Dearing Ave. and Darvills Rd. AM
Site Code :
Start Date : 8/19/2014
Page No : 1

Groups Printed- Car

	Darvills Rd Westbound				Dearing Ave Northbound				Darvills Rd Eastbound				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
06:30 AM	7	1	0	8	0	0	0	0	1	6	0	7	15
06:45 AM	4	2	0	6	0	0	0	0	1	1	0	2	8
Total	11	3	0	14	0	0	0	0	2	7	0	9	23
07:00 AM	10	0	0	10	1	0	0	1	2	3	0	5	16
07:15 AM	9	0	0	9	0	0	0	0	0	4	0	4	13
07:30 AM	13	0	0	13	0	0	0	0	1	4	0	5	18
07:45 AM	11	0	0	11	0	1	0	1	2	5	0	7	19
Total	43	0	0	43	1	1	0	2	5	16	0	21	66
08:00 AM	6	0	0	6	0	0	0	0	2	3	0	5	11
08:15 AM	5	0	0	5	0	1	0	1	6	5	0	11	17
Grand Total	65	3	0	68	1	2	0	3	15	31	0	46	117
Apprch %	95.6	4.4	0		33.3	66.7	0		32.6	67.4	0		
Total %	55.6	2.6	0	58.1	0.9	1.7	0	2.6	12.8	26.5	0	39.3	

	Darvills Rd Westbound			Dearing Ave Northbound			Darvills Rd Eastbound			
Start Time	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	10	0	10	**1**	0	**1**	**2**	3	5	16
07:15 AM	9	0	9	0	0	0	0	4	4	13
07:30 AM	**13**	0	**13**	0	0	0	1	4	5	18
07:45 AM	11	0	11	0	**1**	1	2	**5**	**7**	**19**
Total Volume	43	0	43	1	1	2	5	16	21	66
% App. Total	100	0		50	50		23.8	76.2		
PHF	.827	.000	.827	.250	.250	.500	.625	.800	.750	.868

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Groups Printed- Truck

	Darvills Rd Westbound				Dearing Ave Northbound				Darvills Rd Eastbound				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
06:30 AM	1	1	0	2	1	0	0	1	1	0	0	1	4
06:45 AM	0	1	0	1	1	1	0	2	0	2	0	2	5
Total	1	2	0	3	2	1	0	3	1	2	0	3	9
07:00 AM	0	0	0	0	1	1	0	2	2	0	0	2	4
07:15 AM	0	1	0	1	1	2	0	3	2	1	0	3	7
07:30 AM	2	1	0	3	2	0	0	2	1	0	0	1	6
07:45 AM	1	0	0	1	2	1	0	3	1	1	0	2	6
Total	3	2	0	5	6	4	0	10	6	2	0	8	23
08:00 AM	0	2	0	2	1	0	0	1	1	3	0	4	7
08:15 AM	0	1	0	1	2	0	0	2	0	0	0	0	3
Grand Total	4	7	0	11	11	5	0	16	8	7	0	15	42
Apprch %	36.4	63.6	0		68.8	31.2	0		53.3	46.7	0		
Total %	9.5	16.7	0	26.2	26.2	11.9	0	38.1	19	16.7	0	35.7	

	Darvills Rd Westbound			Dearing Ave Northbound			Darvills Rd Eastbound			
Start Time	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:15 AM										
07:15 AM	0	1	1	1	**2**	**3**	**2**	1	3	**7**
07:30 AM	**2**	1	**3**	**2**	0	2	1	0	1	6
07:45 AM	1	0	1	2	1	3	1	1	2	6
08:00 AM	0	**2**	2	1	0	1	1	**3**	**4**	7
Total Volume	3	4	7	6	3	9	5	5	10	26
% App. Total	42.9	57.1		66.7	33.3		50	50		
PHF	.375	.500	.583	.750	.375	.750	.625	.417	.625	.929

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File Name : TM 1-Dearing Ave. and Darvills Rd. AM
Site Code :
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Groups Printed- Combined

	Darvills Rd Westbound				Dearing Ave Northbound				Darvills Rd Eastbound				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
06:30 AM	8	2	0	10	1	0	0	1	2	6	0	8	19
06:45 AM	4	3	0	7	1	1	0	2	1	3	0	4	13
Total	12	5	0	17	2	1	0	3	3	9	0	12	32
07:00 AM	10	0	0	10	2	1	0	3	4	3	0	7	20
07:15 AM	9	1	0	10	1	2	0	3	2	5	0	7	20
07:30 AM	15	1	0	16	2	0	0	2	2	4	0	6	24
07:45 AM	12	0	0	12	2	2	0	4	3	6	0	9	25
Total	46	2	0	48	7	5	0	12	11	18	0	29	89
08:00 AM	6	2	0	8	1	0	0	1	3	6	0	9	18
08:15 AM	5	1	0	6	2	1	0	3	6	5	0	11	20
Grand Total	69	10	0	79	12	7	0	19	23	38	0	61	159
Apprch %	87.3	12.7	0		63.2	36.8	0		37.7	62.3	0		
Total %	43.4	6.3	0	49.7	7.5	4.4	0	11.9	14.5	23.9	0	38.4	

	Darvills Rd Westbound			Dearing Ave Northbound			Darvills Rd Eastbound			
Start Time	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	10	0	10	**2**	1	3	**4**	3	7	20
07:15 AM	9	**1**	10	1	**2**	3	2	5	7	20
07:30 AM	**15**	1	**16**	2	0	2	2	4	6	24
07:45 AM	12	0	12	2	2	**4**	3	**6**	**9**	**25**
Total Volume	46	2	48	7	5	12	11	18	29	89
% App. Total	95.8	4.2		58.3	41.7		37.9	62.1		
PHF	.767	.500	.750	.875	.625	.750	.688	.750	.806	.890

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File Name : TM 1-Dearing Ave. and Darvills Rd. PM
Site Code :
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Groups Printed- Car

	Darvills Rd Westbound				Dearing Ave Northbound				Darvills Rd Eastbound				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
03:30 PM	8	0	0	8	1	1	0	2	2	14	0	16	26
03:45 PM	11	1	0	12	0	1	0	1	0	9	0	9	22
Total	19	1	0	20	1	2	0	3	2	23	0	25	48
04:00 PM	12	0	0	12	0	5	0	5	2	15	0	17	34
04:15 PM	6	0	0	6	0	1	0	1	2	9	0	11	18
04:30 PM	6	0	0	6	1	4	0	5	0	17	0	17	28
04:45 PM	1	1	0	2	1	3	0	4	2	11	0	13	19
Total	25	1	0	26	2	13	0	15	6	52	0	58	99
05:00 PM	5	1	0	6	1	1	0	2	0	9	0	9	17
05:15 PM	4	0	0	4	2	2	0	4	0	18	0	18	26
Grand Total	53	3	0	56	6	18	0	24	8	102	0	110	190
Apprch %	94.6	5.4	0		25	75	0		7.3	92.7	0		
Total %	27.9	1.6	0	29.5	3.2	9.5	0	12.6	4.2	53.7	0	57.9	

	Darvills Rd Westbound			Dearing Ave Northbound			Darvills Rd Eastbound			
Start Time	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:15 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 03:45 PM										
03:45 PM	11	**1**	**12**	0	1	1	0	9	9	22
04:00 PM	**12**	0	12	0	**5**	**5**	**2**	15	**17**	**34**
04:15 PM	6	0	6	0	1	1	2	9	11	18
04:30 PM	6	0	6	**1**	4	5	0	**17**	17	28
Total Volume	35	1	36	1	11	12	4	50	54	102
% App. Total	97.2	2.8		8.3	91.7		7.4	92.6		
PHF	.729	.250	.750	.250	.550	.600	.500	.735	.794	.750

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Groups Printed- Truck

	Darvills Rd Westbound				Dearing Ave Northbound				Darvills Rd Eastbound				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
03:30 PM	0	1	0	1	0	1	0	1	2	0	0	2	4
03:45 PM	3	0	0	3	0	3	0	3	1	0	0	1	7
Total	3	1	0	4	0	4	0	4	3	0	0	3	11
04:00 PM	2	2	0	4	1	1	0	2	0	0	0	0	6
04:15 PM	2	2	0	4	0	2	0	2	2	0	0	2	8
04:30 PM	0	0	0	0	2	2	0	4	1	2	0	3	7
04:45 PM	2	0	0	2	0	2	0	2	1	1	0	2	6
Total	6	4	0	10	3	7	0	10	4	3	0	7	27
05:00 PM	0	2	0	2	0	0	0	0	0	1	0	1	3
05:15 PM	0	0	0	0	0	3	0	3	1	1	0	2	5
Grand Total	9	7	0	16	3	14	0	17	8	5	0	13	46
Apprch %	56.2	43.8	0		17.6	82.4	0		61.5	38.5	0		
Total %	19.6	15.2	0	34.8	6.5	30.4	0	37	17.4	10.9	0	28.3	

	Darvills Rd Westbound			Dearing Ave Northbound			Darvills Rd Eastbound			
Start Time	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:15 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 03:45 PM										
03:45 PM	**3**	0	3	0	**3**	3	1	0	1	7
04:00 PM	2	**2**	**4**	1	1	2	0	0	0	6
04:15 PM	2	2	4	0	2	2	**2**	0	2	**8**
04:30 PM	0	0	0	**2**	2	**4**	1	**2**	**3**	7
Total Volume	7	4	11	3	8	11	4	2	6	28
% App. Total	63.6	36.4		27.3	72.7		66.7	33.3		
PHF	.583	.500	.688	.375	.667	.688	.500	.250	.500	.875

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File Name : TM 1-Dearing Ave. and Darvills Rd. PM
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Groups Printed- Combined

	Darvills Rd Westbound				Dearing Ave Northbound				Darvills Rd Eastbound				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
03:30 PM	8	1	0	9	1	2	0	3	4	14	0	18	30
03:45 PM	14	1	0	15	0	4	0	4	1	9	0	10	29
Total	22	2	0	24	1	6	0	7	5	23	0	28	59
04:00 PM	14	2	0	16	1	6	0	7	2	15	0	17	40
04:15 PM	8	2	0	10	0	3	0	3	4	9	0	13	26
04:30 PM	6	0	0	6	3	6	0	9	1	19	0	20	35
04:45 PM	3	1	0	4	1	5	0	6	3	12	0	15	25
Total	31	5	0	36	5	20	0	25	10	55	0	65	126
05:00 PM	5	3	0	8	1	1	0	2	0	10	0	10	20
05:15 PM	4	0	0	4	2	5	0	7	1	19	0	20	31
Grand Total	62	10	0	72	9	32	0	41	16	107	0	123	236
Apprch %	86.1	13.9	0		22	78	0		13	87	0		
Total %	26.3	4.2	0	30.5	3.8	13.6	0	17.4	6.8	45.3	0	52.1	

	Darvills Rd Westbound			Dearing Ave Northbound			Darvills Rd Eastbound			
Start Time	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:15 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 03:45 PM										
03:45 PM	**14**	1	15	0	4	4	1	9	10	29
04:00 PM	14	**2**	**16**	1	**6**	7	2	15	17	**40**
04:15 PM	8	2	10	0	3	3	**4**	9	13	26
04:30 PM	6	0	6	**3**	6	**9**	1	**19**	**20**	35
Total Volume	42	5	47	4	19	23	8	52	60	130
% App. Total	89.4	10.6		17.4	82.6		13.3	86.7		
PHF	.750	.625	.734	.333	.792	.639	.500	.684	.750	.813

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File Name : TM 2-Dearing Ave. and Airfield Access Rd. AM
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Groups Printed- Car

	Dearing Ave Southbound				Dearing Ave Northbound				Arbor Tech Drvwy Eastbound				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
06:30 AM	1	0	0	1	0	0	0	0	0	0	0	0	1
06:45 AM	1	3	0	4	0	0	0	0	0	0	0	0	4
Total	2	3	0	5	0	0	0	0	0	0	0	0	5
07:00 AM	1	1	0	2	0	0	0	0	0	0	0	0	2
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	1	0	0	1	0	0	0	0	0	0	0	0	1
07:45 AM	0	1	0	1	1	0	0	1	0	0	0	0	2
Total	2	2	0	4	1	0	0	1	0	0	0	0	5
08:00 AM	1	1	0	2	0	0	0	0	0	0	0	0	2
08:15 AM	3	2	0	5	1	0	0	1	0	0	0	0	6
Grand Total	8	8	0	16	2	0	0	2	0	0	0	0	18
Apprch %	50	50	0		100	0	0		0	0	0		
Total %	44.4	44.4	0	88.9	11.1	0	0	11.1	0	0	0	0	

	Dearing Ave Southbound			Dearing Ave Northbound			Arbor Tech Drvwy Eastbound			
Start Time	Right	Thru	App. Total	Thru	Left	App. Total	Right	Left	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30 AM										
07:30 AM	1	0	1	0	0	0	0	0	0	1
07:45 AM	0	1	1	**1**	0	**1**	0	0	0	2
08:00 AM	1	1	2	0	0	0	0	0	0	2
08:15 AM	**3**	**2**	**5**	1	0	1	0	0	0	**6**
Total Volume	5	4	9	2	0	2	0	0	0	11
% App. Total	55.6	44.4		100	0		0	0		
PHF	.417	.500	.450	.500	.000	.500	.000	.000	.000	.458

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File Name : TM 2-Dearing Ave. and Airfield Access Rd. AM
Site Code :
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Groups Printed- Truck

	Dearing Ave Southbound				Dearing Ave Northbound				Arbor Tech Drvwy Eastbound				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
06:30 AM	2	0	0	2	0	0	0	0	0	1	0	1	3
06:45 AM	1	0	0	1	0	0	0	0	0	2	0	2	3
Total	3	0	0	3	0	0	0	0	0	3	0	3	6
07:00 AM	1	0	0	1	0	0	0	0	0	3	0	3	4
07:15 AM	3	0	0	3	0	0	0	0	0	2	0	2	5
07:30 AM	3	0	0	3	0	0	0	0	0	2	0	2	5
07:45 AM	1	0	0	1	0	0	0	0	0	3	0	3	4
Total	8	0	0	8	0	0	0	0	0	10	0	10	18
08:00 AM	3	0	0	3	0	0	0	0	0	1	0	1	4
08:15 AM	1	0	0	1	0	0	0	0	0	2	0	2	3
Grand Total	15	0	0	15	0	0	0	0	0	16	0	16	31
Apprch %	100	0	0		0	0	0		0	100	0		
Total %	48.4	0	0	48.4	0	0	0	0	0	51.6	0	51.6	

	Dearing Ave Southbound			Dearing Ave Northbound			Arbor Tech Drvwy Eastbound			
Start Time	Right	Thru	App. Total	Thru	Left	App. Total	Right	Left	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	1	0	1	0	0	0	0	**3**	**3**	4
07:15 AM	**3**	0	**3**	0	0	0	0	2	2	**5**
07:30 AM	3	0	3	0	0	0	0	2	2	5
07:45 AM	1	0	1	0	0	0	0	3	3	4
Total Volume	8	0	8	0	0	0	0	10	10	18
% App. Total	100	0		0	0		0	100		
PHF	.667	.000	.667	.000	.000	.000	.000	.833	.833	.900

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Groups Printed- Combined

	Dearing Ave Southbound				Dearing Ave Northbound				Arbor Tech Drvwy Eastbound				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
06:30 AM	3	0	0	3	0	0	0	0	0	1	0	1	4
06:45 AM	2	3	0	5	0	0	0	0	0	2	0	2	7
Total	5	3	0	8	0	0	0	0	0	3	0	3	11
07:00 AM	2	1	0	3	0	0	0	0	0	3	0	3	6
07:15 AM	3	0	0	3	0	0	0	0	0	2	0	2	5
07:30 AM	4	0	0	4	0	0	0	0	0	2	0	2	6
07:45 AM	1	1	0	2	1	0	0	1	0	3	0	3	6
Total	10	2	0	12	1	0	0	1	0	10	0	10	23
08:00 AM	4	1	0	5	0	0	0	0	0	1	0	1	6
08:15 AM	4	2	0	6	1	0	0	1	0	2	0	2	9
Grand Total	23	8	0	31	2	0	0	2	0	16	0	16	49
Apprch %	74.2	25.8	0		100	0	0		0	100	0		
Total %	46.9	16.3	0	63.3	4.1	0	0	4.1	0	32.7	0	32.7	

	Dearing Ave Southbound			Dearing Ave Northbound			Arbor Tech Drvwy Eastbound			
Start Time	Right	Thru	App. Total	Thru	Left	App. Total	Right	Left	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30 AM										
07:30 AM	**4**	0	4	0	0	0	0	2	2	6
07:45 AM	1	1	2	**1**	0	**1**	0	**3**	**3**	6
08:00 AM	4	1	5	0	0	0	0	1	1	6
08:15 AM	4	**2**	**6**	1	0	1	0	2	2	**9**
Total Volume	13	4	17	2	0	2	0	8	8	27
% App. Total	76.5	23.5		100	0		0	100		
PHF	.813	.500	.708	.500	.000	.500	.000	.667	.667	.750

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Groups Printed- Car

	Dearing Ave Southbound				Dearing Ave Northbound				Arbor Tech Drvwy Eastbound				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
03:30 PM	2	0	0	2	0	0	0	0	0	2	0	2	4
03:45 PM	1	0	0	1	0	0	0	0	0	0	0	0	1
Total	3	0	0	3	0	0	0	0	0	2	0	2	5
04:00 PM	1	0	0	1	3	0	0	3	0	1	0	1	5
04:15 PM	2	0	0	2	0	0	0	0	0	1	0	1	3
04:30 PM	0	0	0	0	0	0	0	0	0	5	0	5	5
04:45 PM	1	2	0	3	0	0	0	0	0	4	0	4	7
Total	4	2	0	6	3	0	0	3	0	11	0	11	20
05:00 PM	1	0	0	1	0	0	0	0	0	2	0	2	3
05:15 PM	0	0	0	0	0	0	0	0	0	4	0	4	4
Grand Total	8	2	0	10	3	0	0	3	0	19	0	19	32
Apprch %	80	20	0		100	0	0		0	100	0		
Total %	25	6.2	0	31.2	9.4	0	0	9.4	0	59.4	0	59.4	

	Dearing Ave Southbound			Dearing Ave Northbound			Arbor Tech Drvwy Eastbound			
Start Time	Right	Thru	App. Total	Thru	Left	App. Total	Right	Left	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:15 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	1	0	1	**3**	0	**3**	0	1	1	5
04:15 PM	**2**	0	2	0	0	0	0	1	1	3
04:30 PM	0	0	0	0	0	0	0	**5**	**5**	5
04:45 PM	1	**2**	**3**	0	0	0	0	4	4	**7**
Total Volume	4	2	6	3	0	3	0	11	11	20
% App. Total	66.7	33.3		100	0		0	100		
PHF	.500	.250	.500	.250	.000	.250	.000	.550	.550	.714

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Groups Printed- Truck

	Dearing Ave Southbound				Dearing Ave Northbound				Arbor Tech Drvwy Eastbound				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
03:30 PM	3	0	0	3	0	0	0	0	0	1	0	1	4
03:45 PM	1	0	0	1	0	0	0	0	0	3	0	3	4
Total	4	0	0	4	0	0	0	0	0	4	0	4	8
04:00 PM	2	0	0	2	0	0	0	0	0	2	0	2	4
04:15 PM	4	0	0	4	0	0	0	0	0	2	0	2	6
04:30 PM	0	1	0	1	0	0	0	0	0	4	0	4	5
04:45 PM	1	0	0	1	1	0	0	1	0	1	0	1	3
Total	7	1	0	8	1	0	0	1	0	9	0	9	18
05:00 PM	2	0	0	2	0	0	0	0	0	0	0	0	2
05:15 PM	1	0	0	1	0	0	0	0	0	3	0	3	4
Grand Total	14	1	0	15	1	0	0	1	0	16	0	16	32
Apprch %	93.3	6.7	0		100	0	0		0	100	0		
Total %	43.8	3.1	0	46.9	3.1	0	0	3.1	0	50	0	50	

	Dearing Ave Southbound			Dearing Ave Northbound			Arbor Tech Drvwy Eastbound			
Start Time	Right	Thru	App. Total	Thru	Left	App. Total	Right	Left	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:15 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 03:45 PM										
03:45 PM	1	0	1	0	0	0	0	3	3	4
04:00 PM	2	0	2	0	0	0	0	2	2	4
04:15 PM	**4**	0	**4**	0	0	0	0	2	2	**6**
04:30 PM	0	**1**	1	0	0	0	0	**4**	**4**	5
Total Volume	7	1	8	0	0	0	0	11	11	19
% App. Total	87.5	12.5		0	0		0	100		
PHF	.438	.250	.500	.000	.000	.000	.000	.688	.688	.792

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Groups Printed- Combined

	Dearing Ave Southbound				Dearing Ave Northbound				Arbor Tech Drvwy Eastbound				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
03:30 PM	5	0	0	5	0	0	0	0	0	3	0	3	8
03:45 PM	2	0	0	2	0	0	0	0	0	3	0	3	5
Total	7	0	0	7	0	0	0	0	0	6	0	6	13
04:00 PM	3	0	0	3	3	0	0	3	0	3	0	3	9
04:15 PM	6	0	0	6	0	0	0	0	0	3	0	3	9
04:30 PM	0	1	0	1	0	0	0	0	0	9	0	9	10
04:45 PM	2	2	0	4	1	0	0	1	0	5	0	5	10
Total	11	3	0	14	4	0	0	4	0	20	0	20	38
05:00 PM	3	0	0	3	0	0	0	0	0	2	0	2	5
05:15 PM	1	0	0	1	0	0	0	0	0	7	0	7	8
Grand Total	22	3	0	25	4	0	0	4	0	35	0	35	64
Apprch %	88	12	0		100	0	0		0	100	0		
Total %	34.4	4.7	0	39.1	6.2	0	0	6.2	0	54.7	0	54.7	

	Dearing Ave Southbound			Dearing Ave Northbound			Arbor Tech Drvwy Eastbound			
Start Time	Right	Thru	App. Total	Thru	Left	App. Total	Right	Left	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:15 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	3	0	3	**3**	0	**3**	0	3	3	9
04:15 PM	**6**	0	**6**	0	0	0	0	3	3	9
04:30 PM	0	1	1	0	0	0	0	**9**	**9**	**10**
04:45 PM	2	**2**	4	1	0	1	0	5	5	10
Total Volume	11	3	14	4	0	4	0	20	20	38
% App. Total	78.6	21.4		100	0		0	100		
PHF	.458	.375	.583	.333	.000	.333	.000	.556	.556	.950

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Groups Printed- Car

	Dearing Ave Southbound				Dearing Ave Northbound				W. 10th St Eastbound				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
06:30 AM	0	0	0	0	0	0	0	0	1	0	0	1	1
06:45 AM	0	1	0	1	0	0	0	0	0	0	0	0	1
Total	0	1	0	1	0	0	0	0	1	0	0	1	2
07:00 AM	0	0	0	0	0	1	0	1	0	0	0	0	1
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	1	0	0	1	1
07:45 AM	0	0	1	1	0	0	0	0	1	0	0	1	2
Total	0	0	1	1	0	1	0	1	2	0	0	2	4
08:00 AM	0	0	0	0	0	0	0	0	1	0	0	1	1
08:15 AM	0	0	0	0	0	1	0	1	1	0	0	1	2
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	1	1	2	0	2	0	2	5	0	0	5	9
Apprch %	0	50	50		0	100	0		100	0	0		
Total %	0	11.1	11.1	22.2	0	22.2	0	22.2	55.6	0	0	55.6	

	Dearing Ave Southbound			Dearing Ave Northbound			W. 10th St Eastbound			
Start Time	Right	Thru	App. Total	Thru	Left	App. Total	Right	Left	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:30 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30 AM										
07:30 AM	0	0	0	0	0	0	**1**	0	**1**	1
07:45 AM	0	0	0	0	0	0	1	0	1	1
08:00 AM	0	0	0	0	0	0	1	0	1	1
08:15 AM	0	0	0	0	**1**	**1**	1	0	1	**2**
Total Volume	0	0	0	0	1	1	4	0	4	5
% App. Total	0	0		0	100		100	0		
PHF	.000	.000	.000	.000	.250	.250	1.00	.000	1.00	.625

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Groups Printed- Truck

	Dearing Ave Southbound				Dearing Ave Northbound				W. 10th St Eastbound				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	2	0	0	2	2
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	1	0	0	1	1
Total	0	0	0	0	0	0	0	0	3	0	0	3	3
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	3	0	0	3	3
Apprch %	0	0	0		0	0	0		100	0	0		
Total %	0	0	0	0	0	0	0	0	100	0	0	100	

	Dearing Ave Southbound			Dearing Ave Northbound			W. 10th St Eastbound			
Start Time	Right	Thru	App. Total	Thru	Left	App. Total	Right	Left	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:30 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	**2**	0	**2**	**2**
07:30 AM	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	1	0	1	1
Total Volume	0	0	0	0	0	0	3	0	3	3
% App. Total	0	0		0	0		100	0		
PHF	.000	.000	.000	.000	.000	.000	.375	.000	.375	.375

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Groups Printed- Combined

	Dearing Ave Southbound				Dearing Ave Northbound				W. 10th St Eastbound				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
06:30 AM	0	0	0	0	0	0	0	0	1	0	0	1	1
06:45 AM	0	1	0	1	0	0	0	0	0	0	0	0	1
Total	0	1	0	1	0	0	0	0	1	0	0	1	2
07:00 AM	0	0	0	0	0	1	0	1	0	0	0	0	1
07:15 AM	0	0	0	0	0	0	0	0	2	0	0	2	2
07:30 AM	0	0	0	0	0	0	0	0	1	0	0	1	1
07:45 AM	0	0	1	1	0	0	0	0	2	0	0	2	3
Total	0	0	1	1	0	1	0	1	5	0	0	5	7
08:00 AM	0	0	0	0	0	0	0	0	1	0	0	1	1
08:15 AM	0	0	0	0	0	1	0	1	1	0	0	1	2
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	1	1	2	0	2	0	2	8	0	0	8	12
Apprch %	0	50	50		0	100	0		100	0	0		
Total %	0	8.3	8.3	16.7	0	16.7	0	16.7	66.7	0	0	66.7	

	Dearing Ave Southbound			Dearing Ave Northbound			W. 10th St Eastbound			
Start Time	Right	Thru	App. Total	Thru	Left	App. Total	Right	Left	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:30 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	0	0	0	0	**1**	**1**	0	0	0	1
07:15 AM	0	0	0	0	0	0	**2**	0	**2**	**2**
07:30 AM	0	0	0	0	0	0	1	0	1	1
07:45 AM	0	0	0	0	0	0	2	0	2	2
Total Volume	0	0	0	0	1	1	5	0	5	6
% App. Total	0	0		0	100		100	0		
PHF	.000	.000	.000	.000	.250	.250	.625	.000	.625	.750

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Groups Printed- Car

	Dearing Ave Southbound				Dearing Ave Northbound				W. 10th St Eastbound				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
03:30 PM	0	0	0	0	0	1	0	1	0	0	0	0	1
03:45 PM	0	0	0	0	0	0	0	0	1	0	0	1	1
Total	0	0	0	0	0	1	0	1	1	0	0	1	2
04:00 PM	0	0	0	0	0	1	0	1	0	1	0	1	2
04:15 PM	0	0	0	0	0	1	0	1	0	0	0	0	1
04:30 PM	0	0	0	0	0	0	0	0	2	0	3	5	5
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	2	0	2	2	1	3	6	8
05:00 PM	1	0	0	1	1	0	0	1	0	0	0	0	2
05:15 PM	0	0	0	0	0	0	0	0	1	0	0	1	1
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	1	0	0	1	1	3	0	4	4	1	3	8	13
Apprch %	100	0	0		25	75	0		50	12.5	37.5		
Total %	7.7	0	0	7.7	7.7	23.1	0	30.8	30.8	7.7	23.1	61.5	

	Dearing Ave Southbound			Dearing Ave Northbound			W. 10th St Eastbound			
Start Time	Right	Thru	App. Total	Thru	Left	App. Total	Right	Left	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:30 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 03:45 PM										
03:45 PM	0	0	0	0	0	0	1	0	1	1
04:00 PM	0	0	0	0	**1**	**1**	0	**1**	1	**2**
04:15 PM	0	0	0	0	1	1	0	0	0	1
04:30 PM	0	0	0	0	0	0	**2**	0	**2**	2
Total Volume	0	0	0	0	2	2	3	1	4	6
% App. Total	0	0		0	100		75	25		
PHF	.000	.000	.000	.000	.500	.500	.375	.250	.500	.750

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Groups Printed- Truck

	Dearing Ave Southbound				Dearing Ave Northbound				W. 10th St Eastbound				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
03:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0		0	0	0		0	0	0		
Total %													

	Dearing Ave Southbound			Dearing Ave Northbound			W. 10th St Eastbound			
Start Time	Right	Thru	App. Total	Thru	Left	App. Total	Right	Left	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:30 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 03:30 PM										
03:30 PM	0	0	0	0	0	0	0	0	0	0
03:45 PM	0	0	0	0	0	0	0	0	0	0
04:00 PM	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0		0	0		0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

Peggy Malone & Associates, Inc.
(888) 247-8602

File Name : TM 3-Dearing Ave. and E. 10th St. PM
Site Code :
Start Date : 8/19/2014
Page No : 1

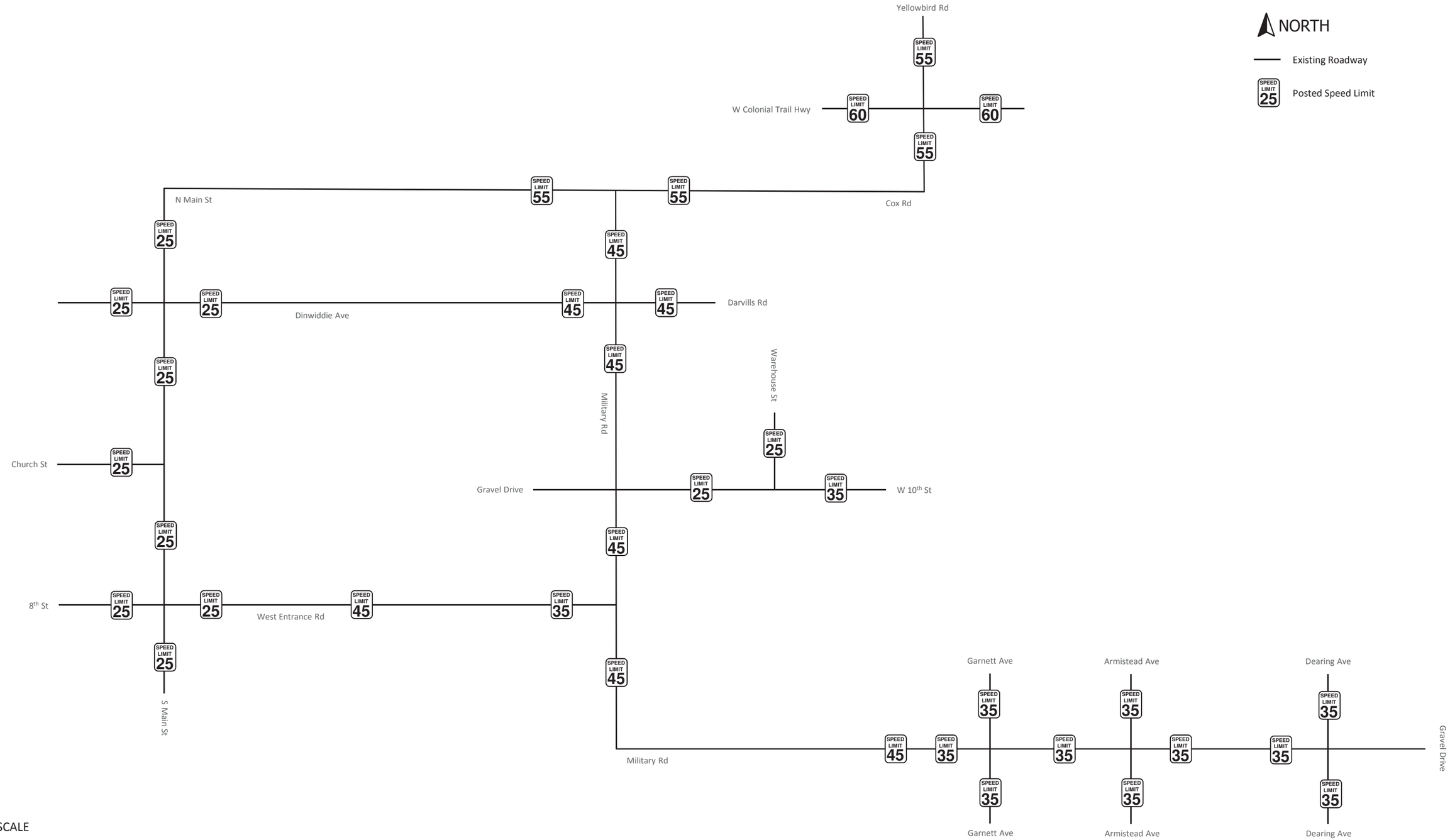
Groups Printed- Combined

	Dearing Ave Southbound				Dearing Ave Northbound				W. 10th St Eastbound				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
03:30 PM	0	0	0	0	0	1	0	1	0	0	0	0	1
03:45 PM	0	0	0	0	0	0	0	0	1	0	0	1	1
Total	0	0	0	0	0	1	0	1	1	0	0	1	2
04:00 PM	0	0	0	0	0	1	0	1	0	1	0	1	2
04:15 PM	0	0	0	0	0	1	0	1	0	0	0	0	1
04:30 PM	0	0	0	0	0	0	0	0	2	0	3	5	5
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	2	0	2	2	1	3	6	8
05:00 PM	1	0	0	1	1	0	0	1	0	0	0	0	2
05:15 PM	0	0	0	0	0	0	0	0	1	0	0	1	1
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	1	0	0	1	1	3	0	4	4	1	3	8	13
Apprch %	100	0	0		25	75	0		50	12.5	37.5		
Total %	7.7	0	0	7.7	7.7	23.1	0	30.8	30.8	7.7	23.1	61.5	

	Dearing Ave Southbound			Dearing Ave Northbound			W. 10th St Eastbound			
Start Time	Right	Thru	App. Total	Thru	Left	App. Total	Right	Left	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:30 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 03:45 PM										
03:45 PM	0	0	0	0	0	0	1	0	1	1
04:00 PM	0	0	0	0	**1**	**1**	0	**1**	1	**2**
04:15 PM	0	0	0	0	1	1	0	0	0	1
04:30 PM	0	0	0	0	0	0	**2**	0	**2**	2
Total Volume	0	0	0	0	2	2	3	1	4	6
% App. Total	0	0		0	100		75	25		
PHF	.000	.000	.000	.000	.500	.500	.375	.250	.500	.750

- **Attachment B**

Excerpts from the 2012 TIA

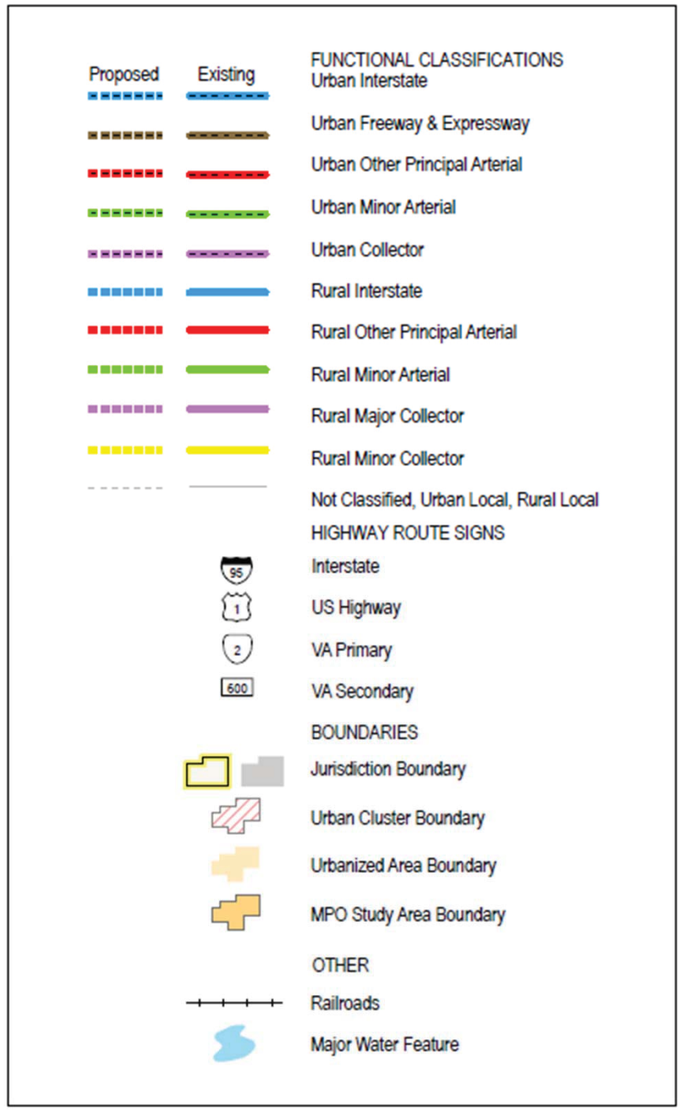


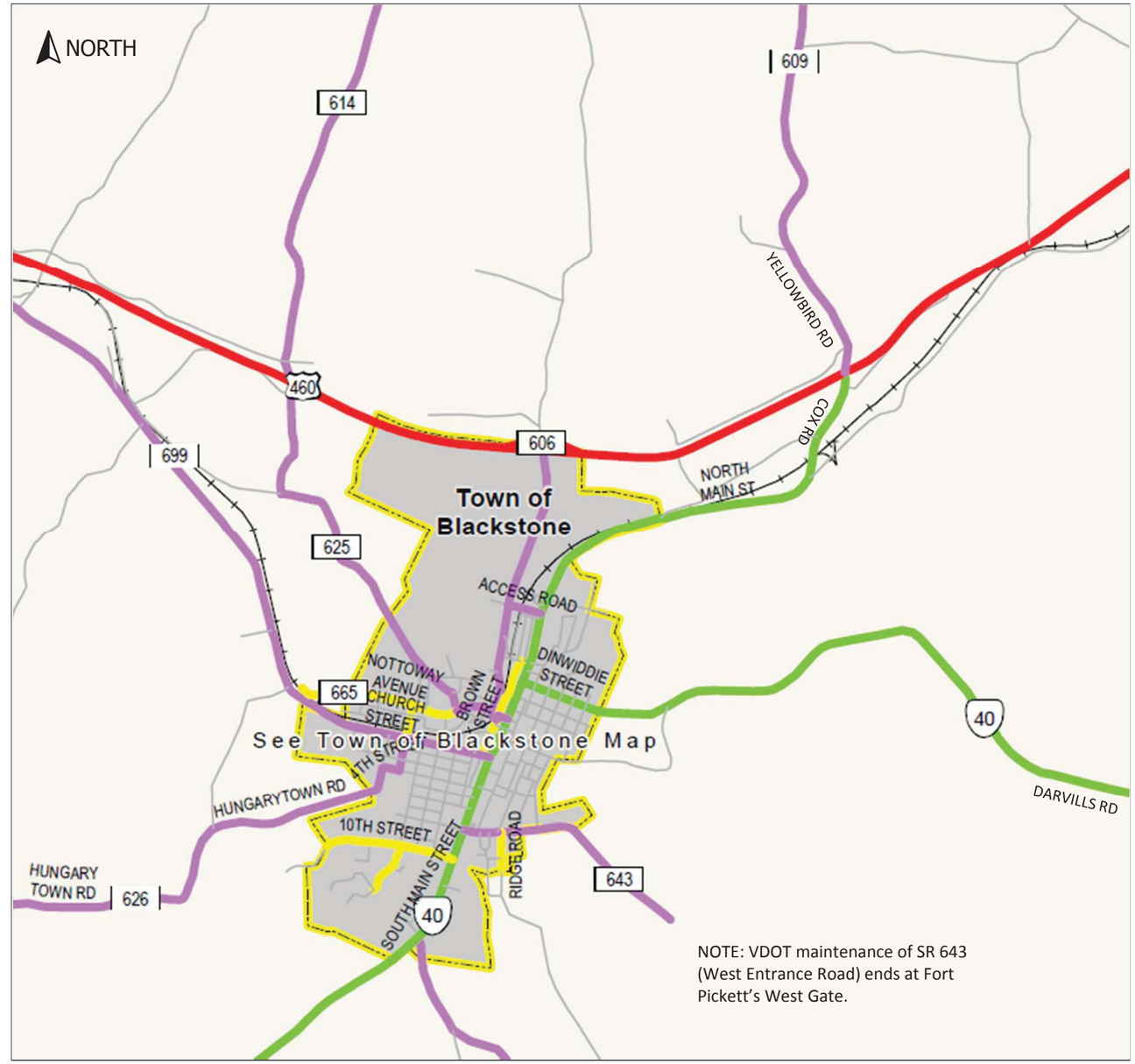
FOREIGN AFFAIRS SECURITY TRAINING CENTER [FASTC]

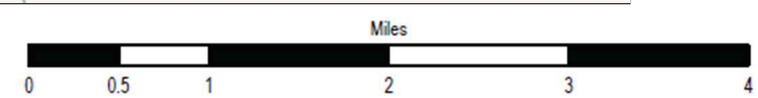
An American Recovery and Reinvestment Act of 2009 Project

Figure 2-7

Posted Speed Limits





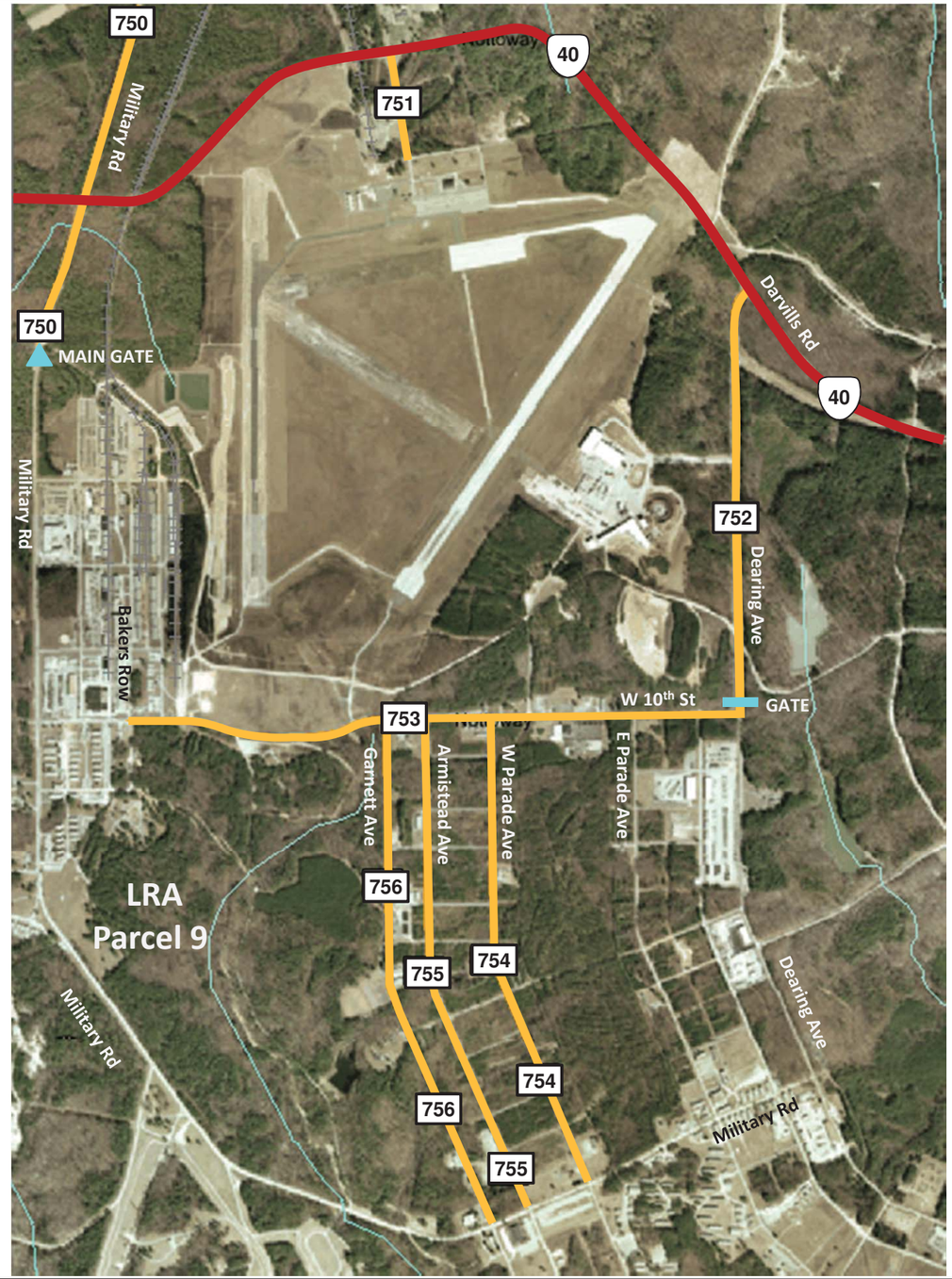


Source: VDOT's Nottoway County 2005 Functional Classification Map (http://www.virginiadot.org/projects/resources/fxn_class/Richmond/Nottoway_County.pdf)

Figure 2-8

Functional Classification Map

NOTE: VDOT maintenance of SR 750 (Military Road) ends at Fort Pickett's Main Gate.



NOTE: Dearing Avenue is gated off just north of W 10th Street to prevent access to Fort Pickett.

NORTH

- VDOT Primary Route
- VDOT Secondary Road
- Manned Gate
- Unmanned Gate
- LRA Parcel 9

Source: VDOT Online Transportation Map (http://www.virginiadot.org/travel/prOTIM.asp)

FOREIGN AFFAIRS SECURITY TRAINING CENTER [FASTC]

An American Recovery and Reinvestment Act of 2009 Project

Figure 2-9

VDOT Secondary Roads within Fort Pickett

VDOT Virginia Department of Transportation

Six-Year Improvement Program

Home | User's Guide | About

All Projects | Major Projects | MPO | Fund | Reports

Line Item Details

Project Summary

UPC	18964
Project	RTE 460 BUS - BRIDGE REPLACEMENT
Scope of Work	Bridge Replacement w/o Added Capacity
Description	FROM: 0.421MI S Rte 641 TO: 0.123 MI N Rte 641
Report Note	
Fund Source	BR/STP

Project Location

District	Richmond	Jurisdiction	Nottoway County
Road System	Primary	Length	0.5450 MI
Route	7460	Street	COX ROAD
Structure No.	28704	Sufficiency Rating	-2
MPO Area	NonMPO		

Estimates & Schedule

	Estimated Cost (Thousands)	Schedule
Prelim. Eng. (PE)	$1,150	Complete
Right of Way (RW)	$710	Underway
Construction (CN)	$10,445	FY2015
Total Estimate	**$12,305**	

Required Allocations

Values in Thousands of Dollars

Fund Sources	Previous Allocations	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	Required After FY2020
CTB Formula: Bridge - State	$0	$0	$2,525	$1,759	$4,531	$0	$0	
Primary Formula: Federal	$1,540	$0	$0	$0	$0	$0	$0	
Primary Formula: Federal	$221	$0	$0	$0	$0	$0	$0	
Primary Formula: Federal	$152	$0	$0	$0	$0	$0	$0	
Primary Formula: State	$1,098	$0	$0	$0	$0	$0	$0	
Primary Formula: State Match	$478	$0	$0	$0	$0	$0	$0	
Total Funding	**$3,489**	**$0**	**$2,525**	**$1,759**	**$4,531**	**$0**	**$0**	**$0**

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Note: the images above and at right show updated project information. Therefore, this figure supersedes Figure 2-10 of the 2012 TIA.

Sources: VDOT's Six-Year Improvement Program (http://syip.virginiadot.org/Pages/lineitemDetails.aspx?syp_scenario_id=193&line_item_id=182471) and VDOT's Dashboard (http://dashboard.virginiadot.org/Pages/Projects/EngineeringDetailDesign.aspx?prj_nbr=18964)

Engineering Dashboard
Project Details

UPC	18964	State Project #	7460067107

Summary

Description	RTE 460 BUS - BRIDGE REPLACEMENT (PETERSBURG, NOTTOWAY)		
District	Richmond	Residency	PETERSBURG
County	NOTTOWAY	Town	
Road System	Primary	Route	7460
Next Scheduled Activity	UTIL RELOC BY OWNERS-DIS	Accomplishment	Contract (1)
Project Status	ACTIVITY DATES SET (15)		
Comments			

Contact Information

VDOT Project Manager	Michael Tatom	Phone	804-524-6407
VDOT Contact	Michael Tatom	Phone	804-524-6407

Schedule

Baseline Ad Date	January 13, 2009
Current Ad Date	December 9, 2014
Actual Ad Date	

R THE ORIGINAL TARGET DATE HAS PASSED

Cost Estimates

Scoping Estimate	$9,514,490
Current Estimate	$12,304,679
Estimate Date	September 15, 2014
Variance	29%

G COST ESTIMATE VARIANCE IS 29.32%

Activities

Activity	Code	Scheduled Begin Date	Actual Begin Date	Scheduled End Date	Actual End Date
AUTHORIZE PE	12	3/1/2007	3/1/2007	3/30/2007	3/5/2007
SERP-NOTICE TO STATE AGENCIES	18	8/1/2002	9/8/2000	11/27/2002	11/16/2000
SCOPE PROJECT	22	12/5/2007	12/5/2007	2/27/2009	2/11/2009
DRAFT ENV. DOCUMENT OR CATEGORICAL EXCLUSION (CE)	25	1/31/2011	11/4/2008	5/27/2011	5/1/2009
CONDUCT LOCATION SURVEY	31S	9/16/2010	9/16/2010	12/1/2010	11/16/2010
R/W&UT DATA-HEARING/PUBLIC INV	44	5/9/2011	5/11/2011	6/17/2011	7/8/2011
ADOPT LOCATION/DESIGN	49	8/22/2011	8/22/2011	11/22/2011	11/17/2011
FURNISH R/W&UT PLANS	51	4/16/2012	5/2/2012	10/31/2012	11/9/2012
NOTICE TO PROCEED/RW ACQUIS	60P	10/22/2012	11/9/2012	11/2/2012	11/13/2012
UTILITY RELOCATION BY UTILITY	67U	4/1/2014		12/1/2014	
ACQUIRE RIGHT OF WAY	69	11/5/2012	11/14/2012	3/31/2014	
APPROVED CONSTRUCTION PLANS	71	8/5/2014		10/28/2014	
ADVERTISE PROJECT/BEGIN CN	80	11/4/2014		12/9/2014	

Map Information

Future Project | Design Underway | Advertised | Construction Started | Construction Completed

Figure 2-10

VDOT US Route 460 Business Bridge Replacement Project Details

BABS LINE

1 Downtown	2 Blackstone Medical Center	3 Patterson & Harris	4 Carver & Tucker	5 Cralle & Northwest	6 Pinewood Apts.	7 Hardy & Falls	8 VUMAC	9 5th & Main	10 Food Lion	11 Wal-Mart	12 Lester & W. Entrance	1 Downtown
6:00 AM	6:02	6:05	6:12	6:16	6:21	6:25	6:30	6:35	6:41	6:45	6:50	6:55
7:00 AM	7:02	7:05	7:12	7:16	7:21	7:25	7:30	7:35	7:41	7:45	7:50	7:55
8:00 AM	8:02	8:05	8:12	8:16	8:21	8:25	8:30	8:35	8:41	8:45	8:50	8:55
9:00 AM	9:02	9:05	9:12	9:16	9:21	9:25	9:30	9:35	9:41	9:45	9:50	9:55
10:00 AM	10:02	10:05	10:12	10:16	10:21	10:25	10:30	10:35	10:41	10:45	10:50	10:55
11:00 AM	11:02	11:05	11:12	11:16	11:21	11:25	11:30	11:35	11:41	11:45	11:50	11:55
12:00 PM	12:02	12:05	12:12	12:16	12:21	12:25	12:30	12:35	12:41	12:45	12:50	12:55
1:00 PM	1:02	1:05	1:12	1:16	1:21	1:25	1:30	1:35	1:41	1:45	1:50	1:55
2:00 PM	2:02	2:05	2:12	2:16	2:21	2:25	2:30	2:35	2:41	2:45	2:50	2:55
3:00 PM	3:02	3:05	3:12	3:16	3:21	3:25	3:30	3:35	3:41	3:45	3:50	3:55
4:00 PM	4:02	4:05	4:12	4:16	4:21	4:25	4:30	4:35	4:41	4:45	4:50	4:55

The bus runs from 6:00 AM to 5:00 PM on Monday through Friday, and from 9:00 AM to 5:00 PM on Saturdays.

Please Note:

Individuals may request, 24 hours in advance, to be picked up and dropped off curbside ANYWHERE within ¾ of a mile of our regular route. Just call 24 hours in advance for special pick-up and drop-off requirements. BABS buses are ADA accessible, and equipped with the latest wheelchair lifts and securement systems.

BABS
101 BABS Lane
Blackstone, VA 23824
(434) 292-3025

The Blackstone Area Bus System (BABS) with assistance from the Virginia Department of Rail and Public Transportation began on January 13, 2003.

Take BABS... she'll get you there.

BABS

BLACKSTONE AREA BUS SYSTEM

BABS LINE

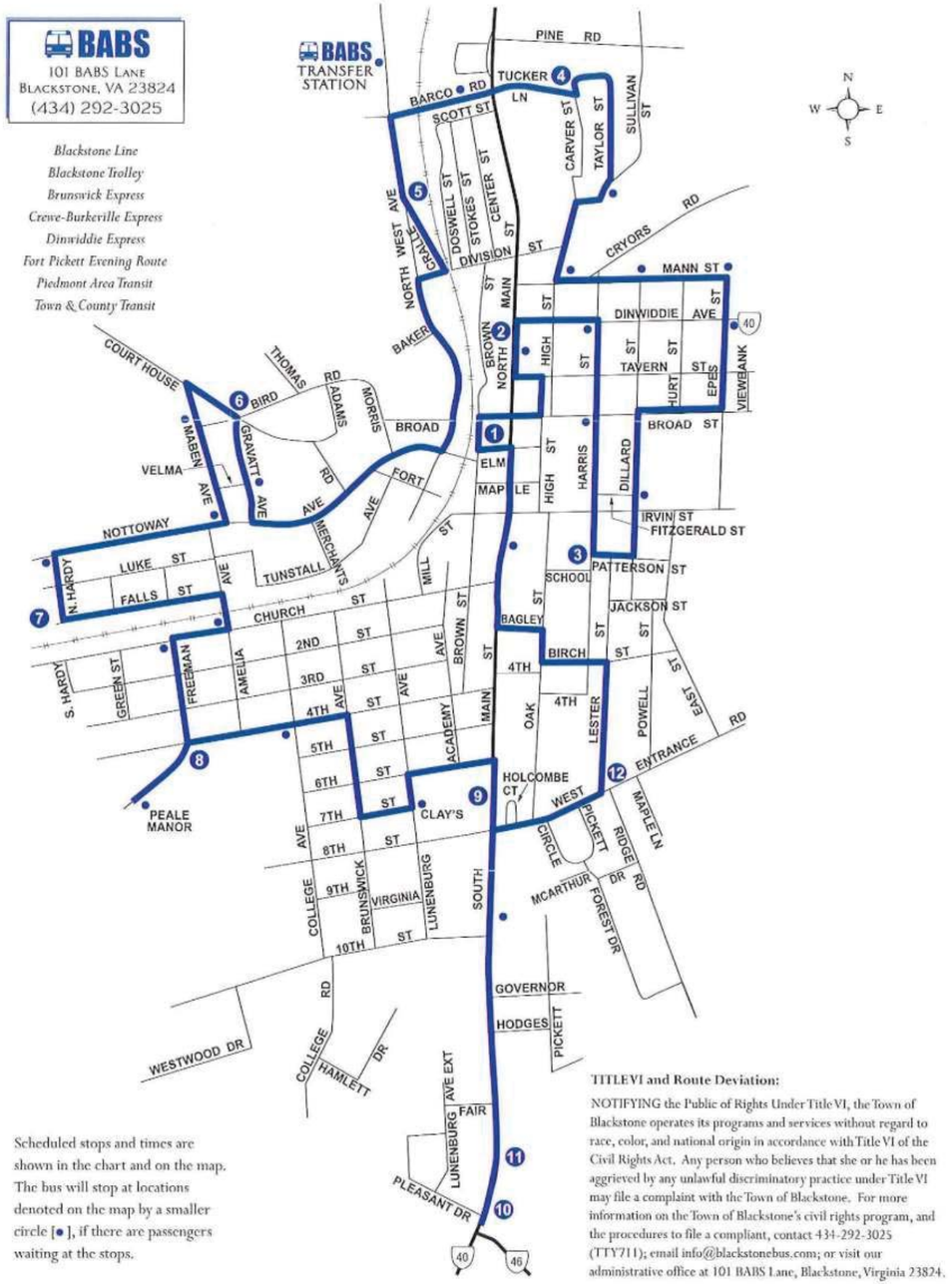
Schedule and Route Map

Revised December 1, 2011

Fare 50¢

The bus is equipped with a wheelchair lift for the disabled. Please ask the driver for help if you need assistance when boarding the bus.

The Blackstone Area Bus System is sponsored by the Town of Blackstone, with assistance from the Virginia Department of Rail and Public Transportation.



Note: the image above shows updated route and schedule information. Therefore, this figure supersedes Figure 3-4 of the 2012 TIA.

Source: Blackstone Area Bus System (BABS) website (http://blackstonebus.com/routes/pdf/babs_line.pdf)

Figure 3-4

Blackstone Area Bus System BABS Line Route Information

- **Attachment C**

Intersection Worksheets

Intersection	
Int Delay, s/veh	5.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	144	14	241	93	2	11	7	96
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	125	-	50	100	-	100	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	2	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	100	13	0	8	25	0	18	0	7
Mvmt Flow	1	157	15	262	101	2	12	8	104

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	101	0	0	157	0	0	748	784	78
Stage 1	-	-	-	-	-	-	159	159	-
Stage 2	-	-	-	-	-	-	589	625	-
Critical Hdwy	6.1	-	-	4.26	-	-	7.86	6.5	7.04
Critical Hdwy Stg 1	-	-	-	-	-	-	6.86	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.86	5.5	-
Follow-up Hdwy	3.2	-	-	2.28	-	-	3.68	4	3.37
Pot Cap-1 Maneuver	991	-	-	1378	-	-	273	327	951
Stage 1	-	-	-	-	-	-	783	770	-
Stage 2	-	-	-	-	-	-	424	480	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	991	-	-	1378	-	-	216	265	951
Mov Cap-2 Maneuver	-	-	-	-	-	-	295	363	-
Stage 1	-	-	-	-	-	-	782	769	-
Stage 2	-	-	-	-	-	-	314	389	-

Approach	EB	WB	NB
HCM Control Delay, s	0.1	5.9	11
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	724	991	-	-	1378	-	-	421
HCM Lane V/C Ratio	0.171	0.001	-	-	0.19	-	-	0.108
HCM Control Delay (s)	11	8.6	-	-	8.2	-	-	14.6
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.6	0	-	-	0.7	-	-	0.4

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	5	26	11
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	2	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	4	9
Mvmt Flow	5	28	12

Major/Minor	Minor2		
Conflicting Flow All	709	784	51
Stage 1	625	625	-
Stage 2	84	159	-
Critical Hdwy	7.5	6.58	7.08
Critical Hdwy Stg 1	6.5	5.58	-
Critical Hdwy Stg 2	6.5	5.58	-
Follow-up Hdwy	3.5	4.04	3.39
Pot Cap-1 Maneuver	325	320	984
Stage 1	444	471	-
Stage 2	920	760	-
Platoon blocked, %			
Mov Cap-1 Maneuver	243	259	984
Mov Cap-2 Maneuver	382	344	-
Stage 1	444	381	-
Stage 2	810	759	-

Approach	SB
HCM Control Delay, s	14.6
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	4.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	80	2	181	100	1	35
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	5	0	2	15	0	21
Mvmt Flow	87	2	197	109	1	38

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	89	0	590	88
Stage 1	-	-	-	-	88	-
Stage 2	-	-	-	-	502	-
Critical Hdwy	-	-	4.12	-	6.4	6.41
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.218	-	3.5	3.489
Pot Cap-1 Maneuver	-	-	1506	-	474	920
Stage 1	-	-	-	-	940	-
Stage 2	-	-	-	-	612	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1506	-	408	920
Mov Cap-2 Maneuver	-	-	-	-	408	-
Stage 1	-	-	-	-	940	-
Stage 2	-	-	-	-	527	-

Approach	EB	WB	NB
HCM Control Delay, s	0	5	9.2
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	889	-	-	1506	-
HCM Lane V/C Ratio	0.044	-	-	0.131	-
HCM Control Delay (s)	9.2	-	-	7.7	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0.5	-

Intersection	
Int Delay, s/veh	5.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	9	39	125	16	18	8	7	18	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	50	-	-	-	150	-	25
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	95	95	95	92	92	92
Heavy Vehicles, %	0	18	0	0	11	63	0	12	0
Mvmt Flow	10	42	136	17	19	8	8	20	1

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	27	0	0	42	0	0	212	123	42
Stage 1	-	-	-	-	-	-	62	62	-
Stage 2	-	-	-	-	-	-	150	61	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.62	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.62	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.62	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4.108	3.3
Pot Cap-1 Maneuver	1600	-	-	1580	-	-	749	749	1034
Stage 1	-	-	-	-	-	-	954	824	-
Stage 2	-	-	-	-	-	-	857	825	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1600	-	-	1580	-	-	601	736	1034
Mov Cap-2 Maneuver	-	-	-	-	-	-	601	736	-
Stage 1	-	-	-	-	-	-	947	818	-
Stage 2	-	-	-	-	-	-	662	816	-

Approach	EB	WB	NB
HCM Control Delay, s	0.4	2.8	10.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	601	736	1034	1600	-	-	1580	-	-	766
HCM Lane V/C Ratio	0.013	0.027	0.001	0.006	-	-	0.011	-	-	0.258
HCM Control Delay (s)	11.1	10	8.5	7.3	0	-	7.3	0	-	11.3
HCM Lane LOS	B	B	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0	0.1	0	0	-	-	0	-	-	1

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	11	166	5
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	18	1	0
Mvmt Flow	12	180	5

Major/Minor	Minor2		
Conflicting Flow All	129	119	23
Stage 1	57	57	-
Stage 2	72	62	-
Critical Hdwy	7.28	6.51	6.2
Critical Hdwy Stg 1	6.28	5.51	-
Critical Hdwy Stg 2	6.28	5.51	-
Follow-up Hdwy	3.662	4.009	3.3
Pot Cap-1 Maneuver	808	773	1060
Stage 1	916	849	-
Stage 2	899	845	-
Platoon blocked, %			
Mov Cap-1 Maneuver	780	759	1060
Mov Cap-2 Maneuver	780	759	-
Stage 1	910	840	-
Stage 2	870	839	-

Approach	SB
HCM Control Delay, s	11.3
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	0	0	0	10	0	6	0	89	34
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	33	0	2	6
Mvmt Flow	0	0	0	11	0	7	0	97	37

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	364	380	109	361	361	115	109	0	0
Stage 1	246	246	-	115	115	-	-	-	-
Stage 2	118	134	-	246	246	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.53	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.597	2.2	-	-
Pot Cap-1 Maneuver	596	556	950	598	569	860	1494	-	-
Stage 1	762	706	-	895	804	-	-	-	-
Stage 2	891	789	-	762	706	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	569	528	950	575	541	860	1494	-	-
Mov Cap-2 Maneuver	569	528	-	575	541	-	-	-	-
Stage 1	762	671	-	895	804	-	-	-	-
Stage 2	884	789	-	724	671	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	10.6	0
HCM LOS	A	B	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1494	-	-	-	657	1451	-	-
HCM Lane V/C Ratio	-	-	-	-	0.026	0.047	-	-
HCM Control Delay (s)	0	-	-	0	10.6	7.6	0	-
HCM Lane LOS	A	-	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0.1	0.1	-	-

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	63	100	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	0
Mvmt Flow	68	109	0

Major/Minor	Major2		
Conflicting Flow All	134	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.12	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.218	-	-
Pot Cap-1 Maneuver	1451	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1451	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	2.9
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	5.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	99	44	5	23	100	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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	0	9	2	0
Mvmt Flow	108	48	5	25	109	11

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	150	114	120	0	-	0
Stage 1	114	-	-	-	-	-
Stage 2	36	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.1	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.2	-	-	-
Pot Cap-1 Maneuver	842	939	1480	-	-	-
Stage 1	911	-	-	-	-	-
Stage 2	986	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	839	939	1480	-	-	-
Mov Cap-2 Maneuver	839	-	-	-	-	-
Stage 1	911	-	-	-	-	-
Stage 2	983	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.1	1.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1480	-	867	-	-
HCM Lane V/C Ratio	0.004	-	0.179	-	-
HCM Control Delay (s)	7.4	0	10.1	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.7	-	-

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	98	20	1	8	0	11	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	10	0	0	0	18	0	0
Mvmt Flow	1	107	22	1	9	0	12	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	9	0	0	128	0	0	135	131	117
Stage 1	-	-	-	-	-	-	120	120	-
Stage 2	-	-	-	-	-	-	15	11	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.28	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.28	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.28	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.662	4	3.3
Pot Cap-1 Maneuver	1624	-	-	1470	-	-	801	763	941
Stage 1	-	-	-	-	-	-	847	800	-
Stage 2	-	-	-	-	-	-	965	890	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1624	-	-	1470	-	-	794	761	941
Mov Cap-2 Maneuver	-	-	-	-	-	-	794	761	-
Stage 1	-	-	-	-	-	-	846	799	-
Stage 2	-	-	-	-	-	-	957	889	-

Approach	EB	WB	NB
HCM Control Delay, s	0.1	0.8	9.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	794	1624	-	-	1470	-	-	951
HCM Lane V/C Ratio	0.015	0.001	-	-	0.001	-	-	0.009
HCM Control Delay (s)	9.6	7.2	0	-	7.5	0	-	8.8
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	1	1	6
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	100	0	0
Mvmt Flow	1	1	7

Major/Minor	Minor2		
Conflicting Flow All	131	141	9
Stage 1	11	11	-
Stage 2	120	130	-
Critical Hdwy	8.1	6.5	6.2
Critical Hdwy Stg 1	7.1	5.5	-
Critical Hdwy Stg 2	7.1	5.5	-
Follow-up Hdwy	4.4	4	3.3
Pot Cap-1 Maneuver	659	754	1079
Stage 1	806	890	-
Stage 2	694	792	-
Platoon blocked, %			
Mov Cap-1 Maneuver	658	752	1079
Mov Cap-2 Maneuver	658	752	-
Stage 1	805	889	-
Stage 2	693	791	-

Approach	SB
HCM Control Delay, s	8.8
HCM LOS	A

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	88	10	0	4	0	4	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	10	0	0	0	18	0	0
Mvmt Flow	1	96	11	0	4	0	4	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	4	0	0	107	0	0	108	107	101
Stage 1	-	-	-	-	-	-	103	103	-
Stage 2	-	-	-	-	-	-	5	4	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.28	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.28	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.28	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.662	4	3.3
Pot Cap-1 Maneuver	1631	-	-	1497	-	-	834	787	960
Stage 1	-	-	-	-	-	-	865	814	-
Stage 2	-	-	-	-	-	-	977	897	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1631	-	-	1497	-	-	833	786	960
Mov Cap-2 Maneuver	-	-	-	-	-	-	833	786	-
Stage 1	-	-	-	-	-	-	864	813	-
Stage 2	-	-	-	-	-	-	976	897	-

Approach	EB	WB	NB
HCM Control Delay, s	0.1	0	9.3
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	833	1631	-	-	1497	-	-	1085
HCM Lane V/C Ratio	0.005	0.001	-	-	-	-	-	0.001
HCM Control Delay (s)	9.3	7.2	0	-	0	-	-	8.3
HCM Lane LOS	A	A	A	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	1
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	0	0
Mvmt Flow	0	0	1

Major/Minor	Minor2		
Conflicting Flow All	107	113	4
Stage 1	4	4	-
Stage 2	103	109	-
Critical Hdwy	7.1	6.5	6.2
Critical Hdwy Stg 1	6.1	5.5	-
Critical Hdwy Stg 2	6.1	5.5	-
Follow-up Hdwy	3.5	4	3.3
Pot Cap-1 Maneuver	877	781	1085
Stage 1	1024	897	-
Stage 2	908	809	-
Platoon blocked, %			
Mov Cap-1 Maneuver	876	780	1085
Mov Cap-2 Maneuver	876	780	-
Stage 1	1023	897	-
Stage 2	907	808	-

Approach	SB
HCM Control Delay, s	8.3
HCM LOS	A

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	6.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	0	0	4	0	0	0	3	0	1
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	0	4	0	0	0	3	0	1

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	8	9	1	10	8	1	1	0	0
Stage 1	1	1	-	7	7	-	-	-	-
Stage 2	7	8	-	3	1	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-
Pot Cap-1 Maneuver	1016	890	1090	1013	891	1090	1635	-	-
Stage 1	1027	899	-	1020	894	-	-	-	-
Stage 2	1020	893	-	1025	899	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	1014	888	1090	1007	889	1090	1635	-	-
Mov Cap-2 Maneuver	1014	888	-	1007	889	-	-	-	-
Stage 1	1025	899	-	1018	892	-	-	-	-
Stage 2	1018	891	-	1021	899	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	8.3	0	5.4
HCM LOS	A	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1635	-	-	1090	-	1635	-	-
HCM Lane V/C Ratio	0.002	-	-	0.004	-	-	-	-
HCM Control Delay (s)	7.2	0	-	8.3	0	0	-	-
HCM Lane LOS	A	A	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	-	0	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	1	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	0	0
Mvmt Flow	0	1	0

Major/Minor	Major2		
Conflicting Flow All	1	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.1	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.2	-	-
Pot Cap-1 Maneuver	1635	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1635	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	3	58	15	5	2	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	67	2	20	0	0	0
Mvmt Flow	3	63	16	5	2	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	22	0	-	0	89	19
Stage 1	-	-	-	-	19	-
Stage 2	-	-	-	-	70	-
Critical Hdwy	4.77	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.803	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1258	-	-	-	917	1065
Stage 1	-	-	-	-	1009	-
Stage 2	-	-	-	-	958	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1258	-	-	-	915	1065
Mov Cap-2 Maneuver	-	-	-	-	915	-
Stage 1	-	-	-	-	1009	-
Stage 2	-	-	-	-	956	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	8.7
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1258	-	-	-	984
HCM Lane V/C Ratio	0.003	-	-	-	0.004
HCM Control Delay (s)	7.9	0	-	-	8.7
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	9	2	15	28	3	311	79	149
v/c Ratio	0.05	0.01	0.08	0.05	0.01	0.60	0.18	0.20
Control Delay	27.2	0.0	27.3	0.2	15.7	22.5	8.9	9.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.2	0.0	27.3	0.2	15.7	22.5	8.9	9.1
Queue Length 50th (ft)	3	0	5	0	1	87	14	27
Queue Length 95th (ft)	16	0	22	0	6	169	33	57
Internal Link Dist (ft)	750		1085			929		1030
Turn Bay Length (ft)		50		225	75		175	
Base Capacity (vph)	335	404	804	616	998	1352	502	1585
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.00	0.02	0.05	0.00	0.23	0.16	0.09

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	7	2	13	1	26	3	190	96	73	136	1
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	190.0	190.0	190.0	190.0	190.0	169.6	190.0	178.7	190.0	184.5	162.6	190.0
Adj Flow Rate, veh/h	1	8	2	14	1	28	3	207	104	79	148	1
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	0	0	12	0	7	7	3	17	17
Cap, veh/h	20	160	154	162	12	232	497	321	161	383	751	5
Arrive On Green	0.10	0.10	0.10	0.10	0.10	0.10	0.29	0.29	0.29	0.07	0.47	0.47
Sat Flow, veh/h	210	1680	1615	1694	121	1442	1258	1123	564	1757	1613	11
Grp Volume(v), veh/h	9	0	2	15	0	28	3	0	311	79	0	149
Grp Sat Flow(s),veh/h/ln	1890	0	1615	1815	0	1442	1258	0	1687	1757	0	1624
Q Serve(g_s), s	0.2	0.0	0.1	0.4	0.0	0.9	0.1	0.0	8.5	1.5	0.0	2.8
Cycle Q Clear(g_c), s	0.2	0.0	0.1	0.4	0.0	0.9	0.1	0.0	8.5	1.5	0.0	2.8
Prop In Lane	0.11		1.00	0.93		1.00	1.00		0.33	1.00		0.01
Lane Grp Cap(c), veh/h	180	0	154	173	0	232	497	0	483	383	0	756
V/C Ratio(X)	0.05	0.00	0.01	0.09	0.00	0.12	0.01	0.00	0.64	0.21	0.00	0.20
Avail Cap(c_a), veh/h	360	0	308	866	0	782	1218	0	1449	604	0	1889
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	21.5	0.0	21.5	21.6	0.0	18.8	13.4	0.0	16.4	11.4	0.0	8.2
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.2	0.0	0.2	0.0	0.0	1.4	0.3	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	0.0	0.2	0.0	0.4	0.0	0.0	4.1	0.7	0.0	1.3
LnGrp Delay(d),s/veh	21.7	0.0	21.5	21.8	0.0	19.1	13.4	0.0	17.8	11.6	0.0	8.4
LnGrp LOS	C		C	C		B	B		B	B		A
Approach Vol, veh/h		11			43			314			228	
Approach Delay, s/veh		21.6			20.0			17.8			9.5	
Approach LOS		C			C			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6		8
Phs Duration (G+Y+Rc), s		11.0	9.4	21.0		11.0		30.4
Change Period (Y+Rc), s		6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s		25.0	10.0	45.0		10.0		61.0
Max Q Clear Time (g_c+I1), s		2.9	3.5	10.5		2.2		4.8
Green Ext Time (p_c), s		0.1	0.1	3.3		0.0		3.4

Intersection Summary	
HCM 2010 Ctrl Delay	14.8
HCM 2010 LOS	B

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	10	91	91	127	123	21
v/c Ratio	0.03	0.19	0.11	0.08	0.16	0.03
Control Delay	12.8	3.1	2.6	2.0	10.9	6.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.8	3.1	2.6	2.0	10.9	6.5
Queue Length 50th (ft)	1	0	0	0	12	0
Queue Length 95th (ft)	12	14	22	28	61	12
Internal Link Dist (ft)	1078			751	648	
Turn Bay Length (ft)		150	225			150
Base Capacity (vph)	1291	827	1042	1727	1634	1583
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.11	0.09	0.07	0.08	0.01

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	9	84	84	117	113	19
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	171.2	172.7	179.2	172.7	166.7	190.0
Adj Flow Rate, veh/h	10	91	91	127	123	21
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	11	10	6	10	14	0
Cap, veh/h	206	310	598	903	438	425
Arrive On Green	0.13	0.13	0.08	0.52	0.26	0.26
Sat Flow, veh/h	1630	1468	1707	1727	1667	1615
Grp Volume(v), veh/h	10	91	91	127	123	21
Grp Sat Flow(s),veh/h/ln	1630	1468	1707	1727	1667	1615
Q Serve(g_s), s	0.2	1.8	1.1	1.3	2.0	0.3
Cycle Q Clear(g_c), s	0.2	1.8	1.1	1.3	2.0	0.3
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	206	310	598	903	438	425
V/C Ratio(X)	0.05	0.29	0.15	0.14	0.28	0.05
Avail Cap(c_a), veh/h	1191	1197	1203	3080	1949	1888
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	13.1	11.4	6.6	4.2	10.0	9.4
Incr Delay (d2), s/veh	0.1	0.6	0.1	0.0	0.1	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	0.1	1.6	0.5	0.6	0.9	0.1
LnGrp Delay(d),s/veh	13.3	12.0	6.7	4.2	10.2	9.4
LnGrp LOS	B	B	A	A	B	A
Approach Vol, veh/h	101			218	144	
Approach Delay, s/veh	12.1			5.3	10.1	
Approach LOS	B			A	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		23.9		10.3	8.9	15.0		
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0		
Max Green Setting (Gmax), s		61.0		25.0	15.0	40.0		
Max Q Clear Time (g_c+I1), s		3.3		3.8	3.1	4.0		
Green Ext Time (p_c), s		1.1		0.3	0.1	1.1		

Intersection Summary	
HCM 2010 Ctrl Delay	8.3
HCM 2010 LOS	A

Lane Group	EBL	EBT	WBL	WBT	NBT	SBL	SBT
Lane Group Flow (vph)	8	18	18	30	137	99	137
v/c Ratio	0.02	0.05	0.04	0.08	0.30	0.21	0.19
Control Delay	26.3	25.8	24.9	13.1	23.2	13.6	13.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.3	25.8	24.9	13.1	23.2	13.6	13.0
Queue Length 50th (ft)	3	6	7	2	45	26	36
Queue Length 95th (ft)	15	23	23	23	96	54	70
Internal Link Dist (ft)		598		847	888		606
Turn Bay Length (ft)	100		150			100	
Base Capacity (vph)	476	497	952	827	1042	611	1471
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.04	0.02	0.04	0.13	0.16	0.09

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	7	16	1	17	5	23	0	94	32	91	115	11
Number	5	2	12	1	6	16	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	190.0	190.0	190.0	190.0	176.7	190.0	190.0	175.1	190.0	182.7	171.2	190.0
Adj Flow Rate, veh/h	8	17	1	18	5	25	0	102	35	99	125	12
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	0	0	0	0	7	7	4	12	12
Cap, veh/h	315	309	18	212	30	150	114	296	102	480	652	63
Arrive On Green	0.17	0.17	0.17	0.12	0.12	0.12	0.00	0.24	0.24	0.09	0.42	0.42
Sat Flow, veh/h	1810	1777	105	1810	257	1284	1272	1247	428	1740	1539	148
Grp Volume(v), veh/h	8	0	18	18	0	30	0	0	137	99	0	137
Grp Sat Flow(s),veh/h/ln	1810	0	1882	1810	0	1541	1272	0	1675	1740	0	1686
Q Serve(g_s), s	0.2	0.0	0.5	0.6	0.0	1.1	0.0	0.0	4.3	2.4	0.0	3.2
Cycle Q Clear(g_c), s	0.2	0.0	0.5	0.6	0.0	1.1	0.0	0.0	4.3	2.4	0.0	3.2
Prop In Lane	1.00		0.06	1.00		0.83	1.00		0.26	1.00		0.09
Lane Grp Cap(c), veh/h	315	0	328	212	0	181	114	0	398	480	0	715
V/C Ratio(X)	0.03	0.00	0.05	0.08	0.00	0.17	0.00	0.00	0.34	0.21	0.00	0.19
Avail Cap(c_a), veh/h	430	0	447	859	0	732	517	0	928	735	0	1495
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	0.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.6	0.0	21.8	24.9	0.0	25.1	0.0	0.0	20.0	14.0	0.0	11.4
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.2	0.0	0.6	0.0	0.0	0.7	0.2	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	0.3	0.3	0.0	0.5	0.0	0.0	2.1	1.1	0.0	1.5
LnGrp Delay(d),s/veh	21.7	0.0	21.8	25.1	0.0	25.7	0.0	0.0	20.7	14.2	0.0	11.6
LnGrp LOS	C		C	C		C			C	B		B
Approach Vol, veh/h		26			48			137			236	
Approach Delay, s/veh		21.8			25.5			20.7			12.7	
Approach LOS		C			C			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6		8
Phs Duration (G+Y+Rc), s		17.0	11.8	21.0		13.4		32.8
Change Period (Y+Rc), s		6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s		15.0	15.0	35.0		30.0		56.0
Max Q Clear Time (g_c+I1), s		2.5	4.4	6.3		3.1		5.2
Green Ext Time (p_c), s		0.1	0.1	2.5		0.2		2.7

Intersection Summary

HCM 2010 Ctrl Delay	17.1
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	18	11	2	46	5	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	247	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	20	12	2	50	5	8

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	20	0	74	20
Stage 1	-	-	-	-	20	-
Stage 2	-	-	-	-	54	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1596	-	930	1058
Stage 1	-	-	-	-	1003	-
Stage 2	-	-	-	-	969	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1596	-	929	1058
Mov Cap-2 Maneuver	-	-	-	-	929	-
Stage 1	-	-	-	-	1003	-
Stage 2	-	-	-	-	968	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	8.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	1000	-	-	1596	-
HCM Lane V/C Ratio	0.013	-	-	0.001	-
HCM Control Delay (s)	8.6	-	-	7.3	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0	-	-	0	-

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	5	1	0	0	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	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	5	1	0	0	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2	0	0	0	-	0
Stage 1	0	-	-	-	-	-
Stage 2	2	-	-	-	-	-
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	1021	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	1021	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	1021	-	-	-	-	-
Mov Cap-2 Maneuver	1021	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	1021	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s		0	0
HCM LOS	-		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	-	-	-	-	-
HCM Lane LOS	-	-	-	-	-
HCM 95th %tile Q(veh)	-	-	-	-	-

Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	8	0	0	2	4	13
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	0	0	2	4	14

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	13	11	18	0	-	0
Stage 1	11	-	-	-	-	-
Stage 2	2	-	-	-	-	-
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	1006	1070	1599	-	-	-
Stage 1	1012	-	-	-	-	-
Stage 2	1021	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	1006	1070	1599	-	-	-
Mov Cap-2 Maneuver	1006	-	-	-	-	-
Stage 1	1012	-	-	-	-	-
Stage 2	1021	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.6	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1599	-	1006	-	-
HCM Lane V/C Ratio	-	-	0.009	-	-
HCM Control Delay (s)	0	-	8.6	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	6.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	7	109	12	152	163	6	30	34	220
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	125	-	50	100	-	100	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	2	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	96	96	96	93	93	93
Heavy Vehicles, %	0	18	31	11	20	0	8	3	5
Mvmt Flow	8	118	13	158	170	6	32	37	237

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	170	0	0	118	0	0	546	620	59
Stage 1	-	-	-	-	-	-	134	134	-
Stage 2	-	-	-	-	-	-	412	486	-
Critical Hdwy	4.1	-	-	4.32	-	-	7.66	6.56	7
Critical Hdwy Stg 1	-	-	-	-	-	-	6.66	5.56	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.66	5.56	-
Follow-up Hdwy	2.2	-	-	2.31	-	-	3.58	4.03	3.35
Pot Cap-1 Maneuver	1420	-	-	1405	-	-	408	400	985
Stage 1	-	-	-	-	-	-	838	782	-
Stage 2	-	-	-	-	-	-	572	547	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1420	-	-	1405	-	-	354	353	985
Mov Cap-2 Maneuver	-	-	-	-	-	-	443	445	-
Stage 1	-	-	-	-	-	-	833	778	-
Stage 2	-	-	-	-	-	-	480	485	-

Approach	EB	WB	NB
HCM Control Delay, s	0.4	3.7	12.7
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	773	1420	-	-	1405	-	-	507
HCM Lane V/C Ratio	0.395	0.005	-	-	0.113	-	-	0.064
HCM Control Delay (s)	12.7	7.5	-	-	7.9	-	-	12.6
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	1.9	0	-	-	0.4	-	-	0.2

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	2	20	8
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	2	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	5	13
Mvmt Flow	2	22	9

Major/Minor	Minor2		
Conflicting Flow All	579	620	85
Stage 1	486	486	-
Stage 2	93	134	-
Critical Hdwy	7.5	6.6	7.16
Critical Hdwy Stg 1	6.5	5.6	-
Critical Hdwy Stg 2	6.5	5.6	-
Follow-up Hdwy	3.5	4.05	3.43
Pot Cap-1 Maneuver	403	396	923
Stage 1	537	542	-
Stage 2	909	777	-
Platoon blocked, %			
Mov Cap-1 Maneuver	261	349	923
Mov Cap-2 Maneuver	408	439	-
Stage 1	534	481	-
Stage 2	655	773	-

Approach	SB
HCM Control Delay, s	12.6
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	3.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	151	2	26	159	1	133
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	7	0	28	7	0	5
Mvmt Flow	164	2	28	173	1	145

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	166	0	394	165
Stage 1	-	-	-	-	165	-
Stage 2	-	-	-	-	229	-
Critical Hdwy	-	-	4.38	-	6.4	6.25
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.452	-	3.5	3.345
Pot Cap-1 Maneuver	-	-	1269	-	615	872
Stage 1	-	-	-	-	869	-
Stage 2	-	-	-	-	814	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1269	-	600	872
Mov Cap-2 Maneuver	-	-	-	-	600	-
Stage 1	-	-	-	-	869	-
Stage 2	-	-	-	-	794	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.1	10
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	869	-	-	1269	-
HCM Lane V/C Ratio	0.168	-	-	0.022	-
HCM Control Delay (s)	10	-	-	7.9	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.6	-	-	0.1	-

Intersection	
Int Delay, s/veh	6.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	9	42	12	9	56	13	55	111	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	50	-	-	-	150	-	25
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	5	20	23	15	25	2	5	1
Mvmt Flow	10	46	13	10	61	14	60	121	18

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	75	0	0	46	0	0	161	160	46
Stage 1	-	-	-	-	-	-	65	65	-
Stage 2	-	-	-	-	-	-	96	95	-
Critical Hdwy	4.1	-	-	4.33	-	-	7.12	6.55	6.21
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.55	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.55	-
Follow-up Hdwy	2.2	-	-	2.407	-	-	3.518	4.045	3.309
Pot Cap-1 Maneuver	1537	-	-	1437	-	-	804	727	1026
Stage 1	-	-	-	-	-	-	946	835	-
Stage 2	-	-	-	-	-	-	911	810	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1537	-	-	1437	-	-	781	717	1026
Mov Cap-2 Maneuver	-	-	-	-	-	-	781	717	-
Stage 1	-	-	-	-	-	-	939	829	-
Stage 2	-	-	-	-	-	-	887	804	-

Approach	EB	WB	NB
HCM Control Delay, s	1.1	0.9	10.5
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	781	717	1026	1537	-	-	1437	-	-	685
HCM Lane V/C Ratio	0.077	0.168	0.018	0.006	-	-	0.007	-	-	0.043
HCM Control Delay (s)	10	11	8.6	7.4	0	-	7.5	0	-	10.5
HCM Lane LOS	B	B	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0.6	0.1	0	-	-	0	-	-	0.1

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	11	6	10
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	64	24	0
Mvmt Flow	12	7	11

Major/Minor	Minor2		
Conflicting Flow All	214	153	68
Stage 1	88	88	-
Stage 2	126	65	-
Critical Hdwy	7.74	6.74	6.2
Critical Hdwy Stg 1	6.74	5.74	-
Critical Hdwy Stg 2	6.74	5.74	-
Follow-up Hdwy	4.076	4.216	3.3
Pot Cap-1 Maneuver	628	700	1001
Stage 1	787	781	-
Stage 2	749	799	-
Platoon blocked, %			
Mov Cap-1 Maneuver	531	690	1001
Mov Cap-2 Maneuver	531	690	-
Stage 1	781	776	-
Stage 2	624	793	-

Approach	SB
HCM Control Delay, s	10.5
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	3	0	1	64	0	56	0	82	7
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	0	3	0	4	0
Mvmt Flow	3	0	1	70	0	61	0	89	8

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	203	177	46	174	173	93	46	0	0
Stage 1	80	80	-	93	93	-	-	-	-
Stage 2	123	97	-	81	80	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.12	6.5	6.23	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.12	5.5	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.12	5.5	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.518	4	3.327	2.2	-	-
Pot Cap-1 Maneuver	759	720	1029	789	724	961	1575	-	-
Stage 1	934	832	-	914	822	-	-	-	-
Stage 2	886	819	-	927	832	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	704	711	1029	780	715	961	1575	-	-
Mov Cap-2 Maneuver	704	711	-	780	715	-	-	-	-
Stage 1	934	821	-	914	822	-	-	-	-
Stage 2	830	819	-	914	821	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	9.7	10	0
HCM LOS	A	B	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1575	-	-	764	855	1385	-	-
HCM Lane V/C Ratio	-	-	-	0.006	0.153	0.013	-	-
HCM Control Delay (s)	0	-	-	9.7	10	7.6	0	-
HCM Lane LOS	A	-	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.5	0	-	-

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	16	42	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	21	14	0
Mvmt Flow	17	46	0

Major/Minor	Major2		
Conflicting Flow All	97	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.31	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.389	-	-
Pot Cap-1 Maneuver	1385	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1385	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	2.1
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	12	18	39	77	29	79
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	92	92	92	92	92	92
Heavy Vehicles, %	0	6	2	4	15	0
Mvmt Flow	13	20	42	84	32	86

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	242	74	117	0	-	0
Stage 1	74	-	-	-	-	-
Stage 2	168	-	-	-	-	-
Critical Hdwy	6.4	6.26	4.12	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.354	2.218	-	-	-
Pot Cap-1 Maneuver	751	977	1471	-	-	-
Stage 1	954	-	-	-	-	-
Stage 2	867	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	728	977	1471	-	-	-
Mov Cap-2 Maneuver	728	-	-	-	-	-
Stage 1	954	-	-	-	-	-
Stage 2	841	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.4	2.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1471	-	859	-	-
HCM Lane V/C Ratio	0.029	-	0.038	-	-
HCM Control Delay (s)	7.5	0	9.4	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.1	-	-

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	28	7	1	74	1	28	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	27	19	0	0	4	0	4	0	0
Mvmt Flow	1	30	8	1	80	1	30	1	1

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	82	0	0	38	0	0	122	120	34
Stage 1	-	-	-	-	-	-	36	36	-
Stage 2	-	-	-	-	-	-	86	84	-
Critical Hdwy	4.37	-	-	4.1	-	-	7.14	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.14	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.14	5.5	-
Follow-up Hdwy	2.443	-	-	2.2	-	-	3.536	4	3.3
Pot Cap-1 Maneuver	1371	-	-	1585	-	-	848	774	1045
Stage 1	-	-	-	-	-	-	974	869	-
Stage 2	-	-	-	-	-	-	917	829	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1371	-	-	1585	-	-	841	772	1045
Mov Cap-2 Maneuver	-	-	-	-	-	-	841	772	-
Stage 1	-	-	-	-	-	-	973	868	-
Stage 2	-	-	-	-	-	-	910	828	-

Approach	EB	WB	NB
HCM Control Delay, s	0.2	0.1	9.4
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	844	1371	-	-	1585	-	-	891
HCM Lane V/C Ratio	0.039	0.001	-	-	0.001	-	-	0.007
HCM Control Delay (s)	9.4	7.6	0	-	7.3	0	-	9.1
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	2	4
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	0	6
Mvmt Flow	0	2	4

Major/Minor	Minor2		
Conflicting Flow All	121	123	81
Stage 1	83	83	-
Stage 2	38	40	-
Critical Hdwy	7.1	6.5	6.26
Critical Hdwy Stg 1	6.1	5.5	-
Critical Hdwy Stg 2	6.1	5.5	-
Follow-up Hdwy	3.5	4	3.354
Pot Cap-1 Maneuver	859	771	968
Stage 1	930	830	-
Stage 2	982	866	-
Platoon blocked, %			
Mov Cap-1 Maneuver	856	769	968
Mov Cap-2 Maneuver	856	769	-
Stage 1	929	829	-
Stage 2	979	865	-

Approach	SB
HCM Control Delay, s	9.1
HCM LOS	A

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	24	3	0	62	0	13	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	27	18	0	0	4	0	1	0	0
Mvmt Flow	1	26	3	0	67	0	14	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	67	0	0	29	0	0	98	97	28
Stage 1	-	-	-	-	-	-	30	30	-
Stage 2	-	-	-	-	-	-	68	67	-
Critical Hdwy	4.37	-	-	4.1	-	-	7.11	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.11	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.11	5.5	-
Follow-up Hdwy	2.443	-	-	2.2	-	-	3.509	4	3.3
Pot Cap-1 Maneuver	1390	-	-	1597	-	-	886	797	1053
Stage 1	-	-	-	-	-	-	989	874	-
Stage 2	-	-	-	-	-	-	945	843	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1390	-	-	1597	-	-	884	796	1053
Mov Cap-2 Maneuver	-	-	-	-	-	-	884	796	-
Stage 1	-	-	-	-	-	-	988	873	-
Stage 2	-	-	-	-	-	-	944	843	-

Approach	EB	WB	NB
HCM Control Delay, s	0.3	0	9.1
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	884	1390	-	-	1597	-	-	985
HCM Lane V/C Ratio	0.016	0.001	-	-	-	-	-	0.001
HCM Control Delay (s)	9.1	7.6	0	-	0	-	-	8.7
HCM Lane LOS	A	A	A	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	1
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	0	6
Mvmt Flow	0	0	1

Major/Minor	Minor2		
Conflicting Flow All	97	99	67
Stage 1	67	67	-
Stage 2	30	32	-
Critical Hdwy	7.1	6.5	6.26
Critical Hdwy Stg 1	6.1	5.5	-
Critical Hdwy Stg 2	6.1	5.5	-
Follow-up Hdwy	3.5	4	3.354
Pot Cap-1 Maneuver	890	795	985
Stage 1	948	843	-
Stage 2	992	872	-
Platoon blocked, %			
Mov Cap-1 Maneuver	889	794	985
Mov Cap-2 Maneuver	889	794	-
Stage 1	947	843	-
Stage 2	991	871	-

Approach	SB
HCM Control Delay, s	8.7
HCM LOS	A

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	0	0	1	0	0	0	1	0	0
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	27	0	0	6	6	0	0	0
Mvmt Flow	0	0	1	0	0	0	1	0	0

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	3	3	1	4	3	0	1	0	0
Stage 1	1	1	-	2	2	-	-	-	-
Stage 2	2	2	-	2	1	-	-	-	-
Critical Hdwy	7.1	6.77	6.2	7.1	6.56	6.26	4.1	-	-
Critical Hdwy Stg 1	6.1	5.77	-	6.1	5.56	-	-	-	-
Critical Hdwy Stg 2	6.1	5.77	-	6.1	5.56	-	-	-	-
Follow-up Hdwy	3.5	4.243	3.3	3.5	4.054	3.354	2.2	-	-
Pot Cap-1 Maneuver	1024	845	1090	1022	885	-	1635	-	-
Stage 1	1027	848	-	1026	886	-	-	-	-
Stage 2	1026	847	-	1026	887	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	-	844	1090	1020	884	-	1635	-	-
Mov Cap-2 Maneuver	-	844	-	1020	884	-	-	-	-
Stage 1	1026	848	-	1025	885	-	-	-	-
Stage 2	1025	846	-	1025	887	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s		0	7.2
HCM LOS	-	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1635	-	-	-	-	-	-	-
HCM Lane V/C Ratio	0.001	-	-	-	-	-	-	-
HCM Control Delay (s)	7.2	0	-	-	0	0	-	-
HCM Lane LOS	A	A	-	-	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-	-	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	1	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	27	0	0
Mvmt Flow	0	1	0

Major/Minor	Major2		
Conflicting Flow All	0	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.37	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.443	-	-
Pot Cap-1 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	-	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	1	19	82	2	1	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	18	2	5	23	0
Mvmt Flow	1	21	89	2	1	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	91	0	-	0	113	90
Stage 1	-	-	-	-	90	-
Stage 2	-	-	-	-	23	-
Critical Hdwy	4.1	-	-	-	6.63	6.2
Critical Hdwy Stg 1	-	-	-	-	5.63	-
Critical Hdwy Stg 2	-	-	-	-	5.63	-
Follow-up Hdwy	2.2	-	-	-	3.707	3.3
Pot Cap-1 Maneuver	1517	-	-	-	835	973
Stage 1	-	-	-	-	883	-
Stage 2	-	-	-	-	948	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1517	-	-	-	834	973
Mov Cap-2 Maneuver	-	-	-	-	834	-
Stage 1	-	-	-	-	883	-
Stage 2	-	-	-	-	947	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	8.9
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1517	-	-	-	934
HCM Lane V/C Ratio	0.001	-	-	-	0.005
HCM Control Delay (s)	7.4	0	-	-	8.9
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	10	15	158	86	4	501	51	414
v/c Ratio	0.07	0.06	0.53	0.15	0.01	0.77	0.18	0.46
Control Delay	41.9	0.4	39.5	6.3	17.0	30.8	11.1	14.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.9	0.4	39.5	6.3	17.0	30.8	11.1	14.0
Queue Length 50th (ft)	5	0	70	0	1	203	11	113
Queue Length 95th (ft)	24	0	160	34	8	371	32	214
Internal Link Dist (ft)	750		1085			929		1030
Turn Bay Length (ft)		50		225	75		175	
Base Capacity (vph)	240	353	632	628	631	1138	347	1460
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.04	0.25	0.14	0.01	0.44	0.15	0.28

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	8	14	125	20	79	4	369	92	48	388	6
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	190.0	170.1	190.0	190.0	185.5	171.2	190.0	182.7	190.0	166.7	182.8	190.0
Adj Flow Rate, veh/h	1	9	15	136	22	86	4	401	100	51	408	6
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.95	0.95	0.95
Percent Heavy Veh, %	13	13	0	5	5	11	0	4	4	14	4	4
Cap, veh/h	13	116	122	201	33	258	483	540	135	292	934	14
Arrive On Green	0.08	0.08	0.08	0.13	0.13	0.13	0.38	0.38	0.38	0.05	0.52	0.52
Sat Flow, veh/h	169	1523	1615	1531	248	1455	988	1413	352	1587	1797	26
Grp Volume(v), veh/h	10	0	15	158	0	86	4	0	501	51	0	414
Grp Sat Flow(s),veh/h/ln	1693	0	1615	1779	0	1455	988	0	1765	1587	0	1823
Q Serve(g_s), s	0.4	0.0	0.6	5.6	0.0	3.4	0.2	0.0	16.1	1.2	0.0	9.3
Cycle Q Clear(g_c), s	0.4	0.0	0.6	5.6	0.0	3.4	0.4	0.0	16.1	1.2	0.0	9.3
Prop In Lane	0.10		1.00	0.86		1.00	1.00		0.20	1.00		0.01
Lane Grp Cap(c), veh/h	128	0	122	234	0	258	483	0	675	292	0	947
V/C Ratio(X)	0.08	0.00	0.12	0.68	0.00	0.33	0.01	0.00	0.74	0.17	0.00	0.44
Avail Cap(c_a), veh/h	257	0	245	674	0	619	779	0	1204	460	0	1687
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	28.3	0.0	28.4	27.3	0.0	23.7	12.8	0.0	17.5	12.6	0.0	9.8
Incr Delay (d2), s/veh	0.3	0.0	0.4	3.4	0.0	0.7	0.0	0.0	1.6	0.3	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	0.2	0.0	0.3	2.9	0.0	1.4	0.0	0.0	8.1	0.5	0.0	4.7
LnGrp Delay(d),s/veh	28.6	0.0	28.9	30.7	0.0	24.4	12.8	0.0	19.2	12.9	0.0	10.2
LnGrp LOS	C		C	C		C	B		B	B		B
Approach Vol, veh/h		25			244			505			465	
Approach Delay, s/veh		28.8			28.5			19.1			10.5	
Approach LOS		C			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6		8
Phs Duration (G+Y+Rc), s		14.7	9.0	31.2		11.0		40.3
Change Period (Y+Rc), s		6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s		25.0	10.0	45.0		10.0		61.0
Max Q Clear Time (g_c+I1), s		7.6	3.2	18.1		2.6		11.3
Green Ext Time (p_c), s		1.1	0.0	7.1		0.0		7.9

Intersection Summary	
HCM 2010 Ctrl Delay	17.9
HCM 2010 LOS	B

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	45	218	222	241	266	55
v/c Ratio	0.14	0.32	0.27	0.16	0.52	0.10
Control Delay	20.6	2.8	3.9	3.1	18.8	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.6	2.8	3.9	3.1	18.8	6.0
Queue Length 50th (ft)	7	0	0	0	40	0
Queue Length 95th (ft)	40	28	51	55	145	21
Internal Link Dist (ft)	1078			751	648	
Turn Bay Length (ft)		150	225			150
Base Capacity (vph)	1075	841	928	1726	1460	1422
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.26	0.24	0.14	0.18	0.04

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR		
Lane Configurations								
Volume (veh/h)	41	201	204	222	245	51		
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	171.2	172.7	179.2	172.7	166.7	190.0		
Adj Flow Rate, veh/h	45	218	222	241	266	55		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Percent Heavy Veh, %	11	10	6	10	14	0		
Cap, veh/h	299	464	508	908	412	399		
Arrive On Green	0.18	0.18	0.13	0.53	0.25	0.25		
Sat Flow, veh/h	1630	1468	1707	1727	1667	1615		
Grp Volume(v), veh/h	45	218	222	241	266	55		
Grp Sat Flow(s),veh/h/ln	1630	1468	1707	1727	1667	1615		
Q Serve(g_s), s	1.0	4.9	3.5	3.2	5.9	1.1		
Cycle Q Clear(g_c), s	1.0	4.9	3.5	3.2	5.9	1.1		
Prop In Lane	1.00	1.00	1.00			1.00		
Lane Grp Cap(c), veh/h	299	464	508	908	412	399		
V/C Ratio(X)	0.15	0.47	0.44	0.27	0.65	0.14		
Avail Cap(c_a), veh/h	988	1085	901	2554	1616	1566		
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	14.2	11.3	8.7	5.4	13.9	12.1		
Incr Delay (d2), s/veh	0.3	0.9	0.6	0.1	0.6	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	0.4	4.3	1.7	1.5	2.7	0.5		
LnGrp Delay(d),s/veh	14.4	12.2	9.3	5.4	14.5	12.2		
LnGrp LOS	B	B	A	A	B	B		
Approach Vol, veh/h	263			463	321			
Approach Delay, s/veh	12.6			7.3	14.1			
Approach LOS	B			A	B			

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		27.7		13.6	11.5	16.2		
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0		
Max Green Setting (Gmax), s		61.0		25.0	15.0	40.0		
Max Q Clear Time (g_c+I1), s		5.2		6.9	5.5	7.9		
Green Ext Time (p_c), s		2.3		1.0	0.4	2.3		

Intersection Summary	
HCM 2010 Ctrl Delay	10.7
HCM 2010 LOS	B

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	21	30	48	97	8	254	23	283
v/c Ratio	0.08	0.11	0.16	0.30	0.02	0.45	0.05	0.41
Control Delay	26.8	22.2	25.5	14.2	17.4	20.0	10.6	14.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.8	22.2	25.5	14.2	17.4	20.0	10.6	14.0
Queue Length 50th (ft)	5	5	12	7	2	53	4	62
Queue Length 95th (ft)	29	32	48	51	12	157	17	128
Internal Link Dist (ft)		598		847		888		606
Turn Bay Length (ft)	100		150		100		100	
Base Capacity (vph)	546	555	1093	995	776	1191	606	1560
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.05	0.04	0.10	0.01	0.21	0.04	0.18

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	19	19	8	44	27	63	7	187	47	21	240	20
Number	5	2	12	1	6	16	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	190.0	190.0	190.0	190.0	178.7	190.0	190.0	175.6	190.0	182.7	171.1	190.0
Adj Flow Rate, veh/h	21	21	9	48	29	68	8	203	51	23	261	22
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	0	0	0	0	7	7	4	12	12
Cap, veh/h	174	121	52	213	56	131	459	390	98	383	686	58
Arrive On Green	0.10	0.10	0.10	0.12	0.12	0.12	0.29	0.29	0.29	0.04	0.44	0.44
Sat Flow, veh/h	1810	1263	541	1810	476	1115	1114	1355	341	1740	1556	131
Grp Volume(v), veh/h	21	0	30	48	0	97	8	0	254	23	0	283
Grp Sat Flow(s),veh/h/ln	1810	0	1804	1810	0	1590	1114	0	1696	1740	0	1688
Q Serve(g_s), s	0.6	0.0	0.8	1.3	0.0	3.0	0.3	0.0	6.5	0.4	0.0	5.9
Cycle Q Clear(g_c), s	0.6	0.0	0.8	1.3	0.0	3.0	0.3	0.0	6.5	0.4	0.0	5.9
Prop In Lane	1.00		0.30	1.00		0.70	1.00		0.20	1.00		0.08
Lane Grp Cap(c), veh/h	174	0	173	213	0	187	459	0	488	383	0	744
V/C Ratio(X)	0.12	0.00	0.17	0.23	0.00	0.52	0.02	0.00	0.52	0.06	0.00	0.38
Avail Cap(c_a), veh/h	521	0	519	1041	0	915	886	0	1139	817	0	1813
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	21.6	0.0	21.7	20.8	0.0	21.6	13.3	0.0	15.5	11.4	0.0	9.8
Incr Delay (d2), s/veh	0.4	0.0	0.7	0.8	0.0	3.1	0.0	0.0	1.2	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	0.3	0.0	0.4	0.7	0.0	1.5	0.1	0.0	3.2	0.2	0.0	2.8
LnGrp Delay(d),s/veh	22.0	0.0	22.3	21.6	0.0	24.7	13.3	0.0	16.8	11.4	0.0	10.2
LnGrp LOS	C		C	C		C	B		B	B		B
Approach Vol, veh/h		51			145			262			306	
Approach Delay, s/veh		22.2			23.7			16.7			10.3	
Approach LOS		C			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6		8
Phs Duration (G+Y+Rc), s		11.0	8.0	21.0		12.1		29.0
Change Period (Y+Rc), s		6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s		15.0	15.0	35.0		30.0		56.0
Max Q Clear Time (g_c+I1), s		2.8	2.4	8.5		5.0		7.9
Green Ext Time (p_c), s		0.1	0.0	5.3		1.0		5.9

Intersection Summary

HCM 2010 Ctrl Delay	15.8
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	1.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	52	8	5	42	19	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	247	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	57	9	5	46	21	4

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	57	0	114	57
Stage 1	-	-	-	-	57	-
Stage 2	-	-	-	-	57	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1547	-	882	1009
Stage 1	-	-	-	-	966	-
Stage 2	-	-	-	-	966	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1547	-	879	1009
Mov Cap-2 Maneuver	-	-	-	-	879	-
Stage 1	-	-	-	-	966	-
Stage 2	-	-	-	-	963	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.8	9.1
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	899	-	-	1547	-
HCM Lane V/C Ratio	0.028	-	-	0.004	-
HCM Control Delay (s)	9.1	-	-	7.3	-
HCM Lane LOS	A	-	-	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	1	3	2	0	0	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	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	3	2	0	0	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	4	0	0	0	-	0
Stage 1	0	-	-	-	-	-
Stage 2	4	-	-	-	-	-
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	1018	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	1019	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	1018	-	-	-	-	-
Mov Cap-2 Maneuver	1018	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	1019	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s		0	0
HCM LOS	-		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	-	-	-	-	-
HCM Lane LOS	-	-	-	-	-
HCM 95th %tile Q(veh)	-	-	-	-	-

Intersection	
Int Delay, s/veh	4.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	20	0	0	4	3	11
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	0	0	4	3	12

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	13	9	15	0	-	0
Stage 1	9	-	-	-	-	-
Stage 2	4	-	-	-	-	-
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	1006	1073	1603	-	-	-
Stage 1	1014	-	-	-	-	-
Stage 2	1019	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	1006	1073	1603	-	-	-
Mov Cap-2 Maneuver	1006	-	-	-	-	-
Stage 1	1014	-	-	-	-	-
Stage 2	1019	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1603	-	1006	-	-
HCM Lane V/C Ratio	-	-	0.022	-	-
HCM Control Delay (s)	0	-	8.7	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	150	15	251	97	2	11	7	100
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	125	-	50	100	-	100	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	2	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	100	13	0	8	25	0	18	0	7
Mvmt Flow	1	163	16	273	105	2	12	8	109

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	105	0	0	163	0	0	778	816	82
Stage 1	-	-	-	-	-	-	165	165	-
Stage 2	-	-	-	-	-	-	613	651	-
Critical Hdwy	6.1	-	-	4.26	-	-	7.86	6.5	7.04
Critical Hdwy Stg 1	-	-	-	-	-	-	6.86	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.86	5.5	-
Follow-up Hdwy	3.2	-	-	2.28	-	-	3.68	4	3.37
Pot Cap-1 Maneuver	986	-	-	1370	-	-	259	314	945
Stage 1	-	-	-	-	-	-	776	766	-
Stage 2	-	-	-	-	-	-	409	468	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	986	-	-	1370	-	-	202	251	945
Mov Cap-2 Maneuver	-	-	-	-	-	-	280	350	-
Stage 1	-	-	-	-	-	-	775	765	-
Stage 2	-	-	-	-	-	-	298	375	-

Approach	EB	WB	NB
HCM Control Delay, s	0.1	5.9	11.1
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	715	986	-	-	1370	-	-	404
HCM Lane V/C Ratio	0.179	0.001	-	-	0.199	-	-	0.116
HCM Control Delay (s)	11.1	8.7	-	-	8.3	-	-	15.1
HCM Lane LOS	B	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.7	0	-	-	0.7	-	-	0.4

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	5	27	11
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	2	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	4	9
Mvmt Flow	5	29	12

Major/Minor	Minor2		
Conflicting Flow All	739	816	53
Stage 1	651	651	-
Stage 2	88	165	-
Critical Hdwy	7.5	6.58	7.08
Critical Hdwy Stg 1	6.5	5.58	-
Critical Hdwy Stg 2	6.5	5.58	-
Follow-up Hdwy	3.5	4.04	3.39
Pot Cap-1 Maneuver	309	306	981
Stage 1	429	458	-
Stage 2	916	756	-
Platoon blocked, %			
Mov Cap-1 Maneuver	228	245	981
Mov Cap-2 Maneuver	367	331	-
Stage 1	429	367	-
Stage 2	802	755	-

Approach	SB
HCM Control Delay, s	15.1
HCM LOS	C

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	4.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	83	2	188	104	1	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	5	0	2	15	0	21
Mvmt Flow	90	2	204	113	1	39

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	92	0	613	91
Stage 1	-	-	-	-	91	-
Stage 2	-	-	-	-	522	-
Critical Hdwy	-	-	4.12	-	6.4	6.41
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.218	-	3.5	3.489
Pot Cap-1 Maneuver	-	-	1503	-	459	917
Stage 1	-	-	-	-	938	-
Stage 2	-	-	-	-	599	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1503	-	392	917
Mov Cap-2 Maneuver	-	-	-	-	392	-
Stage 1	-	-	-	-	938	-
Stage 2	-	-	-	-	512	-

Approach	EB	WB	NB
HCM Control Delay, s	0	5	9.3
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	885	-	-	1503	-
HCM Lane V/C Ratio	0.045	-	-	0.136	-
HCM Control Delay (s)	9.3	-	-	7.8	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0.5	-

Intersection	
Int Delay, s/veh	6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	9	41	130	17	19	8	7	19	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	50	-	-	-	150	-	25
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	95	95	95	92	92	92
Heavy Vehicles, %	0	18	0	0	11	63	0	12	0
Mvmt Flow	10	45	141	18	20	8	8	21	1

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	28	0	0	45	0	0	221	128	45
Stage 1	-	-	-	-	-	-	64	64	-
Stage 2	-	-	-	-	-	-	157	64	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.62	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.62	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.62	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4.108	3.3
Pot Cap-1 Maneuver	1599	-	-	1576	-	-	739	744	1031
Stage 1	-	-	-	-	-	-	952	822	-
Stage 2	-	-	-	-	-	-	850	822	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1599	-	-	1576	-	-	585	730	1031
Mov Cap-2 Maneuver	-	-	-	-	-	-	585	730	-
Stage 1	-	-	-	-	-	-	945	816	-
Stage 2	-	-	-	-	-	-	648	812	-

Approach	EB	WB	NB
HCM Control Delay, s	0.4	2.8	10.3
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	585	730	1031	1599	-	-	1576	-	-	760
HCM Lane V/C Ratio	0.013	0.028	0.001	0.006	-	-	0.011	-	-	0.27
HCM Control Delay (s)	11.2	10.1	8.5	7.3	0	-	7.3	0	-	11.5
HCM Lane LOS	B	B	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0	0.1	0	0	-	-	0	-	-	1.1

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	11	173	5
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	18	1	0
Mvmt Flow	12	188	5

Major/Minor	Minor2		
Conflicting Flow All	134	124	24
Stage 1	60	60	-
Stage 2	74	64	-
Critical Hdwy	7.28	6.51	6.2
Critical Hdwy Stg 1	6.28	5.51	-
Critical Hdwy Stg 2	6.28	5.51	-
Follow-up Hdwy	3.662	4.009	3.3
Pot Cap-1 Maneuver	802	768	1058
Stage 1	913	847	-
Stage 2	897	844	-
Platoon blocked, %			
Mov Cap-1 Maneuver	773	753	1058
Mov Cap-2 Maneuver	773	753	-
Stage 1	907	837	-
Stage 2	867	838	-

Approach	SB
HCM Control Delay, s	11.5
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	2.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	0	0	0	10	0	6	0	93	35
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	33	0	2	6
Mvmt Flow	0	0	0	11	0	7	0	101	38

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	380	396	113	377	377	120	113	0	0
Stage 1	257	257	-	120	120	-	-	-	-
Stage 2	123	139	-	257	257	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.53	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.597	2.2	-	-
Pot Cap-1 Maneuver	581	544	945	584	558	854	1489	-	-
Stage 1	752	699	-	889	800	-	-	-	-
Stage 2	886	785	-	752	699	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	553	515	945	560	528	854	1489	-	-
Mov Cap-2 Maneuver	553	515	-	560	528	-	-	-	-
Stage 1	752	662	-	889	800	-	-	-	-
Stage 2	879	785	-	712	662	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	10.8	0
HCM LOS	A	B	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1489	-	-	-	643	1445	-	-
HCM Lane V/C Ratio	-	-	-	-	0.027	0.05	-	-
HCM Control Delay (s)	0	-	-	0	10.8	7.6	0	-
HCM Lane LOS	A	-	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0.1	0.2	-	-

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	66	104	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	0
Mvmt Flow	72	113	0

Major/Minor	Major2		
Conflicting Flow All	139	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.12	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.218	-	-
Pot Cap-1 Maneuver	1445	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1445	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	3
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	5.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	103	46	5	24	104	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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	0	9	2	0
Mvmt Flow	112	50	5	26	113	11

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	155	118	124	0	-	0
Stage 1	118	-	-	-	-	-
Stage 2	37	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.1	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.2	-	-	-
Pot Cap-1 Maneuver	836	934	1475	-	-	-
Stage 1	907	-	-	-	-	-
Stage 2	985	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	833	934	1475	-	-	-
Mov Cap-2 Maneuver	833	-	-	-	-	-
Stage 1	907	-	-	-	-	-
Stage 2	982	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.1	1.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1475	-	862	-	-
HCM Lane V/C Ratio	0.004	-	0.188	-	-
HCM Control Delay (s)	7.5	0	10.1	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.7	-	-

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	102	21	1	8	0	11	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	10	0	0	0	18	0	0
Mvmt Flow	1	111	23	1	9	0	12	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	9	0	0	134	0	0	139	135	122
Stage 1	-	-	-	-	-	-	124	124	-
Stage 2	-	-	-	-	-	-	15	11	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.28	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.28	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.28	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.662	4	3.3
Pot Cap-1 Maneuver	1624	-	-	1463	-	-	796	760	935
Stage 1	-	-	-	-	-	-	843	797	-
Stage 2	-	-	-	-	-	-	965	890	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1624	-	-	1463	-	-	789	758	935
Mov Cap-2 Maneuver	-	-	-	-	-	-	789	758	-
Stage 1	-	-	-	-	-	-	842	796	-
Stage 2	-	-	-	-	-	-	957	889	-

Approach	EB	WB	NB
HCM Control Delay, s	0.1	0.8	9.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	789	1624	-	-	1463	-	-	949
HCM Lane V/C Ratio	0.015	0.001	-	-	0.001	-	-	0.009
HCM Control Delay (s)	9.6	7.2	0	-	7.5	0	-	8.8
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	1	1	6
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	100	0	0
Mvmt Flow	1	1	7

Major/Minor	Minor2		
Conflicting Flow All	135	147	9
Stage 1	11	11	-
Stage 2	124	136	-
Critical Hdwy	8.1	6.5	6.2
Critical Hdwy Stg 1	7.1	5.5	-
Critical Hdwy Stg 2	7.1	5.5	-
Follow-up Hdwy	4.4	4	3.3
Pot Cap-1 Maneuver	655	748	1079
Stage 1	806	890	-
Stage 2	690	788	-
Platoon blocked, %			
Mov Cap-1 Maneuver	654	747	1079
Mov Cap-2 Maneuver	654	747	-
Stage 1	805	889	-
Stage 2	689	787	-

Approach	SB
HCM Control Delay, s	8.8
HCM LOS	A

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	92	10	0	4	0	4	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	10	0	0	0	18	0	0
Mvmt Flow	1	100	11	0	4	0	4	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	4	0	0	111	0	0	113	112	105
Stage 1	-	-	-	-	-	-	108	108	-
Stage 2	-	-	-	-	-	-	5	4	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.28	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.28	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.28	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.662	4	3.3
Pot Cap-1 Maneuver	1631	-	-	1492	-	-	828	782	955
Stage 1	-	-	-	-	-	-	860	810	-
Stage 2	-	-	-	-	-	-	977	897	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1631	-	-	1492	-	-	827	781	955
Mov Cap-2 Maneuver	-	-	-	-	-	-	827	781	-
Stage 1	-	-	-	-	-	-	859	809	-
Stage 2	-	-	-	-	-	-	976	897	-

Approach	EB	WB	NB
HCM Control Delay, s	0.1	0	9.4
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	827	1631	-	-	1492	-	-	1085
HCM Lane V/C Ratio	0.005	0.001	-	-	-	-	-	0.001
HCM Control Delay (s)	9.4	7.2	0	-	0	-	-	8.3
HCM Lane LOS	A	A	A	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	1
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	0	0
Mvmt Flow	0	0	1

Major/Minor	Minor2		
Conflicting Flow All	112	117	4
Stage 1	4	4	-
Stage 2	108	113	-
Critical Hdwy	7.1	6.5	6.2
Critical Hdwy Stg 1	6.1	5.5	-
Critical Hdwy Stg 2	6.1	5.5	-
Follow-up Hdwy	3.5	4	3.3
Pot Cap-1 Maneuver	870	777	1085
Stage 1	1024	897	-
Stage 2	902	806	-
Platoon blocked, %			
Mov Cap-1 Maneuver	869	776	1085
Mov Cap-2 Maneuver	869	776	-
Stage 1	1023	897	-
Stage 2	901	805	-

Approach	SB
HCM Control Delay, s	8.3
HCM LOS	A

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	6.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	0	0	4	0	0	0	3	0	1
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0
Mvmt Flow	0	0	4	0	0	0	3	0	1

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	8	9	1	10	8	1	1	0	0
Stage 1	1	1	-	7	7	-	-	-	-
Stage 2	7	8	-	3	1	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-
Pot Cap-1 Maneuver	1016	890	1090	1013	891	1090	1635	-	-
Stage 1	1027	899	-	1020	894	-	-	-	-
Stage 2	1020	893	-	1025	899	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	1014	888	1090	1007	889	1090	1635	-	-
Mov Cap-2 Maneuver	1014	888	-	1007	889	-	-	-	-
Stage 1	1025	899	-	1018	892	-	-	-	-
Stage 2	1018	891	-	1021	899	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	8.3	0	5.4
HCM LOS	A	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1635	-	-	1090	-	1635	-	-
HCM Lane V/C Ratio	0.002	-	-	0.004	-	-	-	-
HCM Control Delay (s)	7.2	0	-	8.3	0	0	-	-
HCM Lane LOS	A	A	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	-	0	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	1	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	0	0
Mvmt Flow	0	1	0

Major/Minor	Major2		
Conflicting Flow All	1	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.1	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.2	-	-
Pot Cap-1 Maneuver	1635	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1635	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	3	60	16	5	2	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	67	2	20	0	0	0
Mvmt Flow	3	65	17	5	2	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	23	0	-	0	92	20
Stage 1	-	-	-	-	20	-
Stage 2	-	-	-	-	72	-
Critical Hdwy	4.77	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.803	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1257	-	-	-	913	1064
Stage 1	-	-	-	-	1008	-
Stage 2	-	-	-	-	956	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1257	-	-	-	911	1064
Mov Cap-2 Maneuver	-	-	-	-	911	-
Stage 1	-	-	-	-	1008	-
Stage 2	-	-	-	-	954	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	8.7
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1257	-	-	-	982
HCM Lane V/C Ratio	0.003	-	-	-	0.004
HCM Control Delay (s)	7.9	0	-	-	8.7
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	9	2	16	29	3	324	83	155
v/c Ratio	0.05	0.01	0.08	0.05	0.01	0.61	0.19	0.20
Control Delay	27.8	0.0	27.8	0.2	15.7	22.9	9.0	9.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.8	0.0	27.8	0.2	15.7	22.9	9.0	9.1
Queue Length 50th (ft)	3	0	5	0	1	92	14	28
Queue Length 95th (ft)	16	0	23	0	6	177	34	59
Internal Link Dist (ft)	750		1085			929		1030
Turn Bay Length (ft)		50		225	75		175	
Base Capacity (vph)	332	402	798	613	986	1342	497	1575
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.00	0.02	0.05	0.00	0.24	0.17	0.10

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	7	2	14	1	27	3	198	100	76	142	1
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	190.0	190.0	190.0	190.0	190.0	169.6	190.0	178.7	190.0	184.5	162.5	190.0
Adj Flow Rate, veh/h	1	8	2	15	1	29	3	215	109	83	154	1
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	0	0	12	0	7	7	3	17	17
Cap, veh/h	20	160	154	162	11	234	495	320	162	375	753	5
Arrive On Green	0.10	0.10	0.10	0.10	0.10	0.10	0.29	0.29	0.29	0.07	0.47	0.47
Sat Flow, veh/h	210	1680	1615	1701	113	1442	1251	1119	567	1757	1613	10
Grp Volume(v), veh/h	9	0	2	16	0	29	3	0	324	83	0	155
Grp Sat Flow(s),veh/h/ln	1890	0	1615	1815	0	1442	1251	0	1687	1757	0	1624
Q Serve(g_s), s	0.2	0.0	0.1	0.4	0.0	0.9	0.1	0.0	8.9	1.6	0.0	3.0
Cycle Q Clear(g_c), s	0.2	0.0	0.1	0.4	0.0	0.9	0.1	0.0	8.9	1.6	0.0	3.0
Prop In Lane	0.11		1.00	0.94		1.00	1.00		0.34	1.00		0.01
Lane Grp Cap(c), veh/h	180	0	154	173	0	234	495	0	482	375	0	758
V/C Ratio(X)	0.05	0.00	0.01	0.09	0.00	0.12	0.01	0.00	0.67	0.22	0.00	0.20
Avail Cap(c_a), veh/h	360	0	308	864	0	783	1210	0	1446	592	0	1886
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	21.6	0.0	21.5	21.7	0.0	18.8	13.4	0.0	16.6	11.5	0.0	8.3
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.2	0.0	0.2	0.0	0.0	1.6	0.3	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	0.0	0.2	0.0	0.4	0.0	0.0	4.4	0.8	0.0	1.3
LnGrp Delay(d),s/veh	21.7	0.0	21.6	21.9	0.0	19.0	13.4	0.0	18.2	11.8	0.0	8.4
LnGrp LOS	C		C	C		B	B		B	B		A
Approach Vol, veh/h		11			45			327			238	
Approach Delay, s/veh		21.7			20.1			18.2			9.6	
Approach LOS		C			C			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6		8
Phs Duration (G+Y+Rc), s		11.0	9.5	21.0		11.0		30.5
Change Period (Y+Rc), s		6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s		25.0	10.0	45.0		10.0		61.0
Max Q Clear Time (g_c+I1), s		2.9	3.6	10.9		2.2		5.0
Green Ext Time (p_c), s		0.1	0.1	3.5		0.0		3.6

Intersection Summary

HCM 2010 Ctrl Delay	15.1
HCM 2010 LOS	B

Queues
11: S. Main St & Church St

Base AM
10/22/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	10	95	95	133	128	22
v/c Ratio	0.03	0.20	0.12	0.08	0.17	0.03
Control Delay	12.9	3.1	2.6	2.0	11.0	6.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.9	3.1	2.6	2.0	11.0	6.4
Queue Length 50th (ft)	1	0	0	0	12	0
Queue Length 95th (ft)	12	15	22	29	63	13
Internal Link Dist (ft)	1078			751	648	
Turn Bay Length (ft)		150	225			150
Base Capacity (vph)	1295	830	1042	1727	1630	1580
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.11	0.09	0.08	0.08	0.01

Intersection Summary

HCM 2010 Signalized Intersection Summary
11: S. Main St & Church St

Base AM
10/22/2014

Movement	EBL	EBR	NBL	NBT	SBT	SBR		
Lane Configurations								
Volume (veh/h)	9	87	87	122	118	20		
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	171.2	172.7	179.2	172.7	166.7	190.0		
Adj Flow Rate, veh/h	10	95	95	133	128	22		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Percent Heavy Veh, %	11	10	6	10	14	0		
Cap, veh/h	210	316	594	903	436	422		
Arrive On Green	0.13	0.13	0.09	0.52	0.26	0.26		
Sat Flow, veh/h	1630	1468	1707	1727	1667	1615		
Grp Volume(v), veh/h	10	95	95	133	128	22		
Grp Sat Flow(s),veh/h/ln	1630	1468	1707	1727	1667	1615		
Q Serve(g_s), s	0.2	1.9	1.2	1.4	2.1	0.4		
Cycle Q Clear(g_c), s	0.2	1.9	1.2	1.4	2.1	0.4		
Prop In Lane	1.00	1.00	1.00			1.00		
Lane Grp Cap(c), veh/h	210	316	594	903	436	422		
V/C Ratio(X)	0.05	0.30	0.16	0.15	0.29	0.05		
Avail Cap(c_a), veh/h	1184	1194	1190	3061	1937	1877		
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	13.1	11.3	6.7	4.3	10.2	9.5		
Incr Delay (d2), s/veh	0.1	0.6	0.1	0.0	0.1	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	0.1	1.7	0.5	0.6	1.0	0.2		
LnGrp Delay(d),s/veh	13.3	12.0	6.8	4.3	10.3	9.5		
LnGrp LOS	B	B	A	A	B	A		
Approach Vol, veh/h	105			228	150			
Approach Delay, s/veh	12.1			5.3	10.2			
Approach LOS	B			A	B			

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		24.0		10.4	9.0	15.0		
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0		
Max Green Setting (Gmax), s		61.0		25.0	15.0	40.0		
Max Q Clear Time (g_c+I1), s		3.4		3.9	3.2	4.1		
Green Ext Time (p_c), s		1.1		0.4	0.2	1.1		

Intersection Summary	
HCM 2010 Ctrl Delay	8.3
HCM 2010 LOS	A

Lane Group	EBL	EBT	WBL	WBT	NBT	SBL	SBT
Lane Group Flow (vph)	8	19	20	31	143	103	142
v/c Ratio	0.02	0.05	0.05	0.08	0.31	0.22	0.19
Control Delay	26.4	26.1	25.1	13.1	23.7	13.6	13.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.4	26.1	25.1	13.1	23.7	13.6	13.0
Queue Length 50th (ft)	3	7	7	2	48	27	37
Queue Length 95th (ft)	15	25	25	23	100	56	72
Internal Link Dist (ft)		598		847	888		606
Turn Bay Length (ft)	100		150			100	
Base Capacity (vph)	475	497	950	825	1040	611	1469
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.04	0.02	0.04	0.14	0.17	0.10

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	7	17	1	18	5	24	0	98	33	95	120	11
Number	5	2	12	1	6	16	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	190.0	190.0	190.0	190.0	176.7	190.0	190.0	175.1	190.0	182.7	171.2	190.0
Adj Flow Rate, veh/h	8	18	1	20	5	26	0	107	36	103	130	12
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	0	0	0	0	7	7	4	12	12
Cap, veh/h	313	309	17	220	30	157	113	296	100	474	652	60
Arrive On Green	0.17	0.17	0.17	0.12	0.12	0.12	0.00	0.24	0.24	0.09	0.42	0.42
Sat Flow, veh/h	1810	1783	99	1810	248	1291	1266	1254	422	1740	1544	143
Grp Volume(v), veh/h	8	0	19	20	0	31	0	0	143	103	0	142
Grp Sat Flow(s),veh/h/ln	1810	0	1883	1810	0	1539	1266	0	1677	1740	0	1687
Q Serve(g_s), s	0.2	0.0	0.5	0.6	0.0	1.1	0.0	0.0	4.5	2.6	0.0	3.4
Cycle Q Clear(g_c), s	0.2	0.0	0.5	0.6	0.0	1.1	0.0	0.0	4.5	2.6	0.0	3.4
Prop In Lane	1.00		0.05	1.00		0.84	1.00		0.25	1.00		0.08
Lane Grp Cap(c), veh/h	313	0	326	220	0	187	113	0	396	474	0	713
V/C Ratio(X)	0.03	0.00	0.06	0.09	0.00	0.17	0.00	0.00	0.36	0.22	0.00	0.20
Avail Cap(c_a), veh/h	427	0	444	854	0	726	512	0	923	724	0	1486
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	0.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.8	0.0	22.0	24.8	0.0	25.0	0.0	0.0	20.3	14.2	0.0	11.6
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.3	0.0	0.6	0.0	0.0	0.8	0.2	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	0.3	0.3	0.0	0.5	0.0	0.0	2.2	1.2	0.0	1.6
LnGrp Delay(d),s/veh	21.9	0.0	22.1	25.1	0.0	25.6	0.0	0.0	21.1	14.4	0.0	11.8
LnGrp LOS	C		C	C		C			C	B		B
Approach Vol, veh/h		27			51			143			245	
Approach Delay, s/veh		22.0			25.4			21.1			12.9	
Approach LOS		C			C			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6		8
Phs Duration (G+Y+Rc), s		17.0	11.9	21.0		13.7		32.9
Change Period (Y+Rc), s		6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s		15.0	15.0	35.0		30.0		56.0
Max Q Clear Time (g_c+I1), s		2.5	4.6	6.5		3.1		5.4
Green Ext Time (p_c), s		0.1	0.1	2.6		0.3		2.8

Intersection Summary

HCM 2010 Ctrl Delay	17.3
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	19	11	2	48	5	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	247	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	12	2	52	5	8

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	21	0	78	21
Stage 1	-	-	-	-	21	-
Stage 2	-	-	-	-	57	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1595	-	925	1056
Stage 1	-	-	-	-	1002	-
Stage 2	-	-	-	-	966	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1595	-	924	1056
Mov Cap-2 Maneuver	-	-	-	-	924	-
Stage 1	-	-	-	-	1002	-
Stage 2	-	-	-	-	965	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	8.7
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	997	-	-	1595	-
HCM Lane V/C Ratio	0.013	-	-	0.001	-
HCM Control Delay (s)	8.7	-	-	7.3	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0	-	-	0	-

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	5	1	0	0	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	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	5	1	0	0	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2	0	0	0	-	0
Stage 1	0	-	-	-	-	-
Stage 2	2	-	-	-	-	-
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	1021	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	1021	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	1021	-	-	-	-	-
Mov Cap-2 Maneuver	1021	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	1021	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s		0	0
HCM LOS	-		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	-	-	-	-	-
HCM Lane LOS	-	-	-	-	-
HCM 95th %tile Q(veh)	-	-	-	-	-

Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	8	0	0	2	4	14
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	0	0	2	4	15

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	14	12	20	0	-	0
Stage 1	12	-	-	-	-	-
Stage 2	2	-	-	-	-	-
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	1005	1069	1596	-	-	-
Stage 1	1011	-	-	-	-	-
Stage 2	1021	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	1005	1069	1596	-	-	-
Mov Cap-2 Maneuver	1005	-	-	-	-	-
Stage 1	1011	-	-	-	-	-
Stage 2	1021	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.6	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1596	-	1005	-	-
HCM Lane V/C Ratio	-	-	0.009	-	-
HCM Control Delay (s)	0	-	8.6	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	7	113	12	158	170	6	31	35	229
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	125	-	50	100	-	100	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	2	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	96	96	96	93	93	93
Heavy Vehicles, %	0	18	31	11	20	0	8	3	5
Mvmt Flow	8	123	13	165	177	6	33	38	246

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	177	0	0	123	0	0	567	644	61
Stage 1	-	-	-	-	-	-	138	138	-
Stage 2	-	-	-	-	-	-	429	506	-
Critical Hdwy	4.1	-	-	4.32	-	-	7.66	6.56	7
Critical Hdwy Stg 1	-	-	-	-	-	-	6.66	5.56	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.66	5.56	-
Follow-up Hdwy	2.2	-	-	2.31	-	-	3.58	4.03	3.35
Pot Cap-1 Maneuver	1411	-	-	1398	-	-	394	388	982
Stage 1	-	-	-	-	-	-	834	779	-
Stage 2	-	-	-	-	-	-	559	536	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1411	-	-	1398	-	-	339	340	982
Mov Cap-2 Maneuver	-	-	-	-	-	-	429	434	-
Stage 1	-	-	-	-	-	-	829	775	-
Stage 2	-	-	-	-	-	-	465	473	-

Approach	EB	WB	NB
HCM Control Delay, s	0.4	3.7	13
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	764	1411	-	-	1398	-	-	492
HCM Lane V/C Ratio	0.415	0.005	-	-	0.118	-	-	0.068
HCM Control Delay (s)	13	7.6	-	-	7.9	-	-	12.9
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	2.1	0	-	-	0.4	-	-	0.2

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	2	21	8
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	2	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	5	13
Mvmt Flow	2	23	9

Major/Minor	Minor2		
Conflicting Flow All	601	644	89
Stage 1	506	506	-
Stage 2	95	138	-
Critical Hdwy	7.5	6.6	7.16
Critical Hdwy Stg 1	6.5	5.6	-
Critical Hdwy Stg 2	6.5	5.6	-
Follow-up Hdwy	3.5	4.05	3.43
Pot Cap-1 Maneuver	388	384	917
Stage 1	522	531	-
Stage 2	907	774	-
Platoon blocked, %			
Mov Cap-1 Maneuver	246	337	917
Mov Cap-2 Maneuver	392	427	-
Stage 1	519	468	-
Stage 2	643	770	-

Approach	SB
HCM Control Delay, s	12.9
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	3.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	157	2	27	165	1	138
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	7	0	28	7	0	5
Mvmt Flow	171	2	29	179	1	150

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	173	0	410	172
Stage 1	-	-	-	-	172	-
Stage 2	-	-	-	-	238	-
Critical Hdwy	-	-	4.38	-	6.4	6.25
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.452	-	3.5	3.345
Pot Cap-1 Maneuver	-	-	1261	-	602	864
Stage 1	-	-	-	-	863	-
Stage 2	-	-	-	-	806	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1261	-	586	864
Mov Cap-2 Maneuver	-	-	-	-	586	-
Stage 1	-	-	-	-	863	-
Stage 2	-	-	-	-	785	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.1	10.1
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	861	-	-	1261	-
HCM Lane V/C Ratio	0.175	-	-	0.023	-
HCM Control Delay (s)	10.1	-	-	7.9	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.6	-	-	0.1	-

Intersection	
Int Delay, s/veh	6.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	9	44	12	9	58	14	57	116	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	50	-	-	-	150	-	25
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	5	20	23	15	25	2	5	1
Mvmt Flow	10	48	13	10	63	15	62	126	20

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	78	0	0	48	0	0	166	165	48
Stage 1	-	-	-	-	-	-	67	67	-
Stage 2	-	-	-	-	-	-	99	98	-
Critical Hdwy	4.1	-	-	4.33	-	-	7.12	6.55	6.21
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.55	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.55	-
Follow-up Hdwy	2.2	-	-	2.407	-	-	3.518	4.045	3.309
Pot Cap-1 Maneuver	1533	-	-	1435	-	-	798	722	1024
Stage 1	-	-	-	-	-	-	943	833	-
Stage 2	-	-	-	-	-	-	907	808	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1533	-	-	1435	-	-	775	712	1024
Mov Cap-2 Maneuver	-	-	-	-	-	-	775	712	-
Stage 1	-	-	-	-	-	-	936	827	-
Stage 2	-	-	-	-	-	-	883	802	-

Approach	EB	WB	NB
HCM Control Delay, s	1	0.8	10.5
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	775	712	1024	1533	-	-	1435	-	-	678
HCM Lane V/C Ratio	0.08	0.177	0.019	0.006	-	-	0.007	-	-	0.043
HCM Control Delay (s)	10	11.1	8.6	7.4	0	-	7.5	0	-	10.6
HCM Lane LOS	B	B	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	0.6	0.1	0	-	-	0	-	-	0.1

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	11	6	10
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	64	24	0
Mvmt Flow	12	7	11

Major/Minor	Minor2		
Conflicting Flow All	220	157	71
Stage 1	90	90	-
Stage 2	130	67	-
Critical Hdwy	7.74	6.74	6.2
Critical Hdwy Stg 1	6.74	5.74	-
Critical Hdwy Stg 2	6.74	5.74	-
Follow-up Hdwy	4.076	4.216	3.3
Pot Cap-1 Maneuver	622	697	997
Stage 1	785	779	-
Stage 2	745	798	-
Platoon blocked, %			
Mov Cap-1 Maneuver	522	687	997
Mov Cap-2 Maneuver	522	687	-
Stage 1	780	774	-
Stage 2	615	792	-

Approach	SB
HCM Control Delay, s	10.6
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	5.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	3	0	1	67	0	58	0	85	7
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	0	3	0	4	0
Mvmt Flow	3	0	1	73	0	63	0	92	8

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	213	185	48	181	181	96	48	0	0
Stage 1	85	85	-	96	96	-	-	-	-
Stage 2	128	100	-	85	85	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.12	6.5	6.23	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.12	5.5	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.12	5.5	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.518	4	3.327	2.2	-	-
Pot Cap-1 Maneuver	748	713	1027	781	717	958	1572	-	-
Stage 1	928	828	-	911	819	-	-	-	-
Stage 2	881	816	-	923	828	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	692	704	1027	772	708	958	1572	-	-
Mov Cap-2 Maneuver	692	704	-	772	708	-	-	-	-
Stage 1	928	817	-	911	819	-	-	-	-
Stage 2	823	816	-	910	817	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	9.8	10.1	0
HCM LOS	A	B	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1572	-	-	753	848	1382	-	-
HCM Lane V/C Ratio	-	-	-	0.006	0.16	0.013	-	-
HCM Control Delay (s)	0	-	-	9.8	10.1	7.6	0	-
HCM Lane LOS	A	-	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.6	0	-	-

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	17	44	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	21	14	0
Mvmt Flow	18	48	0

Major/Minor	Major2		
Conflicting Flow All	100	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.31	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.389	-	-
Pot Cap-1 Maneuver	1382	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1382	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	2.1
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	12	19	41	80	30	82
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	92	92	92	92	92	92
Heavy Vehicles, %	0	6	2	4	15	0
Mvmt Flow	13	21	45	87	33	89

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	253	77	122	0	-	0
Stage 1	77	-	-	-	-	-
Stage 2	176	-	-	-	-	-
Critical Hdwy	6.4	6.26	4.12	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.354	2.218	-	-	-
Pot Cap-1 Maneuver	740	973	1465	-	-	-
Stage 1	951	-	-	-	-	-
Stage 2	859	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	716	973	1465	-	-	-
Mov Cap-2 Maneuver	716	-	-	-	-	-
Stage 1	951	-	-	-	-	-
Stage 2	832	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.4	2.6	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1465	-	854	-	-
HCM Lane V/C Ratio	0.03	-	0.039	-	-
HCM Control Delay (s)	7.5	0	9.4	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.1	-	-

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	29	7	1	77	1	29	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	27	19	0	0	4	0	4	0	0
Mvmt Flow	1	32	8	1	84	1	32	1	1

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	85	0	0	39	0	0	128	125	35
Stage 1	-	-	-	-	-	-	38	38	-
Stage 2	-	-	-	-	-	-	90	87	-
Critical Hdwy	4.37	-	-	4.1	-	-	7.14	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.14	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.14	5.5	-
Follow-up Hdwy	2.443	-	-	2.2	-	-	3.536	4	3.3
Pot Cap-1 Maneuver	1368	-	-	1584	-	-	841	769	1044
Stage 1	-	-	-	-	-	-	972	867	-
Stage 2	-	-	-	-	-	-	912	827	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1368	-	-	1584	-	-	834	767	1044
Mov Cap-2 Maneuver	-	-	-	-	-	-	834	767	-
Stage 1	-	-	-	-	-	-	971	866	-
Stage 2	-	-	-	-	-	-	905	826	-

Approach	EB	WB	NB
HCM Control Delay, s	0.2	0.1	9.5
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	837	1368	-	-	1584	-	-	887
HCM Lane V/C Ratio	0.04	0.001	-	-	0.001	-	-	0.007
HCM Control Delay (s)	9.5	7.6	0	-	7.3	0	-	9.1
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	2	4
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	0	6
Mvmt Flow	0	2	4

Major/Minor	Minor2		
Conflicting Flow All	125	127	84
Stage 1	86	86	-
Stage 2	39	41	-
Critical Hdwy	7.1	6.5	6.26
Critical Hdwy Stg 1	6.1	5.5	-
Critical Hdwy Stg 2	6.1	5.5	-
Follow-up Hdwy	3.5	4	3.354
Pot Cap-1 Maneuver	854	767	964
Stage 1	927	827	-
Stage 2	981	865	-
Platoon blocked, %			
Mov Cap-1 Maneuver	851	765	964
Mov Cap-2 Maneuver	851	765	-
Stage 1	926	826	-
Stage 2	978	864	-

Approach	SB
HCM Control Delay, s	9.1
HCM LOS	A

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	25	3	0	65	0	14	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	27	18	0	0	4	0	1	0	0
Mvmt Flow	1	27	3	0	71	0	15	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	71	0	0	30	0	0	102	102	29
Stage 1	-	-	-	-	-	-	31	31	-
Stage 2	-	-	-	-	-	-	71	71	-
Critical Hdwy	4.37	-	-	4.1	-	-	7.11	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.11	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.11	5.5	-
Follow-up Hdwy	2.443	-	-	2.2	-	-	3.509	4	3.3
Pot Cap-1 Maneuver	1385	-	-	1596	-	-	881	792	1052
Stage 1	-	-	-	-	-	-	988	873	-
Stage 2	-	-	-	-	-	-	941	840	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1385	-	-	1596	-	-	879	791	1052
Mov Cap-2 Maneuver	-	-	-	-	-	-	879	791	-
Stage 1	-	-	-	-	-	-	987	872	-
Stage 2	-	-	-	-	-	-	940	840	-

Approach	EB	WB	NB
HCM Control Delay, s	0.3	0	9.2
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	879	1385	-	-	1596	-	-	980
HCM Lane V/C Ratio	0.017	0.001	-	-	-	-	-	0.001
HCM Control Delay (s)	9.2	7.6	0	-	0	-	-	8.7
HCM Lane LOS	A	A	A	-	A	-	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	1
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	0	6
Mvmt Flow	0	0	1

Major/Minor	Minor2		
Conflicting Flow All	102	104	71
Stage 1	71	71	-
Stage 2	31	33	-
Critical Hdwy	7.1	6.5	6.26
Critical Hdwy Stg 1	6.1	5.5	-
Critical Hdwy Stg 2	6.1	5.5	-
Follow-up Hdwy	3.5	4	3.354
Pot Cap-1 Maneuver	884	790	980
Stage 1	944	840	-
Stage 2	991	872	-
Platoon blocked, %			
Mov Cap-1 Maneuver	883	789	980
Mov Cap-2 Maneuver	883	789	-
Stage 1	943	840	-
Stage 2	990	871	-

Approach	SB
HCM Control Delay, s	8.7
HCM LOS	A

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	0	0	1	0	0	0	1	0	0
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	27	0	0	6	6	0	0	0
Mvmt Flow	0	0	1	0	0	0	1	0	0

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	3	3	1	4	3	0	1	0	0
Stage 1	1	1	-	2	2	-	-	-	-
Stage 2	2	2	-	2	1	-	-	-	-
Critical Hdwy	7.1	6.77	6.2	7.1	6.56	6.26	4.1	-	-
Critical Hdwy Stg 1	6.1	5.77	-	6.1	5.56	-	-	-	-
Critical Hdwy Stg 2	6.1	5.77	-	6.1	5.56	-	-	-	-
Follow-up Hdwy	3.5	4.243	3.3	3.5	4.054	3.354	2.2	-	-
Pot Cap-1 Maneuver	1024	845	1090	1022	885	-	1635	-	-
Stage 1	1027	848	-	1026	886	-	-	-	-
Stage 2	1026	847	-	1026	887	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	-	844	1090	1020	884	-	1635	-	-
Mov Cap-2 Maneuver	-	844	-	1020	884	-	-	-	-
Stage 1	1026	848	-	1025	885	-	-	-	-
Stage 2	1025	846	-	1025	887	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s		0	7.2
HCM LOS	-	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1635	-	-	-	-	-	-	-
HCM Lane V/C Ratio	0.001	-	-	-	-	-	-	-
HCM Control Delay (s)	7.2	0	-	-	0	0	-	-
HCM Lane LOS	A	A	-	-	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-	-	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	1	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	27	0	0
Mvmt Flow	0	1	0

Major/Minor	Major2		
Conflicting Flow All	0	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.37	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.443	-	-
Pot Cap-1 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	-	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	1	20	85	2	1	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	18	2	5	23	0
Mvmt Flow	1	22	92	2	1	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	95	0	-	0	117	93
Stage 1	-	-	-	-	93	-
Stage 2	-	-	-	-	24	-
Critical Hdwy	4.1	-	-	-	6.63	6.2
Critical Hdwy Stg 1	-	-	-	-	5.63	-
Critical Hdwy Stg 2	-	-	-	-	5.63	-
Follow-up Hdwy	2.2	-	-	-	3.707	3.3
Pot Cap-1 Maneuver	1512	-	-	-	831	970
Stage 1	-	-	-	-	881	-
Stage 2	-	-	-	-	947	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1512	-	-	-	830	970
Mov Cap-2 Maneuver	-	-	-	-	830	-
Stage 1	-	-	-	-	881	-
Stage 2	-	-	-	-	946	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	8.9
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1512	-	-	-	931
HCM Lane V/C Ratio	0.001	-	-	-	0.005
HCM Control Delay (s)	7.4	0	-	-	8.9
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	10	16	164	89	4	521	53	431
v/c Ratio	0.07	0.06	0.54	0.16	0.01	0.79	0.19	0.48
Control Delay	43.0	0.4	40.5	6.3	17.0	31.5	11.3	14.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.0	0.4	40.5	6.3	17.0	31.5	11.3	14.3
Queue Length 50th (ft)	5	0	74	0	1	217	12	121
Queue Length 95th (ft)	24	0	166	34	8	394	33	227
Internal Link Dist (ft)	750		1085			929		1030
Turn Bay Length (ft)		50		225	75		175	
Base Capacity (vph)	235	348	618	626	608	1113	338	1428
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.05	0.27	0.14	0.01	0.47	0.16	0.30

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	8	15	130	21	82	4	384	96	50	404	6
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	190.0	170.1	190.0	190.0	185.5	171.2	190.0	182.7	190.0	166.7	182.8	190.0
Adj Flow Rate, veh/h	1	9	16	141	23	89	4	417	104	53	425	6
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.95	0.95	0.95
Percent Heavy Veh, %	13	13	0	5	5	11	0	4	4	14	4	4
Cap, veh/h	12	112	119	205	33	263	476	554	138	288	948	13
Arrive On Green	0.07	0.07	0.07	0.13	0.13	0.13	0.39	0.39	0.39	0.05	0.53	0.53
Sat Flow, veh/h	169	1523	1615	1529	249	1455	972	1412	352	1587	1798	25
Grp Volume(v), veh/h	10	0	16	164	0	89	4	0	521	53	0	431
Grp Sat Flow(s),veh/h/ln	1693	0	1615	1779	0	1455	972	0	1765	1587	0	1823
Q Serve(g_s), s	0.4	0.0	0.6	6.0	0.0	3.6	0.2	0.0	17.3	1.2	0.0	9.9
Cycle Q Clear(g_c), s	0.4	0.0	0.6	6.0	0.0	3.6	1.0	0.0	17.3	1.2	0.0	9.9
Prop In Lane	0.10		1.00	0.86		1.00	1.00		0.20	1.00		0.01
Lane Grp Cap(c), veh/h	125	0	119	238	0	263	476	0	693	288	0	961
V/C Ratio(X)	0.08	0.00	0.13	0.69	0.00	0.34	0.01	0.00	0.75	0.18	0.00	0.45
Avail Cap(c_a), veh/h	249	0	238	655	0	603	739	0	1169	448	0	1638
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	29.3	0.0	29.4	28.1	0.0	24.3	13.1	0.0	17.8	12.9	0.0	9.9
Incr Delay (d2), s/veh	0.3	0.0	0.5	3.5	0.0	0.8	0.0	0.0	1.7	0.3	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	0.2	0.0	0.3	3.1	0.0	1.5	0.0	0.0	8.7	0.6	0.0	5.0
LnGrp Delay(d),s/veh	29.6	0.0	29.9	31.6	0.0	25.0	13.1	0.0	19.5	13.2	0.0	10.3
LnGrp LOS	C		C	C		C	B		B	B		B
Approach Vol, veh/h		26			253			525			484	
Approach Delay, s/veh		29.8			29.3			19.4			10.6	
Approach LOS		C			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6		8
Phs Duration (G+Y+Rc), s		15.1	9.2	32.7		11.0		41.8
Change Period (Y+Rc), s		6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s		25.0	10.0	45.0		10.0		61.0
Max Q Clear Time (g_c+I1), s		8.0	3.2	19.3		2.6		11.9
Green Ext Time (p_c), s		1.1	0.0	7.4		0.0		8.4

Intersection Summary	
HCM 2010 Ctrl Delay	18.2
HCM 2010 LOS	B

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	47	227	230	251	277	58
v/c Ratio	0.15	0.33	0.28	0.17	0.54	0.11
Control Delay	21.0	2.9	4.0	3.1	19.2	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.0	2.9	4.0	3.1	19.2	5.9
Queue Length 50th (ft)	8	0	0	0	43	0
Queue Length 95th (ft)	42	29	53	58	152	22
Internal Link Dist (ft)	1078			751	648	
Turn Bay Length (ft)		150	225			150
Base Capacity (vph)	1060	838	924	1720	1452	1414
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.27	0.25	0.15	0.19	0.04

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	43	209	212	231	255	53
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	171.2	172.7	179.2	172.7	166.7	190.0
Adj Flow Rate, veh/h	47	227	230	251	277	58
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	11	10	6	10	14	0
Cap, veh/h	307	476	505	915	421	408
Arrive On Green	0.19	0.19	0.14	0.53	0.25	0.25
Sat Flow, veh/h	1630	1468	1707	1727	1667	1615
Grp Volume(v), veh/h	47	227	230	251	277	58
Grp Sat Flow(s),veh/h/ln	1630	1468	1707	1727	1667	1615
Q Serve(g_s), s	1.0	5.3	3.7	3.4	6.3	1.2
Cycle Q Clear(g_c), s	1.0	5.3	3.7	3.4	6.3	1.2
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	307	476	505	915	421	408
V/C Ratio(X)	0.15	0.48	0.46	0.27	0.66	0.14
Avail Cap(c_a), veh/h	958	1062	875	2477	1567	1519
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	14.4	11.5	8.9	5.5	14.2	12.3
Incr Delay (d2), s/veh	0.3	0.9	0.6	0.1	0.7	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	0.5	4.6	1.8	1.6	2.9	0.5
LnGrp Delay(d),s/veh	14.7	12.4	9.5	5.6	14.9	12.4
LnGrp LOS	B	B	A	A	B	B
Approach Vol, veh/h	274			481	335	
Approach Delay, s/veh	12.8			7.5	14.5	
Approach LOS	B			A	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		28.5		14.0	11.8	16.8		
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0		
Max Green Setting (Gmax), s		61.0		25.0	15.0	40.0		
Max Q Clear Time (g_c+I1), s		5.4		7.3	5.7	8.3		
Green Ext Time (p_c), s		2.5		1.1	0.5	2.4		

Intersection Summary	
HCM 2010 Ctrl Delay	11.0
HCM 2010 LOS	B

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	22	31	50	102	8	265	24	295
v/c Ratio	0.08	0.11	0.17	0.31	0.02	0.46	0.05	0.43
Control Delay	27.3	22.7	25.9	14.3	17.4	20.2	10.6	14.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.3	22.7	25.9	14.3	17.4	20.2	10.6	14.3
Queue Length 50th (ft)	6	6	12	7	2	57	5	67
Queue Length 95th (ft)	29	33	50	53	12	165	17	135
Internal Link Dist (ft)		598		847		888		606
Turn Bay Length (ft)	100		150		100		100	
Base Capacity (vph)	542	551	1084	988	762	1181	603	1553
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.06	0.05	0.10	0.01	0.22	0.04	0.19

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	20	8	46	28	66	7	195	49	22	250	21
Number	5	2	12	1	6	16	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	190.0	190.0	190.0	190.0	178.7	190.0	190.0	175.6	190.0	182.7	171.1	190.0
Adj Flow Rate, veh/h	22	22	9	50	30	72	8	212	53	24	272	23
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	0	0	0	0	7	7	4	12	12
Cap, veh/h	173	123	50	216	56	134	454	389	97	375	686	58
Arrive On Green	0.10	0.10	0.10	0.12	0.12	0.12	0.29	0.29	0.29	0.04	0.44	0.44
Sat Flow, veh/h	1810	1283	525	1810	467	1121	1101	1357	339	1740	1556	132
Grp Volume(v), veh/h	22	0	31	50	0	102	8	0	265	24	0	295
Grp Sat Flow(s),veh/h/ln	1810	0	1807	1810	0	1589	1101	0	1696	1740	0	1688
Q Serve(g_s), s	0.6	0.0	0.8	1.3	0.0	3.2	0.3	0.0	6.9	0.5	0.0	6.2
Cycle Q Clear(g_c), s	0.6	0.0	0.8	1.3	0.0	3.2	0.3	0.0	6.9	0.5	0.0	6.2
Prop In Lane	1.00		0.29	1.00		0.71	1.00		0.20	1.00		0.08
Lane Grp Cap(c), veh/h	173	0	173	216	0	189	454	0	487	375	0	744
V/C Ratio(X)	0.13	0.00	0.18	0.23	0.00	0.54	0.02	0.00	0.54	0.06	0.00	0.40
Avail Cap(c_a), veh/h	519	0	518	1038	0	911	875	0	1135	805	0	1807
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	21.6	0.0	21.8	20.9	0.0	21.7	13.4	0.0	15.8	11.5	0.0	9.9
Incr Delay (d2), s/veh	0.5	0.0	0.7	0.8	0.0	3.4	0.0	0.0	1.4	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	0.4	0.7	0.0	1.6	0.1	0.0	3.4	0.2	0.0	3.0
LnGrp Delay(d),s/veh	22.1	0.0	22.5	21.6	0.0	25.0	13.4	0.0	17.1	11.5	0.0	10.4
LnGrp LOS	C		C	C		C	B		B	B		B
Approach Vol, veh/h		53			152			273			319	
Approach Delay, s/veh		22.3			23.9			17.0			10.5	
Approach LOS		C			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6		8
Phs Duration (G+Y+Rc), s		11.0	8.1	21.0		12.2		29.1
Change Period (Y+Rc), s		6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s		15.0	15.0	35.0		30.0		56.0
Max Q Clear Time (g_c+I1), s		2.8	2.5	8.9		5.2		8.2
Green Ext Time (p_c), s		0.1	0.0	5.5		1.0		6.2

Intersection Summary

HCM 2010 Ctrl Delay	16.1
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	1.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	54	8	5	44	20	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	247	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	59	9	5	48	22	4

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	59	0	118	59
Stage 1	-	-	-	-	59	-
Stage 2	-	-	-	-	59	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1545	-	878	1007
Stage 1	-	-	-	-	964	-
Stage 2	-	-	-	-	964	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1545	-	875	1007
Mov Cap-2 Maneuver	-	-	-	-	875	-
Stage 1	-	-	-	-	964	-
Stage 2	-	-	-	-	961	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.7	9.1
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	895	-	-	1545	-
HCM Lane V/C Ratio	0.029	-	-	0.004	-
HCM Control Delay (s)	9.1	-	-	7.3	-
HCM Lane LOS	A	-	-	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	1	3	2	0	0	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	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	3	2	0	0	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	4	0	0	0	-	0
Stage 1	0	-	-	-	-	-
Stage 2	4	-	-	-	-	-
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	1018	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	1019	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	1018	-	-	-	-	-
Mov Cap-2 Maneuver	1018	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	1019	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s		0	0
HCM LOS	-		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	-	-	-	-	-
HCM Lane LOS	-	-	-	-	-
HCM 95th %tile Q(veh)	-	-	-	-	-

Intersection	
Int Delay, s/veh	4.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	21	0	0	4	3	11
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	23	0	0	4	3	12

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	13	9	15	0	-	0
Stage 1	9	-	-	-	-	-
Stage 2	4	-	-	-	-	-
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	1006	1073	1603	-	-	-
Stage 1	1014	-	-	-	-	-
Stage 2	1019	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	1006	1073	1603	-	-	-
Mov Cap-2 Maneuver	1006	-	-	-	-	-
Stage 1	1014	-	-	-	-	-
Stage 2	1019	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1603	-	1006	-	-
HCM Lane V/C Ratio	-	-	0.023	-	-
HCM Control Delay (s)	0	-	8.7	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	7.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	150	33	386	97	2	17	7	144
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	125	-	50	100	-	100	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	2	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	100	13	3	7	25	0	20	0	12
Mvmt Flow	1	163	36	420	105	2	18	8	157

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	105	0	0	163	0	0	1072	1110	82
Stage 1	-	-	-	-	-	-	165	165	-
Stage 2	-	-	-	-	-	-	907	945	-
Critical Hdwy	6.1	-	-	4.24	-	-	7.9	6.5	7.14
Critical Hdwy Stg 1	-	-	-	-	-	-	6.9	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.9	5.5	-
Follow-up Hdwy	3.2	-	-	2.27	-	-	3.7	4	3.42
Pot Cap-1 Maneuver	986	-	-	1377	-	-	153	211	930
Stage 1	-	-	-	-	-	-	771	766	-
Stage 2	-	-	-	-	-	-	263	343	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	986	-	-	1377	-	-	104	146	930
Mov Cap-2 Maneuver	-	-	-	-	-	-	149	223	-
Stage 1	-	-	-	-	-	-	770	765	-
Stage 2	-	-	-	-	-	-	158	238	-

Approach	EB	WB	NB
HCM Control Delay, s	0	7	14.5
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	559	986	-	-	1377	-	-	265
HCM Lane V/C Ratio	0.327	0.001	-	-	0.305	-	-	0.176
HCM Control Delay (s)	14.5	8.7	-	-	8.8	-	-	21.5
HCM Lane LOS	B	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	1.4	0	-	-	1.3	-	-	0.6

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	5	27	11
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	2	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	4	9
Mvmt Flow	5	29	12

Major/Minor	Minor2		
Conflicting Flow All	1033	1110	53
Stage 1	945	945	-
Stage 2	88	165	-
Critical Hdwy	7.5	6.58	7.08
Critical Hdwy Stg 1	6.5	5.58	-
Critical Hdwy Stg 2	6.5	5.58	-
Follow-up Hdwy	3.5	4.04	3.39
Pot Cap-1 Maneuver	189	205	981
Stage 1	285	334	-
Stage 2	916	756	-
Platoon blocked, %			
Mov Cap-1 Maneuver	117	142	981
Mov Cap-2 Maneuver	230	209	-
Stage 1	285	232	-
Stage 2	753	755	-

Approach	SB
HCM Control Delay, s	21.5
HCM LOS	C

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	5.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	83	2	341	104	1	85
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	6	0	3	14	0	24
Mvmt Flow	90	2	371	113	1	92

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	92	0	945	91
Stage 1	-	-	-	-	91	-
Stage 2	-	-	-	-	854	-
Critical Hdwy	-	-	4.13	-	6.4	6.44
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.227	-	3.5	3.516
Pot Cap-1 Maneuver	-	-	1496	-	293	909
Stage 1	-	-	-	-	938	-
Stage 2	-	-	-	-	421	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1496	-	215	909
Mov Cap-2 Maneuver	-	-	-	-	215	-
Stage 1	-	-	-	-	938	-
Stage 2	-	-	-	-	309	-

Approach	EB	WB	NB
HCM Control Delay, s	0	6.3	9.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	876	-	-	1496	-
HCM Lane V/C Ratio	0.107	-	-	0.248	-
HCM Control Delay (s)	9.6	-	-	8.2	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.4	-	-	1	-

Intersection	
Int Delay, s/veh	9.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	9	41	134	21	19	8	8	68	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	50	-	-	-	150	-	25
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	95	95	95	92	92	92
Heavy Vehicles, %	0	18	1	1	11	63	9	21	12
Mvmt Flow	10	45	146	22	20	8	9	74	2

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	28	0	0	45	0	0	312	137	45
Stage 1	-	-	-	-	-	-	64	64	-
Stage 2	-	-	-	-	-	-	248	73	-
Critical Hdwy	4.1	-	-	4.11	-	-	7.19	6.71	6.32
Critical Hdwy Stg 1	-	-	-	-	-	-	6.19	5.71	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.19	5.71	-
Follow-up Hdwy	2.2	-	-	2.209	-	-	3.581	4.189	3.408
Pot Cap-1 Maneuver	1599	-	-	1570	-	-	627	720	997
Stage 1	-	-	-	-	-	-	930	806	-
Stage 2	-	-	-	-	-	-	741	798	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1599	-	-	1570	-	-	384	705	997
Mov Cap-2 Maneuver	-	-	-	-	-	-	384	705	-
Stage 1	-	-	-	-	-	-	923	800	-
Stage 2	-	-	-	-	-	-	414	787	-

Approach	EB	WB	NB
HCM Control Delay, s	0.4	3.2	11
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	384	705	997	1599	-	-	1570	-	-	742
HCM Lane V/C Ratio	0.023	0.105	0.002	0.006	-	-	0.014	-	-	0.501
HCM Control Delay (s)	14.6	10.7	8.6	7.3	0	-	7.3	0	-	14.6
HCM Lane LOS	B	B	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0.4	0	0	-	-	0	-	-	2.8

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	11	326	5
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	18	3	0
Mvmt Flow	12	354	5

Major/Minor	Minor2		
Conflicting Flow All	169	132	24
Stage 1	68	68	-
Stage 2	101	64	-
Critical Hdwy	7.28	6.53	6.2
Critical Hdwy Stg 1	6.28	5.53	-
Critical Hdwy Stg 2	6.28	5.53	-
Follow-up Hdwy	3.662	4.027	3.3
Pot Cap-1 Maneuver	760	757	1058
Stage 1	904	836	-
Stage 2	867	840	-
Platoon blocked, %			
Mov Cap-1 Maneuver	687	741	1058
Mov Cap-2 Maneuver	687	741	-
Stage 1	898	824	-
Stage 2	780	834	-

Approach	SB
HCM Control Delay, s	14.6
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	4.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	0	0	0	11	0	58	0	93	39
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	31	0	9	6
Mvmt Flow	0	0	0	12	0	63	0	101	42

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	758	747	113	726	726	122	113	0	0
Stage 1	604	604	-	122	122	-	-	-	-
Stage 2	154	143	-	604	604	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.51	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.579	2.2	-	-
Pot Cap-1 Maneuver	326	344	945	343	354	857	1489	-	-
Stage 1	489	491	-	887	799	-	-	-	-
Stage 2	853	782	-	489	491	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	260	281	945	295	290	857	1489	-	-
Mov Cap-2 Maneuver	260	281	-	295	290	-	-	-	-
Stage 1	489	402	-	887	799	-	-	-	-
Stage 2	790	782	-	400	402	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	11.2	0
HCM LOS	A	B	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1489	-	-	-	657	1440	-	-
HCM Lane V/C Ratio	-	-	-	-	0.114	0.171	-	-
HCM Control Delay (s)	0	-	-	0	11.2	8	0	-
HCM Lane LOS	A	-	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0.4	0.6	-	-

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	226	104	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	4	0
Mvmt Flow	246	113	0

Major/Minor	Major2		
Conflicting Flow All	143	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.12	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.218	-	-
Pot Cap-1 Maneuver	1440	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1440	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	5.5
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	5.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	107	62	10	24	104	11
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	92	92	92	92	92	92
Heavy Vehicles, %	2	3	12	19	4	0
Mvmt Flow	116	67	11	26	113	12

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	167	119	125	0	-	0
Stage 1	119	-	-	-	-	-
Stage 2	48	-	-	-	-	-
Critical Hdwy	6.42	6.23	4.22	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.327	2.308	-	-	-
Pot Cap-1 Maneuver	823	930	1402	-	-	-
Stage 1	906	-	-	-	-	-
Stage 2	974	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	816	930	1402	-	-	-
Mov Cap-2 Maneuver	816	-	-	-	-	-
Stage 1	906	-	-	-	-	-
Stage 2	966	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.4	2.2	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1402	-	854	-	-
HCM Lane V/C Ratio	0.008	-	0.215	-	-
HCM Control Delay (s)	7.6	0	10.4	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.8	-	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	118	21	1	13	0	11	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	5	3	10	0	21	0	18	0	0
Mvmt Flow	1	128	23	1	14	0	12	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	14	0	0	151	0	0	162	158	140
Stage 1	-	-	-	-	-	-	142	142	-
Stage 2	-	-	-	-	-	-	20	16	-
Critical Hdwy	4.15	-	-	4.1	-	-	7.28	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.28	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.28	5.5	-
Follow-up Hdwy	2.245	-	-	2.2	-	-	3.662	4	3.3
Pot Cap-1 Maneuver	1585	-	-	1442	-	-	768	738	913
Stage 1	-	-	-	-	-	-	824	783	-
Stage 2	-	-	-	-	-	-	959	886	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1585	-	-	1442	-	-	761	737	913
Mov Cap-2 Maneuver	-	-	-	-	-	-	761	737	-
Stage 1	-	-	-	-	-	-	823	782	-
Stage 2	-	-	-	-	-	-	951	885	-

Approach	EB	WB	NB
HCM Control Delay, s	0.1	0.5	9.8
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	761	1585	-	-	1442	-	-	929
HCM Lane V/C Ratio	0.016	0.001	-	-	0.001	-	-	0.009
HCM Control Delay (s)	9.8	7.3	0	-	7.5	0	-	8.9
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	1	1	6
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	0	26
Mvmt Flow	1	1	7

Major/Minor	Minor2		
Conflicting Flow All	158	169	14
Stage 1	16	16	-
Stage 2	142	153	-
Critical Hdwy	7.1	6.5	6.46
Critical Hdwy Stg 1	6.1	5.5	-
Critical Hdwy Stg 2	6.1	5.5	-
Follow-up Hdwy	3.5	4	3.534
Pot Cap-1 Maneuver	813	728	1000
Stage 1	1009	886	-
Stage 2	866	775	-
Platoon blocked, %			
Mov Cap-1 Maneuver	812	727	1000
Mov Cap-2 Maneuver	812	727	-
Stage 1	1008	885	-
Stage 2	865	774	-

Approach	SB
HCM Control Delay, s	8.9
HCM LOS	A

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	108	10	0	9	0	4	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	5	3	1	0	22	0	1	0	0
Mvmt Flow	1	117	11	0	10	0	4	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	10	0	0	128	0	0	135	135	123
Stage 1	-	-	-	-	-	-	125	125	-
Stage 2	-	-	-	-	-	-	10	10	-
Critical Hdwy	4.15	-	-	4.1	-	-	7.11	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.11	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.11	5.5	-
Follow-up Hdwy	2.245	-	-	2.2	-	-	3.509	4	3.3
Pot Cap-1 Maneuver	1590	-	-	1470	-	-	839	760	933
Stage 1	-	-	-	-	-	-	881	796	-
Stage 2	-	-	-	-	-	-	1014	891	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1590	-	-	1470	-	-	837	759	933
Mov Cap-2 Maneuver	-	-	-	-	-	-	837	759	-
Stage 1	-	-	-	-	-	-	880	795	-
Stage 2	-	-	-	-	-	-	1013	891	-

Approach	EB	WB	NB
HCM Control Delay, s	0.1	0	9.3
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	837	1590	-	-	1470	-	-	1005
HCM Lane V/C Ratio	0.005	0.001	-	-	-	-	-	0.001
HCM Control Delay (s)	9.3	7.3	0	-	0	-	-	8.6
HCM Lane LOS	A	A	A	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	1
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	0	26
Mvmt Flow	0	0	1

Major/Minor	Minor2		
Conflicting Flow All	135	140	10
Stage 1	10	10	-
Stage 2	125	130	-
Critical Hdwy	7.1	6.5	6.46
Critical Hdwy Stg 1	6.1	5.5	-
Critical Hdwy Stg 2	6.1	5.5	-
Follow-up Hdwy	3.5	4	3.534
Pot Cap-1 Maneuver	841	755	1005
Stage 1	1016	891	-
Stage 2	884	792	-
Platoon blocked, %			
Mov Cap-1 Maneuver	840	754	1005
Mov Cap-2 Maneuver	840	754	-
Stage 1	1015	891	-
Stage 2	883	791	-

Approach	SB
HCM Control Delay, s	8.6
HCM LOS	A

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	6.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	16	0	4	0	0	0	3	0	1
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	5	0	0	26	26	0	0	0
Mvmt Flow	17	0	4	0	0	0	3	0	1

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	11	12	4	13	14	1	7	0	0
Stage 1	4	4	-	7	7	-	-	-	-
Stage 2	7	8	-	6	7	-	-	-	-
Critical Hdwy	7.1	6.55	6.2	7.1	6.76	6.46	4.1	-	-
Critical Hdwy Stg 1	6.1	5.55	-	6.1	5.76	-	-	-	-
Critical Hdwy Stg 2	6.1	5.55	-	6.1	5.76	-	-	-	-
Follow-up Hdwy	3.5	4.045	3.3	3.5	4.234	3.534	2.2	-	-
Pot Cap-1 Maneuver	1012	877	1085	1009	835	1017	1627	-	-
Stage 1	1024	887	-	1020	844	-	-	-	-
Stage 2	1020	883	-	1021	844	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	1010	875	1085	1003	833	1017	1627	-	-
Mov Cap-2 Maneuver	1010	875	-	1003	833	-	-	-	-
Stage 1	1022	887	-	1018	842	-	-	-	-
Stage 2	1018	881	-	1017	844	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	8.6	0	5.4
HCM LOS	A	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1627	-	-	1024	-	1602	-	-
HCM Lane V/C Ratio	0.002	-	-	0.021	-	-	-	-
HCM Control Delay (s)	7.2	0	-	8.6	0	0	-	-
HCM Lane LOS	A	A	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	-	0	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	1	5
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	5	0	0
Mvmt Flow	0	1	5

Major/Minor	Major2		
Conflicting Flow All	1	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.15	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.245	-	-
Pot Cap-1 Maneuver	1602	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1602	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	3	223	69	5	2	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	67	3	21	12	4	0
Mvmt Flow	3	242	75	5	2	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	80	0	-	0	327	78
Stage 1	-	-	-	-	78	-
Stage 2	-	-	-	-	249	-
Critical Hdwy	4.77	-	-	-	6.44	6.2
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	2.803	-	-	-	3.536	3.3
Pot Cap-1 Maneuver	1192	-	-	-	663	988
Stage 1	-	-	-	-	940	-
Stage 2	-	-	-	-	788	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1192	-	-	-	661	988
Mov Cap-2 Maneuver	-	-	-	-	661	-
Stage 1	-	-	-	-	940	-
Stage 2	-	-	-	-	786	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	9.6
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1192	-	-	-	792
HCM Lane V/C Ratio	0.003	-	-	-	0.005
HCM Control Delay (s)	8	0	-	-	9.6
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	9	2	18	34	3	331	97	155
v/c Ratio	0.05	0.01	0.09	0.06	0.01	0.62	0.22	0.20
Control Delay	28.4	0.0	28.4	0.3	15.7	23.2	9.2	9.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.4	0.0	28.4	0.3	15.7	23.2	9.2	9.1
Queue Length 50th (ft)	3	0	6	0	1	95	17	28
Queue Length 95th (ft)	17	0	25	2	6	184	39	59
Internal Link Dist (ft)	750		1085			929		1030
Turn Bay Length (ft)		50		225	75		175	
Base Capacity (vph)	329	400	769	605	976	1327	493	1565
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.01	0.02	0.06	0.00	0.25	0.20	0.10

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	7	2	16	1	31	3	198	107	89	142	1
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	190.0	190.0	190.0	190.0	184.8	168.1	190.0	178.7	190.0	184.5	162.5	190.0
Adj Flow Rate, veh/h	1	8	2	17	1	34	3	215	116	97	154	1
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	0	0	13	0	7	7	3	17	17
Cap, veh/h	20	159	153	158	9	238	492	311	168	375	758	5
Arrive On Green	0.09	0.09	0.09	0.09	0.09	0.09	0.28	0.28	0.28	0.07	0.47	0.47
Sat Flow, veh/h	210	1680	1615	1666	98	1429	1251	1093	590	1757	1613	10
Grp Volume(v), veh/h	9	0	2	18	0	34	3	0	331	97	0	155
Grp Sat Flow(s),veh/h/ln	1890	0	1615	1764	0	1429	1251	0	1683	1757	0	1624
Q Serve(g_s), s	0.2	0.0	0.1	0.5	0.0	1.1	0.1	0.0	9.3	1.9	0.0	3.0
Cycle Q Clear(g_c), s	0.2	0.0	0.1	0.5	0.0	1.1	0.1	0.0	9.3	1.9	0.0	3.0
Prop In Lane	0.11		1.00	0.94		1.00	1.00		0.35	1.00		0.01
Lane Grp Cap(c), veh/h	179	0	153	167	0	238	492	0	478	375	0	763
V/C Ratio(X)	0.05	0.00	0.01	0.11	0.00	0.14	0.01	0.00	0.69	0.26	0.00	0.20
Avail Cap(c_a), veh/h	358	0	306	835	0	779	1203	0	1435	582	0	1876
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	21.7	0.0	21.7	21.9	0.0	18.8	13.6	0.0	16.8	11.6	0.0	8.2
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.3	0.0	0.3	0.0	0.0	1.8	0.4	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	0.0	0.3	0.0	0.4	0.0	0.0	4.5	0.9	0.0	1.3
LnGrp Delay(d),s/veh	21.9	0.0	21.7	22.1	0.0	19.1	13.6	0.0	18.6	11.9	0.0	8.3
LnGrp LOS	C		C	C		B	B		B	B		A
Approach Vol, veh/h		11			52			334			252	
Approach Delay, s/veh		21.8			20.1			18.6			9.7	
Approach LOS		C			C			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6		8
Phs Duration (G+Y+Rc), s		11.0	9.8	21.0		11.0		30.8
Change Period (Y+Rc), s		6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s		25.0	10.0	45.0		10.0		61.0
Max Q Clear Time (g_c+I1), s		3.1	3.9	11.3		2.2		5.0
Green Ext Time (p_c), s		0.1	0.1	3.5		0.0		3.7

Intersection Summary

HCM 2010 Ctrl Delay	15.3
HCM 2010 LOS	B

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	10	104	98	134	133	22
v/c Ratio	0.03	0.21	0.12	0.08	0.18	0.03
Control Delay	13.0	3.1	2.6	2.0	11.1	6.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.0	3.1	2.6	2.0	11.1	6.4
Queue Length 50th (ft)	1	0	0	0	13	0
Queue Length 95th (ft)	12	16	23	29	66	13
Internal Link Dist (ft)	1078			751	648	
Turn Bay Length (ft)		150	225			150
Base Capacity (vph)	1306	839	1042	1727	1628	1578
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.12	0.09	0.08	0.08	0.01

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	9	96	90	123	122	20
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	171.2	172.7	179.2	172.7	166.7	190.0
Adj Flow Rate, veh/h	10	104	98	134	133	22
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	11	10	6	10	14	0
Cap, veh/h	219	327	588	898	432	419
Arrive On Green	0.13	0.13	0.09	0.52	0.26	0.26
Sat Flow, veh/h	1630	1468	1707	1727	1667	1615
Grp Volume(v), veh/h	10	104	98	134	133	22
Grp Sat Flow(s),veh/h/ln	1630	1468	1707	1727	1667	1615
Q Serve(g_s), s	0.2	2.1	1.3	1.4	2.2	0.4
Cycle Q Clear(g_c), s	0.2	2.1	1.3	1.4	2.2	0.4
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	219	327	588	898	432	419
V/C Ratio(X)	0.05	0.32	0.17	0.15	0.31	0.05
Avail Cap(c_a), veh/h	1174	1186	1175	3034	1920	1860
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	13.1	11.3	6.8	4.3	10.4	9.7
Incr Delay (d2), s/veh	0.1	0.7	0.1	0.0	0.1	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	0.1	1.8	0.6	0.7	1.0	0.2
LnGrp Delay(d),s/veh	13.2	12.0	6.9	4.4	10.5	9.7
LnGrp LOS	B	B	A	A	B	A
Approach Vol, veh/h	114			232	155	
Approach Delay, s/veh	12.1			5.5	10.4	
Approach LOS	B			A	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		24.1		10.7	9.1	15.0		
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0		
Max Green Setting (Gmax), s		61.0		25.0	15.0	40.0		
Max Q Clear Time (g_c+I1), s		3.4		4.1	3.3	4.2		
Green Ext Time (p_c), s		1.2		0.4	0.2	1.1		

Intersection Summary	
HCM 2010 Ctrl Delay	8.5
HCM 2010 LOS	A

Lane Group	EBL	EBT	WBL	WBT	NBT	SBL	SBT
Lane Group Flow (vph)	8	19	20	32	144	108	147
v/c Ratio	0.02	0.05	0.05	0.09	0.32	0.23	0.20
Control Delay	26.4	26.1	25.2	13.0	23.7	13.7	13.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.4	26.1	25.2	13.0	23.7	13.7	13.0
Queue Length 50th (ft)	3	7	7	2	49	29	39
Queue Length 95th (ft)	15	25	25	24	101	58	74
Internal Link Dist (ft)		598		847	888		606
Turn Bay Length (ft)	100		150			100	
Base Capacity (vph)	474	496	949	824	1039	611	1468
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.04	0.02	0.04	0.14	0.18	0.10

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	7	17	1	18	5	25	0	99	33	99	124	11
Number	5	2	12	1	6	16	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	190.0	190.0	190.0	190.0	176.6	190.0	190.0	175.1	190.0	182.7	171.1	190.0
Adj Flow Rate, veh/h	8	18	1	20	5	27	0	108	36	108	135	12
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	0	0	0	0	7	7	4	12	12
Cap, veh/h	312	308	17	222	29	159	113	296	99	474	655	58
Arrive On Green	0.17	0.17	0.17	0.12	0.12	0.12	0.00	0.24	0.24	0.09	0.42	0.42
Sat Flow, veh/h	1810	1783	99	1810	240	1297	1260	1258	419	1740	1549	138
Grp Volume(v), veh/h	8	0	19	20	0	32	0	0	144	108	0	147
Grp Sat Flow(s),veh/h/ln	1810	0	1883	1810	0	1537	1260	0	1677	1740	0	1687
Q Serve(g_s), s	0.2	0.0	0.5	0.6	0.0	1.2	0.0	0.0	4.6	2.7	0.0	3.5
Cycle Q Clear(g_c), s	0.2	0.0	0.5	0.6	0.0	1.2	0.0	0.0	4.6	2.7	0.0	3.5
Prop In Lane	1.00		0.05	1.00		0.84	1.00		0.25	1.00		0.08
Lane Grp Cap(c), veh/h	312	0	325	222	0	189	113	0	394	474	0	713
V/C Ratio(X)	0.03	0.00	0.06	0.09	0.00	0.17	0.00	0.00	0.37	0.23	0.00	0.21
Avail Cap(c_a), veh/h	425	0	443	851	0	723	508	0	920	720	0	1481
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	0.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.9	0.0	22.1	24.8	0.0	25.1	0.0	0.0	20.4	14.3	0.0	11.6
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.2	0.0	0.6	0.0	0.0	0.8	0.2	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	0.3	0.3	0.0	0.5	0.0	0.0	2.2	1.3	0.0	1.7
LnGrp Delay(d),s/veh	22.0	0.0	22.2	25.1	0.0	25.7	0.0	0.0	21.2	14.5	0.0	11.8
LnGrp LOS	C		C	C		C			C	B		B
Approach Vol, veh/h		27			52			144			255	
Approach Delay, s/veh		22.1			25.4			21.2			13.0	
Approach LOS		C			C			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6		8
Phs Duration (G+Y+Rc), s		17.0	12.0	21.0		13.8		33.0
Change Period (Y+Rc), s		6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s		15.0	15.0	35.0		30.0		56.0
Max Q Clear Time (g_c+I1), s		2.5	4.7	6.6		3.2		5.5
Green Ext Time (p_c), s		0.1	0.1	2.6		0.3		2.9

Intersection Summary

HCM 2010 Ctrl Delay	17.3
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	1.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	20	11	2	52	5	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	247	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	12	2	57	5	8

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	22	0	83	22
Stage 1	-	-	-	-	22	-
Stage 2	-	-	-	-	61	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1593	-	919	1055
Stage 1	-	-	-	-	1001	-
Stage 2	-	-	-	-	962	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1593	-	918	1055
Mov Cap-2 Maneuver	-	-	-	-	918	-
Stage 1	-	-	-	-	1001	-
Stage 2	-	-	-	-	961	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	8.7
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	993	-	-	1593	-
HCM Lane V/C Ratio	0.013	-	-	0.001	-
HCM Control Delay (s)	8.7	-	-	7.3	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0	-	-	0	-

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	168	54	0	0	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	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	183	59	0	0	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	117	0	0	0	-	0
Stage 1	0	-	-	-	-	-
Stage 2	117	-	-	-	-	-
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	879	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	908	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	879	-	-	-	-	-
Mov Cap-2 Maneuver	879	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	908	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s		0	0
HCM LOS	-		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	-	-	-	-	-
HCM Lane LOS	-	-	-	-	-
HCM 95th %tile Q(veh)	-	-	-	-	-

Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	8	0	0	2	4	14
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	0	0	2	4	15

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	14	12	20	0	-	0
Stage 1	12	-	-	-	-	-
Stage 2	2	-	-	-	-	-
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	1005	1069	1596	-	-	-
Stage 1	1011	-	-	-	-	-
Stage 2	1021	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	1005	1069	1596	-	-	-
Mov Cap-2 Maneuver	1005	-	-	-	-	-
Stage 1	1011	-	-	-	-	-
Stage 2	1021	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.6	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1596	-	1005	-	-
HCM Lane V/C Ratio	-	-	0.009	-	-
HCM Control Delay (s)	0	-	8.6	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	7.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	64	5	0	16	1	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	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	70	5	0	17	1	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	18	1	1	0	-	0
Stage 1	1	-	-	-	-	-
Stage 2	17	-	-	-	-	-
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	1000	1084	1622	-	-	-
Stage 1	1022	-	-	-	-	-
Stage 2	1006	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	1000	1084	1622	-	-	-
Mov Cap-2 Maneuver	1000	-	-	-	-	-
Stage 1	1022	-	-	-	-	-
Stage 2	1006	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.9	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1622	-	1006	-	-
HCM Lane V/C Ratio	-	-	0.075	-	-
HCM Control Delay (s)	0	-	8.9	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	0	1	0	0	0	0	69	11
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	0	1	0	0	0	0	75	12

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	84	90	3	84	86	81	5	0	0
Stage 1	3	3	-	81	81	-	-	-	-
Stage 2	81	87	-	3	5	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	903	800	1081	903	804	979	1616	-	-
Stage 1	1020	893	-	927	828	-	-	-	-
Stage 2	927	823	-	1020	892	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	903	800	1081	902	804	979	1616	-	-
Mov Cap-2 Maneuver	903	800	-	902	804	-	-	-	-
Stage 1	1020	893	-	927	828	-	-	-	-
Stage 2	927	823	-	1019	892	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	8.7	0	0
HCM LOS	A	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1616	-	-	984	-	1509	-	-
HCM Lane V/C Ratio	-	-	-	0.002	-	-	-	-
HCM Control Delay (s)	0	-	-	8.7	0	0	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	-	0	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	5
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	0	0	5

Major/Minor	Major2		
Conflicting Flow All	87	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.12	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.218	-	-
Pot Cap-1 Maneuver	1509	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1509	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	10.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	7	113	18	207	170	6	48	35	354
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	125	-	50	100	-	100	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	2	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	96	96	96	93	93	93
Heavy Vehicles, %	0	18	31	11	20	0	8	3	5
Mvmt Flow	8	123	20	216	177	6	52	38	381

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	177	0	0	123	0	0	669	746	61
Stage 1	-	-	-	-	-	-	138	138	-
Stage 2	-	-	-	-	-	-	531	608	-
Critical Hdwy	4.1	-	-	4.32	-	-	7.66	6.56	7
Critical Hdwy Stg 1	-	-	-	-	-	-	6.66	5.56	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.66	5.56	-
Follow-up Hdwy	2.2	-	-	2.31	-	-	3.58	4.03	3.35
Pot Cap-1 Maneuver	1411	-	-	1398	-	-	332	338	982
Stage 1	-	-	-	-	-	-	834	779	-
Stage 2	-	-	-	-	-	-	485	482	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1411	-	-	1398	-	-	275	284	982
Mov Cap-2 Maneuver	-	-	-	-	-	-	353	375	-
Stage 1	-	-	-	-	-	-	829	775	-
Stage 2	-	-	-	-	-	-	383	408	-

Approach	EB	WB	NB
HCM Control Delay, s	0.4	4.3	17.9
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	741	1411	-	-	1398	-	-	425
HCM Lane V/C Ratio	0.634	0.005	-	-	0.154	-	-	0.079
HCM Control Delay (s)	17.9	7.6	-	-	8	-	-	14.2
HCM Lane LOS	C	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	4.6	0	-	-	0.5	-	-	0.3

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	2	21	8
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	2	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	5	13
Mvmt Flow	2	23	9

Major/Minor	Minor2		
Conflicting Flow All	703	746	89
Stage 1	608	608	-
Stage 2	95	138	-
Critical Hdwy	7.5	6.6	7.16
Critical Hdwy Stg 1	6.5	5.6	-
Critical Hdwy Stg 2	6.5	5.6	-
Follow-up Hdwy	3.5	4.05	3.43
Pot Cap-1 Maneuver	328	335	917
Stage 1	454	477	-
Stage 2	907	774	-
Platoon blocked, %			
Mov Cap-1 Maneuver	163	282	917
Mov Cap-2 Maneuver	273	369	-
Stage 1	451	403	-
Stage 2	525	770	-

Approach	SB
HCM Control Delay, s	14.2
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	5.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	157	2	82	165	1	279
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	7	0	28	7	0	5
Mvmt Flow	171	2	89	179	1	303

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	173	0	530	172
Stage 1	-	-	-	-	172	-
Stage 2	-	-	-	-	358	-
Critical Hdwy	-	-	4.38	-	6.4	6.25
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.452	-	3.5	3.345
Pot Cap-1 Maneuver	-	-	1261	-	513	864
Stage 1	-	-	-	-	863	-
Stage 2	-	-	-	-	712	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1261	-	473	864
Mov Cap-2 Maneuver	-	-	-	-	473	-
Stage 1	-	-	-	-	863	-
Stage 2	-	-	-	-	656	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.7	11.5
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	861	-	-	1261	-
HCM Lane V/C Ratio	0.353	-	-	0.071	-
HCM Control Delay (s)	11.5	-	-	8.1	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	1.6	-	-	0.2	-

Intersection	
Int Delay, s/veh	9.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	9	44	13	10	58	14	60	257	21
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	50	-	-	-	150	-	25
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	5	20	23	15	25	2	5	1
Mvmt Flow	10	48	14	11	63	15	65	279	23

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	78	0	0	48	0	0	198	167	48
Stage 1	-	-	-	-	-	-	67	67	-
Stage 2	-	-	-	-	-	-	131	100	-
Critical Hdwy	4.1	-	-	4.33	-	-	7.12	6.55	6.21
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.55	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.55	-
Follow-up Hdwy	2.2	-	-	2.407	-	-	3.518	4.045	3.309
Pot Cap-1 Maneuver	1533	-	-	1435	-	-	761	720	1024
Stage 1	-	-	-	-	-	-	943	833	-
Stage 2	-	-	-	-	-	-	873	806	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1533	-	-	1435	-	-	689	709	1024
Mov Cap-2 Maneuver	-	-	-	-	-	-	689	709	-
Stage 1	-	-	-	-	-	-	936	827	-
Stage 2	-	-	-	-	-	-	783	800	-

Approach	EB	WB	NB
HCM Control Delay, s	1	0.9	12.6
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	689	709	1024	1533	-	-	1435	-	-	635
HCM Lane V/C Ratio	0.095	0.394	0.022	0.006	-	-	0.008	-	-	0.14
HCM Control Delay (s)	10.8	13.3	8.6	7.4	0	-	7.5	0	-	11.6
HCM Lane LOS	B	B	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	1.9	0.1	0	-	-	0	-	-	0.5

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	11	61	10
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	64	24	0
Mvmt Flow	12	66	11

Major/Minor	Minor2		
Conflicting Flow All	299	159	71
Stage 1	92	92	-
Stage 2	207	67	-
Critical Hdwy	7.74	6.74	6.2
Critical Hdwy Stg 1	6.74	5.74	-
Critical Hdwy Stg 2	6.74	5.74	-
Follow-up Hdwy	4.076	4.216	3.3
Pot Cap-1 Maneuver	547	695	997
Stage 1	783	778	-
Stage 2	672	798	-
Platoon blocked, %			
Mov Cap-1 Maneuver	367	685	997
Mov Cap-2 Maneuver	367	685	-
Stage 1	778	772	-
Stage 2	432	792	-

Approach	SB
HCM Control Delay, s	11.6
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	7.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	3	0	1	70	0	206	0	85	8
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	0	3	0	4	0
Mvmt Flow	3	0	1	76	0	224	0	92	9

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	420	312	48	308	308	97	48	0	0
Stage 1	211	211	-	97	97	-	-	-	-
Stage 2	209	101	-	211	211	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.12	6.5	6.23	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.12	5.5	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.12	5.5	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.518	4	3.327	2.2	-	-
Pot Cap-1 Maneuver	547	606	1027	644	609	956	1572	-	-
Stage 1	796	731	-	910	819	-	-	-	-
Stage 2	798	815	-	791	731	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	399	569	1027	613	572	956	1572	-	-
Mov Cap-2 Maneuver	399	569	-	613	572	-	-	-	-
Stage 1	796	686	-	910	819	-	-	-	-
Stage 2	611	815	-	742	686	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	12.7	11.7	0
HCM LOS	B	B	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1572	-	-	471	837	1381	-	-
HCM Lane V/C Ratio	-	-	-	0.009	0.358	0.059	-	-
HCM Control Delay (s)	0	-	-	12.7	11.7	7.8	0	-
HCM Lane LOS	A	-	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	1.6	0.2	-	-

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	75	44	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	21	14	0
Mvmt Flow	82	48	0

Major/Minor	Major2		
Conflicting Flow All	101	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.31	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.389	-	-
Pot Cap-1 Maneuver	1381	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1381	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	4.9
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	13	25	56	80	30	85
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	92	92	92	92	92	92
Heavy Vehicles, %	0	6	2	4	15	0
Mvmt Flow	14	27	61	87	33	92

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	288	79	125	0	-	0
Stage 1	79	-	-	-	-	-
Stage 2	209	-	-	-	-	-
Critical Hdwy	6.4	6.26	4.12	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.354	2.218	-	-	-
Pot Cap-1 Maneuver	707	970	1462	-	-	-
Stage 1	949	-	-	-	-	-
Stage 2	831	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	676	970	1462	-	-	-
Mov Cap-2 Maneuver	676	-	-	-	-	-
Stage 1	949	-	-	-	-	-
Stage 2	794	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.5	3.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1462	-	844	-	-
HCM Lane V/C Ratio	0.042	-	0.049	-	-
HCM Control Delay (s)	7.6	0	9.5	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	35	7	1	92	1	29	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	27	19	0	0	4	0	4	0	0
Mvmt Flow	1	38	8	1	100	1	32	1	1

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	101	0	0	46	0	0	150	147	42
Stage 1	-	-	-	-	-	-	44	44	-
Stage 2	-	-	-	-	-	-	106	103	-
Critical Hdwy	4.37	-	-	4.1	-	-	7.14	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.14	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.14	5.5	-
Follow-up Hdwy	2.443	-	-	2.2	-	-	3.536	4	3.3
Pot Cap-1 Maneuver	1349	-	-	1575	-	-	813	748	1034
Stage 1	-	-	-	-	-	-	965	862	-
Stage 2	-	-	-	-	-	-	895	814	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1349	-	-	1575	-	-	806	747	1034
Mov Cap-2 Maneuver	-	-	-	-	-	-	806	747	-
Stage 1	-	-	-	-	-	-	964	861	-
Stage 2	-	-	-	-	-	-	888	813	-

Approach	EB	WB	NB
HCM Control Delay, s	0.2	0.1	9.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	810	1349	-	-	1575	-	-	865
HCM Lane V/C Ratio	0.042	0.001	-	-	0.001	-	-	0.008
HCM Control Delay (s)	9.6	7.7	0	-	7.3	0	-	9.2
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	2	4
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	0	6
Mvmt Flow	0	2	4

Major/Minor	Minor2		
Conflicting Flow All	148	151	101
Stage 1	103	103	-
Stage 2	45	48	-
Critical Hdwy	7.1	6.5	6.26
Critical Hdwy Stg 1	6.1	5.5	-
Critical Hdwy Stg 2	6.1	5.5	-
Follow-up Hdwy	3.5	4	3.354
Pot Cap-1 Maneuver	825	744	943
Stage 1	908	814	-
Stage 2	974	859	-
Platoon blocked, %			
Mov Cap-1 Maneuver	822	743	943
Mov Cap-2 Maneuver	822	743	-
Stage 1	907	813	-
Stage 2	971	858	-

Approach	SB
HCM Control Delay, s	9.2
HCM LOS	A

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	31	3	0	80	0	14	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	27	18	0	0	4	0	1	0	0
Mvmt Flow	1	34	3	0	87	0	15	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	87	0	0	37	0	0	126	125	35
Stage 1	-	-	-	-	-	-	38	38	-
Stage 2	-	-	-	-	-	-	88	87	-
Critical Hdwy	4.37	-	-	4.1	-	-	7.11	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.11	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.11	5.5	-
Follow-up Hdwy	2.443	-	-	2.2	-	-	3.509	4	3.3
Pot Cap-1 Maneuver	1365	-	-	1587	-	-	850	769	1044
Stage 1	-	-	-	-	-	-	980	867	-
Stage 2	-	-	-	-	-	-	922	827	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1365	-	-	1587	-	-	848	768	1044
Mov Cap-2 Maneuver	-	-	-	-	-	-	848	768	-
Stage 1	-	-	-	-	-	-	979	866	-
Stage 2	-	-	-	-	-	-	921	827	-

Approach	EB	WB	NB
HCM Control Delay, s	0.2	0	9.3
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	848	1365	-	-	1587	-	-	961
HCM Lane V/C Ratio	0.018	0.001	-	-	-	-	-	0.001
HCM Control Delay (s)	9.3	7.6	0	-	0	-	-	8.8
HCM Lane LOS	A	A	A	-	A	-	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	1
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	0	6
Mvmt Flow	0	0	1

Major/Minor	Minor2		
Conflicting Flow All	125	126	87
Stage 1	87	87	-
Stage 2	38	39	-
Critical Hdwy	7.1	6.5	6.26
Critical Hdwy Stg 1	6.1	5.5	-
Critical Hdwy Stg 2	6.1	5.5	-
Follow-up Hdwy	3.5	4	3.354
Pot Cap-1 Maneuver	854	768	961
Stage 1	926	827	-
Stage 2	982	866	-
Platoon blocked, %			
Mov Cap-1 Maneuver	853	767	961
Mov Cap-2 Maneuver	853	767	-
Stage 1	925	827	-
Stage 2	981	865	-

Approach	SB
HCM Control Delay, s	8.8
HCM LOS	A

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	6	0	1	0	0	0	1	0	0
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	27	0	0	6	6	0	0	0
Mvmt Flow	7	0	1	0	0	0	1	0	0

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	11	11	9	12	19	0	17	0	0
Stage 1	9	9	-	2	2	-	-	-	-
Stage 2	2	2	-	10	17	-	-	-	-
Critical Hdwy	7.1	6.77	6.2	7.1	6.56	6.26	4.1	-	-
Critical Hdwy Stg 1	6.1	5.77	-	6.1	5.56	-	-	-	-
Critical Hdwy Stg 2	6.1	5.77	-	6.1	5.56	-	-	-	-
Follow-up Hdwy	3.5	4.243	3.3	3.5	4.054	3.354	2.2	-	-
Pot Cap-1 Maneuver	1012	836	1079	1010	867	-	1613	-	-
Stage 1	1017	841	-	1026	886	-	-	-	-
Stage 2	1026	847	-	1016	873	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	-	835	1079	1008	866	-	1613	-	-
Mov Cap-2 Maneuver	-	835	-	1008	866	-	-	-	-
Stage 1	1016	841	-	1025	885	-	-	-	-
Stage 2	1025	846	-	1015	873	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s		0	7.2
HCM LOS	-	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1613	-	-	-	-	-	-	-
HCM Lane V/C Ratio	0.001	-	-	-	-	-	-	-
HCM Control Delay (s)	7.2	0	-	-	0	0	-	-
HCM Lane LOS	A	A	-	-	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-	-	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	1	15
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	27	0	0
Mvmt Flow	0	1	16

Major/Minor	Major2		
Conflicting Flow All	0	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.37	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.443	-	-
Pot Cap-1 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	-	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	1	79	236	2	1	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	18	2	5	23	0
Mvmt Flow	1	86	257	2	1	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	259	0	-	0	346	258
Stage 1	-	-	-	-	258	-
Stage 2	-	-	-	-	88	-
Critical Hdwy	4.1	-	-	-	6.63	6.2
Critical Hdwy Stg 1	-	-	-	-	5.63	-
Critical Hdwy Stg 2	-	-	-	-	5.63	-
Follow-up Hdwy	2.2	-	-	-	3.707	3.3
Pot Cap-1 Maneuver	1317	-	-	-	610	786
Stage 1	-	-	-	-	739	-
Stage 2	-	-	-	-	885	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1317	-	-	-	609	786
Mov Cap-2 Maneuver	-	-	-	-	609	-
Stage 1	-	-	-	-	739	-
Stage 2	-	-	-	-	884	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	9.9
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1317	-	-	-	733
HCM Lane V/C Ratio	0.001	-	-	-	0.006
HCM Control Delay (s)	7.7	0	-	-	9.9
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	10	16	172	102	4	525	58	431
v/c Ratio	0.07	0.06	0.55	0.18	0.01	0.78	0.21	0.47
Control Delay	43.7	0.5	40.8	6.0	17.5	31.7	11.7	14.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.7	0.5	40.8	6.0	17.5	31.7	11.7	14.4
Queue Length 50th (ft)	5	0	79	0	1	223	13	123
Queue Length 95th (ft)	24	0	174	36	8	406	36	231
Internal Link Dist (ft)	750		1085			929		1030
Turn Bay Length (ft)		50		225	75		175	
Base Capacity (vph)	229	343	601	632	593	1083	334	1414
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.05	0.29	0.16	0.01	0.48	0.17	0.30

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	8	15	137	21	94	4	384	99	55	404	6
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	190.0	170.1	190.0	190.0	185.5	171.2	190.0	182.7	190.0	166.7	182.8	190.0
Adj Flow Rate, veh/h	1	9	16	149	23	102	4	417	108	58	425	6
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.95	0.95	0.95
Percent Heavy Veh, %	13	13	0	5	5	11	0	4	4	14	4	4
Cap, veh/h	12	110	117	214	33	273	476	550	143	287	950	13
Arrive On Green	0.07	0.07	0.07	0.14	0.14	0.14	0.39	0.39	0.39	0.05	0.53	0.53
Sat Flow, veh/h	169	1523	1615	1541	238	1455	972	1400	363	1587	1798	25
Grp Volume(v), veh/h	10	0	16	172	0	102	4	0	525	58	0	431
Grp Sat Flow(s),veh/h/ln	1693	0	1615	1778	0	1455	972	0	1763	1587	0	1823
Q Serve(g_s), s	0.4	0.0	0.6	6.4	0.0	4.2	0.2	0.0	17.8	1.4	0.0	10.1
Cycle Q Clear(g_c), s	0.4	0.0	0.6	6.4	0.0	4.2	0.9	0.0	17.8	1.4	0.0	10.1
Prop In Lane	0.10		1.00	0.87		1.00	1.00		0.21	1.00		0.01
Lane Grp Cap(c), veh/h	122	0	117	247	0	273	476	0	693	287	0	963
V/C Ratio(X)	0.08	0.00	0.14	0.70	0.00	0.37	0.01	0.00	0.76	0.20	0.00	0.45
Avail Cap(c_a), veh/h	245	0	234	643	0	597	727	0	1148	440	0	1610
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	29.9	0.0	30.0	28.4	0.0	24.5	13.2	0.0	18.1	13.1	0.0	10.1
Incr Delay (d2), s/veh	0.3	0.0	0.5	3.5	0.0	0.9	0.0	0.0	1.7	0.3	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	0.2	0.0	0.3	3.3	0.0	1.8	0.0	0.0	8.9	0.6	0.0	5.1
LnGrp Delay(d),s/veh	30.2	0.0	30.6	31.9	0.0	25.4	13.2	0.0	19.9	13.5	0.0	10.4
LnGrp LOS	C		C	C		C	B		B	B		B
Approach Vol, veh/h		26			274			529			489	
Approach Delay, s/veh		30.4			29.5			19.8			10.8	
Approach LOS		C			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6		8
Phs Duration (G+Y+Rc), s		15.6	9.4	33.2		11.0		42.5
Change Period (Y+Rc), s		6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s		25.0	10.0	45.0		10.0		61.0
Max Q Clear Time (g_c+I1), s		8.4	3.4	19.8		2.6		12.1
Green Ext Time (p_c), s		1.2	0.0	7.4		0.0		8.4

Intersection Summary

HCM 2010 Ctrl Delay	18.7
HCM 2010 LOS	B

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	47	230	239	254	278	58
v/c Ratio	0.15	0.33	0.29	0.17	0.54	0.11
Control Delay	21.1	2.9	4.0	3.1	19.3	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.1	2.9	4.0	3.1	19.3	5.9
Queue Length 50th (ft)	8	0	0	0	44	0
Queue Length 95th (ft)	42	29	56	59	152	22
Internal Link Dist (ft)	1078			751	648	
Turn Bay Length (ft)		150	225			150
Base Capacity (vph)	1054	837	922	1719	1450	1413
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.27	0.26	0.15	0.19	0.04

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR		
Lane Configurations								
Volume (veh/h)	43	212	220	234	256	53		
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	171.2	172.7	179.2	172.7	166.7	190.0		
Adj Flow Rate, veh/h	47	230	239	254	278	58		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Percent Heavy Veh, %	11	10	6	10	14	0		
Cap, veh/h	308	483	510	919	421	408		
Arrive On Green	0.19	0.19	0.14	0.53	0.25	0.25		
Sat Flow, veh/h	1630	1468	1707	1727	1667	1615		
Grp Volume(v), veh/h	47	230	239	254	278	58		
Grp Sat Flow(s),veh/h/ln	1630	1468	1707	1727	1667	1615		
Q Serve(g_s), s	1.0	5.4	3.9	3.5	6.4	1.2		
Cycle Q Clear(g_c), s	1.0	5.4	3.9	3.5	6.4	1.2		
Prop In Lane	1.00	1.00	1.00			1.00		
Lane Grp Cap(c), veh/h	308	483	510	919	421	408		
V/C Ratio(X)	0.15	0.48	0.47	0.28	0.66	0.14		
Avail Cap(c_a), veh/h	947	1058	865	2447	1548	1500		
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	14.6	11.5	9.0	5.5	14.4	12.5		
Incr Delay (d2), s/veh	0.3	0.9	0.7	0.1	0.7	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	0.5	4.7	1.9	1.6	3.0	0.5		
LnGrp Delay(d),s/veh	14.8	12.4	9.6	5.6	15.1	12.5		
LnGrp LOS	B	B	A	A	B	B		
Approach Vol, veh/h	277			493	336			
Approach Delay, s/veh	12.8			7.5	14.7			
Approach LOS	B			A	B			

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		28.9		14.1	12.0	16.9		
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0		
Max Green Setting (Gmax), s		61.0		25.0	15.0	40.0		
Max Q Clear Time (g_c+I1), s		5.5		7.4	5.9	8.4		
Green Ext Time (p_c), s		2.5		1.1	0.5	2.4		

Intersection Summary	
HCM 2010 Ctrl Delay	11.0
HCM 2010 LOS	B

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	22	31	50	105	8	268	25	296
v/c Ratio	0.08	0.11	0.17	0.32	0.02	0.47	0.06	0.43
Control Delay	27.4	22.8	25.9	14.2	17.4	20.3	10.7	14.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.4	22.8	25.9	14.2	17.4	20.3	10.7	14.3
Queue Length 50th (ft)	6	6	12	7	2	58	5	67
Queue Length 95th (ft)	30	33	50	54	12	167	18	136
Internal Link Dist (ft)		598		847		888		606
Turn Bay Length (ft)	100		150		100		100	
Base Capacity (vph)	541	551	1082	986	759	1180	602	1552
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.06	0.05	0.11	0.01	0.23	0.04	0.19

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	20	8	46	28	69	7	198	49	23	251	21
Number	5	2	12	1	6	16	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	190.0	190.0	190.0	190.0	178.5	190.0	190.0	175.6	190.0	182.7	171.1	190.0
Adj Flow Rate, veh/h	22	22	9	50	30	75	8	215	53	25	273	23
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	0	0	0	0	7	7	4	12	12
Cap, veh/h	173	122	50	216	54	135	452	390	96	374	687	58
Arrive On Green	0.10	0.10	0.10	0.12	0.12	0.12	0.29	0.29	0.29	0.04	0.44	0.44
Sat Flow, veh/h	1810	1283	525	1810	453	1132	1100	1361	336	1740	1556	131
Grp Volume(v), veh/h	22	0	31	50	0	105	8	0	268	25	0	296
Grp Sat Flow(s),veh/h/ln	1810	0	1807	1810	0	1585	1100	0	1697	1740	0	1688
Q Serve(g_s), s	0.6	0.0	0.8	1.3	0.0	3.3	0.3	0.0	7.0	0.5	0.0	6.2
Cycle Q Clear(g_c), s	0.6	0.0	0.8	1.3	0.0	3.3	0.3	0.0	7.0	0.5	0.0	6.2
Prop In Lane	1.00		0.29	1.00		0.71	1.00		0.20	1.00		0.08
Lane Grp Cap(c), veh/h	173	0	172	216	0	190	452	0	486	374	0	745
V/C Ratio(X)	0.13	0.00	0.18	0.23	0.00	0.55	0.02	0.00	0.55	0.07	0.00	0.40
Avail Cap(c_a), veh/h	518	0	517	1036	0	908	872	0	1133	801	0	1803
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	21.7	0.0	21.8	20.9	0.0	21.7	13.4	0.0	15.9	11.5	0.0	9.9
Incr Delay (d2), s/veh	0.5	0.0	0.7	0.8	0.0	3.6	0.0	0.0	1.4	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	0.4	0.7	0.0	1.6	0.1	0.0	3.5	0.2	0.0	3.0
LnGrp Delay(d),s/veh	22.2	0.0	22.5	21.7	0.0	25.3	13.5	0.0	17.2	11.6	0.0	10.4
LnGrp LOS	C		C	C		C	B		B	B		B
Approach Vol, veh/h		53			155			276			321	
Approach Delay, s/veh		22.4			24.1			17.1			10.5	
Approach LOS		C			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6		8
Phs Duration (G+Y+Rc), s		11.0	8.1	21.0		12.3		29.1
Change Period (Y+Rc), s		6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s		15.0	15.0	35.0		30.0		56.0
Max Q Clear Time (g_c+I1), s		2.8	2.5	9.0		5.3		8.2
Green Ext Time (p_c), s		0.1	0.0	5.5		1.1		6.3

Intersection Summary

HCM 2010 Ctrl Delay	16.2
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	1.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	57	8	5	45	20	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	247	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	62	9	5	49	22	4

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	62	0	122	62
Stage 1	-	-	-	-	62	-
Stage 2	-	-	-	-	60	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1541	-	873	1003
Stage 1	-	-	-	-	961	-
Stage 2	-	-	-	-	963	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1541	-	870	1003
Mov Cap-2 Maneuver	-	-	-	-	870	-
Stage 1	-	-	-	-	961	-
Stage 2	-	-	-	-	960	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.7	9.2
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	890	-	-	1541	-
HCM Lane V/C Ratio	0.029	-	-	0.004	-
HCM Control Delay (s)	9.2	-	-	7.3	-
HCM Lane LOS	A	-	-	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	1	62	153	0	0	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	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	67	166	0	0	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	333	0	0	0	-	0
Stage 1	0	-	-	-	-	-
Stage 2	333	-	-	-	-	-
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	662	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	726	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	662	-	-	-	-	-
Mov Cap-2 Maneuver	662	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	726	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s		0	0
HCM LOS	-		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	-	-	-	-	-
HCM Lane LOS	-	-	-	-	-
HCM 95th %tile Q(veh)	-	-	-	-	-

Intersection	
Int Delay, s/veh	4.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	21	0	0	4	3	11
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	23	0	0	4	3	12

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	13	9	15	0	-	0
Stage 1	9	-	-	-	-	-
Stage 2	4	-	-	-	-	-
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	1006	1073	1603	-	-	-
Stage 1	1014	-	-	-	-	-
Stage 2	1019	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	1006	1073	1603	-	-	-
Mov Cap-2 Maneuver	1006	-	-	-	-	-
Stage 1	1014	-	-	-	-	-
Stage 2	1019	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1603	-	1006	-	-
HCM Lane V/C Ratio	-	-	0.023	-	-
HCM Control Delay (s)	0	-	8.7	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	8.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	151	15	0	6	1	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	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	164	16	0	7	1	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	8	1	1	0	-	0
Stage 1	1	-	-	-	-	-
Stage 2	7	-	-	-	-	-
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	1013	1084	1622	-	-	-
Stage 1	1022	-	-	-	-	-
Stage 2	1016	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	1013	1084	1622	-	-	-
Mov Cap-2 Maneuver	1013	-	-	-	-	-
Stage 1	1022	-	-	-	-	-
Stage 2	1016	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.3	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1622	-	1019	-	-
HCM Lane V/C Ratio	-	-	0.177	-	-
HCM Control Delay (s)	0	-	9.3	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0.6	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	2	0	1	0	0	11	0	157	0
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	0	1	0	0	12	0	171	0

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	179	173	2	173	174	171	3	0	0
Stage 1	2	2	-	171	171	-	-	-	-
Stage 2	177	171	-	2	3	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	783	720	1082	790	719	873	1619	-	-
Stage 1	1021	894	-	831	757	-	-	-	-
Stage 2	825	757	-	1021	893	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	772	720	1082	789	719	873	1619	-	-
Mov Cap-2 Maneuver	772	720	-	789	719	-	-	-	-
Stage 1	1021	894	-	831	757	-	-	-	-
Stage 2	814	757	-	1020	893	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	9.2	9.2	0
HCM LOS	A	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1619	-	-	854	873	1406	-	-
HCM Lane V/C Ratio	-	-	-	0.004	0.014	-	-	-
HCM Control Delay (s)	0	-	-	9.2	9.2	0	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	3
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	0	0	3

Major/Minor	Major2		
Conflicting Flow All	171	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.12	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.218	-	-
Pot Cap-1 Maneuver	1406	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1406	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	7.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	150	33	386	97	2	17	7	144
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	125	-	50	100	-	100	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	2	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	100	13	3	7	25	0	20	0	12
Mvmt Flow	1	163	36	420	105	2	18	8	157

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	105	0	0	163	0	0	1072	1110	82
Stage 1	-	-	-	-	-	-	165	165	-
Stage 2	-	-	-	-	-	-	907	945	-
Critical Hdwy	6.1	-	-	4.24	-	-	7.9	6.5	7.14
Critical Hdwy Stg 1	-	-	-	-	-	-	6.9	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.9	5.5	-
Follow-up Hdwy	3.2	-	-	2.27	-	-	3.7	4	3.42
Pot Cap-1 Maneuver	986	-	-	1377	-	-	153	211	930
Stage 1	-	-	-	-	-	-	771	766	-
Stage 2	-	-	-	-	-	-	263	343	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	986	-	-	1377	-	-	104	146	930
Mov Cap-2 Maneuver	-	-	-	-	-	-	149	223	-
Stage 1	-	-	-	-	-	-	770	765	-
Stage 2	-	-	-	-	-	-	158	238	-

Approach	EB	WB	NB
HCM Control Delay, s	0	7	14.5
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	559	986	-	-	1377	-	-	265
HCM Lane V/C Ratio	0.327	0.001	-	-	0.305	-	-	0.176
HCM Control Delay (s)	14.5	8.7	-	-	8.8	-	-	21.5
HCM Lane LOS	B	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	1.4	0	-	-	1.3	-	-	0.6

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	5	27	11
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	2	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	4	9
Mvmt Flow	5	29	12

Major/Minor	Minor2		
Conflicting Flow All	1033	1110	53
Stage 1	945	945	-
Stage 2	88	165	-
Critical Hdwy	7.5	6.58	7.08
Critical Hdwy Stg 1	6.5	5.58	-
Critical Hdwy Stg 2	6.5	5.58	-
Follow-up Hdwy	3.5	4.04	3.39
Pot Cap-1 Maneuver	189	205	981
Stage 1	285	334	-
Stage 2	916	756	-
Platoon blocked, %			
Mov Cap-1 Maneuver	117	142	981
Mov Cap-2 Maneuver	230	209	-
Stage 1	285	232	-
Stage 2	753	755	-

Approach	SB
HCM Control Delay, s	21.5
HCM LOS	C

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	5.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	83	2	341	104	1	85
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	6	0	3	13	0	24
Mvmt Flow	90	2	371	113	1	92

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	92	0	945	91
Stage 1	-	-	-	-	91	-
Stage 2	-	-	-	-	854	-
Critical Hdwy	-	-	4.13	-	6.4	6.44
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.227	-	3.5	3.516
Pot Cap-1 Maneuver	-	-	1496	-	293	909
Stage 1	-	-	-	-	938	-
Stage 2	-	-	-	-	421	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1496	-	215	909
Mov Cap-2 Maneuver	-	-	-	-	215	-
Stage 1	-	-	-	-	938	-
Stage 2	-	-	-	-	309	-

Approach	EB	WB	NB
HCM Control Delay, s	0	6.3	9.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	876	-	-	1496	-
HCM Lane V/C Ratio	0.107	-	-	0.248	-
HCM Control Delay (s)	9.6	-	-	8.2	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.4	-	-	1	-

Intersection	
Int Delay, s/veh	8.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	9	41	135	13	19	53	9	23	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	50	-	-	-	150	-	25
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	95	95	95	92	92	92
Heavy Vehicles, %	0	18	1	1	11	63	9	21	12
Mvmt Flow	10	45	147	14	20	56	10	25	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	76	0	0	45	0	0	243	167	45
Stage 1	-	-	-	-	-	-	64	64	-
Stage 2	-	-	-	-	-	-	179	103	-
Critical Hdwy	4.1	-	-	4.11	-	-	7.19	6.71	6.32
Critical Hdwy Stg 1	-	-	-	-	-	-	6.19	5.71	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.19	5.71	-
Follow-up Hdwy	2.2	-	-	2.209	-	-	3.581	4.189	3.408
Pot Cap-1 Maneuver	1536	-	-	1570	-	-	697	693	997
Stage 1	-	-	-	-	-	-	930	806	-
Stage 2	-	-	-	-	-	-	807	774	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1536	-	-	1570	-	-	540	682	997
Mov Cap-2 Maneuver	-	-	-	-	-	-	540	682	-
Stage 1	-	-	-	-	-	-	923	800	-
Stage 2	-	-	-	-	-	-	600	767	-

Approach	EB	WB	NB
HCM Control Delay, s	0.4	1.1	10.9
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	540	682	-	1536	-	-	1570	-	-	746
HCM Lane V/C Ratio	0.018	0.037	-	0.006	-	-	0.009	-	-	0.498
HCM Control Delay (s)	11.8	10.5	0	7.4	0	-	7.3	0	-	14.5
HCM Lane LOS	B	B	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0.1	-	0	-	-	0	-	-	2.8

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	151	186	5
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	18	3	0
Mvmt Flow	164	202	5

Major/Minor	Minor2		
Conflicting Flow All	152	139	48
Stage 1	75	75	-
Stage 2	77	64	-
Critical Hdwy	7.28	6.53	6.2
Critical Hdwy Stg 1	6.28	5.53	-
Critical Hdwy Stg 2	6.28	5.53	-
Follow-up Hdwy	3.662	4.027	3.3
Pot Cap-1 Maneuver	780	750	1027
Stage 1	896	831	-
Stage 2	894	840	-
Platoon blocked, %			
Mov Cap-1 Maneuver	749	738	1027
Mov Cap-2 Maneuver	749	738	-
Stage 1	890	824	-
Stage 2	860	834	-

Approach	SB
HCM Control Delay, s	14.5
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	0	0	0	11	0	12	0	92	37
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	26	0	26	1	0	29	5	2	6
Mvmt Flow	0	0	0	12	0	13	0	100	40

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	418	431	109	411	411	120	109	0	0
Stage 1	291	291	-	120	120	-	-	-	-
Stage 2	127	140	-	291	291	-	-	-	-
Critical Hdwy	7.36	6.5	6.46	7.11	6.5	6.49	4.15	-	-
Critical Hdwy Stg 1	6.36	5.5	-	6.11	5.5	-	-	-	-
Critical Hdwy Stg 2	6.36	5.5	-	6.11	5.5	-	-	-	-
Follow-up Hdwy	3.734	4	3.534	3.509	4	3.561	2.245	-	-
Pot Cap-1 Maneuver	506	520	883	553	534	864	1463	-	-
Stage 1	668	675	-	887	800	-	-	-	-
Stage 2	822	785	-	719	675	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	473	485	883	525	498	864	1463	-	-
Mov Cap-2 Maneuver	473	485	-	525	498	-	-	-	-
Stage 1	668	630	-	887	800	-	-	-	-
Stage 2	810	785	-	671	630	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	10.7	0
HCM LOS	A	B	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1463	-	-	-	660	1437	-	-
HCM Lane V/C Ratio	-	-	-	-	0.038	0.064	-	-
HCM Control Delay (s)	0	-	-	0	10.7	7.7	0	-
HCM Lane LOS	A	-	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0.1	0.2	-	-

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	84	100	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	3	2	5
Mvmt Flow	91	109	0

Major/Minor	Major2		
Conflicting Flow All	140	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.13	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.227	-	-
Pot Cap-1 Maneuver	1437	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1437	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	3.5
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	5.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	105	62	10	23	100	11
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	4	10	2	3
Mvmt Flow	114	67	11	25	109	12

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	162	115	121	0	-	0
Stage 1	115	-	-	-	-	-
Stage 2	47	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.14	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.236	-	-	-
Pot Cap-1 Maneuver	829	937	1454	-	-	-
Stage 1	910	-	-	-	-	-
Stage 2	975	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	822	937	1454	-	-	-
Mov Cap-2 Maneuver	822	-	-	-	-	-
Stage 1	910	-	-	-	-	-
Stage 2	967	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.3	2.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1454	-	861	-	-
HCM Lane V/C Ratio	0.007	-	0.211	-	-
HCM Control Delay (s)	7.5	0	10.3	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.8	-	-

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	119	21	1	17	0	11	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	1	10	0	6	2	18	2	0
Mvmt Flow	1	129	23	1	18	0	12	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	18	0	0	152	0	0	167	164	141
Stage 1	-	-	-	-	-	-	143	143	-
Stage 2	-	-	-	-	-	-	24	21	-
Critical Hdwy	4.12	-	-	4.1	-	-	7.28	6.52	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.28	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.28	5.52	-
Follow-up Hdwy	2.218	-	-	2.2	-	-	3.662	4.018	3.3
Pot Cap-1 Maneuver	1599	-	-	1441	-	-	763	729	912
Stage 1	-	-	-	-	-	-	823	779	-
Stage 2	-	-	-	-	-	-	954	878	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1599	-	-	1441	-	-	756	728	912
Mov Cap-2 Maneuver	-	-	-	-	-	-	756	728	-
Stage 1	-	-	-	-	-	-	822	778	-
Stage 2	-	-	-	-	-	-	946	877	-

Approach	EB	WB	NB
HCM Control Delay, s	0.1	0.4	9.8
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	756	1599	-	-	1441	-	-	964
HCM Lane V/C Ratio	0.016	0.001	-	-	0.001	-	-	0.009
HCM Control Delay (s)	9.8	7.3	0	-	7.5	0	-	8.8
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	1	1	6
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	1	1	7

Major/Minor	Minor2		
Conflicting Flow All	164	175	18
Stage 1	21	21	-
Stage 2	143	154	-
Critical Hdwy	7.12	6.52	6.22
Critical Hdwy Stg 1	6.12	5.52	-
Critical Hdwy Stg 2	6.12	5.52	-
Follow-up Hdwy	3.518	4.018	3.318
Pot Cap-1 Maneuver	801	718	1061
Stage 1	998	878	-
Stage 2	860	770	-
Platoon blocked, %			
Mov Cap-1 Maneuver	800	717	1061
Mov Cap-2 Maneuver	800	717	-
Stage 1	997	877	-
Stage 2	859	769	-

Approach	SB
HCM Control Delay, s	8.8
HCM LOS	A

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	109	10	0	13	0	4	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	1	1	0	8	2	1	2	0
Mvmt Flow	1	118	11	0	14	0	4	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	14	0	0	129	0	0	141	140	124
Stage 1	-	-	-	-	-	-	126	126	-
Stage 2	-	-	-	-	-	-	15	14	-
Critical Hdwy	4.12	-	-	4.1	-	-	7.11	6.52	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.11	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.11	5.52	-
Follow-up Hdwy	2.218	-	-	2.2	-	-	3.509	4.018	3.3
Pot Cap-1 Maneuver	1604	-	-	1469	-	-	831	751	932
Stage 1	-	-	-	-	-	-	880	792	-
Stage 2	-	-	-	-	-	-	1007	884	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1604	-	-	1469	-	-	830	750	932
Mov Cap-2 Maneuver	-	-	-	-	-	-	830	750	-
Stage 1	-	-	-	-	-	-	879	791	-
Stage 2	-	-	-	-	-	-	1006	884	-

Approach	EB	WB	NB
HCM Control Delay, s	0.1	0	9.4
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	830	1604	-	-	1469	-	-	1066
HCM Lane V/C Ratio	0.005	0.001	-	-	-	-	-	0.001
HCM Control Delay (s)	9.4	7.2	0	-	0	-	-	8.4
HCM Lane LOS	A	A	A	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	1
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	0	0	1

Major/Minor	Minor2		
Conflicting Flow All	140	146	14
Stage 1	14	14	-
Stage 2	126	132	-
Critical Hdwy	7.12	6.52	6.22
Critical Hdwy Stg 1	6.12	5.52	-
Critical Hdwy Stg 2	6.12	5.52	-
Follow-up Hdwy	3.518	4.018	3.318
Pot Cap-1 Maneuver	830	745	1066
Stage 1	1006	884	-
Stage 2	878	787	-
Platoon blocked, %			
Mov Cap-1 Maneuver	829	744	1066
Mov Cap-2 Maneuver	829	744	-
Stage 1	1005	884	-
Stage 2	877	786	-

Approach	SB
HCM Control Delay, s	8.4
HCM LOS	A

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	6.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	16	4	3	0	1	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	92	92	92	92	92	92
Heavy Vehicles, %	5	0	0	0	0	26
Mvmt Flow	17	4	3	0	1	5

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	11	4	7	0	-	0
Stage 1	4	-	-	-	-	-
Stage 2	7	-	-	-	-	-
Critical Hdwy	6.45	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	1001	1085	1627	-	-	-
Stage 1	1011	-	-	-	-	-
Stage 2	1008	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	999	1085	1627	-	-	-
Mov Cap-2 Maneuver	999	-	-	-	-	-
Stage 1	1011	-	-	-	-	-
Stage 2	1006	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.6	7.2	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1627	-	1015	-	-
HCM Lane V/C Ratio	0.002	-	0.021	-	-
HCM Control Delay (s)	7.2	0	8.6	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	3	80	22	5	2	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	67	4	23	12	4	0
Mvmt Flow	3	87	24	5	2	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	29	0	-	0	120	27
Stage 1	-	-	-	-	27	-
Stage 2	-	-	-	-	93	-
Critical Hdwy	4.77	-	-	-	6.44	6.2
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	2.803	-	-	-	3.536	3.3
Pot Cap-1 Maneuver	1250	-	-	-	871	1054
Stage 1	-	-	-	-	990	-
Stage 2	-	-	-	-	926	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1250	-	-	-	868	1054
Mov Cap-2 Maneuver	-	-	-	-	868	-
Stage 1	-	-	-	-	990	-
Stage 2	-	-	-	-	923	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	8.8
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1250	-	-	-	952
HCM Lane V/C Ratio	0.003	-	-	-	0.005
HCM Control Delay (s)	7.9	0	-	-	8.8
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	9	2	18	33	3	331	95	155
v/c Ratio	0.05	0.01	0.09	0.06	0.01	0.62	0.22	0.20
Control Delay	28.2	0.0	28.4	0.2	15.7	23.2	9.2	9.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.2	0.0	28.4	0.2	15.7	23.2	9.2	9.1
Queue Length 50th (ft)	3	0	6	0	1	95	17	28
Queue Length 95th (ft)	17	0	25	1	6	184	38	59
Internal Link Dist (ft)	750		1085			929		1030
Turn Bay Length (ft)		50		225	75		175	
Base Capacity (vph)	329	400	769	601	977	1328	493	1566
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.01	0.02	0.05	0.00	0.25	0.19	0.10

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	7	2	16	1	30	3	198	107	87	142	1
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	190.0	190.0	190.0	190.0	184.8	166.7	190.0	178.7	190.0	184.5	162.5	190.0
Adj Flow Rate, veh/h	1	8	2	17	1	33	3	215	116	95	154	1
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	0	0	14	0	7	7	3	17	17
Cap, veh/h	20	159	153	158	9	235	492	311	168	375	757	5
Arrive On Green	0.09	0.09	0.09	0.09	0.09	0.09	0.28	0.28	0.28	0.07	0.47	0.47
Sat Flow, veh/h	210	1680	1615	1666	98	1417	1251	1093	590	1757	1613	10
Grp Volume(v), veh/h	9	0	2	18	0	33	3	0	331	95	0	155
Grp Sat Flow(s),veh/h/ln	1890	0	1615	1764	0	1417	1251	0	1683	1757	0	1624
Q Serve(g_s), s	0.2	0.0	0.1	0.5	0.0	1.0	0.1	0.0	9.2	1.8	0.0	3.0
Cycle Q Clear(g_c), s	0.2	0.0	0.1	0.5	0.0	1.0	0.1	0.0	9.2	1.8	0.0	3.0
Prop In Lane	0.11		1.00	0.94		1.00	1.00		0.35	1.00		0.01
Lane Grp Cap(c), veh/h	179	0	153	167	0	235	492	0	479	375	0	762
V/C Ratio(X)	0.05	0.00	0.01	0.11	0.00	0.14	0.01	0.00	0.69	0.25	0.00	0.20
Avail Cap(c_a), veh/h	358	0	306	836	0	772	1204	0	1436	582	0	1877
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	21.7	0.0	21.6	21.8	0.0	18.8	13.5	0.0	16.8	11.6	0.0	8.2
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.3	0.0	0.3	0.0	0.0	1.8	0.4	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	0.0	0.3	0.0	0.4	0.0	0.0	4.5	0.9	0.0	1.3
LnGrp Delay(d),s/veh	21.8	0.0	21.7	22.1	0.0	19.1	13.5	0.0	18.6	11.9	0.0	8.3
LnGrp LOS	C		C	C		B	B		B	B		A
Approach Vol, veh/h		11			51			334			250	
Approach Delay, s/veh		21.8			20.1			18.6			9.7	
Approach LOS		C			C			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6		8
Phs Duration (G+Y+Rc), s		11.0	9.8	21.0		11.0		30.8
Change Period (Y+Rc), s		6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s		25.0	10.0	45.0		10.0		61.0
Max Q Clear Time (g_c+I1), s		3.0	3.8	11.2		2.2		5.0
Green Ext Time (p_c), s		0.1	0.1	3.5		0.0		3.7

Intersection Summary

HCM 2010 Ctrl Delay	15.3
HCM 2010 LOS	B

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	10	104	98	134	130	22
v/c Ratio	0.03	0.21	0.12	0.08	0.17	0.03
Control Delay	13.0	3.1	2.6	2.0	11.1	6.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.0	3.1	2.6	2.0	11.1	6.5
Queue Length 50th (ft)	1	0	0	0	12	0
Queue Length 95th (ft)	12	15	23	29	64	13
Internal Link Dist (ft)	1078			751	648	
Turn Bay Length (ft)		150	225			150
Base Capacity (vph)	1306	839	1042	1727	1629	1578
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.12	0.09	0.08	0.08	0.01

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	9	96	90	123	120	20
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	171.2	172.7	179.2	172.7	166.7	190.0
Adj Flow Rate, veh/h	10	104	98	134	130	22
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	11	10	6	10	14	0
Cap, veh/h	219	327	590	898	432	419
Arrive On Green	0.13	0.13	0.09	0.52	0.26	0.26
Sat Flow, veh/h	1630	1468	1707	1727	1667	1615
Grp Volume(v), veh/h	10	104	98	134	130	22
Grp Sat Flow(s),veh/h/ln	1630	1468	1707	1727	1667	1615
Q Serve(g_s), s	0.2	2.1	1.3	1.4	2.2	0.4
Cycle Q Clear(g_c), s	0.2	2.1	1.3	1.4	2.2	0.4
Prop In Lane	1.00	1.00	1.00			1.00
Lane Grp Cap(c), veh/h	219	327	590	898	432	419
V/C Ratio(X)	0.05	0.32	0.17	0.15	0.30	0.05
Avail Cap(c_a), veh/h	1174	1186	1177	3034	1920	1860
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	13.1	11.3	6.8	4.3	10.3	9.7
Incr Delay (d2), s/veh	0.1	0.7	0.1	0.0	0.1	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	0.1	1.8	0.6	0.7	1.0	0.2
LnGrp Delay(d),s/veh	13.2	12.0	6.9	4.4	10.5	9.7
LnGrp LOS	B	B	A	A	B	A
Approach Vol, veh/h	114			232	152	
Approach Delay, s/veh	12.1			5.4	10.4	
Approach LOS	B			A	B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		24.1		10.7	9.1	15.0		
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0		
Max Green Setting (Gmax), s		61.0		25.0	15.0	40.0		
Max Q Clear Time (g_c+I1), s		3.4		4.1	3.3	4.2		
Green Ext Time (p_c), s		1.1		0.4	0.2	1.1		

Intersection Summary	
HCM 2010 Ctrl Delay	8.5
HCM 2010 LOS	A

Lane Group	EBL	EBT	WBL	WBT	NBT	SBL	SBT
Lane Group Flow (vph)	8	19	20	33	144	109	145
v/c Ratio	0.02	0.05	0.05	0.09	0.32	0.23	0.20
Control Delay	26.6	26.2	25.2	12.8	23.8	13.7	13.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.6	26.2	25.2	12.8	23.8	13.7	13.0
Queue Length 50th (ft)	3	7	7	2	49	29	38
Queue Length 95th (ft)	15	25	26	24	101	58	74
Internal Link Dist (ft)		598		847	888		606
Turn Bay Length (ft)	100		150			100	
Base Capacity (vph)	474	496	949	823	1039	611	1467
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.04	0.02	0.04	0.14	0.18	0.10

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	7	17	1	18	5	26	0	99	33	100	122	11
Number	5	2	12	1	6	16	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	190.0	190.0	190.0	190.0	176.5	190.0	190.0	175.1	190.0	182.7	171.2	190.0
Adj Flow Rate, veh/h	8	18	1	20	5	28	0	108	36	109	133	12
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	0	0	0	0	7	7	4	12	12
Cap, veh/h	311	307	17	224	29	162	113	295	98	474	653	59
Arrive On Green	0.17	0.17	0.17	0.12	0.12	0.12	0.00	0.23	0.23	0.09	0.42	0.42
Sat Flow, veh/h	1810	1783	99	1810	233	1303	1263	1258	419	1740	1547	140
Grp Volume(v), veh/h	8	0	19	20	0	33	0	0	144	109	0	145
Grp Sat Flow(s),veh/h/ln	1810	0	1883	1810	0	1535	1263	0	1677	1740	0	1687
Q Serve(g_s), s	0.2	0.0	0.5	0.6	0.0	1.2	0.0	0.0	4.6	2.7	0.0	3.5
Cycle Q Clear(g_c), s	0.2	0.0	0.5	0.6	0.0	1.2	0.0	0.0	4.6	2.7	0.0	3.5
Prop In Lane	1.00		0.05	1.00		0.85	1.00		0.25	1.00		0.08
Lane Grp Cap(c), veh/h	311	0	324	224	0	190	113	0	394	474	0	712
V/C Ratio(X)	0.03	0.00	0.06	0.09	0.00	0.17	0.00	0.00	0.37	0.23	0.00	0.20
Avail Cap(c_a), veh/h	425	0	442	849	0	721	508	0	918	719	0	1478
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	0.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	22.0	0.0	22.1	24.8	0.0	25.1	0.0	0.0	20.5	14.4	0.0	11.7
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.2	0.0	0.6	0.0	0.0	0.8	0.2	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	0.3	0.3	0.0	0.6	0.0	0.0	2.2	1.3	0.0	1.7
LnGrp Delay(d),s/veh	22.0	0.0	22.2	25.0	0.0	25.7	0.0	0.0	21.3	14.5	0.0	11.9
LnGrp LOS	C		C	C		C			C	B		B
Approach Vol, veh/h		27			53			144			254	
Approach Delay, s/veh		22.2			25.4			21.3			13.0	
Approach LOS		C			C			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6		8
Phs Duration (G+Y+Rc), s		17.0	12.0	21.0		13.9		33.0
Change Period (Y+Rc), s		6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s		15.0	15.0	35.0		30.0		56.0
Max Q Clear Time (g_c+I1), s		2.5	4.7	6.6		3.2		5.5
Green Ext Time (p_c), s		0.1	0.1	2.6		0.3		2.9

Intersection Summary	
HCM 2010 Ctrl Delay	17.4
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	2.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	18	151	10	44	50	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	247	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	20	164	11	48	54	10

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	20	0	90	20
Stage 1	-	-	-	-	20	-
Stage 2	-	-	-	-	70	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1596	-	910	1058
Stage 1	-	-	-	-	1003	-
Stage 2	-	-	-	-	953	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1596	-	904	1058
Mov Cap-2 Maneuver	-	-	-	-	904	-
Stage 1	-	-	-	-	1003	-
Stage 2	-	-	-	-	946	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.3	9.2
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	925	-	-	1596	-
HCM Lane V/C Ratio	0.069	-	-	0.007	-
HCM Control Delay (s)	9.2	-	-	7.3	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0.2	-	-	0	-

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	0	25	7	47	148	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	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	27	8	51	161	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	227	161	161	0	-	0
Stage 1	161	-	-	-	-	-
Stage 2	66	-	-	-	-	-
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	761	884	1418	-	-	-
Stage 1	868	-	-	-	-	-
Stage 2	957	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	756	884	1418	-	-	-
Mov Cap-2 Maneuver	756	-	-	-	-	-
Stage 1	868	-	-	-	-	-
Stage 2	951	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.2	1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1418	-	884	-	-
HCM Lane V/C Ratio	0.005	-	0.031	-	-
HCM Control Delay (s)	7.6	0	9.2	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	8	0	0	49	152	14
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	0	0	53	165	15

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	226	173	180	0	-	0
Stage 1	173	-	-	-	-	-
Stage 2	53	-	-	-	-	-
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	762	871	1396	-	-	-
Stage 1	857	-	-	-	-	-
Stage 2	970	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	762	871	1396	-	-	-
Mov Cap-2 Maneuver	762	-	-	-	-	-
Stage 1	857	-	-	-	-	-
Stage 2	970	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.8	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1396	-	762	-	-
HCM Lane V/C Ratio	-	-	0.011	-	-
HCM Control Delay (s)	0	-	9.8	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	7.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	64	5	0	16	1	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	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	70	5	0	17	1	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	18	1	1	0	-	0
Stage 1	1	-	-	-	-	-
Stage 2	17	-	-	-	-	-
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	1000	1084	1622	-	-	-
Stage 1	1022	-	-	-	-	-
Stage 2	1006	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	1000	1084	1622	-	-	-
Mov Cap-2 Maneuver	1000	-	-	-	-	-
Stage 1	1022	-	-	-	-	-
Stage 2	1006	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.9	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1622	-	1006	-	-
HCM Lane V/C Ratio	-	-	0.075	-	-
HCM Control Delay (s)	0	-	8.9	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	0	1	0	0	0	0	69	11
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	0	1	0	0	0	0	75	12

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	84	90	3	84	86	81	5	0	0
Stage 1	3	3	-	81	81	-	-	-	-
Stage 2	81	87	-	3	5	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	903	800	1081	903	804	979	1616	-	-
Stage 1	1020	893	-	927	828	-	-	-	-
Stage 2	927	823	-	1020	892	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	903	800	1081	902	804	979	1616	-	-
Mov Cap-2 Maneuver	903	800	-	902	804	-	-	-	-
Stage 1	1020	893	-	927	828	-	-	-	-
Stage 2	927	823	-	1019	892	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	8.7	0	0
HCM LOS	A	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1616	-	-	984	-	1509	-	-
HCM Lane V/C Ratio	-	-	-	0.002	-	-	-	-
HCM Control Delay (s)	0	-	-	8.7	0	0	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	-	0	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	5
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	0	0	5

Major/Minor	Major2		
Conflicting Flow All	87	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.12	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.218	-	-
Pot Cap-1 Maneuver	1509	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1509	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	10.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	7	113	18	207	170	6	48	35	354
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	125	-	50	100	-	100	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	2	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	96	96	96	93	93	93
Heavy Vehicles, %	0	18	31	11	20	0	8	3	5
Mvmt Flow	8	123	20	216	177	6	52	38	381

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	177	0	0	123	0	0	669	746	61
Stage 1	-	-	-	-	-	-	138	138	-
Stage 2	-	-	-	-	-	-	531	608	-
Critical Hdwy	4.1	-	-	4.32	-	-	7.66	6.56	7
Critical Hdwy Stg 1	-	-	-	-	-	-	6.66	5.56	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.66	5.56	-
Follow-up Hdwy	2.2	-	-	2.31	-	-	3.58	4.03	3.35
Pot Cap-1 Maneuver	1411	-	-	1398	-	-	332	338	982
Stage 1	-	-	-	-	-	-	834	779	-
Stage 2	-	-	-	-	-	-	485	482	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1411	-	-	1398	-	-	275	284	982
Mov Cap-2 Maneuver	-	-	-	-	-	-	353	375	-
Stage 1	-	-	-	-	-	-	829	775	-
Stage 2	-	-	-	-	-	-	383	408	-

Approach	EB	WB	NB
HCM Control Delay, s	0.4	4.3	17.9
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	741	1411	-	-	1398	-	-	425
HCM Lane V/C Ratio	0.634	0.005	-	-	0.154	-	-	0.079
HCM Control Delay (s)	17.9	7.6	-	-	8	-	-	14.2
HCM Lane LOS	C	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	4.6	0	-	-	0.5	-	-	0.3

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	2	21	8
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	2	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	0	5	13
Mvmt Flow	2	23	9

Major/Minor	Minor2		
Conflicting Flow All	703	746	89
Stage 1	608	608	-
Stage 2	95	138	-
Critical Hdwy	7.5	6.6	7.16
Critical Hdwy Stg 1	6.5	5.6	-
Critical Hdwy Stg 2	6.5	5.6	-
Follow-up Hdwy	3.5	4.05	3.43
Pot Cap-1 Maneuver	328	335	917
Stage 1	454	477	-
Stage 2	907	774	-
Platoon blocked, %			
Mov Cap-1 Maneuver	163	282	917
Mov Cap-2 Maneuver	273	369	-
Stage 1	451	403	-
Stage 2	525	770	-

Approach	SB
HCM Control Delay, s	14.2
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	5.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	157	2	82	165	1	279
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	7	0	28	8	0	5
Mvmt Flow	171	2	89	179	1	303

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	173	0	530	172
Stage 1	-	-	-	-	172	-
Stage 2	-	-	-	-	358	-
Critical Hdwy	-	-	4.38	-	6.4	6.25
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.452	-	3.5	3.345
Pot Cap-1 Maneuver	-	-	1261	-	513	864
Stage 1	-	-	-	-	863	-
Stage 2	-	-	-	-	712	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1261	-	473	864
Mov Cap-2 Maneuver	-	-	-	-	473	-
Stage 1	-	-	-	-	863	-
Stage 2	-	-	-	-	656	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.7	11.5
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	861	-	-	1261	-
HCM Lane V/C Ratio	0.353	-	-	0.071	-
HCM Control Delay (s)	11.5	-	-	8.1	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	1.6	-	-	0.2	-

Intersection	
Int Delay, s/veh	6.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	9	44	14	8	58	144	62	128	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	50	-	-	-	150	-	25
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	5	20	23	15	25	2	5	1
Mvmt Flow	10	48	15	9	63	157	67	139	15

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	220	0	0	48	0	0	237	304	48
Stage 1	-	-	-	-	-	-	67	67	-
Stage 2	-	-	-	-	-	-	170	237	-
Critical Hdwy	4.1	-	-	4.33	-	-	7.12	6.55	6.21
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.55	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.55	-
Follow-up Hdwy	2.2	-	-	2.407	-	-	3.518	4.045	3.309
Pot Cap-1 Maneuver	1361	-	-	1435	-	-	717	604	1024
Stage 1	-	-	-	-	-	-	943	833	-
Stage 2	-	-	-	-	-	-	832	703	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1361	-	-	1435	-	-	690	595	1024
Mov Cap-2 Maneuver	-	-	-	-	-	-	690	595	-
Stage 1	-	-	-	-	-	-	935	826	-
Stage 2	-	-	-	-	-	-	803	698	-

Approach	EB	WB	NB
HCM Control Delay, s	1	0.3	12
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	NBLn3	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	690	595	1024	1361	-	-	1435	-	-	489
HCM Lane V/C Ratio	0.098	0.234	0.015	0.007	-	-	0.006	-	-	0.184
HCM Control Delay (s)	10.8	12.9	8.6	7.7	0	-	7.5	0	-	14
HCM Lane LOS	B	B	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	0.9	0	0	-	-	0	-	-	0.7

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	62	11	10
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	64	23	0
Mvmt Flow	67	12	11

Major/Minor	Minor2		
Conflicting Flow All	296	226	141
Stage 1	159	159	-
Stage 2	137	67	-
Critical Hdwy	7.74	6.73	6.2
Critical Hdwy Stg 1	6.74	5.73	-
Critical Hdwy Stg 2	6.74	5.73	-
Follow-up Hdwy	4.076	4.207	3.3
Pot Cap-1 Maneuver	550	638	912
Stage 1	717	728	-
Stage 2	738	800	-
Platoon blocked, %			
Mov Cap-1 Maneuver	439	628	912
Mov Cap-2 Maneuver	439	628	-
Stage 1	711	723	-
Stage 2	600	794	-

Approach	SB
HCM Control Delay, s	14
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	5.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	3	0	1	69	0	75	0	81	8
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	5	0	5	2	0	4	27	1	2
Mvmt Flow	3	0	1	75	0	82	0	88	9

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	230	194	47	189	189	92	47	0	0
Stage 1	97	97	-	92	92	-	-	-	-
Stage 2	133	97	-	97	97	-	-	-	-
Critical Hdwy	7.15	6.5	6.25	7.12	6.5	6.24	4.37	-	-
Critical Hdwy Stg 1	6.15	5.5	-	6.12	5.5	-	-	-	-
Critical Hdwy Stg 2	6.15	5.5	-	6.12	5.5	-	-	-	-
Follow-up Hdwy	3.545	4	3.345	3.518	4	3.336	2.443	-	-
Pot Cap-1 Maneuver	719	705	1014	771	709	960	1414	-	-
Stage 1	902	819	-	915	823	-	-	-	-
Stage 2	863	819	-	910	819	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	648	692	1014	759	696	960	1414	-	-
Mov Cap-2 Maneuver	648	692	-	759	696	-	-	-	-
Stage 1	902	803	-	915	823	-	-	-	-
Stage 2	790	819	-	892	803	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	10.1	10.2	0
HCM LOS	B	B	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1414	-	-	712	852	1369	-	-
HCM Lane V/C Ratio	-	-	-	0.006	0.184	0.018	-	-
HCM Control Delay (s)	0	-	-	10.1	10.2	7.7	0	-
HCM Lane LOS	A	-	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.7	0.1	-	-

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	23	43	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	24	3	27
Mvmt Flow	25	47	0

Major/Minor	Major2		
Conflicting Flow All	97	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	1369	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1369	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	2.7
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	2.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	13	25	56	76	29	84
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	92	92	92	92	92	92
Heavy Vehicles, %	3	2	1	1	1	1
Mvmt Flow	14	27	61	83	32	91

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	281	77	123	0	-	0
Stage 1	77	-	-	-	-	-
Stage 2	204	-	-	-	-	-
Critical Hdwy	6.43	6.22	4.11	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.318	2.209	-	-	-
Pot Cap-1 Maneuver	707	984	1470	-	-	-
Stage 1	943	-	-	-	-	-
Stage 2	828	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	677	984	1470	-	-	-
Mov Cap-2 Maneuver	677	-	-	-	-	-
Stage 1	943	-	-	-	-	-
Stage 2	792	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.4	3.2	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1470	-	852	-	-
HCM Lane V/C Ratio	0.041	-	0.048	-	-
HCM Control Delay (s)	7.6	0	9.4	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	39	7	1	93	1	29	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	85	92	92	92	92	85	92	85	92
Heavy Vehicles, %	2	9	0	0	2	2	4	2	0
Mvmt Flow	1	42	8	1	101	1	32	1	1

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	102	0	0	50	0	0	156	153	46
Stage 1	-	-	-	-	-	-	49	49	-
Stage 2	-	-	-	-	-	-	107	104	-
Critical Hdwy	4.12	-	-	4.1	-	-	7.14	6.52	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.14	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.14	5.52	-
Follow-up Hdwy	2.218	-	-	2.2	-	-	3.536	4.018	3.3
Pot Cap-1 Maneuver	1490	-	-	1570	-	-	806	739	1029
Stage 1	-	-	-	-	-	-	959	854	-
Stage 2	-	-	-	-	-	-	894	809	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1490	-	-	1570	-	-	799	738	1029
Mov Cap-2 Maneuver	-	-	-	-	-	-	799	738	-
Stage 1	-	-	-	-	-	-	958	853	-
Stage 2	-	-	-	-	-	-	886	808	-

Approach	EB	WB	NB
HCM Control Delay, s	0.2	0.1	9.7
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	802	1490	-	-	1570	-	-	867
HCM Lane V/C Ratio	0.042	0.001	-	-	0.001	-	-	0.008
HCM Control Delay (s)	9.7	7.4	0	-	7.3	0	-	9.2
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	2	4
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	85	85	85
Heavy Vehicles, %	2	2	2
Mvmt Flow	0	2	5

Major/Minor	Minor2		
Conflicting Flow All	154	156	102
Stage 1	104	104	-
Stage 2	50	52	-
Critical Hdwy	7.12	6.52	6.22
Critical Hdwy Stg 1	6.12	5.52	-
Critical Hdwy Stg 2	6.12	5.52	-
Follow-up Hdwy	3.518	4.018	3.318
Pot Cap-1 Maneuver	813	736	953
Stage 1	902	809	-
Stage 2	963	852	-
Platoon blocked, %			
Mov Cap-1 Maneuver	810	735	953
Mov Cap-2 Maneuver	810	735	-
Stage 1	901	808	-
Stage 2	960	851	-

Approach	SB
HCM Control Delay, s	9.2
HCM LOS	A

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	35	3	0	81	0	14	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	85	92	92	92	92	85	92	85	92
Heavy Vehicles, %	2	9	0	0	2	2	1	2	0
Mvmt Flow	1	38	3	0	88	0	15	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	88	0	0	41	0	0	131	130	40
Stage 1	-	-	-	-	-	-	42	42	-
Stage 2	-	-	-	-	-	-	89	88	-
Critical Hdwy	4.12	-	-	4.1	-	-	7.11	6.52	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.11	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.11	5.52	-
Follow-up Hdwy	2.218	-	-	2.2	-	-	3.509	4.018	3.3
Pot Cap-1 Maneuver	1508	-	-	1581	-	-	844	761	1037
Stage 1	-	-	-	-	-	-	975	860	-
Stage 2	-	-	-	-	-	-	921	822	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1508	-	-	1581	-	-	842	760	1037
Mov Cap-2 Maneuver	-	-	-	-	-	-	842	760	-
Stage 1	-	-	-	-	-	-	974	859	-
Stage 2	-	-	-	-	-	-	920	822	-

Approach	EB	WB	NB
HCM Control Delay, s	0.2	0	9.4
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	842	1508	-	-	1581	-	-	970
HCM Lane V/C Ratio	0.018	0.001	-	-	-	-	-	0.001
HCM Control Delay (s)	9.4	7.4	0	-	0	-	-	8.7
HCM Lane LOS	A	A	A	-	A	-	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	1
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	85	85	85
Heavy Vehicles, %	2	2	2
Mvmt Flow	0	0	1

Major/Minor	Minor2		
Conflicting Flow All	130	132	88
Stage 1	88	88	-
Stage 2	42	44	-
Critical Hdwy	7.12	6.52	6.22
Critical Hdwy Stg 1	6.12	5.52	-
Critical Hdwy Stg 2	6.12	5.52	-
Follow-up Hdwy	3.518	4.018	3.318
Pot Cap-1 Maneuver	843	759	970
Stage 1	920	822	-
Stage 2	972	858	-
Platoon blocked, %			
Mov Cap-1 Maneuver	842	758	970
Mov Cap-2 Maneuver	842	758	-
Stage 1	919	822	-
Stage 2	971	857	-

Approach	SB
HCM Control Delay, s	8.7
HCM LOS	A

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	6	1	1	0	1	15
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	92	92	92	92	92	92
Heavy Vehicles, %	27	0	0	0	0	6
Mvmt Flow	7	1	1	0	1	16

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	11	9	17	0	-	0
Stage 1	9	-	-	-	-	-
Stage 2	2	-	-	-	-	-
Critical Hdwy	6.67	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.67	-	-	-	-	-
Critical Hdwy Stg 2	5.67	-	-	-	-	-
Follow-up Hdwy	3.743	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	948	1079	1613	-	-	-
Stage 1	953	-	-	-	-	-
Stage 2	960	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	947	1079	1613	-	-	-
Mov Cap-2 Maneuver	947	-	-	-	-	-
Stage 1	953	-	-	-	-	-
Stage 2	959	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.8	7.2	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1613	-	964	-	-
HCM Lane V/C Ratio	0.001	-	0.008	-	-
HCM Control Delay (s)	7.2	0	8.8	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	1	27	103	2	1	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	22	3	5	23	0
Mvmt Flow	1	29	112	2	1	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	114	0	-	0	145	113
Stage 1	-	-	-	-	113	-
Stage 2	-	-	-	-	32	-
Critical Hdwy	4.1	-	-	-	6.63	6.2
Critical Hdwy Stg 1	-	-	-	-	5.63	-
Critical Hdwy Stg 2	-	-	-	-	5.63	-
Follow-up Hdwy	2.2	-	-	-	3.707	3.3
Pot Cap-1 Maneuver	1488	-	-	-	800	945
Stage 1	-	-	-	-	862	-
Stage 2	-	-	-	-	939	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1488	-	-	-	799	945
Mov Cap-2 Maneuver	-	-	-	-	799	-
Stage 1	-	-	-	-	862	-
Stage 2	-	-	-	-	938	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	9
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1488	-	-	-	904
HCM Lane V/C Ratio	0.001	-	-	-	0.005
HCM Control Delay (s)	7.4	0	-	-	9
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	10	16	172	100	4	525	57	431
v/c Ratio	0.07	0.06	0.55	0.17	0.01	0.78	0.21	0.47
Control Delay	43.7	0.5	40.8	6.1	17.5	31.6	11.7	14.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.7	0.5	40.8	6.1	17.5	31.6	11.7	14.4
Queue Length 50th (ft)	5	0	79	0	1	223	13	123
Queue Length 95th (ft)	24	0	174	36	8	406	35	230
Internal Link Dist (ft)	750		1085			929		1030
Turn Bay Length (ft)		50		225	75		175	
Base Capacity (vph)	229	343	601	635	593	1084	332	1415
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.05	0.29	0.16	0.01	0.48	0.17	0.30

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	8	15	137	21	92	4	384	99	54	404	6
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	190.0	170.1	190.0	190.0	185.5	172.7	190.0	182.7	190.0	165.2	182.8	190.0
Adj Flow Rate, veh/h	1	9	16	149	23	100	4	417	108	57	425	6
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.95	0.95	0.95
Percent Heavy Veh, %	13	13	0	5	5	10	0	4	4	15	4	4
Cap, veh/h	12	110	117	214	33	274	476	550	143	285	950	13
Arrive On Green	0.07	0.07	0.07	0.14	0.14	0.14	0.39	0.39	0.39	0.05	0.53	0.53
Sat Flow, veh/h	169	1523	1615	1541	238	1468	972	1400	363	1573	1798	25
Grp Volume(v), veh/h	10	0	16	172	0	100	4	0	525	57	0	431
Grp Sat Flow(s),veh/h/ln	1693	0	1615	1778	0	1468	972	0	1763	1573	0	1823
Q Serve(g_s), s	0.4	0.0	0.6	6.4	0.0	4.1	0.2	0.0	17.8	1.4	0.0	10.1
Cycle Q Clear(g_c), s	0.4	0.0	0.6	6.4	0.0	4.1	0.9	0.0	17.8	1.4	0.0	10.1
Prop In Lane	0.10		1.00	0.87		1.00	1.00		0.21	1.00		0.01
Lane Grp Cap(c), veh/h	123	0	117	247	0	274	476	0	693	285	0	963
V/C Ratio(X)	0.08	0.00	0.14	0.70	0.00	0.36	0.01	0.00	0.76	0.20	0.00	0.45
Avail Cap(c_a), veh/h	245	0	234	644	0	602	727	0	1149	437	0	1611
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	29.9	0.0	30.0	28.3	0.0	24.5	13.2	0.0	18.1	13.1	0.0	10.1
Incr Delay (d2), s/veh	0.3	0.0	0.5	3.5	0.0	0.8	0.0	0.0	1.7	0.3	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	0.2	0.0	0.3	3.3	0.0	1.7	0.0	0.0	8.9	0.6	0.0	5.1
LnGrp Delay(d),s/veh	30.2	0.0	30.5	31.9	0.0	25.3	13.2	0.0	19.8	13.4	0.0	10.4
LnGrp LOS	C		C	C		C	B		B	B		B
Approach Vol, veh/h		26			272			529			488	
Approach Delay, s/veh		30.4			29.5			19.8			10.7	
Approach LOS		C			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6		8
Phs Duration (G+Y+Rc), s		15.6	9.3	33.1		11.0		42.5
Change Period (Y+Rc), s		6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s		25.0	10.0	45.0		10.0		61.0
Max Q Clear Time (g_c+I1), s		8.4	3.4	19.8		2.6		12.1
Green Ext Time (p_c), s		1.2	0.0	7.4		0.0		8.4

Intersection Summary

HCM 2010 Ctrl Delay	18.6
HCM 2010 LOS	B

Queues
11: S. Main St & Church St

Base + B PM
10/22/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	47	230	239	253	278	58
v/c Ratio	0.15	0.33	0.29	0.17	0.54	0.11
Control Delay	21.1	2.9	4.0	3.1	19.3	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.1	2.9	4.0	3.1	19.3	5.9
Queue Length 50th (ft)	8	0	0	0	44	0
Queue Length 95th (ft)	42	29	56	59	152	22
Internal Link Dist (ft)	1078			751	648	
Turn Bay Length (ft)		150	225			150
Base Capacity (vph)	1054	837	922	1719	1450	1413
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.27	0.26	0.15	0.19	0.04

Intersection Summary

HCM 2010 Signalized Intersection Summary
11: S. Main St & Church St

Base + B PM
10/22/2014

Movement	EBL	EBR	NBL	NBT	SBT	SBR		
Lane Configurations								
Volume (veh/h)	43	212	220	233	256	53		
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	171.2	172.7	179.2	172.7	166.7	190.0		
Adj Flow Rate, veh/h	47	230	239	253	278	58		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Percent Heavy Veh, %	11	10	6	10	14	0		
Cap, veh/h	308	483	510	919	421	408		
Arrive On Green	0.19	0.19	0.14	0.53	0.25	0.25		
Sat Flow, veh/h	1630	1468	1707	1727	1667	1615		
Grp Volume(v), veh/h	47	230	239	253	278	58		
Grp Sat Flow(s),veh/h/ln	1630	1468	1707	1727	1667	1615		
Q Serve(g_s), s	1.0	5.4	3.9	3.5	6.4	1.2		
Cycle Q Clear(g_c), s	1.0	5.4	3.9	3.5	6.4	1.2		
Prop In Lane	1.00	1.00	1.00			1.00		
Lane Grp Cap(c), veh/h	308	483	510	919	421	408		
V/C Ratio(X)	0.15	0.48	0.47	0.28	0.66	0.14		
Avail Cap(c_a), veh/h	947	1058	865	2448	1549	1501		
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	14.6	11.5	9.0	5.5	14.4	12.5		
Incr Delay (d2), s/veh	0.3	0.9	0.7	0.1	0.7	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	0.5	4.7	1.9	1.6	3.0	0.5		
LnGrp Delay(d),s/veh	14.8	12.4	9.6	5.6	15.1	12.5		
LnGrp LOS	B	B	A	A	B	B		
Approach Vol, veh/h	277			492	336			
Approach Delay, s/veh	12.8			7.5	14.7			
Approach LOS	B			A	B			

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		28.9		14.1	12.0	16.9		
Change Period (Y+Rc), s		6.0		6.0	6.0	6.0		
Max Green Setting (Gmax), s		61.0		25.0	15.0	40.0		
Max Q Clear Time (g_c+I1), s		5.5		7.4	5.9	8.4		
Green Ext Time (p_c), s		2.5		1.1	0.5	2.4		

Intersection Summary	
HCM 2010 Ctrl Delay	11.0
HCM 2010 LOS	B

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	22	31	50	107	8	267	26	296
v/c Ratio	0.08	0.11	0.17	0.33	0.02	0.47	0.06	0.43
Control Delay	27.4	22.8	25.9	14.1	17.6	20.3	10.7	14.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.4	22.8	25.9	14.1	17.6	20.3	10.7	14.3
Queue Length 50th (ft)	6	6	12	7	2	58	5	67
Queue Length 95th (ft)	30	33	50	54	12	166	18	136
Internal Link Dist (ft)		598		847		888		606
Turn Bay Length (ft)	100		150		100		100	
Base Capacity (vph)	541	551	1083	986	760	1180	602	1551
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.06	0.05	0.11	0.01	0.23	0.04	0.19

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	20	8	46	28	71	7	197	49	24	251	21
Number	5	2	12	1	6	16	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	190.0	190.0	190.0	190.0	178.4	190.0	190.0	175.6	190.0	182.7	171.1	190.0
Adj Flow Rate, veh/h	22	22	9	50	30	77	8	214	53	26	273	23
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	0	0	0	0	7	7	4	12	12
Cap, veh/h	172	122	50	217	53	137	452	389	96	376	688	58
Arrive On Green	0.10	0.10	0.10	0.12	0.12	0.12	0.29	0.29	0.29	0.04	0.44	0.44
Sat Flow, veh/h	1810	1283	525	1810	444	1139	1100	1360	337	1740	1556	131
Grp Volume(v), veh/h	22	0	31	50	0	107	8	0	267	26	0	296
Grp Sat Flow(s),veh/h/ln	1810	0	1807	1810	0	1583	1100	0	1697	1740	0	1688
Q Serve(g_s), s	0.6	0.0	0.8	1.3	0.0	3.3	0.3	0.0	7.0	0.5	0.0	6.2
Cycle Q Clear(g_c), s	0.6	0.0	0.8	1.3	0.0	3.3	0.3	0.0	7.0	0.5	0.0	6.2
Prop In Lane	1.00		0.29	1.00		0.72	1.00		0.20	1.00		0.08
Lane Grp Cap(c), veh/h	172	0	172	217	0	190	452	0	485	376	0	746
V/C Ratio(X)	0.13	0.00	0.18	0.23	0.00	0.56	0.02	0.00	0.55	0.07	0.00	0.40
Avail Cap(c_a), veh/h	517	0	516	1034	0	905	871	0	1131	800	0	1800
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	21.8	0.0	21.9	20.9	0.0	21.8	13.5	0.0	15.9	11.5	0.0	9.9
Incr Delay (d2), s/veh	0.5	0.0	0.7	0.8	0.0	3.7	0.0	0.0	1.4	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	0.4	0.7	0.0	1.7	0.1	0.0	3.5	0.2	0.0	3.0
LnGrp Delay(d),s/veh	22.2	0.0	22.6	21.7	0.0	25.5	13.5	0.0	17.3	11.6	0.0	10.4
LnGrp LOS	C		C	C		C	B		B	B		B
Approach Vol, veh/h		53			157			275			322	
Approach Delay, s/veh		22.4			24.3			17.2			10.5	
Approach LOS		C			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6		8
Phs Duration (G+Y+Rc), s		11.0	8.2	21.0		12.3		29.2
Change Period (Y+Rc), s		6.0	6.0	6.0		6.0		6.0
Max Green Setting (Gmax), s		15.0	15.0	35.0		30.0		56.0
Max Q Clear Time (g_c+I1), s		2.8	2.5	9.0		5.3		8.2
Green Ext Time (p_c), s		0.1	0.0	5.5		1.1		6.2

Intersection Summary

HCM 2010 Ctrl Delay	16.2
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	5.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	50	59	7	43	150	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	247	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	54	64	8	47	163	12

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	54	0	116	54
Stage 1	-	-	-	-	54	-
Stage 2	-	-	-	-	62	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1551	-	880	1013
Stage 1	-	-	-	-	969	-
Stage 2	-	-	-	-	961	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1551	-	875	1013
Mov Cap-2 Maneuver	-	-	-	-	875	-
Stage 1	-	-	-	-	969	-
Stage 2	-	-	-	-	956	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1	10.1
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	883	-	-	1551	-
HCM Lane V/C Ratio	0.198	-	-	0.005	-
HCM Control Delay (s)	10.1	-	-	7.3	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.7	-	-	0	-

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	1	10	20	137	53	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	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	11	22	149	58	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	250	58	58	0	-	0
Stage 1	58	-	-	-	-	-
Stage 2	192	-	-	-	-	-
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	739	1008	1546	-	-	-
Stage 1	965	-	-	-	-	-
Stage 2	841	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	727	1008	1546	-	-	-
Mov Cap-2 Maneuver	727	-	-	-	-	-
Stage 1	965	-	-	-	-	-
Stage 2	828	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	0.9	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1546	-	974	-	-
HCM Lane V/C Ratio	0.014	-	0.012	-	-
HCM Control Delay (s)	7.4	0	8.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	21	0	0	141	56	11
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	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	23	0	0	153	61	12

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	220	67	73	0	-	0
Stage 1	67	-	-	-	-	-
Stage 2	153	-	-	-	-	-
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	768	997	1527	-	-	-
Stage 1	956	-	-	-	-	-
Stage 2	875	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	768	997	1527	-	-	-
Mov Cap-2 Maneuver	768	-	-	-	-	-
Stage 1	956	-	-	-	-	-
Stage 2	875	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.8	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1527	-	768	-	-
HCM Lane V/C Ratio	-	-	0.03	-	-
HCM Control Delay (s)	0	-	9.8	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	8.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	151	15	0	6	1	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	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	164	16	0	7	1	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	8	1	1	0	-	0
Stage 1	1	-	-	-	-	-
Stage 2	7	-	-	-	-	-
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	1013	1084	1622	-	-	-
Stage 1	1022	-	-	-	-	-
Stage 2	1016	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	1013	1084	1622	-	-	-
Mov Cap-2 Maneuver	1013	-	-	-	-	-
Stage 1	1022	-	-	-	-	-
Stage 2	1016	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.3	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1622	-	1019	-	-
HCM Lane V/C Ratio	-	-	0.177	-	-
HCM Control Delay (s)	0	-	9.3	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0.6	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	2	0	1	0	0	11	0	157	0
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	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	0	1	0	0	12	0	171	0

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	179	173	2	173	174	171	3	0	0
Stage 1	2	2	-	171	171	-	-	-	-
Stage 2	177	171	-	2	3	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	783	720	1082	790	719	873	1619	-	-
Stage 1	1021	894	-	831	757	-	-	-	-
Stage 2	825	757	-	1021	893	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	772	720	1082	789	719	873	1619	-	-
Mov Cap-2 Maneuver	772	720	-	789	719	-	-	-	-
Stage 1	1021	894	-	831	757	-	-	-	-
Stage 2	814	757	-	1020	893	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	9.2	9.2	0
HCM LOS	A	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1619	-	-	854	873	1406	-	-
HCM Lane V/C Ratio	-	-	-	0.004	0.014	-	-	-
HCM Control Delay (s)	0	-	-	9.2	9.2	0	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	3
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	0	0	3

Major/Minor	Major2		
Conflicting Flow All	171	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.12	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.218	-	-
Pot Cap-1 Maneuver	1406	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1406	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0
HCM LOS	

Minor Lane/Major Mvmt

- **Attachment D**

Turn Lane Analysis

No Action Alternative											
Left Turn Storage Lane Warrant											
Int #	Type	Street 1	Street 2	AM		PM		Additional Treatment Required			Exhibit Ref #*
				VL	VO	VL	VO				
1	4-Lane Hwy	US 460 EB	Cox Rd	1	350	7	334	No			Figure 3-3
1	4-Lane Hwy	US 460 WB	Cox Rd	251	166	158	132	No			Figure 3-3
Int #	Type	Street 1	Street 2	AM			PM			Additional Treament Required	Exhibit Ref #*
				VA	VO	L	VA	VO	L		
2	2-Lane Hwy	Cox Rd WB	Military Rd	292	85	64%	192	159	14%	Yes: S=200 (PM Peak)	Figure 3-22, Figure 3-19
3	2-Lane Hwy	Darvills Rd EB	Military Rd	180	44	5%	65	81	14%	No	Figure 3-11, Figure 3-13
3	2-Lane Hwy	Darvills Rd WB	Military Rd	44	180	39%	81	65	11%	No	Figure 3-16, Figure 3-12
3	2-Lane Hwy	Military Rd NB	Darvills Rd	27	189	26%	191	27	30%	No	Figure 3-15
3	2-Lane Hwy	Military Rd SB	Darvills Rd	189	27	6%	27	191	41%	No	Figure 3-11, Figure 3-16
13	2-Lane Hwy	Darvills Rd WB	Dearing Ave	50	30	4%	49	62	10%	No	Figure 3-11, Figure 3-12
Right Turn Treatment											
Int #	Type	Street 1	Street 2	AM		PM		Additional Treament Required			Exhibit Ref #*
				PHV - A	PHV - R	PHV - A	PHV - R				
1	4-Lane Hwy	US 460 EB	Cox Rd	166	15	132	12	No			Figure 3-27
1	4-Lane Hwy	US 460 WB	Cox Rd	350	2	334	6	No			Figure 3-27
Int #	Type	Street 1	Street 2	AM		PM		Additional Treament Required			Exhibit Ref #*
				PHV - A	PHV - R	PHV - A	PHV - R				
2	2-Lane Hwy	Cox Rd EB	Military Rd	85	2	159	2	No			Figure 3-26
3	2-Lane Hwy	Darvills Rd EB	Military Rd	180	130	65	12	Yes: S=200 (AM Peak)			Figure 3-26
3	2-Lane Hwy	Darvills Rd WB	Military Rd	44	8	81	14	No			Figure 3-26
3	2-Lane Hwy	Military Rd NB	Darvills Rd	27	1	191	18	No			Figure 3-26
3	2-Lane Hwy	Military Rd SB	Darvills Rd	189	5	27	10	No			Figure 3-26
13	2-Lane Hwy	Darvills Rd EB	Dearing Ave	30	11	62	8	No			Figure 3-26

VL = Left Turning Volumne (VPH)
VO = Opposing Volume (VPH)
VA = Advancing Volume (VPH)
PHV - R = Peak Hour Volume Right Turns(VPH)
PHV - A = Peak Hour Volumne Approaching Total (VPH)
L = Left turn volume/VA
*VDOT Road Design Manual, Appendix F

Option A											
Left Turn Storage Lane Warrant											
Int #	Type	Street 1	Street 2	AM		PM		Additional Treatment Required			Exhibit Ref #*
				VL	VO	VL	VO				
1	4-Lane Hwy	US 460 EB	Cox Rd	1	485	7	383	No			Figure 3-3
1	4-Lane Hwy	US 460 WB	Cox Rd	386	184	207	138	Yes: S=250 (AM Peak)			Figure 3-3
Int #	Type	Street 1	Street 2	AM			PM			Additional Treament Required	Exhibit Ref #*
				VA	VO	L	VA	VO	L		
2	2-Lane Hwy	Cox Rd WB	Military Rd	445	85	77%	247	159	33%	Yes: S=200 (PM Peak)	Figure 3-22, Figure 3-21
3	2-Lane Hwy	Darvills Rd EB	Military Rd	184	48	5%	66	82	14%	No	Figure 3-17, Figure 3-19
3	2-Lane Hwy	Darvills Rd WB	Military Rd	48	184	44%	82	66	12%	No	Figure 3-16, Figure 3-12
3	2-Lane Hwy	Military Rd NB	Darvills Rd	78	342	10%	338	82	18%	No	Figure 3-12, Figure 3-14
3	2-Lane Hwy	Military Rd SB	Darvills Rd	342	78	3%	82	338	13%	No	Figure 3-11, Figure 3-13
Right Turn Treatment											
Int #	Type	Street 1	Street 2	AM		PM		Additional Treament Required			Exhibit Ref #*
				PHV - A	PHV - R	PHV - A	PHV - R				
1	4-Lane Hwy	US 460 EB	Cox Rd	184	33	138	18	No			Figure 3-27
1	4-Lane Hwy	US 460 WB	Cox Rd	485	2	383	6	No			Figure 3-27
Int #	Type	Street 1	Street 2	AM		PM		Additional Treament Required			Exhibit Ref #*
				PHV - A	PHV - R	PHV - A	PHV - R				
2	2-Lane Hwy	Cox Rd EB	Military Rd	85	2	159	2	No			Figure 3-26
3	2-Lane Hwy	Darvills Rd EB	Military Rd	184	134	66	13	Yes: S=200 (AM Peak)			Figure 3-26
3	2-Lane Hwy	Darvills Rd WB	Military Rd	48	8	82	14	No			Figure 3-26
3	2-Lane Hwy	Military Rd NB	Darvills Rd	78	2	338	21	No			Figure 3-26
3	2-Lane Hwy	Military Rd SB	Darvills Rd	342	5	82	10	No			Figure 3-26

VL = Left Turning Volumne (VPH)
VO = Opposing Volume (VPH)
VA = Advancing Volume (VPH)
PHV - R = Peak Hour Volume Right Turns(VPH)
PHV - A = Peak Hour Volumne Approaching Total (VPH)
L = Left turn volume/VA
*VDOT Road Design Manual, Appendix F

Option B											
Left Turn Storage Lane Warrant											
Int #	Type	Street 1	Street 2	AM		PM		Additional Treatment Required			Exhibit Ref #*
				VL	VO	VL	VO				
1	4-Lane Hwy	US 460 EB	Cox Rd	1	485	7	383	No			Figure 3-3
1	4-Lane Hwy	US 460 WB	Cox Rd	386	184	207	138	Yes: S=250 (AM Peak)			Figure 3-3
Int #	Type	Street 1	Street 2	AM		PM				Additional Treament Required	Exhibit Ref #*
				VA	VO	L	VA	VO	L		
2	2-Lane Hwy	Cox Rd WB	Military Rd	445	85	77%	247	159	33%	Yes: S=200 (PM Peak)	Figure 3-22, Figure 3-21
3	2-Lane Hwy	Darvills Rd EB	Military Rd	185	85	5%	67	210	13%	No	Figure 3-11, Figure 3-13
3	2-Lane Hwy	Darvills Rd WB	Military Rd	85	185	15%	210	67	4%	No	Figure 3-13, Figure 3-11
3	2-Lane Hwy	Military Rd NB	Darvills Rd	32	342	28%	204	83	30%	No	Figure 3-15
3	2-Lane Hwy	Military Rd SB	Darvills Rd	342	32	44%	83	204	75%	No	Figure 3-16
13	2-Lane Hwy	Darvills Rd WB	Dearing Ave	54	169	19%	50	109	14%	No	Figure 3-14, Figure 3-13
Right Turn Treatment											
Int #	Type	Street 1	Street 2	AM		PM		Additional Treament Required			Exhibit Ref #*
				PHV - A	PHV - R	PHV - A	PHV - R				
1	4-Lane Hwy	US 460 EB	Cox Rd	184	33	138	18	No			Figure 3-27
1	4-Lane Hwy	US 460 WB	Cox Rd	485	2	383	6	No			Figure 3-27
Int #	Type	Street 1	Street 2	AM		PM		Additional Treament Required			Exhibit Ref #*
				PHV - A	PHV - R	PHV - A	PHV - R				
2	2-Lane Hwy	Cox Rd EB	Military Rd	85	2	159	2	No			Figure 3-26
3	2-Lane Hwy	Darvills Rd EB	Military Rd	185	135	67	14	Yes: S=200 (AM Peak)			Figure 3-26
3	2-Lane Hwy	Darvills Rd WB	Military Rd	85	53	210	144	Yes: T=200 (PM Peak)[a]			Figure 3-26
3	2-Lane Hwy	Military Rd NB	Darvills Rd	32	0	204	14	No			Figure 3-26
3	2-Lane Hwy	Military Rd SB	Darvills Rd	342	5	83	10	No			Figure 3-26
13	2-Lane Hwy	Darvills Rd EB	Dearing Ave	169	151	109	59	Yes: S=200 (AM Peak)			Figure 3-26

VL = Left Turning Volumne (VPH)

VO = Opposing Volume (VPH)

VA = Advancing Volume (VPH)

PHV - R = Peak Hour Volume Right Turns(VPH)

PHV - A = Peak Hour Volumne Approaching Total (VPH)

L = Left turn volume/VA

[a] No existing right turn lane. Minimum storage would be 100 feet per VDOT Road Design Manual, Appendix F, Table 3-1

*VDOT Road Design Manual, Appendix F

SECTION 3 – TURNING LANES

Turn Lane Criteria for Single and Dual Lanes

As a general policy, left-turn lanes are to be provided for traffic in both directions in the design of median crossovers and in one direction for directional median openings (see Figure 3-25 illustration) on non-access controlled four-lane or greater divided highways using controls as shown in Figure 3-1 and adjusted upward as determined by Figure 3-3 or by capacity analysis for left-turn storage.

Left-turn lanes should also be established on two-lane and four lane undivided highways where needed for storage of left-turn vehicles and/or prevention of thru-traffic delay as shown in Figure 3-1 and adjusted upward as determined by Table 3-1 and Figure 3-5 through 3-22 or by capacity analysis for left-turn storage.

LENGTH OF STORAGE		TAPER - Rural	
Rural - For Design Speeds 50 MPH or Higher	*L - 200' min. (For 240 or fewer vehicles during peak hour, making turn)	- For Design Speeds 35 MPH or Higher	**T - 200' Min.
Rural - For Design Speeds 45 MPH or Less	*L - 100' min. (For 60 or fewer vehicles during peak hour, making turn)	- For Design Speeds 30 MPH or Less	**T - 100' Min. (single) **T - 200' Min. (dual)
*Distance L to be adjusted upward as determined by capacity analysis for Left and Right Turn Storage.		**Tapers are to be straight-line unless local policy requires reverse curves. In congested areas the taper length may be reduced to increase storage length. However, a design waiver shall be required.	
LENGTH OF STORAGE		TAPER - Urban	
Urban - Length determined by capacity analysis for Left and Right Turn Storage (100' Minimum)		- For Design Speeds 50 MPH or Higher	**T - 200' Min.
		- For Design Speeds 45 MPH or Less	**T - 100' Min. (single) **T - 150' Min. (dual)

FIGURE 3-1 TURN LANE CRITERIA FOR SINGLE AND DUAL LANES

Taper rates: Rural - 8:1 for design speeds 30 mph and less, 15:1 for design speeds 35 mph and greater. Urban - 8:1 for design speeds 45 mph and less, 15:1 for design speeds 50 mph and greater. For urban dual lane taper (150' min.), See 2011 AASHTO Green Book, Chapter 9, Section 9.7.1, page 9-127. *

Note: Taper lengths shown above were compiled using these formulas and were rounded up.

* Rev. 1/14

Warrants for Left Turn Storage Lanes on Four-Lane Highways

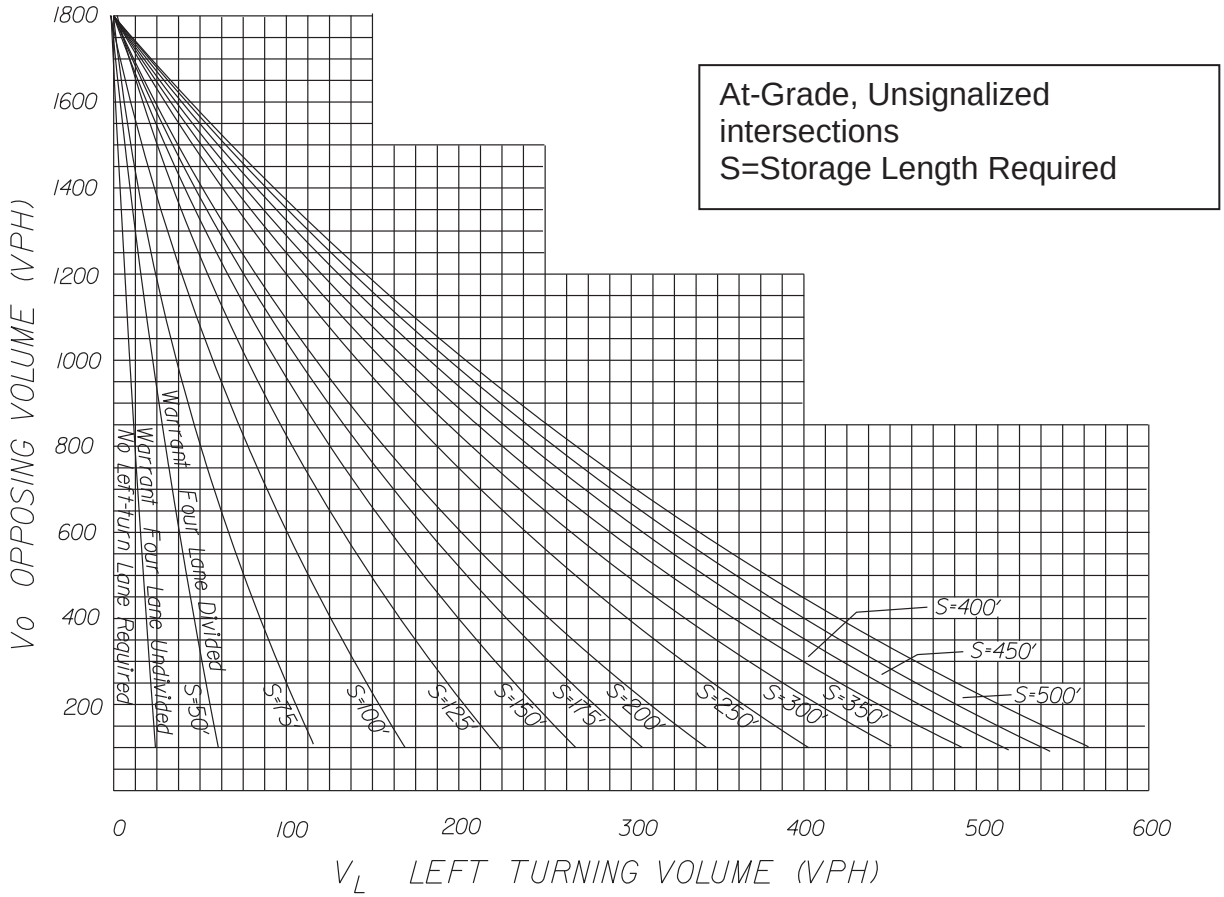


FIGURE 3-3 WARRANTS FOR LEFT TURN STORAGE LANES ON FOUR-LANE HIGHWAYS

Figure 3-3 was derived from *Highway Research Report No. 211*.

Opposing volume and left turning volume in vehicles per hour (VPH) are used for left turn storage lane warrants on four-lane highways.

For plan detail requirements when curb and/or gutter are used, see VDOT's *Road Design Manual*, Section 2E-3 on the VDOT web site: *http://www.virginiadot.org/business/locdes/rdmanual-index.asp.*

Left-turn lanes should also be established on two-lane highways where traffic volumes are high enough to warrant them.

Deleted Information*

* Rev. 1/14

WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAY

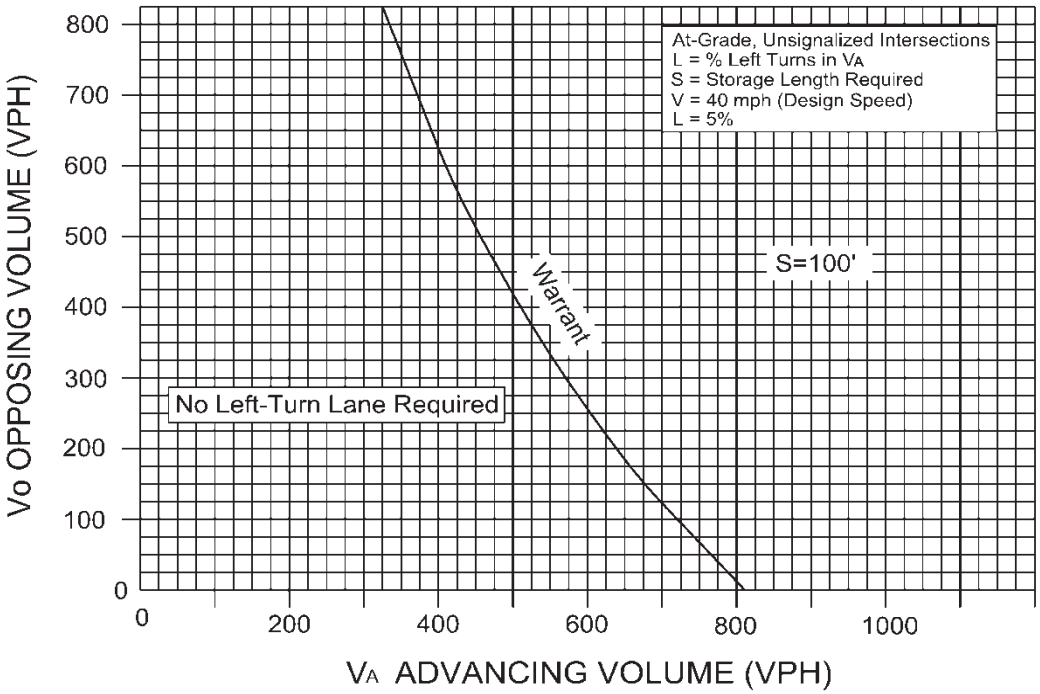


FIGURE 3-5

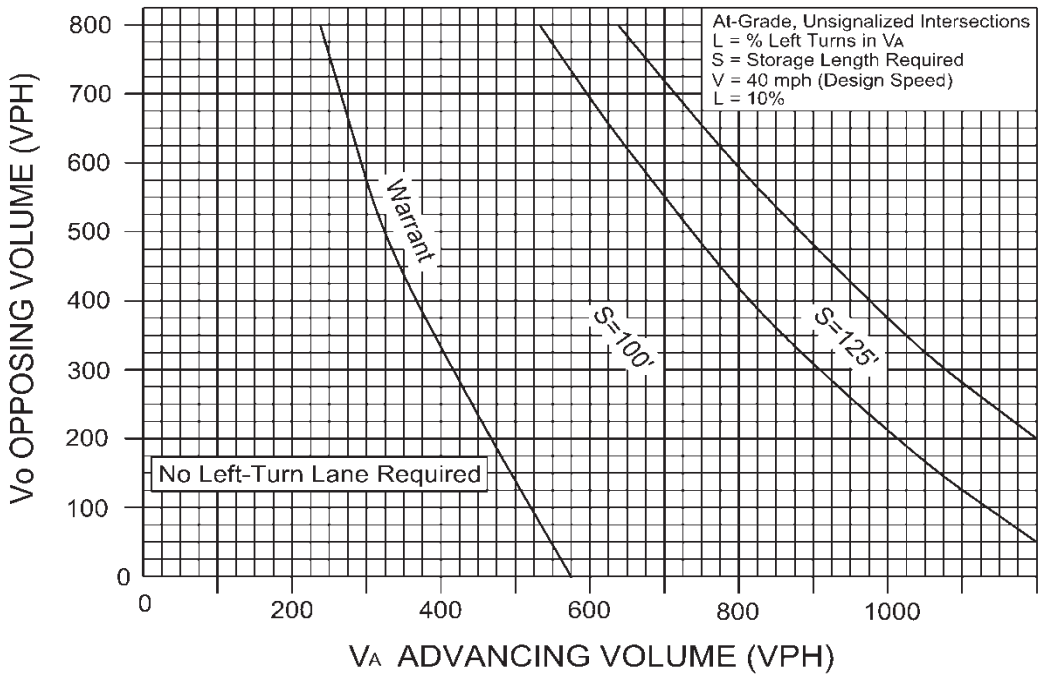


FIGURE 3-6

WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAY

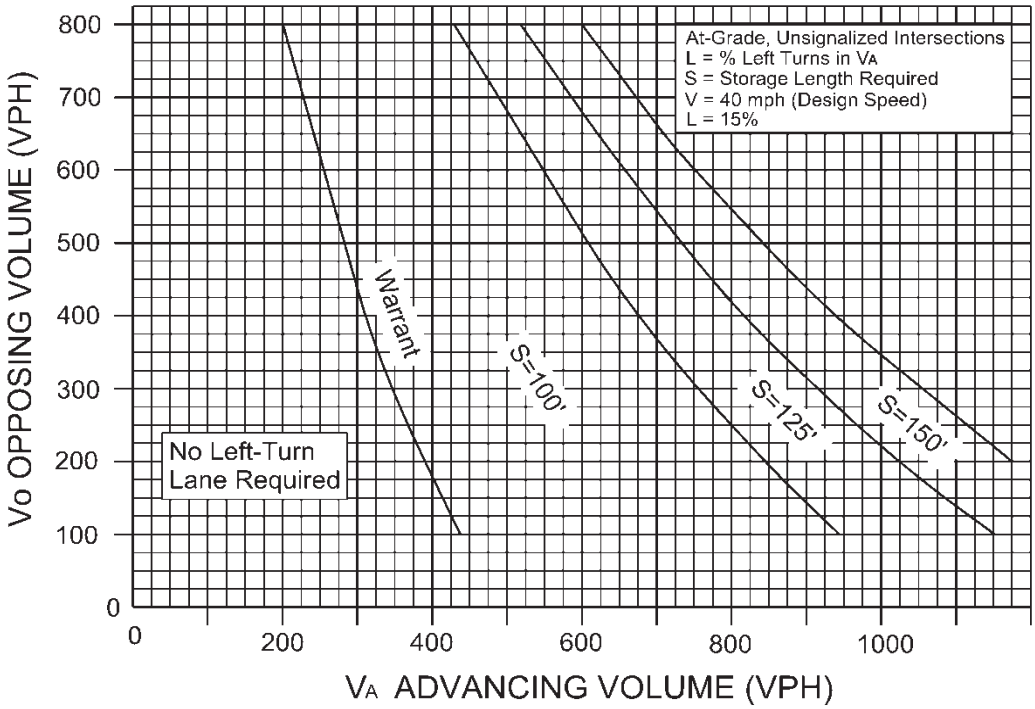


FIGURE 3-7

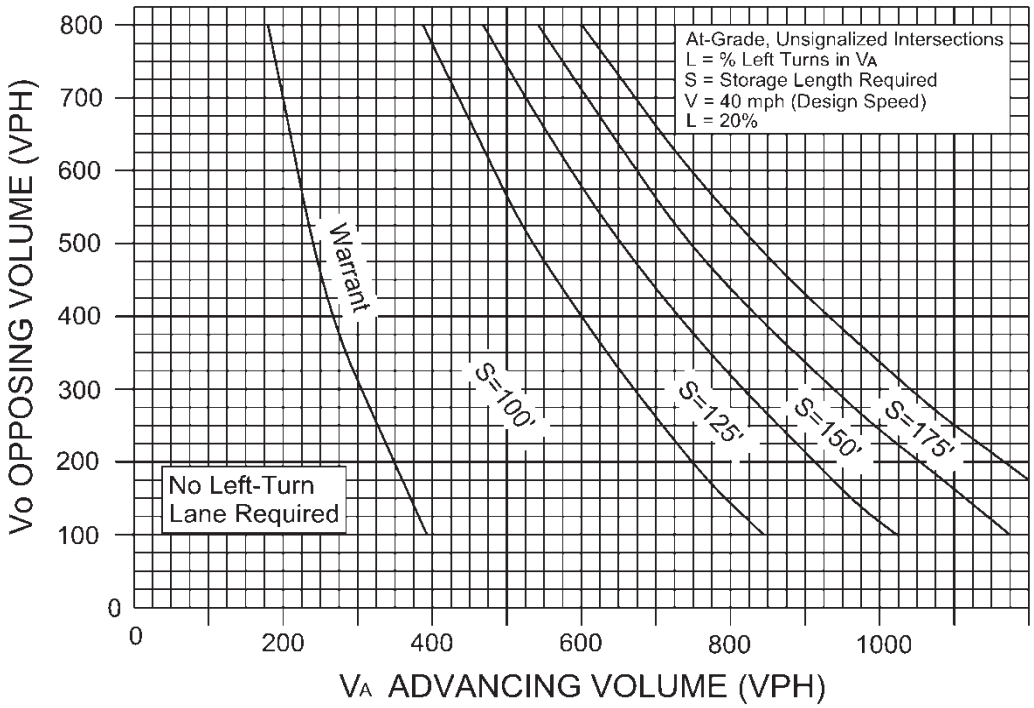


FIGURE 3-8

WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAY

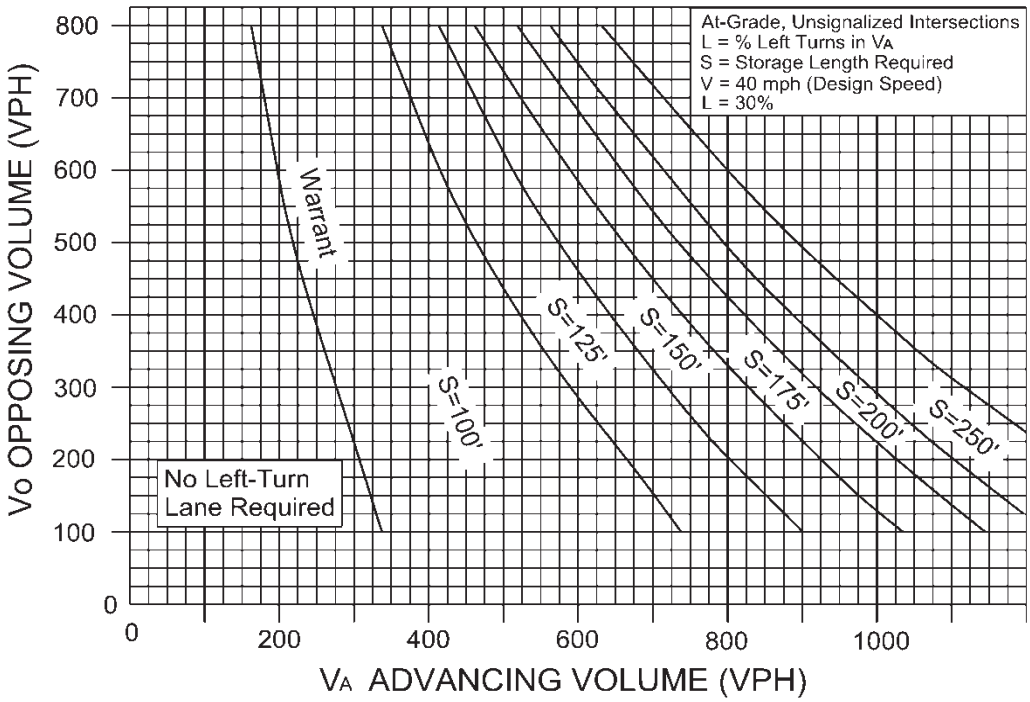


FIGURE 3-9

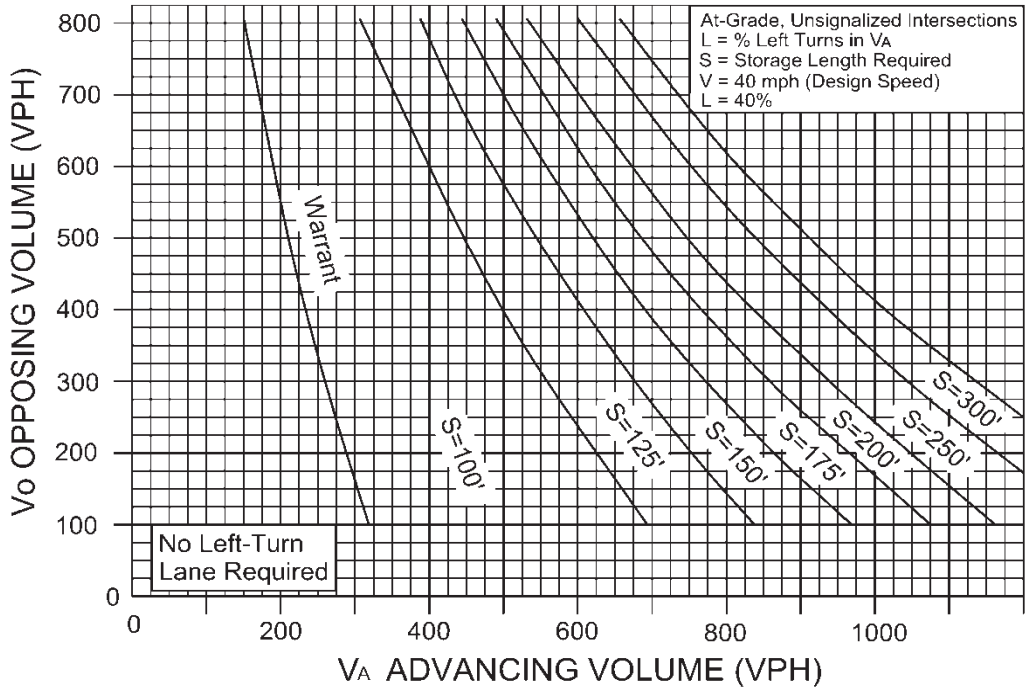


FIGURE 3-10

WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAY

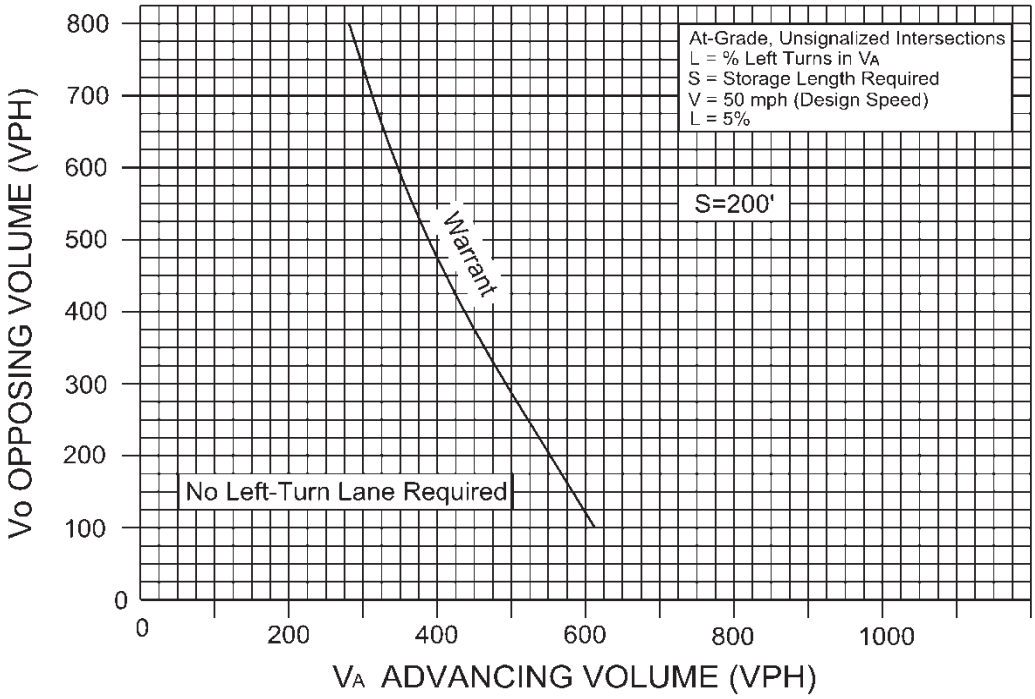


FIGURE 3-11

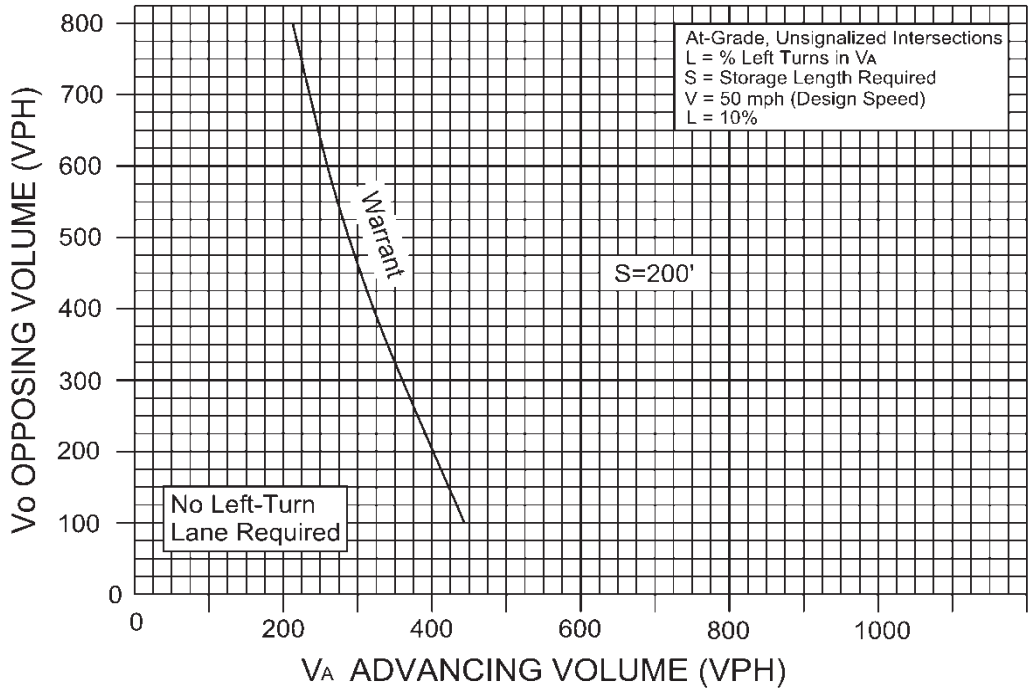


FIGURE 3-12

WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAY

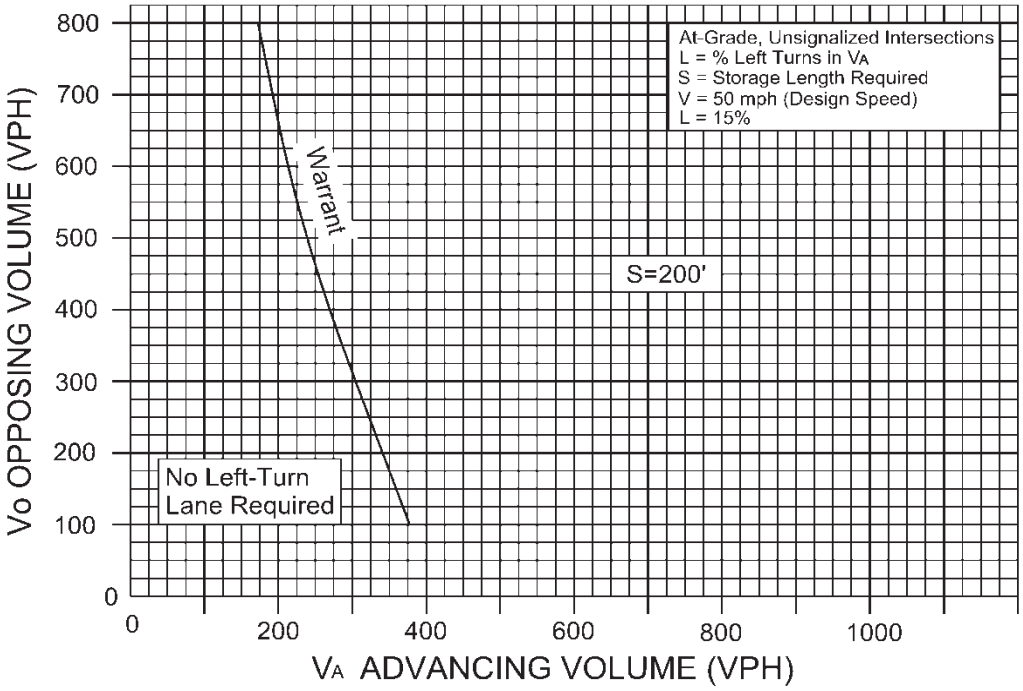


FIGURE 3-13

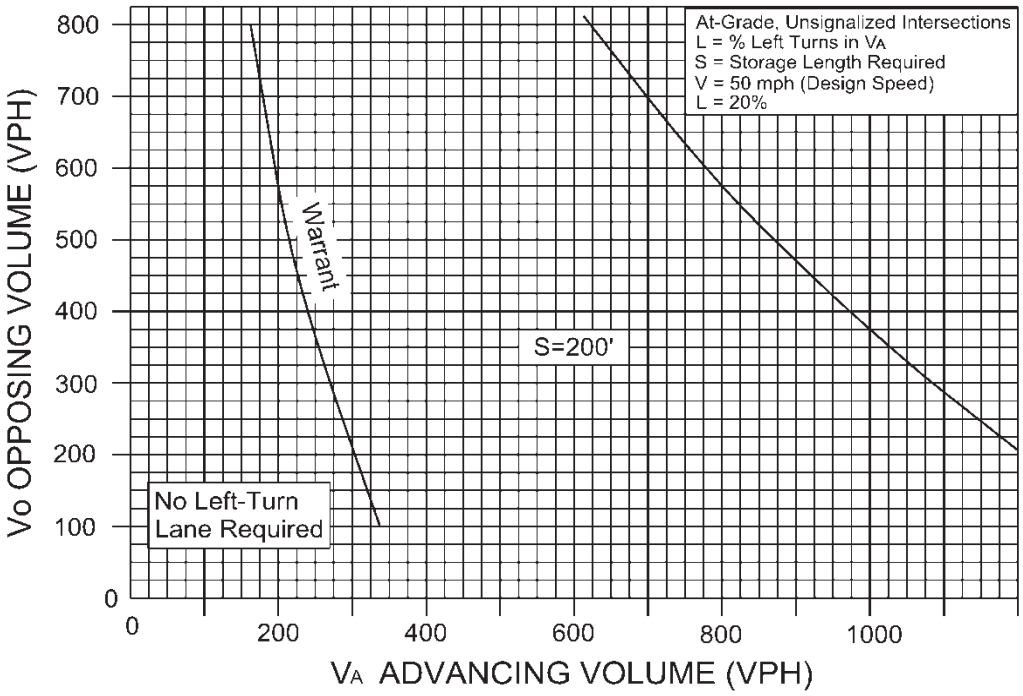


FIGURE 3-14

WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAY

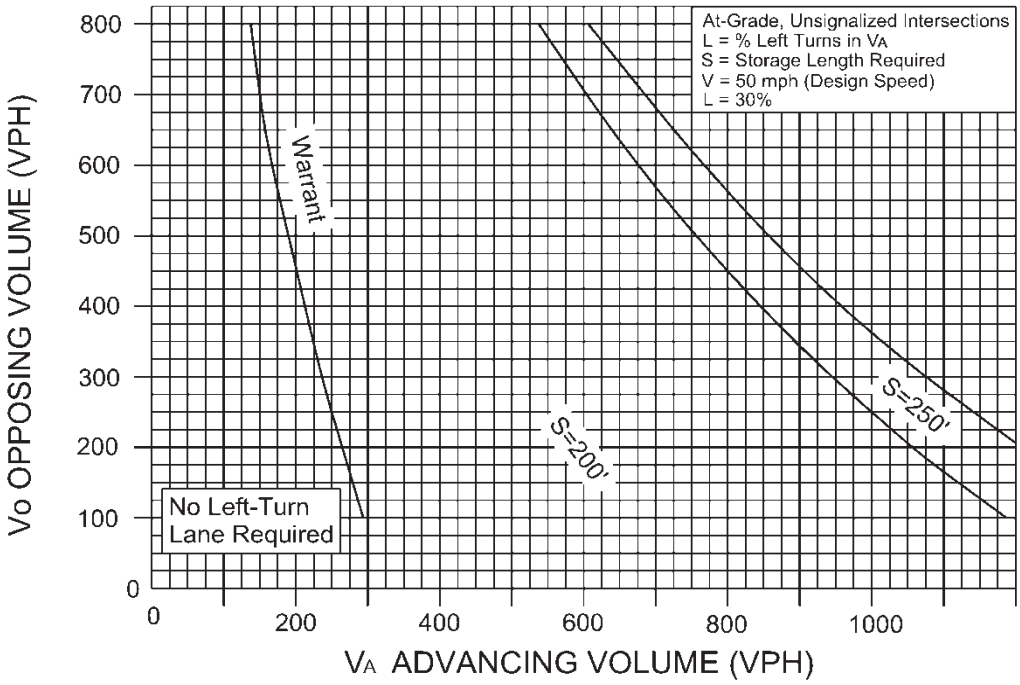


FIGURE 3-15

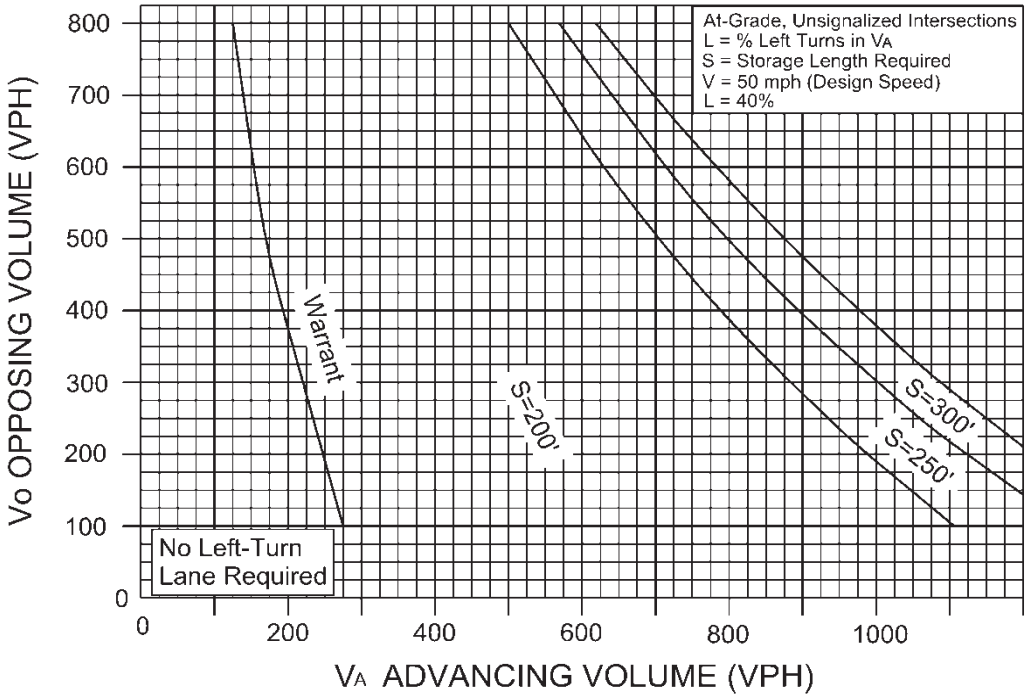


FIGURE 3-16

WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAY

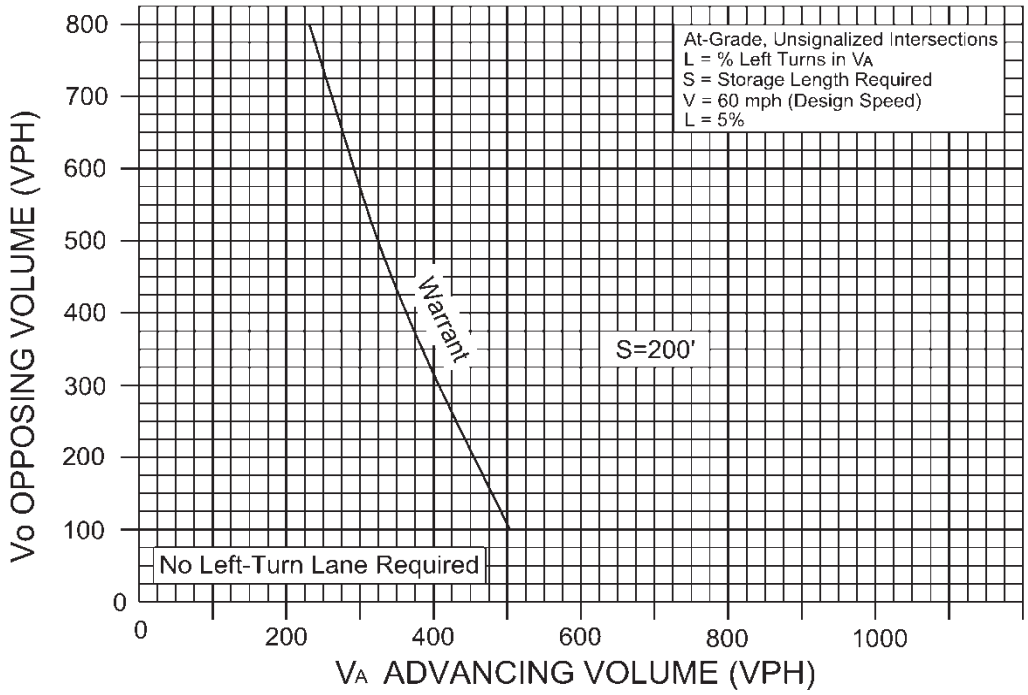


FIGURE 3-17

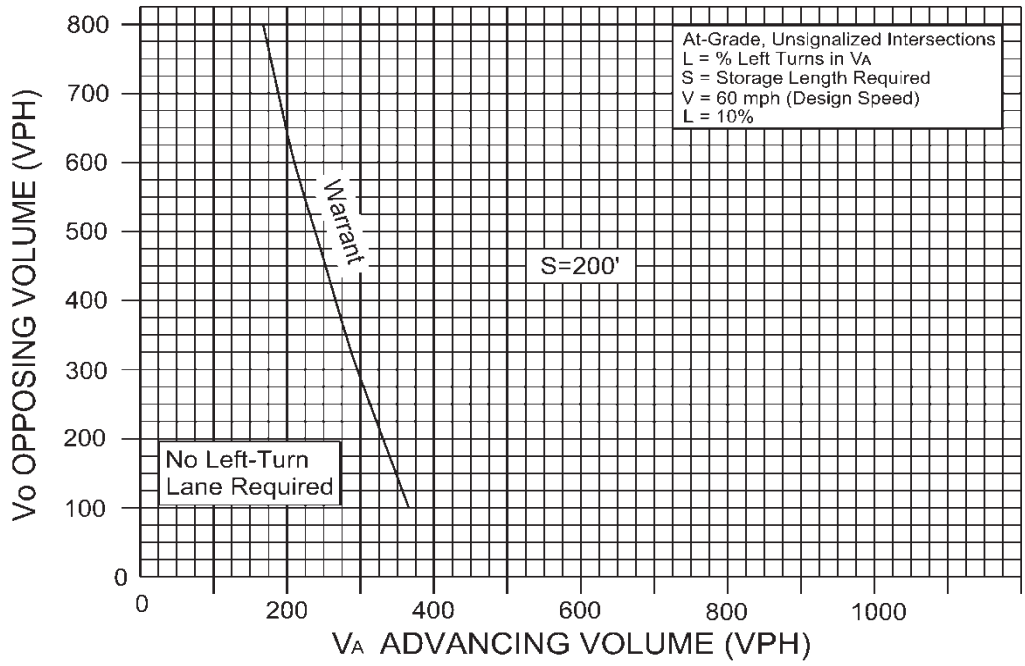


FIGURE 3-18

WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAY

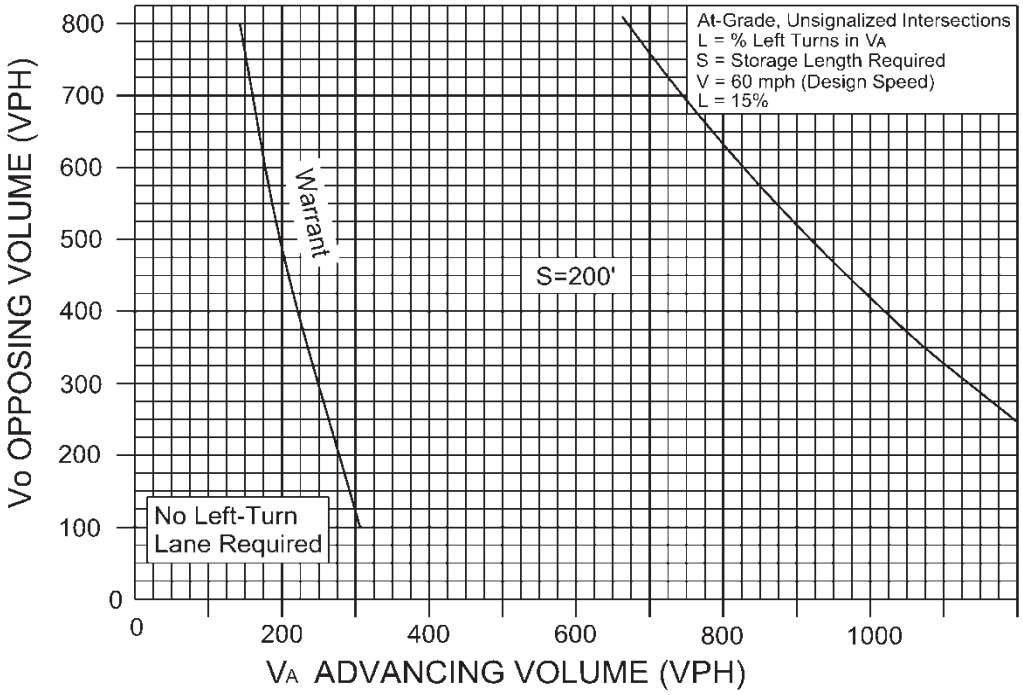


FIGURE 3-19

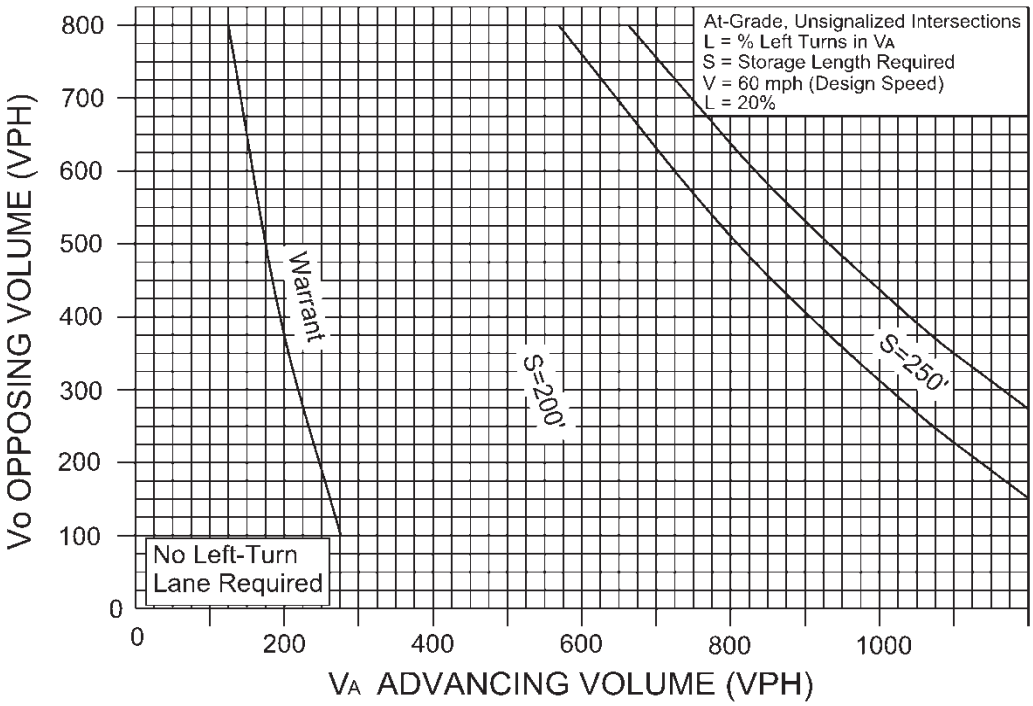


FIGURE 3-20

WARRANT FOR LEFT-TURN STORAGE LANES ON TWO-LANE HIGHWAY

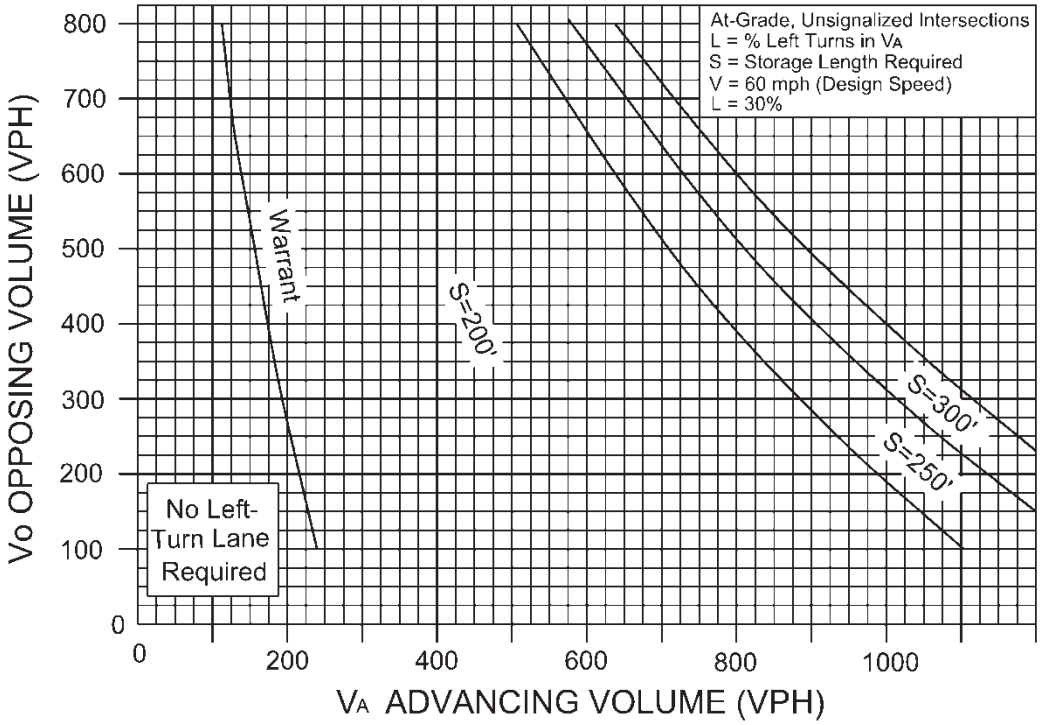


FIGURE 3-21

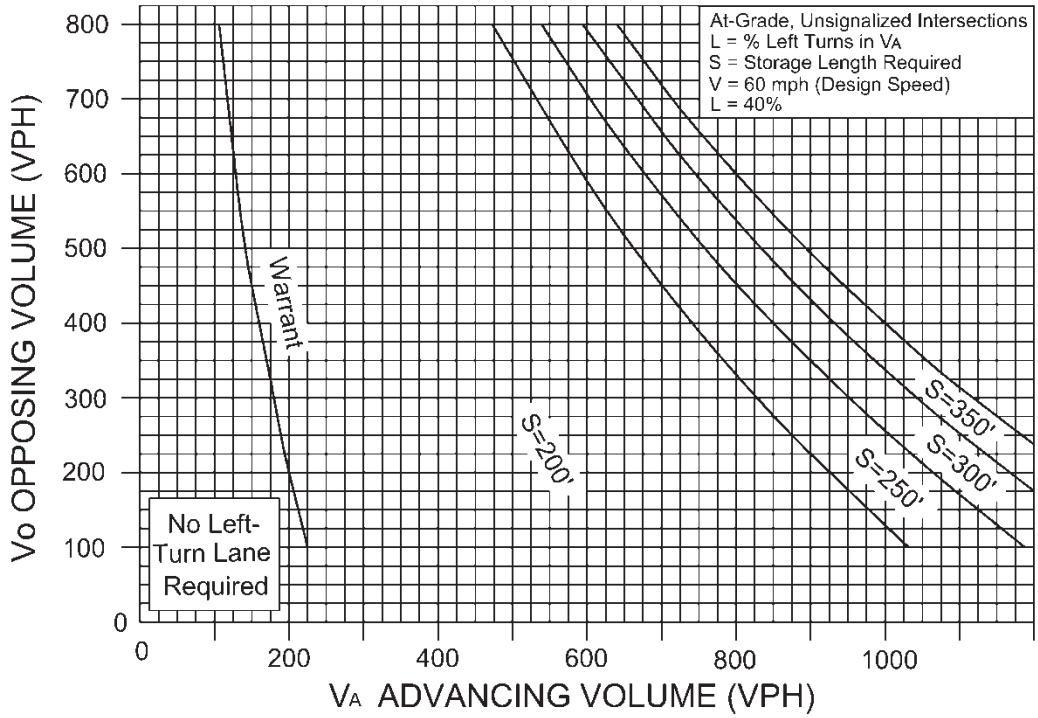
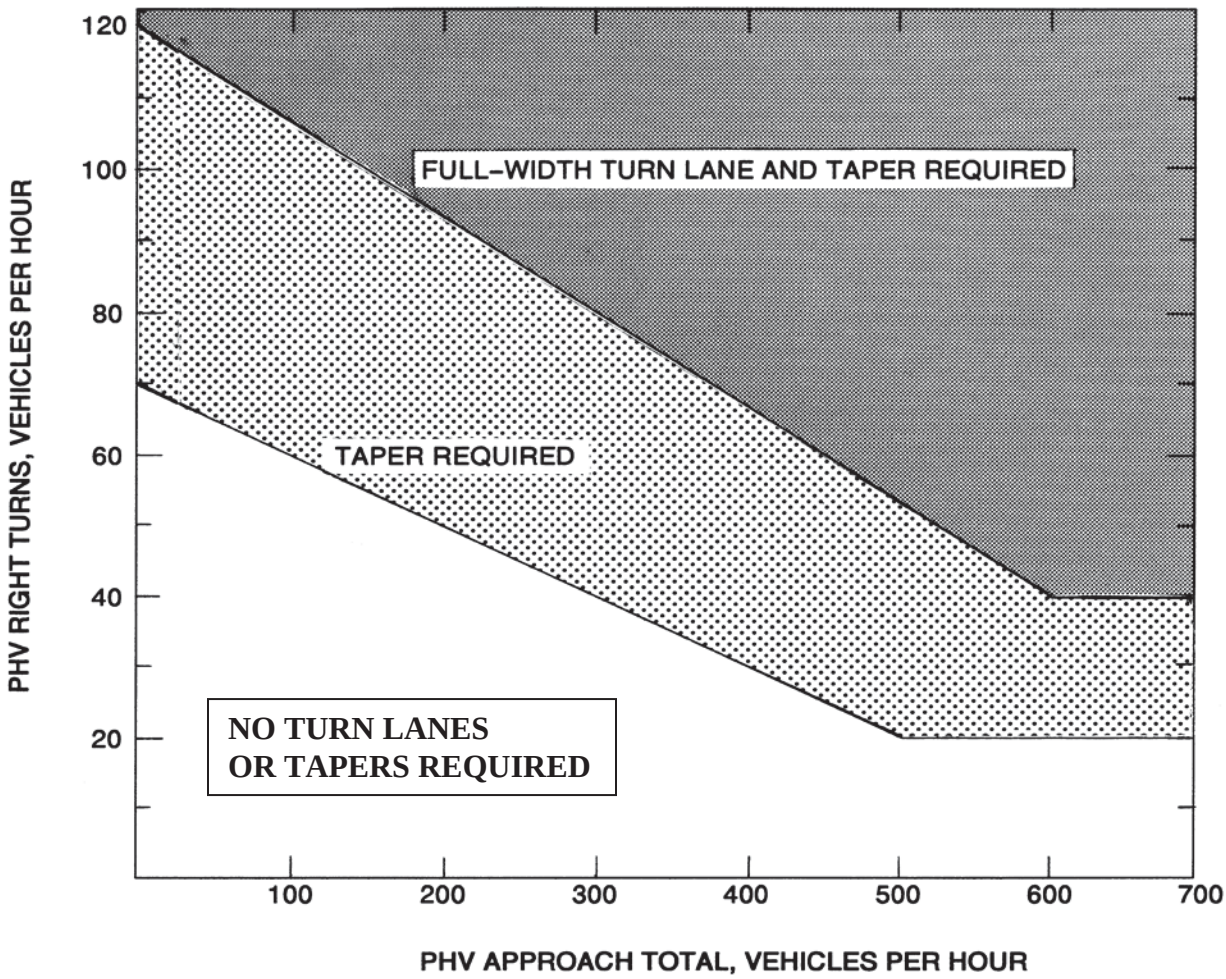


FIGURE 3-22



Appropriate Radius required at all Intersections and Entrances (Commercial or Private).

LEGEND

PHV - Peak Hour Volume (also Design Hourly Volume equivalent)

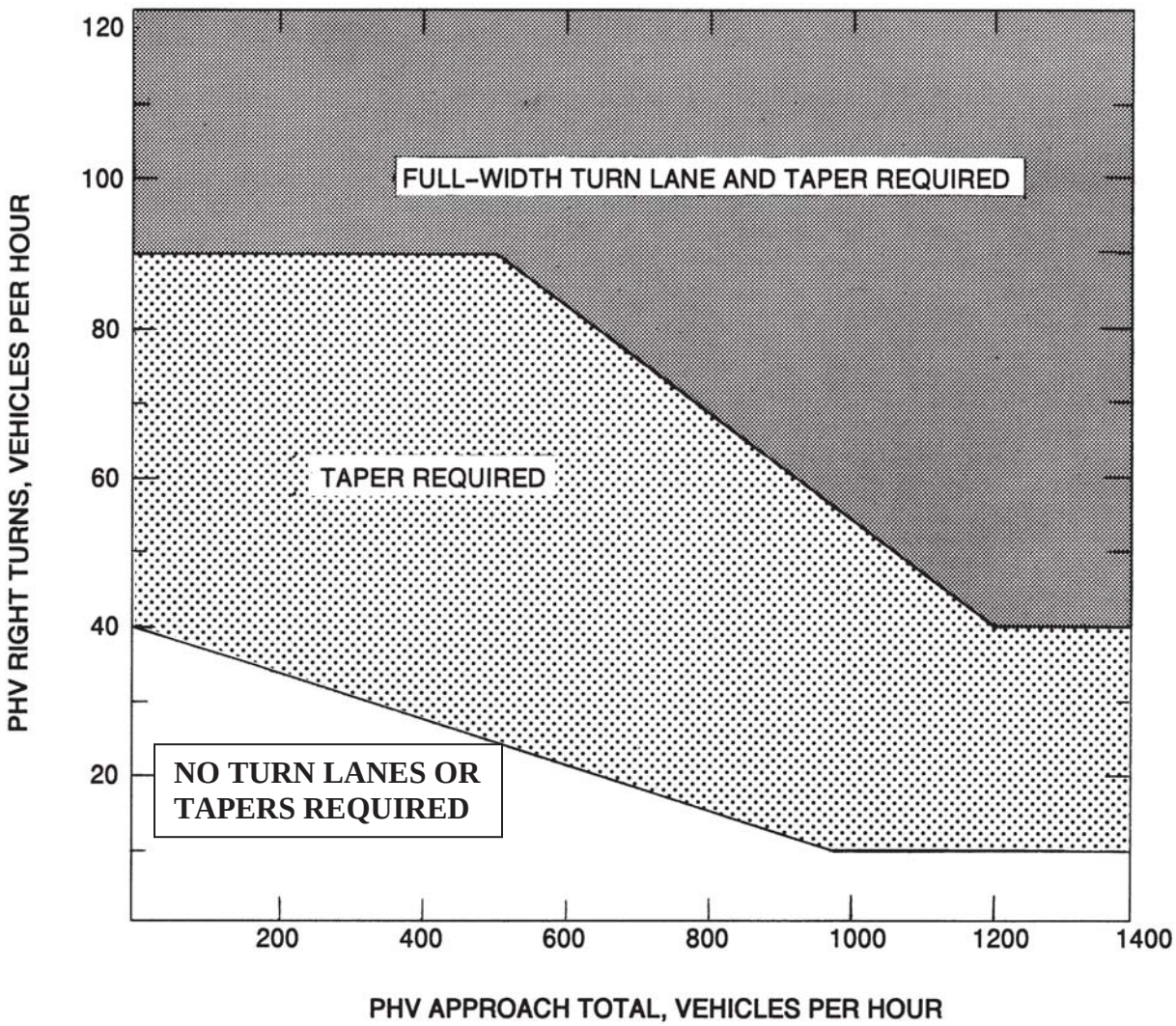
Adjustment for Right Turns

For posted speeds at or under 45 mph, PHV right turns > 40, and PHV total < 300.
Adjusted right turns = PHV Right Turns - 20
If PHV is not known use formula: PHV = ADT x K x D

K = the percent of AADT occurring in the peak hour
D = the percent of traffic in the peak direction of flow

Note: An average of 11% for K x D will suffice.

FIGURE 3-26 GUIDELINES FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)



Appropriate Radius required at all Intersections and Entrances (Commercial or Private).

LEGEND

PHV- - Peak Hour Volume (also Design Hourly Volume equivalent)

Adjustment for Right Turns

If PHV is not known use formula: PHV = ADT x K x D

K = the percent of AADT occurring in the peak hour
D = the percent of traffic in the peak direction of flow

Note: An average of 11% for K x D will suffice.

FIGURE 3-27 GUIDELINES FOR RIGHT TURN TREATMENT (4-LANE HIGHWAY)

APPENDIX I
AIR QUALITY ANALYSIS

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PREFACE TO APPENDIX I, AIR QUALIY ANALYSIS

Air quality analysis was conducted in 2012 to determine projected future emissions, including those from construction and operation activities. The Proposed Action of this Supplemental Draft EIS includes all of the same types of air emissions activities that were analyzed in the 2012 Draft EIS. Air emissions were analyzed, where applicable, based on proposed construction activities and operational emissions that would occur during full operation. The activities were estimated from alternatives concepts as they were being developed. Detail calculations of total construction activities have continued to evolve. Since Build Alternative 3 includes a smaller building footprint (no housing component, for example) and fewer fulltime employees than did Build Alternatives 1 and 2 presented in the 2012 Draft EIS, emissions would be expected to be less than those quantified and presented in this appendix. Therefore, the 2012 air quality analysis generally represents the air quality effects from Build Alternative 3.

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FOREIGN AFFAIRS SECURITY TRAINING CENTER
[FASTC]
An American Recovery and Reinvestment Act of 2009 Project

Environmental Impact Statement for Department of State Foreign Affairs Security Training Center at Nottoway County, Virginia

Air Quality Analysis- Technical Report

Final Report August 6, 2012

Prepared for: U.S. General Services Administration
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Philadelphia, PA 19107

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List of Acronyms and Abbreviations

ARNG	Army National Guard
CAA	Clean Air Act
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2e	CO_2 equivalent
DOS	Department of State
DPM	diesel particulate matter
DS	Bureau of Diplomatic Security
FASTC	Foreign Affairs Security Training Center
GHG	greenhouse gases
GSA	U.S. General Services Administration
HAPs	hazardous air pollutants
Pb	lead
LRA	Local Reuse Authority
MSATs	Mobile Source Air Toxins
NAAQS	National Ambient Air Quality Standards
NO_2	nitrogen dioxide
NO_x	nitrogen oxide
O_3	ozone
PM	particulate matter
SO_2	sulfur dioxide
U.S.	United States
USEPA	U.S. Environmental Protection Agency
VAARNG	Virginia Army National Guard
VOC	volatile organic chemical
WRAP	Western Regional Air Partnership

CHAPTER 1 INTRODUCTION

The United States (U.S.) General Services Administration (GSA) is proposing to acquire land and develop a U.S. Department of State (DOS), Bureau of Diplomatic Security (DS) Foreign Affairs Security Training Center (FASTC) in Nottoway County, Virginia. The proposed location is near the town of Blackstone within and adjacent to the Army National Guard (ARNG) Maneuver Training Center (MTC) Fort Pickett, which is operated by the Virginia Army National Guard (VAARNG). The development of FASTC would establish a consolidated training center from which DS may efficiently conduct training for a wide array of DS law enforcement and security disciplines to meet increased demand for well-trained personnel. Currently, DS training functions are conducted in 19 separate leased and contracted training facilities dispersed around the country. The proposed FASTC would consolidate training functions at one central facility.

1.1 PURPOSE AND NEED

The purpose of the proposed FASTC in Nottoway County is to consolidate existing dispersed training functions into a single suitable location to improve training efficiency and enhance training operations. The proposed FASTC is needed to meet the increased demand for well-trained security personnel. The consolidated center would provide training for 8,000-10,000 students per year. FASTC would include driving tracks, firing ranges, mock urban environments, explosives ranges, classrooms, simulation labs, a fitness center, administrative offices, dormitories, a dining hall, and emergency response facilities.

To accommodate these facilities, a minimum of 1,500 developable acres would be required for the programmatic needs and for appropriate safety buffers and security perimeters surrounding the facility. DOS also requires proximity to Washington, D.C., specifically a site within a four hour drive and 220 miles of DS headquarters in Arlington, Virginia.

1.2 DESCRIPTION OF ALTERNATIVES

The alternatives fully evaluated include no action as well as two build alternatives. The two build alternatives consist of varied layouts according to the programmatic requirements of the proposed FASTC facility with site designs that have potential to have the least environmental impact.

Under the No Action Alternative, the proposed FASTC would not be established and DOS would continue training operations at existing dispersed facilities. The parcels of land at Fort Pickett and Nottoway County being considered for the build alternatives would not be developed by GSA and DOS, and the existing air quality would remain unchanged.

Under Build Alternative 1, the training of domestic and overseas staff and students would occur at the site in hard skills and soft skills facilities proposed for ARNG MTC Fort Pickett Parcel 21/20 comprising approximately 570 acres, and Nottoway County's LRA Parcel 9 in Pickett Park, which encompasses 750 acres. Classrooms, administration buildings and dormitories would form a "Main Campus" that would be

centrally located on a plateau along the western boundary of the Parcel 21/20. Firing Ranges would be located in the east-central portion of Parcel 21/20, northeast of the Main Campus. Explosives Ranges would be located in the northern portion of Parcel 21/20. Access to the Explosives Ranges from the Firing Ranges and Main Campus is achieved with a combination of new roads and existing tank trails.

Build Alternative 2 includes all of the FASTC program elements that are included in Build Alternative 1, but the proposed sites would include Parcel 21/20, LRA Parcel 9 and also LRA Parcel 10, a 135 acre parcel also owned by Nottoway County. The major difference under Build Alternative 2 is the location of the Main Campus. Rather than be located on the 21/20 parcel, the Main Campus would be located on LRA Parcel 10, west of LRA Parcel 9 on West Entrance Road.

Build Alternative 1 and Build Alternative 2 would have identical air emissions and are analyzed together in this report as “Build Alternatives”

CHAPTER 2 DESCRIPTION OF EXISTING DATA/USE OF BEST AVAILABLE DATA

The data used for the air quality construction analysis were obtained from the following resources:

- FASTC_Building_List_by_Phase_12_20_11_w_pkg_2-9-2012. 2012. Cardno TEC, Inc.;
- FASTC IllustrativePlan_January_2012; and
- Updated Building Phasing Table dated 4-20-12.

Based on the data provided in these documents, assumptions for construction were derived and are listed in the Appendix A. Appendix A also contains calculations used for both construction and operations. Detailed construction assumptions are located in Appendix A, Tab G and identify where these references were used as resources for information.

Operational data were obtained using best engineering practices in conjunction with the following resources:

- FASTC Trip Gen 2-6-2012.xls;
- Noise Modeling Data Validation Package for FASTC EIS/MP;
- Firing Ranges.xls; and
- FASTC_Building_List_by_Phase_12_20_11_w_pkg_2-9-2012. 2012.

In addition, technical resources used to calculate air quality emissions can be found in Section 6, References.

CHAPTER 3 STANDARDS AND METHODS OF IMPACTS ANALYSIS

3.1 AIR QUALITY STANDARDS

3.1.1 National Ambient Air Quality Standards

Air quality is defined by ambient air concentrations of specific pollutants determined by the U.S. Environmental Protection Agency (USEPA) to be of concern related to the health and welfare of the general public and the environment and are widespread across the U.S. The primary pollutants of concern, called "criteria pollutants," include carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than or equal to 10 microns in diameter (PM_{10}), particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$), and lead (PB). Under the Clean Air Act (CAA), the USEPA has established National Ambient Air Quality Standards (NAAQS) (40 Code of Federal Regulations [CFR] Part 50) for these pollutants. These standards represent the maximum allowable atmospheric concentrations that may occur while ensuring protection of public health and welfare, with a reasonable margin of safety. Short-term standards (1-, 8-, and 24-hour periods) are established for pollutants contributing to acute health effects, while long-term standards (quarterly and annual averages) are established for pollutants contributing to chronic health effects. The Virginia Department of Environmental Quality has adopted the NAAQS, which are presented in Table 3.2-1.

Table 3.1-1 National Ambient Air Quality Standards

Pollutant	*Averaging Time*	*Primary Standards*	*Secondary Standards*
CO	8-hr 1-hr	9 ppm (10 mg/m^3) 35 ppm (40 mg/m^3)	None
Pb	Rolling 3-Month Average	0.15 µg/m^3	Same as Primary
NO_2	Annual (arithmetic average)	53 ppb	Same as Primary
	1-hr	100 ppb	None
PM_{10}	24-hr	150 µg/m^3	Same as Primary
$PM_{2.5}$	Annual (arithmetic average)	15.0 µg/m^3	Same as Primary
	24-hr	35 µg/m^3	Same as Primary
O_3	8-hr	0.075 ppm	Same as Primary
SO_2	Annual (arithmetic average)	0.03 ppm	None
	24-hr	0.14 ppm	None
	3-hr	None	0.5 ppm
	1-hr	75 ppb	None

Source: USEPA 2011
Notes: ppb – parts per billion; ppm – parts per million; mg/m^3– milligrams per cubic meter; µg/m^3 – micrograms per cubic meter

In addition to the ambient air quality standards for criteria pollutants, national standards exist for hazardous air pollutants (HAPs) which are regulated under Section 112(b) of the 1990 CAA Amendments. The National Emission Standards for Hazardous Air Pollutants (NESHAPs) regulate HAP emissions from stationary sources (40 CFR Part 61 and 63). HAPs emitted from mobile sources are called

Mobile Source Air Toxics (MSATs); these are compounds emitted from highway vehicles and non-road equipment that are known or suspected to cause cancer or other serious health and environmental effects. In 2001, USEPA issued its first MSAT Rule, which identified 21 compounds as being HAPs that required regulation. A subset of six of these MSAT compounds were identified as having the greatest influence on health and include benzene; 1,3-butadiene; formaldehyde; acrolein; acetaldehyde; and diesel particulate matter (DPM). In February 2007, USEPA issued a second MSAT Rule which generally supported the findings in the first rule and provided additional recommendations of compounds having the greatest impact on health. The rule also identified several engine emission certification standards that must be implemented.

Unlike the criteria pollutants, there are no NAAQS for benzene and other HAPs. The primary control methodologies instituted by federal regulation for MSATs involve technological improvements for reducing their content in fuel and altering engine operating characteristics to reduce the volume of pollutants generated during combustion.

3.1.2 Greenhouse Gases

Greenhouse Gases (GHGs) are gas emissions that trap heat in the atmosphere. These emissions occur from natural processes and human activities. Scientific evidence indicates a trend of increasing global temperature over the past century due to an increase in GHG emissions from human activities. The climate change associated with this global warming is predicted to produce negative economic and social consequences across the globe.

USEPA issued the Final *Mandatory Reporting of Greenhouse Gases Rule* on September 22, 2009. GHGs covered under the Final *Mandatory Reporting of Greenhouse Gases Rule* are CO_2, methane, and nitrous oxide, and hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride and other fluorinated gases including nitrogen trifluoride and hydrofluorinated ethers. Each GHG is assigned a global warming potential (GWP). The GWP is the ability of a gas or aerosol to trap heat in the atmosphere. The GWP rating system is standardized to CO_2, which has a value of one. For example, CH_4 has a GWP of 21, which means that it has a global warming effect 21 times greater than CO_2 on an equal-mass basis. The equivalent CO_2 rate is calculated by multiplying the emission of each GHG by its GWP and adding the results together to produce a single, combined emission rate representing all GHGs. Under the rule, suppliers of fossil fuels or industrial GHGs, manufacturers of mobile sources and engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions as CO_2 equivalent (CO_2e) are required to submit annual reports to USEPA.

On a national scale, federal agencies are addressing emissions of GHGs by reductions mandated in federal laws and Executive Orders. Most recently, Executive Order 13423 *Strengthening Federal Environmental, Energy, and Transportation Management,* and Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance,* were enacted to address GHGs, including GHG emissions inventory, reduction, and reporting.

GHG emissions occur locally, but GHG impacts are both global in scale and cumulative over time.

3.1.3 Regional Air Quality

Air quality in a given location is described by the concentration of various pollutants in the atmosphere. A region's air quality is influenced by many factors including the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. Pollutant emissions typically refer to the amount of pollutants or pollutant precursors introduced into the atmosphere by a source or group of sources. Pollutant emissions contribute to the ambient air concentrations of criteria pollutants, either by directly affecting the pollutant concentrations measured in the ambient air or by interacting in the atmosphere to form criteria pollutants. Primary pollutants, such as CO, SO_2, Pb, and some particulates, are emitted directly into the atmosphere from emission sources. Secondary pollutants, such as O_3, NO_2, and some particulates are formed through atmospheric chemical reactions that are influenced by meteorology, ultraviolet light, and other atmospheric processes.

3.2 AIR QUALITY IMPACT ANALYSIS METHODS

Air quality impacts were estimated for the two primary elements associated with the FASTC Build Alternatives: construction and operations. The following is a discussion of the assumptions, references, and methods used to perform the air emission estimate calculations.

3.2.1 Construction

Air quality impacts from proposed construction activities were estimated from (1) combustion emissions due to the use of fossil fuel-powered equipment; (2) fugitive dust emissions (PM_{10} and $PM_{2.5}$) during earth-moving activities, and the operation of equipment on bare soil; and (3) volatile organic chemical (VOC) emissions from application of asphalt materials during paving operations.

Factors needed to derive the construction source emission rates were obtained from *USEPA NONROAD 2008a Model* (EPA 2008a); *USEPA Motor Vehicle Emission Simulator (MOVES)* (EPA 2010); *Federal Greenhouse Gas Accounting and Reporting Guidance: Technical Support Document* (Council on Environmental Quality 2010); *Comparison of Asphalt Paving Emission Factors* (CARB 2005); *Western Regional Air Partnership* (*WRAP) Fugitive Dust Handbook* (WRAP 2004) and *Analysis of the Fine Fraction of Particulate Matter in Fugitive Dust* (MRI 2005).

The analysis assumed that all construction equipment was manufactured in 2010. This approach is based on the well-known longevity of diesel engines. The analysis also inherently reduced PM_{10} fugitive dust emissions from earth-moving activities by 50 percent as this control level is included in the emission factor itself in the form of wetting.

Productivity rates for equipment were derived from the 2012 National Construction Estimator, Craftsman Book Company.

Off-Road Equipment Emissions. The NONROAD model (EPA 2008a) is the EPA standard method for preparing emission inventories for mobile sources that are not classified as being related to on-road traffic, railroads, air traffic, or water-going vessels. As such, it is the starting place for quantifying emissions from construction-related equipment. The NONROAD model uses the following general

equation to estimate emissions separately for CO, nitrogen oxide (NOx), PM_{10}, $PM_{2.5}$, and total hydrocarbons, nearly all of which are non-methane hydrocarbons.

EMS = EF * HP * LF * Act * DF

Where:

EMS = estimated emissions

EF = emissions factor in grams per horsepower hours

HP = peak horsepower

LF = load factor (assumed percentage of peak horsepower)

Act = activity in hours of operation per period of operation

DF = deterioration factor

NONROAD2008a emissions factors assume a technology year of 2005 for the construction years. This includes a mix of Tier 0, Tier 1, and Tier 2 engines.

Default NONROAD2008a national equipment population for 2012 utilized for all activities as the assumed equipment population mix.

It is assumed that the equipment in use in 2012 is most likely the equipment in use in 2020. Heavy Duty Diesels typically have a 15 year service life.

Construction calculations were performed for the Build Alternatives.

Fugitive Dust. Emission rates for fugitive dust were estimated using guidelines outlined in the WRAP fugitive dust handbook (WRAP 2004) and AP-42, Volume 1, Section 13.2.2 (USEPA 1995). The methodology used in the WRAP Handbook assumes standard dust mitigation best practices activities of 50 percent from wetting. The WRAP handbook offers several options for selecting factors for PM_{10} (coarse PM) depending on what information is known.

After PM_{10} is estimated, the fraction of fugitive dust emitted as $PM_{2.5}$ is estimated, the most recent WRAP study (MRI 2005) recommends the use of a fractional factor of 0.10 to estimate the $PM_{2.5}$ portion of the PM_{10}. The WRAP factors were used to estimate fugitive dust emissions from land disturbance activities.

For site preparation activities, the emission factor was obtained from Table 3-2 of the WRAP Fugitive Dust Handbook. The areas of disturbance and approximate durations were used, resulting in the selection of the first factor with worst-case conditions for use in the analysis.

VOC Emissions from Paving. VOC emissions from the application of hot mix asphalt were calculated for the construction of the roads and tracks. The estimates used the published CARB hot mix asphalt emission factor.

Construction Workers – Mobile Sources. Mobile source emissions were calculated for construction workers for each of the construction years. These emissions assumed that each worker drove their own car or participated in a carpool. The average mileage driven each workday is assumed to be 80 miles

round trip for workers coming from the Richmond/Petersburg, VA area. Emission factors were derived from the USEPA MOVES mobile emissions model for the years 2004 -2019.

3.2.2 Operations

Operations evaluated for air emissions include emissions from emergency generators, boilers, ordnance detonation, instructors and staff personally owned vehicles and vehicles used on the tracks.

Generator Emissions. Seven generators, ranging from 13 kilowatt (kW) to 700 kW would run diesel fuel for up to 146 hours per year, total. To calculate emissions, factors from AP-42, Volume 1, Section 3.3, *Gas and Diesel Industrial Engines* and Section 3.4, *Large Stationary Diesel and All Stationary Dual-fuel Engines* were used with an assumed load factor of 50 percent.

Boiler Emissions. Eighteen boilers, ranging from 0.18 to 3.35 thousand British thermal units (BTU)/hr would provide hot water and heat to the buildings. To calculate emissions, factors from AP-42, Volume 1, Section 1.3, *Fuel Oil Combustion* were used.

Ordnance Detonation Emissions. Ordnance detonation would include both firing ranges and explosives. Emissions factors from AP-42, Volume 1, Section 15.1, *Small Cartridges <30 millimeter* were used for firing range ordnance. VOCs are not included in AP-42 emissions factors for ordnance and therefore are not calculated. Explosives proposed primarily consist of C2 and C4 detasheets, with very small amounts of black power and flash bangs. Detasheet is a proprietary flexible rubberized explosive, somewhat similar to plastic explosives, originally manufactured by DuPont. It is now manufactured by another company, and the ingredients are primarily pentaerythritol (PETN) (>60%) with nitrocellulose and a binder. Detonation of these explosive materials generates carbon monoxide. It has been estimated that on average approximately 297 pounds of carbon monoxide are released for every ton of PETN detonated (EPA 1995). The quantity of Detasheet proposed for use at FASTC would be less than 350 pounds a year. Thus the amount of CO and any other minor constituent that would be released would only total a few pounds per year. Emissions from explosives detonation are therefore negligible and are not further quantified.

Personally Owned Vehicles and Shuttle Emissions – Mobile Sources. Mobile source emissions were calculated for instructors, staff and students. These emissions assumed that instructors and staff drove their own car or participated in a carpool. The average mileage driven each workday ranges from 40 to 45 miles round trip. Students were assumed to drive their own cars only to the site at the beginning and end of each training session or arrive on a shuttle. During the training sessions, students were assumed to arrive on site using shuttles and be transported from dorms on shuttles. Emission factors were derived from the USEPA MOVES mobile emissions model for the years 2006-2019.

Track Emissions – Mobile Sources. Mobile source emissions were calculated for the training tracks. These emissions assumed that the tracks operate 250 days a year. Cars were assumed on paved tracks and sports utility/pickups were assumed on unpaved tracks. Emission factors were derived from the USEPA MOVES mobile emissions model for the years 1987-2016.

FASTC operation emissions would come from mobile sources, generators and boilers. Mobile source emissions would include commuters from northern Virginia/DC, staff commuting to work from within

the regional area, students commuting onsite from local hotels, and from training activities such as ordnance detonation and operation of the driver training courses. Assumptions used in the analysis of operational emissions are as follows:

- The generators would run 0.5 hours per week for testing and maintenance and 120 hours a year for power outages;
- The generators would supply power for 25 percent of the building load at 8 watts per square foot (SF) for buildings A10 and S04, at 10 watts per SF for building A07, and at 4 watts per SF for building S01;
- The generators would supply power for 100 percent of the building load at 80 watts per SF for building I07;
- The generators would run at 50 percent load;
- The boilers would provide heating and hot water, 10 hours per day from October 15 through April 14 and hot water only 2 hours per day April 15 through October 14 for buildings A01, I07, S04, A02, A03, and R06;
- Boilers in the dormitories, A06a, A06b, A06c, A06d, A06e, A06f would provide heating and hot water, 10 hours per day from October 15 through April 14 and hot water only 5 hours per day April 15 through October 14;
- The boiler in the dining facility, A07 would provide heating and hot water, 10 hours per day from October 15th through April 14 and hot water only 6 hours per day April 15 through October 14;
- Boilers were sized at 20 BTU per SF for buildings A01, S04, A02, and A03; 30 BTU per SF for building A07, 10 BTU per SF for building I07, 25 BTU per SF for buildings A06a, A06b, A06c, A06d, A06e, and A06f, and 15 BTU per SF for building R06.
- Ninety percent of the instructors and support staff would live within 50 miles of the site.
- In Phase 1, some students would be housed in local hotels and transported daily to the site using 25-passenger shuttle buses. At full operation, 250 students would be housed at local hotels and transported daily to the site using 10-12, 25-passenger shuttle buses and 450 students would be housed at the site in dormitories. Students staying in the dormitories would arrive to the site on Sunday and depart on Friday; 60 percent would be bused and 40 percent would use their personal vehicles.
- Driver training tracks would be expected to be used 250 days per year.

CHAPTER 4 EXISTING CONDITIONS

The study area for the air quality analysis includes the Central Virginia Intrastate Air Quality Control Region which is defined in 40 CFR Part 81.143, and comprises several counties, including Brunswick, Lunenburg and Nottoway counties along with associated towns and cities. Air quality in the study area is considered good, and the study area designated as unclassifiable, attainment, or better than national standards for all criteria pollutants (40 CFR 81.347). Because the study area is in attainment for all criteria pollutants, the CAA General Conformity Rule (40 CFR Parts 51 and 93) does not apply and is not addressed in this air quality analysis.

The area is characterized by a rural economy. One of the largest employers is Fort Pickett. Service and logging are two of the economic sectors that predominate in the region, with few sizeable industries. For this reason, the area does not have a significant number of stationary sources of air pollution. Only Interstate 85, which runs southwest of Petersburg, is within reasonable proximity of the area and the lack of high speed transportation routes impacts the viability of manufacturing growth. Many of the residents are either employed in small businesses or commute to other areas to work. Both Lunenburg and Brunswick Counties have substantial numbers of residents who commute outside of the localities to work (VEC 2012). Nottoway County has a similar number of individuals commuting into the area and commuting out of the area for work, primarily due to the number of individuals who work at Fort Pickett (VEC 2012b,c).

CHAPTER 5 IMPACT ANALYSIS RESULTS

This section provides a description of the impacts associated with implementation of the Build and No Action Alternatives. The analysis evaluates projected future emissions, including construction and operations, to determine potential impacts. Air quality impacts would be significant if emissions associated with the Build Alternative would: 1) increase ambient air pollution concentrations above the NAAQS, 2) impair visibility within federally-mandated Prevention of Significant Deterioration Class I areas, 3) result in the potential for any stationary source to be considered a major source of emissions as defined in 40 CFR Part 52.21 (total emissions of any pollutant subject to regulation under the CAA that is greater than 250 tons per year for attainment areas), or 4) for mobile source emissions, result in an increase in emissions to exceed 250 tons per year for any pollutant.

Pollutants considered in this analysis include the criteria pollutants. Airborne emissions of Pb are only evaluated for ordnance detonation because the only Pb emission source associated with the Build Alternatives is the firing ranges.

For criteria pollutant emissions, 250 tons per year per pollutant was used as a comparative analysis threshold. This value is used by the USEPA in their New Source Review standards as an indicator for impact analysis for listed new major stationary sources in attainment areas. No similar regulatory threshold is available for mobile source emissions, which are the primary sources for the construction phases, and also a component of operational emissions for the Build Alternatives. Lacking any mobile source emissions thresholds, the 250 tons per year major stationary source threshold was used to equitably assess and compare mobile source emissions.

Pollutants would be generated by numerous sources, including diesel exhaust from construction equipment, gasoline exhaust from the driving tracks and operations such as generators and boilers. In general, VOC, CO, NO_x, and SO_2 emissions are primarily generated by diesel-fueled heavy equipment operating in construction areas. Particulate matter emissions, in the form of PM_{10} and $PM_{2.5}$ are primarily due to fugitive dust created by land disturbance activities, which include land clearing, soil excavation, cutting, filling, trenching, and grading. The fugitive dust emission factor for PM_{10}, which is used as part of the $PM_{2.5}$ calculation (MRI 2005), is assumed to include the effects of typical control measures such as routine site watering for dust control. A dust control effectiveness of 50 percent is assumed, based on the estimated control effectiveness of watering (WRAP 2004). Other sources of emissions include diesel emissions from heavy construction equipment and tailpipe emissions from construction worker personally owned vehicles. Because of the rural nature of the site and the level of development, the emissions associated with construction workers commuting to the area to work were included in the analysis.

MSATs would be the primary HAPs emitted by vehicles during construction and operations. The equipment used during construction would likely vary in age and have a range of pollution reduction

effectiveness. Construction equipment, however, would be operated intermittently over a large area and would produce negligible ambient HAPs in a localized area. Operational equipment, including vehicles driven by commuters, is anticipated to be primarily newer equipment (post-2010 model year) that generate lower emissions and would also produce negligible ambient HAPs. Therefore MSAT emissions are not considered further in this analysis.

Air emissions were analyzed, where applicable, based on construction activities that would be required in order to implement the Build Alternatives and the operational emissions for FASTC once it would be fully built out and implemented.

5.1 BUILD ALTERNATIVES CONSTRUCTION

Emissions from construction would include combustion emissions due to use of fossil fuel-powered equipment and fugitive dust emissions (PM_{10} and $PM_{2.5}$) during clearing, demolition activities, earth moving activities, and operation of equipment on bare soil. Construction would occur throughout the period 2014-2020 and would be segmented into three phases, with most construction activity occurring in Phase 1. Design of the proposed FASTC has not yet been initiated and the final phasing plan would continue to be developed as part of the master planning process; therefore, the actual phasing scenario may vary. Table 5.1-1 presents the primary construction activities that would utilize heavy duty diesel equipment for the Build Alternatives, by phase.

Table 5.1-1 Construction Activity Estimates for FASTC Build Alternatives

Phase	Clearing (AC)	Grading (SF)	Building Demolition (SF)	Asphalt-Concrete Demo (SF)	Building Construction (SF)	Paving (SF)
Phase 1	736	8,836,808	98,828	580,304	1,042,088	4,361,628
Phases 2 & 3	244	1,283658	8,732	28,776	1,234,603	244,976

Table 5.1-2 presents the construction emission estimates for the Build Alternatives, by year.

Table 5.1-2 Construction Emission Estimates for FASTC Build Alternatives

Year	VOC tons/yr	CO tons/yr	NO_x tons/yr	SO_2 tons/yr	PM_{10} tons/yr	$PM_{2.5}$ tons/yr
2014	2.93	36.34	35.00	0.77	148.11	16.53
2015	2.91	34.71	34.85	0.77	148.12	16.54
2016	3.49	54.44	44.82	0.97	153.83	17.50
2017	4.16	69.29	55.79	1.21	182.36	20.76
2018	1.27	35.44	21.01	0.44	34.25	4.29
2019	0.69	15.61	11.15	0.24	28.55	3.33
2020	0.69	15.12	11.13	0.24	28.54	3.32
Significance Threshold	250	250	250	250	250	250

Fugitive dust from land disturbance activities would be the primary source of emissions during construction. Most fugitive dust emissions would occur during Phase 1, which would involve disturbance of over 1,100 acres. PM_{10} emissions are estimated using wetting to reduce dust release by 50 percent. PM_{10} emissions are predicted to be greatest in 2017, at 182.36 tons per year. These emissions however, would remain well below the significance threshold of 250 tons per year. Construction emissions would not have a significant impact on the region's air quality.

5.2 BUILD ALTERNATIVES OPERATIONS

Table 5.2-3 presents the annual emission estimates for FASTC during the years 2017-2020, when both construction and operations are ongoing. Operational activities included in this table are the commuter traffic as well as track operation, both of which would be phased in over time with increasing activity as the bulk of the FASTC complex becomes operational. Boiler and emergency generator operations have been included at 100 percent beginning in 2017 even though the entire complex is not complete at that time, as it has not been determined exactly when each building that would include these sources would become operational. The stationary sources, however, represent the smallest segment of operational emissions and so inclusion of all boiler and emergency generators for the period 2017-2019 provides a maximum emissions scenario for those years.

Table 5.2-3 Emission Estimates for FASTC, 2017-2020 (Construction and Operations)

Year	VOC tons/yr	CO tons/yr	NO_x tons/yr	SO_2 tons/yr	PM_{10} tons/yr	$PM_{2.5}$ tons/yr
2017	4.85	117.93	65.34	19.27	183.26	21.06
2018	2.05	92.67	31.34	18.50	35.20	4.63
2019	1.49	84.74	20.86	18.32	19.58	3.74
2020	1.55	92.11	21.22	18.33	29.62	3.78
Significance Threshold	250	250	250	250	250	250

Table 5.2-4 presents the annual emissions based on full build out, beginning in 2020. All of the criteria pollutant emissions remain well below the significance threshold of 250 tons per year. The carbon dioxide equivalent GHG emissions for the stationary sources would be well below the 25,000 metric tons (tonnes) per year threshold established by the Mandatory Greenhouse Gas Reporting Rule. Based on the emission estimates, operation of the FASTC complex would not have a significant impact on the local or regional air quality.

Table 5.2-4 Annual Operational Emission Estimates for FASTC

	VOC Tons/yr	CO Tons/yr	NO_x Tons/yr	SO_2 Tons/yr	PM_{10} Tons/yr	$PM_{2.5}$ Tons/yr	Pb Tons/yr	CO_2e Tonnes/yr
Stationary Sources								
Emergency Generators	0.07	0.30	0.99	0.01	0.06	< 0.04	0	54.67
Boilers	0.14	1.27	5.07	18.01	0.51	< 0.04	0	5,151.72
Ordnance detonation	ND	1.73	0.07	0.03	0.12	0.10	0.5	0.00
Subtotal	***0.21***	***3.30***	***6.13***	***18.05***	***0.69***	***0.10***	***0.5***	***5,206***
Mobile Sources (Commuters and Track Operations)								
2020 +	0.66	73.68	3.97	0.05	0.38	0.35	0	2,925
Grand Total	**0.87**	**76.98**	**10.10**	**18.10**	**1.07**	**1.45**	**0.5**	**8,131**
Significance Threshold	250	250	250	250	250	250	250	25,000

Notes: ND = No data, VOCs are not assessed in the reference for ordnance (AP-42).

The proposed boilers are all less than 10,000,000 BTU/hr and therefore are exempt from permitting per 9 VAC 5-80-1320.B.b. The emergency generators are exempt from permitting per 9 VAC 5-80-1320.B.2.b, provided hours of operation are kept below 500 hours per year.

5.3 NO ACTION ALTERNATIVE

Under the No Action Alternative, FASTC would not be developed; therefore, none of the construction or operational emissions would occur.

CHAPTER 6 REFERENCES

Blue Ridge Research and Consulting. 2012. Noise Modeling Data Validation Package for FASTC EIS/MP. February.

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APPENDIX A ASSUMPTIONS AND CALCULATIONS

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List of Assumptions

Air quality impacts were estimated for the two primary elements associated with the Foreign Affairs Security Training Center (FASTC) proposed actions: construction and operations. The following is a discussion of the assumptions, references, and methods used to perform the air emission estimate calculations.

GENERAL PROJECT ASSUMPTIONS

- Build Alternatives Illustrative Plan dated January 2012 was used to derive project area metrics
- Alternatives are assumed to have the same air emissions since both alternatives will require the construction of the same facilities just at different locations within the area.
- Phasing assumptions were derived from spreadsheet dates 2-9-2012 and updated phasing table dated 5-4-2012.
- Phase 1 (2014-2017) – 736 acres cleared/1,042,088 SF of buildings constructed/4,361,628 SF paved
- Phase 2 (2016-2018) -12 acres cleared/527415 SF of buildings constructed/48720 SF paved
- Phase 3 (2017-2020) – 232 acres cleared/707,189 SF of buildings constructed/ 196,254 SF paved
- All D06 area parking was proposed as surface parking in the January 2012 alternatives and there was no parking garages proposed.

CONSTRUCTION ASSUMPTIONS

- Air quality impacts from proposed construction activities were estimated from (1) combustion emissions due to the use of fossil fuel-powered equipment; (2) fugitive dust emissions (PM_{10} and $PM_{2.5}$) during earth-moving activities, and the operation of equipment on bare soil; and (3) VOC emissions from application of asphalt materials during paving operations.

- Factors needed to derive the construction source emission rates were obtained from *USEPA NONROAD 2008a Model* (EPA 2008a); *USEPA Motor Vehicle Emission Simulator (MOVES)* (EPA 2010); *Federal Greenhouse Gas Accounting and Reporting Guidance: Technical Support Document* (CEQ 2010); *Comparison of Asphalt Paving Emission Factors* (CARB 2005); *WRAP Fugitive Dust Handbook* (WRAP 2004) and *Analysis of the Fine Fraction of Particulate Matter in Fugitive Dust* (MRI 2005).

- The analysis assumed that all construction equipment was manufactured in 2010. This approach is based on the well-known longevity of diesel engines. The analysis also inherently reduced PM_{10} fugitive dust emissions from earth-moving activities by 50 percent as this control level is included in the emission factor itself in the form of wetting.

- Productivity rates for equipment were derived from the 2012 National Construction Estimator, Craftsman Book Company.

General Construction Assumptions

<u>Construction Numbers Used in Formulas</u>

- Building Excavation Depth = 3 feet
- Parking area excavation = 0.333333333 feet (4 inches gravel)
- Parking area gravel = 0.333333333 feet (4 inches gravel)
- Asphalt pavement thickness = 0.333333333 feet (4 inches)
- Gravel thickness beneath bldgs = 0.5 feet (6 inches)
- Concrete slab beneath bldgs = 0.5 feet (6 inches)
- Concrete for sidewalks, etc. = 0.333333333 feet (4 inches)

- Road excavation depth = 3 feet

Demolition

- All buildings assumed to be single story.
- Existing building square footage demolished determined using Constraints Map November 2010 and Google Earth.
- Existing sidewalk square footage demolished determined using Constraints Map November 2010 and Google Earth.
- Road demolition determined using FASTC Traffic Study for EIS, Figures 2 and 3 and Google Earth.

Building Clearing & Grading Areas

- Area to be cleared = the building foundation footprint plus the area of any associated parking lot, with an additional 50 foot buffer around the total area.
- Relative building and lot sizes have been determined from the file IllustrativePlan_January_2012
- The area to be graded = the building footprint plus the parking lot area, not the total cleared area.

Parking Areas

- Parking spaces =220 SF
- Parking lanes =12 ft wide

Sidewalks

- Sidewalk area = 10% of building footprint area

Roads and Tank Trail

- New roads – 11,400 LF x 24 ft wide, 2-lanes.
- Relocated Tank Trail – 7,200 LF x 24 ft wide
- 6 ft wide, gravel shoulders
- Additional 12 ft clearing for slope adjustments
- Additional 6t drainage ditch for 50% of roads

Drive Tracks

- High Speed Driving Course Assumptions (shoulder, drainage and clearing assumptions are same as for roads)
    - Track 1 = 21400 LF
    - Track 2 = 27520 LF
    - Track 3 = 18240 LF
- Mock Urban Driving Track
    - 6.3 miles of track
    - 10 parking spaces
    - Track will be 24 ft wide for 50% (3.15 miles) and 36 ft wide for 50% (3.15 miles)
- Unimproved Road Driving Course (shoulder, drainage and clearing assumptions are same as for roads)
    - 2.6 miles of course
- Off-Road Driving Course (shoulder, drainage and clearing assumptions are same as for roads)
    - 2.4 miles of course

Explosives Simulation Alley

- 9,600 linear feet of road (see Roads Assumptions)

Explosives Demonstration Range & Post Blast Training Range

- An area with a 500 foot radius will be completely cleared and graded in the center of the range
- An additional 300 meter exclusion/safety zone ring will be cleared

Baffled Outdoor Tactical Combat Range

- Would be constructed in Phase I

Off-Road Equipment Emissions. The NONROAD model (EPA 2008a) is the EPA standard method for preparing emission inventories for mobile sources that are not classified as being related to on-road traffic, railroads, air traffic, or water-going vessels. As such, it is the starting place for quantifying emissions from construction-related equipment. The NONROAD model uses the following general equation to estimate emissions separately for CO, NOx, PM10, PM2.5, and total hydrocarbons (THC), nearly all of which are NMHC1:

EMS = EF * HP * LF * Act * DF

Where:

EMS = estimated emissions

EF = emissions factor in grams per horsepower hours

HP = peak horsepower

LF = load factor (assumed percentage of peak horsepower)

Act = activity in hours of operation per period of operation

DF = deterioration factor

NONROAD2008a emissions factors assume a technology year of 2005 for the construction years. This includes a mix of Tier 0, Tier 1, and Tier 2 engines.

Default NONROAD2008a national equipment population for 2012 utilized for all activities as the assumed equipment population mix.

It is assumed that the equipment in use in 2012 is most likely the equipment in use in 2020. Heavy Duty Diesels typically have a 15 year service life.

Construction calculations were performed for each of the relevant proposed actions.

Fugitive Dust. Emission rates for fugitive dust were estimated using guidelines outlined in the Western Regional Air Partnership (WRAP) fugitive dust handbook (WRAP 2004) and AP-42, Volume 1, Section 13.2.2. The methodology used in the WRAP Handbook assumes standard dust mitigation best practices activities of 50 percent from wetting. The WRAP handbook offers several options for selecting factors for PM_{10} (coarse PM) depending on what information is known.

After PM_{10} is estimated, the fraction of fugitive dust emitted as $PM_{2.5}$ is estimated, the most recent WRAP study (MRI 2005) recommends the use of a fractional factor of 0.10 to estimate the $PM_{2.5}$ portion of the PM_{10}. The WRAP factors were used to estimate fugitive dust emissions from land disturbance activities.

For site preparation activities, the emission factor was obtained from Table 3-2 of the WRAP Fugitive Dust Handbook. The areas of disturbance and approximate durations were used, resulting in the selection of the first factor with worst-case conditions for use in the analysis.

VOC Emissions from Paving. VOC emissions from the application of hot mix asphalt were calculated for the construction of the roads and tracks. The estimates used the published CARB hot mix asphalt emission factor.

Construction Workers – Mobile Sources. Mobile source emissions were calculated for construction workers for each of the construction years. These emissions assumed that each worker drove their own car or participated in a carpool. The average mileage driven each workday is assumed to be 80 miles round trip for workers coming from the Richmond/Petersburg VA area. Emission factors were derived from the USEPA MOVES mobile emissions model for the years 2004 -2019.

- 2014 Construction workers - 191 vehicles/80 miles per day/240 days
- 2015 Construction workers - 191 vehicles/80 miles per day/240 days
- 2016 Construction workers - 353 vehicles/80 miles per day/240 days
- 2017 Construction workers - 479 vehicles/80 miles per day/240 days
- 2018 Construction workers - 287 vehicles/80 miles per day/240 days
- 2019 Construction workers - 125 vehicles/80 miles per day/240 days
- 2020 Construction workers - 125 vehicles/80 miles per day/240 days

OPERATIONS ASSUMPTIONS

Operations evaluated for air emissions include emissions from emergency generators, boilers, ordnance detonation, instructors and staff POVs and vehicles used on the tracks.

Generator Emissions. Seven generators, ranging from 13 kW to 700 kW would run diesel fuel for up to 146 hours per year, total. To calculate emissions, factors from AP-42, Volume 1, Section 3.3, *Gas and Diesel Industrial Engines* and Section 3.4, *Large Stationary Diesel and All Stationary Dual-fuel Engines* were used with an assumed load factor of 50%.

Boiler Emissions. Eighteen boilers, ranging from 0.18 to 3.35 MMBtu/hr would provide hot water and heat to the buildings. To calculate emissions, factors from AP-42, Volume 1, Section 1.3, *Fuel Oil Combustion* were used.

Ordnance Detonation Emissions. Ordnance detonation would include both firing ranges and explosives. Emission factors were not available for the explosives. Emissions factors from AP-42, Volume 1, Section 15.1, *Small Cartridges <30 mm* were used.

- Small arms fire – 190,000 rounds/year

POV and Shuttle Emissions – Mobile Sources. Mobile source emissions were calculated for instructors, staff and students. These emissions assumed that instructors and staff drove their own car or participated in a carpool. The average mileage driven each workday ranges from 40 to 45 miles round trip. Students were assumed to drive their own cars only to the site at the beginning and end of each training session or arrive on a shuttle. During the training sessions students were assumed to arrive on site using shuttles and be transported from dorms on shuttles. Emission factors were derived from the USEPA MOVES mobile emissions model for the years 2006-2019.

- 2017 Instructors & staff - 435 vehicles/40-45 miles per day/240 days
    - Student Hotel Shuttle - 11 vehicles/40 miles per day/240 days
- 2018 Instructors & staff - 627 vehicles/40-45 miles per day/240 days
    - Student Hotel Shuttle - 11 vehicles/40 miles per day/240 days
- 2019 Instructors & staff - 820 vehicles/40-45 miles per day/240 days
    - Student Hotel Shuttle - 11 vehicles/40 miles per day/240 days
- 2020 Instructors & staff – 1,012 vehicles/40-45 miles per day/240 days
    - Student Hotel Shuttle - 11 vehicles/40 miles per day/240 days
    - Student Dorm Bus - 11 vehicles/5 miles per day/240 days
    - Student POV - 170 vehicles/176 miles per day/100 days
- Airport Shuttles

- Dulles - 8 vehicles/176 miles per day/100 days
- Richmond - 4 vehicles/62 miles per day/100 days

Track Emissions – Mobile Sources. Mobile source emissions were calculated for the training tracks. These emissions assumed that the tracks operate 250 days a year. Cars were assumed on paved tracks and sports utility/pickups were assumed on unpaved tracks. Emission factors were derived from the USEPA MOVES mobile emissions model for the years 1987-2016.

Once FASTC is developed, operation emissions would come from mobile sources, generators and boilers. Mobile source emissions would include commuters from northern Virginia/DC, staff commuting to work from within the regional area, students commuting onsite from local hotels, and from training activities such as ordnance detonation and operation of the driver training courses. Assumptions used in the analysis of operational emissions are as follows:

- The generators would run 0.5 hours per week for testing and maintenance and 120 hours a year for power outages;
- The generators would supply power for 25% of the building load at 8 watts per SF for buildings A10 and S04, at 10 watts per SF for building A07, and at 4 watts per SF for building S01;
- The generators would supply power for 100% of the building load at 80 watts per SF for building I07;
- The generators would run at 50% load;
- The boilers would provide heating and hot water, 10 hours per day from October 15th through April 14 and hot water only 2 hours per day April 15th through October 14th for buildings A01, I07, S04, A02, A03, and R06;
- Boilers in the dormitories, A06a, A06b, A06c, A06d, A06e, A06f would provide heating and hot water, 10 hours per day from October 15th through April 14 and hot water only 5 hours per day April 15th through October 14th;
- The boiler in the dining facility, A07 would provide heating and hot water, 10 hours per day from October 15th through April 14 and hot water only 6 hours per day April 15th through October 14th;
- Boilers were sized at 20 BTU per SF for buildings A01, S04, A02, and A03; 30 BTU per SF for building A07, 10 BTU per SF for building I07, 25 BTU per SF for buildings A06a, A06b, A06c, A06d, A06e, and A06f, and 15 BTU per SF for building R06.
- Ninety percent of the instructors and support staff would live within 50 miles of the site.
- In Phase 1, all students would be housed in local hotels and transported daily to the site using 25 passenger shuttle buses. At full operation 250 students would be housed at local hotels and transported daily to site using 25 passenger shuttle buses and 450 students would be housed at the site in dormitories. Students staying in the dormitories would arrive to the site on Sunday and depart on Friday; 60 percent would be bused and 40 percent would use their personal vehicles.
- Ordnance emissions do not include the explosives range. Factors were not available for the types of explosives used. Primary emissions expected from the explosives include CO and CO_2.
- Driver training tracks would be expected to be used 250 days per year.
- Cars would be used on the paved driving tracks. Trucks or sports utility vehicles would be used on the non-paved tracks.

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TAB A. EMISSIONS SUMMARY FOR FASTC

Table 1. Construction Emissions By Year

Year	VOC tons/yr	CO tons/yr	NOx tons/yr	SO2 tons/yr	PM10 tons/yr	PM2.5 tons/yr	CO2e tonnes/yr
2014	2.93	36.34	35.00	0.77	148.11	16.53	5,363
2015	2.91	34.71	34.85	0.77	148.12	16.54	5244
2016	3.49	54.44	44.82	0.97	153.83	17.50	7276
2017	4.16	69.29	55.79	1.21	182.36	20.76	9224
2018	1.27	35.44	21.01	0.44	34.25	4.29	3881
2019	0.69	15.61	11.15	0.24	28.55	3.33	1966
2020	0.69	15.12	11.13	0.24	28.54	3.32	1950

Table 2. Operational Stationary Emissions By Type 2020 +

	VOC tons/yr	CO tons/yr	NOx tons/yr	SO2 tons/yr	PM10 tons/yr	PM2.5 tons/yr	CO_2e tonnes/yr	Pb tons/yr
Emergency Generators	0.07	0.30	0.99	0.01	0.06	< 0.04	54.67	[1]ND
Boilers	0.14	1.27	5.07	18.01	0.51	< 0.04	5,151.72	[1]ND
Ordnance	[1]ND	1.73	0.07	0.03	0.12	0.10	0.00	0.05
Total	0.21	3.30	6.13	18.05	0.69	0.10	5,206	0.05

[1]ND = Not Determined

Table 3. Operational Mobile Source Emissions By Year

Operational Mobile Emissions	VOC tons/yr	CO tons/yr	NOx tons/yr	SO2 tons/yr	PM10 tons/yr	PM2.5 tons/yr	CO_2e tonnes/yr
POV -2017	0.39	40.15	2.82	0.01	0.20	0.18	1,643
POV -2018	0.48	48.74	3.60	0.01	0.24	0.22	2,032
POV -2019	0.50	60.63	2.98	0.04	0.32	0.29	2,423
POV -2020 +	0.57	68.49	3.37	0.04	0.36	0.33	2,819
Tracks	0.09	5.18	0.60	0.00	0.02	0.02	106
Totals (POVs + Tracks)							
2017	0.48	45.33	3.42	0.01	0.22	0.20	1,749
2018	0.58	53.93	4.20	0.01	0.26	0.24	2,138
2019	0.60	65.82	3.58	0.04	0.34	0.31	2,529
2020 +	0.66	73.68	3.97	0.05	0.38	0.35	2,925

Table 4. Total Operational Emissions 2020+ (Fully Operational)

Stationary and Mobile Sources	VOC tons/yr	CO tons/yr	NOx tons/yr	SO2 tons/yr	PM10 tons/yr	PM2.5 tons/yr	CO_2e tonnes/yr
2020 +	0.87	76.98	10.10	18.10	1.07	0.45	8,131

Table 4. Grand Total Emissions By Year

Year	VOC tons/yr	CO tons/yr	NOx tons/yr	SO2 tons/yr	PM10 tons/yr	PM2.5 tons/yr	CO_2e tonnes/yr
2014	2.93	36.34	35.00	0.77	148.11	16.53	5,363
2015	2.91	34.71	34.85	0.77	148.12	16.54	5244
2016	3.49	54.44	44.82	0.97	153.83	17.50	7276
2017	4.85	117.93	65.34	19.27	183.26	21.06	16179
2018	2.05	92.67	31.34	18.50	35.20	4.63	11225
2019	1.49	84.74	20.86	18.32	29.58	3.74	9701
2020	1.55	92.11	21.22	18.33	29.62	3.78	10081

TAB B. CONSTRUCTION EMISSIONS

Basic Conversions

453.59	grams per pound
43,560	Conversion from Acre to SF
0.03704	Cubic feet to Cubic Yards
0.1111	Square Feet to Square Yards
1.4	tons/CY for Gravel
80,000	lbs/Truck Load for Delivery
1.66	CY for each CY of asphalt/concrete demo
0.333333333	asphalt thickness for demolition
0.333333333	asphalt thickness for pavement
2000	pounds per ton
145	lb/ft^3 density of Hot Mix Asphalt

2014

Table 1. Clearing - 2014 184 Acres

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	2,134	145	0.58	0.38	1.41	4.17	0.12	0.30	0.29	535.69	149.05	559.70	1,651.62	45.60	117.13	113.62	211,993
Loader w/ integral Backhoe	2,134	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	691.66	123.09	631.87	545.81	12.79	91.40	88.66	59,463
Small backhoe	2,134	55	0.21	1.43	7.35	6.35	0.15	1.06	1.03	691.66	77.82	399.46	345.05	8.09	57.78	56.05	37,591
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck	977	230	16	7.50E-05	7.96E-04	2.90E-03	2.36E-05	5.01E-05	4.88E-05	3.45	1.19	12.61	45.95	0.37	0.79	0.77	54,710
										Subtotal (lbs):	**351**	**1,604**	**2,588**	**67**	**267**	**259**	**363,757**

Table 2. Building Demolition - 2014

24,707 SF 1,235 Estimated CY of debris based on 20 SF/CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
bits	206	86	0.59	0.45	3.84	4.70	0.13	0.45	0.43	594.79	10	88	108	3	10	10	13,699
Wheel Loader w/ integral Backhoe	206	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	691.66	12	61	53	1	9	9	5,736
Wheel mounted air compressor	206	49	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	4	33	59	2	7	7	7,810
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY Capacity)	113	230	27	7.50E-05	7.96E-04	2.90E-03	2.36E-05	5.01E-05	4.88E-05	3.45	0.2	2.5	9.0	0.1	0.2	0.2	10,663
										Subtotal (lbs):	**27**	**185**	**229**	**6**	**26**	**26**	**37,908**

Table 3. Demo Asphalt/Concrete- 2014

145,076 SF 2,973 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
D-6K Crawler Dozer with attachments	351	125	0.59	0.34	1.21	4.08	0.12	0.23	0.22	535.79	20	69	233	7	13	13	30,574.57
Wheel mounted air compressor	351	49	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	7	57	101	3	12	12	13,313.40
Excavator with attachments	121	380	0.59	0.31	2.50	4.51	0.13	0.55	0.54	595.21	19	149	269	8	33	32	35,567.85
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY Capacity)	273	230	27	7.50E-05	7.96E-04	2.90E-03	2.36E-05	5.01E-05	4.88E-05	3.45	0.6	6	22	0	0	0	25,665.30
										Subtotal (lbs):	**46**	**281**	**625**	**17**	**58**	**57**	**105,121**

Table 4. Site Prep - Excavate/Fill - Trenching - Grading 2014

Site Prep - Excavate/Fill (CY)	256,322 CY	Assume 60% hauled in or out	153,793 CY hauled				
Trenching (LF)	325 LF	Assume 4 ft deep trench, 5 feet wide	241 CY			Assume 60% hauled in or out	144 CY hauled
Grading (SY)	2,209,202 SF	Convert	245,442 SY			Assume compact 0.5 feet (0.166 yards)	40,907 CY compacted

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Backhoe Excavator	513	243	0.59	0.34	1.21	4.03	0.12	0.22	0.22	535.79	55.73	195.94	652.92	18.68	36.10	35.02	86,816.96
Skid Steer Loader	2,461	160	0.23	0.38	1.47	4.34	0.12	0.31	0.30	535.67	76.51	293.45	866.10	23.00	60.97	59.14	106,939.66
Dozer	1,139	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	535.69	80.93	303.89	896.73	24.76	63.60	61.69	115,099.49
Scraper Hauler Excavator	1,139	365	0.58	0.38	1.42	4.19	0.12	0.30	0.29	535.69	200.58	754.65	2,226.15	61.27	157.66	152.93	284,821.54
Compactor	303	103	0.58	0.40	1.57	4.57	0.12	0.32	0.31	535.63	15.77	62.67	182.22	4.60	12.74	12.35	21,376.39
Grader	1,818	285	0.58	0.34	1.21	4.07	0.12	0.23	0.22	535.79	227.79	800.30	2,696.68	76.36	149.44	144.96	354,992.57
Trenching with backhoe loader	3	87	0.59	0.34	1.21	4.07	0.12	0.23	0.22	535.79	0.13	0.47	1.58	0.04	0.09	0.09	208.54
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY capacity)	9,196	230	16	7.50E-05	7.96E-04	2.90E-03	2.36E-05	5.01E-05	4.88E-05	3.45	11	119	432	4	7	7	514,863.29
Delivery Truck	1	365	45	7.50E-05	7.96E-04	2.90E-03	2.36E-05	5.01E-05	4.88E-05	3.45	0	0	0	0	0	0	155.37
										Subtotal (lbs):	**669**	**2,530**	**7,955**	**212**	**488**	**473**	**1,485,274**

Table 5. Building Construction- Structure - 2014

260,522 SF

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Crane	9,900	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530.30	1026.39	5094.37	21972.25	476.53	867.74	841.71	2,215,271.92
Concrete truck	1,303	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536.26	69.50	538.85	1600.65	42.74	77.82	75.49	198,663.54
Diesel Generator (Assume 5 generators)	1,042	40	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	17.77	137.79	245.47	6.94	29.39	28.50	32,269.33
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Diesel Pickup Truck	94	400	30	7.50E-05	7.96E-04	2.90E-03	2.36E-05	5.01E-05	4.88E-05	3.45	0.21	2.24	8.16	0.07	0.14	0.14	9,714.52
Delivery Truck	6,253	365	60	7.50E-05	7.96E-04	2.90E-03	2.36E-05	5.01E-05	4.88E-05	3.45	28.15	298.55	1087.90	8.86	18.80	18.29	1,295,268.73
										Subtotal (lbs):	**1142**	**6072**	**24914**	**535**	**994**	**964**	**3,751,188**

Table 6. Gravel Work - 2014

22,896 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	229	185	0.59	0.34	1.21	4.08	0.12	0.23	0.22	535.79	19	67	225	6	12	12	29,519.85
Wheel Loader for Spreading	286	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	535.77	11	40	137	4	8	7	17,352.40
Compactor	170	135	0.43	0.36	1.34	4.45	0.12	0.26	0.25	535.74	8	29	97	3	6	5	11,628.40
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (gravel delivery)	2,957	230	26	7.50E-05	7.96E-04	2.90E-03	2.36E-05	5.01E-05	4.88E-05	3.45	5.7	60.7	221.3	1.8	3.8	3.7	263,506.51
										Subtotal (lbs):	**43.77**	**196.74**	**679.85**	**14.39**	**29.59**	**28.72**	**322,007**

Table 7. Concrete Work - Foundation and Sidewalks - 2014

Foundation Work	4,080 CY
Sidewalks, etc.	506 CY
Total	4,586 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Concrete Mixer (3 mixers total to one truck)	241	3.5	0.43	0.69	3.04	6.17	0.13	0.54	0.52	588.29	0.55	2.44	4.95	0.10	0.43	0.42	471.38
Concrete Truck	437	300	0.43	0.38	1.75	6.18	0.11	0.27	0.26	529.89	47.15	216.85	767.94	14.16	33.38	32.37	65,820.22
										Subtotal (lbs):	**47.70**	**219.29**	**772.89**	**14.26**	**33.81**	**32.79**	**66,292**

Table 8. Paving Surface and Paving HMA - 2014

Pavement - Surface Area 1,090,407 SF 13,463 CY
Paving - HMA 370,460 CF

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Grader	3,339	145	0.59	0.38	1.41	4.16	0.12	0.30	0.29	535.69	237.05	889.40	2,620.90	72.58	186.23	180.65	337,392.52
Steel drum roller/vibratory roller	6,679	401	0.59	0.34	2.46	5.53	0.12	0.34	0.33	535.80	1,189.14	8,579.37	19,281.26	401.50	1,179.86	1,144.46	1,866,499.05
Paving Machine	6,679	164	0.59	0.38	1.44	4.25	0.12	0.30	0.29	535.68	541.40	2,055.16	6,058.04	164.17	427.42	414.60	763,189.42
Asphalt Curbing Machine	668	130	0.59	0.40	1.57	4.57	0.12	0.32	0.31	535.63	44.62	177.34	515.64	13.01	36.04	34.96	60,491.56
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck	8,057	230	17	7.50E-05	7.96E-04	2.90E-03	2.36E-05	5.01E-05	4.88E-05	3.45	10.10	107.14	390.41	3.18	6.75	6.57	464,826.99
Water Truck	10,686	230	10	7.50E-05	7.96E-04	2.90E-03	2.36E-05	5.01E-05	4.88E-05	3.45	8.02	85.04	309.88	2.52	5.36	5.21	368,950.15
Hot Mix Asphalt (HMA)	**Volume of HMA (ft^3)**	**Weight of HMA (tons)**		**VOC[4]** lb/ton of asphalt	**CO**	**Nox**	**SO_2**	**PM10**	**PM2.5**	**CO_2**	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Standard Hot Mix Asphalt	370,460	26,858		0.04	-	-	-	-	-	-	1,074.33	-	-	-	-	-	-
										Subtotal (lbs):	**3,104.67**	**11,893.46**	**29,176.13**	**656.96**	**1,841.65**	**1,786.44**	**3,861,350**

2015

Table 9. Clearing 2015

184 Acres

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	2,134	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	535.69	151.62	569.35	1,680.09	46.39	119.15	115.58	215,648.20
Loader w/ integral Backhoe	2,134	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	691.66	123.09	631.87	545.81	12.79	91.40	88.66	59,462.71
Small backhoe	2,134	55	0.21	1.43	7.35	6.35	0.15	1.06	1.03	691.66	77.82	399.46	345.05	8.09	57.78	56.05	37,591.37
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck	977	230	16	8.14E-05	8.95E-04	3.48E-03	2.34E-05	6.07E-05	5.91E-05	3.45	1.29	14.18	55.11	0.37	0.96	0.94	54,638.74
										Subtotal (lbs):	**354**	**1,615**	**2,626**	**68**	**269**	**261**	**367,341**

Table 10. Building Demolition - 2015

24,707 SF 1,235 Estimated CY of debris based on 20 SF/CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
bits	206	86	0.59	0.45	3.84	4.70	0.13	0.45	0.43	594.79	10	88	108	3	10	10	13,699.01
Wheel Loader w/ integral Backhoe	206	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	691.66	12	61	53	1	9	9	5,735.98
Wheel mounted air compressor	206	49	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	4	33	59	2	7	7	7,810.17
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY Capacity)	113	230	27	8.14E-05	8.95E-04	3.48E-03	2.34E-05	6.07E-05	5.91E-05	3.44	0.3	2.8	10.7	0.1	0.2	0.2	10,628.79
										Subtotal (lbs):	**27**	**186**	**231**	**6**	**26**	**26**	**37,874**

Table 11. Demo Asphalt/Concrete- 2015

145,076 SF 2,973 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
D-6K Crawler Dozer with attachments	351	125	0.59	0.34	1.21	4.08	0.12	0.23	0.22	535.79	20	69	233	7	13	13	30,574.57
Wheel mounted air compressor	351	49	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	7	57	101	3	12	12	13,313.40
Excavator with attachments	121	380	0.59	0.31	2.50	4.51	0.13	0.55	0.54	595.21	19	149	269	8	33	32	35,567.85
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY Capacity)	273	230	27	8.14E-05	8.95E-04	3.48E-03	2.34E-05	6.07E-05	5.91E-05	3.45	0.6	7	26	0	0	0	25,631.77
										Subtotal (lbs):	**46**	**282**	**629**	**17**	**58**	**57**	**105,088**

Table 12. Site Prep - Excavate/Fill - Trenching - Grading 2015

Site Prep - Excavate/Fill (CY)	256,322 CY	Assume 60% hauled in or out	153,793 CY hauled		
Trenching (LF)	325 LF	Assume 4 ft deep trench, 5 feet wide	241 CY	Assume 60% hauled in or out	144 CY hauled
Grading (SY)	2,209,202 SF	Convert	245,442 SY	Assume compact 0.5 feet (0.166 yards)	40,907 CY compacted

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Backhoe Excavator	513	243	0.59	0.34	1.21	4.03	0.12	0.22	0.22	535.79	55.73	195.94	652.92	18.68	36.10	35.02	86,816.96
Skid Steer Loader	2,461	160	0.23	0.38	1.47	4.34	0.12	0.31	0.30	535.67	76.51	293.45	866.10	23.00	60.97	59.14	106,939.66
Dozer	1,139	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	535.69	80.93	303.89	896.73	24.76	63.60	61.69	115,099.49
Scraper Hauler Excavator	1,139	365	0.58	0.38	1.42	4.19	0.12	0.30	0.29	535.69	200.58	754.65	2,226.15	61.27	157.66	152.93	284,821.54
Compactor	303	103	0.58	0.40	1.57	4.57	0.12	0.32	0.31	535.63	15.77	62.67	182.22	4.60	12.74	12.35	21,376.39
Grader	1,818	285	0.58	0.34	1.21	4.07	0.12	0.23	0.22	535.79	227.79	800.30	2,696.68	76.36	149.44	144.96	354,992.57
Trenching with backhoe loader	3	87	0.59	0.34	1.21	4.07	0.12	0.23	0.22	535.79	0.13	0.47	1.58	0.04	0.09	0.09	208.54
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY capacity)	9,196	230	16	8.14E-05	8.95E-04	3.48E-03	2.34E-05	6.07E-05	5.91E-05	3.45	12	133	519	3	9	9	514,190.57
Delivery Truck	1	365	45	8.14E-05	8.95E-04	3.48E-03	2.34E-05	6.07E-05	5.91E-05	3.45	0	0	0	0	0	0	155.17
										Subtotal (lbs):	**670**	**2,545**	**8,041**	**212**	**490**	**475**	**1,484,601**

Table 13. Building Construction- Structure - 2015

260,522 SF

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Crane	9,900	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530.30	1026.39	5094.37	21972.25	476.53	867.74	841.71	2,215,271.92
Concrete truck	1,303	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536.26	69.50	538.85	1600.65	42.74	77.82	75.49	198,663.54
Diesel Generator (Assume 5 generators)	1,042	40	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	17.77	137.79	245.47	6.94	29.39	28.50	32,269.33
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Diesel Pickup Truck	94	400	30	8.14E-05	8.95E-04	3.48E-03	2.34E-05	6.07E-05	5.91E-05	3.45	0.23	2.52	9.79	0.07	0.17	0.17	9,701.82
Delivery Truck	6,253	365	60	8.14E-05	8.95E-04	3.48E-03	2.34E-05	6.07E-05	5.91E-05	3.45	30.53	335.71	1304.68	8.77	22.77	22.16	1,293,576.35
										Subtotal (lbs):	**1144**	**6109**	**25133**	**535**	**998**	**968**	**3,749,483**

Table 14. Gravel Work - 2015

22,896 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	229	185	0.59	0.34	1.21	4.08	0.12	0.23	0.22	535.79	19	67	225	6	12	12	29,519.85
Wheel Loader for Spreading	286	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	535.77	11	40	137	4	8	7	17,352.40
Compactor	170	135	0.43	0.36	1.34	4.45	0.12	0.26	0.25	535.74	8	29	97	3	6	5	11,628.40
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (gravel delivery)	2,957	230	26	8.14E-05	8.95E-04	3.48E-03	2.34E-05	6.07E-05	5.91E-05	3.45	6.2	68.3	265.4	1.8	4.6	4.5	263,162.21
										Subtotal (lbs):	**44**	**136**	**459**	**13**	**26**	**25**	**58,501**

Table 15. Concrete Work - Foundation and Sidewalks - 2015

Foundation Work	4,080 CY
Sidewalks, etc.	506 CY
Total	4,586 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Concrete Mixer (3 mixers total to one truck)	241	3.5	0.43	0.69	3.04	6.17	0.13	0.54	0.52	588.29	0.55	2.44	4.95	0.10	0.43	0.42	471.38
Concrete Truck	437	300	0.43	0.38	1.75	6.18	0.11	0.27	0.26	529.89	47.15	216.85	767.94	14.16	33.38	32.37	65,820.22
										Subtotal (lbs):	**47.70**	**219.29**	**772.89**	**14.26**	**33.81**	**32.79**	**66,292**

Table 16. Paving Surface and Paving HMA - 2015

Pavement - Surface Area 1,090,407 SF 13,463 CY
Paving - HMA 370,460 CF

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Grader	3,339	145	0.59	0.38	1.41	4.16	0.12	0.30	0.29	535.69	237.05	889.40	2,620.90	72.58	186.23	180.65	337,392.52
Steel drum roller/vibratory roller	6,679	401	0.59	0.34	2.46	5.53	0.12	0.34	0.33	535.80	1,189.14	8,579.37	19,281.26	401.50	1,179.86	1,144.46	1,866,499.05
Paving Machine	6,679	164	0.59	0.38	1.44	4.25	0.12	0.30	0.29	535.68	541.40	2,055.16	6,058.04	164.17	427.42	414.60	763,189.42
Asphalt Curbing Machine	668	130	0.59	0.40	1.57	4.57	0.12	0.32	0.31	535.63	44.62	177.34	515.64	13.01	36.04	34.96	60,491.56
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck	8,057	230	17	8.14E-05	8.95E-04	3.48E-03	2.34E-05	6.07E-05	5.91E-05	3.45	10.96	120.48	468.20	3.15	8.17	7.95	464,219.65
Water Truck	10,686	230	10	8.14E-05	8.95E-04	3.48E-03	2.34E-05	6.07E-05	5.91E-05	3.45	8.70	95.63	371.63	2.50	6.49	6.31	368,468.08
Hot Mix Asphalt (HMA)	**Volume of HMA (ft^3)**	**Weight of HMA (tons)**		**VOC[4]** lb/ton of asphalt	**CO**	**Nox**	**SO_2**	**PM10**	**PM2.5**	**CO_2**	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Standard Hot Mix Asphalt	370,460	26,858		0.04	-	-	-	-	-	-	1,074.33	-	-	-	-	-	-
										Subtotal (lbs):	**3,106.20**	**11,917.38**	**29,315.67**	**656.90**	**1,844.21**	**1,788.93**	**3,860,260**

2016

Table 17. Clearing 2016 (Phase I and II)

188 Acres

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	2,181	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	535.69	154.92	581.73	1,716.62	47.40	121.74	118.09	220,336
Loader w/ integral Backhoe	2,181	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	691.66	125.77	645.60	557.68	13.07	93.39	90.59	60,755
Small backhoe	2,181	55	0.21	1.43	7.35	6.35	0.15	1.06	1.03	691.66	79.51	408.14	352.55	8.26	59.04	57.27	38,409
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck	998	230	16	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3.44	1	15	57	0	1	1	55,720
										Subtotal (lbs):	**362**	**1,650**	**2,684**	**69**	**275**	**267**	**375,220**

Table 18. Building Demolition - 2016

24,707 SF 1,235 Estimated CY of debris based on 20 SF/CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Hydraulic excavator	206	86	0.59	0.45	3.84	4.70	0.13	0.45	0.43	594.79	10	88	108	3	10	10	13,699
Wheel Loader w/ integral Backhoe	206	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	691.66	12	61	53	1	9	9	5,736
Wheel mounted air compressor	206	49	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	4	33	59	2	7	7	7,810
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY Capacity)	113	230	27	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3.44	0.3	2.8	10.8	0.1	0.2	0.2	10,628.8
										Subtotal (lbs):	**27**	**186**	**231**	**6**	**26**	**26**	**37,874**

Table 19. Demo Asphalt/Concrete- 2016

145,076 SF 2,973 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
D-6K Crawler Dozer with attachments	351	125	0.59	0.34	1.21	4.08	0.12	0.23	0.22	535.79	20	69	233	7	13	13	30,575
Wheel mounted air compressor	351	49	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	7	57	101	3	12	12	13,313
Excavator with attachments	121	380	0.59	0.31	2.50	4.51	0.13	0.55	0.54	595.21	19	149	269	8	33	32	35,568
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY Capacity)	273	230	27	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3.44	0.6	7	26	0	0	0	25,583
										Subtotal (lbs):	**46**	**282**	**629**	**17**	**58**	**57**	**105,039**

Table 20. Site Prep - Excavate/Fill - Trenching - Grading 2016 (Phase I and II)

Site Prep - Excavate/Fill (CY)	263,388 CY	Assume 60% hauled in or out	158,033 CY hauled				
Trenching (LF)	537 LF	Assume 4 ft deep trench, 5 feet wide	398 CY			Assume 60% hauled in or out	239 CY hauled
Grading (SY)	2,287,228 SF	Convert	254,111 SY			Assume compact 0.5 feet (0.166 yards)	42,352 CY compacted

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Backhoe Excavator	527	243	0.59	0.34	1.21	4.03	0.12	0.22	0.22	535.79	57.26	201.34	670.92	19.19	37.10	35.98	89,210
Skid Steer Loader	2,529	160	0.23	0.38	1.47	4.34	0.12	0.31	0.30	535.67	78.62	301.54	889.98	23.64	62.65	60.77	109,888
Dozer	1,171	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	535.69	83.16	312.26	921.45	25.44	65.35	63.39	118,272
Scraper Hauler Excavator	1,171	365	0.58	0.38	1.42	4.19	0.12	0.30	0.29	535.69	206.11	775.46	2,287.52	62.96	162.00	157.14	292,673
Compactor	314	103	0.58	0.40	1.57	4.57	0.12	0.32	0.31	535.63	16.32	64.88	188.65	4.76	13.19	12.79	22,131
Grader	1,882	285	0.58	0.34	1.21	4.07	0.12	0.23	0.22	535.79	235.83	828.57	2,791.92	79.06	154.72	150.08	367,530
Trenching with backhoe loader	6	87	0.59	0.34	1.21	4.07	0.12	0.23	0.22	535.79	0.22	0.78	2.62	0.07	0.15	0.14	345
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY capacity)	9,455	230	16	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3.44	13	141	537	4	9	9	527,656
Delivery Truck	1	365	45	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3.44	0	0	0	0	0	0	155
										Subtotal (lbs):	**690**	**2,626**	**8,290**	**219**	**504**	**489**	**1,527,860**

Table 21. Building Construction- Structure - 2016 (Phase I and Phase II)

436,327 SF

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Crane	16,580	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530.30	1719.02	8532.15	36799.53	798.10	1453.31	1409.71	3,710,178
Concrete truck	2,182	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536.26	116.40	902.48	2680.79	71.57	130.34	126.43	332,725
Diesel Generator (Assume 5 generators)	1,745	40	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	29.76	230.78	411.12	11.63	49.21	47.74	54,045
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Diesel Pickup Truck	157	400	30	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3.44	0.39	4.34	16.51	0.11	0.29	0.28	16,218
Delivery Truck	10,472	365	60	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3.44	51.52	578.06	2201.12	14.79	38.31	37.32	2,162,362
										Subtotal (lbs):	**1917**	**10248**	**42109**	**896**	**1671**	**1621**	**6,275,528**

Table 22. Gravel Work - 2016

24,241 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	242	185	0.59	0.34	1.21	4.08	0.12	0.23	0.22	535.79	20	70	238	7	13	13	31,254
Wheel Loader for Spreading	303	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	535.77	12	43	145	4	8	8	18,372
Compactor	180	135	0.43	0.36	1.34	4.45	0.12	0.26	0.25	535.74	8	31	102	3	6	6	12,311
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (gravel delivery)	3,131	230	26	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3.44	6.6	74.3	283.1	1.9	4.9	4.8	278,088.5
										Subtotal (lbs):	**47**	**218**	**769**	**15**	**32**	**31**	**340,026**

Table 23. Concrete Work - Foundation and Sidewalks - 2016

Foundation Work	5,224 CY
Sidewalks, etc.	582 CY
Total	5,806 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Concrete Mixer (3 mixers total to one truck)	306	3.5	0.43	0.69	3.04	6.17	0.13	0.54	0.52	588.29	0.70	3.09	6.26	0.13	0.55	0.53	597
Concrete Truck	553	300	0.43	0.38	1.75	6.18	0.11	0.27	0.26	529.89	59.69	274.53	972.24	17.92	42.26	40.99	83,330
										Subtotal (lbs):	**60**	**278**	**978**	**18**	**43**	**42**	**83,927**

Table 24. Paving Surface and Paving HMA - 2016

Pavement - Surface Area 1,106,647 SF 13,663 CY
Paving - HMA 375,873 CF

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Grader	3,389	145	0.59	0.38	1.41	4.16	0.12	0.30	0.29	535.69	240.58	902.65	2,659.93	73.66	189.01	183.34	342,417
Steel drum roller/vibratory roller	6,778	401	0.59	0.34	2.46	5.53	0.12	0.34	0.33	535.80	1,206.85	8,707.15	19,568.43	407.48	1,197.43	1,161.51	1,894,298
Paving Machine	6,778	164	0.59	0.38	1.44	4.25	0.12	0.30	0.29	535.68	549.47	2,085.77	6,148.26	166.61	433.78	420.77	774,556
Asphalt Curbing Machine	678	130	0.59	0.40	1.57	4.57	0.12	0.32	0.31	535.63	45.29	179.98	523.32	13.21	36.58	35.48	61,392
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck	8,177	230	17	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3.44	11.20	125.71	478.66	3.22	8.33	8.12	470,232
Water Truck	10,845	230	10	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3.44	8.89	99.78	379.93	2.55	6.61	6.44	373,241
Hot Mix Asphalt (HMA)	**Volume of HMA (ft^3)**	**Weight of HMA (tons)**		**VOC[4]** lb/ton of asphalt	**CO**	**Nox**	**SO_2**	**PM10**	**PM2.5**	**CO_2**	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Standard Hot Mix Asphalt	375,873	27,251		0.04	-	-	-	-	-	-	1,090.03	-	-	-	-	-	-
										Subtotal (lbs):	**3,152**	**12,101**	**29,759**	**667**	**1,872**	**1,816**	**3,916,137**

2017

Table 25. Clearing 2017

246 Acres

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	2,854	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	535.69	202.72	761.20	2,246.21	62.02	159.30	154.52	288,312
Loader w/ integral Backhoe	2,854	87	0.21	1.43	7.35	6.35	0.15	1.06	0.00	691.66	164.57	844.78	729.73	17.10	122.20	0.00	79,499
Small backhoe	2,854	55	0.21	1.43	7.35	6.35	0.15	1.06	1.03	691.66	104.04	534.06	461.32	10.81	77.25	74.94	50,258
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck	1,306	230	16	8.24E-05	9.46E-04	3.53E-03	2.34E-05	6.14E-05	5.97E-05	3.43	2	20	75	0	1	1	72,760
										Subtotal (lbs):	**473**	**2,160**	**3,512**	**90**	**360**	**231**	**490,829**

Table 26. Building Demolition - 2017

26,890 SF 1,345 Estimated CY of debris based on 20 SF/CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Hydraulic excavator	224	86	0.59	0.45	3.84	4.70	0.13	0.45	0.43	594.79	10	88	108	3	10	10	13,699
Wheel Loader w/ integral Backhoe	224	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	691.66	12	61	53	1	9	9	5,736
Wheel mounted air compressor	224	49	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	4	33	59	2	7	7	7,810
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY Capacity)	123	230	27	8.24E-05	9.46E-04	3.53E-03	2.34E-05	6.14E-05	5.97E-05	3.43	0.3	2.9	10.9	0.1	0.2	0.2	10,607.0
										Subtotal (lbs):	**27**	**186**	**231**	**6**	**26**	**26**	**37,852**

Table 27. Demo Asphalt/Concrete- 2017

152,270 SF 3,121 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
D-6K Crawler Dozer with attachments	368	125	0.59	0.34	1.21	4.08	0.12	0.23	0.22	535.79	21	72	244	7	14	13	32,091
Wheel mounted air compressor	368	49	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	8	60	106	3	13	12	13,974
Excavator with attachments	127	380	0.59	0.31	2.50	4.51	0.13	0.55	0.54	595.21	20	157	283	8	35	34	37,332
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY Capacity)	286	230	27	8.24E-05	9.46E-04	3.53E-03	2.34E-05	6.14E-05	5.97E-05	3.43	0.6	7	28	0	0	0	26,796
										Subtotal (lbs):	**49**	**296**	**661**	**18**	**61**	**60**	**110,192**

Table 28. Site Prep - Excavate/Fill - Trenching - Grading 2017

Site Prep - Excavate/Fill (CY)	291,697 CY	Assume 60% hauled in or out	175,018 CY hauled			
Trenching (LF)	702 LF	Assume 4 ft deep trench, 5 feet wide	520 CY		Assume 60% hauled in or out	312 CY hauled
Grading (SY)	2,549,623 SF	Convert	283,263 SY		Assume compact 0.5 feet (0.166 yards)	47,211 CY compacted

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Backhoe Excavator	583	243	0.59	0.34	1.21	4.03	0.12	0.22	0.22	535.79	63.42	222.98	743.03	21.25	41.08	39.85	98,799
Skid Steer Loader	2,800	160	0.23	0.38	1.47	4.34	0.12	0.31	0.30	535.67	87.07	333.95	985.63	26.18	69.38	67.30	121,698
Dozer	1,296	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	535.69	92.10	345.82	1,020.48	28.18	72.37	70.20	130,984
Scraper Hauler Excavator	1,296	365	0.58	0.38	1.42	4.19	0.12	0.30	0.29	535.69	228.26	858.80	2,533.38	69.72	179.41	174.03	324,130
Compactor	350	103	0.58	0.40	1.57	4.57	0.12	0.32	0.31	535.63	18.20	72.33	210.29	5.31	14.70	14.26	24,670
Grader	2,098	285	0.58	0.34	1.21	4.07	0.12	0.23	0.22	535.79	262.89	923.62	3,112.22	88.13	172.47	167.29	409,694
Trenching with backhoe loader	7	87	0.59	0.34	1.21	4.07	0.12	0.23	0.22	535.79	0.29	1.02	3.42	0.10	0.19	0.18	450
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3] lb/mile**	**CO[3] lb/mile**	**NOx[3] lb/mile**	**SO_2[3] lb/mile**	**PM10[3] lb/mile**	**PM2.5[3] lb/mile**	**CO_2[3] lb/mile**	**VOC lb**	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**CO_2 lb**
Dump Truck (12 CY capacity)	10,474	230	16	8.24E-05	9.46E-04	3.53E-03	2.34E-05	6.14E-05	5.97E-05	3.43	14	161	599	4	10	10	583,326
Delivery Truck	1	365	45	8.24E-05	9.46E-04	3.53E-03	2.34E-05	6.14E-05	5.97E-05	3.43	0	0	0	0	0	0	155
										Subtotal (lbs):	**766**	**2,919**	**9,208**	**243**	**560**	**543**	**1,693,907**

Table 29. Building Construction- Structure - 2017

613,124 SF

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Crane	23,299	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530.30	2415.56	11989.32	51710.47	1121.48	2042.18	1980.91	5,213,519
Concrete truck	3,066	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536.26	163.57	1268.16	3767.03	100.57	183.15	177.65	467,544
Diesel Generator (Assume 5 generators)	2,452	40	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	41.82	324.28	577.70	16.34	69.16	67.08	75,944
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3] lb/mile**	**CO[3] lb/mile**	**NOx[3] lb/mile**	**SO_2[3] lb/mile**	**PM10[3] lb/mile**	**PM2.5[3] lb/mile**	**CO_2[3] lb/mile**	**VOC lb**	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**CO_2 lb**
Diesel Pickup Truck	221	400	30	8.24E-05	9.46E-04	3.53E-03	2.34E-05	6.14E-05	5.97E-05	3.43	0.55	6.27	23.36	0.16	0.41	0.40	22,742
Delivery Truck	14,715	365	60	8.24E-05	9.46E-04	3.53E-03	2.34E-05	6.14E-05	5.97E-05	3.43	72.79	835.45	3114.99	20.67	54.24	52.68	3,032,295
										Subtotal (lbs):	**2694**	**14423**	**59194**	**1259**	**2349**	**2279**	**8,812,043**

Table 30. Gravel Work - 2017

28,397 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	284	185	0.59	0.34	1.21	4.08	0.12	0.23	0.22	535.79	23	83	279	8	15	15	36,612
Wheel Loader for Spreading	355	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	535.77	14	50	170	5	10	9	21,521
Compactor	210	135	0.43	0.36	1.34	4.45	0.12	0.26	0.25	535.74	10	36	120	3	7	7	14,422
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3] lb/mile**	**CO[3] lb/mile**	**NOx[3] lb/mile**	**SO_2[3] lb/mile**	**PM10[3] lb/mile**	**PM2.5[3] lb/mile**	**CO_2[3] lb/mile**	**VOC lb**	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**CO_2 lb**
Dump Truck (gravel delivery)	3,668	230	26	8.24E-05	9.46E-04	3.53E-03	2.34E-05	6.14E-05	5.97E-05	3.43	7.8	89.6	334.0	2.2	5.8	5.6	325,096.1
										Subtotal (lbs):	**55**	**258**	**903**	**18**	**38**	**37**	**397,652**

Table 31. Concrete Work - Foundation and Sidewalks - 2017

Foundation Work	7,975 CY
Sidewalks, etc.	847 CY
Total	8,822 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Concrete Mixer (3 mixers total to one truck)	465	3.5	0.43	0.69	3.04	6.17	0.13	0.54	0.52	588.29	1.06	4.69	9.51	0.20	0.83	0.81	907
Concrete Truck	840	300	0.43	0.38	1.75	6.18	0.11	0.27	0.26	529.89	90.70	417.14	1,477.28	27.24	64.21	62.28	126,617
										Subtotal (lbs):	**92**	**422**	**1,487**	**27**	**65**	**63**	**127,524**

Table 32. Paving Surface and Paving HMA - 2017

Pavement - Surface Area 1,155,711 SF 14,269 CY
Paving - HMA 392,227 CF

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Grader	3,539	145	0.59	0.38	1.41	4.16	0.12	0.30	0.29	535.69	251.25	942.67	2,777.86	76.92	197.39	191.47	357,599
Steel drum roller/vibratory roller	7,079	401	0.59	0.34	2.46	5.53	0.12	0.34	0.33	535.80	1,260.36	9,093.18	20,436.01	425.55	1,250.52	1,213.01	1,978,283
Paving Machine	7,079	164	0.59	0.38	1.44	4.25	0.12	0.30	0.29	535.68	573.83	2,178.24	6,420.85	174.00	453.02	439.43	808,897
Asphalt Curbing Machine	708	130	0.59	0.40	1.57	4.57	0.12	0.32	0.31	535.63	47.29	187.96	546.52	13.79	38.20	37.05	64,114
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck	8,540	230	17	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3.44	11.70	131.28	499.88	3.36	8.70	8.48	491,081
Water Truck	11,326	230	10	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3.44	9.29	104.20	396.78	2.67	6.91	6.73	389,789
Hot Mix Asphalt (HMA)	**Volume of HMA (ft^3)**	**Weight of HMA (tons)**		**VOC[4]** lb/ton of asphalt	**CO**	**Nox**	**SO_2**	**PM10**	**PM2.5**	**CO_2**	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Standard Hot Mix Asphalt	392,227	28,436		0.04	-	-	-	-	-	-	1,137.46	-	-	-	-	-	-
										Subtotal (lbs):	**3,291**	**12,638**	**31,078**	**696**	**1,955**	**1,896**	**4,089,762**

2018

Table 33. Clearing 2018

62 Acres

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	719	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	535.69	51.09	191.85	566.12	15.63	40.15	38.94	72,664
Loader w/ integral Backhoe	719	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	691.66	41.48	212.91	183.91	4.31	30.80	29.87	20,036
Small backhoe	719	55	0.21	1.43	7.35	6.35	0.15	1.06	1.03	691.66	26.22	134.60	116.27	2.72	19.47	18.89	12,667
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck	329	230	16	8.24E-05	9.60E-04	3.52E-03	2.34E-05	6.14E-05	5.95E-05	3	0	5	19	0	0	0	18,308
										Subtotal (lbs):	**119**	**544**	**885**	**23**	**91**	**88**	**123,675**

Table 34. Building Demolition - 2018

2,183 SF 109 Estimated CY of debris based on 20 SF/CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Hydraulic excavator	18	86	0.59	0.45	3.84	4.70	0.13	0.45	0.43	594.79	10	88	108	3	10	10	13,699
Wheel Loader w/ integral Backhoe	18	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	691.66	12	61	53	1	9	9	5,736
Wheel mounted air compressor	18	49	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	4	33	59	2	7	7	7,810
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY Capacity)	10	230	27	8.24E-05	9.60E-04	3.52E-03	2.34E-05	6.14E-05	5.95E-05	3.43	0.3	3.0	10.9	0.1	0.2	0.2	10,589.5
										Subtotal (lbs):	**27**	**186**	**231**	**6**	**26**	**26**	**37,835**

Table 35. Demo Asphalt/Concrete- 2018

7,194 SF 147 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
D-6K Crawler Dozer with attachments	17	125	0.59	0.34	1.21	4.08	0.12	0.23	0.22	535.79	1	3	12	0	1	1	1,516
Wheel mounted air compressor	17	49	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	0	3	5	0	1	1	660
Excavator with attachments	6	380	0.59	0.31	2.50	4.51	0.13	0.55	0.54	595.21	1	7	13	0	2	2	1,764
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY Capacity)	14	230	27	8.24E-05	9.60E-04	3.52E-03	2.34E-05	6.14E-05	5.95E-05	3	0.0	0	1	0	0	0	1,264
										Subtotal (lbs):	**2**	**14**	**31**	**1**	**3**	**3**	**5,204**

Table 36. Site Prep - Excavate/Fill - Trenching - Grading 2018

Site Prep - Excavate/Fill (CY)	35,375 CY	Assume 60% hauled in or out	21,225 CY hauled			
Trenching (LF)	377 LF	Assume 4 ft deep trench, 5 feet wide	279 CY		Assume 60% hauled in or out	168 CY hauled
Grading (SY)	340,421 SF	Convert	37,821 SY		Assume compact 0.5 feet (0.166 yards)	6,303 CY compacted

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Backhoe Excavator	71	243	0.59	0.34	1.21	4.03	0.12	0.22	0.22	535.79	7.69	27.04	90.11	2.58	4.98	4.83	11,982
Skid Steer Loader	340	160	0.23	0.38	1.47	4.34	0.12	0.31	0.30	535.67	10.56	40.50	119.53	3.17	8.41	8.16	14,759
Dozer	157	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	535.69	11.17	41.94	123.76	3.42	8.78	8.51	15,885
Scraper Hauler Excavator	157	365	0.58	0.38	1.42	4.19	0.12	0.30	0.29	535.69	27.68	104.15	307.23	8.46	21.76	21.11	39,308
Compactor	47	103	0.58	0.40	1.57	4.57	0.12	0.32	0.31	535.63	2.43	9.66	28.08	0.71	1.96	1.90	3,294
Grader	280	285	0.58	0.34	1.21	4.07	0.12	0.23	0.22	535.79	35.10	123.32	415.54	11.77	23.03	22.34	54,702
Trenching with backhoe loader	4	87	0.59	0.34	1.21	4.07	0.12	0.23	0.22	535.79	0.16	0.55	1.84	0.05	0.10	0.10	242
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY capacity)	1,278	230	16	8.24E-05	9.60E-04	3.52E-03	2.34E-05	6.14E-05	5.95E-05	3	2	20	73	0	1	1	71,056
Delivery Truck	1	365	45	8.24E-05	9.60E-04	3.52E-03	2.34E-05	6.14E-05	5.95E-05	3	0	0	0	0	0	0	154
										Subtotal (lbs):	**96**	**367**	**1,159**	**31**	**70**	**68**	**211,381**

Table 37. Building Construction- Structure - 2018

352,602 SF

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Crane	13,399	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530	1389.17	6894.95	29738.22	644.96	1174.44	1139.20	2,998,247
Concrete truck	1,763	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536	94.07	729.31	2166.39	57.84	105.33	102.17	268,880
Diesel Generator (Assume 5 generators)	1,410	40	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595	24.05	186.49	332.23	9.39	39.77	38.58	43,675
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Diesel Pickup Truck	127	400	30	8.24E-05	9.60E-04	3.52E-03	2.34E-05	6.14E-05	5.95E-05	3	0.31	3.66	13.41	0.09	0.23	0.23	13,057
Delivery Truck	8,462	365	60	8.24E-05	9.60E-04	3.52E-03	2.34E-05	6.14E-05	5.95E-05	3	41.83	487.61	1788.31	11.87	31.17	30.23	1,740,974
										Subtotal (lbs):	**1549**	**8302**	**34039**	**724**	**1351**	**1310**	**5,064,833**

Table 38. Gravel Work - 2018

5501 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	55	185	0.59	0.34	1.21	4.08	0.12	0.23	0.22	536	5	16	54	2	3	3	7,092
Wheel Loader for Spreading	69	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	536	3	10	33	1	2	2	4,169
Compactor	41	135	0.43	0.36	1.34	4.45	0.12	0.26	0.25	536	2	7	23	1	1	1	2,794
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (gravel delivery)	711	230	26	8.24E-05	9.60E-04	3.52E-03	2.34E-05	6.14E-05	5.95E-05	3	1.5	17.6	64.6	0.4	1.1	1.1	62,873.2
										Subtotal (lbs):	**11**	**50**	**175**	**3**	**7**	**7**	**76,929**

Table 39. Concrete Work - Foundation and Sidewalks - 2018

Foundation Work	3,895 CY
Sidewalks, etc.	341 CY
Total	4,236 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Concrete Mixer (3 mixers total to one truck)	223	3.5	0.43	0.69	3.04	6.17	0.13	0.54	0.52	588	0.51	2.25	4.57	0.09	0.40	0.39	435
Concrete Truck	403	300	0.43	0.38	1.75	6.18	0.11	0.27	0.26	530	43.55	200.30	709.33	13.08	30.83	29.90	60,797
										Subtotal (lbs):	**44**	**203**	**714**	**13**	**31**	**30**	**61,232**

Table 40. Paving Surface and Paving HMA - 2018

Pavement - Surface Area 65,304 SF 806 CY
Paving - HMA 21,767 CF

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Grader	200	145	0.59	0.38	1.41	4.16	0.12	0.30	0.29	536	14.20	53.27	156.96	4.35	11.15	10.82	20,206
Steel drum roller/vibratory roller	400	401	0.59	0.34	2.46	5.53	0.12	0.34	0.33	536	71.22	513.81	1,154.75	24.05	70.66	68.54	111,784
Paving Machine	400	164	0.59	0.38	1.44	4.25	0.12	0.30	0.29	536	32.42	123.08	362.81	9.83	25.60	24.83	45,707
Asphalt Curbing Machine	40	130	0.59	0.40	1.57	4.57	0.12	0.32	0.31	536	2.67	10.62	30.88	0.78	2.16	2.09	3,623
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck	483	230	17	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3	0.66	7.42	28.25	0.19	0.49	0.48	27,749
Water Truck	640	230	10	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3	0.52	5.89	22.42	0.15	0.39	0.38	22,025
Hot Mix Asphalt (HMA)	**Volume of HMA (ft^3)**	**Weight of HMA (tons)**		**VOC[4]** lb/ton of asphalt	**CO**	**Nox**	**SO_2**	**PM10**	**PM2.5**	**CO_2**	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Standard Hot Mix Asphalt	21,767	1,578		0.04	-	-	-	-	-	-	63.12	-	-	-	-	-	-
										Subtotal (lbs):	**184.82**	**714.09**	**1,756.07**	**39.34**	**110.45**	**107.14**	**231,094**

2019

Table 41. Clearing 2019

58 Acres

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	673	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	536	47.79	179.47	529.59	14.62	37.56	36.43	67,976
Loader w/ integral Backhoe	673	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	692	38.80	199.18	172.05	4.03	28.81	27.95	18,744
Small backhoe	673	55	0.21	1.43	7.35	6.35	0.15	1.06	1.03	692	24.53	125.92	108.77	2.55	18.21	17.67	11,849
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck	308	230	16	8.21E-05	9.74E-04	3.52E-03	2.35E-05	6.15E-05	5.93E-05	3	0	5	18	0	0	0	17,106
										Subtotal (lbs):	**112**	**509**	**828**	**21**	**85**	**82**	**115,676**

Table 42. Building Demolition - 2019

2,183 SF 109 Estimated CY of debris based on 20 SF/CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Hydraulic excavator	18	86	0.59	0.45	3.84	4.70	0.13	0.45	0.43	594.79	10	88	108	3	10	10	13,699
Wheel Loader w/ integral Backhoe	18	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	691.66	12	61	53	1	9	9	5,736
Wheel mounted air compressor	18	49	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	4	33	59	2	7	7	7,810
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY Capacity)	10	230	27	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3	0.3	2.8	10.8	0.1	0.2	0.2	10,629
										Subtotal (lbs):	**27**	**186**	**231**	**6**	**26**	**26**	**37,874**

Table 43. Demo Asphalt/Concrete- 2019

7,194 SF 147 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
D-6K Crawler Dozer with attachments	17	125	0.59	0.34	1.21	4.08	0.12	0.23	0.22	535.79	1	3	12	0	1	1	1,516
Wheel mounted air compressor	17	49	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	0	3	5	0	1	1	660
Excavator with attachments	6	380	0.59	0.31	2.50	4.51	0.13	0.55	0.54	595.21	1	7	13	0	2	2	1,764
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY Capacity)	14	230	27	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3	0.0	0	1	0	0	0	1,269
										Subtotal (lbs):	**2**	**14**	**31**	**1**	**3**	**3**	**5,209**

Table 44. Site Prep - Excavate/Fill - Trenching - Grading 2019

Site Prep - Excavate/Fill (CY)	28,309 CY	Assume 60% hauled in or out	16,985 CY hauled			
Trenching (LF)	165 LF	Assume 4 ft deep trench, 5 feet wide	122 CY		Assume 60% hauled in or out	73 CY hauled
Grading (SY)	262,395 SF		29,152 SY		Assume compact 0.5 feet (0.166 yards)	4,859 CY compacted

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Backhoe Excavator	57	243	0.59	0.34	1.21	4.03	0.12	0.22	0.22	535.79	6.15	21.64	72.11	2.06	3.99	3.87	9,588
Skid Steer Loader	272	160	0.23	0.38	1.47	4.34	0.12	0.31	0.30	535.67	8.45	32.41	95.66	2.54	6.73	6.53	11,811
Dozer	126	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	535.69	8.94	33.56	99.04	2.73	7.02	6.81	12,712
Scraper Hauler Excavator	126	365	0.58	0.38	1.42	4.19	0.12	0.30	0.29	535.69	22.15	83.35	245.86	6.77	17.41	16.89	31,457
Compactor	36	103	0.58	0.40	1.57	4.57	0.12	0.32	0.31	535.63	1.87	7.44	21.64	0.55	1.51	1.47	2,539
Grader	216	285	0.58	0.34	1.21	4.07	0.12	0.23	0.22	535.79	27.06	95.05	320.29	9.07	17.75	17.22	42,164
Trenching with backhoe loader	2	87	0.59	0.34	1.21	4.07	0.12	0.23	0.22	535.79	0.07	0.24	0.80	0.02	0.04	0.04	106
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY capacity)	1,019	230	16	8.21E-05	9.74E-04	3.52E-03	2.35E-05	6.15E-05	5.93E-05	3	1	16	58	0	1	1	56,595
Delivery Truck	1	365	45	8.21E-05	9.74E-04	3.52E-03	2.35E-05	6.15E-05	5.93E-05	3	0	0	0	0	0	0	154
										Subtotal (lbs):	**76**	**290**	**914**	**24**	**55**	**54**	**167,125**

Table 45. Building Construction- Structure - 2019

176,797 SF

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Crane	6,718	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530	696.54	3457.17	14910.94	323.39	588.87	571.20	1,503,341
Concrete truck	884	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536	47.17	365.68	1086.24	29.00	52.81	51.23	134,818
Diesel Generator (Assume 5 generators)	707	40	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595	12.06	93.51	166.58	4.71	19.94	19.34	21,899
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Diesel Pickup Truck	64	400	30	8.21E-05	9.74E-04	3.52E-03	2.35E-05	6.15E-05	5.93E-05	3	0.16	1.86	6.72	0.04	0.12	0.11	6,539
Delivery Truck	4,243	365	60	8.21E-05	9.74E-04	3.52E-03	2.35E-05	6.15E-05	5.93E-05	3	20.91	247.96	895.52	5.98	15.66	15.10	871,912
										Subtotal (lbs):	**777**	**4166**	**17066**	**363**	**677**	**657**	**2,538,509**

Table 46. Gravel Work - 2019

4,156 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	42	185	0.59	0.34	1.21	4.08	0.12	0.23	0.22	536	3	12	41	1	2	2	5,358
Wheel Loader for Spreading	52	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	536	2	7	25	1	1	1	3,150
Compactor	31	135	0.43	0.36	1.34	4.45	0.12	0.26	0.25	536	1	5	18	0	1	1	2,111
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (gravel delivery)	537	230	26	8.21E-05	9.74E-04	3.52E-03	2.35E-05	6.15E-05	5.93E-05	3	1.1	13.5	48.7	0.3	0.9	0.8	47,444.9
										Subtotal (lbs):	**8**	**38**	**132**	**3**	**6**	**5**	**58,064**

Table 47. Concrete Work - Foundation and Sidewalks - 2019

Foundation Work	2,751 CY
Sidewalks, etc.	265 CY
Total	3,016 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Concrete Mixer (3 mixers total to one truck)	159	3.5	0.43	0.69	3.04	6.17	0.13	0.54	0.52	588	0.36	1.60	3.25	0.07	0.28	0.28	310
Concrete Truck	287	300	0.43	0.38	1.75	6.18	0.11	0.27	0.26	530	31.01	142.61	505.04	9.31	21.95	21.29	43,287
										Subtotal (lbs):	**31**	**144**	**508**	**9**	**22**	**22**	**43,597**

Table 48. Paving Surface and Paving HMA - 2019

Pavement - Surface Area 49,064 SF 606 CY
Paving - HMA 16,354 CF

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Grader	150	145	0.59	0.38	1.41	4.16	0.12	0.30	0.29	536	10.67	40.02	117.93	3.27	8.38	8.13	15,181
Steel drum roller/vibratory roller	301	401	0.59	0.34	2.46	5.53	0.12	0.34	0.33	536	53.51	386.04	867.58	18.07	53.09	51.50	83,985
Paving Machine	301	164	0.59	0.38	1.44	4.25	0.12	0.30	0.29	536	24.36	92.47	272.59	7.39	19.23	18.66	34,341
Asphalt Curbing Machine	30	130	0.59	0.40	1.57	4.57	0.12	0.32	0.31	536	2.01	7.98	23.20	0.59	1.62	1.57	2,722
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck	363	230	17	8.21E-05	9.74E-04	3.52E-03	2.35E-05	6.15E-05	5.93E-05	3	0.50	5.90	21.31	0.14	0.37	0.36	20,747
Water Truck	481	230	10	8.21E-05	9.74E-04	3.52E-03	2.35E-05	6.15E-05	5.93E-05	3	0.39	4.68	16.91	0.11	0.30	0.29	16,467
Hot Mix Asphalt (HMA)	**Volume of HMA (ft^3)**	**Weight of HMA (tons)**		**VOC[4]** lb/ton of asphalt	**CO**	**Nox**	**SO_2**	**PM10**	**PM2.5**	**CO_2**	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Standard Hot Mix Asphalt	16,354	1,186		0.04	-	-	-	-	-	-	47.43	-	-	-	-	-	-
										Subtotal (lbs):	**139**	**537**	**1,320**	**30**	**83**	**80**	**173,443**

2020

Table 49. Clearing 2020

58 Acres

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	673	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	536	47.79	179.47	529.59	14.62	37.56	36.43	67,976
Loader w/ integral Backhoe	673	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	692	38.80	199.18	172.05	4.03	28.81	27.95	18,744
Small backhoe	673	55	0.21	1.43	7.35	6.35	0.15	1.06	1.03	692	24.53	125.92	108.77	2.55	18.21	17.67	11,849
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck	308	230	16	8.19E-05	1.01E-03	3.51E-03	2.36E-05	6.10E-05	5.91E-05	3	0	5	18	0	0	0	17,071
										Subtotal (lbs):	**112**	**510**	**828**	**21**	**85**	**82**	**115,640**

Table 50. Building Demolition - 2020

2,183 SF 109 Estimated CY of debris based on 20 SF/CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Hydraulic excavator	18	86	0.59	0.45	3.84	4.70	0.13	0.45	0.43	594.79	10	88	108	3	10	10	13,699
Wheel Loader w/ integral Backhoe	18	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	691.66	12	61	53	1	9	9	5,736
Wheel mounted air compressor	18	49	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	4	33	59	2	7	7	7,810
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY Capacity)	10	230	27	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3	0.3	2.8	10.8	0.1	0.2	0.2	10,628.8
										Subtotal (lbs):	**27**	**186**	**231**	**6**	**26**	**26**	**37,874**

Table 51. Demo Asphalt/Concrete- 2020

7,194 SF 147 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
D-6K Crawler Dozer with attachments	17	125	0.59	0.34	1.21	4.08	0.12	0.23	0.22	535.79	1	3	12	0	1	1	1,516
Wheel mounted air compressor	17	49	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595.16	0	3	5	0	1	1	660
Excavator with attachments	6	380	0.59	0.31	2.50	4.51	0.13	0.55	0.54	595.21	1	7	13	0	2	2	1,764
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY Capacity)	14	230	27	8.20E-05	9.20E-04	3.50E-03	2.35E-05	6.10E-05	5.94E-05	3	0.0	0	1	0	0	0	1,269
										Subtotal (lbs):	**2**	**14**	**31**	**1**	**3**	**3**	**5,209**

Table 52. Site Prep - Excavate/Fill - Trenching - Grading 2020

Site Prep - Excavate/Fill (CY)	28,309 CY	Assume 60% hauled in or out	16,985 CY hauled			
Trenching (LF)	165 LF	Assume 4 ft deep trench, 5 feet wide	122 CY		Assume 60% hauled in or out	73 CY hauled
Grading (SY)	262,395 SF	Convert	29,152 SY		Assume compact 0.5 feet (0.166 yards)	4,859 CY compacted

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Backhoe Excavator	57	243	0.59	0.34	1.21	4.03	0.12	0.22	0.22	535.79	6.15	21.64	72.11	2.06	3.99	3.87	9,588
Skid Steer Loader	272	160	0.23	0.38	1.47	4.34	0.12	0.31	0.30	535.67	8.45	32.41	95.66	2.54	6.73	6.53	11,811
Dozer	126	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	535.69	8.94	33.56	99.04	2.73	7.02	6.81	12,712
Scraper Hauler Excavator	126	365	0.58	0.38	1.42	4.19	0.12	0.30	0.29	535.69	22.15	83.35	245.86	6.77	17.41	16.89	31,457
Compactor	36	103	0.58	0.40	1.57	4.57	0.12	0.32	0.31	535.63	1.87	7.44	21.64	0.55	1.51	1.47	2,539
Grader	216	285	0.58	0.34	1.21	4.07	0.12	0.23	0.22	535.79	27.06	95.05	320.29	9.07	17.75	17.22	42,164
Trenching with backhoe loader	2	87	0.59	0.34	1.21	4.07	0.12	0.23	0.22	535.79	0.07	0.24	0.80	0.02	0.04	0.04	106
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (12 CY capacity)	1,019	230	16	8.19E-05	1.01E-03	3.51E-03	2.36E-05	6.10E-05	5.91E-05	3	1	17	58	0	1	1	56,477
Delivery Truck	1	365	45	8.19E-05	1.01E-03	3.51E-03	2.36E-05	6.10E-05	5.91E-05	3	0	0	0	0	0	0	154
										Subtotal (lbs):	**76**	**290**	**914**	**24**	**55**	**54**	**167,007**

Table 53. Building Construction- Structure - 2020

176,797 SF

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Crane	6,718	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530	696.54	3457.17	14910.94	323.39	588.87	571.20	1,503,341
Concrete truck	884	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	536	47.17	365.68	1086.24	29.00	52.81	51.23	134,818
Diesel Generator (Assume 5 generators)	707	40	0.59	0.33	2.54	4.53	0.13	0.54	0.53	595	12.06	93.51	166.58	4.71	19.94	19.34	21,899
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Diesel Pickup Truck	64	400	30	8.19E-05	1.01E-03	3.51E-03	2.36E-05	6.10E-05	5.91E-05	3	0.16	1.93	6.70	0.04	0.12	0.11	6,526
Delivery Truck	4,243	365	60	8.19E-05	1.01E-03	3.51E-03	2.36E-05	6.10E-05	5.91E-05	3	20.86	256.87	893.78	6.00	15.53	15.04	870,092
										Subtotal (lbs):	**777**	**4175**	**17064**	**363**	**677**	**657**	**2,536,676**

Table 54. Gravel Work - 2020

4,156 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Dozer	42	185	0.59	0.34	1.21	4.08	0.12	0.23	0.22	536	3.44	12.07	40.81	1.15	2.26	2.19	5,358
Wheel Loader for Spreading	52	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	536	2.05	7.34	24.89	0.68	1.40	1.36	3,150
Compactor	31	135	0.43	0.36	1.34	4.45	0.12	0.26	0.25	536	1.42	5.27	17.54	0.45	1.01	0.98	2,111
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3]** lb/mile	**CO[3]** lb/mile	**NOx[3]** lb/mile	**SO_2[3]** lb/mile	**PM10[3]** lb/mile	**PM2.5[3]** lb/mile	**CO_2[3]** lb/mile	**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
Dump Truck (gravel delivery)	537	230	26	8.19E-05	1.01E-03	3.51E-03	2.36E-05	6.10E-05	5.91E-05	3	1.13	13.98	48.63	0.33	0.84	0.82	47,345.9
										Subtotal (lbs):	**8**	**39**	**132**	**3**	**6**	**5**	**57,965**

Table 55. Concrete Work - Foundation and Sidewalks - 2020

Foundation Work	2,751 CY
Sidewalks, etc.	265 CY
Total	3,016 CY

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Concrete Mixer (3 mixers total to one truck)	159	3.5	0.43	0.69	3.04	6.17	0.13	0.54	0.52	588	0.36	1.60	3.25	0.07	0.28	0.28	310
Concrete Truck	287	300	0.43	0.38	1.75	6.18	0.11	0.27	0.26	530	31.01	142.61	505.04	9.31	21.95	21.29	43,287
										Subtotal (lbs):	**31**	**144**	**508**	**9**	**22**	**22**	**43,597**

Table 56. Paving Surface and Paving HMA - 2020

Pavement - Surface Area	49,064 SF	606 CY
Paving - HMA	16,354 CF	

Off-road Equipment	Cumulative Hours of Operation[1]	Engine HP	Load Factor	VOC[2] g/hp-hr	CO[2] g/hp-hr	NOx[2] g/hp-hr	SO_2[2] g/hp-hr	PM10[2] g/hp-hr	PM2.5[2] g/hp-hr	CO_2[2] g/hp-hr	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Grader	150	145	0.59	0.38	1.41	4.16	0.12	0.30	0.29	536	10.67	40.02	117.93	3.27	8.38	8.13	15,181
Steel drum roller/vibratory roller	301	401	0.59	0.34	2.46	5.53	0.12	0.34	0.33	536	53.51	386.04	867.58	18.07	53.09	51.50	83,985
Paving Machine	301	164	0.59	0.38	1.44	4.25	0.12	0.30	0.29	536	24.36	92.47	272.59	7.39	19.23	18.66	34,341
Asphalt Curbing Machine	30	130	0.59	0.40	1.57	4.57	0.12	0.32	0.31	536	2.01	7.98	23.20	0.59	1.62	1.57	2,722
On-road Equipment	**Cumulative Hours of Operation[1]**	**Engine HP**	**Productivity based Speed (miles/hour)**	**VOC[3] lb/mile**	**CO[3] lb/mile**	**NOx[3] lb/mile**	**SO_2[3] lb/mile**	**PM10[3] lb/mile**	**PM2.5[3] lb/mile**	**CO_2[3] lb/mile**	**VOC lb**	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**CO_2 lb**
Dump Truck	363	230	17	8.19E-05	1.01E-03	3.51E-03	2.36E-05	6.10E-05	5.91E-05	3	0.50	6.11	21.27	0.14	0.37	0.36	20,703
Water Truck	481	230	10	8.19E-05	1.01E-03	3.51E-03	2.36E-05	6.10E-05	5.91E-05	3	0.39	4.85	16.88	0.11	0.29	0.28	16,433
Hot Mix Asphalt (HMA)	**Volume of HMA (ft^3)**	**Weight of HMA (tons)**		**VOC[4] lb/ton of asphalt**	**CO**	**Nox**	**SO_2**	**PM10**	**PM2.5**	**CO_2**	**VOC lb**	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**CO_2 lb**
Standard Hot Mix Asphalt	16,354	1,186		0.04	-	-	-	-	-	-	47.43	-	-	-	-	-	-
										Subtotal (lbs):	**139**	**537**	**1,319**	**30**	**83**	**80**	**173,365**

Table 57. Fugitive Dust Emissions

Year	PM_{10} tons/acre/mo	acres	days of disturbance	PM_{10} Total	$PM_{2.5}/PM_{10}$ Ratio	$PM_{2.5}$ Total
2014	0.42	28	250	146.1	0.1	14.6
2015	0.42	28	250	146.1	0.1	14.6
2016	0.42	29	250	151.4	0.1	15.1
2017	0.42	34	250	179.4	0.1	17.9
2018	0.42	6	250	33.3	0.1	3.3
2019	0.42	5	250	28.0	0.1	2.8
2020	0.42	5	250	28.0	0.1	2.8

Table 58. Construction Emission Summary by Year

Year	VOC tons/yr	CO tons/yr	NOx tons/yr	SO2 tons/yr	PM10 tons/yr	PM2.5 tons/yr	CO_{2e} tonnes/yr
2014	2.7	11.5	33.5	0.8	148.0	16.4	4,532
2015	2.7	11.5	33.6	0.8	148.0	16.4	4,412
2016	3.2	13.8	42.7	1.0	153.6	17.3	5,742
2017	3.7	16.7	53.1	1.2	182.1	20.5	7,147
2018	1.0	5.2	19.5	0.4	34.1	4.1	2,636
2019	0.6	2.9	10.5	0.2	28.5	3.3	1,424
2020	0.6	2.9	10.5	0.2	28.5	3.3	1,423

[1]Complied from 2010 National Estimator, Equipment Manufacture's websites such as Freightliner and Cat, PACES, U.S. EPA. Open Burning and Construction Activities: Improved PM Fine Emission Estimation Techniques in the Nation Emissions Inventory, Ohio Emergency Management Agency. Appendix F Debris Estimating Guides, and Henderson, Chris. Project Management for Construction. Fundamental Concepts for Owners, Engineers, Architects, and Builders. Version 2.2. 2008

[2]US EPA NONROAD2008a Model

[3]MOVES (Motor Vehicle Emission Simulator)
2010/08/26

[4]California Air Resources Board. "Comparison of Asphalt Paving Emission Factors." Draft 5/11/05

TAB C. COMMUTER EMISSIONS

Table 1. 2014 Construction Workers 213 [1]construction workers

Vehicles	# vehicles	# days	[2]mi/day	[3]VOCs lb/mi	[3]CO lb/mi	[3]NOx lb/mi	[3]SO_2 lb/mi	[3]PM_{10} lb/mi	[3]$PM_{2.5}$ lb/mi	[4,5]CO_2 g/mi	[4,5]CH_4 g/mi	[4,5]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
carpool	21	240	80	1.175E-04	1.096E-02	9.232E-04	0.000E+00	4.56841E-05	4.11753E-05	519.00	0.04	0.05	48.07	4483.92	377.57	0.00	18.68	16.84	212,250,240	14,723	19,221
passenger vehicles	170	240	80	1.166E-04	1.382E-02	8.183E-04	6.180E-06	6.76923E-05	6.13809E-05	182.00	0.02	0.02	381.42	45209.14	2677.28	20.22	221.47	200.82	595,445,760	52,347	52,347
												Tons per Year	**0.21**	**24.85**	**1.53**	**0.01**	**0.12**	**0.11**			
												Metric Tons per Year							**808**	**0.07**	**0.07**
																		CO2e in metric tons/year	**831**		

Table 2. 2015 Construction Workers 213 [1]construction workers

Vehicles	# vehicles	# days	[4]mi/day	[3]VOCs lb/mi	[3]CO lb/mi	[3]NOx lb/mi	[3]SO_2 lb/mi	[3]PM_{10} lb/mi	[3]$PM_{2.5}$ lb/mi	[4,5]CO_2 g/mi	[4,5]CH_4 g/mi	[4,5]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
carpool	21	240	80	1.142E-04	1.072E-02	9.093E-04	0.000E+00	4.85082E-05	4.2586E-05	519.00	0.04	0.05	46.70	4384.96	371.86	0.00	19.84	17.42	212,250,240	14,723	19,221
passenger vehicles	170	240	80	1.034E-04	1.284E-02	6.461E-04	6.531E-06	6.5688E-05	5.95411E-05	182.00	0.02	0.02	338.34	42018.09	2113.67	21.37	214.91	194.80	595,445,760	52,347	52,347
												Tons per Year	**0.19**	**23.20**	**1.24**	**0.01**	**0.12**	**0.11**			
												Metric Tons per Year							**808**	**0.07**	**0.07**
																		CO2e in metric tons/year	**831**		

Table 3. 2016 Construction Workers 393 [1]construction workers

Vehicles	# vehicles	# days	[4]mi/day	[3]VOCs lb/mi	[3]CO lb/mi	[3]NOx lb/mi	[3]SO_2 lb/mi	[3]PM_{10} lb/mi	[3]$PM_{2.5}$ lb/mi	[4,5]CO_2 g/mi	[4,5]CH_4 g/mi	[4,5]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
carpool	39	240	80	1.124E-04	1.045E-02	8.967E-04	0.000E+00	4.90407E-05	4.40092E-05	519.00	0.04	0.05	84.80	7884.20	676.61	0.00	37.00	33.21	391,616,640	27,164	35,464
passenger vehicles	314	240	80	9.775E-05	1.216E-02	5.813E-04	6.822E-06	6.3817E-05	5.78549E-05	182.00	0.02	0.02	590.06	73414.00	3508.71	41.18	385.23	349.24	1,098,639,360	96,584	96,584
												Tons per Year	**0.34**	**40.65**	**2.09**	**0.02**	**0.21**	**0.19**			
												Metric Tons per Year							**1,490**	**0.12**	**0.13**
																		CO2e in metric tons/year	**1,534**		

Table 4. 2017 Construction Workers 532 [1]construction workers

Vehicles	# vehicles	# days	[4]mi/day	[3]VOCs lb/mi	[3]CO lb/mi	[3]NOx lb/mi	[3]SO_2 lb/mi	[3]PM_{10} lb/mi	[3]$PM_{2.5}$ lb/mi	[4,5]CO_2 g/mi	[4,5]CH_4 g/mi	[4,5]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
carpool	53	240	80	1.089E-04	1.013E-02	8.840E-04	0.000E+00	4.73247E-05	4.40133E-05	519.00	0.04	0.05	111.25	10348.23	902.98	0.00	48.34	44.96	530,127,360	36,772	48,008
passenger vehicles	426	240	80	9.382E-05	1.162E-02	5.389E-04	7.028E-06	6.16122E-05	5.59427E-05	182.00	0.02	0.02	766.63	94924.72	4403.97	57.43	503.47	457.14	1,487,216,640	130,744	130,744
												Tons per Year	**0.44**	**52.64**	**2.65**	**0.03**	**0.28**	**0.25**			
												Metric Tons per Year							**2,017**	**0.17**	**0.18**
																		CO2e in metric tons/year	**2,076**		

Table 5. 2018 Construction Workers 319 [1]construction workers

Vehicles	# vehicles	# days	[4]mi/day	[3]VOCs lb/mi	[3]CO lb/mi	[3]NOx lb/mi	[3]SO_2 lb/mi	[3]PM_{10} lb/mi	[3]$PM_{2.5}$ lb/mi	[4,5]CO_2 g/mi	[4,5]CH_4 g/mi	[4,5]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
carpool	32	240	80	1.067E-04	9.833E-03	8.696E-04	0.000E+00	4.66181E-05	4.4434E-05	519.00	0.04	0.05	65.34	6022.34	532.64	0.00	28.55	27.21	317,877,120	22,049	28,787
passenger vehicles	255	240	80	8.991E-05	1.112E-02	5.093E-04	7.204E-06	5.93055E-05	5.39807E-05	182.00	0.02	0.02	440.53	54480.16	2495.46	35.30	290.59	264.50	891,770,880	78,397	78,397
												Tons per Year	**0.25**	**30.25**	**1.51**	**0.02**	**0.16**	**0.15**			
												Metric Tons per Year							**1,210**	**0.10**	**0.11**
																		CO2e in metric tons/year	**1,245**		

Table 6. 2019 Construction Workers 139 [1]construction workers

Vehicles	# vehicles	# days	[4]mi/day	[3]VOCs lb/mi	[3]CO lb/mi	[3]NOx lb/mi	[3]SO_2 lb/mi	[3]PM_{10} lb/mi	[3]$PM_{2.5}$ lb/mi	[4,5]CO_2 g/mi	[4,5]CH_4 g/mi	[4,5]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
carpool	14	240	80	1.067E-04	9.557E-03	8.561E-04	0.000E+00	4.65353E-05	4.39866E-05	519.00	0.04	0.05	28.47	2550.60	228.47	0.00	12.42	11.74	138,510,720	9,608	12,543
passenger vehicles	111	240	80	8.593E-05	1.067E-02	4.873E-04	7.357E-06	5.68927E-05	5.19227E-05	182.00	0.02	0.02	183.46	22791.17	1040.36	15.71	121.47	110.86	388,577,280	34,161	34,161
												Tons per Year	**0.11**	**12.67**	**0.63**	**0.01**	**0.07**	**0.06**			
												Metric Tons per Year							**527**	**0.04**	**0.05**
																		CO2e in metric tons/year	**542**		

Table 7. 2020 Construction Workers 139 [1]construction workers

Vehicles	# vehicles	# days	[4]mi/day	[3]VOCs lb/mi	[3]CO lb/mi	[3]NOx lb/mi	[3]SO_2 lb/mi	[3]PM_{10} lb/mi	[3]$PM_{2.5}$ lb/mi	[4,5]CO_2 g/mi	[4,5]CH_4 g/mi	[4,5]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
carpool	14	240	80	1.023E-04	9.232E-03	8.406E-04	0.000E+00	4.61531E-05	4.13221E-05	519.00	0.04	0.05	27.31	2463.95	224.34	0.00	12.32	11.03	138,510,720	9,608	12,543
passenger vehicles	111	240	80	8.221E-05	1.025E-02	4.682E-04	7.654E-06	5.49388E-05	5.032E-05	182.00	0.02	0.02	175.53	21887.06	999.52	16.34	117.30	107.44	388,577,280	34,161	34,161
												Tons per Year	**0.10**	**12.18**	**0.61**	**0.01**	**0.06**	**0.06**			
												Metric Tons per Year							**527**	**0.04**	**0.05**
																		CO2e in metric tons/year	**542**		

Table 8. 2017 Instructors and Staff Commuters 460 [6]Employees 460 [6]Average Daily Trips

Vehicles	# vehicles	# days	[4]mi/day	[3]VOCs lb/mi	[3]CO lb/mi	[3]NOx lb/mi	[3]SO_2 lb/mi	[3]PM_{10} lb/mi	[3]$PM_{2.5}$ lb/mi	[4,5]CO_2 g/mi	[4,5]CH_4 g/mi	[4,5]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
passenger vehicles	410	240	40	1.089E-04	1.013E-02	8.840E-04	0.000E+00	4.73247E-05	4.40133E-05	182.00	0.02	0.02	428.67	39875.68	3479.52	0.00	186.27	173.24	716,352,000	62,976	62,976
carpool	25	240	45	1.269E-04	1.189E-02	9.205E-04	8.699E-07	3.68692E-05	3.46772E-05	519.00	0.04	0.05	34.25	3209.99	248.53	0.23	9.95	9.36	140,130,000	9,720	12,690
												Tons per Year	**0.23**	**21.54**	**1.86**	**0.00**	**0.10**	**0.09**			
												Metric Tons per Year							**856**	**0.07**	**0.08**
																		CO2e in metric tons/year	**881**		

Table 9. 2018 Instructors and Staff Commuters 663 [6]Employees 663 [6]Average Daily Trips

Vehicles	# vehicles	# days	[4]mi/day	[3]VOCs lb/mi	[3]CO lb/mi	[3]NOx lb/mi	[3]SO_2 lb/mi	[3]PM_{10} lb/mi	[3]$PM_{2.5}$ lb/mi	[4,5]CO_2 g/mi	[4,5]CH_4 g/mi	[4,5]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
passenger vehicles	591	240	40	1.067E-04	9.833E-03	8.696E-04	0.000E+00	4.66181E-05	4.4434E-05	182.00	0.02	0.02	605.24	55780.69	4933.45	0.00	264.46	252.07	1,032,481,252	90,768	90,768
carpool	36	240	45	1.254E-04	1.154E-02	9.085E-04	7.291E-07	3.58417E-05	3.37851E-05	519.00	0.04	0.05	48.80	4490.11	353.56	0.28	13.95	13.15	201,969,978	14,009	18,290
												Tons per Year	**0.33**	**30.14**	**2.64**	**0.00**	**0.14**	**0.13**			
												Metric Tons per Year							**1,234**	**0.10**	**0.11**
																		CO2e in metric tons/year	**1,270**		

Table 10. 2019 Instructors and Staff Commuters 867 [6]Employees 867 [6]Average Daily Trips

Vehicles	# vehicles	# days	[4]mi/day	[3]VOCs lb/mi	[3]CO lb/mi	[3]NOx lb/mi	[3]SO_2 lb/mi	[3]PM_{10} lb/mi	[3]$PM_{2.5}$ lb/mi	[4,5]CO_2 g/mi	[4,5]CH_4 g/mi	[4,5]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
passenger vehicles	773	240	40	8.593E-05	1.067E-02	4.873E-04	7.357E-06	5.68927E-05	5.19227E-05	182.00	0.02	0.02	637.45	79191.22	3614.88	54.58	422.06	385.19	1,350,167,791	118,696	118,696
carpool	47	240	45	1.067E-04	9.557E-03	8.561E-04	0.000E+00	4.65353E-05	4.39866E-05	519.00	0.04	0.05	54.29	4863.52	435.66	0.00	23.68	22.38	264,114,587	18,320	23,918
												Tons per Year	**0.35**	**42.03**	**2.03**	**0.03**	**0.22**	**0.20**			
												Metric Tons per Year							**1,614**	**0.14**	**0.14**
																		CO2e in metric tons/year	**1,661**		

Table 11. 2020 + Instructors and Staff Commuters 1070 [6]Employees 1070 [6]Average Daily Trips

Vehicles	# vehicles	# days	[4]mi/day	[3]VOCs lb/mi	[3]CO lb/mi	[3]NOx lb/mi	[3]SO_2 lb/mi	[3]PM_{10} lb/mi	[3]$PM_{2.5}$ lb/mi	[4,5]CO_2 g/mi	[4,5]CH_4 g/mi	[4,5]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
passenger vehicles	954	240	40	8.221E-05	1.025E-02	4.682E-04	7.654E-06	5.49388E-05	5.032E-05	182.00	0.02	0.02	752.71	93856.10	4286.15	70.08	502.99	460.70	1,666,297,043	146,488	146,488
carpool	58	240	45	1.023E-04	9.232E-03	8.406E-04	0.000E+00	4.61531E-05	4.13221E-05	519.00	0.04	0.05	64.26	5798.36	527.93	0.00	28.99	25.95	325,954,565	22,610	29,518
												Tons per Year	**0.41**	**49.83**	**2.41**	**0.04**	**0.27**	**0.24**			
												Metric Tons per Year							**1,992**	**0.17**	**0.18**
																		CO2e in metric tons/year	**2,050**		

Table 12. 2017-2020 Student Shuttles Area Hotels 260 [6]Students 11 [6]Average Daily Trips

Vehicles	# vehicles	# days	[4]mi/day	[3]VOCs lb/mi	[3]CO lb/mi	[3]NOx lb/mi	[3]SO_2 lb/mi	[3]PM_{10} lb/mi	[3]$PM_{2.5}$ lb/mi	[4,5]CO_2 g/mi	[4,5]CH_4 g/mi	[4,5]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
25 Passenger Van	11	240	40	1.089E-04	1.013E-02	8.840E-04	0.000E+00	4.73247E-05	4.40133E-05	519.00	0.04	0.05	11.50	1069.84	93.35	0.00	5.00	4.65	54,806,400	3,802	4,963
												Tons per Year	**0.01**	**0.53**	**0.05**	**0.00**	**0.00**	**0.00**			
												Metric Tons per Year							**55**	**0.00**	**0.00**
																		CO2e in metric tons/year	**56**		

Assume no Student Shuttle from Dorms until 2020

Table 13. 2020 Student Shuttles Dorm Bus 270 [6]Students 11 [6]Average Daily Trips

Vehicles	# vehicles	# days	[4]mi/day	[3]VOCs lb/mi	[3]CO lb/mi	[3]NOx lb/mi	[3]SO_2 lb/mi	[3]PM_{10} lb/mi	[3]$PM_{2.5}$ lb/mi	[4,5]CO_2 g/mi	[4,5]CH_4 g/mi	[4,5]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
carpool	11	240	5	1.023E-04	9.232E-03	8.406E-04	0.000E+00	4.61531E-05	4.13221E-05	519.00	0.04	0.05	1.33	119.65	10.89	0.00	0.60	0.54	6,726,240	467	609
												Tons per Year	**0.00**	**0.06**	**0.01**	**0.00**	**0.00**	**0.00**			
												Metric Tons per Year							**7**	**0.00**	**0.00**
																		CO2e in metric tons/year	**7**		

Table 14. 2020 Student POV 180 [6]Students 180 [6]Average Daily Trips only allowed to drive in once (Sunday) and out once (Friday)

Vehicles	# vehicles	# days	[4]mi/day	[3]VOCs lb/mi	[3]CO lb/mi	[3]NOx lb/mi	[3]SO_2 lb/mi	[3]PM_{10} lb/mi	[3]$PM_{2.5}$ lb/mi	[4,5]CO_2 g/mi	[4,5]CH_4 g/mi	[4,5]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
passenger vehicles	160	100	176	9.382E-05	1.162E-02	5.389E-04	7.028E-06	6.16122E-05	5.59427E-05	182.00	0.02	0.02	264.91	32801.05	1521.78	19.85	173.97	157.96	513,904,696	45,178	45,178
carpool	10	100	176	1.089E-04	1.013E-02	8.840E-04	0.000E+00	4.73247E-05	4.40133E-05	519.00	0.04	0.05	18.75	1744.30	152.21	0.00	8.15	7.58	89,358,261	6,198	8,092
												Tons per Year	**0.14**	**17.27**	**0.84**	**0.01**	**0.09**	**0.08**			
												Metric Tons per Year							**603**	**0.05**	**0.05**
																		CO2e in metric tons/year	**621**		

Table 15. Student Shuttles from Washington Dulles Airport 189 [6]Students 8 [6]Average Daily Trips drive in once (Sunday) and out once (Friday)

Vehicles	# vehicles	# days	[4]mi/day	[3]VOCs lb/mi	[3]CO lb/mi	[3]NOx lb/mi	[3]SO_2 lb/mi	[3]PM_{10} lb/mi	[3]$PM_{2.5}$ lb/mi	[4,5]CO_2 g/mi	[4,5]CH_4 g/mi	[4,5]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
carpool	8	100	176	1.089E-04	1.013E-02	8.840E-04	0.000E+00	4.73247E-05	4.40133E-05	519.00	0.04	0.05	14.49	1347.99	117.62	0.00	6.30	5.86	69,056,064	4,790	6,254
												Tons per Year	**0.01**	**0.67**	**0.06**	**0.00**	**0.00**	**0.00**			
												Metric Tons per Year							**69**	**0.00**	**0.01**
																		CO2e in metric tons/year	**71**		

Table 16. Student Shuttles for Richmond International Airport 81 [6]Students 4 [6]Average Daily Trips drive in once (Sunday) and out once (Friday)

Vehicles	# vehicles	# days	[4]mi/day	[3]VOCs lb/mi	[3]CO lb/mi	[3]NOx lb/mi	[3]SO_2 lb/mi	[3]PM_{10} lb/mi	[3]$PM_{2.5}$ lb/mi	[4,5]CO_2 g/mi	[4,5]CH_4 g/mi	[4,5]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
carpool	4	100	62	1.089E-04	1.013E-02	8.840E-04	0.000E+00	4.73247E-05	4.40133E-05	519.00	0.04	0.05	2.70	251.25	21.92	0.00	1.17	1.09	12,871,200	893	1,166
												Tons per Year	**0.00**	**0.13**	**0.01**	**0.00**	**0.00**	**0.00**			
												Metric Tons per Year							**13**	**0.00**	**0.00**
																		CO2e in metric tons/year	**13**		

[1]Construction worker population from calculations based on "Estimate of Construction Labor", EnVErgie Consulting, LLC, January 2012.

2Construction worker commute is based on need for worker pool drawn from Richmond/Petersburg VA area due to limited resources in Nottoway County

[3] Emission factors from MOVES2010

[4]Emission Factors from *Federal Greenhouse Gas Accounting and Reporting Guidance: Technical Support Document* (CEQ. 2010), Table D-11

[5]Emission Factors from *Federal Greenhouse Gas Accounting and Reporting Guidance: Technical Support Document* (CEQ. 2010), Table D-12

[6] Data from: Tentative Trip Generation Summary for Foreign Affairs Security Training Center (FASTC) at Fort Pickett - Nottoway County, Virginia

-Numbers of employees and students are tentative (including student housing options for Phase 1); build alternatives are not final.
-In Phase 1 all students will be housed at local hotels and transported daily to site using 25 passenger shuttle buses.
-At full build out 250 students will be housed at local hotels and transported daily to site using 25 passenger shuttle buses.
-At full build out 450 students will be housed on site in dormitories and will arrive on site on Sunday and depart on Friday; 60% will be bused and 40% will use their personal vehicles (POV). Trips shown for students in dormitories are applicable to Friday only.

Commuter Assumptions:

1. 90% of instructors and support staff will live within 50 miles of FASTC.
2. Most instructors and support staff will arrive via personal vehicles.
   Perhaps 40-50 may utilize expanded commercial van pools from the greater Richmond area.
3. Instructors and support staff will arrive between 06:30 and 08:15 and depart at 17:00.
4. No on-site housing for students. All students will be housed in area hotels.
5. Students will not use personal vehicles; all will be transported daily to FASTC using 25 passenger shuttle buses.
6. Students buses from hotels will arrive between 07:30 and 08:00 and depart at 17:00.
7. 70% of students arriving on buses will come from Washington Dulles Airport. 30% of the students arriving on buses will come from Richmond International Airport.

Table 17. Construction POV Emissions Summary

Year	VOC tons/yr	CO tons/yr	NOx tons/yr	SO2 tons/yr	PM10 tons/yr	PM2.5 tons/yr	CO_2e tonnes/yr
2014	0.2	24.8	1.5	0.0	0.1	0.1	831
2015	0.2	23.2	1.2	0.0	0.1	0.1	831
2016	0.3	40.6	2.1	0.0	0.2	0.2	1,534
2017	0.4	52.6	2.7	0.0	0.3	0.3	2,076
2018	0.3	30.3	1.5	0.0	0.2	0.1	1,245
2019	0.1	12.7	0.6	0.0	0.1	0.1	542
2020	0.1	12.2	0.6	0.0	0.1	0.1	542

Table 18. Operational POV Emissions Summary

Year	VOC tons/yr	CO tons/yr	NOx tons/yr	SO2 tons/yr	PM10 tons/yr	PM2.5 tons/yr	CO_2e tonnes/yr
2017	0.4	40.2	2.8	0.0	0.2	0.2	1,643
2018	0.5	48.7	3.6	0.0	0.2	0.2	2,032
2019	0.5	60.6	3.0	0.0	0.3	0.3	2,423
2020	0.6	68.5	3.4	0.0	0.4	0.3	2,819

TAB D. TRACK OPERATION EMISSIONS

Table 1. D02 High-Speed Anti-Terrorism Driving 2020

270 [1]Vehicles/day Track 1
270 [1]Vehicles/day Track 2
270 [1]Vehicles/day Track 3

Track	Vehicles	count of vehicles	# days	miles per trip	[2]VOCs lb/mi	[2]CO lb/mi	[2]NOx lb/mi	[2]SO_2 lb/mi	[2]PM_{10} lb/mi	[2]$PM_{2.5}$ lb/mi	[3,4]CO_2 g/mi	[3,4]CH_4 g/mi	[3,4]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
1	cars	270	250	1.7	3.037E-04	1.928E-02	2.186E-03	2.565E-06	7.74307E-05	6.83189E-05	182.00	0.02	0.02	34.85	2211.81	250.81	0.29	8.89	7.84	20,884,500	1,836	1,836
2	cars	270	250	2.5	3.037E-04	1.928E-02	2.186E-03	2.565E-06	7.74307E-05	6.83189E-05	182.00	0.02	0.02	51.25	3252.67	368.84	0.43	13.07	11.53	30,712,500	2,700	2,700
3	cars	270	250	2.0	3.037E-04	1.928E-02	2.186E-03	2.565E-06	7.74307E-05	6.83189E-05	182.00	0.02	0.02	41.00	2602.14	295.07	0.35	10.45	9.22	24,570,000	2,160	2,160
													Tons per Year	**0.06**	**4.03**	**0.46**	**0.00**	**0.02**	**0.01**			
													Metric Tons per Year							**76**	**0.01**	**0.01**
																			CO2e in metric tons/year	**78**		

Table 2. Mock Urban Driving Course Exercises

36 [1]Vehicles/day MUOT D03

Track	Vehicles	count of vehicles	# days	miles per trip	[2]VOCs lb/mi	[2]CO lb/mi	[2]NOx lb/mi	[2]SO_2 lb/mi	[2]PM_{10} lb/mi	[2]$PM_{2.5}$ lb/mi	[3,4]CO_2 g/mi	[3,4]CH_4 g/mi	[3,4]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
MUOT	cars	36	250	6.3	4.299E-04	1.804E-02	2.058E-03	5.449E-06	9.05872E-05	8.09908E-05	182.00	0.02	0.02	24.38	1022.78	116.71	0.31	5.14	4.59	10,319,400	907	907
													Tons per Year	**0.01**	**0.51**	**0.06**	**0.00**	**0.00**	**0.00**			
													Metric Tons per Year							**10**	**0.00**	**0.00**
																			CO2e in metric tons/year	**11**		

Table 3. Urban Drive Course Exercises for E04, Explosives Simulation Alley

36 [1]Vehicles/day ESA E04

Track	Vehicles	count of vehicles	# days	miles per trip	[2]VOCs lb/mi	[2]CO lb/mi	[2]NOx lb/mi	[2]SO_2 lb/mi	[2]PM_{10} lb/mi	[2]$PM_{2.5}$ lb/mi	[3,4]CO_2 g/mi	[3,4]CH_4 g/mi	[3,4]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
ESA	cars	36	250	1.8	4.761E-04	1.774E-02	2.056E-03	6.616E-06	8.10285E-05	7.16157E-05	182.00	0.02	0.02	7.71	287.32	33.31	0.11	1.31	1.16	2,948,400	259	259
													Tons per Year	**0.00**	**0.14**	**0.02**	**0.00**	**0.00**	**0.00**			
													Metric Tons per Year							**3**	**0.00**	**0.00**
																			CO2e in metric tons/year	**3**		

Table 4. Rural Drive Course Exercises for E04, Explosives Simulation Alley

36 [1]Vehicles/day ESA E04

Track	Vehicles	count of vehicles	# days	miles per trip	[2]VOCs lb/mi	[2]CO lb/mi	[2]NOx lb/mi	[2]SO_2 lb/mi	[2]PM_{10} lb/mi	[2]$PM_{2.5}$ lb/mi	[3,4]CO_2 g/mi	[3,4]CH_4 g/mi	[3,4]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
ESA	SUV/pickups	36	250	1.8	7.462E-04	2.742E-02	3.899E-03	4.146E-06	0.000109867	9.88276E-05	364.00	0.03	0.03	12.09	444.24	63.16	0.07	1.78	1.60	5,896,800	502	518
													Tons per Year	**0.01**	**0.22**	**0.03**	**0.00**	**0.00**	**0.00**			
													Metric Tons per Year							**6**	**0.00**	**0.00**
																			CO2e in metric tons/year	**6**		

Table 5. Off-Road Driving Exercises

16 [1]Vehicles/day D05

Track	Vehicles	count of vehicles	# days	miles per trip	[2]VOCs lb/mi	[2]CO lb/mi	[2]NOx lb/mi	[2]SO_2 lb/mi	[2]PM_{10} lb/mi	[2]$PM_{2.5}$ lb/mi	[3,4]CO_2 g/mi	[3,4]CH_4 g/mi	[3,4]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
D05	SUV/pickups	16	250	2.4	7.462E-04	2.742E-02	3.899E-03	4.146E-06	0.000109867	9.88276E-05	364.00	0.03	0.03	7.16	263.25	37.43	0.04	1.05	0.95	3,494,400	298	307
													Tons per Year	**0.00**	**0.13**	**0.02**	**0.00**	**0.00**	**0.00**			
													Metric Tons per Year							**3**	**0.00**	**0.00**
																			CO2e in metric tons/year	**4**		

Table 6. Off-Road Driving Exercises

16 [1]Vehicles/day D04

Track	Vehicles	count of vehicles	# days	miles per trip	[2]VOCs lb/mi	[2]CO lb/mi	[2]NOx lb/mi	[2]SO_2 lb/mi	[2]PM_{10} lb/mi	[2]$PM_{2.5}$ lb/mi	[3,4]CO_2 g/mi	[3,4]CH_4 g/mi	[3,4]N_2O g/mi	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 g	CH_4 g	N_2O g
D04	SUV/pickups	16	250	2.6	7.462E-04	2.742E-02	3.899E-03	4.146E-06	0.000109867	9.88276E-05	364.00	0.03	0.03	7.76	285.19	40.55	0.04	1.14	1.03	3,785,600	322	333
													Tons per Year	**0.00**	**0.14**	**0.02**	**0.00**	**0.00**	**0.00**			
													Metric Tons per Year							**4**	**0.00**	**0.00**
																			CO2e in metric tons/year	**4**		

[1]Vehicle counts from Noise Modeling Data Validation Package for FASTC EIS/MP, Blue Ridge Research and Consulting, February 2012.
[2] Emission factors from MOVES2010
[3]Emission Factors from *Federal Greenhouse Gas Accounting and Reporting Guidance: Technical Support Document* (CEQ. 2010), Table D-11
[4]Emission Factors from *Federal Greenhouse Gas Accounting and Reporting Guidance: Technical Support Document* (CEQ. 2010), Table D-12

Table 7. Tracks Emissions Summary

	VOC tons/yr	CO tons/yr	NOx tons/yr	SO2 tons/yr	PM10 tons/yr	PM2.5 tons/yr	CO_2e tonnes/yr
Tracks	0.1	5.2	0.6	0.0	0.0	0.0	106

TAB E. OPERATIONAL EMISSIONS FROM STATIONARY SOURCES

Table 1. Operational Emissions - Emergency Generators

Assume the IC engines are typically operated 0.5 hours per week for testing and maintenance = 26 hr/yr
Assume additional five 24-hour periods for total power outages per year = 120 hr/yr
146 Total

Generator size kW	#	CO lb/yr	NOx lb/yr	PM lb/yr	SO2 lb/yr	VOC lb/yr	CO2 lb/yr	CH4 lb/yr
13	2	17	79	6	N.D.	6	2926	N.D.
30	1	20	91	6	N.D.	7	3376	N.D.
50	1	33	152	11	N.D.	12	5626	N.D.
125	2	163	758	54	N.D.	62	28132	N.D.
700	1	377	890	48	28	44	79455	48
	Tons/yr	**0.30**	**0.99**	**0.06**	**0.01**	**0.07**	59.76	0.02
						metric tons/yr	**CO2e =**	**54.67**

50% Load Factor

Pollutant	Emission Factors Diesel Fuel [a, b] > 447 kW or > 600 hp lb/hp-hr	Emission Factors Diesel Fuel [a, b] < 447 kW or < 600 hp lb/hp-hr
CO	0.0055	0.00668
NO_x	0.013	0.031
PM	0.0007	0.0022
SO_2 [c]	0.00809	N.D.
S	0.05	N.D.
VOC	0.000642	0.0025141
CO2	1.16	1.15
CH4	0.000705	N.D.

[a] Emission factors used to estimate emissions from the consumption of diesel fuel.
[b] Emission factors from U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors - Volume I (AP-42), Section 3.4, 5th Edition; . factors based upon power output
[c] The variable S in the emissions factor equals the sulfur content of the fuel expressed as percent weight.
SO_2 factor was assumed to equal 0.05 for diesel fuel.

Table 2. Operational Parameters - Boilers

1-02-005-02/03 Distillate oil fired Boilers <100 Million Btu/hr

Example boiler that is < 10 MM Btu:

Heat Input (MMBtu/hr)[a]	Fuel Type	Annual Hours of Operation	Est. Qty Oil consumed Annually (gal)	
3.35	Oil	2186	65,580	Admin and Classroom Building
1.34	Oil	2735	32,820	75 PN Dormitory
1.34	Oil	2735	32,820	75 PN Dormitory
1.34	Oil	2918	35,016	Dining Facility
0.39	Oil	2186	6,012	Firearms Classroom Building
3.35	Oil	2186	65,580	50-M Indoor Firing Ranges (2 of 4)
1.34	Oil	2735	32,820	75 PN Dormitory
1.34	Oil	2735	32,820	75 PN Dormitory
1.34	Oil	2735	32,820	75 PN Dormitory
1.34	Oil	2735	32,820	75 PN Dormitory
3.35	Oil	2186	65,580	Technical Security Training Center
1.00	Oil	2186	19,674	Jericho Facility
0.32	Oil	2186	4,919	Explosive Breaching Range Classroom
0.14	Oil	2186	2,186	Data Center
0.18	Oil	2186	2,733	Live Fire Shoot House Classroom
1.00	Oil	2186	19,674	Simulation Building
1.00	Oil	2186	19,674	Armory
0.25	Oil	2186	3,826	Visitor Control Center

Manufacture	Boiler Model	Oil Burner Input MBH	GPH
Utica	SFH-3100W	140	1
Utica	SFH-4125W	175	1
Utica	SFH-5175W	245	2
Utica	SFH-6225W	315	2
Utica	SFH-7275W	385	3
Cleaver Brooks	CB 30 HP	1004	9
Cleaver Brooks	CB 40 HP	1339	12
Cleaver Brooks	CB 100 HP	3348	30

140,000 btu/gal fuel oil

Assume heat 10/15 to 4/14
182 heating days
183 non heating days

Total est. quantity of oil consumed annually 507,372 gal

Table 3. Emission Factors for Boilers

Pollutant	Emission Factor ($lb/10^3$ gal)[a,b] <100 MMBtu/hr
CO	5
NO_x	20
PM[c]	2
SO_2	71
VOC	0.556
CO2	22,300
N2O	0.26
CH4	0.216

0.5 Percent Sulfur content in fuel

[a] Emission factors from U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors - Volume I (AP-42), Section 1.3, 5th Edition.

[b] Emission factors based on burning fuel oil with a heating value of 140 MMBtu/10^3 gal

[c] PM is less than 1 micrometer in size.

Table 4. Annual Emissions for Boilers

	Annual Emissions in lbs							
	VOC	**CO**	**NOx**	**SO2**	**PM**	**CO2**	**N2O**	**CH4**
Admin and Classroom Building	36	328	1312	4656	131	1462434	17.05	14.17
75 PN Dormitory	18	164	656	2330	66	731886	8.53	7.09
75 PN Dormitory	18	164	656	2330	66	731886	8.53	7.09
Dining Facility	19	175	700	2486	70	780856.8	9.10	7.56
Firearms Classroom Building	3	30	120	427	12	134056.45	1.56	1.30
50-M Indoor Firing Ranges (2 of 4)	36	328	1312	4656	131	1462434	17.05	14.17
75 PN Dormitory	18	164	656	2330	66	731886	8.53	7.09
75 PN Dormitory	18	164	656	2330	66	731886	8.53	7.09
75 PN Dormitory	18	164	656	2330	66	731886	8.53	7.09
75 PN Dormitory	18	164	656	2330	66	731886	8.53	7.09
Technical Security Training Center	36	328	1312	4656	131	1462434	17.05	14.17
Jericho Facility	11	98	393	1397	39	438730.2	5.12	4.25
Explosive Breaching Range Classroom	3	25	98	349	10	109682.55	1.28	1.06
Data Center	1	11	44	155	4	48747.8	0.57	0.47
Live Fire Shoot House Classroom	2	14	55	194	5	60934.75	0.71	0.59
Simulation Building	11	98	393	1397	39	438730.2	5.12	4.25
Armory	11	98	393	1397	39	438730.2	5.12	4.25
Visitor Control Center	2	19	77	272	8	85308.65	0.99	0.83
Total in Tons/yr	**0.14**	**1.27**	**5.07**	**18.01**	**0.51**	5657.20	0.07	0.05
					CO2e =	**5151.72**	metric tons/yr	

Table 5. Total Annual Emissions for All Equipment

	VOC t/yr	**CO t/yr**	**NOx t/yr**	**SO2 t/yr**	**PM10 t/yr**	**PM2.5 t/yr**	**CO2e MT/yr**
Generator	0.07	0.30	0.99	0.01	0.06	< 0.04	54.67
Boiler	0.14	1.27	5.07	18.01	0.51	< 0.04	5151.72
Total	**0.21**	**1.57**	**6.06**	**18.03**	**0.57**	**<0.08**	**5206.39**

TAB F. ORDNANCE EMISSIONS

Table 1. [1]Firing Range Ordnance Emission Factors

Pollutant	12 Gauge #00 Shot Cartridges lb/item	5.56 mm Ball Cartridge lb/item	9-mm Ball Cartridge lb/item	.45 Caliber Ball Cartridge lb/item	.40 Caliber lb/item[2]	.357 Caliber lb/item[2]
CO_2	0.0013	0.00087	0.00020	0.00022	0.00021	0.00021
CO	0.0015	0.0016	0.00031	0.00026	0.00019	0.00019
Pb	0.00005	0.0000051	0.0000068	0.000012	0.000018	0.000018
CH_4	0.000013	0.0000097	0.0000014	0.00000078	0.0000007	0.00000070
NO_x	0.000042	0.000085	0.000015	0.0000081	0.0000037	0.0000037
$PM_{2.5}$	0.000067	0.000028	0.00002	0.000031	0.000038	0.000038
PM_{10}	0.000074	0.000039	0.000024	0.000037	0.000042	0.000042
SO_2	[3]ND	[3]ND	0.000021	0.000032	[3]ND	[3]ND

[1]from *Compilation of Air Pollutant Emission Factors - Volume I, Section 15.1 , Tables 15.1.2-1, 15.1.6-1, 15.1.21-1, 15.1.23-1 and 15.1.25-1* . 5th Edition, USEPA.

[2] .38 caliber special ball cartridge emission factors

[3]No data

Table 2. Emissions from Firing Range Ordnance Detonation

Ordinance Emissions Range	Weapon Type	Caliber	Rounds/yr	Emissions in pounds/year							
				CO_2	CO	Pb	CH_4	NO_x	$PM_{2.5}$	PM_{10}	SO_2
R02 - Indoor Firing Ranges	Handgun	0.375 mag	190,000	39.90	36.10	3.42	0.13	0.70	7.22	7.98	N.D.
	Handgun	9 mm	190,000	38.00	58.90	0.97	0.27	2.85	3.80	4.56	3.99
	Handgun	.40 cal	190,000	39.90	36.10	3.42	0.13	0.70	7.22	7.98	N.D.
	Rifle	5.56 mm	190,000	165.30	304.00	0.97	1.84	16.15	5.32	7.41	N.D.
	Sub-machine gun	9 mm	190,000	38.00	58.90	0.97	0.27	2.85	3.80	4.56	3.99
	Sub-machine gun	.40 cal	190,000	39.90	36.10	3.42	0.13	0.70	7.22	7.98	N.D.
	Sub-machine gun	.45 cal	190,000	41.80	49.40	2.28	0.15	1.54	5.89	7.03	6.08
	Shotgun	12 gauge	190,000	247.00	285.00	9.50	2.47	7.98	12.73	14.06	N.D.
R03a - Live Fire Shoot House (1 story)	Handgun	0.375 mag	190,000	39.90	36.10	3.42	0.13	0.70	7.22	7.98	N.D.
	Handgun	9 mm	190,000	38.00	58.90	0.97	0.27	2.85	3.80	4.56	3.99
	Handgun	.40 cal	190,000	39.90	36.10	3.42	0.13	0.70	7.22	7.98	N.D.
	Rifle	5.56 mm	190,000	165.30	304.00	0.97	1.84	16.15	5.32	7.41	N.D.
R03b - Live Fire Shoot House (2 story)	Handgun	0.375 mag	190,000	39.90	36.10	3.42	0.13	0.70	7.22	7.98	N.D.
	Handgun	9 mm	190,000	38.00	58.90	0.97	0.27	2.85	3.80	4.56	3.99
	Handgun	.40 cal	190,000	39.90	36.10	3.42	0.13	0.70	7.22	7.98	N.D.
	Rifle	5.56 mm	190,000	165.30	304.00	0.97	1.84	16.15	5.32	7.41	N.D.
R04 - Baffled Indoor Tactical Combat Range	Handgun	0.375 mag	190,000	39.90	36.10	3.42	0.13	0.70	7.22	7.98	N.D.
	Handgun	9 mm	190,000	38.00	58.90	0.97	0.27	2.85	3.80	4.56	3.99
	Handgun	.40 cal	190,000	39.90	36.10	3.42	0.13	0.70	7.22	7.98	N.D.
	Rifle	5.56 mm	190,000	165.30	304.00	0.97	1.84	16.15	5.32	7.41	N.D.
	Sub-machine gun	9 mm	190,000	38.00	58.90	0.97	0.27	2.85	3.80	4.56	3.99
	Sub-machine gun	.40 cal	190,000	39.90	36.10	3.42	0.13	0.70	7.22	7.98	N.D.
	Sub-machine gun	.45 cal	190,000	41.80	49.40	2.28	0.15	1.54	5.89	7.03	6.08
	Shotgun	12 gauge	190,000	247.00	285.00	9.50	2.47	7.98	12.73	14.06	N.D.
R05 - Existing Outdoor Rifle Range	Handgun	0.375 mag	190,000	39.90	36.10	3.42	0.13	0.70	7.22	7.98	N.D.
	Handgun	9 mm	190,000	38.00	58.90	0.97	0.27	2.85	3.80	4.56	3.99
	Handgun	.40 cal	190,000	39.90	36.10	3.42	0.13	0.70	7.22	7.98	N.D.
	Rifle	5.56 mm	190,000	165.30	304.00	0.97	1.84	16.15	5.32	7.41	N.D.
	Sub-machine gun	9 mm	190,000	38.00	58.90	0.97	0.27	2.85	3.80	4.56	3.99
	Sub-machine gun	.40 cal	190,000	39.90	36.10	3.42	0.13	0.70	7.22	7.98	N.D.
	Sub-machine gun	.45 cal	190,000	41.80	49.40	2.28	0.15	1.54	5.89	7.03	6.08
	Shotgun	12 gauge	190,000	247.00	285.00	9.50	2.47	7.98	12.73	14.06	N.D.
			Emissions in Tons/year	**1.26**	**1.73**	**0.05**	**0.01**	**0.07**	**0.10**	**0.12**	**0.03**
			CO2e in metric tons	**1.14**							

TAB G. FASTC CONSTRUCTION DATA

Project Name	Building Number	Phase	FootPrint (AC)	Clearing (AC)	Grading (sf)	Demo Bldgs (SF)	Demo asphalt/ concrete (SF)	Site Prep - Excavate/Fill (CY)	Trenching (LF)	Building Construction - Total Size (sf)	Building Construction- foundation footprint (sf)	# Stories	Paving - Surface area (SF)	Pavement type, vehicle or aircraft	Paving - HMA (CF)	Sidewalks (sf)	Gravel Work (CY)	Concrete Work - sidewalks, etc (CY)	Concrete Work - foundation (CY)	Additional excavation, please specify type (washrack, sw pond, etc.)
CONSTRUCTION PROJECTS																				
Admin and Classroom Building (portion of 145,000 sf facility)	A01	1	5	2.54	1,680	N/A	N/A	187	75	5,040	1,680	3	N/A	N/A		168	31	2	31	N/A
75 PN Dormitory	A06a	1	2.7	1.25	16,285	N/A	N/A	1,809	100	48,855	16,285	3	N/A	N/A		1,629	302	20	302	N/A
75 PN Dormitory	A06b	1	2.7	1.25	16,285	N/A	N/A	1,809	100	48,855	16,285	3	N/A	N/A		1,629	302	20	302	N/A
Dining Facility	A07	1	5	2.13	38,542	N/A	N/A	4,282	50	38,542	38,542	1	N/A	N/A		3,854	714	48	714	N/A
Parking for Main Campus Area (Buildings A01, A07, A02, A03, A04, I07, and R06)		1	10	8.41	301,920	N/A	N/A	3,727	0	N/A	N/A	N/A	301,920	Vehicle	100,638.99	30,192	3,727	373		N/A
Fitness Center	A08	1	5	1.39	18,703	N/A	N/A	2,078	25	37,406	18,703	2	N/A	N/A		1,870	346	23	346	N/A
Parking for dormitories and Fitness Center (A06a - f, A08)		1	3	2.36	55,708	N/A	N/A	688	0	N/A	N/A	N/A	55,708	Vehicle	18,569.15	5,571	688	69		N/A
Warehouse	A09	1	8	3.94	98,552	9,300	17,951	10,950	25	98,552	98,552	1	N/A	N/A		9,855	1,825	122	1,825	N/A
Driver Training Building	D01	1	5	N/A	6,414	8,436	1,410	713	75	12,828	6,414	2	N/A	N/A		641	119	8	119	N/A
Parking area for A09, D01, and D06		1	2	N/A	56,000	N/A	N/A	691	0	N/A	N/A	N/A	56,000	Vehicle	18,666.48	5,600	691	69		
High-Speed Anti-Terrorism Driving Tracks	D02	1	550	119.93	3,068,386	37158	391859	505,860	0	N/A	N/A	N/A	2,079,860	Vehicle	693,279.73	N/A	37,881			N/A
Classroom Building (track 1)	D02a	1	N/A	0.85	8,318	N/A	N/A	581	100	4,846	4,846	1	3,472	Vehicle	1,157.32	485	133	6	90	N/A
Classroom Building (track 2)	D02b	1	N/A	0.85	8,318	N/A	N/A	581	100	4,846	4,846	1	3,472	Vehicle	1,157.32	485	133	6	90	N/A
Classroom Building (track 3)	D02c	1	N/A	0.85	8,318	N/A	N/A	581	100	4,846	4,846	1	3,472	Vehicle	1,157.32	485	133	6	90	N/A
Mock-Urban Driving Track	D03	1	80	22.96	1,000,120	N/A	N/A	111,124	0	N/A	N/A	N/A	1,000,120	Vehicle	333,370.00	N/A	12,347			N/A
Unimproved Road Driving Course	D04	1	100	20.80	494,208	17664	64576	85,419	0	N/A	N/A	N/A	N/A	N/A		N/A	6,101			N/A
Off-Road Driving Course	D05	1	100	19.20	456,192	9,344	59,481	78,848	0	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A
Vehicle Maintenance Shop	D06	1	5	1.41	18,223	N/A	N/A	2,025	25	18,223	18,223	1	N/A	N/A		1,822	337	22	337	2 washracks
Garage- 80 Armored Vehicles	D06a	1	2	1.80	31,973	N/A	N/A	3,553	25	31,973	31,973	1	N/A	N/A		3,197	592	39	592	N/A
Covered Parking - 130 Training Vehicles	D06b	1	N/A	1.45	63,360	N/A	N/A	782	0	N/A	N/A	N/A	63,360	Vehicle	21,119.79	N/A	782			N/A
Explosives Classroom Bldg	E01	1	5	1.13	14,430	N/A	N/A	878	75	7,086	7,086	1	7,344	Vehicle	2,447.98	709	222	9	131	N/A
Explosives Demonstration Range	E02	1	100	69.87	785,398	N/A	N/A	145	0	?	?	?	7,854	Explosive (6 in)	3,926.99	N/A	97			
Post Blast Training Range	E03	1	200	69.87	785,398	N/A	N/A	2,963	0	?	?	?	160,000	Explosive (6 in)	80,000	N/A	1,975			N/A
Explosives Simulation Alley for IED Recognition	E04	1	60	14.55	345,600	2130	16148	59,733	0	N/A	N/A	N/A	230,400	Vehicle	76,799	N/A	4,267			N/A
Explosives Simulation Alley for IED Recognition - Classroom Bldg	E04a	1	N/A	0.88	9,026	N/A	N/A	627	50	5,218	5,218	1	3,808	Vehicle	1,269	522	144	6	97	N/A
Explosives Simulation Alley for IED Recognition - Structures	E04b	1	N/A	330.56	130,903	N/A	N/A	14,545	0	130,903	130,903	1	N/A	N/A		13,090	2,424	162	2,424	N/A
Emergency Services Building	I03	1	5	N/A	14,739	N/A	N/A	509	50	6,629	3,315	2	11,424	Vehicle	3,808	331	202	4	61	N/A
Firearms Classroom Building	R01	1	3	1.32	27,556	N/A	N/A	1,165	100	16,712	8,356	2	19,200	Vehicle	6,400	836	392	10	155	N/A
50-M Indoor Firing Ranges (2 of 4)	R02	1	6	5.92	163,880	N/A	N/A	18,209	100	163,880	163,880	1	N/A	N/A		16,388	3,035	202	3,035	N/A
Parking lot for R02 and R07 (136 spaces)		1	N/A	2.11	48,688	N/A	N/A	5,410	0	N/A	N/A	N/A	48,688	Vehicle	16,229	4,869	601	60		
Live-Fire Shooting Houses - 1 Story	R03a	1	3	0.85	17,812	N/A	N/A	1,536	150	13,324	13,324	1	4,488	Vehicle	1,496	1,332	302	16	247	N/A
Live-Fire Shooting Houses-2 Story	R03b	1	3	0.76	6,662	N/A	N/A	740	150	13,324	6,662	2	N/A	N/A		666	123	8	123	N/A
150 M Baffled Outdoor Tactical Combat Range (2 of 3)	R04	1	25	5.85	215,000	N/A	N/A	23,889	0	215,000	215,000	1	N/A	N/A		21,500	3,981	265	3,981	N/A
300-M Baffled Outdoor Rifle Range / Drive and Shoot - **Class room only**	R05	1	1	0.85	8,318	N/A	N/A	581	75	4,846	4,846	1	3,472	Vehicle	1,157	485	133	6	90	N/A
Central Ammo & Explosives Storage	R08	1	15	N/A	3,808	N/A	N/A	47	500	N/A	N/A	N/A	3,808	Vehicle	1,269	N/A	47			N/A
Supply CAC	S02	1	1	0.89	10,494	N/A	N/A	790	25	6,686	6,686	1	3,808	Vehicle	1,269	669	171	8	124	N/A
Tactical Training Building	T01	1	3	N/A	34,681	N/A	N/A	2,238	25	36,657	18,329	2	16,352	Vehicle	5,451	1,833	541	23	339	N/A
Mock Urban Tactical Training Area and Rappel Tower (20 of 45)	T02/T03	1	15	0.59	23,256	8730	28776	2,584	0	23,256	23,256	1	N/A	N/A		4,651	431	57	431	N/A
Tactical Maze	T04	1	5	N/A	13,254	6065	102	1,473	0	39,763	13,254	3	N/A	N/A		1,325	245	16	245	N/A
Roads in Admin and Explosives Range Areas		1		17.27	410,400	N/A	N/A	70,933	0	N/A	N/A	N/A	273,600	Vehicle	91,199	27,360	5,067	338		
Quick Range (Relocated from ITF)	N/A	1	?	?	?	N/A	N/A	?	0	3,990	?	?	?	?		?	?			N/A
Phase 1 Totals			**1,335**	**737**	**8,836,808**	**98,827**	**580,303**	**1,025,286**	**1300**	**1,042,086**	**881,309**		**4,361,630**		**1,481,838**	**164,048**	**91,584**	**2,025**	**16,321**	
2014 Totals			**334**	**184**	**2,209,202**	**24,707**	**145,076**	**256,322**	**325**	**260,522**	**220,327**	**0**	**1,090,407**	**0**	**370,460**	**41,012**	**22,896**	**506**	**4,080**	**0**
2015 Totals			**334**	**184**	**2,209,202**	**24,707**	**145,076**	**256,322**	**325**	**260,522**	**220,327**	**0**	**1,090,407**	**0**	**370,460**	**41,012**	**22,896**	**506**	**4,080**	**0**
2016 Totals			**334**	**184**	**2,209,202**	**24,707**	**145,076**	**256,322**	**325**	**260,522**	**220,327**	**0**	**1,090,407**	**0**	**370,460**	**41,012**	**22,896**	**506**	**4,080**	**0**
2017 Totals			**334**	**184**	**2,209,202**	**24,707**	**145,076**	**256,322**	**325**	**260,522**	**220,327**	**0**	**1,090,407**	**0**	**370,460**	**41,012**	**22,896**	**506**	**4,080**	**0**
Phase 1 by Year			333.85	184.1578781																
Admin and Classroom Building (completion of 145,000 sf facility)	A01	2	5	0.00	46,667	N/A	N/A	5,185	75	140,000	46,667	3	N/A	N/A		4,667	864	58	864	N/A
Technical Security Training Center	A02	2	5	2.31	47,309	N/A	N/A	5,257	50	141,928	47,309	3	N/A	N/A		4,731	876	58	876	N/A
Jericho Facility	A03	2	3	0.76	11,913	N/A	N/A	1,324	50	35,738	11,913	3	N/A	N/A		1,191	221	15	221	N/A
Training CAC	A04	2	3	0.56	2,934	N/A	N/A	326	25	2,934	2,934	1	N/A	N/A		293	54	4	54	N/A
75 PN Dormitory	A06c	2	2.7	1.25	16,285	N/A	N/A	1,809	100	48,855	16,285	3	N/A	N/A		1,629	302	20	302	N/A
75 PN Dormitory	A06d	2	2.7	1.25	16,285	N/A	N/A	1,809	100	48,855	16,285	3	N/A	N/A		1,629	302	20	302	N/A
75 PN Dormitory	A06e	2	2.7	1.25	16,285	N/A	N/A	1,809	100	48,855	16,285	3	N/A	N/A		1,629	302	20	302	N/A
75 PN Dormitory	A06f	2	2.7	1.25	16,285	N/A	N/A	1,809	100	48,855	16,285	3	N/A	N/A		1,629	302	20	302	N/A
Main CAC (2 shacks, 1 story each)	S01	2	N/A	0.37	724	N/A	N/A	80	10	724	724	1	N/A	N/A		72	13	1	13	N/A
Visitor Control Center	S04	2	10	2.79	59,391	N/A	N/A	1,787	25	10,671	10,671	1	48,720	Vehicle	16,240	1,067	799	13	198	N/A
Phase 2 Totals			**37**	**12**	**234078**	**0**	**0**	**21197**	**635**	**527415**	**185,358**	**24**	**48720**	**0**	**16240**	**18536**	**4034**	**229**	**3433**	**0**
2016 Totals			**12**	**4**	**78026**	**0**	**0**	**7066**	**212**	**175805**	**61786**	**8**	**16240**	**0**	**5413**	**6179**	**1345**	**76**	**1144**	**0**
2017 Totals			**12**	**4**	**78026**	**0**	**0**	**7066**	**212**	**175805**	**61786**	**8**	**16240**	**0**	**5413**	**6179**	**1345**	**76**	**1144**	**0**
2018 Totals			**12**	**4**	**78026**	**0**	**0**	**7066**	**212**	**175805**	**61786**	**8**	**16240**	**0**	**5413**	**6179**	**1345**	**76**	**1144**	**0**
Covered Parking - 100 Motorpool	A10	3	N/A	1.12	48,738	N/A	N/A	602	0	N/A	N/A	N/A	48,738	Vehicle	16,245.84	N/A	602			N/A
Mock-Urban Driving Classroom	D03a	3	N/A	0.85	8,318	N/A	N/A	581	25	4,846	4,846	1	3,472	Vehicle	1,157	485	133	6	90	N/A
Unimproved Road Driving Course Classroom Building	D04a	3	N/A	0.85	8,318	N/A	N/A	581	25	4,846	4,846	1	3,472	Vehicle	1,157.32	485	133	6	90	N/A
Off-Road Driving Course Classroom	D05a	3	N/A	0.85	8,318	N/A	N/A	581	25	4,846	4,846	1	3,472	Vehicle	1,157	485	133	6	90	N/A

Surface Parking - 100 Junk Vehicles	D06c	3	N/A	0.87	38,016	N/A	N/A	469	0	N/A	N/A	N/A	38,016	Vehicle	12,671.87	N/A	469			N/A
Surface Parking - 200 Training Vehicles	D06d	3	N/A	1.75	76,032	N/A	N/A	939	0	N/A	N/A	N/A	76,032	Vehicle	25,343.75	N/A	939			N/A
Explosives Demonstration Range Classroom Building	E02a	3	N/A	0.86	8,470	N/A	N/A	565	400	4,662	4,662	1	3,808	Vehicle	1,269.32	466	133	6	86	N/A
Post Blast Training Range Classroom	E03a	3	N/A	0.85	8,470	N/A	N/A	565	0	4,662	4,662	1	3,808	Vehicle	1,269	466	133	6	86	N/A
E03a Viewing Area		3	N/A	N/A	500	N/A	N/A	56	0	500	500	1	N/A	N/A		N/A	9		9	
Explosive Breaching Range	E05	3	200	200	?	N/A	N/A	?	0	N/A	N/A	N/A	N/A	N/A		N/A				N/A
Explosive Breaching Range Classroom	E05a	3	N/A	N/A	18,752	N/A	N/A	1,707	25	14,944	14,944	1	3,808	Vehicle	1,269	1,494	324	18	277	N/A
Explosive Breaching House	E05b	3	N/A	N/A	1,778	N/A	N/A	198	50	3,556	1,778	2	N/A	N/A		N/A	33		33	N/A
Explosive Breaching Wall 1	E05c	3	N/A	N/A	300	N/A	N/A	33	0	300	300	1	N/A	N/A		N/A	6		6	N/A
Explosive Breaching Wall 2	E05d	3	N/A	N/A	600	N/A	N/A	67	0	600	600	1	N/A	N/A		N/A	11		11	N/A
Post Blast Training Range Storage	E05e	3	N/A	N/A	2,000	N/A	N/A	222	25	2,000	2,000	1	N/A	N/A		N/A	37		37	N/A
Data Center	I07	3	3	0.55	6,912	N/A	N/A	768	0	13,824	6,912	2	N/A	N/A		691	128	9	128	N/A
Live Fire Shoot House Classroom	R03c	3	N/A	0.96	10,949	N/A	N/A	1,217	50	10,949	10,949	1	N/A	N/A		1,095	203	14	203	N/A
150 M Baffled Outdoor Tactical Combat Range (1 of 3)	R04	3	25	0.00	156,880	N/A	N/A	17,431	0	156,880	156,880	1	N/A	N/A		15,688	2,905	194	2,905	N/A
Simulation Building	R06	3	3	1.36	24,555	N/A	N/A	2,728	25	49,110	24,555	2	N/A	N/A		2,456	455	30	455	N/A
Armory	R07	3	10	3.72	91,445	N/A	N/A	9,012	10	159,634	79,817	2	11,628	Vehicle	3,876	7,982	1,622	99	1,478	N/A
Mock Urban Tactical Training Area (25 of 45)	T02	3	15	6.84	271,030	8730	28776	30,114	0	271,030	271,030	1	N/A	N/A		54,206	5,019	669	5,019	N/A
Tank Trail		3		10.91	259,200	N/A	N/A	44,800	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3,200			N/A
Phase 3 Totals			**256**	**232**	**1,049,581**	**8,730**	**28,776**	**113,237**	**660**	**707,189**	**594,127**	**21**	**196,254**	**0**	**65,417**	**85,998**	**16,625**	**1,062**	**11,002**	**0**
2017 Totals			**64**	**58**	**262,395**	**2,183**	**7,194**	**28,309**	**165**	**176,797**	**148,532**	**5**	**49,064**	**0**	**16,354**	**21,499**	**4,156**	**265**	**2,751**	**0**
2018 Totals			**64**	**58**	**262,395**	**2,183**	**7,194**	**28,309**	**165**	**176,797**	**148,532**	**5**	**49,064**	**0**	**16,354**	**21,499**	**4,156**	**265**	**2,751**	**0**
2019 Totals			**64**	**58**	**262,395**	**2,183**	**7,194**	**28,309**	**165**	**176,797**	**148,532**	**5**	**49,064**	**0**	**16,354**	**21,499**	**4,156**	**265**	**2,751**	**0**
2020 Totals			**64**	**58**	**262,395**	**2,183**	**7,194**	**28,309**	**165**	**176,797**	**148,532**	**5**	**49,064**	**0**	**16,354**	**21,499**	**4,156**	**265**	**2,751**	**0**

Project Totals

	PHASE 1				Phase 2				Phase 3				PROJECT TOTALS PER AREA					
	SF Buildings	SF Pavement	SF Sidewalks	AC clearing	SF Buildings	SF Pavement	SF Sidewalks	AC clearing	SF Buildings	SF Pavement	SF Sidewalks	AC clearing	SF buildings		SF Sidewalks	SF Pavement	SF Sidewalks	AC clearing
Main Campus Area	91,495	357,628	44,912	16.78	138,691	48,720	13,869	11.80	6,912	0	691	0.55	237,098		59,473	406,348	59,473	29
High Speed Driving Track Area	173,015	2,146,276	22,901	134.82					0	0	0	0.00	173,015		22,901	2,146,276	22,901	135
Off Road & Unimproved Driving Track Area				40.00					9,692	6,944	969	1.69	9,692		4,846	6,944	969	1
Mock Urban Tactical Area	190,960	1,000,120	19,589	22.96					4,846	3,472	485	0.85	195,806		20,073	1,003,592	20,073	24
Explosives Range Area	7,086	175,198	709	140.86					29,446	11,424	2,427	201.71	36,532		3,135	186,622	3,135	343
Firing Range Area	412,068	79,656	46,076	17.67					115,321	11,628	11,532	6.05	527,389		527,389	91,284	57,608	24

PROJECT GRAND TOTALS

TAB H. CONSTRUCTION ASSUMPTIONS

Parking Lot and Space Information

1) Manual on uniform traffic control devices (MUTCD) states that standard parking spaces are a minimum of 8 feet by 22 feet.
To allow for some variation in the number of parking spaces, parking space size has been rounded up to 10 feet by 22 feet.
The area for each parking space used in the calculations is therefore 220 square feet.
2) Lanes between rows of parking spaces are assumed to be 12 feet wide, the same as driving lanes.
3) Note that for all driving and explosives ranges, the parking areas have been assigned to and included in the calculations
for the associated buildings, not for the ranges themselves
4) The file IllustrativePlan_January_2012 shows only two parking lots for the Main Campus Area, one for the main admin
buildings and the other for the dorms plus Fitness Center. These two parking lots have therefore been included separately
in the construction calculations, using the number of parking spaces allotted for each building as provided in the
FASTC_Building_List_by_Phase_12_20_11_w_pkg_2-9-2012 file, which total 840 spaces for the Main Admin area and
145 spaces for the dorms/Fitness Center parking lot.
5) Based on the site map (IllustrativePlan_January_2012), specifically the area marked for the Main Admin area parking lot,
the 840 required spaces can be accomodated in a parking lot with 10 rows of 84 spaces, which would cover an area of
840 spaces * 220 SF per space = 184,800 SF. For the ten rows, the lot will need 5 24-foot wide double lanes plus a 24-foot wide double lane
on either side, which will add (840 feet for length of lot x 24 feet wide x 5 lanes) = 100,800 feet for the interior lanes plus
((24 feet * 5 lanes) + (10 parking rows * 22 feet per row)) * 24 feet width * 2 exterior lanes = 16,320 SF. This brings the total
area for the parking lot to 301920 SF
5) Based on the site map (IllustrativePlan_January_2012), specifically the area marked for the Dorm/FC area parking lot,
the 145 required spaces can be accomodated in a parking lot with 4 rows of 36 spaces, which would cover an area of
145 spaces * 220 SF per space = 31,900 SF. For the 4 rows, the lot will need 2 24-foot wide double lanes plus a 24-foot wide double lane
on either side, which will add (360 feet for length of lot x 24 feet wide x 2 lanes) = 17,280 feet for the interior lanes plus
((24 feet * 2 lanes) + (4 parking rows * 22 feet per row)) * 24 feet width * 2 exterior lanes = 6,528 SF. This brings the total
area for the parking lot to 55708 SF

Sidewalks

A general assumption was made that the sidewalk area would be approximately 10% of the building footprint area.

Roads

New roads, as depicted in Illustrative plan are assumed to be
approximately 11,400 linear feet. With a standard 24-foot wide 2-lane road, the square footage of pavement is
273600 SF also assume that shoulders will not be paved (gravel only)
The road will have 6-foot wide shoulders on each side, which will also need to be cleared, plus an additional 12-foot
wide band on each side to adjust the slopes away from the road. In addition, have assumed that drainage ditches will
be required for 50% of the roadway, which would be the equivalent of one 6-foot wide ditch running the length of the road.
All of this area will need to be cleared. This means the following area will need to be cleared:
(24 ft road +12 ft shoulders + 24 ft slopes + 6 ft ditch) * road length = 752400 SF
In acres, the amount to be cleared would be 17.272727
For grading, it is assumed that only the road and shoulder would be graded (the remaining areas would be excavated, and grading would be included in the excavating).
(24 ft road +12 ft shoulders) * road length = 410400 SF to be graded
The road and shoulder will also have to be excavated to a depth of 3 feet 1231200 cubic feet of excavation
For gravel work, assume that only the road and shoulders would be covered with gravel. The same SF area to be graded will also be covered with gravel.
For cut and fill to adjust slopes along both sides of the road, assume that land surface will have to be excavated to a depth of 3 feet for the entire length of the road.
Also assume that the 6-foot wide ditch along one side of the road will have to be excavated to a depth of 3 feet for the entire length of the road.
((12 ft slopes *2) * 3 ft excavation depth + 6 ft ditch * 3 ft excavation depth) * road length = 684000 cubic feet to be excavated
Total excavation for road and slopes and ditches would be 1915200 cubic feet to be excavated

Tank Trail

Based on the IllustrativePlan_January_2012, approximately 7,200 linear feet of tank trail will need to be
relocated to the northern portion of the Explosives Ranges, in area that is not yet cleared. Assuming a standard
2-lane road width of 24 feet, the area to be cleared for the trail would be 172,000 SF. As with the roads, the trail will have 6-foot-wide shoulders
and 12-foot wide slopes on either side. It has also been assumed that drainage ditches will be required for 50% of the tank trail. The trail
will not be paved, but it has been assumed that the trail and shoulders will be gravel. The trail, shoulders, slopes, and ditches will need to be cleared.
(24 ft trail +12 ft shoulders + 24 ft slopes + 6 ft ditch) * trail length = 475200 SF
In acres, the amount to be cleared would be 10.909091
For grading, it is assumed that only the trail and shoulder would be graded (the remaining areas would be excavated, and grading would be included in the excavating).
(24 ft road +12 ft shoulders) * trail length = 259200 SF to be graded
The road and shoulder will also have to be excavated to a depth of 3 feet 777600 cubic feet of excavation
For gravel work, assume that only the trail and shoulders would be covered with gravel. The same SF area to be graded will also be covered with gravel.
For cut and fill to adjust slopes along both sides of the trail, assume that land surface will have to be excavated to a depth of 3 feet for the entire length of the trail.
Also assume that the 6-foot wide ditch along one side of the trail will have to be excavated to a depth of 3 feet for the entire length of the trail.
((12 ft slopes *2) * 3 ft excavation depth + 6 ft ditch * 3 ft excavation depth) * trail length = 432000 cubic feet to be excavated
Total excavation for road and slopes and ditches would be 1209600 cubic feet to be excavated

D02 High Speed Antiterrorism Driving Course

Measured distances along the three separate tracks included in D02 from the
IllustrativePlan_January_2012. Each track distance also includes
some distance on roads driving to the track (Track 1 numbers include distance on paved road past D04 and D05 to E04).

Track 1	21400	feet
Track 2	27520	feet
Track 3	18240	feet
Total track length	67160	feet

Each track will have two lanes. According to the National Manual on Geometric Standards (Green book),
each highway lane is 12 feet wide. The square footage area of paving is therefore

Track 1	513600	SF
Track 2	660480	SF
Track 3	437760	SF
	1611840	square footage of paved track for D02 track

also assume that shoulders will not be paved (gravel only)

The track will have 6-foot wide shoulders on each side, which will also need to be cleared, plus an additional 12-foot wide band on each side to adjust the slopes away from the track. In addition, have assumed that drainage ditches will be required for 50% of the track, which would be the equivalent of one 6-foot wide ditch running the length of the track.
All of this area will need to be cleared. This means the following area will need to be cleared:
(24 ft road +12 ft shoulders + 24 ft slopes + 6 ft ditch) * track length = 4432560 SF
In acres, the amount to be cleared would be 101.75758
For grading, it is assumed that only the track and shoulder would be graded (the remaining areas would be excavated, and grading would be included in the excavating).
(24 ft road +12 ft shoulders) * track length = 2417760 SF to be graded
The road and shoulder will also have to be excavated to a depth of 3 feet 7253280 cubic feet of excavation
For gravel work, assume that only the track and shoulders would be covered with gravel. The same SF area to be graded will also be covered with gravel.
For cut and fill to adjust slopes along both sides of the track, assume that land surface will have to be excavated to a depth of 3 feet for the entire length of the track.
Also assume that the 6-foot wide ditch along one side of the road will have to be excavated to a depth of 3 feet for the entire length of the road.
((12 ft slopes *2) * 3 ft excavation depth + 6 ft ditch * 3 ft excavation depth) * track length = 4029600 cubic feet to be excavated
Total excavation for road and slopes and ditches would be 11282880 cubic feet to be excavated

The information provided states that there will be 3 circular skidpads, approximately 75 meters in diameter each, for a total of approximately 4.5 acres. Each of these skid pads will also need to be paved.
4.5 acres total for all 3 skid pads
43560 SF per acre
196020 SF for the three skid pads
75 meters = 246.063 feet diameter of each skid pad
When adding 6 -foot shoulders to the skidpads, plus a 12-foot-wide band to allow slope adjustments, and a 6-foot wide ditch around the pad, the diameter of the area to be cleared would be 246.063 + 12 + 24 + 12 = 294.063 feet for a radius of 147.0315 feet
The area to be cleared would then be Pi*r-squared * 3 = 203747.15 SF
In acres, the amount to be cleared would be 4.6773909
For grading, it is assumed that only the skidpads and shoulders would be graded (the remaining areas would be excavated, and grading would be included in the excavating).
Diameter of graded area would be 246.063 + 12 = 258.063 feet for a radius of 129.0315 feet
The area to be graded would then be Pi * r-squared * 3 = 156914.2 SF
For gravel work, assume that only the skidpad and shoulders would be covered with gravel. The same SF area to be graded will also be covered with gravel.
For excavation, assume that the skidpads, shoulders, slope adjustment areas, and drainage ditches will all be excavated to a depth of 3 feet. The excavation volume would then be the SF area to be cleared * depth of excavation = 611241.44 cubic feet

IllustrativePlan_January_2012 shows three ram pads, 2 at approx. 320 x 600 (192,000 SF) , and one at 200 x 400 ft (80,0000 SF).

272000 SF paved area for the 3 ram pads
As with the D02 track itself, the ram pads will have 6-foot wide shoulders, 12-foot wide areas to adjust slopes, and a 6-foot wide drainage ditch. For the two larger pads, that translates to an area of (320 ft pad + 12 ft shoulders + 24 ft slopes + 12 ft ditches) * (600 ft pad + 12 ft shoulders + 24 ft slopes + 12 ft ditches) = 238464 SF
For the smaller pad, that translates to an area of (200 ft pad + 12 + 24 + 12) * (400 ft pad + 12 + 24 + 12) = 111104 SF
Total area to be cleared = 2 * larger pad + 1 * smaller pad = 588032 SF
In acres, the amount to be cleared would be 13.499357
For grading, it is assumed that only the ram pads and shoulders would be graded (the remaining areas would be excavated, and grading would be included in the excavating).
The area to be graded for the larger pads would be 332 ft * 612 ft = 203184
The area to be graded for the smaller pad would be 212 ft * 412 ft = 87344
Total area to be graded = 2 * larger pad + 1 * smaller pad = 493712 SF
For gravel work, assume that only the ram pads and shoulders would be covered with gravel. The same SF area to be graded will also be covered with gravel.
For excavation, assume that the ram pads, shoulders, slope adjustment areas, and drainage ditches will all be excavated to a depth of 3 feet. The excavation volume would then be the SF area to be cleared * depth of excavation = 1764096 cubic feet

D03 Mock Urban Driving Track
The proposed street grid in the D03 Mock Urban training track is assumed to be approximately 6.3 miles. Assuming two lane roads throughout this grid, with an additional lane for approximately half that length, to imitate wider city streets, the width of the road would be 36 feet for 3.15 miles and 24 feet for 3.15 miles.
997920 SF of road area that would need to be paved
2200 SF of paved area for 10 proposed parking spaces
Total 1000120 SF of pavement for D03 Driving Track

D04 Unimproved Road Driving Course
Measured distances from IllustrativePlan_January_2012 give approximately 2.6 miles for this unpaved driving course.
The road will have 6-foot wide shoulders on each side, which will also need to be cleared, plus an additional 12-foot wide band on each side to adjust the slopes away from the road. In addition, have assumed that drainage ditches will be required for 50% of the roadway, which would be the equivalent of one 6-foot wide ditch running the length of the road.
All of this area will need to be cleared. This means the following area will need to be cleared:
(24 ft road +12 ft shoulders + 24 ft slopes + 6 ft ditch) * road length = 906048 SF
In acres, the amount to be cleared would be 20.8
For grading, it is assumed that only the road and shoulder would be graded (the remaining areas would be excavated, and grading would be included in the excavating).
(24 ft road +12 ft shoulders) * road length = 494208 SF to be graded
The road and shoulder will also have to be excavated to a depth of 3 feet 1482624 cubic feet of excavation
For gravel work, assume that only the road and shoulders would be covered with gravel. The same SF area to be graded will also be covered with gravel.
For cut and fill to adjust slopes along both sides of the road, assume that land surface will have to be excavated to a depth of 3 feet for the entire length of the road.
Also assume that the 6-foot wide ditch along one side of the road will have to be excavated to a depth of 3 feet for the entire length of the road.
((12 ft slopes *2) * 3 ft excavation depth + 6 ft ditch * 3 ft excavation depth) * road length = 823680 cubic feet to be excavated
Total excavation for road and slopes and ditches would be 2306304 cubic feet to be excavated

D05 Off-Road Driving Course
Measured distances from map give approximately 2.4 miles for this driving course.
The road will have 6-foot wide shoulders on each side, which will also need to be cleared, plus an additional 12-foot

wide band on each side to adjust the slopes away from the road. In addition, have assumed that drainage ditches will
be required for 50% of the roadway, which would be the equivalent of one 6-foot wide ditch running the length of the road.
All of this area will need to be cleared. This means the following area will need to be cleared:
(24 ft road +12 ft shoulders + 24 ft slopes + 6 ft ditch) * road length = 836352 SF
In acres, the amount to be cleared would be 19.2
For grading, it is assumed that only the road and shoulder would be graded (the remaining areas would be excavated, and grading would be included in the excavating).
(24 ft road +12 ft shoulders) * road length = 456192 SF to be graded
The road and shoulder will also have to be excavated to a depth of 3 feet 1368576 cubic feet of excavation
Assume that this off-road driving course will have no gravel.
For cut and fill to adjust slopes along both sides of the road, assume that land surface will have to be excavated to a depth of 3 feet for the entire length of the road.
Also assume that the 6-foot wide ditch along one side of the road will have to be excavated to a depth of 3 feet for the entire length of the road.
((12 ft slopes *2) * 3 ft excavation depth + 6 ft ditch * 3 ft excavation depth) * road length = 760320 cubic feet to be excavated
Total excavation for road and slopes and ditches would be 2128896 cubic feet to be excavated

D06a, Armored Vehicle Garage
Have assumed that all parking for the 80 vehicles will be inside the building, and that parking for
employees, visitors, etc. have been accounted for in the 36 parking spaces at D06, the Vehicle Maintenance
Shop.
D06b-d, A10 Surface and Covered Parking
Have assumed no building construction, and that the entire SF area will be paved for vehicle parking.

E02 Explosives Demonstration Range & E03 Post Blast Training Range
An area with a 500 foot radius will be completely cleared of vegetation in the center of the range. In addition,
the range will have a 300 meter exclusion/safety zone ring (a doughnut) around it. I have assumed that a circular area with a
radius of 300 meters will be cleared, and that the central zone with a 500 foot radius will be graded.
984.25197 radius in feet
3043424 SF area to be cleared
500 radius of central area
785398.16 SF area to be graded

E02 has a post-blast recovery pad. A 6-inch thick asphalt pad is assumed
The size of the pad is listed as 100 feet in diameter.
50 radius in feet
7853.9816 SF area to be underlain by asphalt

E03 Post Blast Training Range
Preliminary DOPAA says there will be a 400 x 400 ft explosives demonstration pad and a post blast
recovery pad, the first with a sand base and the second underlain by asphalt. The site drawing
depicts two 400 x 400 foot pads proposed for this site. The amount of asphalt needed for the
range is therefore 160,000 SF.

E04 Explosives Simulation Alley
The IllustrativePlan_January_2012 shows 9,600 linear feet of road. Assuming the standard 2 lane
road with lanes 12 feet wide, that translates to
230400 SF of asphalt paved road
The road will have 6-foot wide shoulders on each side, which will also need to be cleared, plus an additional 12-foot
wide band on each side to adjust the slopes away from the road. In addition, have assumed that drainage ditches will
be required for 50% of the roadway, which would be the equivalent of one 6-foot wide ditch running the length of the road.
All of this area will need to be cleared. This means the following area will need to be cleared:
(24 ft road +12 ft shoulders + 24 ft slopes + 6 ft ditch) * road length = 633600 SF
In acres, the amount to be cleared would be 14.545455
For grading, it is assumed that only the road and shoulder would be graded (the remaining areas would be excavated, and grading would be included in the excavating).
(24 ft road +12 ft shoulders) * road length = 345600 SF to be graded
The road and shoulder will also have to be excavated to a depth of 3 feet 1036800 cubic feet of excavation
For gravel work, assume that only the road and shoulders would be covered with gravel. The same SF area to be graded will also be covered with gravel.
For cut and fill to adjust slopes along both sides of the road, assume that land surface will have to be excavated to a depth of 3 feet for the entire length of the road.
Also assume that the 6-foot wide ditch along one side of the road will have to be excavated to a depth of 3 feet for the entire length of the road.
((12 ft slopes *2) * 3 ft excavation depth + 6 ft ditch * 3 ft excavation depth) * road length = 576000 cubic feet to be excavated
Total excavation for road and slopes and ditches would be 1612800 cubic feet to be excavated

All concrete sidewalks have been taken into account under the Explosives Alley - Structures.

R01, Firearms Classroom Building
FASTC_Building_List_by_Phase_12_20_11_w_pkg_2-9-2012 has 62 parking spaces for this building.
IllustrativePlan_January_2012 shows two parking strips along the road near this building, with a
total area of approximately 19,200 SF, which would account for the 62 spaces + driving lanes.
All parking for R04 has therefore been assigned to the R01 lot.

R02, 50-M Indoor Firing Ranges
All ranges will be inside one main structure. Two of the indoor ranges will be completed during Phase I of the
construction. All of the clearing, grading, construction, pavement, and concrete figures have therefore been
calculated under Phase I, as the remaining work will all be conducted inside the building.

R02/R07 Parking Areas
According to the Building List table, a total of 156 parking spaces will be needed for
the two structures.
Total dimensions of the lot would be 358 feet long (31 spaces @ 10 feet wide, plus a 24-foot
driving lane at each end) and 136 feet wide (4 rows of spaces @ 22 feet plus two interior 24-foot driving lanes).
Total area of the lot: 48688 SF

R04, Baffled Outdoor Tactical Combat Range
At present, the amount of construction per phase at this range is unresolved. All construction activities have therefore temporarily been assigned to Phase 1.

R08, Central Ammo & Explosives Storage
This facility is already in use at Ft Pickett.
The calculations here are simply for the addition of the 10 new spaces with an entry drive lane and a lane along the length of the spaces, an area of 112 feet x 34 feet.

S02, Supply CAC
Have assumed the parking lot for 10 spaces is directly adjacent to the building.

Parking at T01 - T04
The parking construction information has therefore been included with the T01 calculations.

T02/T03 Sidewalks
The sidewalks for the D03 Mock Urban driving range have been included with the T02/T03 construction numbers. Normally, sidewalks have been estimated at 10% of bulding footprint area. In this case, to allow for sidewalks along "city streets," the sidewalks have been estimated at 20% of the building footprint area.

E03 Post Blast Training Area

The second viewing area has been included as a separate line in the calculations
This viewing area is within the cleared area of the range but will need grading and is assumed to need a concrete foundation, just like a building.

E05, Explosive Breaching Range
Assumed entire area will need to be cleared. All 200 acres are therefore listed for clearing.
It has been assumed that grading is needed only in the areas around the structures (E05a - E05e).
It has also been assumed that the Breaching walls will need concrete foundations to anchor the steel beams that will hold up concrete panels. The width of the wall is assumed to be 10 feet, based on the Illustrative Plan map.

Building Clearing & Grading Areas
For all areas that will need to be cleared prior to construction (which will be most of the areas at the FASTC), the area to be cleared has been determined as follows: the building foundation footprint plus the area of any associated parking lot, with an additional 50 foot buffer around the total area. Relative building and lot sizes have been determined from the file IllustrativePlan_January_2012.
The area to be graded is the building footprint plus the parking lot area, not the total cleared area.

Construction Numbers Used in Formulas

Building Excavation Depth =	3	feet	
Parking area excavation =	0.3333333	feet	(4 inches gravel)
Parking area gravel =	0.3333333	feet	(4 inches gravel)
Asphalt pavement thickness =	0.3333333	feet	(4 inches)
Gravel thickness beneath bldgs =	0.5	feet	(6 inches)
Concrete slab beneath bldgs =	0.5	feet	(6 inches)
Concrete for sidewalks, etc. =	0.3333333	feet	(4 inches)
Road excavation depth =	3	feet	

Conversions
1 cubic yard = 27 cubic feet
1 square yard = 9 square feet
1 meter = 3.28084 feet

Building Demolition
All buildings assumed to be single story. Existing building square footage demolished determined using Constraints Map November 2010 and Google Earth.

Road and Sidewalk Demolition
Existing sidewalk square footage demolished determined using Constraints Map November 2010 and Google Earth.
Road demolition determined using FASTC Traffic Study for EIS, Figures 2 and 3 and Google Earth.

Boilers
Boiler sizes were determined based on BTU/SF ratings from Chris Cursi and rounded up to nearest boiler size.

TAB I. VEHICLE ASSUMPTIONS

POVs

	Staff	Staff ADT	Students - Shuttle bus Area Hotel	Students - Shuttle bus Area Hotel ADT	Students in Dorms Bus	Students in Dorms Bus - ADT	Students in Dorm POV	Students in Dorm POV - ADT	Construction Worker	Construction Worker ADT
2014	0	-	-	-	-	-	-	-	213	100
2015	0	-	-	-	-	-	-	-	213	100
2016	0	-	-	-	-	-	-	-	393	100
2017	460	1,604	260	48	-	-	-	-	532	100
2018	663	2,156	260	48	-	-	-	-	319	100
2019	867	2,708	260	48	-	-	-	-	139	100
2020	1,070	3,260	250	48	270	24	180	180	139	100

Construction worker numbers from 2 ConstructionEstimates.xls. Tab D- AnnConsWorkers.
Assume 20% of construction workers carpool. Two workers per carpool
Carpool is 50/460 of the total daily trips 11% of trips are carpools
For Student POVs assume 2 trips per week, 50 weeks of instruction, to and from Washington DC
Assume that school operates 50 weeks a year for shuttling students
Assume that in 2017 the staff and first students arrive
assume staff increases linearly until 2020
Assume traffic in years additional to 2020 are at the same approximate level
Assume POV are passenger vehicles. Combined emission factor of cars and passenger trucks from MOVES.
Passenger vehicles emission factors are derived from MOVES for a specific year. For POVs the past 10 model years are used.
Car pools and shuttle buses use the Light Commercial Trucks emission factor from MOVES for a specific year. Car pools and shuttle buses the past 2 model years are used.
Emissions calculations for 2017 -2020 shuttle buses use emission factors for 2017.
Emissions calculations for dorm shuttle buses use emission factors for 2020.
Student POVs and shuttles from the airports use emission factors for 2017.
All POVs, car pools, and shuttle buses assumed Rural Unrestricted road type.

Track Usage

From Construction Assumptions				
E04	9600	feet	1.818181818	miles
D03			6.3	miles
D04			2.6	miles
D05			2.4	miles
From IllustrativePlan_January_2012				
Track 1	9000	feet	1.7	miles
Track 2	13200	feet	2.5	miles
Track 3	10300	feet	2.0	miles

Assume cars used on paved surfaces and trucks/suvs on non paved surfaces.

Vehicle count from Noise Study.

Track vehicle emission factors are derived from MOVES for a specific year. For track vehicles the model years, 2016 - 1987 are used.

Road Types	
D02	Urban Restricted Access and Rural Restricted Access
D03	Urban Restricted Access and Urban Unrestricted Access
E04 - Urban	Urban Unrestricted Access
E04 - Rural	Rural Unrestricted Access
D05	Rural Unrestricted Access
D04	Rural Unrestricted Access

Appendix J

Economic and Fiscal Impacts Analysis

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FOREIGN AFFAIRS SECURITY TRAINING CENTER
[FASTC]
An American Recovery and Reinvestment Act of 2009 Project

Supplemental Draft Environmental Impact Statement for U.S. Department of State Foreign Affairs Security Training Center at Nottoway County, Virginia

Economic and Fiscal Impact Studies Technical Report

October 2014

Prepared for: U.S. General Services Administration
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ACRONYMS AND ABBREVIATIONS

DOS	U.S. Department of State
DS	Bureau of Diplomatic Security
FASTC	Foreign Affairs Security Training Center
FTE	full-time equivalent
GSA	U.S. General Services Administration
IMPLAN	Impacts Analysis for Planning (economic modeling software)
ROI	region of influence
SDEIS	Supplemental Draft Environmental Impact Statement
U.S.	United States
VAPA	Virginia Auditor of Public Accounts

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EXECUTIVE SUMMARY

The economic and fiscal impact technical studies were prepared in support of the Supplemental Draft Environmental Impact Statement (SDEIS) for the proposed construction and operations of the United States Department of State Foreign Affairs Security Training Center (FASTC) in Nottoway County, Virginia. The purpose of these studies is to provide estimates of the potential impact of the proposed project on the economic and fiscal conditions of the economic region that would be most strongly affected. This economic region consists of Nottoway County and seven surrounding counties in south-central Virginia. Analyses in the technical studies quantify the following types of impacts on the affected region:

- Economic impacts from the construction of FASTC on an eight-county economic region
- Economic impacts from the operations of FASTC on an eight-county economic region
- Fiscal impacts from the operations of FASTC on local governments in Nottoway County
- Fiscal impacts from the operations of FASTC on local governments in Chesterfield County

The technical studies do not address alternatives to the proposed action, cumulative or other impacts unrelated to the proposed action, significance of impacts, or potential mitigations. Such issues are addressed in appropriate sections of the SDEIS. The technical studies were prepared using the most current and best available data for relevant issues such as geographic origin of the necessary construction labor force and the locations of residence for expected new population, as well as the proposed project's implementation schedule. These impact analyses are essentially a snapshot in time; therefore, should ongoing planning, scheduling, and federal legislative activities result in changes to various input assumptions, the actual economic impacts may vary somewhat from the conclusions presented in this report.

Impacts are presented on a year-by-year basis. Since 2020 would be the first complete year of FASTC full-operations, estimates of impacts from operations for that year are considered steady-state impacts, meaning that the same magnitude of impacts could be expected every year during the lifetime of FASTC operations (given current planning assumptions and economic conditions). Impacts are also estimated based upon current economic conditions and dollars; all quantified dollar impacts are presented in constant 2014 dollar values. Economic conditions that may be affected by the value of currency, multi-factor productivity, and other macro-economic conditions are held constant due to the high potential for errors in projecting these variables into the future.

The economic impact technical study addresses economic impacts to the eight-county region by analyzing a combined economic region referred to as the region of influence (ROI) of the proposed action. Because the project would be located in Nottoway County, economic impacts would be expected to be concentrated there, as well as in nearby Chesterfield County, which has a relatively large and rapidly growing economy. The other six counties included in the ROI – Amelia, Brunswick, Dinwiddie, Lunenburg, Mecklenburg, and Prince Edward – would be expected to share in the residual economic impacts. The assumptions incorporated into the analysis are summarized in Attachment A.

The fiscal impact technical study addresses fiscal impacts to the two counties in the ROI expected to have fiscal conditions most strongly affected by the proposed action – Nottoway County and Chesterfield County. These two counties would be expected to accrue most of the economic benefits associated with the proposed action, and thus collect the majority of the tax and fee revenue generated by the proposed action. Additionally, these two counties are anticipated to be the home to most of the new residential population to the region and, as such, would incur the most additional government cost.

Economic Impact Summary Estimates

As construction would begin prior to operations, economic impacts would initially be entirely construction related. As operations ramp up (starting in 2016) and construction starts to wind down (after 2017), the generation of economic impacts becomes more related to operations. Impacts generated by operations are expected to exceed impacts generated by construction beginning in 2018.

Tables ES-1, ES-2, and ES-3 summarize economic impact estimates for the eight-county economic region. Figures ES-1, ES-2, and ES-3 illustrate those estimates along with projections for 2021 to demonstrate the nature of steady-state impacts.

Table ES-1. Total Impact – Annual Full-time Equivalent (FTE) Jobs

	2015	2016	2017	2018	2019	2020
Construction	254	1,633	1,130	525	463	36
Operations	0	78	392	705	744	783
Total	254	1,711	1,522	1,230	1,207	819

Note: Jobs directly attributed to FASTC employment plus jobs created through economic output in the region. Economic output is the total production and sales volume generated in the ROI as a result of the construction and operations of FASTC.

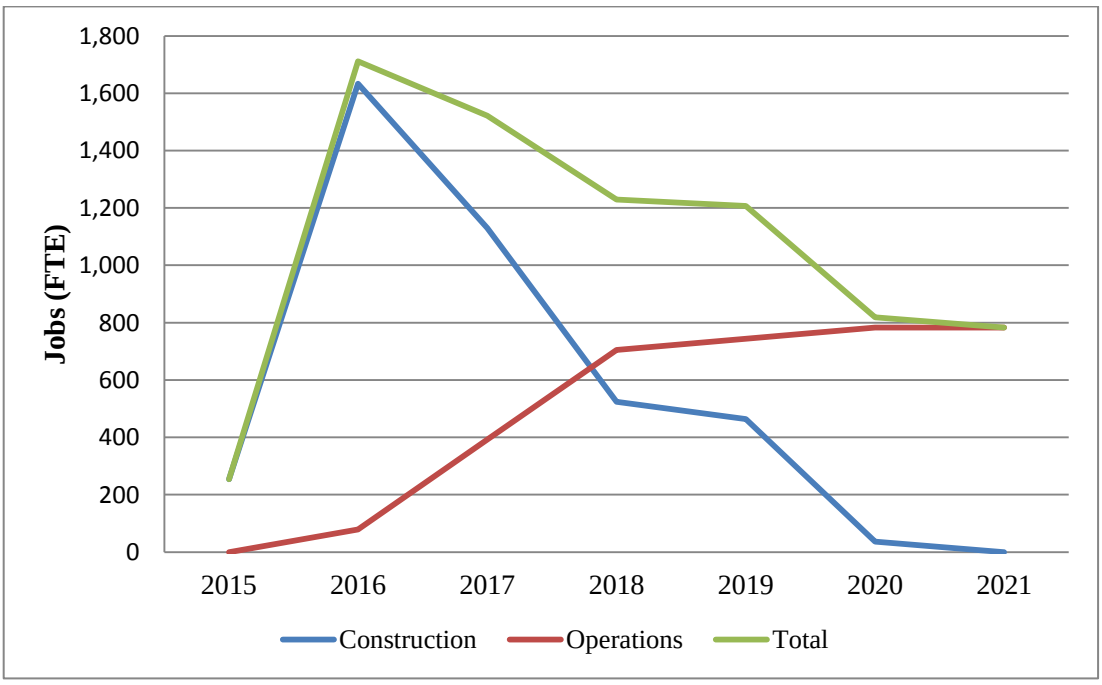

Figure ES-1. FTE Jobs Impact from Combined Construction and Operations, 2015-2021

Table ES-2. Total Impact – Annual Labor Income (2014 Constant Dollars)

	2015	2016	2017	2018	2019	2020
Construction	$11,478,013	$71,683,135	$50,883,881	$23,627,350	$20,877,884	$1,632,426
Operations	$0	$4,392,002	$21,957,111	$39,522,799	$41,718,509	$43,914,221
Total	$11,478,013	$76,075,137	$72,840,992	$63,150,149	$62,596,393	$45,546,647

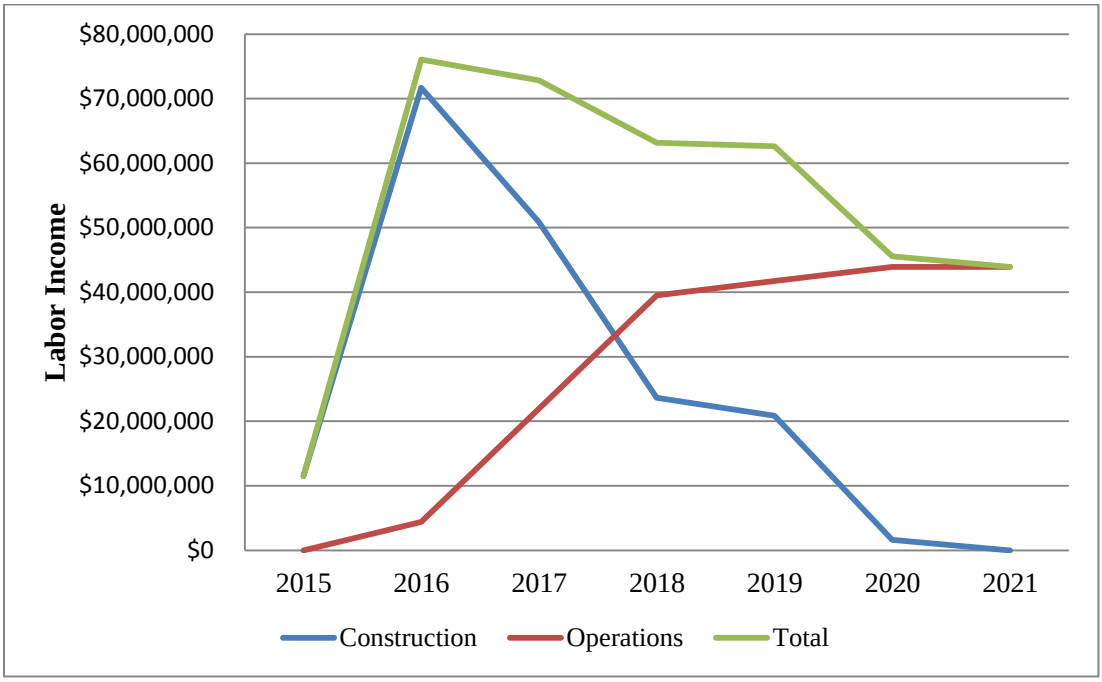

Figure ES-2. Labor Income Impact from Combined Construction and Operations, 2015-2021, Constant 2014 Dollars

Table ES-3. Total Impact – Annual Economic Output (2014 Constant Dollars)

	2015	2016	2017	2018	2019	2020
Construction	$30,666,700	$192,404,665	$136,577,398	$63,418,158	$56,038,316	$4,381,595
Operations	$0	$9,717,977	$48,588,504	$87,459,306	$92,318,155	$97,177,007
Total	$30,666,700	$202,122,642	$185,165,902	$150,877,464	$148,356,471	$101,558,602

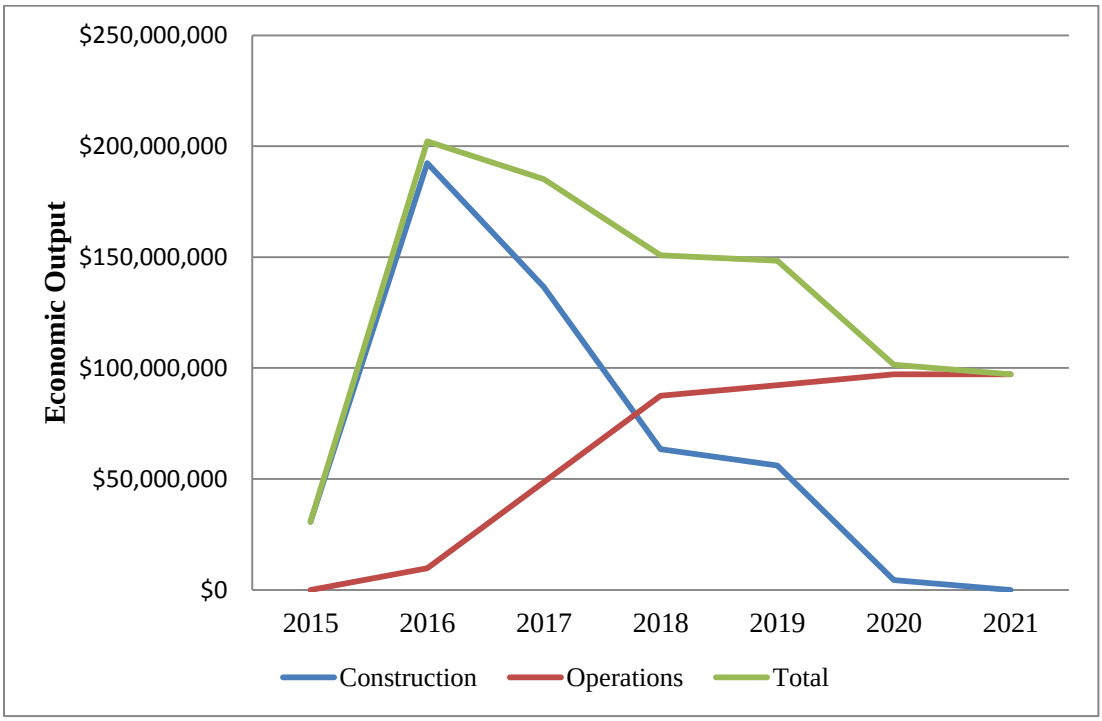

Figure ES-3. Economic Output Impact from Combined Construction and Operations, 2015-2021, Constant 2014 Dollars

Fiscal Impact Summary Estimates

The fiscal impact technical study quantifies estimated impacts to local governments within Nottoway County and Chesterfield County. Estimates are presented in terms of net revenues (total revenues minus total costs) of these local governments. Additional qualitative analysis of potential impacts from the operations phase on the net revenues of the remaining six counties in the eight-county economic region is also provided. The small percentage of potential residents that may be added throughout the other counties is not known in sufficient detail to provide a quantitative fiscal impact analysis for those other counties. Combined, local governments in other counties in the ROI would be expected to receive less revenue, incur lower costs, and see only marginal changes in net revenue. Fiscal impacts to local governments are addressed for the operations phase only. Table ES-4 shows summary estimates for net revenues for Nottoway and Chesterfield Counties. Figures ES-4 and ES-5 illustrate those estimates along with projections for 2021, which further illustrate the nature of steady-state impacts.

Estimates assume that most trainee lodging would take place in Chesterfield County, but if capacity in the accommodations industry in Nottoway County were to increase (e.g., if a new motel were built), then net revenues to Nottoway County would increase.

Table ES-4. Total Impact – Net Revenues to Local Governments from FASTC Operations

	2016	2017	2018	2019	2020
Nottoway County	$46,619	$233,092	$422,539	$443,474	$466,783
Chesterfield County	$131,977	$659,884	$1,187,791	$1,253,778	$1,319,766

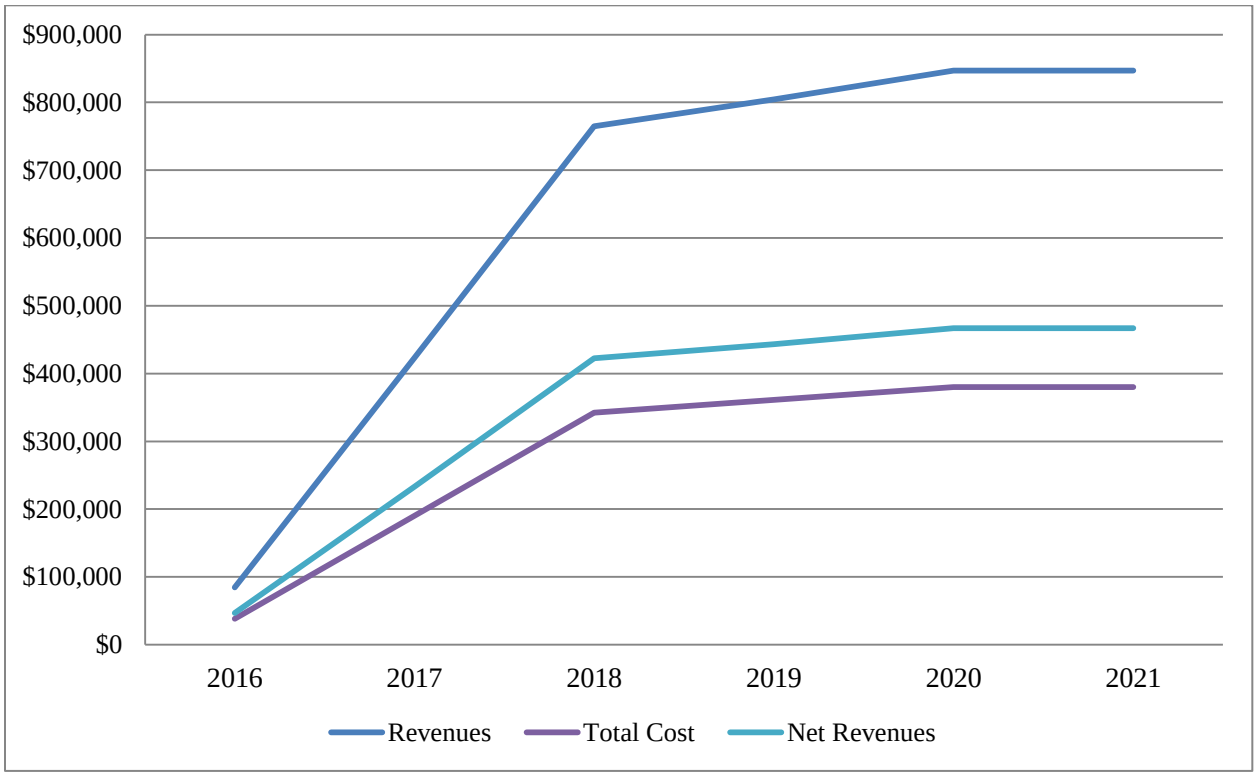

Figure ES-4. Nottoway County Local Government Revenue, Cost, and Net Revenue, 2016 to 2021, Constant 2014 Dollars

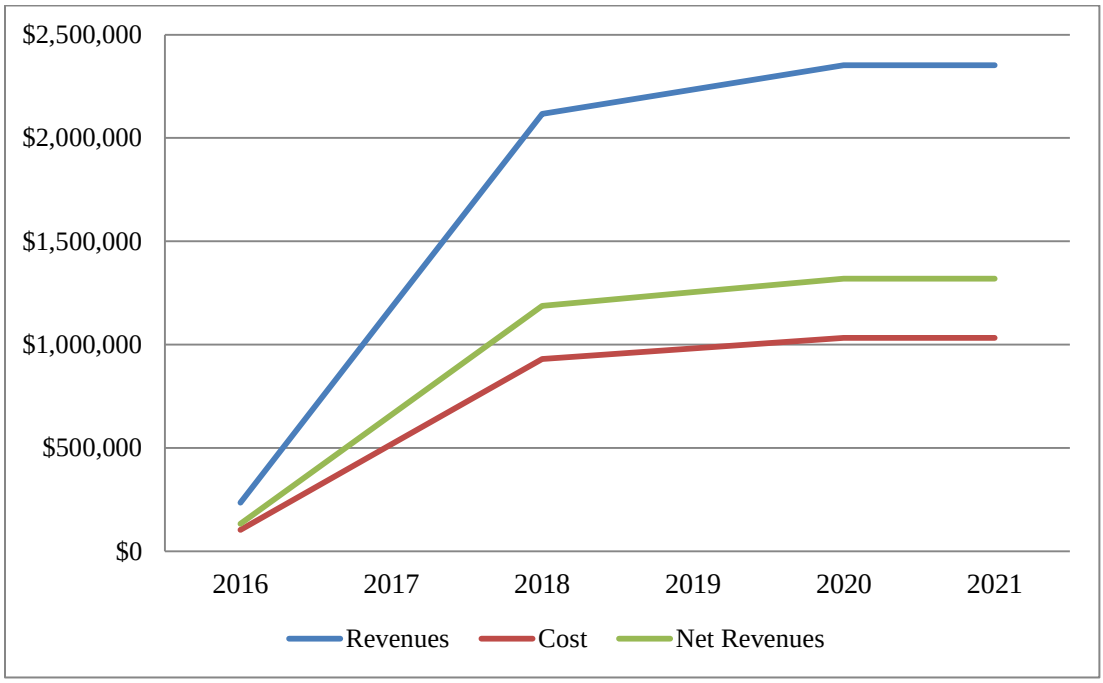

Figure ES-5. Chesterfield County Local Government Revenue, Cost, and Net Revenue, 2016 to 2021, Constant 2014 Dollars

CHAPTER 1. INTRODUCTION

The United States (U.S.) General Services Administration (GSA) is proposing to acquire land and develop a U.S. Department of State (DOS), Bureau of Diplomatic Security (DS) Foreign Affairs Security Training Center (FASTC) in Nottoway County, Virginia. The proposed location is near the town of Blackstone and includes land parcels within the Army National Guard Maneuver Training Center Fort Pickett and Nottoway County Local Redevelopment Authority area. The development of FASTC would establish a consolidated training center from which DS may efficiently conduct hard skills training for a wide array of DS law enforcement and security disciplines to meet increased demand for well-trained personnel. Currently, DS hard skills training functions are conducted in 11 separate leased and contracted training facilities dispersed around the country. The proposed FASTC would consolidate hard skills training functions at one central facility.

The proposed FASTC project would consist of two major phases, a construction phase and an operations phase. Construction of FASTC would last about 5 years and is expected to begin in 2015 and be completed in early 2020. The operations phase would overlap with the construction phase; operations would begin in 2016 and increase in magnitude until full operations begin in 2020. FASTC full-operations would then continue for the foreseeable future.

This technical report identifies the economic and fiscal impacts associated with implementation of the proposed FASTC project. Economic impacts relate to the project's potential for generating jobs, labor income, and economic output. Fiscal impacts relate to the project's potential for generating revenues and costs to local governments. The Impact Analysis for Planning (IMPLAN) model, a standard tool used for economic impact analysis, was used to generate economic impacts. The IMPLAN model was also used to generate estimates of local government revenue impacts, while estimates of local government costs were estimated based on expected new population to the region and data on per capita local government costs.

The economic and fiscal impact studies are presented separately; Chapter 2 presents the economic impact study and Chapter 3 presents the fiscal impact study. Both Chapter 2 and Chapter 3 contain two parts – an approach to analysis section and an estimated impacts section. The approach to analysis sections address the data and methods that were used to conduct the economic and fiscal impact studies. The estimated impacts sections provide the results of the respective studies. The estimates of the economic impact analysis are presented for three economic variables – jobs, labor income, and economic output. Estimates for the fiscal impact analysis are presented for total local government revenues, costs, and net revenues.

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CHAPTER 2. ECONOMIC IMPACT TECHNICAL STUDY

2.1 APPROACH TO ANALYSIS OF ECONOMIC IMPACTS

2.1.1 Region of Influence

This economic impact technical study analyzes the economic impacts of the FASTC project on the regional of influence (ROI), consisting of eight counties in south-central Virginia; all estimates are presented for the combined ROI. While the FASTC project would be located in Nottoway County, the economic effects of the project would also extend into surrounding counties through the purchase of goods and services, employee residential spending, etc. Counties in the ROI include Amelia, Brunswick, Chesterfield, Dinwiddie, Lunenburg, Mecklenburg, Nottoway, and Prince Edward. In order to conduct the analysis and present economic impact estimates for the combined ROI, eight sets of IMPLAN data – one for each county in the ROI – were combined into a single economic model.

The following Figures 2-1 and 2-2 provide information on the ROI and each of the counties within the ROI. Figure 2-1 shows the population for each county and indicates the relative size of the population for each county compared to other counties in the ROI. Figure 2-2 shows the overall size of each county economy and indicates the relative size of each county economy compared to other counties in the ROI.

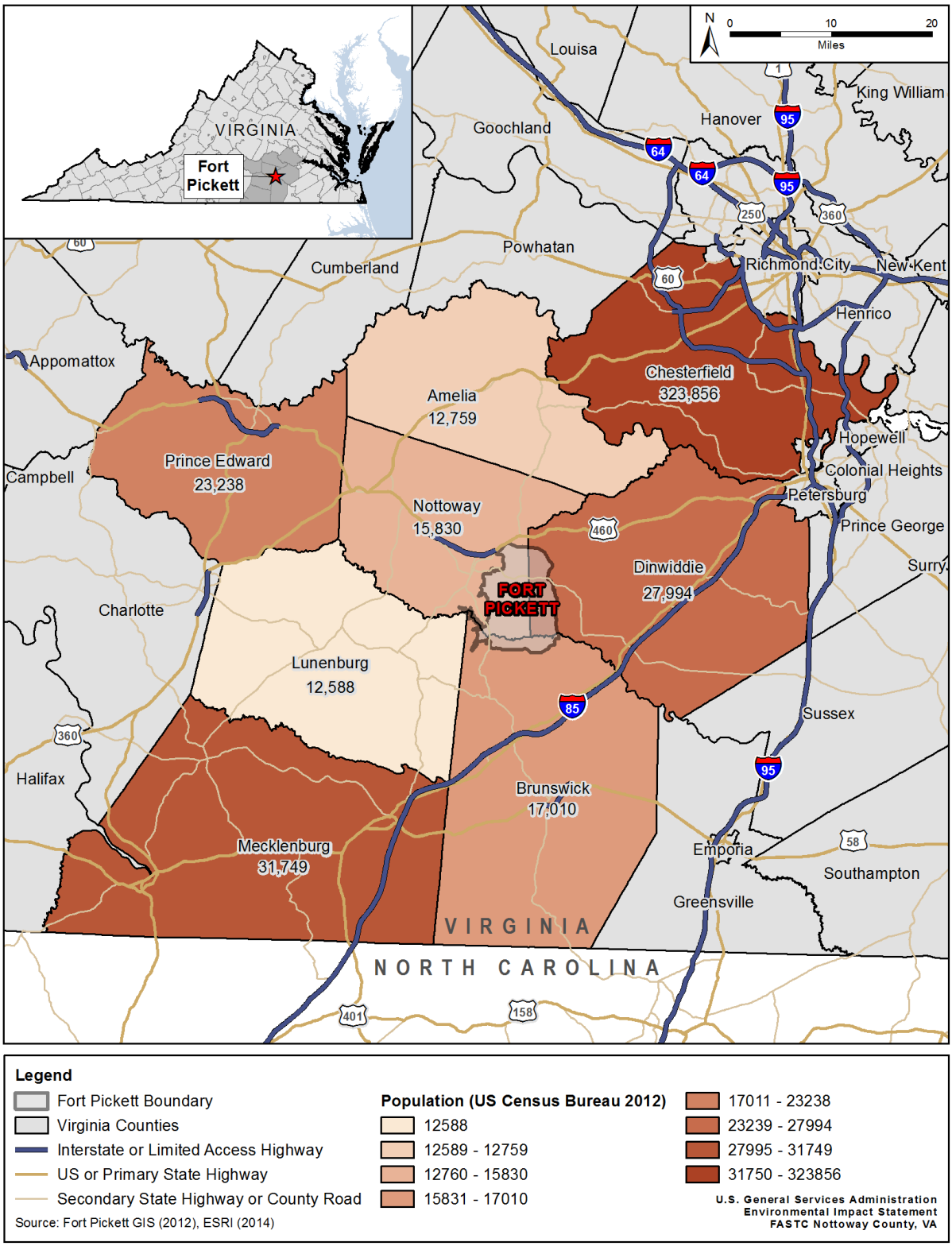

Figure 2-1. ROI Population

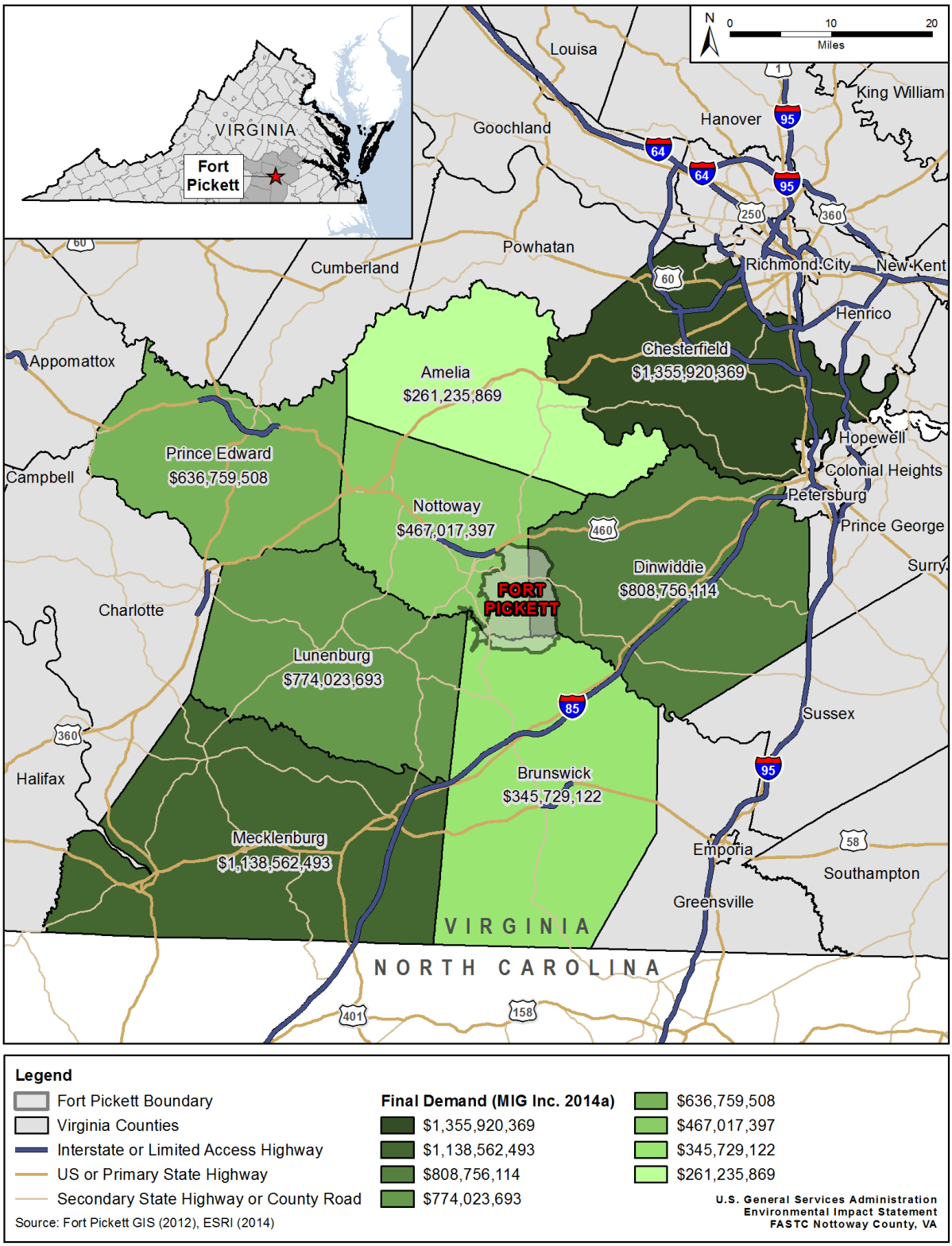

Figure 2-2. ROI Final Demand (Size of Economy)

2.1.2 Input Data and Modeling Procedures

Input data for the economic model were collected from GSA and DOS and are based on experience and knowledge that the agencies have gained from construction and operation of facilities with similar functions as the proposed FASTC. For analysis of the construction phase, GSA provided information on anticipated construction expenditures. For analysis of the operations phase, DOS provided data on payroll and non-payroll operational expenditures, and the projected number and length of stay for trainees. The agencies also provided a timeline for construction (provided by GSA) and operations (provided by DOS), which allowed for the analysis to be conducted on a year-by-year basis.

Some estimates were made prior to economic modeling to allow for incorporation of primary data into the IMPLAN model. Additional estimates were made post-modeling, such as conversion of IMPLAN jobs estimates to full-time equivalent (FTE), so that estimates could be presented in a consistent manner. Estimates typically used factors that were gathered from GSA or DOS, federal statistical agencies, or the private firm that has proprietorship over the IMPLAN model. In order to complete certain portions of the analyses, some assumptions were made. Attachment A provides a summary of these assumptions.

2.1.2.1 Construction Expenditures

In total, GSA estimated construction expenditures to be approximately $350 million. This initial estimate was used as a basis to establish the amount of expenditures that would be made on construction occurring within the ROI. Portions of the initial estimate that relate to construction contractor contingencies and certain fees were identified in GSA estimates and were excluded from analysis because this money is estimated to be spent outside of the ROI. The initial estimate also included expenditures related to escalation, or construction cost inflation; this was also removed from analysis because the analysis was conducted in constant dollars (an analysis that assumes no changes, over time, to prices, wages, or other economic variables). After removing expenditures that would likely not impact the economy of the ROI, it was estimated that a total of $294 million would be spent on construction over the course of the construction phase.

The construction plan established by GSA enabled the distribution of these expenditures over time on an annualized basis. Table 2-1 shows construction expenditures in the ROI spread out over the course of the construction phase. These construction expenditures were input into the IMPLAN model (IMPLAN Sector 36[1]) to generate estimates of economic impacts related to the construction phase.

Table 2-1. Total Expenditures on Construction in the ROI, 2015 to 2020, Constant 2014 Dollars

2015	2016	2017	2018	2019	2020
$18,649,254	$117,123,578	$83,139,530	$38,604,893	$34,112,520	$2,667,233

Source: GSA 2014a.

Note: GSA construction estimate adjusted to include only expenditures expected to be made for construction in the ROI.

[1] IMPLAN sectors are representations of industries within a regional economy. Applying project-related expenditures to a particular IMPLAN sector simulates expenditures being made in a corresponding industry.

2.1.2.2 Operational Expenditures

There would be three major sources of local expenditures derived from operational activities at FASTC: 1) payroll; 2) purchases of goods and services that would be required to operate FASTC; and 3) purchases by trainees. Since it is expected that FASTC would maintain operations for the foreseeable future, impacts related to FASTC operations would be considered economically sustainable in comparison to the construction phase (which would be completed in early 2020). The following sections discuss the sources and magnitude of FASTC local operational expenditures.

Operational Payroll Expenditures

DOS provided information on total government employment and average salaries that would be associated with FASTC operations. The employment totals in Table 2-2 represent all government employees. As Table 2-2 indicates, direct operational employment related to FASTC would build up from the first year of operations in 2016 until full operations are reached in 2020. Since 2020 would be the first full year of steady-state operations, the direct operational jobs indicated in Table 2-2 would be generated every year in perpetuity, absent any unforeseen changes. These data were input into the IMPLAN model as employment in the federal government, non-military sector (IMPLAN sector 439).

Table 2-2. Estimated Direct Operational Employment (FTE), 2016 to 2020

2016	2017	2018	2019	2020[1]
34	170	305	322	339

Source: DOS 2014.

Note: [1]2020 represents a steady-state. This number of jobs would be expected to continue annually for the foreseeable future.

[2] Average annual salary for these employees was estimated to be about $82,000 per year (DOS 2014)

Table 2-3 shows payroll expenditures that would be associated with direct operational employment. Similar to growth in employment from 2016 to 2020, payroll expenditures would increase from the start of operations in 2016 until full operations would be reached in 2020. These data were input into the IMPLAN model as employee compensation in the federal government, non-military sector (IMPLAN sector 439).

Table 2-3. Estimated Income of Direct Operations Workers, 2016 to 2020, Constant 2014 Dollars

2016	2017	2018	2019	2020[1]
$2,613,759	$13,068,796	$23,523,832	$24,830,711	$26,137,591

Source: DOS 2014.

Note: [1]Estimate for 2020 represents steady-state payroll expenditures. This level of payroll would be expected to continue annually for the foreseeable future.

Non-payroll Operational Expenditures

DOS provided information on FASTC non-payroll operational expenditures. These data represent purchases of goods and services within the ROI that would be made to maintain the operations of FASTC. Because operational expenditures would be related to on-site activities, these operational

expenditures would be paid to firms in the ROI that would be contracted to provide goods and services. Table 2-4 details the types of goods and services that would be required to operate FASTC and the expected level of expenditures for each type of goods and services. Non-payroll operational expenditures would be expected to reach a steady-state in 2020, at about $18 million per year. These expenditures were input into the IMPLAN model as industry sales in various IMPLAN sectors.

Table 2-4. Non-payroll Operational Expenditures in the ROI, 2016 to 2020, Constant 2014 Dollars

Expenditure Category	IMPLAN Sector	2016	2017	2018	2019	2020[1]
Fleet Management/Shuttle Transportation	338	$97,187	$485,934	$874,680	$923,274	$971,867
Training Vehicle Ops, Maintenance & Repair	414	$200,000	$1,000,000	$1,800,000	$1,900,000	$2,000,000
Wrecker/Salvage Services	338	$32,500	$162,500	$292,500	$308,750	$325,000
Emergency Medical Services	396	$25,000	$125,000	$225,000	$237,500	$250,000
Technology Maintenance - Technicians	373	$100,000	$500,000	$900,000	$950,000	$1,000,000
Facility Management Services Vehicle Fuel	326	$1,196	$5,980	$10,764	$11,362	$11,960
Building Operations Maintenance	385	$139,359	$696,796	$1,254,233	$1,323,912	$1,393,592
Building Custodial Services	388	$104,735	$523,677	$942,619	$994,986	$1,047,354
Range Maintenance & Custodial Services	388	$31,200	$156,000	$280,800	$296,400	$312,000
Landscaping/Grounds	388	$6,480	$32,400	$58,320	$61,560	$64,800
Emergency Generator Fuel/Maintenance	331	$240	$1,200	$2,160	$2,280	$2,400
Telecommunication/Fiber Optic	351	$40,000	$200,000	$360,000	$380,000	$400,000
Radio Systems	351	$1,200	$6,000	$10,800	$11,400	$12,000
Electricity	31	$87,479	$437,397	$787,314	$831,053	$874,793
Water and Sewer	432	$229,625	$1,148,125	$2,066,625	$2,181,438	$2,296,250
Storm water Management	388	$5,000	$25,000	$45,000	$47,500	$50,000
Animal Management/Pest Control	388	$8,000	$40,000	$72,000	$76,000	$80,000
Road Maintenance	338	$5,400	$27,000	$48,600	$51,300	$54,000
Snow removal and storm cleanup	338	$1,800	$9,000	$16,200	$17,100	$18,000
Supplies and Equipment	319	$700,000	$3,500,000	$6,300,000	$6,650,000	$7,000,000
Operational Expenditures (Total)		$1,816,402	$9,082,008	$16,347,614	$17,255,815	$18,164,016

Source: DOS 2014.

Notes: [1]Estimate for 2020 represents steady-state non-payroll operational expenditures. This level of expenditure would be expected to continue annually for the foreseeable future.

Trainee Expenditures

The primary focus of FASTC would be to train security personnel. Trainees would be expected to spend money in the local communities within the ROI. Table 2-5 shows expected annual number of trainee-days (annual number of trainees multiplied by the average number of days each trainee would spend at FASTC) and annual trainee expenditures broken down by type of expenditure.

Trainee-days were multiplied by an estimate of daily per-trainee expenditures to yield total trainee expenditures in the ROI. Daily per-trainee expenditures were estimated based on lodging rates negotiated by DOS (DOS 2014) and per diem government travel rates. Daily per-trainee spending was estimated to be $121 per trainee day, with $75 per trainee day spent on lodging (which was input into

IMPLAN Sector 411), $41 per trainee day spent on meals (IMPLAN Sector 413), and $5 per trainee day spent on incidentals (IMPLAN Sector 325).

Table 2-5. Annual Trainee-Days and Estimated Trainee Expenditures, 2016-2020, Constant 2014 Dollars

	2016	2017	2018	2019	2020[1]
Annual Trainee-days	**12,880**	**64,400**	**115,920**	**122,360**	**128,800**
Annual Trainee Expenditures	**$1,558,480**	**$7,792,400**	**$14,026,320**	**$14,805,560**	**$15,584,800**
Trainee Expenditures on Lodging[2]	*$966,000*	*$4,830,000*	*$8,694,000*	*$9,177,000*	*$9,660,000*
Trainee Expenditures on Meals[3]	*$528,080*	*$2,640,400*	*$4,752,720*	*$5,016,760*	*$5,280,800*
Trainee Expenditures on Incidentals	*$64,400*	*$322,000*	*$579,600*	*$611,800*	*$644,000*

Sources: DOS 2014 (for trainee-days and lodging expenditures), GSA 2014b (for meals/incidentals).

Note: [1]Estimate for 2020 represents steady-state trainee expenditures. This level of expenditure would be expected to continue annually for the foreseeable future.

[2]Trainee expenditures on lodging would be funded via federal contracts with hotels/motels within the ROI.

[3]Some meals would be eaten on-site during the instructional day and funded via federal contracts with food services providers.

2.1.3 Result Variables

Economic variables that are presented as impacts include Jobs, Labor Income, and Economic Output. Each of these variables consists of a direct and an indirect/induced element.

Direct impacts are associated with FASTC itself and include construction and operations jobs; the incomes earned by those workers; the economic output associated with initial purchases of local construction materials and supplies; and goods and services that facilitate the operations of FASTC. Additional direct impacts are generated through non-payroll expenditures and trainee expenditures.

Indirect impacts are the jobs, income, and economic output generated by the businesses that supply goods and services to FASTC. Indirect jobs include jobs at companies that supply construction materials/supplies or support jobs directly related to FASTC operations. Indirect jobs extend to include jobs related to the manufacture of products used to construct and operate the facility. Indirect labor income includes the income earned by people working indirect jobs. Indirect output includes the total sales volume related to the supply of goods and services to FASTC.

Induced impacts are the result of spending of the wages and salaries of the direct and indirect employees on items such as food, housing, transportation, and medical services. This spending creates induced employment in nearly all sectors of the economy, especially service sectors.

<u>Jobs</u>

Jobs impacts represent the number of FTE jobs that would be created or sustained within the ROI as a result of the construction and operations of FASTC. Some direct operational job estimates were provided by DOS (Table 2-2) but estimates for all other jobs were calculated by the IMPLAN model, based on expenditures. The IMPLAN model generates jobs numbers that include part-time jobs, but these jobs numbers were adjusted to FTE using conversion factors published by MIG Inc. (MIG Inc. 2014b), the developer of the IMPLAN model.

Labor Income

Labor income impacts represent the income generated through the jobs that would be created or sustained within the ROI as a result of the construction and operations of FASTC. Some direct operational labor income estimates were provided by DOS (Table 2-3) but estimates for all other labor income were calculated by the IMPLAN model, based on expenditures.

Economic Output

Economic output impacts represent total production and sales volume that would be generated in the ROI as a result of the construction and operations of FASTC. Economic output is generated by increases in expenditures associated with FASTC construction and operations.

2.2 ESTIMATED ECONOMIC IMPACTS

This section presents estimates of economic impacts of proposed FASTC construction and operations on the economy of the ROI. Variables that are estimated include jobs, labor income, and economic output. Estimates are provided in terms of direct impacts, indirect/induced impacts, and total impacts, on an annual basis.

2.2.1 Jobs

2.2.1.1 Construction Phase

Table 2-6 presents estimates of the number of FTE jobs that would be generated by the construction of FASTC, during the life of the construction phase, from 2015 to 2020. Construction would be expected to begin in late 2015 and build up, reaching a peak in 2016 when 1,633 FTE jobs would be generated or sustained within the ROI. After 2016, construction would begin to wind down with 1,130 FTE jobs in 2017 and about 500 FTE jobs in 2018 and 2019. Most aspects of construction would be complete by the end of 2019 and construction would conclude in the early months of 2020. Figure 2-3 illustrates the results presented in Table 2-6.

Table 2-6. Annual FTE Jobs Impact from Construction, 2015-2020

	2015	2016	2017	2018	2019	2020
Direct	160	1,046	713	331	292	23
Indirect/Induced	94	587	417	194	171	13
Total	254	1,633	1,130	525	463	36

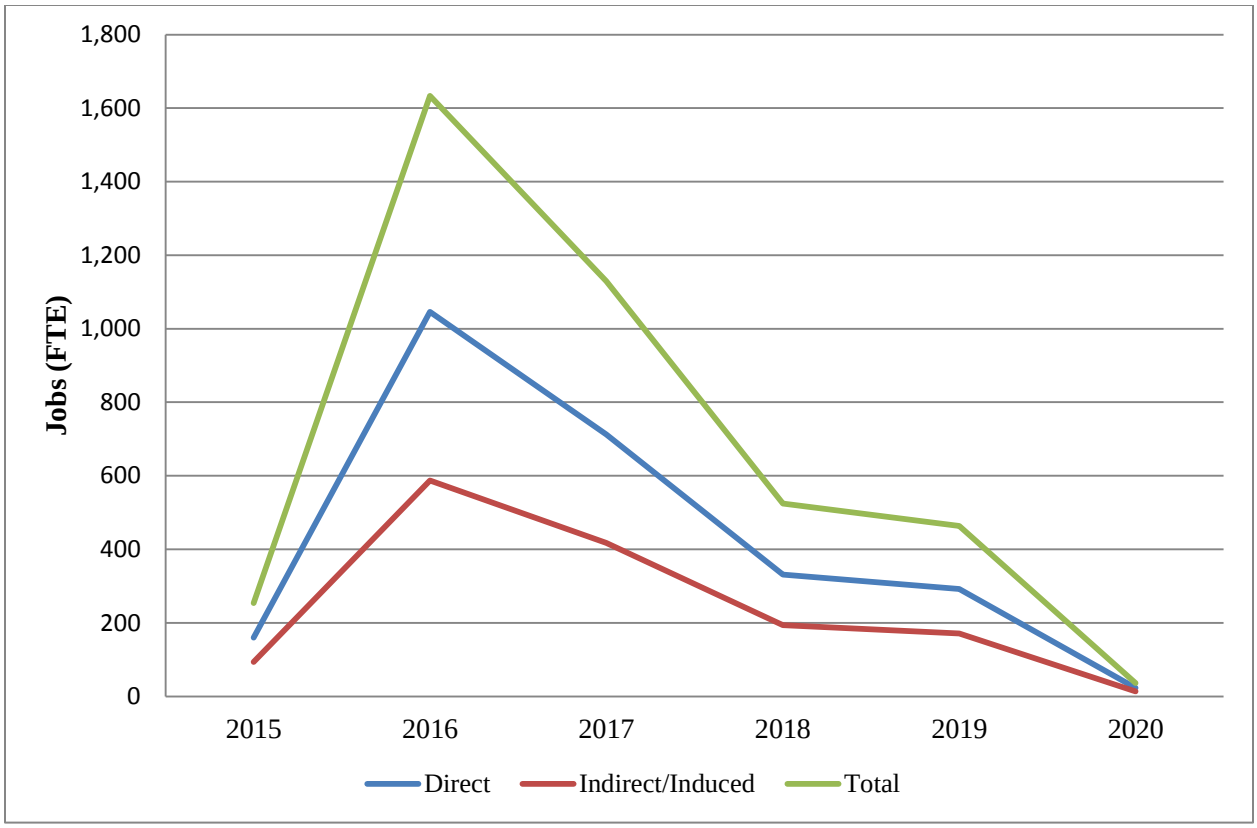

Figure 2-3. FTE Jobs Impact from Construction, 2015-2020

2.2.1.2 Operations Phase

Table 2-7 presents estimates of FTE jobs that would result from the operations phase of FASTC. Operations would be expected to begin in 2016 and build up to a steady-state by 2020. At steady-state operations, 574 direct FTE jobs and 209 indirect/induced FTE jobs would be generated or sustained within the ROI. Total FTE jobs impacts would increase from 78 in 2016 to a steady-state total of 783 in 2020. Figure 2-4 illustrates the results presented in Table 2-7 along with estimates for the year 2021, which further illustrate the steady-state nature of operational impacts.

Table 2-7. Annual FTE Jobs Impact from Operations, 2016-2020

	2016	2017	2018	2019	2020[1]
Direct[2]	57	287	516	545	574
Indirect/Induced	21	105	188	199	209
Total	78	392	704	744	783

Notes: [1]Estimate for 2020 represents steady-state operations. This level of jobs would be expected to continue annually for the foreseeable future.
[2] Direct operations jobs include those directly related to FASTC (see Table 2-2) and direct jobs from operational contract spending and trainee spending, which are estimates that are generated by the IMPLAN model.

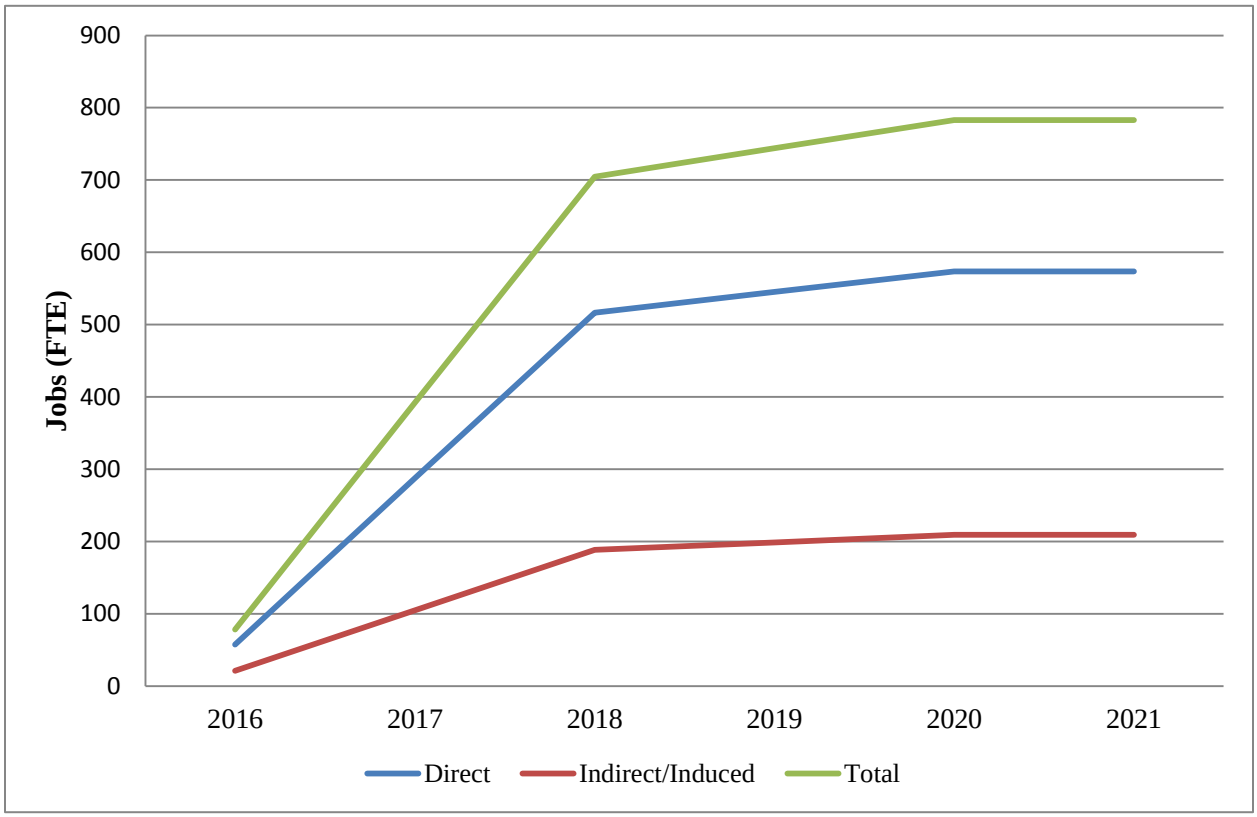

Figure 2-4. FTE Jobs Impact from Operations, 2016-2021

Table 2-8 provides a breakdown of industries in which at least five additional jobs would occur during the steady-state period beginning in 2020. Federal government jobs (at FASTC) would bring the most additional jobs to the ROI (339). Jobs in food services and drinking places (103) and hotels and motels (82) would also be generated as a result of FASTC operations.

Table 2-8. Industries with At Least Five Jobs Generated

	Direct	Indirect/Induced	Total
Federal government	339	0	339
Food services and drinking places	80	23	103
Hotels and motels	82	0	82
Services to buildings and dwellings	24	7	31
Automotive repair and maintenance	23	2	25
Transportation and support activities for transportation	17	0	17
Wholesale trade businesses	5	5	10
Real estate establishments	0	10	10
Investment related activities	0	9	9
Employment services	0	9	9
Offices of physicians, dentists, and other health practitioners	0	8	8
Other state and local government enterprises	7	1	8
General merchandise stores	0	7	7
Facilities support services	6	0	6
Maintenance/repair/construction of nonresidential structures	0	6	6
Civic, social, professional, and similar organizations	0	6	6
Food and beverage stores	0	6	6
Private hospitals	0	5	5
Nursing and residential care facilities	0	5	5

2.2.1.3 Combined Construction and Operations

Table 2-9 presents estimates of FTE jobs that would result from the combined construction and operations of FASTC. Construction would be expected to begin in 2015 and build up, reaching a peak in 2016. Operations would be expected to begin in 2016 and build up, reaching a steady-state by 2020. From 2016 to 2019, there would be more than 1,000 FTE jobs in the ROI associated with FASTC construction and operations. As there would be some construction work done in 2020, estimated impacts for 2021 represent the steady-state for combined impacts. Figure 2-5 illustrates the results presented in Table 2-9 along with estimates for 2022 to further illustrate the steady-state nature of operational impacts.

Table 2-9. Annual FTE Jobs Impact from Combined Construction and Operations, 2015-2021

	2015	2016	2017	2018	2019	2020	2021[1]
Direct	160	1,103	1,000	847	837	597	574
Indirect/Induced	94	608	522	382	370	223	209
Total	254	1,711	1,522	1,229	1,207	820	783

Note: [1]Estimate for 2020 represents steady-state operations but some construction activity would also generate impacts. As such, 2021 represents the steady state for combined impacts. This level of jobs would be expected to continue annually for the foreseeable future.

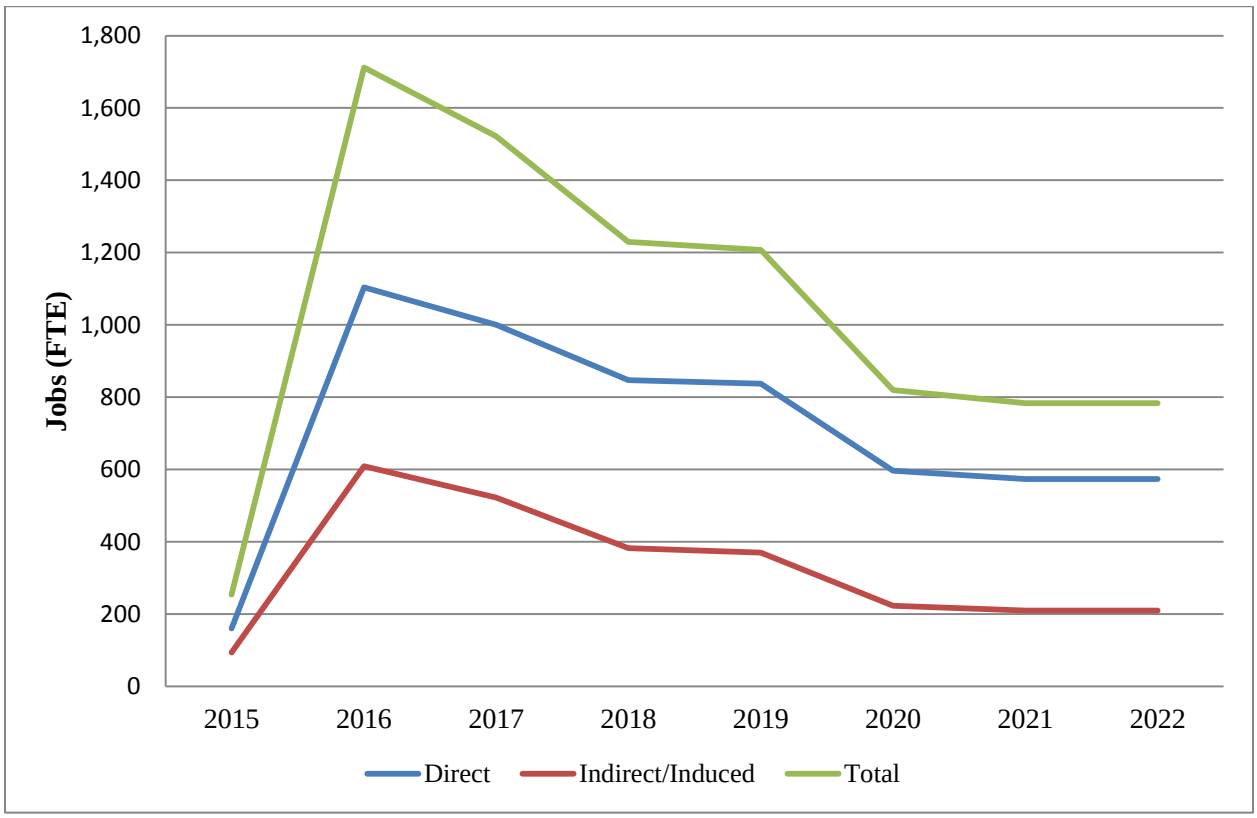

Figure 2-5. FTE Jobs Impact from Combined Construction and Operations, 2015-2021

2.2.2 Labor Income

2.2.2.1 Construction Phase

Table 2-10 presents estimates of labor income that would be generated by the construction of FASTC during the life of the construction phase, from 2015 to 2020. Construction would be expected to begin in 2015 and build up, reaching a peak in 2016. At the peak of the construction phase, nearly $72 million in labor income would be generated within the ROI. After 2016, construction would begin to wind down with about $51 million in labor income generated in 2017 and about $20 million in labor income generated in 2018 and 2019. Construction activities would only take place during the very early part of 2020 and would generate an estimated $1.6 million in labor income. Figure 2-6 illustrates the results presented in Table 2-10.

Table 2-10. Annual Labor Income Impact from Construction, 2015-2020, Constant 2014 Dollars

	2015	2016	2017	2018	2019	2020
Direct	$7,085,641	$44,158,682	$31,345,799	$14,555,065	$12,861,321	$1,005,617
Indirect/Induced	$4,392,372	$27,524,453	$19,538,082	$9,072,286	$8,016,562	$626,809
Total	$11,478,013	$71,683,135	$50,883,881	$23,627,351	$20,877,883	$1,632,426

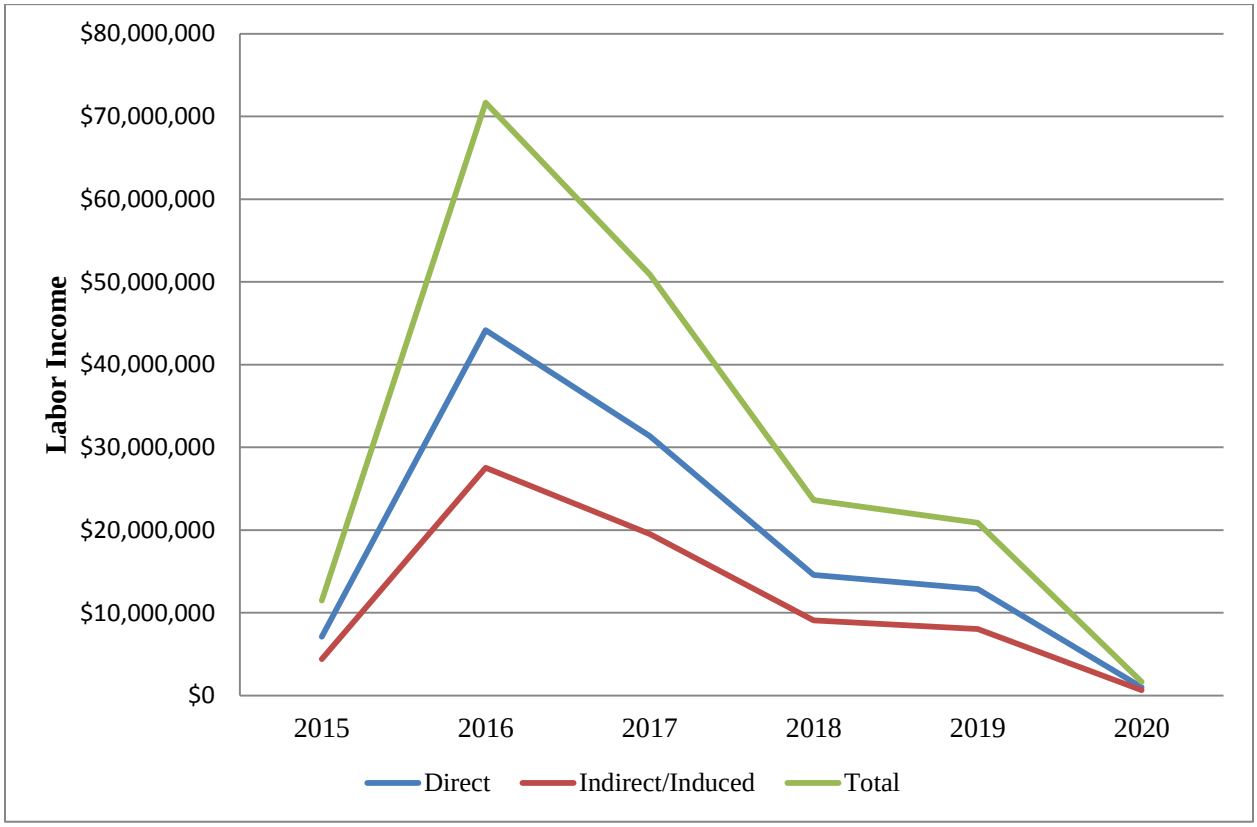

Figure 2-6. Labor Income Impact from Construction, 2015-2020, Constant 2014 Dollars

2.2.2.2 Operations Phase

Table 2-11 presents estimates of labor income that would result from the operation of FASTC. Operations would be expected to begin in 2016 and build up, reaching a steady-state by 2020. At steady-state operations, $34.4 million in direct labor income and $9.5 million in indirect/induced labor income would be generated as a result of FASTC operations. Total labor income impacts, from FASTC operations, would increase from $4.4 million in 2016 to a steady-state total of $43.9 million in 2020. Figure 2-7 illustrates the results presented in Table 2-11 along with estimates for 2021 that further illustrate the steady-state nature of impacts.

Table 2-11. Annual Labor Income Impact from Operations, 2016-2020, Constant 2014 Dollars

	2016	2017	2018	2019	2020[1]
Direct	$3,444,838	$17,221,731	$30,999,115	$32,721,287	$34,443,461
Indirect/Induced	$947,164	$4,735,380	$8,523,684	$8,997,222	$9,470,760
Total	$4,392,002	$21,957,111	$39,522,799	$41,718,509	$43,914,221

Notes: [1]Estimate for 2020 represents steady-state operations. This level of labor income would be expected to continue annually for the foreseeable future.

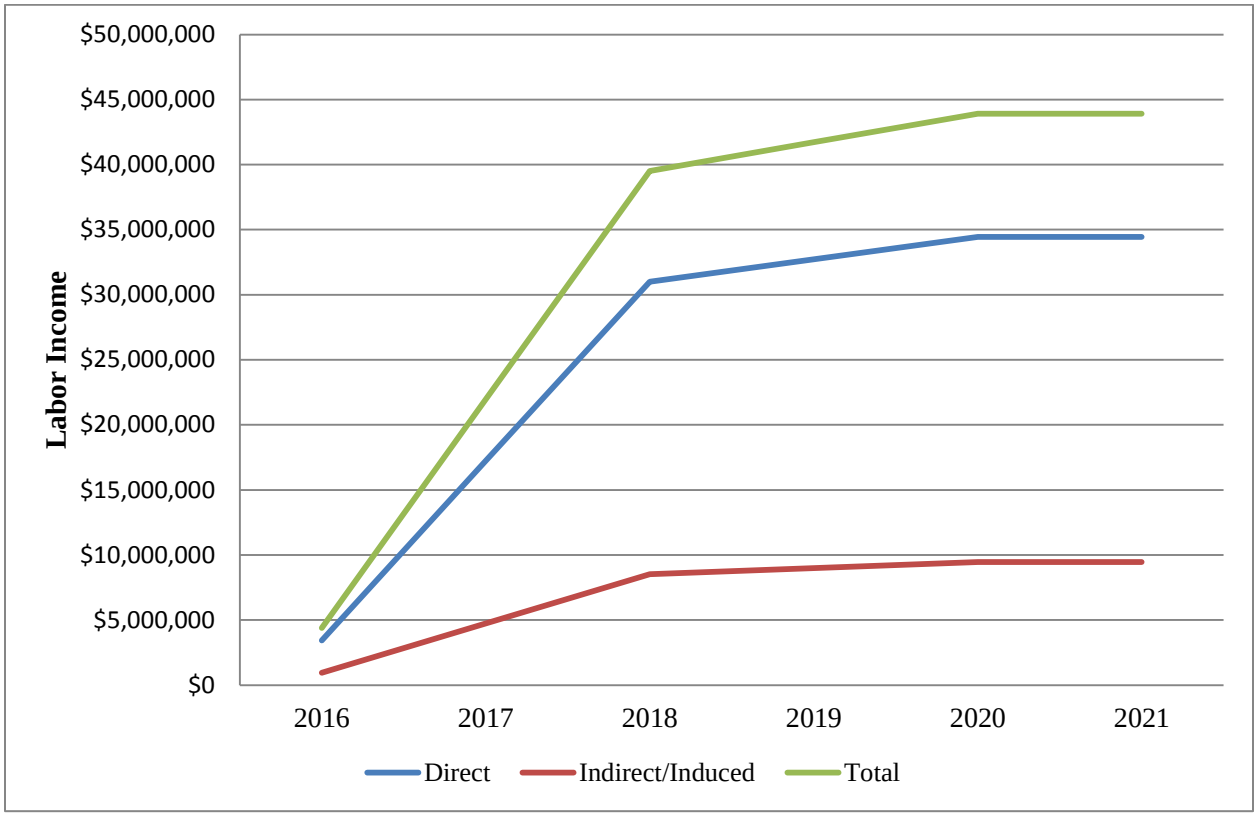

Figure 2-7. Labor Income Impact from Operations, 2016-2021, Constant 2014 Dollars

2.2.2.3 Combined Construction and Operations

Table 2-12 presents estimates of labor income that would result from the combined construction and operations of FASTC. Construction would be expected to begin in 2015 and build up, reaching a peak in 2016. Operations would be expected to begin in 2016 and build up, reaching a steady-state by 2020. From 2016 to 2019 combined labor income impacts would range from $62.6 million to $76 million per year. Then as construction concludes, steady-state operational levels, around $44 million per year would persist for the foreseeable future. Figure 2-8 illustrates the results presented in Table 2-12.

Table 2-12. Annual Labor Income Impact from Combined Construction and Operations, 2015-2021, Constant 2014 Dollars

	2015	2016	2017	2018	2019	2020	2021[1]
Direct	$7,085,641	$47,603,520	$48,567,530	$45,554,180	$45,582,609	$35,449,078	$34,443,461
Indirect/ Induced	$4,392,372	$28,471,617	$24,273,462	$17,595,970	$17,013,784	$10,097,569	$9,470,760
Total	$11,478,013	$76,075,137	$72,840,992	$63,150,150	$62,596,393	$45,546,647	$43,914,221

Note: [1] Estimate for 2020 represents steady-state operations but some construction activity would also generate impacts. As such, 2021 represents the steady-state for combined impacts. This level of labor income would be expected to continue annually for the foreseeable future.

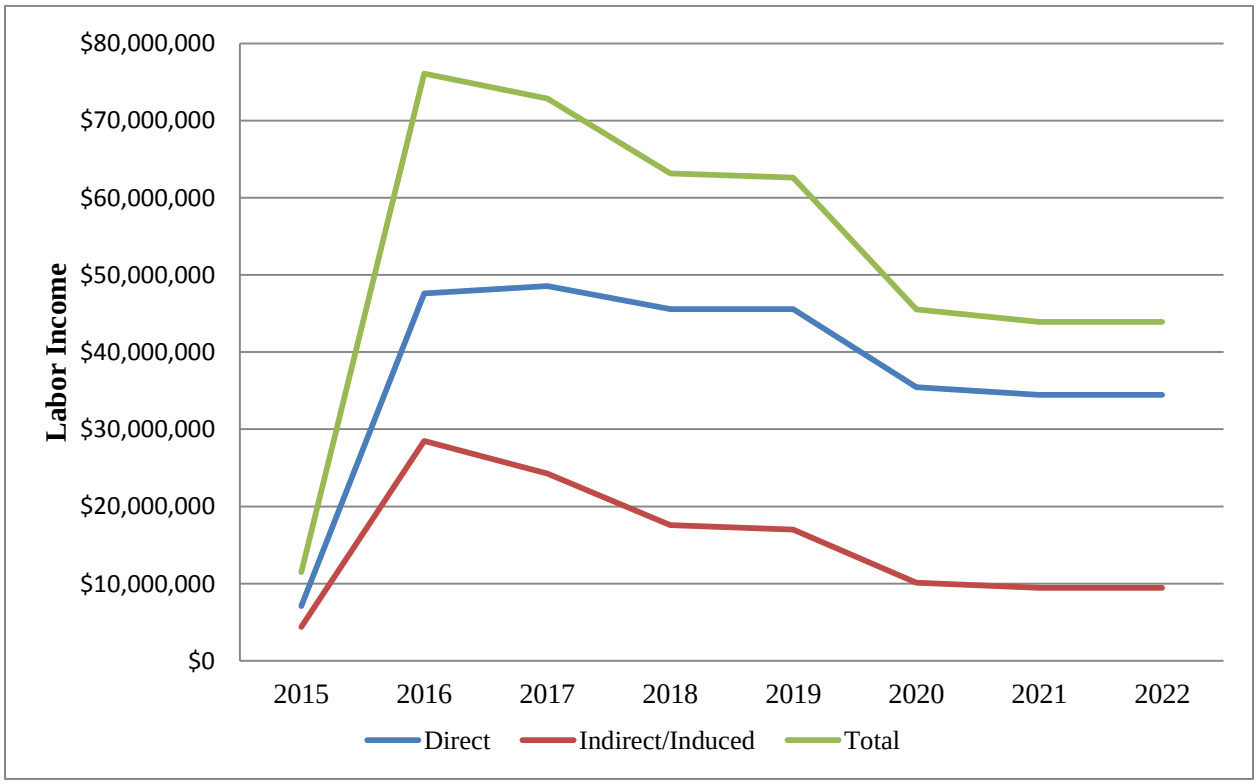

Figure 2-8. Labor Income Impact from Combined Construction and Operations, 2015-2022, Constant 2014 Dollars

2.2.3 Economic Output

2.2.3.1 Construction Phase

Table 2-13 shows estimates of economic output that would be generated by the construction of FASTC, from 2015 to 2020. Construction would be expected to begin in 2015 and build up, reaching a peak in 2016. Impacts to economic output would be $30.7 million in 2015 and increase to $192 million in 2016. Impacts to economic output would begin to decline after 2016 with economic output of $136.6 million in 2017, $63.4 million in 2018, $56 million in 2019, and $4.4 million in 2020. Figure 2-9 illustrates the results presented in Table 2-13.

Table 2-13. Economic Output Impact from Construction, 2015-2020, Constant 2014 Dollars

	2015	2016	2017	2018	2019	2020
Direct	$18,649,254	$117,123,578	$83,139,530	$38,604,893	$34,112,520	$2,667,233
Indirect/Induced	$12,017,446	$75,281,087	$53,437,867	$24,813,265	$21,925,796	$1,714,362
Total	$30,666,700	$192,404,665	$136,577,397	$63,418,158	$56,038,316	$4,381,595

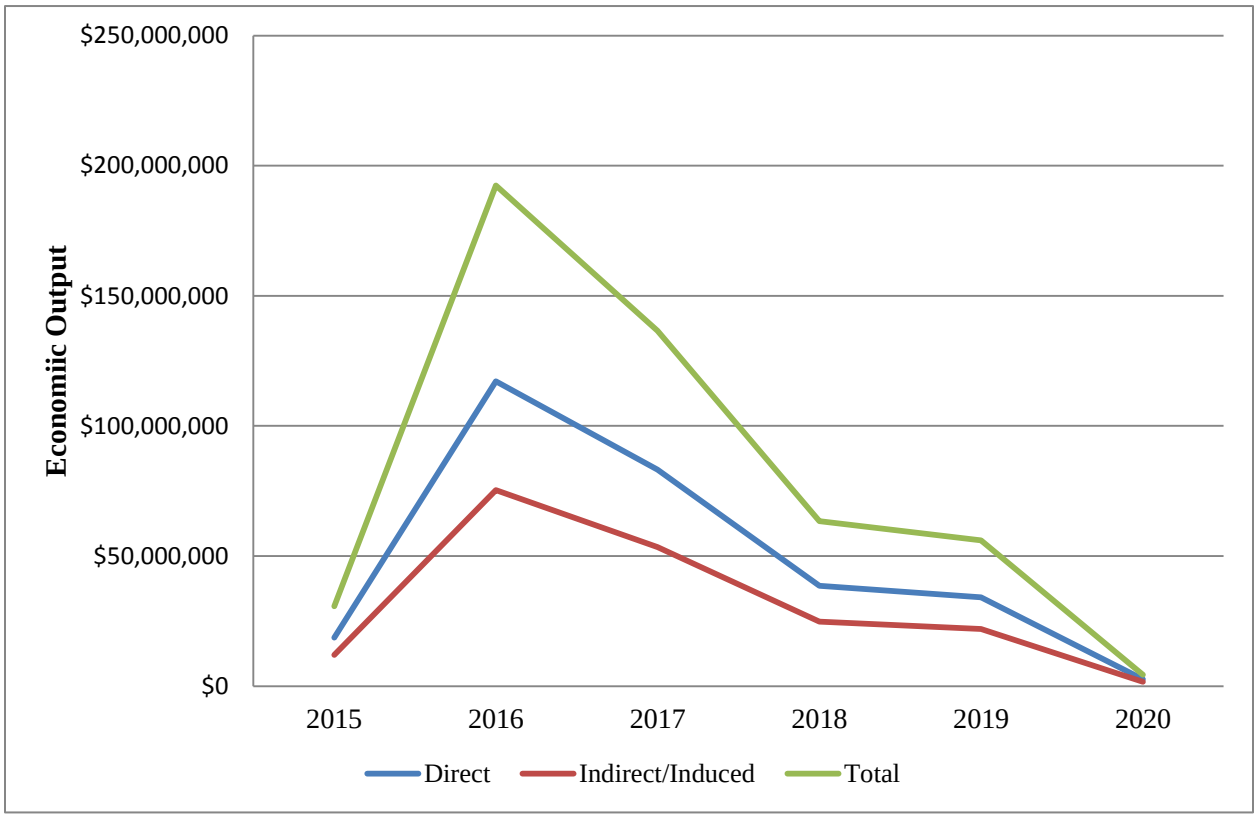

Figure 2-9. Economic Output Impact from Construction, 2015-2020, Constant 2014 Dollars

2.2.3.2 Operations Phase

Table 2-14 presents estimates of economic output that would result from the operations of FASTC. Operations would be expected to begin in 2016 and reach a steady-state by 2020. At steady-state operations, $68.5 million in direct economic output and $28.7 million in indirect/induced economic output per year would be generated by FASTC operations. Total economic output impacts would increase from $9.7 million in 2016 to a steady-state total of $97.2 million in 2020. Figure 2-10 illustrates the results presented in Table 2-14 along with estimates for the year 2021 that further illustrate the steady-state nature of impacts.

Table 2-14. Annual Economic Output Impact from Operations, 2016-2020, Constant 2014 Dollars

	2016	2017	2018	2019	2020[1]
Direct	$6,849,127	$34,245,643	$61,642,156	$65,066,719	$68,491,285
Indirect/Induced	$2,868,849	$14,342,861	$25,817,150	$27,251,436	$28,685,722
Total	$9,717,976	$48,588,504	$87,459,306	$92,318,155	$97,177,007

Note: [1]Estimate for 2020 represents steady-state operations. This level of labor income would be expected to continue annually for the foreseeable future.

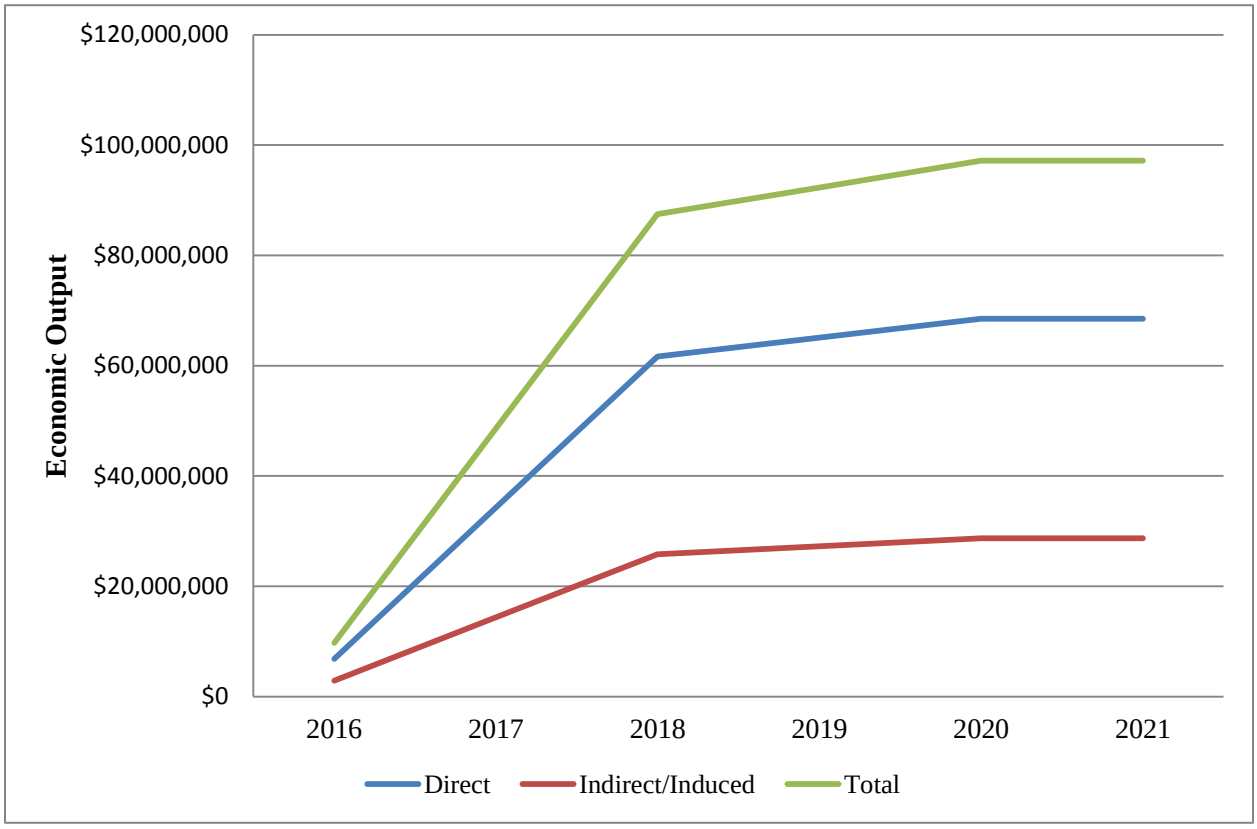

Figure 2-10. Economic Output Impact from Operations, 2016-2021, Constant 2014 Dollars

2.2.3.3 Combined Construction and Operations

Table 2-15 shows estimates of economic output that would be generated by the combined construction and operations of FASTC. Construction would begin in 2015 and build up, reaching a peak in 2016. Operations would begin in 2016 and build up, reaching a steady-state by 2020. From 2016 to 2019 between $150 and $200 million annually in economic output would be generated. The steady-state level of about $100 million annually would extend into the foreseeable future. Figure 2-11 illustrates the results presented in Table 2-15, along with estimates for the year 2021 that further illustrate the steady-state nature of impacts.

Table 2-15. Annual Economic Output Impact from Combined Construction and Operations, 2015-2021, Constant 2014 Dollars

	2015	2016	2017	2018	2019	2020	2021[1]
Direct	$18,649,254	$123,972,705	$117,385,173	$100,247,050	$99,179,240	$71,158,518	$68,491,285
Indirect/ Induced	$12,017,446	$78,149,936	$67,780,729	$50,630,415	$49,177,231	$30,400,084	$28,685,722
Total	$30,666,700	$202,122,641	$185,165,902	$150,877,465	$148,356,471	$101,558,602	$97,177,007

Note: [1]Estimate for 2020 represents steady-state operations but some construction activity would also generate impacts. As such, 2021 represents the steady-state for combined impacts. This level of labor income would be expected to continue annually for the foreseeable future.

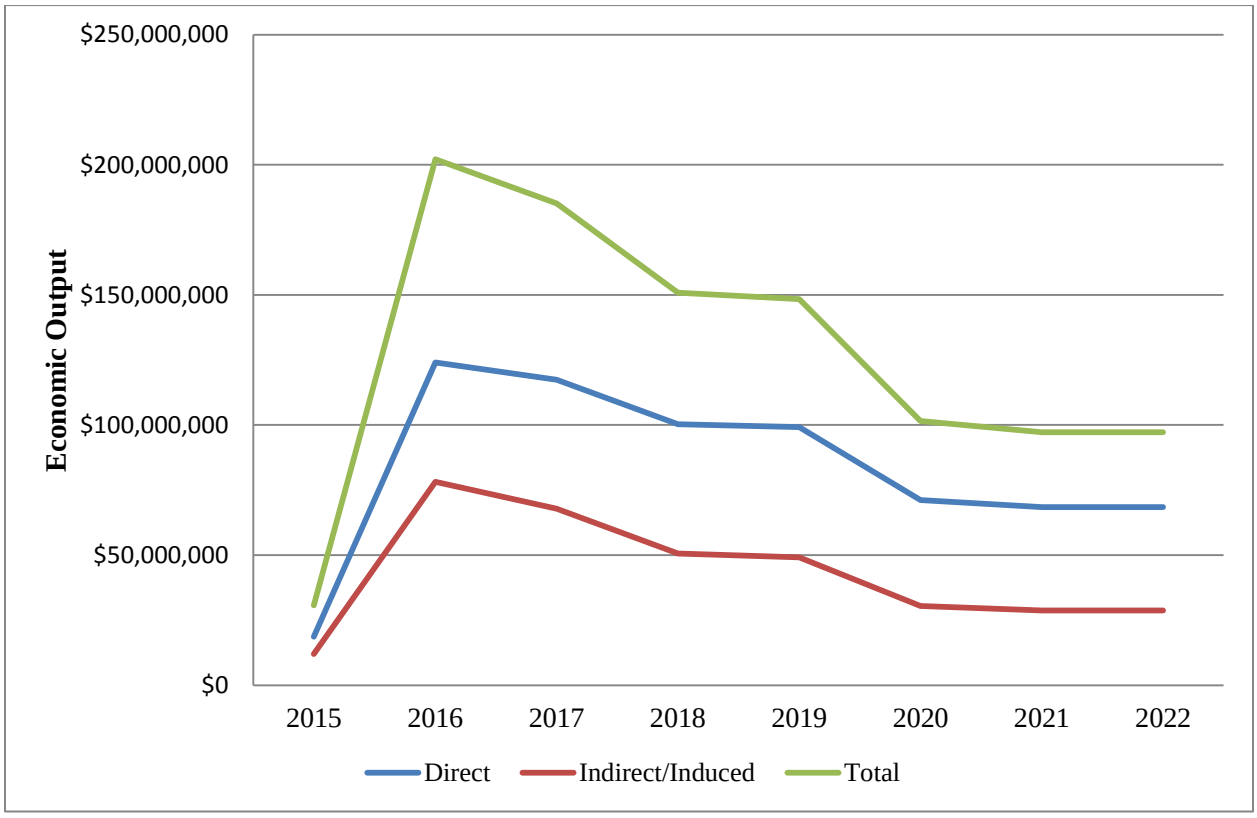

Figure 2-11. Economic Output Impact from Combined Construction and Operations, 2015-2022, Constant 2014 Dollars

CHAPTER 3. FISCAL IMPACT TECHNICAL STUDY

3.1 APPROACH TO ANALYSIS OF FISCAL IMPACTS

The fiscal impact technical study assesses local government revenues and costs that would be associated with the operations phase of FASTC. It is anticipated the FASTC operations would generate government revenues via associated economic growth and would generate additional government costs caused by associated population increases. Fiscal impacts of the construction phase are not assessed because construction would be temporary and would not be expected to induce any new population to relocate to the ROI. With no additional population relocating to the ROI for the construction phase, government costs related to construction would be minimal and it would be expected that local governments would benefit fiscally.

The fiscal impact analysis focuses on the two counties where impacts would be expected to be the largest – Nottoway and Chesterfield Counties. In a survey of residential preference conducted among existing DOS employees who would likely relocate to work at FASTC, Nottoway and Chesterfield Counties were identified as the areas most likely to see an influx of residents. Therefore, the fiscal impact analysis focuses on these counties. In order to estimate fiscal impacts for these counties, estimates of population and place of residence were incorporated into the economic analysis to isolate portions of expenditures that would be relevant to the two counties being analyzed.

Estimates of local government revenue were generated by the IMPLAN model by conducting individual economic impact analysis for Nottoway and Chesterfield Counties. Additional local government revenues from the sale of land needed for FASTC that would be paid directly to Nottoway County is discussed but not included in quantitative analysis. The reason for this is that the price received from GSA for the land is assumed to be revenue neutral over time because, theoretically, in real estate valuation, the sale price of the land is equal the discounted value of monthly lease and rental fee revenue that would otherwise be paid by others to Nottoway County over time.

Local government costs were established based on two categories: costs associated with additional residential population and costs associated with direct operations:

The per-capita method (Burchell 1992) was used to estimate costs associated with additional residential population by multiplying the number of new residents to each county by the average government cost per resident.

The employment anticipation method (Burchell 1992) was used to estimate costs related to direct operations. This method uses the number of anticipated employees as a proxy for the size and scale of activities that occur at a building or facility. The size and scale of activities at a building or facility is representative of the demand that the building or facility owners and occupants would have for public services. The resulting costs would be borne by local governments who provide those services. The estimate of cost to local government service providers that would be generated by FASTC operations was calculated by multiplying the number of anticipated and relevant direct employees at FASTC (Table

2-2) by the per-employee cost of local government public safety services, which represent the only type of public services the FASTC facility would be anticipated to demand from local governments. Since direct operations would occur in Nottoway County, analysis assumed all costs would accrue to the Nottoway County government. To avoid double counting, only anticipated employees who would be non-Nottoway County residents were considered relevant for this part of the analysis as costs associated with residents are already estimated with the per-capita method.

3.1.1 Local Government Revenue

Estimated local government revenue were generated by the IMPLAN model, similar to how economic impacts were generated – through operational payroll expenditures, non-payroll operational expenditures, and trainee expenditures. These expenditures were adjusted to reflect the portions of expenditures that would be expected to occur in Nottoway and Chesterfield counties, respectively.

While estimates are presented for Nottoway and Chesterfield counties, estimates are not specific to the county governments. Estimates reflect impacts to all local governments within the counties, to include city, town, or other municipal governments. As such, estimates for the town of Blackstone municipal government are included within the estimates for Nottoway County. The IMPLAN model does not provide the capability to split county revenue estimates among local town governments (i.e. the model does not report how much revenue would go to the Nottoway County government versus the town of Blackstone government). However, as a general guide, recent data show that Nottoway County has annual revenues about 2.5 times the size of the town of Blackstone's revenues. This 2.5 to 1 ratio translates to an approximately 70% county to 30% town relationship. This implies that of the total local government revenues generated from FASTC operations within Nottoway County, the Nottoway County government would receive about 70% , and the town of Blackstone government would receive about 30%. This is not intended to imply that only 30% of taxable activity would occur in Blackstone; rather, the lower ratio takes into account that taxable activity taking place in Blackstone may be taxed by both the town and the county.

3.1.1.1 Operational Payroll Expenditures

Operational payroll expenditures would generate revenue to local governments through sales taxes and through other means such as utilities taxes, business license taxes, and miscellaneous non-tax sources associated with general increases in economic activity.

Table 3-1 shows the percentage of operational payroll expenditures that would be made by FASTC to employees, by assumed county of employee residence. The information in Table 3-1 was generated based on a survey of existing DOS employees who would likely relocate to work at FASTC. Survey results are representative of where relocating FASTC employees would likely reside and the expected place of residence was used to proxy the location of personal spending.

About 70% of FASTC employees would be expected to reside in Chesterfield County and 15% would be expected to reside in Nottoway County. The remaining 15% of FASTC employees would be expected to reside in other counties in the ROI.

Table 3-1. Percentage of Operational Payroll Expenditures, by County of Residence

County	% of Payroll Expenditures
Nottoway County	15%
Chesterfield County	70%
Other ROI Counties[1]	15%

Source: Estimated based on place of residence for new FASTC employees as determined in survey of existing DOS employees who would likely relocate.

Note: [1]Amelia, Brunswick, Dinwiddie, Lunenburg, Mecklenburg, and Prince Edward counties

Table 3-2 and Table 3-3 show the direct payroll expenditures that were input into the IMPLAN model to generate estimates of local government revenue in Nottoway and Chesterfield Counties. The estimates of payroll expenditures received by employees residing in Nottoway and Chesterfield counties were calculated using personal expenditures information presented in Table 2-3 in conjunction with percentages presented in Table 3-1.

Table 3-2. Operational Payroll Expenditures by County of Residence, 2016-2020, Constant 2014 Dollars

County	2016	2017	2018	2019	2020[1]
Nottoway County	$392,064	$1,960,319	$3,528,575	$3,724,607	$3,920,639
Chesterfield County	$1,821,790	$9,108,951	$16,396,111	$17,307,006	$18,217,901

Note: [1]Estimate for 2020 represents steady-state personal expenditures. This level of expenditure would be expected to continue annually for the foreseeable future.

3.1.1.2 Non-payroll Expenditures

Non-payroll expenditures would be made to local firms to facilitate the operations of FASTC. These expenditures would generate local government revenue through taxes and fees. The geographic location of firms that would contract with FASTC is unknown at this time, and estimates of non-payroll expenditures, by county, shown in Table 3-4 and Table 3-5 are not certain. They are estimates based on data relating to the presence of existing business establishments that was available in the IMPLAN model (MIG Inc. 2014a).

Based on existing data related to the number and size of establishments in relevant industries, and the total amount of non-payroll expenditures (presented in Table 2-4), Table 3-3 shows estimated non-payroll expenditures for goods and services (by expenditure category) that would be expected to be made in Nottoway County to support the operations of FASTC. There is some potential that new businesses may develop in Nottoway County that would do business with FASTC, which would increase non-payroll expenditures in Nottoway County.

Table 3-3. Non-payroll Expenditures in Nottoway County, 2016-2020, Constant 2014 Dollars[1]

Expenditure Category	2016	2017	2018	2019	2020[2]
Fleet Management/Shuttle Transportation	$8,000	$40,000	$72,000	$76,000	$80,000
Training Vehicle Ops, Maintenance & Repair	$150,000	$750,000	$1,350,000	$1,425,000	$1,500,000
Wrecker/Salvage Services	$3,250	$16,250	$29,250	$30,875	$32,500
Emergency Medical Services	$25,000	$125,000	$225,000	$237,500	$250,000
Technology Maintenance - Technicians	$50,000	$250,000	$450,000	$475,000	$500,000
Facility Management Services Vehicle Fuel	$1,196	$5,980	$10,764	$11,362	$11,960
Building Operations Maintenance	$0	$0	$0	$0	$0
Building Custodial Services	$52,368	$261,839	$471,310	$497,493	$523,677
Range Maintenance & Custodial Services	$15,600	$78,000	$140,400	$148,200	$156,000
Landscaping/Grounds	$3,240	$16,200	$29,160	$30,780	$32,400
Emergency Generator Fuel/Maintenance	$240	$1,200	$2,160	$2,280	$2,400
Telecommunication/Fiber Optic	$0	$0	$0	$0	$0
Radio Systems	$0	$0	$0	$0	$0
Electricity	$87,479	$437,397	$787,314	$831,053	$874,793
Water and Sewer	$229,625	$1,148,125	$2,066,625	$2,181,438	$2,296,250
Stormwater Management	$2,500	$12,500	$22,500	$23,750	$25,000
Animal Management/Pest Control	$4,000	$20,000	$36,000	$38,000	$40,000
Road Maintenance	$540	$2,700	$4,860	$5,130	$5,400
Snow removal and storm cleanup	$180	$900	$1,620	$1,710	$1,800
Supplies and Equipment	$175,000	$875,000	$1,575,000	$1,662,500	$1,750,000
Operational Expenditures (Total)	$808,218	$4,041,091	$7,273,963	$7,678,071	$8,082,180

Notes: [1] Contractors to FASTC are unknown at this time; estimates are based on existing data and are not certain or binding.

[2] Estimate for 2020 represents steady-state non-payroll expenditures. This level of expenditures would be expected to continue annually for the foreseeable future.

Table 3-4 shows estimated non-payroll expenditures for goods and services (by expenditure category) that would be expected to be made in Chesterfield County to support the operations of FASTC.

Table 3-4. Non-payroll Expenditures in Chesterfield County, 2016-2020, Constant 2014 Dollars[1]

Expenditure Category	2016	2017	2018	2019	2020[2]
Fleet Management/Shuttle Transportation	$60,000	$300,000	$540,000	$570,000	$600,000
Training Vehicle Ops, Maintenance & Repair	$20,000	$100,000	$180,000	$190,000	$200,000
Wrecker/Salvage Services	$24,375	$121,875	$219,375	$231,563	$243,750
Emergency Medical Services	$0	$0	$0	$0	$0
Technology Maintenance - Technicians	$50,000	$250,000	$450,000	$475,000	$500,000
Facility Management Services Vehicle Fuel	$0	$0	$0	$0	$0
Building Operations Maintenance	$104,519	$522,597	$940,675	$992,934	$1,045,194
Building Custodial Services	$52,368	$261,839	$471,310	$497,493	$523,677
Range Maintenance & Custodial Services	$15,600	$78,000	$140,400	$148,200	$156,000
Landscaping/Grounds	$3,240	$16,200	$29,160	$30,780	$32,400
Emergency Generator Fuel/Maintenance	$0	$0	$0	$0	$0
Telecommunication/Fiber Optic	$40,000	$200,000	$360,000	$380,000	$400,000
Radio Systems	$1,200	$6,000	$10,800	$11,400	$12,000
Electricity	$0	$0	$0	$0	$0
Water and Sewer	$0	$0	$0	$0	$0
Stormwater Management	$2,500	$12,500	$22,500	$23,750	$25,000
Animal Management/Pest Control	$4,000	$20,000	$36,000	$38,000	$40,000
Road Maintenance	$4,050	$20,250	$36,450	$38,475	$40,500
Snow removal and storm cleanup	$1,350	$6,750	$12,150	$12,825	$13,500
Supplies and Equipment	$350,000	$1,750,000	$3,150,000	$3,325,000	$3,500,000
Operational Expenditures (Total)	$733,202	$3,666,011	$6,598,820	$6,965,420	$7,332,021

Notes: [1] Contractors to FASTC are unknown at this time; estimates are based on existing data and are not certain or binding.
[2] Estimate for 2020 represents steady-state non-payroll expenditures. This level of expenditures would be expected to continue annually for the foreseeable future.

Table 3-5 shows a side-by side comparison of estimated expenditures by county during the steady-state period of operations, which would begin in 2020. The breakdown of which county where operational expenditures would be made was based on existing data relating to current employment in each industry, in each county. The general assumption was that FASTC would contract from firms nearby (in Nottoway County) when possible. However, for some industries, data showed that there was limited or no employment suggesting that Nottoway County establishments would only be able to accommodate a portion of the business or none at all. Overall, about $8 million per year in non-payroll expenditures would be made in Nottoway County and about $7.3 million per year would be made in Chesterfield County, during the steady-state period.

Table 3-5. Non-payroll Expenditures in Nottoway and Chesterfield Counties, Steady-State Period, Constant 2014 Dollars

Expenditure Category	Nottoway County	Chesterfield County
Fleet Management/Shuttle Transportation	$80,000	$600,000
Training Vehicle Ops, Maintenance & Repair	$1,500,000	$200,000
Wrecker/Salvage Services	$32,500	$243,750
Emergency Medical Services	$250,000	$0
Technology Maintenance - Technicians	$500,000	$500,000
Facility Management Services Vehicle Fuel	$11,960	$0
Building Operations Maintenance	$0	$1,045,194
Building Custodial Services	$523,677	$523,677
Range Maintenance & Custodial Services	$156,000	$156,000
Landscaping/Grounds	$32,400	$32,400
Emergency Generator Fuel/Maintenance	$2,400	$0
Telecommunication/Fiber Optic	$0	$400,000
Radio Systems	$0	$12,000
Electricity	$874,793	$0
Water and Sewer	$2,296,250	$0
Stormwater Management	$25,000	$25,000
Animal Management/Pest Control	$40,000	$40,000
Road Maintenance	$5,400	$40,500
Snow removal and storm cleanup	$1,800	$13,500
Supplies and Equipment	$1,750,000	$3,500,000
Operational Expenditures (Total)	$8,082,180	$7,332,021

3.1.1.3 Trainee Expenditures

Table 3-6 shows estimated total trainee expenditures, distributed between Nottoway and Chesterfield Counties. Trainee expenditures would generate tax revenue, primarily through local sales taxes. These expenditures were estimated under the assumption that only existing accommodations in Nottoway County would be available.

Given the number of trainee days, there would be a consistent, daily demand for about 350 hotel/motel rooms. Hotels/motels in Nottoway County do not have capacity to meet that demand and most trainee lodging is assumed to take place in Chesterfield County. If additional accommodations were to be built in Nottoway County near the FASTC facility, trainee expenditures in Nottoway County would be higher and expenditures in Chesterfield would be lower.

Table 3-6. Trainee Expenditures by County

County	2016	2017	2018	2019	2020[1]
Nottoway County	**$493,948**	**$2,469,740**	**$4,445,532**	**$4,692,506**	**$4,939,480**
Trainee Expenditures on Lodging[2]	*$144,900*	*$724,500*	*$1,304,100*	*$1,376,550*	*$1,449,000*
Trainee Expenditures on Meals[3]	*$316,848*	*$1,584,240*	*$2,851,632*	*$3,010,056*	*$3,168,480*
Trainee Expenditures on Incidentals	*$32,200*	*$161,000*	*$289,800*	*$305,900*	*$322,000*
Chesterfield County	**$967,932**	**$4,839,660**	**$8,711,388**	**$9,195,354**	**$9,679,320**
Trainee Expenditures on Lodging[2]	*$724,500*	*$3,622,500*	*$6,520,500*	*$6,882,750*	*$7,245,000*
Trainee Expenditures on Meals	*$211,232*	*$1,056,160*	*$1,901,088*	*$2,006,704*	*$2,112,320*
Trainee Expenditures on Incidentals	*$32,200*	*$161,000*	*$289,800*	*$305,900*	*$322,000*

Note: [1]Estimate for 2020 represents steady-state trainee expenditures. This level of expenditures would be expected to continue annually for the foreseeable future.
[2]Trainee expenditures on lodging would be funded via federal contracts with hotels/motels within the ROI.
[3]Some meals would be eaten on-site during the instructional day and funded via federal contracts with food services providers.

3.1.2 Local Government Costs

As explained in Section 3.1, local government costs were established based on two categories: costs associated with additional residential population and costs associated with direct operations:

The per-capita method (Burchell 1992) was used to estimate costs associated with additional residential population by multiplying the number of new residents to each county by the average government cost per resident.

The employment anticipation method (Burchell 1992) was used to estimate costs related to direct operations by multiplying the number of anticipated direct employees at FASTC (Table 2-2) by the per-employee cost of government public safety services. Since direct operations would occur in Nottoway County, this portion of the government cost analysis was only conducted for Nottoway County. Since costs associated with residents were estimated with the per-capita method, only employees that are anticipated to be non-residents of Nottoway County were used in the employment anticipation method.

Data sources used to make government cost estimates included data from DOS and the U.S. Census Bureau to estimate additional population, and location of residence for additional population, the

Virginia Auditor of Public Accounts for information on county government costs, and the Bureau of labor Statistics for information on the number of employees in Nottoway County.

3.1.2.1 Local Government Costs Associated with Additional Residential Population

Table 3-7 displays the number of employees who would be expected to relocate from their current residences to work at FASTC. These employees would add to the population of the ROI, primarily Chesterfield and Nottoway Counties. All other employment associated with FASTC would be expected to be filled by current residents of the ROI and would not be expected to add to population.

Table 3-7. FASTC Transfer Employees, 2016-2020

2016	2017	2018	2019	2020[1]
21	106	191	201	212

Source: DOS 2014
Note: 12020 transfer employees represent a steady-state. This number of transfer employees would be expected to continue annually for the foreseeable future.

FASTC transfers may bring their families or other household members, which would also serve to increase population in the ROI. Table 3-8 shows the average household size for the U.S. as of the most recent decennial census. The average household size of 2.58 persons per household implies that for every employee who transfers to work at FASTC, an additional 1.58 persons (for instance, a spouse and 0.58 children on average) would also relocate to the region, adding to population.

Table 3-8. Average Household Size, 2010 U.S. Average

	U.S. Average
Average Household Size	2.58

Source: U.S. Census Bureau 2010

Table 3-9 shows the estimated total new population to the region resulting from FASTC operations, given the number of transfer employees and the assumed average household size. This population would be spread throughout the region, but the bulk of new population would be expected to reside in Nottoway and Chesterfield counties. The percentage breakdown of place of residence for new population provided in Table 3-1 suggests that about 70%% of new population would reside in Chesterfield County and 15% would reside in Nottoway County.

Table 3-9. Total New Population to the Region

2016	2017	2018	2019	2020[1]
55	273	492	520	547

Note: [1]2020 new population represents a steady-state. This number of new population would be expected to continue annually for the foreseeable future.

Given total new population and the percentage breakdown, Table 3-10 shows the expected number of new population for Nottoway and Chesterfield counties. As shown in Table 3-10, at steady-state operations, which begin in 2020, there would be 82 new people residing in Nottoway County and 381

new people residing in Chesterfield County. Each new resident identified in Table 3-9 would receive government services and thus increase costs to local government.

Table 3-10. New Population by County, 2016-2020

	2016	2017	2018	2019	2020[1]
Nottoway County	8	41	74	78	82
Chesterfield County	38	191	343	362	381

Note: [1]2020 new population represents a steady-state. This number of new population would be expected to continue annually for the foreseeable future.

Table 3-11 and Table 3-12 provide a breakdown of per capita government costs during 2013 for Nottoway County and Chesterfield County, respectively. A total of $2,160 per person was spent by Nottoway County and $2,710 per person was spent by Chesterfield County in 2013. The highest per capita cost items included education, public safety, and health and welfare.

Table 3-11. Nottoway County, Per Capita Government Costs, 2013

Expenditure Category	Per Capita Expenditure
General Government and Administration	$70
Judicial Administration	$41
Public Safety	$249
Public Works	$65
Health and Welfare	$283
Education	$1,386
Parks, Recreation, and Cultural Services	$16
Community Development	$49
Total	$2,159

Source: VAPA 2014.

Table 3-12. Chesterfield County, Per Capita Government Costs, 2013

Expenditure Category	Per Capita Expenditure
General Government and Administration	$96
Judicial Administration	$50
Public Safety	$537
Public Works	$61
Health and Welfare	$215
Education	$1,649
Parks, Recreation, and Cultural Services	$50
Community Development	$53
Total	$2,711

Source: VAPA 2014.

The per capita government costs shown in Table 3-11 and 3-12 were multiplied by the expected new populations for each county (Table 3-10) to yield estimates of local government costs attributable to FASTC operations.

3.1.2.2 Local Government Costs Associated with FASTC Operations

Local government costs associated with the FASTC facility are anticipated to be incurred only by Nottoway County and are estimated based on the number of direct operational employees that would be anticipated to reside outside of Nottoway County. Only those employees that are anticipated to reside outside of Nottoway County are included to avoid double counting because costs associated with employees that would reside in Nottoway County are accounted for in association with additional residential population (see Section 3.1.2.1). Table 3-13 utilizes information from Tables 2-2 and 3-1 to estimate the number of direct operational employees that would not reside in Nottoway County.

Table 3-13. Estimated Direct Operational FASTC Employees with Residence Outside of Nottoway County

	2016	2017	2018	2019	2020[1]
Direct Operational Employees	34	170	305	322	339
% of Employees Residing Outside of Nottoway County	85%	85%	85%	85%	85%
Direct Operational Employees residing Outside of Nottoway County[2]	29	145	259	274	288

Note: [1]2020 new population represents a steady-state. This number of new population would be expected to continue annually for the foreseeable future.
[2] Calculated by multiplying the first row by the second row.

The number of direct operational FASTC employees with residence outside of Nottoway County was multiplied by estimated, per employee, Nottoway County expenditures on public safety services to estimate local government costs. Table 3-14 shows The amount Nottoway County spent on safety services in FY 2013, the number of employees there were in the county in 2013, and the per employee expenditure on public safety services.

Table 3-14. Per Employee Public Safety Expenditures, Nottoway County, 2013

	Expenditures/Employees
Expenditure on Public Safety Services	$3,955,238
Total County Employees	5,613
Per Employee Expenditures	$705

Sources: VAPA 2014. BLS 2014.

3.2 ESTIMATED FISCAL IMPACTS

Estimated fiscal impacts compare projected local government revenue to projected local government costs during the operations phase of FASTC for Nottoway and Chesterfield counties. Due to the expectation that more new population associated with FASTC would live in Chesterfield County, local government revenue and local government costs are higher there than in Nottoway County. Local governments in both counties would be expected to have positive net revenue as a result of FASTC operations.

Fiscal impacts from the construction phase are not quantified in this section (refer to Section 3.1); however, it would be expected that there would be increased government revenues in Nottoway County, Chesterfield County, and other counties in the ROI. Government costs associated with construction would be minimal in all counties of the ROI, as little to no new population would be anticipated to relocate to the area for the temporary project. Government costs associated with construction would be most likely to occur in Nottoway County; these costs would be associated with use of roads and other municipal infrastructure, but since the construction project itself would take place at Fort Pickett, costs to governments in Nottoway County would be minimal.

3.2.1 Nottoway County

Table 3-15 shows projected local government revenue, cost, and net revenue (revenue minus cost) for Nottoway County from 2016 to 2020. In 2020, the first year of FASTC steady-state operations, local governments in Nottoway County would collect about $850,000 in revenue and spend about $380,000. Steady-state total net revenue for local governments would be about $467,000. Figure 3-1 illustrates the results presented in Table 3-12, along with estimates for 2021 that further illustrate the steady-state nature of impacts.

In addition to revenues presented in Table 3-15, Nottoway County would receive a one-time payment for the sale of land that would be used by FASTC. Since the amount of the payment is unknown at this time, and the payment is assumed to be net revenue neutral over the long-term, the value of the sale is not included in the fiscal analysis. (See Attachment A of this technical study for details on this assumption).

Furthermore, estimates presented in Table 3-15 assume no hotel development in Nottoway County. If a hotel were to be built and capture a large portion of trainee expenditures on accommodations, Nottoway County revenues would be substantially higher.

Table 3-15. Annual Nottoway County Local Government Revenue, Cost, and Net Revenue, 2016 to 2020, Constant 2014 Dollars

	2016	2017	2018	2019	2020[1]
Revenue	$84,703	$423,512	$764,696	$804,673	$847,024
Total Cost	$38,084	$190,420	$342,156	$361,199	$380,241
Cost (Residential Population)	$17,719	$88,597	$159,474	$168,334	$177,194
Cost (Direct Operations)	*$20,365*	*$101,823*	*$182,682*	*$192,865*	*$203,047*
Net Revenue	$46,619	$233,092	$422,540	$443,474	$466,783

Note: [1]2020 local government revenue, cost, and net revenue represent a steady state. These numbers would be expected to continue annually for the foreseeable future.

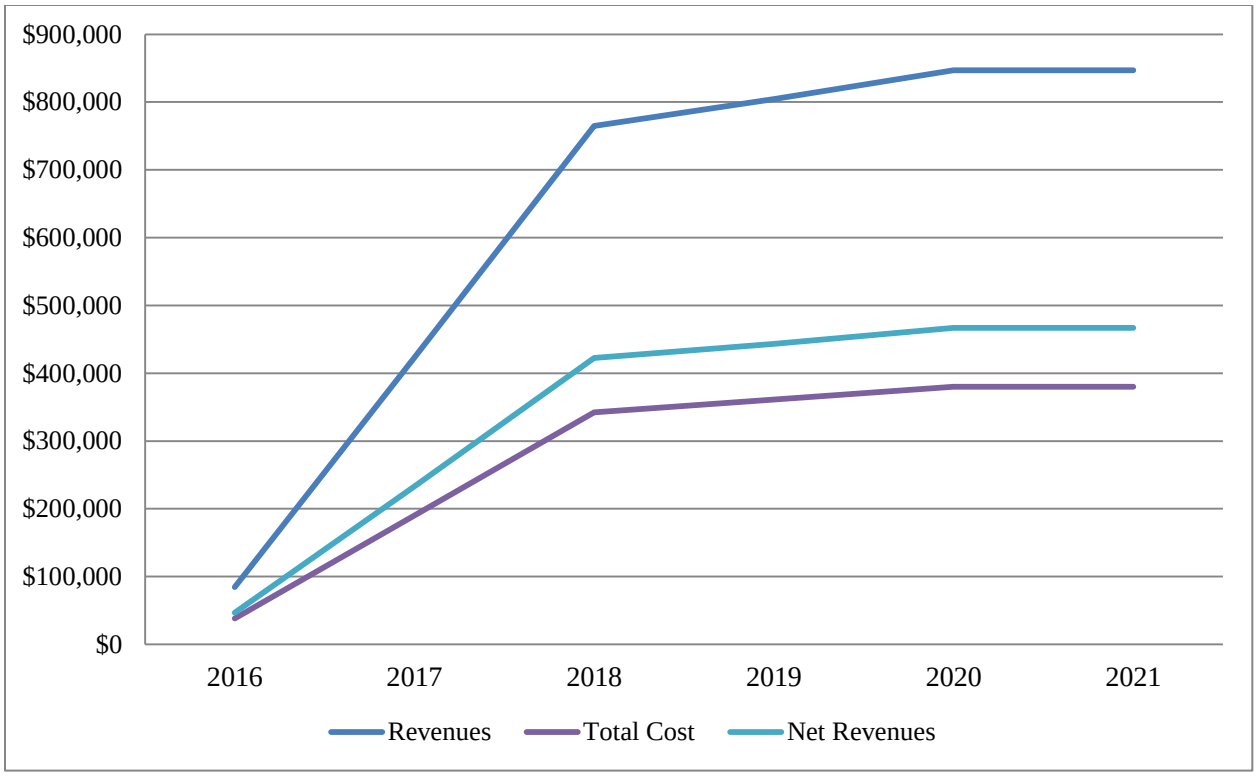

Figure 3-1. Nottoway County Local Government Revenue, Cost, and Net Revenue, 2016 to 2021, Constant 2014 Dollars

3.2.2 Chesterfield County

Table 3-16 shows projected local government revenue, cost, and net revenue (revenue minus cost) for Chesterfield County from 2016 to 2020. In 2020, the first year of FASTC steady-state operations, local governments in Chesterfield County would collect about $2.4 million in revenue and spend about $1.03 million. Net revenue for local governments would be about $1.3 million. Figure 3-2 illustrates the results presented in Table 3-16, along with estimates for 2021 that further illustrate the steady-state nature of impacts.

Table 3-16. Annual Chesterfield County Local Government Revenue, Cost, and Net Revenue, 2016 to 2020, Constant 2014 Dollars

	2016	2017	2018	2019	2020[1]
Revenue	$235,289	$1,176,445	$2,117,600	$2,235,243	$2,352,887
Cost	$103,312	$516,561	$929,809	$981,465	$1,033,121
Net Revenue	$131,977	$659,884	$1,187,791	$1,253,778	$1,319,766

Note: [1]2020 local government revenue, cost, and net revenue represent a steady-state. These numbers would be expected to continue annually for the foreseeable future.

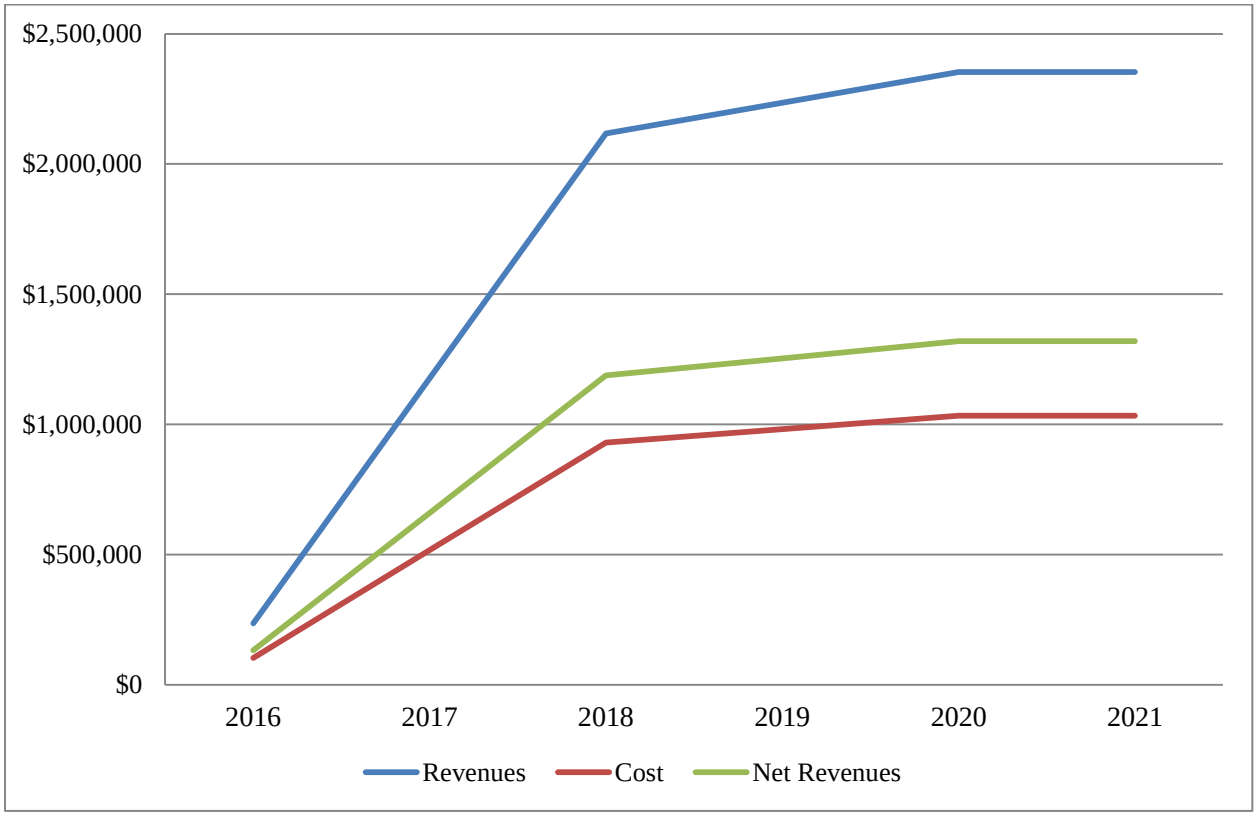

Figure 3-2. Chesterfield County Local Government Revenue, Cost, and Net Revenue, 2016 to 2021, Constant 2014 Dollars

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CHAPTER 4. REFERENCES

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ATTACHMENT A:
SUMMARY OF ASSUMPTIONS

Economic Impact Analysis

- The economic effects of the project would be in Nottoway County and also extend into surrounding counties where the purchase of goods and services and employee residential locations; etc. would occur. Counties in the ROI include Amelia, Brunswick, Chesterfield, Dinwiddie, Lunenburg, Mecklenburg, Nottoway, and Prince Edward.
- Construction and operational data used in estimates were provided by GSA and DOS, respectively, based on the best available information. GSA provided information on construction, DOS provided information on operations.
- Timeline provided by GSA/DOS used in the analysis: Construction 2015-2020 (only first month or so in 2020). Operations 10% capacity in 2016, 50% in 2017, 90% in 2018, 95% in 2019, and 100% in 2020.
- Construction Expenditures: GSA estimated total construction expenditures to be approximately $350 million. After excluding expenditures that would likely not reach the economy of the ROI (construction contractor contingencies, certain fees, and escalation or construction cost inflation), it was estimated that over the course of the construction phase a total of $294 million would be spent on construction within the ROI.
- Operations expenditures include: local expenditures derived from operational activities associated with implementation of FASTC: 1) payroll; 2) purchases of goods and services that would be required to operate FASTC; and 3) purchases by trainees.

Fiscal Impact Analysis

- Analyzes local government revenue and local government costs that would be associated with the operations phase of FASTC.
- Government costs are assumed to be the results of an increase in population caused by the project and by direct operations at the FASTC facility. A DOS employee survey identified Nottoway and Chesterfield Counties as the areas likely to receive the largest influx of population. Therefore the fiscal impact analysis focuses on these counties. Costs related to direct FASTC operations are only incurred by Nottoway County.
- The purchase of land from Nottoway County is assumed to be revenue neutral over time for the County. The sales price would theoretically be equal the discounted value of monthly lease and rental income that would have been received by the County.

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Appendix K

Responses to Comments on the 2012 Draft EIS

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APPROACH TO COMMENT AND RESPONSE PRESENTATION

Pursuant to guidelines of the Council on Environmental Quality (CEQ) for implementing the National Environmental Policy Act (NEPA), the U.S. General Services Administration (GSA) as the lead agency of this Environmental Impact Statement (EIS) provides responses to comments received during the public comment period of the Draft EIS (October 26, 2012 to December 10, 2012). When appropriate, GSA has added clarifying information in the main text of the Supplemental Draft EIS to further respond to comments. The approach to the presentation of the comments received and responses provided is summarized as follows:

- Appendix K is a separate appendix of the Supplemental Draft EIS where all comments received and GSA responses are located.
- Appendix K begins with a table that lists all commenters by category. Commenters on the Draft EIS include federal agencies, Commonwealth of Virginia agencies, local agencies and officials, and individuals.
- Comments received are grouped by the respective commenter. When a commenter used more than one method to make comments, all methods (letter, email, or on a comment sheet at the public meeting) are provided and grouped together under the same commenter.

Each commenter's statement is given a number and letter. The statements are bracketed according to individual topic or point of discussion. These brackets are illustrated on each commenter's statement and given an alpha-numeric code. The code consists of a letter indicating the group of the commenter (F is federal agency, T is Tribe, C is Commonwealth agency, L is local official or agency, and I is for Individual); and a number for the commenter followed by a letter indicating a particular comment. (e.g., F1 is federal agency commenter; F1-A is that commenters first comment). Each of the bracketed comments has a corresponding response in the response column.

The intent of the responses is to directly address the comments. Where comments were considered to be opinions or suggestions of the commenter and a detailed response is not required, the response "comment noted" is given. Where comments are re-stating elements of the Draft EIS, they are considered to be for informational purposes and do not require a response. Such comments are not given a bracket or code. Responses provided to similar comments are cross-referenced to avoid extensive duplication. In general, the comments that are addressed first (e.g., agencies) have more extensive responses and similar comments that appear later in the appendix are referred to the earlier response of another commenter (e.g., Refer to response F1-B). Where applicable, responses provide the reader with a reference to a section of the Supplemental Draft EIS for more detail, or to a section of the Supplemental Draft EIS that has been revised.

COMMENT INDEX

Commenter by Category (Note: All written comments are grouped by commenter)	Comment Number	Page Number
Federal Agencies		
Army Corps of Engineers	F1	K-4
U.S. Environmental Protection Agency	F2	K-7
U.S. Department of Interior	F3	K-20
State Agencies		
Commonwealth of Virginia Department of Transportation	C1	K-22
Commonwealth of Virginia: Department of Environmental Quality Department of Game and Inland Fisheries Department of Conservation and Recreation Department of Historic Resources Department of Health Department of Forestry Marine Resources Commission Department of Aviation Nottoway County Prince Edward County Lunenburg County Crater Planning District Commission Richmond Regional Planning District Commission	C2	K-28
Tribes		
Eastern Band of Cherokee	T1	K-81
Tuscarora Nation	T2	K-82
Local Officials and Agencies		
Lunenburg County	L1	K-84
Mecklenburg County	L2	K-85
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Town of Crewe	L4	K-87
Downtown Blackstone Inc.	L5	K-88
City of Emporia	L6	K-89
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Abbot	I1	K-90
Coleburn	I2	K-93

Duncanson	I3	K-94
Glancy	I4	K-95
Hasbrouk	I5	K-96
Public	I6	K-97

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FEDERAL AGENCIES

Draft EIS comments (UNCLASSIFIED) **Hamilton, Julie S NAO** <Julie.S.Hamilton@usace.army.mil> Thu, Nov 8, 2012 at 3:56 PM To: "FASTC.info@gsa.gov" <FASTC.info@gsa.gov> Classification: UNCLASSIFIED Caveats: NONE Please see attached. Julie S. Hamilton Environmental Scientist USACE, Norfolk District 9100 Arboretum Parkway, Suite 235 Richmond, VA 23236 804.323.3783 julie.s.hamilton@usace.army.mil www.nao.usace.army.mil (Email correspondence may be subject to FOIA) Look Deep into nature, and then you will understand everything better. --Albert Einstein The Norfolk District is committed to providing the highest level of support to the public. In order for us to better serve you, we would appreciate you completing our Customer Satisfaction Survey located at http://per2.nwp.usace.army.mil/survey.html. We value your comments and appreciate your taking the time to complete the survey. Classification: UNCLASSIFIED Caveats: NONE -- You received this message because you are subscribed to the Google Groups "FASTC Info" group. To post to this group, send email to fastc.info@gsa.gov. To unsubscribe from this group, send email to fastc.info+unsubscribe@gsa.gov. For more options, visit https://groups.google.com/a/gsa.gov/groups/opt_out. **Comment Matrix FASTC Draft EIS 10-26-2012.pdf** 20K	**GSA Response** No response necessary on this page.

Comment/Response Matrix
Draft Environmental Impact Statement for
Foreign Affairs Security Training Center
Nottoway County, Virginia
October 26, 2012

Reviewer	Comment	
Julie Hamilton-USACE	Please show wetland and stream impact maps with more details. Possibly, by parcel to better evaluate avoidance and minimization on-site.	F1-A
	Please show where the 100 ft buffers around streams and wetlands will be less than 100 ft.	F1-B
	It is preferred that the remaining wetlands and streams that are not impacted be deed restricted to protect them in perpetuity.	F1-C
	Please describe what areas of wetlands will be cleared. How will they be cleared? Will they be grubbed or will the stumps remain in place? Are these areas going to be converted from forested wetlands to scrub shrub or emergent wetlands? Please explain why they need to be cleared but no structure built?	F1-D
	It is preferred that stormwater does not directly outfall into streams and wetlands. It is preferred that level spreaders be utilized when stormwater outfalls come in close contact with wetlands. It is also preferred that stormwater culverts do not enter a stream perpendicularly but parallel to minimize impacts to the other side of the stream.	F1-E
	The use of LID methods are supported. How many areas will utilize these methods?	F1-F
	Please provide a map showing the location of the proposed potential on-site mitigation site within the ACUB. Has this site been disturbed in the past? Will this site mitigate for both wetlands and streams?	F1-G
	Please be aware road improvements outside of the 4 parcels that impact wetlands or streams may be considered a part of this project especially if they would not be constructed but for the FASTC project. Those impacts would be considered cumulative and would require compensatory mitigation.	F1-H
	Please be aware utilities that need to be improved or brought in for the project outside of the 4 parcels that cause impacts to wetlands or streams would also be considered part of this project if they would not be constructed but for the FASTC project. Those impacts would be considered cumulative and require compensatory mitigation.	F1-I

GSA Response

F1-A

Figures showing direct wetland impacts by parcel, and text discussing avoidance areas, have been added to Section 4.1.4 *Wetlands*.

F1-B

Wetland impact figures added to Section 4.1.4 (refer to Response F1-A) include the requested 100 foot buffers.

F1-C

Wetland and stream preservation would be addressed as part of the Section 404/401 Joint Permit Application.

F1-D

Clearing of vegetation in wetlands would be to provide appropriate clear zones, such as, for safety zones for vehicles on drive tracks. The mechanism for clearing and type of wetland that remains would be specified in the project design and would be addressed in detail as part of the Section 404/401 Joint Permit Application process.

F1-E

The design process would incorporate these practices to the extent feasible and would utilize all measures to reduce impacts.

F1-F

Low Impact Development (LID) methods would be utilized to the extent feasible in accordance with all applicable regulations and guidelines, including but not limited to Sec 438 of the Energy Independence and Security Act, state and local regulations, GSA sustainability guidelines, and Leadership in Energy and Environmental Design (LEED) design criteria. Design details would be provided as part of the Section 404/401 Joint Permit Application process.

F1-G

Mitigation bank credit availability letters would be obtained from all appropriate mitigation banks as part of the Section 404/401 Joint Permit Application process. The potential wetland mitigation bank in the Army Compatible Use Buffer (ACUB) has not yet been constructed. Should this potential site become available for use in the time period required for this project, details about the site would be incorporated in the permit application.

F1-H

There are no road improvements planned outside the Build Alternative 3 site.

F1-I

New utilities would be constructed in areas already disturbed along existing or planned roadways or utility corridors and would not impact additional areas (Refer to TableES-2, Section 4.2.8.1, and Table 6.16-1).

Comment/Response Matrix
Draft Environmental Impact Statement for
Foreign Affairs Security Training Center
Nottoway County, Virginia
October 26, 2012

Reviewer	Comment	
	Please provide a large scale map of labeled wetlands with the acreage per polygon and the wetland type.	F1-J
	Please provide a large scale map of labeled streams with linear feet per reach and the type of stream R4 or R3.	F1-K
	Please provide a plan for stormwater.	F1-L
	Please provide a plan for erosion and sediment control.	F1-M
	To minimize impacts it is preferred to utilize existing roads that already have stream crossings.	F1-N

GSA Response

F1-J
Detailed mapping of wetland impacts would be developed during project design and provided as part of the Section 404/401 Joint Permit Application process.

F1-K
This information would be developed during project design and provided as part of the Section 404/401 Joint Permit Application process.

F1-L
Detailed mapping of stream impacts would be developed during project design and provided as part of the Section 404/401 Joint Permit Application process.

F1-M
The erosion and sediment control plan would be developed during project design and provided as part of the Section 404/401 Joint Permit Application process.

F1-N
The alternatives development process and the build alternatives of this EIS have incorporated existing roads and stream crossings where feasible. This wetland impact avoidance measure would be carried through to the design process. Additional opportunities for impact minimization would be considered during project design.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

December 14, 2012

Ms. Abigail Low
GSA Project Manager
20 N 8th Street
Philadelphia, PA 19107

Re: U.S. Department of State Bureau of Diplomatic Security, Foreign Affairs Security Training Center, Nottoway County, VA (CEQ No. 20120342)

Dear Ms. Low:

In accordance with the National Environmental Policy Act (NEPA) of 1969, Section 309 of the Clean Air Act and the Council on Environmental Quality regulations implementing NEPA (40 CFR 1500-1508), the U.S. Environmental Protection Agency has reviewed the Draft Environmental Impact Statement (DEIS) for the U.S. Department of State Foreign Affairs Security Training Center in Nottoway County, Virginia.

The DEIS addresses the proposed development and operation of the Department of State (DOS) Foreign Affairs Security Training Center (FASTC) in Nottoway County Virginia, on land within and adjacent to the Army National Guard Maneuver Training Center Fort Pickett (Fort Pickett). The purpose and need for the proposed FASTC in Nottoway County is to consolidate existing dispersed training functions into a single suitable location to improve training efficiency and enhance training operations. The FASTC would include facilities for soft skills training, such as classrooms, simulation labs, and a fitness center; hard skills training, such as driving tracks, mock urban environments, and firing and explosives ranges; as well as administrative and life support facilities including administrative offices, dormitories, a dining hall, and emergency medical response services. It is anticipated that the facility will require approximately 1500 acres of property.

The DEIS summarizes the process followed in screening, study and selection of the proposed location at Fort Pickett. Fort Pickett encompasses approximately 45,000 acres, most of which were identified as no longer required by the U.S. Army by the 1995 Defense Base Closure and Realignment Commission. One hundred forty acres were identified as a U.S. Army Reserve enclave. The Virginia Army National Guard (VAARNG) has operational control over approximately 42,000 acres of Fort Pickett through a 1997 facility land use agreement and it is currently being used as a Maneuver Training Center. Approximately 2,950 acres were not needed for military uses and were deeded to Nottoway County in 2000 for use in the economic

GSA Response
No response necessary on this page.

development activities of the Local Redevelopment Authority (LRA). FASTC operations appear to have compatible and appropriate requirements for the excised property.

The DEIS evaluates two build alternatives, Alternative 1 and Alternative 2 (the Preferred Alternative), and the No Action Alternative. Under Build Alternative 1, training would occur at the site in hard and soft skills training facilities and life support facilities located on Parcel 21/20 off Dearing Road and LRA Parcel 9 off Military Road. Under Build Alternative 2, the facilities would be located on Parcel 21/20, LRA Parcel 9, and two additional parcels—the Grid Parcel and LRA Parcel 10. The major differences between Build Alternative 1 and Build Alternative 2 are the locations of the Main Campus, Mock Urban Environments, and three buildings of the High Speed Driving Track Area. Under Build Alternative 2, the Main Campus would be located on LRA Parcel 10 (instead of Parcel 21/20 in Alternative 1); the Mock Urban Environments would be located on LRA Parcel 9 and the Grid Parcel (instead of only LRA Parcel 9, for Alternative 1).

The proposed re-use of the Fort Pickett site for FASTC involves notable environmental impacts to the property for either Build Alternative 1 or 2. Impacts include 7.01 acres of wetlands (5.20 direct fill/1.81 indirect clearing) for Alternative 1 in addition to 27.56 acres of wetland buffer clearing; or for Alternative 2, 6.5 acres of wetlands (4.20 direct fill/2.30 indirect clearing) and approximately 22.01 acres of wetland buffer clearing. Alternative 1 would impact 1,205 linear feet of stream and Alternative 2 would impact 1,127 linear feet of stream. The net increase of impervious surface for Alternative 1 would be 214 acres and 225 acres of net increase for Alternative 2. Vegetation clearing for Alternative 1 would be 500 acres (460 forest; 40 shrub/grass) and Alternative 2 would impact 525 acres of vegetation (480 forest; 45 shrub/grass). GSA has identified Alternative 2 as the Preferred Alternative, which appears also to be the alternative which minimizes some critical environmental impacts.

EPA understands the purpose and need for the proposed action for the DOS FASTC. EPA appreciates the effort made by GSA to involve Federal agencies in the NEPA process, including allowing EPA to be a Cooperating Agency in development of this EIS. However, as a result of our review of the DEIS, EPA has some questions and concerns regarding impacts to vegetation, wetlands, threatened and endangered species, and noise. It is understood that establishment of a facility of this size is likely to result in some environmental damages. It is hoped that during more detailed planning, additional avoidance and minimization measures will be sought and implemented as allowed. EPA commends the effort made to find a suitable location for the FASTC. A detailed description of our questions/concerns is presented in the Technical Comments (enclosed) for your consideration. EPA rated the DEIS an EC-2 (Environmental Concerns/Insufficient Information), which indicates that we have environmental concerns regarding the proposal and that the study does not contain sufficient information to fully assess the environmental impacts that should be avoided by this project. A copy of the EPA's rating system is enclosed for your information. F2-A F2-B

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GSA Response

F2-A
Comments noted. Should the decision be made to move forward with the FASTC project, GSA would be committed to incorporating all feasible impact avoidance and minimization measures into the design, construction, and operation of the facility.

F2-B
Responses to the technical comments are provided below. EPA's rating of EC-2 is noted; however, please be advised that GSA has made every effort to include all pertinent information requested by EPA during the development of the Draft EIS. Additional information has been added to the Supplemental Draft EIS, where appropriate, to further address technical comments, as noted in responses below.

Thank you for providing EPA with the opportunity to review this project. If you have questions regarding these comments, the staff contact for this project is Karen DelGrosso; she can be reached at 215-814-2765.

Sincerely,

Barbara Rudnick
NEPA Team Leader
Office of Environmental Programs

Enclosure (2)

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GSA Response

No response necessary on this page.

Technical Comments

Groundwater/Surface Water

Page 3-19 references EBS-13 (within the LRA Parcel 9) as having an ongoing remedial action and monitoring program associated with the Former Recycling Compound, specifically the Paint Pit. "Land Use Controls [LUCs] are in place to protect against groundwater usage/contact until contaminant concentrations are brought into compliance with regulatory levels." The DEIS states, "In addition, a groundwater monitoring program is ongoing for the Trimble Road Landfill (adjacent to Parcel 21/20). Additional information on EBS-13 and landfill is provided in Section 3.15." There is no Section 3.15 in the DEIS; it is assumed, however, that the reference should be to Section 3.2.11.2. F2-C

The areas discussed should be identified on a map (Figures 2.2-1 and 2.2-2). EPA appreciates that as stated on page 3-125, "The LUCs prohibit the disturbance of soils in a 4 acre portion of the site thereby blocking human exposure to contaminated groundwater. The LUCs also prevent exposure to materials potentially presenting an explosive hazard (MPPEH), which are also suspected to be in the area. Plans for development would need to be made consistent with these limitations." It is encouraged that the FASTC project be discussed with the remedial team to ensure that the proposed actions will not impede on remedial efforts or pose threats for contamination. F2-D

Page 3-20 states in reference to Parcel 21/20, "According to the 2012 Virginia 305(b) list the waters of Birchin Creek are classified as 3A. A 3A classification indicates that no data are available within the data window of the current assessment to determine if any designated use is attained and the water was not previously listed as impaired and is therefore considered to be unimpaired." Please clarify: will Birchin Creek be assessed for baseline data so that information will be recorded for future assessment and/or monitoring of impact from FASTC activities? F2-E

In reference to LRA Parcel 10, "None of the surface waters present on the LRA Parcel 10 are classified as impaired by DEQ. These waters are either unimpaired or have not been assessed." Will the surface waters on LRA Parcel 10 be assessed prior to project implementation? F2-F

Threatened and Endangered Species

Page 4-15 states, "The USFWS has concurred with GSA's "no affect" determination with regards to Michaux's Sumac, Roanoke logperch, dwarf wedgemussel and bald eagle (Appendix C). Virginia agencies, Virginia Department of Game and Inland Fisheries and Department of Conservation and Recreation were provided GSA's assessment of effects with regard to state threatened and endangered species (Appendix C), but did not pursue an informal review." Appendix C provides a copy of the letter from the Department of Game and Inland Fisheries dated July 30, 2012 stating that they are unable to provide a review due to staffing limitations. EPA appreciates that Virginia agencies were given an opportunity to comment on the DEIS. F2-G

(F2-G continued on next page.)

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GSA Response

F2-C

Section 3.1.4.2 has been revised to read, "Additional information on EBS-13 and the landfill is provided in Section 3.2.11.2."

F2-D

A figure has been added to Section 3.2.11.2 to identify the locations of the areas of concern. The Trimble Landfill has been excluded from the boundary of Parcel 21/20 and continued access for monitoring would be assured through a Land Use Permit with the Department of the Army that would be supplemented with a Memorandum of Agreement with the Virginia Army National Guard (VaARNG). Text addressing this has been added to Section 4.1.4.1. *Groundwater* in this Supplemental Draft EIS. GSA is currently pursuing documentation on the future regulatory status of the fence around the 18 acre portion of the site, as noted on page 3-125 of this Supplemental Draft EIS.

F2-E

Surface waters of the site will be assessed using the Unified Stream Methodology as required for the Section 401/404 Joint Permit Application for wetland impacts. Any water/stream quality data collected as part of that process would be shared with VDEQ for use as a baseline for monitoring impacts from FASTC activities. Because complex assessment of the quality of surface and ground waters, i.e., biological integrity, chemical, physical, habitat, and toxicity, as reported in the Virginia 305(b) list, is the responsibility of each state under the Clean Water Act, VDEQ Office of Water Quality Monitoring and Assessment was consulted regarding any future plans for assessment of the waters of this project site. VDEQ indicated that they do not have assessments planned for the waters of this project site. Therefore, the data provided in the 2012 Virginia 305(b) is the best available data for reference in this EIS. BMPs and stormwater management controls would be implemented to protect surface waters and avoid impacts during and after FASTC construction. Page 3-20 of the Supplemental Draft EIS has been revised for clarification.

F2-F

See response F2-E

F2-G

GSA agrees with EPA that state consultation is important. GSA held an agency scoping meeting with Commonwealth of Virginia agencies on October 11, 2011 in Richmond, Virginia for the Draft EIS and November 3, 2014 for the Supplement Draft EIS. GSA also consulted with Virginia agencies in correspondence dated July 16, 2012, early in the process of preparing the Draft EIS, which included detailed analysis of state and federal threatened and endangered species and specifically the results of a Michaux's sumac survey performed to support GSA's determination of no affect. Virginia agencies declined to participate in any consultation. All coordination letters with federal and state agencies and supporting documentation regarding federal and state threatened and

(Response continued on following page.)

2

Because State consultation is important, it is worth pursuing input even if it means waiting for their review. In addition, it is important to include the most recent state and federal threatened and endangered species coordination letters within the FEIS. It is also recommended that the appropriate state and federal agencies be contacted annually regarding species of concern. F2-G

Noise

Page 3-59 states, "Under enhanced propagation conditions ((Figure 3.2-2), the High Complaint Risk area (130 to 140 dB PK15 [met]) extends beyond the Fort Pickett boundary less than 2,950 feet (0.6 miles) at Ranges 15 and 16 and from the artillery firing points near the boundary. The Moderate Complaint Risk area (115 to 130 dB PK15 [met]) extends beyond the boundary in most directions up to 7,220 feet (1.4 miles)." In addition, "Under neutral propagation conditions (Figure 3.2-3), the High Complaint Risk area (130 to 140 dB PK50 [met]) remains within Fort Pickett except for small areas near Ranges 15 and 16 from the artillery firing points near the boundary. The Moderate Complaint Risk area (115 to 130 dB PK50 [met]) extends beyond the boundary less than 4,250 feet (0.8 miles). Ranges 15 and 16 should be clearly depicted on a map. It is important to note that this information is baseline although Figures 4.2-5 through 4.2-10 show baseline + build alternative noise contours. It would be helpful to have an overlay map showing baseline and build alternatives noise impacts to have a clearer image of impacts. Are there any mitigation measures that can be implemented in and around these areas to reduce noise impact? F2-H

Page 3-49 states, "Though the complaint risk guidelines would indicate a moderate to high risk of complaints, these areas are sparsely developed, and as such, the risk of complaints from off-post residences is low under the baseline scenario. Although these baseline contours do extend outside Fort Pickett in certain areas they do not extend beyond the ACUB."

Page 4-35 states, "Complaint risk from residents in the surrounding community would still be expected to be low because of the existing acclimation to baseline noise from Fort Pickett munitions and aircraft operations, sparse residential development in that area, and the infrequency of peak events." Because this rational is based on assumption, it would seem prudent to incorporate a periodic noise assessment to factor in a tolerance threshold. Although complaints are expected to be low, it is not known when the tolerance threshold would be surpassed. Please describe and document communication made to affected residences. F2-I

The FEIS should quantify the number of residences, etc. that may be impacted in addition to identifying any sensitive resources (including schools, churches, etc.). Outreach to these affected areas should be made and appropriate mitigation, monitoring and adaptive management should be considered. F2-J

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GSA Response

F2-G (Response continued from previous page.)
endangered species were discussed in the Draft EIS and are included in Appendix C of the Draft and Supplemental Draft EIS. The 2012 correspondence has been updated in 2014 and added to Appendix C. The organization of Appendix C has been improved in the Supplemental Draft EIS to assist the reader in locating the relevant information. Should the proposed project move forward, GSA would continue to coordinate with the Commonwealth of Virginia. Also refer to responses to comments from Commonwealth of Virginia agencies regarding threatened and endangered species, C2-S through C2-Y.
Since publication of the Draft EIS in 2012, the Northern long-eared bat has been proposed for listing under the federal Endangered Species Act. An analysis of this species and agency coordination has been added to the Supplemental Draft EIS.

F2-H
Section 3.2.3.4, *Baseline Complaint Risk Areas* on page 3-59 has been revised to replace "Ranges 15 and 16" with the directional information "northeastern, southeastern, and southern Fort Pickett boundary" to make it easier for the reader to find the areas being discussed.
Figures 4.2-5 through 4.2-10 do provide the requested overlay of the baseline and the build alternative noise contours. The baseline (dashed line) is shown with the proposed build alternative contours (solid line). The noise effects from the build alternative would be contained within, and would not exist in isolation from, the existing baseline, except in those areas shown between the dashed and solid lines. The proposed contours would only change the baseline in the area between where the baseline and the proposed (solid lines) extend (and are visible in the figure) beyond the baseline. This area represents the Build Alternative 3 impact area. Mitigation measures under consideration are the implementation of public notices prior to peak noise events (also refer to Table 6.15-1).

F2-I
DOS would consider notification of the community prior to the higher level noise events. Residents of the affected areas were notified directly about the Draft EIS and Public Information Meeting (as documented in Chapter 9). Public comments have not indicated any concerns about the effects of noise from FASTC. Statements made at the public information meeting by residents living near the proposed FASTC site indicated existing noise from aircraft is the most frequently noticed noise in the area and there was no concern about noise from the proposed project.

F2-J
A figure showing residences and other sensitive land uses has been added to Section 4.2.3 of the Supplemental Draft EIS. DOS would consider notification of the community prior to the higher level noise events. Also refer to Section 6.16 *Other Management Actions.*

3

Hazardous Areas

Page 3-119 states that there are three locations on Parcel 21/20 western boundary that show evidence of petroleum contamination based on laboratory analysis of soil samples. As the DEIS states, it is possible that residual gasoline contamination is present at some location along the pipeline on Parcel 21/20 and that a Phase II ESA recommends further investigation which GSA intends to conduct to determine if contamination is present. The area of potential impact should be depicted on a map in relation to proposed actions. Results of the Phase II ESA should be used in the planning of the proposed action. This is also recommended for the Grid Parcel in which investigations of the pipeline are to be conducted. F2-K

Page 3-121 states that groundwater samples indicated contamination (elevated levels of bis(2-ethylhexyl)phthalate) at Building 767 (site identification PA-39). Where is this area on the Grid Parcel? What DOS action is proposed in or near this area? F2-L

Page 3-122 states, "The Grid Parcel does not currently contain any structures." "Since it is likely that these structures contained LBP/ACM [Lead Based Paint/Asbestos-Containing Materials] and no documentation of their removal or disposal was available for review, site soils may contain these substances and present a Business Environmental Risk." Will soils in the Grid Parcel be tested for LBP/ACM contamination before implementation of the proposed action? F2-M

Page 3-122 states that there could be a potential for radon levels on the Grid Parcel which may be above the USEPA Action Level. What follow-up action is proposed for testing and monitoring of radon within buildings? F2-N

Page 3-124 states, "Three unlabeled 50-gallon drums were noted on the property at 507 Garnett Ave and were believed to contain soils associated with the environmental investigation conducted at site EBS-115. It is unknown if the contents of the drums would be classified as hazardous waste." Was the area where the drums were located (on LRA Parcel 9) assessed for potential contamination? Does there appear to be a need to sample the soils? F2-O

Page 3-125 discusses the Former Fuel Station Site BCT-22. The DEIS states, "The continued presence of MTBE in MW-14 confirms that the BCT-22 plume has entered LRA Parcel 9. Without current downgradient sampling data, the extent of the plume is not known. However, since no groundwater wells or buildings are proposed in the areas downgradient of the plume, associated health risks are considered to be low." Are there land use controls in place? Will sampling be conducted? What steps are in place to ensure that the area is avoided to safeguard exposure? F2-P

Page 3-126 states, "Building 1284 is currently located on LRA Parcel 9 (838 Garnett Ave) and no lead abatement information was obtained for this building." Does GSA plan to survey Building 1284 for LPB? F2-Q

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GSA Response

F2-K

Figure 3.2-16, depicting potential sites of concern, has been added in Section 3.2.11 of the Supplemental Draft EIS. Phase II soil testing is not possible on Parcel 21/20 at this time. As noted in section 3.2.11, if contamination is encountered during construction it would be remediated on a case by case basis in accordance with all applicable laws. Results of additional Phase II investigations on the Grid Parcel have been incorporated into the Supplemental Draft EIS in Section 3.2.11.

F2-L

The PA-39 release area is located north and east of the Grid Parcel at a motor pool; it has been depicted on Figure 3.2-16 and added to Section 3.2.11 of the Supplemental Draft EIS. Section 3.2.11 of the Draft EIS indicated that further investigation would take place. This same section in the Supplemental Draft EIS indicates that these investigations have occurred and no contamination of groundwater was found.

F2-M

Soils on the Grid Parcel have been tested since the publication of the Draft EIS. The results are included in section 3.2.11 in the Supplemental Draft EIS.

F2-N

Facilities would be designed to prevent occupant exposures to radon above the EPA action level (4 pCi/L), in accordance with GSA Facilities Standards for Public Buildings (P100). This information has been added to Section 4.2.11 of the Supplemental Draft EIS.

F2-O

Section 3.2.11 of the Supplemental Draft EIS includes results of additional investigations, which indicate that these barrels have been removed and there is no longer any concern.

F2-P

There are no land use controls in place for BCT-22. VAARNG is responsible for monitoring the plume. Sampling of the existing wells has been conducted since publication of the Draft EIS, and results are included in section 3.2.11 of the Supplemental Draft EIS.

F2-Q

As indicated in section 4.2.11 of the Draft EIS and Supplemental Draft EIS, prior to demolition all buildings would be tested for LBP to determine disposal options and appropriate demolition safety measures.

4

Page 3-126 states, "Due to the history of LBP removal using sandblasting with no collection measures, LBP may be present in the soil under the tanks (Woodward-Clyde 1997)." Does GSA intend to survey the soils for LBP? Where are the three elevated water storage towers located on LRA Parcel 9 in relation to proposed project areas? F2-R

Page 3-126 states, "Installation personnel indicated that removal of the debris subsequent to demolition may have been incomplete, and ACM may still be present in the soils in these areas. Asbestos is also known to be present on water main piping throughout the parcel (GSA 2010)." Does GSA plan to test soils for ACM? F2-S

Page 3-127 states, "Because Nottoway County is classified by the USEPA as having a predicted average indoor radon screening level greater than 4 pCi/L, there is also potential for radon levels on Parcel 10 above the USEPA Action Level." As a result of the predicted radon screening levels, it would be prudent to test for radon once buildings are constructed. This should be stipulated and implemented upon building completion so that if needed remedial actions can be incorporated. Please state GSA's intention. F2-T

Vegetation

Page 4-12 states, under Build Alternative 1 vegetation clearing would involve approximately 500 acres (460 forest; 40 shrub/grass) from Parcel 21/20 and LRA Parcel 9 for the construction of the FASTC facility. As for the Preferred Alternative, page 4-15 states that under Build Alternative 2, approximately 525 acres of land would be directly impacted by clearing on Parcel 21/20, the Grid Parcel, LRA Parcel 9 and LRA Parcel 10 for the construction of the FASTC facility. "Approximately 480 acres of forest and 45 acres of shrubland/grassland would be cleared from these parcels. Currently, approximately 1,335 acres on these parcels contain forestland and 105 acres contain grassland/shrubland. Therefore, the clearing associated with FASTC construction would eliminate approximately 36% of forestland and 43% of grassland/shrubland on these parcels with the greater impact being realized on LRA Parcel 9 and LRA Parcel 10."

The DEIS states that 33,892 acres of forest and 3,000 acres of grassland/shrubland are within Fort Pickett and 415 acres of forest surrounds and encompasses LRA Parcel 10. The Preferred Alternative would constitute an approximate loss of 1.4% of the forestland and 1.6% of the grassland/shrubland present within the surrounding area. Do these figures take into consideration future/cumulative projects presumed to impact terrestrial biological resources? As noted on page 5-17, "Insufficient details on each project are available to assess the total loss of habitat for all of the cumulative projects." Thus, it is difficult to fully assess impacts to forested areas and its impact on habitat, fragmentation, etc. Despite the percentage of clearing in comparison with the total remaining on Fort Pickett, every effort should be made to minimize impacts to forested areas and grassland/shrubland areas and to ensure that the FASTC in combination with future/cumulative projects does not have a compounded impact on vegetation F2-U

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GSA Response

F2-R
As noted in section 3.2.11, only one of the water tanks is in the project area. Figures 2.2.1 and 2.2.2 show the existing water tower in relationship to the proposed action. It is located in the center portion of LRA Parcel 9 and would be surrounded by drive tracks upon completion of the FASTC. Draft EIS Section 4.2.11 noted that soils around the water tank would be tested. The soils around the water tank have since been tested and the results included in Section 3.2.11 of the Supplemental Draft EIS.

F2-S
Soils on LRA Parcel 9 have been tested. The results are included in Section 4.2.11 in the Supplemental Draft EIS.

F2-T
Please refer to response F2-N.

F2-U
Comments noted. Reducing impacts to vegetation has been a primary planning consideration in the development of the alternatives. Refer to Sections 2.2.2.2, 4.1.5.3, and 6.4.1 and Tables ES-2 and 6.16-1 for forest impact avoidance, minimization, and mitigation measures that would be incorporated into the design of the project to reduce project impacts to forest and other vegetation communities. As requested by EPA, the estimated acres planned for re-establishment of cleared vegetation has now been included in these sections of the Supplemental Draft EIS.

GSA would consider additional forest mitigation contingent upon availability of funding. There is no guarantee funding would be available to support the suggested mitigation plan options, but during facility design GSA would coordinate with Virginia Department of Forestry, incorporate all practicable measures to reduce long term forest impacts, and implement mitigation to the extent feasible.

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resources and habitat. It is important to consider the beneficial value that forests have in relation to carbon uptake for Green House Gas (GHG) emissions and incorporate mitigation in the form of replanting trees to compensate for the quantity of trees lost due to construction and operation of FASTC. Forests have a valuable role in the ecosystem and habitat which should be properly mitigated for and addressed by GSA. F2-U

The DEIS should provide a complete description of the terrestrial habitat resources in the study area. The composition and characteristics of each community type should be summarized and the functions and total acreage indicated. In addition, the species should be mapped relative to habitat locations and species density. Typically, an analysis of forest fragmentation associated with each alternative is provided to assess potential impacts on species. F2-V

To determine the baseline value of the habitat and the severity of the potential impacts from the proposed project, EPA recommends that a baseline Habitat Evaluation Procedure (HEP) be completed on the study area using the U.S. Fish and Wildlife Service's Habitat Evaluation Procedure. If the impacts of the wildlife and terrestrial habitat are unavoidable, the HEP will help to determine the type of mitigation measures which would be considered appropriate for the potential impacts. EPA appreciates the mitigation proposed as outlined on page 6.2 (avoid disturbance when possible, treat disturbed edges, re-establish appropriate native plant communities, and connect plant communities across larger areas). However, the HEP will help to determine more effective mitigation appropriate for the study area. Because the direct vegetation impact is considerable, it would be advantageous to implement a more robust mitigation plan to compensate for vegetation loss. F2-W

Wetlands

Page 4-8 states, "Under Build Alternative 1, direct impacts from the construction of the FASTC facility would result from filling of approximately 0.07 acres (0.17%) of wetlands on Parcel 21/20 and approximately 5.13 acres (10%) of wetlands on LRA Parcel 9. An additional 0.19 acres (0.46%) of wetlands would be indirectly impacted by clearing and conversion of forested wetland classified as palustrine forested (PFO) on Parcel 21/20 and approximately 1.62 acres (3.2%) on LRA Parcel 9." The DEIS also states that, "Build Alternative 1 would clear approximately 2.29 acres of the wetland buffer present on Parcel 21/20 and approximately 25.27 acres of the wetland buffer present on LRA Parcel 9."

Page 4-10 states, "Under Build Alternative 2, the construction of the FASTC facility would have direct fill impacts on wetlands of approximately 0.06 acres (0.15%) of wetlands on Parcel 21/20; 0.062 acres (4%) of wetlands on the Grid Parcel and 4.08 acres (8%) of wetlands on LRA Parcel 9." In addition, "Clearing would indirectly impact an additional 2.25 acres (4.5%) of wetlands on LRA Parcel 9 and 0.05 acres (0.3%) of wetlands on LRA Parcel 10. Wetland clearing would not be required on Parcel 21/20 or the Grid Parcel." The DEIS states, that "Build Alternative 2 would directly impact approximately 0.41 acres of wetland buffer on

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GSA Response

F2-U
(Response on previous page.)

F2-V
Vegetation communities, habitat types, and forest blocks present on each study area parcel are described in Section 3.1.5.1 and Figure 3.1.6 of the Draft and Supplemental Draft EIS. The study area parcels are also compared with habitat found within Fort Pickett overall. Wildlife present on each parcel within the various habitats of the study areas is described in Section 3.1.5.2, and a comprehensive list of wildlife confirmed or presumed to be present in the study areas, is included in Appendix D. Impacts to vegetation and wildlife, as well as forest fragmentation, are analyzed for each alternative in Section 4.1.5.1 of the Draft and Supplemental Draft EIS.

F2-W
Habitat and wildlife within Fort Pickett have been evaluated through various habitat and wildlife studies, as documented in the Fort Pickett Integrated National Resources Management Plan (VaARNG 2007). These studies, along with field investigations conducted in 2012 for the Draft EIS, provide a sufficient habitat baseline for the study area to evaluate impacts. Further, the USFWS HEP was not requested by USFWS. The EIS preparers have not identified data gaps that would justify additional, costly studies to determine impacts of the proposed project. Also refer to Response F2-U regarding mitigation.

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Parcel 21/20; 1.26 acres of wetland buffer on the Grid Parcel; 19.2 acres of wetland buffer on LRA Parcel 9; and 1.14 acres of wetland buffer on LRA Parcel 10 from clearing." As the DEIS states, GSA would obtain a permit for wetlands and stream impacts from USACE under CWA Sections 404 and 401, which would require full mitigation of impacts.

EPA appreciates effort to further avoid and minimize impacts to aquatic resources and buffers as more detailed plans are developed. As GSA understands, the resources have important functions in the ecosystem and for water quality. Compensatory mitigation is often not required for buffers which are lost. Consideration of voluntary preservation of buffers, enhancement or establishment of buffers to protect existing or replacement wetlands could be evaluated. F2-X

Unavoidable wetlands and stream impacts under Alternative 1 or 2 would be mitigated via one or more of the three proposed mitigation options: (1) purchase mitigation credits from an approved wetlands and stream mitigation bank within the Nottoway River watershed; (2) in lieu fee payment to the Virginia Aquatic Resources Trust Fund managed by the Nature Conservancy; and/or (3) purchase of mitigation credits from the ARNG Maneuver Training Center Fort Pickett located in the Army Compatible Use Buffer area. EPA questions the third mitigation option and requests additional information as to the bank to be used for purchasing mitigation credits. EPA would like to emphasize that the mitigation should be located in the service area to replace lost functions and values in the watershed. If GSA plans to use a bank, please show that the bank has the appropriate number and resource type credits available. F2-Y

Environmental Justice

Page 3-83 states, "Environmental justice is achieved if minority and low-income communities are not subjected to disproportionately high or adverse environmental effects. The environmental justice analysis addresses the characteristics of race, ethnicity and low income status for populations residing in areas potentially affected by implementation of the Proposed Action." While it is true that a major part of the goal of Environmental Justice is to assure that minority and/or low-income populations are not exposed to disproportionately high or adverse environmental impacts, it is also import to recognize that those populations need to be meaningfully involved in decision making, that these populations have access to information, are able to participate in a timely and appropriate manner, and that their comments and concerns are heard and given appropriate consideration during the process. The goal of the Environmental Justice assessment is to accurately identify the populations of potential Environmental Justice concern, and to use that information to determine if there may be any potentially disproportionate or adverse impacts that may impact those populations. The assessment is also conducted to assure that populations of concern are able to participate in an appropriate manner, and that they are able to express their concerns, receive information, and participate in decision making in a way that is meaningful and appropriate. F2-Z

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GSA Response

F2-X

Impact avoidance and minimization measures incorporated into the development of the alternatives include maintaining the 100-foot buffer along streams and wetlands wherever feasible. This goal was noted in Sections 3.1.4.4, 4.1.4.1, and 4.1.4.2 *Wetlands* of the Draft EIS. Additional text has also been added to Sections 2.2.3.2, 2.2.3.3, 6.3, and Tables ES-2 and 6.15-1 of this Supplemental Draft EIS.

F2-Y

GSA would secure letters of availability of mitigation credits from all appropriate mitigation banks during the Section 404/401 Joint Permit Application process. Preliminary inquiries made to wetland mitigation banks in the service area indicated that mitigation bank credits would be available for the project. Mitigation option (3) was noted as a potential mitigation bank if it becomes available. Mitigation option (3) has been revised in this Supplemental Draft EIS to clarify that the potential mitigation bank in the Fort Pickett ACUB is "…under consideration by ARNG within the Nottoway River watershed portion of the ACUB."

F2-Z

The environmental justice analysis has been conducted for the Draft and Supplemental Draft EIS in accord with the noted principles. Extensive public outreach has occurred in the area since September 2011. As noted in Section 1.5 of the Draft and Supplemental Draft EIS, outreach to the community has been ongoing throughout the EIS process and included a scoping meeting held in October 2011 and a Draft EIS public information meeting held November 7, 2012. A public information meeting will be held for the Supplemental Draft EIS on January 26, 2015. Information about the proposed project and the details of all meetings held in Blackstone and Nottoway County has been extensively reported in local media on a daily or weekly basis and were easily accessible by minority and low-income people. Residents living in proximity to the proposed explosive ranges, those who would be displaced by the project, and the NAACP in Nottoway County were notified directly about opportunities for involvement in the decision about the project (refer to Chapter 9 *Draft EIS Distribution List*). Representatives of the community have been meaningfully involved throughout the process and have had numerous opportunities to ask questions directly of GSA and DOS representatives. There were no impacts identified that indicated the need for a more aggressive outreach program than has already been undertaken. The overwhelming majority of the community has voiced nothing but support for the proposed project. (continued on following page)

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The percentages of minority and low income populations in the counties in the study area are above the state averages for minority and low income populations in the state of Virginia. There needs to be some mention of this in the FEIS. F2-AA

It would be helpful to show areas of potential Environmental Justice concern on all maps so that other reviewers and readers may be able to assess the proximity of the areas of potential Environmental Justice concern as related to project activities and potential impacts. F2-BB

Whenever possible and appropriate, tables should present data comparisons for the state, county and study area. F2-CC

Are there or will there be any activities taking place in close proximity to minority and/or low income populations in the short or long term that may cumulatively or singularly expose these at risk populations to potentially disproportionate or adverse impacts as related to construction, truck traffic, fugitive dusts, loss of services, noise, vibration, etc.? F2-DD

GSA references adherence to LEED/LID practices in Table 4.3-1. However, EPA is providing detailed information below for your consideration: F2-EE

Leadership in Energy and Environmental Design (LEED)

The LEED (Leadership in Energy and Environmental Design) Green Building Rating System is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. Members of the U.S. Green Building Council representing all segments of the building industry developed LEED and continue to contribute to its evolution. LEED standards are currently available for:

- New construction and major renovation projects (LEED-NC)
- Existing building operations (LEELD-EB, Pilot version)
- Commercial interiors projects (LEED-CI, Pilot version)
- Core and shell projects (LEED-CS, Pilot version)

LEED was created in order to define "green building" by establishing a common standard of measurement; promote integrated, whole-building design practices; recognize environmental leadership in the building industry; stimulate green competition; raise consumer awareness of green building benefits; and transform the building market.

LEED provides a complete framework for assessing building performance and meeting sustainability goals. Based on well-founded scientific standards, LEED emphasizes state of the art strategies for sustainable site development, water savings, energy efficiency, materials,

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GSA Response

F2-Z (continued from previous page) Residents and businesses that would be relocated were visited by GSA representatives and would be provided all legally available assistance during the relocation process. Also refer to Section 6.16 *Other Management Actions.* Through GSA's Urban Development/Good Neighbor program and USEPA's Community Assistance and Research expertise, GSA and USEPA, in a joint effort with the town, county, Fort Pickett, and the Virginia Economic Development Partnership, will assist Blackstone and Nottoway County in preparing for FASTC-related economic effects. (refer to Tables ES-2 and 6.16-1).

F2-AA
Section 3.2.5.2 of the Draft EIS and Supplemental Draft EIS indicates those counties that have minority and low income populations greater than the state average.

F2-BB
A figure showing Environmental Justice areas in proximity to project impacts has been added to Section 4.2.5.1 *Environmental Justice.*

F2-CC
Section 3.2.5.2 and Tables 3.2-25 and 3.2-26 of the Draft EIS and Supplemental Draft EIS do include data comparisons for the state, county, and study area for minority and low income populations.

F2-DD
Additional discussion on proximity of Environmental Justice populations to impacts has been added to Section 4.2.5.1 *Environmental Justice.* Section 5.4.9 on cumulative impacts has also been updated accordingly.

F2-EE
Comment noted; should the decision be made to implement the project, the information provided would be considered during design.

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selection and indoor environmental quality. LEED recognizes achievements and promotes expertise in green building through a comprehensive system offering project certification, professional accreditation, training and practical resources. For more information, contact the U.S. Green Building Council at the following web address: http://www.usgbc.org/leed/leedmain.asp.

Low Impact Development (LID)

Federal agencies are required to reduce the impacts on watershed hydrology and aquatic resources. This effort commonly referred to as low impact development (LID), implements environmentally and economically beneficial landscape practices into landscape programs, policies and practices by using a natural approach to land development and stormwater management. Federal agencies are required by Executive Order 13148 to incorporate the principles put forth in a Guidance dated August 10, 1995. This Guidance is intended to promote principles of "sustainable landscape design and management" which recognizes the interconnection of natural resources, human resources, site design, building design, energy management, water supply, waste prevention, and facility maintenance and operation.

It is important to incorporate LID efforts to mitigate the effects of development through traditional stormwater management practices which have proven to not be entirely successful. Traditional collection and conveyance systems, stormwater ponds and other stormwater facilities do not replicate natural systems, which greatly slow water before it reaches streams, wetlands and other waters. Development often times results in the loss of trees and other vegetation, the compaction of soils by heavy equipment, and the creation of vast stretches of connected impervious areas. These combined factors are extremely difficult to compensate for using traditional practices. As a result, the following site design (goals) and planning practices can be used to minimize stormwater impacts.

Goal: Minimize direct stormwater impacts to streams and wetlands to the maximum extent practicable.
Practices:

1. Locate stormwater facilities outside of streams and wetlands;
2. maintain natural drainage routes on site;
3. preserve riparian buffers; and
4. distribute "Integrated Management Practices" (IMP) used in lieu of centralized ponds.

Goal: Preserve the natural cover on as much of the site as possible, especially for areas located on hydrologic soil groups (HSG) A and B.
Practices:

1. Utilize clustered development designs and preserve a significant portion of the site in a natural state;

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GSA Response
No response necessary on this page.

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2. utilize "fingerprint" clearing by limiting the clearing and grading of forests and native vegetation to the minimum area needed for the construction of the lots, the provision of necessary access, and fire protection;
3. avoid impacts to wetlands to vegetated riparian buffers; and
4. preserve A and B Soils in natural cover.

Goal: Minimize the overall impervious cover.
Practices:
1. Utilize the minimum required width for streets and roads;
2. utilize street layouts that reduce the number of homes per unit length;
3. minimize cul-de-sac diameters, use doughnut cul-de-sacs, or use alternative turnarounds;
4. minimize excess parking space construction, utilize pervious pavers in low-use parking areas;
5. utilize structured or shared parking;
6. reduce home setbacks and frontages;
7. where permitted, minimize sidewalk construction by utilizing sidewalks on one side only, utilizing "Skinny" sidewalks, or substituting sidewalks with pervious trails through common greenspace;
8. substitute pervious surfaces for impervious wherever possible;
9. where permitted, avoid the use of curb and gutter and utilize vegetated open swales, preferably "engineered swales" with a permeable soil base; and
10. minimize compaction of the landscape and in areas where soils will be "disked" prior to seeding, and amended with loam or sand to increase absorption capacity.

Goal: Locate infiltration practices on HSG A and B soils wherever possible. Thus, every effort should be made to utilize areas with these soils for IMP that promote infiltration.

Goal: Locate impervious areas on less permeable soils (HSG C and D). Placement of impervious areas on lower permeability soils minimizes the potential loss of infiltration/recharge capacity on the site.

Goal: "Disconnect" impervious areas. "Disconnecting" means having impervious cover drain to pervious cover (i.e. downspouts draining to the yard, not the driveway). This decreases both the runoff volume and Time of Concentration.

Goal: Increase the travel time of water off of the site (Time of Concentration).
Practices:
1. Flatten grades for stormwater conveyance to the minimum sufficient to allow positive drainage;
2. increase the travel time in vegetated swales by using more circuitous flow routes, rougher vegetation in swales, and check dams; and
3. utilize "engineered" swales in lieu of pipes or hardened channels.

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GSA Response
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Goal: Utilize soil management/enhancement techniques to increase soil absorption.
Practices:
1. Delineate soils on site for the preservation of infiltration capacity; and
2. require compacted soils in areas receiving sheetflow runoff (such as yards, downslope of downspouts).

Goal: Revegetate all cleared and graded areas.

Goal: Use "engineered swales" for conveyance in lieu of curb and gutter wherever possible.

Goal: Utilize level spreading of flow into natural open space.

For additional and more comprehensive LID information, please refer to the following web sites.

LID Manuals:
- http://www.epa.gov/owow/nps/lid_hydr.pdf
- http://www.epa.gov/owow/nps/lid/lidnatl.pdf
- http://www.bmpdatabase.org
- http://www.epa.gov/ednnrmrl/
- Combined Sewer Overflows Guidance for Monitoring and Modeling Document Type, Published: 1/1/99 http://www.epa.gov/npdes/pubs/chap05-sco.pdf

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GSA Response
No response necessary on this page.

United States Department of the Interior OFFICE OF THE SECRETARY Office of Environmental Policy and Compliance Custom House, Room 244 200 Chestnut Street Philadelphia, Pennsylvania 19106-2904 TAKE PRIDE IN AMERICA IN REPLY REFER TO: December 7, 2012 9043.1 ER 12/790 Ms. Abigail Low GSA Project Manager 20 N 8th Street Philadelphia, PA 19107. Dear Ms. Low, The U.S. Department of the Interior has no comment on the Draft Environmental Impact Statement for the U.S. Department of State (DOS), Bureau of Diplomatic Security, Foreign Affairs Security Training Center (FASTC) at the Virginia Army National Guard's Maneuver Training Center at Fort Pickett and Nottoway County's Pickett Park in Nottoway County, Virginia. **F3** We appreciate the opportunity to provide these comments. Sincerely, Lindy Nelson Regional Environmental Officer,	**GSA Response** **F3** Comment noted.

STATE AGENCIES

COMMONWEALTH of VIRGINIA
DEPARTMENT OF TRANSPORTATION
RICHMOND DISTRICT
2430 Pine Forest Drive
COLONIAL HEIGHTS, VA 23834
www.VDOT.Virginia.gov

Gregory A. Whirley
COMMISSIONER

November 15, 2012

Abigail Low, Project Manager
U.S. General Services Administration
20 N 8th Street
Philadelphia, PA 19107

RE: Foreign Affairs Security Training Center (FASTC) at Fort Pickett
Traffic Impact Analysis (TIA) Report dated 10/8/12
Virginia Department of Transportation (Department) Comments

Dear Ms. Low:

As part of a technical study associated with an Environmental Impact Statement, in determining the impacts of the proposed FASTC development on the surrounding transportation system, developed was the subject TIA. Submitted by the US General Services Administration (GSA) on October 22, 2012 for Department comment is that TIA prepared by Timmons Group.

In anticipation of issuance of the preceding TIA formal comments, a meeting was held between the Department and representatives from the GSA, Timmons Group, Department of State (DOS) and CardnoTEC on November 8, 2012 to discuss the preliminary findings. Summarizing the findings and meeting discussion, noted below are the Department's comments.

The Department has evaluated the TIA in accordance with §15.2-2222.1 of the Code of Virginia and the Virginia Traffic Impact Analysis Regulations, 24 VAC 30-155 (also known as Chapter 527) and **finds that the report conforms to the requirements of Chapter 527 in regard to the accuracy of the methodologies, assumptions and findings/conclusions presented in the analysis.** *Considered in the evaluation were impacts to only those intersections/roadways maintained by the Department.* C1-A

Project Details

Proposed is the establishment of a Diplomatic Security consolidated training center by the GSA and DOS to be located within and adjacent to the Fort Pickett National Guard Maneuver Training Center (Fort Pickett) currently occupied by the Virginia Army National Guard. The purpose of the

WE KEEP VIRGINIA MOVING

GSA Response

C1-A
Comment noted.

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facility is to provide skills to foreign affairs staff, Diplomatic Security agents, Foreign Services officers and other personnel.

The project construction timeline, training center alternatives and traffic generation are as follows:

- Training center construction is proposed in three phases. Those phases and anticipated completion dates are as follows: Phase 1 – 2017, Phase 2 – 2018 and Phase 3 – 2020 (buildout).
- The report analysis considers the completion years of each Phase 1 (2017) and Phase 3 (2020); Phase 2 work will not result in any traffic increase as proposed are only site improvements.
- Two build alternatives are considered in each phase; Build Alternative 1 and 2. Impacts to study intersections differ with each Build Alternative
- Site generated traffic at buildout is anticipated at 3,512 ADT; applicable to both Build Alternatives 1 and 2. The number of employees/students is the same for both.
- Access to the Fort will be through two entrances/checkpoints: Main Gate (Route 750 Military Road) and the West Gate (Route 643 West Entrance Road).

Study Intersections

The following state maintained TIA report study areas were reviewed by the Department (study intersections as numbered on report Fig 1-2):

Outside the Fort Pickett Reservation Boundary Limits:

1 Route 460 and Cox Road (Rt 460 Bus)

Within the Fort Pickett Reservation Boundary Limits:

2 Cox Road (Rt 460 Bus) and Military Road (Rt 750)
3 Darvills Rd. (Rt 40) and Military Road (Rt 750)
6 Military Rd (Fort) and Route 756 (Garnett Avenue)
8 Warehouse St. (Fort) and Rt 753 (West 10th St.)

Study areas 4, 5, 7, 9, 10 and 11 as indicated on the figure were not reviewed by the Department as they do not impact state maintained roadways/intersections.

C1-B

GSA Response

C1-B
Comment noted.

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Page 3 of 6

Current and No-Build Intersection Impacts

Existing and future traffic volumes without the proposed training center result in all state maintained study intersections operating at an acceptable level of service (LOS) during the AM and PM peak hours. No intersection improvements warranted. C1-C

2017 (Phase 1) Build Alternative 1 and 2 Intersection Impacts

All state maintained study intersections will operate at an acceptable LOS during the AM and PM peak hours with the anticipated Phase 1 site generated traffic. However, turn lane improvements in accordance with Department warrants only are recommended at three of the state maintained intersections. C1-D

2020 (Phase 2) Build Alternative 1 and 2 Intersection Impacts

State maintained intersections 1 and 3 are shown to experience an unacceptable LOS with Phase 2 site generated traffic. To address the unacceptable level service, turn lane improvements and intersection signage/flashing beacon alterations are recommended. Turn lane improvements are subsequently proposed at intersection 2 with the anticipated traffic as Department warrants are met. C1-E

Mitigation Measures

The Department concurs with the study approach and conclusions on the report mitigation measures for the noted state maintained intersections: C1-F

- *Intersection 1 - Rt 460 at Cox Rd. (Rt 460 Bus)*

  Phase 1 Rt 460 WB LTL/Taper extension – 350' lane/200' taper

  Phase 2 Rt 460 WB LTL/Taper extension – 500' lane/200' taper

  Rt 460 Bus NB Left-Thru construction– 200' lane/200' taper

- *Intersection 2 - Cox Rd. (Rt 460 Bus) at Military Rd. (Rt 750)*

  Phase 1 Rt 460 Bus WB LTL/Taper construction – 200' lane/200' taper

  Phase 2 Same Phase 1 improvements

- *Intersection 3 - Darvills Rd. (Rt 40) at Military Rd. (Rt 750)*

  Phase 1 Rt 40 EB RTL/Taper extension – 200' lane/200' taper

GSA Response

C1-C
The traffic analysis has been updated in Section 4.2.6 and Appendix H of the Supplemental Draft EIS.

C1-D
The traffic analysis has been updated in Section 4.2.6 and Appendix H of the Supplemental Draft EIS.

C1-E
The traffic analysis has been updated in Section 4.2.6 and Appendix H of the Supplemental Draft EIS.

C1-F
Virginia Department of Transportation (VDOT) concurrence with the approach and conclusions on mitigation measures noted. The traffic impact analysis has been updated for Build Alternative 3 in Section 4.2.6 and Appendix H of the Supplemental Draft EIS. Because of the reduction in employees traveling to FASTC, there would no longer be adverse impacts to traffic capacity or unacceptable LOS at intersections. Under Build Alternative 3 the turning lane analysis determined that the additional project traffic would result in the existing turning lane storage being less than VDOT design standards at one intersection Option A and three intersections under Option B. To address VDOT turning lane storage criteria, additional study by VDOT of potential turning lane improvements would be warranted.
Regarding the implementation of improvements, should VDOT determine they are warranted, GSA and DOS have no authority to fund or implement roadway improvements outside property boundaries. Intersection improvements would be under the jurisdiction of VDOT. Funding and implementation of improvements would have to occur through the appropriate Commonwealth of Virginia transportation organizations. Accordingly, state and/or local governments would determine whether improvements identified would be implemented.

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Phase 2	Rt 40 EB RTL/Taper extension – 200' lane/200' taper	C1-F
	Rt 750 NB LTL/Taper extension – 200' lane/200' taper	
	Rt 750 NB RT Taper extension – 200'	
	Overall Intersection - Stop control changes – switch from Rt 750 approaches to Rt 40 approaches	
	Overall Intersection – Remove existing red flashing beacon and replace with a yellow and red flashing beacon	
	Overall Intersection – Install "Stop Ahead" signs on both approaches of Rt 40	

No improvements are warranted at state maintained intersections 6 and 8.

VDOT Suggested Improvements

The Department offers the following suggestions, to further mitigate anticipated impacts, with the noted intersection improvements as indicated above.

- *Intersection 1 - Rt 460 at Cox Rd. (Rt 460 Bus)* — C1-G

Phase 2	Rt 460 Bus NB - Construction of a 200'/200' RTL/Taper in association with the warranted/proposed NB Left-Thru.

- *Intersection 3 - Darvills Rd. (Rt 40) at Military Rd. (Rt 750)* — C1-H

Phase 2	Overall Intersection – Construction of a round-about in lieu of the mitigation measures.

Roadway Abandonment

Under the Build Alternative proposals, construction of the training facility would take place over the existing State maintained routes of 754, 755 and 756. Prior to construction, the noted routes are to be abandoned from the Secondary System of State Highways.

Abandonment would be considered under Code Section 33.1-151 whereby Nottoway County initiates the process with the Department. Attached is a flow chart identifying the abandonment administrative steps involved. Further direction on the process is available in the *Guide for Additions and Abandonments and Discontinuances* found at the following link: C1-I

http://www.virginiadot.org/business/resources/additionsabandonmentsanddiscontiniuances.pdf

GSA Response

C1-F
(Response on previous page.)

C1-G
Suggestion noted. Also refer to Response C1-F.

C1-H
Suggestion noted. Also refer to Response C1-F.

C1-I
GSA appreciates the information provided with regard to roadway abandonment and would ensure the necessary steps are taken to comply with this requirement.

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Department Considerations

The Department advises the following items/impacts be considered in moving forward with development of the FASTC facility and in undertaking the mitigation measures:

- *Improvements Concurrent with Department UPC 18964* – The Department is currently investigating the possibility of incorporating the intersection 1 turn lane improvements identified in both the TIA mitigation measure (NB Left-Thru) and the Department suggested improvement (NB RTL/Taper) into the anticipated Rt 460/Rt 460 Bus intersection work identified on the UPC project. If incorporated, it is anticipated that the work would be complete prior to 2017. C1-J
- *Right-of-Way Acquisition* – Mitigation measure intersection improvements may warrant the need to acquire additional right-of-way to accommodate turn lanes. Acquiring the right-of-way may further require negotiations with private land owners possibly adding to the project cost and impacting the schedule. Recommended is early research on the existing right-of-way designation/dedication/width to determine the extent of required acquisition. C1-K
- *VDOT Permitting Requirements* – A Land Use Permit issued by the Department is required for all work within the state maintained right-of-way, including for the construction of access to the site from a state route, for the demolition/reconstruction of access points that that adjoin Rt 753 (W. 10th St.) and for any intersection improvement work. A plan identifying the proposed right-of-way work shall be submitted for review/approval prior to permit issuance. C1-L
- *Roadway Abandonment* – This item could impact the project schedule as training center construction cannot proceed until the impacted state routes are abandoned. Recommended is early coordination between the Department and Nottoway County on the process of abandoning the roadways, since the abandonment process can take up to 6 months. Note that the process can only proceed with Nottoway County BOS determination that either (1) "no public necessity exists for the continuance of the section of secondary road as a public road" (i.e. lack of public use) or (2) the safety and welfare of the public would be served best by abandoning the section of road". C1-M
- *Access Management* – Although no new access points off of a state maintained route are indicated in the TIA, be advised that should the current concept be revised and a new access proposed, the location of the access shall comply with spacing standards (between other intersections) as outlined in the Department's Access Management Regulations. C1-N
- *Zoning* – Not identified in the report is the current zoning of the land which the improvements are proposed. Confirmed at the November 8 meeting by Timmons was that the property is currently zoned for it intended use. C1-O

GSA Response

C1-J
GSA appreciates VDOT's efforts to incorporate the noted intersection improvements at Route 460/Route 460 Business (Cox Road) into state project UPC 18964.

C1-K
Comment noted. Refer to Response C1-F.

C1-L
GSA would determine the need for a Land Use Permit for access to a state route during project design, and would submit plans to VDOT, if required.

C1-M
GSA appreciates the information provided with regard to the scheduling requirements for roadway abandonment. The necessary steps would be taken to comply with this requirement.

C1-N
Comment noted

C1-O
Comment noted. Zoning is discussed in Section 3.2.4 of the Draft and Supplemental Draft EIS.

Ms. Low
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Should you have any questions on the comments, I can be reached at 804-863-4012.

As the project moves forward, I'll also be the main point of contact for all project related items that entail Department involvement.

Please advise on the need for direction on the abandonment process, access to right-of-way records, or any general assistance on transportation related items as the project moves forward.

Sincerely,

Brian Lokker, P.E.
Area Land Use Engineer, South

Attachment – Abandonment Flow Chart
CC: J. Bernard (DOS)
S. Dunn (Timmons)
M. Goodman (GSA)
K. Hall (CardnoTEC)

GSA Response
No response necessary on this page.

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

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Director

(804) 698-4000
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December 6, 2012

Ms. Abigail Low
General Services Administration
20 N. 8th Street
Philadelphia, PA 19107

RE: Draft Environmental Impact Statement: U.S. General Services Administration Foreign Affairs Training Center located in Nottoway County, DEQ 12-189F

Dear Ms. Low:

The Commonwealth of Virginia has completed its review of the draft environmental impact statement (EIS) for the above-referenced project. The Department of Environmental Quality (DEQ) is responsible for coordinating Virginia's review of federal environmental documents prepared pursuant to the National Environmental Policy Act and responding to appropriate federal officials on behalf of the Commonwealth. The following agencies, localities and planning district commissions participated in this review:

Department of Environmental Quality
Department of Game and Inland Fisheries
Department of Conservation and Recreation
Department of Historic Resources
Department of Health
Department of Forestry
Marine Resources Commission
Department of Aviation
Nottoway County
Prince Edward County
Lunenburg County
Crater Planning District Commission
Richmond Regional Planning District Commission

GSA Response

No response necessary on this page.

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DEQ 12-189F
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The Department of Agriculture and Consumer Services, the Department of Mines Minerals and Energy, Department of Transportation, Commonwealth Regional Commission, Southside Planning District Commission, Town of Blackstone, Amelia County, Brunswick County, Chesterfield County, Dinwiddie County, Department of Military Affairs, Southside Virginia Community College, Southern Piedmont Agricultural Research and Extension Center, Conservation Management Institute and the Department of State Police also were invited to comment.

PROJECT DESCRIPTION

The U.S. General Services Administration (GSA) submitted a draft EIS for the proposed construction of the Foreign Affairs Security Training Center (FASTC) and associated land acquisition in Nottoway County. The proposed project site is located on four parcels of land within and adjacent to the Army National Guard Maneuver Training Center at Fort Pickett, which is operated by the Virginia Army National Guard. The four parcels comprise approximately 1,502 acres. The FASTC would be a consolidated training center for a rotating student population (primarily government employees) of 8,000 to 10,000 annually. Approximately 850 to 1,070 employees would work at the FASTC. Development would include classrooms, simulation labs, fitness center, driving tracks, mock urban environments, firing and explosives ranges, administrative offices, dormitories, dining hall and facilities for emergency medical response services. The FASTC is scheduled to be constructed in three phases from 2014 to 2017, 2016 to 2018, and 2018 to 2020. The draft EIS considers two build alternatives as well as a no action alternative. According to the draft EIS, the major differences between Build Alternative 1 and Build Alternative 2 (Preferred Alternative) are the locations of the Main Campus, Mock Urban Environments, and three buildings of the High Speed Driving Track Area. Build Alternative 2 would also require utilities infrastructure improvements.

ENVIRONMENTAL IMPACTS AND MITIGATION

1. Subaqueous Lands Management. The EIS (page 4-6) states that both build alternatives would include stream crossings.

1(a) Agency Jurisdiction. The Virginia Marine Resources Commission (VMRC) regulates encroachments in, on or over state-owned subaqueous beds as well as tidal wetlands pursuant to Virginia Code § 28.2-1200 through 1400.

The VMRC serves as the clearinghouse for the Joint Permit Application (JPA) used by the:

- U.S. Army Corps of Engineers (Corps) for issuing permits pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act;

GSA Response

No response necessary on this page.

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Page 3

- DEQ for issuance of a Virginia Water Protection (VWP) permit;
- VMRC for encroachments on or over state-owned subaqueous beds as well as tidal wetlands; and
- local wetlands board for impacts to wetlands.

The VMRC will distribute the completed JPA to the appropriate agencies. Each agency will conduct its review and respond.

1(b) Agency Findings. VMRC states that any activities or construction within perennial streams draining 5 square miles or greater would need to be reviewed for potential authorization from the VMRC. The submerged lands under these waterways are considered to be public, state-owned property, managed by VMRC. While VMRC was unable to determine if there are to be any direct impacts to these jurisdictional lands, if there are proposed impacts, a Joint Permit Application (JPA) would need to be completed and submitted for VMRC's review and possible permit issuance through the public interest review process. The following web address links to the JPA: *http://www.nao.usace.army.mil/Portals/31/docs/regulatory/RPSPdocs/Revised_Standard_JPA_JULY2012_FillableForm.pdf.* C2-A

1(c) Requirement. If there are proposed impacts to state-owned subaqueous beds and tidal wetlands as well as proposed stream crossings, a Joint Permit Application (JPA) would need to be completed and submitted to VMRC. C2-B

1(d) Agency Recommendation. Coordinate with VMRC regarding applicable permits and the submission of a JPA. C2-C

2. Water Quality and Wetlands. The EIS (pages 4-5 to 4-11) states that impacts to water resources are evaluated for both temporary construction and long-term operational phases. Wetlands and streams would be impacted by the implementation of both build alternatives.

2(a) Agency Jurisdiction. The State Water Control Board promulgates Virginia's water regulations, covering a variety of permits to include Virginia Pollutant Discharge Elimination System Permit, Virginia Pollution Abatement Permit, Surface and Groundwater Withdrawal Permit, and the Virginia Water Protection (VWP) Permit. The VWP Permit is a state permit which governs wetlands, surface water and surface water withdrawals/impoundments. It also serves as § 401 certification of the federal Clean Water Act § 404 permits for dredge and fill activities in waters of the United States. The VWP Permit (VWPP) Program is under the Office of Wetlands and Water Protection/Compliance within the DEQ Division of Water Quality Programs. In addition to central office staff who review and issue VWP permits for transportation and water

GSA Response

C2-A
A Joint Permit Application for wetland impacts would be submitted for VMRC's review.

C2-B
A Joint Permit Application for wetland impacts would be submitted for VMRC's review.

C2-C
VMRC would be included in agency coordination regarding the Joint Permit Application.

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withdrawal projects, the six DEQ regional offices perform permit application reviews and issue permits for the covered activities.

2(b) Agency Comments. The DEQ Blue Ridge Regional Office (BRRO) states that the draft EIS (page 4-8, Section 4.1.4.1 Wetlands) indicates that the GSA would have to obtain a permit from the Corps for wetlands and stream impacts under Clean Water Act Sections 404 and 401. The VWP Program states that GSA also needs to coordinate these permits with DEQ BRRO. C2-D

2(c) Requirement.

- If impacts to surface waters and wetlands are proposed, a VWP Permit from DEQ may be required. C2-E

2(d) Agency Recommendations. Coordinate with the DEQ BRRO regarding applicable permits.

In general, DEQ recommends that impacts to surface waters, including wetlands, be avoided to the maximum extent practicable and encourages the following construction practices to minimize impacts:

- Operate machinery and construction vehicles outside of stream-beds and wetlands; use synthetic mats when in-stream work is unavoidable.
- Preserve the top 12 inches of material removed from wetlands for use as wetland seed and root-stock in the excavated area.
- Design erosion and sedimentation controls in accordance with the most current edition of the *Virginia Erosion and Sediment Control Handbook*. These controls should be in place prior to clearing and grading, and maintained in good working order to minimize impacts to state waters. The controls should remain in place until the area is stabilized. C2-F
- Place heavy equipment, located in temporarily impacted wetland areas, on mats, geotextile fabric, or use other suitable measures to minimize soil disturbance, to the maximum extent practicable.
- Restore all temporarily disturbed wetland areas to pre-construction conditions and plant or seed with appropriate wetlands vegetation in accordance with the cover type (emergent, scrub-shrub or forested). The applicant should take all appropriate measures to promote revegetation of these areas. Stabilization and restoration efforts should occur immediately after the temporary disturbance of each wetland area instead of waiting until the entire project has been completed.
- Place all materials which are temporarily stockpiled in wetlands, designated for use for the immediate stabilization of wetlands, on mats or geotextile fabric in order to prevent entry in state waters. These materials should be managed in a

GSA Response

C2-D

GSA would coordinate with both the Army Corps of Engineers and the VDEQ Blue Ridge Regional Office in obtaining permits.

C2-E

GSA would obtain all required permits.

C2-F

The alternatives development process and the build alternatives of this EIS have incorporated existing roads and stream crossings where feasible. This wetland impact avoidance measure would be carried through to the design process. Additional opportunities for impact minimization and use of existing stream crossings would be considered during project design. Sections 4.1.4.1 and 4.1.4.3 discuss avoidances and regulations that would be followed as well as mitigation for wetland impacts.

All wetlands and streams on all proposed site parcels, including those within 50 feet of all project activities, were flagged during the 2011-2012 wetland delineations.

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manner that prevents leachates from entering state waters and must be entirely removed within thirty days following completion of that construction activity. The disturbed areas should be returned to their original contours, stabilized within thirty days following removal of the stockpile, and restored to the original vegetated state.

- Flag or mark all non-impacted surface waters within the project or right-of-way limits that are within 50 feet of any clearing, grading or filling activities for the life of the construction activity within that area. The project proponent should notify all contractors that these marked areas are surface waters where no activities are to occur.
- Employ measures to prevent spills of fuels or lubricants into state waters.

C2-F

3. Erosion and Sediment and Stormwater Management Controls. The EIS (page 5-15) states that erosion and sedimentation controls would be employed for all construction projects as required by federal and state regulations.

3(a) Agency Jurisdiction. The Department of Conservation and Recreation (DCR) Division of Stormwater Management (DSM) administers the Virginia Erosion and Sediment Control Law and Regulations (VESCL&R) and the Virginia Stormwater Management Law and Regulations (VSWML&R).

3(b) Erosion and Sediment Control. According to DCR, the applicant and its authorized agents conducting regulated land disturbing activities on private and public lands in the state must comply with the VESCL&R and VSWML&R, including coverage under the general permit for stormwater discharge from construction activities, and other applicable federal nonpoint source pollution mandates (e.g. Clean Water Act-Section 313). Clearing and grading activities, installation of staging areas, parking lots, roads, buildings, utilities, borrow areas, soil stockpiles, and related land-disturbance activities that result in the land-disturbance of equal to or greater than 10,000 square feet would be regulated by VESCL&R. Accordingly, the applicant must prepare and implement an ESC plan to ensure compliance with state law and regulations. The ESC plan is submitted to the DCR regional office that serves the area where the project is located for review for compliance. The applicant is ultimately responsible for achieving project compliance through oversight of on-site contractors, regular field inspection, prompt action against non-compliant sites, and other mechanisms consistent with agency policy (Reference: VESCL §10.1-567).

C2-G

3(c) Virginia Stormwater Management Program General Permit for Stormwater Discharges from Construction Activities. According the DCR, the operator or owner of construction activities involving land-disturbing activities equal to or greater than 1 acre are required to register for coverage under the General Permit for Discharges of

C2-H

GSA Response

C2-F
(Response provided on previous page.)

C2-G
All regulated land disturbance would be conducted in compliance with the minimum standards outlined in the Virginia Erosion and Sediment Control Regulations; also refer to Section 4.1.3.1 of the Draft and Supplemental Draft EIS.

C2-H
GSA would obtain all applicable permits and prepare all required plans, including a Stormwater Pollution Prevention Plan; also refer to Section 4.1.4.1 of the Draft and Supplemental Draft EIS.

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Stormwater from Construction Activities and develop a project-specific stormwater pollution prevention plan (SWPPP).

- Construction activities requiring registration also includes the land-disturbance of less than one acre of total land area that is part of a larger common plan of development or sale if the larger common plan of development will ultimately disturb equal to or greater than one acre.
- The SWPPP must be prepared prior to submission of the registration statement for coverage under the general permit.
- The SWPPP must address water quality and quantity in accordance with the Virginia Stormwater Management Program (VSMP) Permit Regulations.

General information and registration forms for the general permit are available on DCR's website at *www.dcr.virginia.gov/soil_and_water/index.shtml.* C2-H

4. Air Pollution Control. The EIS (page 4-24) states that an air emissions analysis indicates that construction and operational emissions would remain well below the significance thresholds and would not have a significant impact on the local or regional air quality.

4(a) Agency Jurisdiction. DEQ's Air Quality Division, on behalf of the State Air Pollution Control Board, is responsible for developing regulations that become Virginia's Air Pollution Control Law. DEQ is charged with carrying out mandates of the state law and related regulations as well as Virginia's federal obligations under the Clean Air Act as amended in 1990. The objective is to protect and enhance public health and quality of life through control and mitigation of air pollution. The division ensures the safety and quality of air in Virginia by monitoring and analyzing air quality data, regulating sources of air pollution, and working with local, state and federal agencies to plan and implement strategies to protect Virginia's air quality. The appropriate regional office is directly responsible for the issuance of necessary permits to construct and operate all stationary sources in the region as well as monitoring emissions from these sources for compliance. As a part of this mandate, environmental impact reports of projects to be undertaken in the state are also reviewed. In the case of certain projects, additional evaluation and demonstration must be made under the general conformity provisions of state and federal law.

4(b) Ozone Attainment Area. The DEQ Air Division states that the proposed project is located in an ozone attainment area. C2-I

4(c) Requirements.

4(c)(i) Open Burning. If the project includes the burning of vegetative debris and/or demolition and construction material, this activity must meet the requirements under 9VAC5-130 *et seq.* of the regulations for open burning, and it may require a permit. The C2-J

GSA Response

C2-H
(Response provided on previous page.)

C2-I
Comment noted. This status is reflected in Section 3.2.2.2 of the Draft and Supplemental Draft EIS.

C2-J
GSA Facilities Standards for Public Buildings (P100) would require that 50% of construction debris be recycled or reused. The remaining vegetative debris and/or demolition and construction materials would be disposed of in accordance with all laws and regulations. Open burning of construction debris would not be conducted. Nottoway County does not have ordinances and permitting requirements for open burning. This information has been added to Section 4.2.2.1 *Air Quality, Construction*.

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regulations provide for, but do not require, the local adoption of a model ordinance concerning open burning. The responsible party should contact Nottoway County to determine what local requirements, if any, exist. C2-J

4(c)(ii) Fugitive Dust. During construction, fugitive dust must be kept to a minimum by using control methods outlined in 9VAC5-50-60 *et seq.* of the Regulations for the Control and Abatement of Air Pollution. These precautions include, but are not limited to, the following: C2-K

- Use, where possible, water or chemicals for dust control;
- Install and use hoods, fans and fabric filters to enclose and vent the handling of dusty materials;
- Cover open equipment for conveying materials; and
- Promptly remove spilled or tracked dirt or other materials from paved streets and remove dried sediments resulting from soil erosion.

4(c)(iii) Fuel-Burning Equipment. Fuel-burning equipment (boilers, generators, compressors, etc.) or any other air-pollution-emitting equipment may be subject to 9VAC5-80, Article 6, Permits for New and Modified sources. C2-L

4(d) Agency Recommendation. Contact DEQ BRRO for information on requirements related to registration of fuel-burning equipment, as applicable. C2-M

5. Solid and Hazardous Waste Management. The EIR (page 4-7) indicates that implementation of the proposed action would increase the use of petroleum products, hazardous waste and other materials. However, adherence to regulations and plans for the transport and storage of hazardous waste, pesticides and fertilizers would avoid or minimize the potential for accidental release.

5(a) Agency Jurisdiction. Solid and hazardous wastes in Virginia are regulated by DEQ, the Virginia Waste Management Board and the Environmental Protection Agency (EPA). They administer programs created by the federal Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response Compensation and Liability Act (CERCLA), commonly called Superfund, and the Virginia Waste Management Act. DEQ administers regulations established by the Virginia Waste Management Board and reviews permit applications for completeness and conformance with facility standards and financial assurance requirements. All Virginia localities are required, under the Solid Waste Management Planning Regulations, to identify the strategies they will follow on the management of their solid wastes to include items such as facility siting, long-term (20-year) use, and alternative programs such as materials recycling and composting.

GSA Response

C2-J
(Response provided on previous page.)

C2-K
Section 4.2.2 discusses fugitive dust control. Additional language has been added to the Supplemental Draft EIS to encompass additional measures that may be employed.

C2-L
The proposed boilers are all less than 10,000,000 Btu/hr and therefore are exempt from permitting regulations of the Commonwealth of Virginia for stationary sources of air emissions. The emergency generators are exempt from permitting regulations provided hours of operation are kept below 500 hours per year. Refer to Section 4.2.2.

C2-M
Section 4.2.2 analyzes fuel-burning equipment relative to the requirements of 9VAC5-80.

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5(b) Agency Comments. The DEQ Division of Land Protection and Revitalization (DLPR) (formerly known as the DEQ Waste Division) states that the EIS addresses potential solid waste and/or hazardous waste issues and includes a thorough review of potential environmental issues related to the parcels identified for development. The report appears to indicate that DEQ's databases and DLPR files were searched, and indicates that DEQ offices had been contacted about possible ground contamination concerns. The DLPR staff has conducted a cursory review of its database files under zip code 23824, including a Geographic Information System database search (within a 0.5-mile radius) of the project site, and identified the information below. Comments from the DEQ Federal Facilities Program are included. The sites identified are for reference as their proximity to the subject site are unknown.

RCRA/Hazardous Waste Facilities

- BRAC Property Fort Pickett, 403 Military Road, Blackstone, VA 23824. ID# 0213720931. Contact: Francis Gilmore at 434-292-3317.
- Fort Pickett USARC AMSA No. 88, Bldg 564 Kemper Avenue, Blackstone, VA 23824. ID# VAR000005553. Contact: Michele Brown at 804-233-6473. C2-N
- MTC Fort Pickett, VAARNG-FM-E, Bldg 234, Blackstone, VA 23824. ID# VAD988228359. Contact: David K. Short at 434-292-2144.
- VAARNG-ARMORY-Blackstone, N. High Street, Blackstone, VA 23824. ID# VAD982677429. Contact: Pamela W. Coleman at 434-298-6445.
- VIP & SU Southern Piedmont AES, Highway 40 East, Blackstone, VA 23824. ID# 988224937. Contact: Jack Nunes at 540-231-8758.

CERCLA Site

- Fort Pickett, Kemper Avenue, Blackstone, VA 23824. EPA ID 2210020705. Not NPL.

The following websites may prove helpful in locating additional information:

- www.epa.gov/superfund/sites/cursites/index.htm
- www.epa.gov/enviro/html/rcris/rcris_query_java.html

Formally Used Defense Sites

- C03VA0028/VA9799F7770, Fort Picket Mil Resv, Blackstone
- C03VA0220/VA9899F1674, Fort Pickett A ARPT, Blackstone

GSA Response

C2-N

Sections 3.2.11 and 4.2.11 of the Draft and Supplemental Draft EIS are based on comprehensive Phase I and Phase II Environmental Site Assessments performed for the proposed project land parcels. All potential sites of environmental concern have been documented. Follow up investigations have been conducted since the publication of the Draft EIS, and the results are included in this Sections 3.2.11 and 4.2.11 of the Supplemental Draft EIS.

Regarding the sites noted from VDEQ's database, sites 0213720931 and VAD988228359 are within Pickett Park northeast of LRA Parcel 9. Neither site would be affected by the project. Site VAR00000553 is located adjacent to the Grid parcel, which has recently been subject to soil and groundwater testing to ensure activities associated with Site VAR00000553 have not affected soils or groundwater conditions on the Grid Parcel (refer to Section 3.2.11 and 4.2.11). Sites VAD982677429 and 988224937 are not located near any of the FASTC parcels.

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The DEQ's Federal Facilities Restoration Program reviewed this submittal and it appears that the project will not impact any sites at Fort Pickett (Environmental Restoration Program, Base Realignment and Closure, and Formerly Used Defense Sites).

Solid Waste Facility C2-N

- SWP333 – U.S. Army Fort Pickett, Closed Sanitary Landfill, Rives Road at 9th Street, Blackstone, VA 23824.

Petroleum Release Site

- ID# 20112039 – Grant Residence, 39 Maple Lane, Blackstone, VA 23824. Event Date: 10/25/2010. Status: Closed.

5(c) Requirements.

5(c)(i) Asbestos-Containing Materials and Lead-Based Paint. All structures being demolished or removed should be checked for asbestos-containing materials (ACM) and lead-based paint (LBP) prior to demolition. If ACM and LBP are found, in addition to the federal waste-related regulations mentioned above, state regulations 9VAC20-81-640 for ACM and 9VAC20-60-261 for LBP must be followed. C2-O

5(c)(ii) Soil and Waste Management. Any soil that is suspected of contamination or wastes that are generated must be tested and disposed of in accordance with applicable Federal, State, and local laws and regulations. C2-P

5(c)(iii) Petroleum Storage Tanks. Conduct the removal, relocation or closure of any regulated petroleum storage tanks – aboveground storage tanks (ASTs) or underground storage tank (USTs) – in accordance with the requirements of the Virginia Tank Regulations 9VAC25-91-10 *et seq.* for ASTs and 9VAC25-580-10 *et seq.* for USTs. Report the installation or use of any portable aboveground petroleum storage tank (> 660 gallons, 9VAC 25-91-10 *et seq.*) for more than 120 days the DEQ BRRO Petroleum Storage Tank Program. C2-Q

5(d) Agency Recommendations.

- DEQ encourages all projects and facilities to implement pollution prevention principles, including: C2-R
  - the reduction, reuse and recycling of all solid wastes generated; and
  - the minimization and proper handling of generated hazardous wastes.

GSA Response

C2-N
(Response provided on previous page.)

C2-O
As indicated in section 4.2.11.1, surveys would be conducted prior to demolition and any disposal would be adhere to applicable state, federal, and local requirements for protecting human health and safety and the environment.

C2-P
Procedures would be in place for safe handling, use, and disposal of existing or introduced hazardous substances and waste during demolition, construction, and operations. Also refer to Response C2-N.

C2-Q
Section 4.2.11.1 indicates that tanks would be removed and closed by a licensed contractor in coordination with VDEQ. Additional investigations have been conducted since publication of the Draft EIS to locate and characterize soil conditions associated with undocumented USTs/ASTs to the extent feasible. The results of these investigations are included in Section 4.2.11 of this Supplemental Draft EIS. Contaminant levels are not anticipated to be high and would be managed on a case by case basis in accordance with applicable federal, state, and local regulations, if such locations are encountered during demolition activities. If unregistered or unknown USTs are encountered during construction, they would be removed and closed by a licensed contractor in coordination with VDEQ.

C2-R
Chapter 6 and Table 6.16-1 of the Draft and Supplemental Draft EIS discuss impact minimization and mitigation measures including pollution prevention and hazardous materials/hazardous waste management (CERCLA, RCRA, Oil Pollution Act, Pollution Prevention Act). The description of the Proposed Action (Section 2.1) addresses energy efficiency and reduction of waste, pollution, and environmental impacts to achieve certification as LEED Silver buildings. Pollution prevention principles are also incorporated into GSA Sustainable Design Principles.

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- Contact the U.S. Environmental Protection Agency (EPA) for information concerning Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) obligations at Fort Pickett's Main Post, including establish the nature and extent of any known environmental contamination at or near Fort Pickett, or other Areas of Concern (AOCs) which may be in close proximity to the proposed project. C2-R

6. Natural Heritage Resources. The EIS (pages 4-16 and 4-17) states that mitigation for habitat loss would be implemented to the extent feasible.

6(a) Agency Jurisdiction.

6(a)(i) Natural Heritage Resources. The mission of the DCR is to conserve Virginia's natural and recreational resources. DCR supports a variety of environmental programs organized within seven divisions including the Division of Natural Heritage (DNH). DNH's mission is conserving Virginia's biodiversity through inventory, protection, and stewardship. The Virginia Natural Area Preserves Act, 10.1-209 through 217 of the *Code of Virginia*, was passed in 1989 and codified DCR's powers and duties related to statewide biological inventory: maintaining a statewide database for conservation planning and project review, land protection for the conservation of biodiversity, and the protection and ecological management of natural heritage resources (the habitats of rare, threatened and endangered species, significant natural communities, geologic sites, and other natural features).

6(a)(ii) Threatened and Endangered Plant and Insect Species. The Endangered Plant and Insect Species Act of 1979, Chapter 39, §3.1-102- through 1030 of the *Code of Virginia*, as amended, authorizes the Virginia Department of Agriculture and Consumer Services (VDACS) to conserve, protect and manage endangered species of plants and insects. VDACS Virginia Endangered Plant and Insect Species Program personnel cooperates with the U.S. Fish and Wildlife Service (FWS), DCR DNH and other agencies and organizations on the recovery, protection or conservation of listed threatened or endangered species and designated plant and insect species that are rare throughout their worldwide ranges. In those instances where recovery plans, developed by FWS, are available, adherence to the order and tasks outlined in the plans should be followed to the extent possible. VDACS has regulatory authority to conserve rare and endangered plant and insect species through the Virginia Endangered Plant and Insect Species Act. Under a Memorandum of Agreement established between the VDACS and DCR, DCR has the authority to report for VDACS on state-listed plant and insect species.

GSA Response
C2-R
(Response provided on previous page.)

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6(b) Agency Findings. The DCR DNH searched its Biotics Data System for occurrences of natural heritage resources from the project area. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information in DCR's files, the Fort Pickett Impact Area is within the project vicinity. Conservation sites are tools for representing key areas of the landscape that warrant further review for possible conservation action because of the natural heritage resources and habitat they support. Conservation sites are polygons built around one or more rare plant, animal, or natural community designed to include the element and, where possible, its associated habitat, and buffer or other adjacent land thought necessary for the element's conservation. Conservation sites are given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain; on a scale of 1-5, 1 being most significant. Fort Pickett Impact Area Conservation Site has been given a biodiversity significance ranking of B1, which represents a site of outstanding significance. The natural heritage resource of concern at this site is Michaux's sumac (*Rhus michauxii*, G2G3/S1/LE/LT). C2-S

Michaux's sumac is a dioecious shrub that grows from 0.3 – 0.6 meter tall (NatureServe 2011). This plant occurs in sandy or rocky, open, hardwood-dominated forests and savannas (Van Alstine and Smith, 1995), sometimes in association with circumneutral soils. It is dependent upon some form of disturbance to maintain its open habitat (NatureServe 2011). Periodic, naturally occurring fires provided such disturbance historically; however, today many of this plant's occurrences are in areas artificially disturbed such as highway, powerline and railroad rights-of-way, edges of cultivated fields, and other cleared lands. In Virginia, all but one of the known occurrences are located within Fort Pickett in the southern Piedmont where it is maintained by frequent fires. The major threats to Michaux's sumac include fire suppression and habitat degradation (NatureServe 2011). The optimal survey time period for Michaux's sumac is during the period of flowering / fruiting from June 1 – October 31 when the plant has higher visibility, but the plant can be identified as long as the leaves are present from May 1 – October 31. Michaux's sumac is classified as endangered by the FWS and listed as threatened by the Virginia Department of Agriculture and Consumer Services (VDACS).

6(c) State-listed Plant and Insect Species.

- As identified in Item 6(b), Michaux's sumac is classified as endangered by VDACS. Due to the potential for this site to support populations of Michaux's sumac, DCR recommends an inventory for the resource in the study area. With the survey results, DCR DNH can more accurately evaluate potential impacts to C2-T

GSA Response

C2-S

Section 3.1.5.3 of the Draft EIS identified Michaux's sumac as a federally listed species known to be present at Fort Pickett. All details about state and federal threatened and endangered species were provided in correspondence to Ms. Rene Hypes, Virginia Department of Conservation and Recreation (DCR) Division of Natural Heritage, dated July 16, 2012.

Section 3.1.5.3 of the Draft and Supplemental Draft EIS indicates that the only suitable habitat for Michaux's sumac in the project area was on an existing power line on LRA Parcel 10. GSA contracted with a USFWS approved botanist to conduct a survey for Michaux's sumac, and the plant was not found. The findings of this survey were included in correspondence sent to DCR on July 16 2012 (refer to Appendix C of the Draft and Supplemental Draft EIS) and were included in Section 3.1.5.3 of the Draft and Supplemental Draft EIS. Refer to Appendix C for the correspondence, which includes the Michaux's sumac survey submitted to USFWS and USFWS concurrence with GSA's "no affect" determination with regards to Michaux's Sumac. LRA Parcel 10 is no longer included in the proposed site for Build Alternative 3 in this Supplemental Draft EIS.

C2-T

Refer to Response C2-S.

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natural heritage resources and offer specific protection recommendations for minimizing impacts to the documented resources. Survey results should be coordinated with DCR DNH and FWS. Upon review of the results, if it is determined the species is present, and there is a likelihood of a negative impact on the species, DCR DNH will recommend coordination with VDACS to ensure compliance with Virginia's Endangered Plant and Insect Species Act. C2-T

- VDACS did not respond to DEQ's request for comment.

6(d) Natural Area Preserves. DCR found that there are no State Natural Area Preserves under its jurisdiction in the project vicinity. C2-U

6(e) Agency Recommendations. DCR DNH has the following recommendations:

- Conduct inventory for Michaux's sumac in the study area.
- Coordinate survey results with DCR DNH (and VDACS if directed by DCR DNH) and FWS.
- Coordinate with DHR DNH since its biologists are qualified and available to conduct inventories for rare, threatened, and endangered species and to discuss arrangements for field work. C2-V

7. Fisheries and Wildlife Management. The EIS (page 4-17) states that impacts to protected species would be minimized through regulatory compliance.

7(a) Jurisdiction. The Department of Game and Inland Fisheries (DGIF), as the Commonwealth's wildlife and freshwater fish management agency, exercises enforcement and regulatory jurisdiction over wildlife and freshwater fish, including state- or federally-listed endangered or threatened species, but excluding listed insects (Virginia Code Title 29.1). DGIF is a consulting agency under the U.S. Fish and Wildlife Coordination Act (16 U.S.C. sections 661 *et seq.*) and provides environmental analysis of projects or permit applications coordinated through DEQ and several other state and federal agencies. DGIF determines likely impacts upon fish and wildlife resources and habitat, and recommends appropriate measures to avoid, reduce or compensate for those impacts.

7(b) Agency Findings. According to DGIF's records, the state-listed threatened barking tree frogs have been documented from the project area. However, DGIF believes these specimens were moved to this site in agricultural supplies and are not a native population of the species. Therefore, DGIF has determined this project is not likely to result in adverse impacts upon this species. C2-W

7(c) Agency Comments. DGIF generally does not support proposals to mitigate wetland impacts through the construction of stormwater management ponds or support C2-X

GSA Response

C2-T
(Response provided on previous page.)

C2-U
Comment noted.

C2-V
Refer to response C2-S.

C2-W
Comment noted.

C2-X
Sections 4.1.4.3 and 6.3 of the Draft and Supplemental Draft EIS note proposed mitigation through wetland mitigation banks. Stormwater management ponds are not part of the planned mitigation for wetland impacts. GSA will coordinate with Commonwealth of Virginia agencies regarding mitigation during the Joint Permit Application process.

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the creation of in-stream stormwater management ponds. DGIF is willing to assist the GSA in developing a plan that includes open-space, wildlife habitat, and natural stream channels which retain their wooded buffers. C2-X

7(d) Agency Recommendations. To minimize overall impacts to wildlife and natural resources, DGIF offers the following recommendations about development activities:

- Avoid and minimize impacts to undisturbed forest, wetlands, and streams to the fullest extent practicable. Avoidance and minimization of impact may include relocating stream channels as opposed to filling or channelizing as well as using, and incorporating into the development plan, a natural stream channel design and wooded buffers.
- Maintain undisturbed wooded buffers of at least 100 feet in width around all on-site wetlands and on both sides of all perennial and intermittent streams. C2-Y
- Maintain wooded lots to the fullest extent possible.
- Design the stormwater controls for this project to replicate and maintain the hydrographic condition of the site prior to the change in landscape. This should include, but not be limited to the following:
  - using bioretention areas; and
  - minimizing the use of curb and gutter in favor of grassed swales.

  Bioretention areas (also called rain gardens) and grass swales are components of Low Impact Development (LID). They are designed to capture stormwater runoff as close to the source as possible and allow it to slowly infiltrate into the surrounding soil. They benefit natural resources by filtering pollutants and decreasing downstream runoff volumes.
- Adhere to a time-of-year restriction from March 15 to August 15 of any year to protect nesting resident and migratory songbirds.
- Adhere to erosion and sediment controls during ground disturbance.

7(e) Additional Information. DGIF maintains a database (*http://vafwis.org/fwis/)* of wildlife locations, including threatened and endangered species, trout streams and anadromous fish waters.

8. Forestry Resources. The EIS (page ES-9) states that 500 to 525 acres of forested area may be impacted by the proposed action.

8(a) Agency Jurisdiction. The mission of the Department of Forestry (DOF) is to protect and develop healthy, sustainable forest resources for Virginians. DOF was established in 1914 to prevent and suppress forest fires and reforest bare lands. Since the Department's inception, it has grown and evolved to encompass other protection and management duties including: protecting Virginia's forests from wildfire, protecting

GSA Response

C2-X
(Response provided on previous page.)

C2-Y
Chapter 6 and Table 6.16-1 of the Draft and Supplemental Draft EIS list impact minimization and mitigation measures that would be incorporated into the project, including many that are noted by Virginia Department of Game and Inland Fisheries.
Extensive efforts have been made in the alternatives planning process (refer to Chapter 2 of the Draft and Supplemental Draft EIS) to minimize impacts where feasible. A 100-foot buffer would be maintained around wetlands and streams wherever feasible.

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Virginia's waters, managing and conserving Virginia's forests, managing state-owned lands and nurseries, and managing regulated incentive programs for forest landowners.

8(b) Agency Finding. The DOF finds that this project will have a significant impact on the forest resources of the Commonwealth from the removal of 525 acres of heavily forested land. This includes areas within identified project parcels LRA 10 and 21/20 that have been determined to have a high forest conservation value (FCV) (4 out of possible 5 ranking) employing the DOF InForest Geographic Information System analysis and evaluation methodology. Virginia has been losing approximately 16,000 acres of forestland annually based on a 10-year average ending in 2010, and urbanization and development represent the single biggest factor in the loss of this forestland acreage. C2-Z

8(c) Agency Recommendations. DOF recommends that GSA develop a forest mitigation plan to support the Governor's goal to conserve 400,000 acres of land by the end of his administration and DOF policy objectives for limiting the rate and degree of forestland loss in the Commonwealth as the project moves forward. DOF welcomes discussions with the Foreign Affairs Security Training Center sponsors concerning potential mitigation plan options for this project.

These options could be structured to help meet DOF forest conservation objectives and complement Department of Defense (DOD) and DGIF species habitat considerations, while simultaneously further enhancing forested national security buffers around sensitive areas within the center's development footprint. Given these objectives, potential opportunities for mitigation include but are not limited to the following: C2-AA

- *LRA parcel 9, the Grid and 21/20:* Design development footprints for each parcel to maximize the amount of forested area between the sections to be developed and the surrounding undeveloped forest.
  - This suggestion is made to keep forest fragmentation to a minimum and to support DoD and DGIF objectives that the value of the retained forest to interior species is optimized. Of particular interest to DOF is the forest block located on the westernmost portion of LRA Parcel 9 that is considered in the EIS to be large enough to have moderate value to forest interior species and areas within 21/20 that have been determined to have high FCV as determined by the DOF InForest evaluation program.
- *LRA parcel 10:* Submit additional information to DOF about the proposed development footprint for review and comment.
  - The EIS offers only general guidance on development plans and LRA parcel 10 contains high FCV areas. The forest conservation value of LRA parcel 10 is considered high because it is a second growth mixed forest

GSA Response

C2-Z

The Virginia Department of Forestry's (DOF) determination of significant impact to forest resources is noted. Reducing impacts to vegetation has been a primary planning consideration in the development of the alternatives, and vegetation would be re-planted where feasible to offset the impacts. Forest impacts have been reduced with Build Alternative 3 as compared with the 2012 build alternatives. Refer to Supplemental Draft EIS Sections 2.2.2.2, 4.1.5.3, and 6.4.1 and Tables ES-2 and 6.16-1 for forest impact avoidance, minimization, and mitigation measures that would be incorporated into the design of the project to reduce project impacts to forest and other vegetation communities.

C2-AA

GSA would consider additional forest mitigation contingent upon availability of funding. There is no guarantee funding would be available to support the suggested mitigation plan options, but during facility design GSA would incorporate all practicable measures to reduce long term forest impacts and implement mitigation to the extent feasible. Also refer to Response C2-Z.

Sections 4.1.4.3 and 6.3, and Table 6.16-1 of the Draft and Supplemental Draft EIS discuss avoidance, minimization, and mitigation measures for the protection of wetlands and streams on or adjacent to the project site parcels.

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that has been subject to very little previous development, it is part of a larger contiguous forest, and its western edge abuts a wetland area that may have water quality value for the adjacent residential areas. C2-AA

- *State to federal land conversion*: Consult with DOF regarding LRA parcel 9 and LRA parcel 10 (since these parcels will convert to federal land under the preferred build alternative) on the outline of the parcel footprints as the project proceeds through its various phases so forest mitigation efforts can be optimized. C2-BB
- *Buffer extension:* Coordinate discussion with DOF and Fort Pickett representatives on the possibility of extending the current Army Compatible Use Buffer north of Lunenburg County to provide additional protection for existing forest as well as providing additional security. C2-CC
- *Forest replacement:* Under the preferred build alternative option, 525 acres of heavily forested land will be lost and DOF would like to see that loss mitigated. Potential opportunities for mitigation include but are not limited to the following recommendations: C2-DD
  - Reforest and protect open federal lands within the Commonwealth of Virginia to create forestlands.
  - U.S. Army Fort Pickett, as the landlord installation for the proposed center, could work with DOF or another Virginia conservation agency or group to create a forest land conservation fund that would be used for the purchase of conservation easements or property acquisitions of forestlands. These purchases could be within the impacted area or statewide and would ensure that the forested lands are managed and retained as forest lands in perpetuity.

9. Geologic Resources.

9(a) Agency Jurisdiction. The DMME, through its six divisions, regulates the mineral industry, provides mineral research and offers advice on wise use of resources. The Department's mission is to enhance the development and conservation of energy and mineral resources in a safe and environmentally sound manner in order to support a more productive economy in Virginia.

9(b) Agency Comments. The DMME did not respond to DEQ's request for comments. C2-EE

For information on geologic resources, contact DMME (David Spears at *David.Spears@dmme.virginia.gov*).

GSA Response

C2-AA
(Response provided on previous page.)

C2-BB
Refer to Response C2-AA

C2-CC
Refer to Response C2-AA

C2-DD
Refer to Response C2-AA

C2-EE
Comment noted.

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10. Historic and Archaeological Resources. The EIS (page 4-22) states that GSA will comply with Section 106 requirements.

10(a) Agency Jurisdiction. DHR conducts reviews of projects to determine their effect on historic structures or cultural resources under its jurisdiction. DHR, as the designated State's Historic Preservation Office, ensures that federal actions comply with Section 106 of the National Historic Preservation Act of 1962 (NHPA), as amended, and its implementing regulation at 36 CFR Part 800. The NHPA requires federal agencies to consider the effects of federal projects on properties that are listed or eligible for listing on the National Register of Historic Places. Section 106 also applies if there are any federal involvements, such as licenses, permits, approvals or funding. DHR also provides comments to DEQ through the state environmental impact report review process.

10(b) Agency Finding. DHR states that it has been in consultation with the GSA regarding this project. DHR's detailed comments submitted directly to the GSA are attached for reference. A brief summary of the letter regarding Phase I and II Cultural Resource Surveys follows. DHR states that the architectural surveys meet DHR's Data Sharing System Quality Control Standards. DHR concurs with the GSA's consultant that identified resources are not recommended as individually eligible for listing in the Virginia Landmarks Register (VLR) or the National Register of Historic Places (NRHP). However, one previously surveyed resource (Farley's) along West Entrance Road should be considered potentially eligible. DHR also states that the archaeological resource reports submitted for review meet its requirements. However, DHR states that it does not agree with the consultant that sufficient research has been conducted in connection with the isolated grave stone. DHR also requests additional information on two identified archaeological sites. DHR concludes by stating that it does not plan to comment on effects to historic properties until it receives additional information. C2-FF

10(c) Agency Recommendation. DHR requests that the GSA continue to consult directly with DHR pursuant to Section 106 of the National Historic Preservation Act (as amended) and its implementing regulations codified at 36 CFR Part 800 which require federal agencies to consider the effects of their undertakings on historic properties. C2-GG

10(d) Requirement. The GSA must comply with Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations at 36 CFR 800. C2-HH

11. Public Water Supply. The EIS (pages 4-7 and 4-10) states that the build alternatives would use publicly supplied drinking water.

GSA Response

C2-FF
Additional research on the isolated grave stone and two identified archaeological sites has been conducted and the updated Phase I and Phase II Archaeological Report and Addendum Phase II Evaluation Report have been updated and resubmitted to DHR. Section 4.2.1 and Appendices E and F of the Supplemental Draft EIS have been updated to include the additional information and correspondence.

C2-GG
GSA will continue consultation with DHR pursuant to section 106 of NHPA.

C2-HH
Section 4.2.1.3 indicates that compliance with Section 106 would take place and that any mitigation measures would be determined through consultation.

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11(a) Agency Jurisdiction. The Virginia Department of Health (VDH) Office of Drinking Water (ODW) reviews projects for the potential to impact public drinking water sources (groundwater wells, springs and surface water intakes). VDH administers both federal and state laws governing waterworks operation.

11(b) Agency Findings. VDH ODW finds that there are no apparent impacts to public drinking water sources due to this project. No groundwater wells are within a 1-mile radius. No surface water intakes are located within a 5-mile radius of the project site. The project does not fall within Zone 1 (up to 5 miles into the watershed). The project is within Zone 2 (greater than 5 miles into the watershed) of one public surface water source but is outside of VDH's review area. C2-II

11(c) Requirements.

- Installation of new water lines and appurtenances must comply with the state's waterworks regulations.
- Potential impacts to public water distribution systems must be verified by the local utility, according to VDH. C2-JJ

11(d) Agency Recommendation. VDH recommends correcting an error in Chapter 3.2.8.1 under "Utilities and Infrastructure/Potable Water" to reflect that VDH ODW, under the requirements of the Safe Drinking Water Act and the provisions of the Virginia Waterworks Regulations, permits the Town of Blackstone's Water Treatment Plant (Blackstone, Town of; Waterworks ID #VA5135100), instead of DEQ. C2-KK

11(e) Water Conservation Recommendations. DEQ recommends that the GSA considers the following water conservation measures to the extent practicable:

- Grounds should be landscaped with hardy native plant species to conserve water as well as minimize the need to use fertilizers and pesticides.
- Convert turf to low water-use landscaping such as drought resistant grass, plants, shrubs and trees.
- Consider installing low-flow restrictors/aerators to faucets.
- Improve irrigation practices by:
  - upgrading with a sprinkler clock; watering at night, if possible, to reduce evapotranspiration (lawns need only 1 inch of water per week and do not need to be watered daily; over watering causes 85 percent of turf problems);
  - installing a rain shutoff device; and
  - collecting rainwater with a rain bucket or cistern system with drip lines.
- Consider replacement of old equipment with new high-efficiency machines to reduce water usage by 30-50 percent per use.
- Check for and repair leaks during routine maintenance activities.

C2-LL

GSA Response

C2-II
Comment noted

C2-JJ
All applicable regulations concerning the water lines would be adhered to for the proposed project. Town of Blackstone officials have been notified of the predicted waters demands and have indicated that they have no concerns about the proposed demand. Also refer to Section 4.2.8 of the Draft and Supplemental Draft EIS.

C2-KK
In the Supplemental Draft EIS, Section 3.2.8.1 has been revised to indicate the Virginia Department of Health Office of Drinking Water permits the water treatment plant.

C2-LL
As noted in Sections 4.1.4.1, 4.1.4.3, 4.3.1, 5.4.4, and 6.3 of the Draft and Supplemental Draft EIS, LID methods would be utilized to the extent feasible, including but not limited to Sec 438 of the Energy Independence and Security Act, GSA sustainability guidelines, and LEED design criteria. Specific measures that would be incorporated into the design, including ultra-low flow fixtures, rain collection, use of grey water, native plant species for non-irrigated landscaping, and avoidance of permanent irrigation, have been added to Sections 4.2.8.3 and 6.12 and Tables ES-2 and 6.16-1 of the Supplemental Draft EIS.

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12. Sewage Systems.

12(a) Discharging Sewer System Regulations. DEQ has approval authority for most discharging sewage collection systems and treatment works, except for single family home (less than 1,000 gallon per day) systems. This authority is contained in the Sewage Collection and Treatment (SCAT) Regulations (9VAC25-790 *et seq.*). Additional information is available on the DEQ website at *www.deq.virginia.gov/Programs/Water/WastewaterAssistanceTraining/WastewaterEngineering/Regulations.aspx.* Construction of sanitary wastewater collection systems must comply with the state's sewerage regulations.

12(b) Requirements.

- Contact DEQ BRRO to ensure compliance with the SCAT Regulations, as applicable.
- Potential impacts to sanitary sewage collection systems must be verified by the local utility, according to VDH.

C2-MM

13. Aviation Impacts. According to the EIS, the proposed facility is near the Blackstone Army Airfield/Allen C. Perkinson Municipal Airport (page 3-68).

13(a) Agency Jurisdiction. The Virginia Department of Aviation (DOAv) is a state agency that plans for the development of the state aviation system; promotes aviation; grants aircraft and airports licenses; and provides financial and technical assistance to cities, towns, counties and other governmental subdivisions for the planning, development, construction and operation of airports, and other aviation facilities.

13(b) Agency Finding. DOAv states that it does not object to the project. However, due to the proximity of the proposed transmission lines that will be erected as part of this project to the Allen C. Perkinson/Blackstone Airfield, GSA is required to submit a 7460 Form to the Federal Aviation Administration (FAA) to determine if the proposal will constitute a hazard to air navigation. If the FAA deems the proposed development to be a hazard to air navigation, DOAV would not object to mitigation measures, such as obstruction lights, provided there are no negative impacts to the approach minimums to the airport and the measures will not result in the reduction of runway length.

C2-NN

13(c) Requirements.

- Take all efforts to limit the dust/glare generated from this project that could potentially negatively impact aircraft operations.
- Submit 7460 Form to the FAA for review.

C2-OO

GSA Response

C2-MM
All applicable regulations concerning the sewer collection system would be adhered to for the proposed project. Town of Blackstone officials have been notified of the predicted sewer demands and have indicated that they have no concerns about proposed demand. Sections 4.2.8.1 and 5.4.13 of the Supplemental Draft EIS contain updated information about sewer capacity.

C2-NN
Form 7460 would be submitted to the FAA.

C2-OO
Form 7460 would be submitted to the FAA. Noted requirements have been added to Sections 4.2.4.1 and 6.8 and Tables ES-2 and 6.16-1 of the Supplemental Draft EIS.

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14. Transportation Impacts. The EIS (page 4-63) indicates that there would be an increase in traffic but road improvements would be implemented.

14(a) Agency Jurisdiction. The Virginia Department of Transportation (VDOT) provides comments pertaining to potential impacts to existing and future transportation systems.

14(b) Agency Comments. VDOT did not respond to DEQ's request for comments. C2-PP

15. Agricultural Lands. The EIS (pages 4-4 and 4-5) states that the build alternatives would impact 20 acres of prime farmland soils, but the impact would not be significant based on site assessment criteria and coordination with the Natural Resources Conservation Service.

15(a) Agency Jurisdiction. The 2001 Virginia General Assembly established the Office of Farmland Preservation within VDACS to help reduce the loss of agricultural land.

15(b) Agency Comments. VDACS did not respond to DEQ's request for comments. C2-QQ

15(c) Recommendation. Coordinate the proposed development with VDACS (*Keith.Tignor@vdacs.virginia.gov*). C2-RR

16. Pollution Prevention. DEQ advocates that principles of pollution prevention be used in all construction projects as well as in facility operations. Effective siting, planning, and on-site Best Management Practices (BMPs) will help to ensure that environmental impacts are minimized. However, pollution prevention techniques also include decisions related to construction materials, design, and operational procedures that will facilitate the reduction of wastes at the source. C2-SS

16(a) Recommendations. We have several pollution prevention recommendations that may be helpful in constructing or operating this project: C2-TT

- Consider development of an effective Environmental Management System (EMS). An effective EMS will ensure that the proposed facility is committed to minimizing its environmental impacts, setting environmental goals, and achieving improvements in its environmental performance. DEQ offers EMS development assistance and recognizes facilities with effective Environmental Management Systems through its Virginia Environmental Excellence Program.
- Consider environmental attributes when purchasing materials. For example, the extent of recycled material content, toxicity level, and amount of

GSA Response

C2-PP
VDOT submitted comments under a separate letter. Refer to comments and responses C1-A through C1-P.

C2-QQ
Comment noted.

C2-RR
Comment noted.

C2-SS
Chapter 6 and Table 6.16-1 of the Draft and Supplemental Draft EIS discuss impact minimization and mitigation measures including pollution prevention The description of the Proposed Action (Section 2.1) addresses energy efficiency and reduction of waste, pollution, and environmental impacts to achieve certification of LEED Silver buildings. Pollution prevention principles are also incorporated into GSA Sustainable Design Principles.

C2-TT
Comment noted; also refer to response C2-SS.

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packaging should be considered and can be specified in purchasing contracts.

- Consider contractors' commitment to the environment when choosing contractors. Specifications regarding raw materials and construction practices can be included in contract documents and requests for proposals. C2-TT
- Choose sustainable materials and practices for building construction and design.
- Integrate pollution prevention techniques into the facility maintenance and operation, to include inventory control for centralized storage of hazardous materials. Maintenance facilities should have sufficient and suitable space to allow for effective inventory control and preventive maintenance.

DEQ's Office of Pollution Prevention provides information and technical assistance relating to pollution prevention techniques and EMS. If interested, please contact DEQ (Sharon Baxter at 804-698-4344).

17. Regional and Local Comments. The Richmond Regional Commission, Crater Planning District Commission, Commonwealth Regional Commission, Southside Planning District Commission, Nottoway County, Town of Blackstone, Amelia County, Prince Edward County, Brunswick County, Chesterfield County, Dinwiddie County and Lunenburg County were invited to comment.

17(a) Agency Jurisdiction. In accordance with the Code of Virginia, Section 15.2-4207, planning district commissions encourage and facilitate local government cooperation and state-local cooperation in addressing, on a regional basis, problems of greater than local significance. The cooperation resulting from this is intended to facilitate the recognition and analysis of regional opportunities and take account of regional influences in planning and implementing public policies and services. Planning district commissions promote the orderly and efficient development of the physical, social and economic elements of the districts by planning, and encouraging and assisting localities to plan, for the future.

17(b) Comments.

- Lunenburg County states that it supports the project.
- Prince Edward County has no comments.
- Nottoway County states that as this facility will be entirely contained within the county, its impacts are of special interest to its citizens and elected leaders. Despite the size and complexity of the project, the county states that its review of the EIS has not shown any potential impacts to be problematic for Nottoway County. It also appears to have no negative impacts to the surrounding area. The C2-UU

GSA Response

C2-TT

(Response provided on previous page.)

C2-UU

Comment noted.

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Board of Supervisors is unanimous in its support of the draft EIS and the project as presented.

- The Crater Planning District Commission finds the proposal to be in full accord with the commission's environmental policy directives.
- The Richmond Regional Planning District Commission states that it defers comments to other planning district commissions and localities since the project site is outside of its boundary.

C2-UU

Commonwealth Regional Commission, Southside Planning District Commission, Town of Blackstone, Amelia County, Brunswick County, Chesterfield County, and Dinwiddie County did not respond to DEQ's request for comments.

REGULATORY AND COORDINATION NEEDS

1. Subaqueous Lands. The Virginia Marine Resources Commission (VMRC), pursuant to Virginia Code § 28.2-1200 through 1400, regulates encroachments in, on or over any state-owned bays, rivers, streams or creeks throughout the Commonwealth. For information on permits issued by the VMRC and on submitting a JPA, contact the VMRC Habitat Management Division (Tony Watkinson at 757-247-2250 or *Tony.Watkinson@mrc.virginia.gov*). C2-VV

2. Water Quality. GSA should ensure compliance with the Virginia Water Protection (VWP) Program pursuant to Virginia Code §62.1-44.15:20 *et seq.* and Virginia regulations 9VAC25-210-10 *et seq.* Contact DEQ BRRO (Kip Foster at *Kip.Foster@deq.virginia.gov*) if impacts to wetlands or streams are proposed to ensure compliance with the VWP Program. C2-WW

3. Air Quality Regulations. According to the DEQ Air Division, the following regulations may apply:

- 9VAC5-50-60 *et seq.* of the regulations governing fugitive dust.
- 9VAC5-130 *et seq.* of the regulations governing open burning.

For information on local requirements pertaining to open burning, contact Nottoway County. C2-XX

3(a) Fuel-burning Equipment. Contact DEQ BRRO (David Jed Brown at 434-582-6210 or *David.Brown@deq.virginia.gov*) for potential requirements related to registration of new equipment, as applicable. C2-YY

GSA Response

C2-UU
(Response provided on previous page.)

C2-VV
Refer to response C2-A.

C2-WW
Refer to response C2-D.

C2-XX
Refer to responses C2-J and C2-K.

C2-YY
Refer to response C2-L.

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4. Erosion and Sediment Control and Stormwater Management.

4(a) Erosion and Sediment Control. If this project will disturb equal to or greater than 10,000 square feet on public or private lands, the property owner must submit a project-specific erosion and sediment control plan to the DCR Southern Piedmont Office at (434) 210-0287 (Reference: VESCL §10.1-563; VESCR §4VAC50-30-30, §4VAC50-30-40). C2-ZZ

4(b) General Permit for Stormwater Discharges from Construction Activities. For projects involving land-disturbing activities equal to or greater than 1 acre, the owner or operator of construction activities are required to apply for registration coverage under the General Permit for Discharges of Stormwater from Construction Activities and develop a project-specific stormwater pollution prevention plan (SWPPP). The SWPPP must address water quality and quantity in accordance with the Virginia Stormwater Management Program (VSMP) Permit Regulations. Specific questions regarding the Stormwater Management Program requirements should be directed to Holly Sepety with DCR at (804) 225-2613 (Reference: VSWML §10.1-603.1 *et seq.*; VSMP Permit Regulations §4VAC-50 *et seq.*). C2-AAA

5. Solid Waste and Hazardous Substances. All solid waste, hazardous waste, and hazardous materials must be managed in accordance with all applicable federal, state, and local environmental regulations.

Applicable state regulations may include:

- Virginia Waste Management Act (*Code of Virginia* section 10.1-1400 *et seq.*);
- Virginia Hazardous Waste Management Regulations (VHWMR) (9VAC20-60);
- Virginia Solid Waste Management Regulations (VSWMR) (9VAC20-81); and
- Virginia Regulations for the Transportation of Hazardous Materials (9VAC20-110).

Applicable federal regulations may include:

- Resource Conservation and Recovery Act (RCRA) (42 U.S.C. section 6901 *et seq.*), and the applicable regulations contained in Title 40 of the Code of Federal Regulations; and
- U.S. Department of Transportation Rules for Transportation of Hazardous Materials, 49 CFR Parts 107, 171.1-172.558.

For additional information on waste management, contact DEQ BRRO (Aziz Farahmand at 540-562-6872 or Aziz.Farahmand@deq.virginia.gov). C2-BBB

5(a) Asbestos-Containing Material. It is the responsibility of the owner or operator of a renovation or demolition activity, prior to the commencement of the renovation or C2-CCC

GSA Response

C2-ZZ
Refer to response C2-G.

C2-AAA
Refer to response C2-H.

C2-BBB
Solid waste, hazardous waste, and hazardous materials would be managed in accordance with all applicable federal, state, and local regulations.

C2-CCC
Refer to response C2-O.

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demolition, to thoroughly inspect the affected part of the facility where the operation will occur for the presence of asbestos, including Category I and Category II nonfriable asbestos-containing material (as applicable). Upon classification as friable or non-friable, all asbestos-containing material shall be disposed of in accordance with the Virginia Solid Waste Management Regulations (9VAC20-81-640) and transported in accordance with the Virginia regulations governing Transportation of Hazardous Materials (9VAC20-110-10 *et seq.*). Contact the DEQ Division of Land Protection and Revitalization (formerly the Waste Division) (Linda Richardson at 804-698-4318) and the Department of Labor and Industry (Ronald L. Graham 804-371-0444) for additional information. C2-CCC

5(b) Lead-Based Paint. If applicable, this project must comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations and with the Virginia Lead-Based Paint Activities Rules and Regulations. For additional information regarding these requirements, contact the Department of Professional and Occupational Regulation (David Dick at 804-367-8588). C2-DDD

5(c) Coordination.

- Contact the U.S. Environmental Protection Agency (EPA) (Jerry Hoover, Regional Project Manager, at 215-814-2077) for information concerning Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) obligations at Fort Pickett's Main Post, including establish the nature and extent of any known environmental contamination at or near Fort Pickett, or other Areas of Concern (AOCs) which may be in close proximity to the proposed project.
- Conduct the removal, relocation or closure of any regulated petroleum storage tanks – aboveground storage tanks (ASTs) or underground storage tank (USTs) –in accordance with the requirements of the Virginia Tank Regulations 9VAC25-91-10 *et seq.* for ASTs and 9VAC25-580-10 *et seq.* for USTs. Documentation and / or questions should be submitted to DEQ BRRO (David Miles at 540-562-6741 or *David.Miles@deq.virginia.gov*).
- Report the installation or use of any portable aboveground petroleum storage tank (> 660 gallons, 9VAC 25-91-10 *et seq.*) for more than 120 days the DEQ BRRO Petroleum Storage Tank Program (David Miles at 540-562-6741 or *David.Miles@deq.virginia.gov*).

C2-EEE

6. Protected Species and Natural Heritage Resources.

- Coordinate survey results for Michaux's sumac with DCR DNH (Rene Hypes at *Rene.Hypes@dcr.virginia.gov* or 804-371-2708) and FWS (Cindy Schulz at 804-693-6694 or *cindy_schulz@fws.gov*). C2-FFF

GSA Response

C2-CCC
(Response provided on previous page.)

C2-DDD
Section 4.2.11.1 of the Draft and Supplemental Draft EIS indicates that LBP would be characterized, managed, transported, and disposed of according to applicable state, federal, and local requirements for protecting human health and safety and the environment.

C2-EEE
Refer to response C2-P and C2-R.

C2-FFF
Refer to response C2-T.

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- Coordinate with DHR DNH (J. Christopher Ludwig, Natural Heritage Inventory Manager, at *chris.ludwig@dcr.virginia.gov* or 804-371-6206) since its biologists are qualified and available to conduct inventories for rare, threatened, and endangered species and to discuss arrangements for field work.
- Coordinate with VDACS (Keith Tignor at 804-786-8938 or *Keith.Tignor@vdacs.virginia.gov*) to ensure protection of state-listed plant species and compliance with state protected species legislation.
- Contact the FWS (Cindy Schulz at 804-693-6694 or *cindy_schulz@fws.gov*) to ensure the protection of any federally-listed species and compliance with federal protected species legislation.
- DGIF's database may be accessed at *http://vafwis.org/fwis/* or by contacting DGIF (Shirl Dressler at 804-367-6913).
- Contact the DCR DNH (804-371-2708) for an update on natural heritage information if a significant amount of time passes before the project is implemented.

C2-FFF

7. Historic and Archaeological Resources. Continue to coordinate with DHR (Andrea Kampinen at *Andrea.Kampinen@dhr.virginia.gov* and Ethel Eaton at 804-482-6088 or *Ethel.Eaton@dhr.virginia.gov*) as required by Section 106 of the National Historic Preservation Act.

C2-GGG

8. Forest Resources. Consider mitigation options regarding the loss of forest lands and coordinate with DOF (Greg Evans, DOF Voluntary Mitigation Program Manager, at 434-220-9020 or at *Gregory.Evans@dof.virginia.gov*) regarding its mitigation recommendations and request for additional information.

C2-HHH

9. Aviation Impacts. Coordinate with the FAA Airport District Office (703-661-1354) regarding Form 7460-1 to ensure compliance with federal regulations or guidelines. Contact DOAv (Scott Denny at *Scott.Denny@doav.virginia.gov* or 804-236-3632) for additional information and coordination as necessary.

C2-III

10. Waterworks and Sewerage Regulations.

- All utility work involving installation of new waterlines and appurtenances must comply with the Commonwealth's waterworks regulations and all applicable standards of the locality.
- Potential impacts to public water distribution systems must be verified by the local utility, according to VDH. Contact VDH (Barry Matthews at *Barry.Matthews@vdh.virginia.gov*) for additional information.
- Contact DEQ BRRO (Kip Foster at 540-562-6782 or *Kip.Foster@deq.virginia.gov*) to ensure compliance with the Sewage Collection and Treatment (SCAT) Regulations, as applicable.

C2-JJJ

GSA Response

C2-FFF
(Response provided on previous page.)

C2-GGG
Refer to response C2-GG.

C2-HHH
Refer to response C2-AA.

C2-III
Refer to response C2-NN.

C2-JJJ
Refer to responses C2-JJ and C2-MM.

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Thank you for the opportunity to comment on the draft EIS. Detailed comments of reviewing agencies are attached for your review. If you have questions, please do not hesitate to call me at (804) 698-4325 or Julia Wellman at (804) 698-4326.

Sincerely,

Ellie Irons, Program Manager
Environmental Impact Review

Enclosures

ec: Dennis Morris, Crater PDC
Robert A. Crum, Richmond Regional PDC
Mary Hickman, Commonwealth Regional Council
Gail Moody, Southside PDC
James Stegmaier, Chesterfield County
Wade Bartlett, Prince Edward County
Tracy Gee, Lunenburg County
John N. Prosise, Nottoway County
Taylor Harvey, Amelia County
Charlette T. Woolridge, Brunswick County
Kevin Massengill, Dinwiddie County
Philip Vannoorbeeck,Town of Blackstone
Amy Ewing, DGIF
Keith Tignor, VDACS
Robbie Rhur, DCR
Barry Matthews, VDH
Steve Coe, DEQ DLPR
Kotur Narasimhan, DEQ DAPC
Mick Cholko, DEQ BRRO
Roger Kirchen, DHR
Jay Woodward, VMRC
Jim Cromwell/Chip Ray, VDOT
David Spears, DMME
Buck Kline, DOF
Greg Evans, DOF
Scott Denny, DOAV
Cotton Puryear, Department of Military Affairs
Ronnie Rice, Department of State Police

GSA Response

No response necessary on this page.

U.S. General Services Administration Draft EIS Foreign Affairs Training Center DEQ 12-189F Page 26 John Cavan, Southside VA Community College Carol Wilkinson, Southern Piedmont Agricultural REC Brian Murphy, Conservation Management Institute	**GSA Response** No response necessary on this page.

Wellman, Julia (DEQ)

From: Woodward, Jay (MRC)
Sent: Friday, November 02, 2012 10:33 AM
To: Wellman, Julia (DEQ)
Subject: DEIS for Foreign Affiars Security Training Center, Nottoway County, Virginia (October 2012)

Julia,

We have reviewed the subject document and would like to provide the following comments:

Any activities or construction within perennial streams draining 5 square miles or greater would need to reviewed for potential authorization from the Virginia Marine Resources Commission. The submerged lands under these waterways are considered to be public, state-owned property and we are the agency who manages those submerged lands. While I was unable to determine if there are to be any direct impacts to these jurisdictional lands, please be advised that if there are proposed impacts, a Joint Permit Application would need to be completed and submitted to us for our review and possible permit issuance through our public interest review process. Here is a link to the application website: C2-KKK

http://www.nao.usace.army.mil/Portals/31/docs/regulatory/RPSPdocs/Revised_Standard_JPA_JULY2012_FillableForm.pdf

Thank you for the opportunity to comment and should you have any questions please feel free to contact me directly as I am the Environmental Engineer assigned to this area of the state.

Jay Woodward
Environmental Engineer
Habitat Management Division
Virginia Marine Resources Commission
(757) 247-8032 office
(757) 504-7009 mobile
jay.woodward@mrc.virginia.gov
Website: www.mrc.virginia.gov

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GSA Response

C2-KKK
Refer to response C2-A.

DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR PROGRAM COORDINATION

ENVIRONMENTAL REVIEW COMMENTS APPLICABLE TO AIR QUALITY

TO: Julia H. Wellman **DEQ - OEIA PROJECT NUMBER: 12 – 189F**

PROJECT TYPE: ☐ STATE EA / EIR **X FEDERAL EA / EIS** ☐ SCC

☐ CONSISTENCY CERTIFICATION

PROJECT TITLE: FOREIGN AFFAIRS TRAINING CENTER

PROJECT SPONSOR: U. S. GENERAL SERVICE ADMINISTRATION

PROJECT LOCATION: ☐ **OZONE ATTAINMENT AREA**

REGULATORY REQUIREMENTSMAY BE APPLICABLE TO: X **CONSTRUCTION**
☐ OPERATION

STATE AIR POLLUTION CONTROL BOARD REGULATIONS THAT MAY APPLY:

1. ☐ 9 VAC 5-40-5200 C & 9 VAC 5-40-5220 E – STAGE I
2. ☐ 9 VAC 5-40-5200 C & 9 VAC 5-40-5220 F – STAGE II Vapor Recovery
3. ☐ 9 VAC 5-40-5490 et seq. – Asphalt Paving operations
4. X **9 VAC 5-130 et seq. – Open Burning**
5. X **9 VAC 5-50-60 et seq. Fugitive Dust Emissions**
6. ☐ 9 VAC 5-50-130 et seq. - Odorous Emissions; Applicable to_____
7. ☐ 9 VAC 5-50-160 et seq. – Standards of Performance for Toxic Pollutants
8. ☐ 9 VAC 5-50-400 Subpart_____, Standards of Performance for New Stationary Sources, designates standards of performance for the_____
9. ☐ 9 VAC 5-80-1100 et seq. of the regulations – Permits for Stationary Sources
10. ☐ 9 VAC 5-80-1700 et seq. Of the regulations – Major or Modified Sources located in PSD areas. This rule may be applicable to the _____
11. ☐ 9 VAC 5-80-2000 et seq. of the regulations – New and modified sources located in non-attainment areas
12. ☐ 9 VAC 5-80-800 et seq. Of the regulations – Operating Permits and exemptions. This rule may be applicable to _____

COMMENTS SPECIFIC TO THE PROJECT:

K. S. Narasimhan

(Kotur S. Narasimhan)
Office of Air Data Analysis **DATE: November 9, 2012**

GSA Response
No response necessary on this page.

Wellman, Julia (DEQ)

From: Cholko, Michael (DEQ)
Sent: Wednesday, November 14, 2012 3:58 PM
To: Wellman, Julia (DEQ)
Subject: 12-189F Foreign Affairs Security Training Center - Nottoway County/Fort Pickett

Only issue we saw was under 4.1.4.1 (page 4-8) "Wetlands":

Text states US General Services Administration would have to obtain a permit from USACE for wetlands and stream impacts under CWA Sections 404 and 401. According to our VWP person (Mark Bushing), they also need to coordinate these permits with DEQ, not solely with Corps of Engineers. C2-LLL

Michael F. Cholko
Pollution Response Coordinator / Environmental Impact Review Coordinator
Virginia Department of Environmental Quality
Blue Ridge Regional Office - Lynchburg
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Lynchburg, VA 24502
434-582-6236
434-582-5125 (fax)
mfcholko@deq.virginia.gov

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GSA Response

C2-LLL
Refer to response C2-D.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

MEMORANDUM

TO: Julia Wellman, DEQ/EIR Environmental Program Planner

FROM: Steve Coe, Division of Land Protection & Revitalization Review Coordinator

DATE: November 14, 2012

COPIES: Sanjay Thirunagari, DLP&R Review Manager
EIR File

SUBJECT: EIR – No. 12-189FS - Foreign Affairs Training Center Fort Pickett, Nottoway County, VA 23824 –DEQ Review

The Division of Land Protection & Revitalization has completed its review of the Environmental Impact Report for the Foreign Affairs Training Center Fort Pickett, Nottoway County, VA 23824. Project description: acquisition of land and the development of a consolidated Foreign Affairs Security Training Center (FASTC) in Nottoway County.

We have the following comments concerning the waste issues associated with this project:

The report submitted for the EIR addressed potential solid waste and/or hazardous waste issues. The report indicates a thorough review of potential environmental issues related to the parcels identified for development. The report appears to indicate that DEQ's databases and DLPR files were searched, and indicates that DEQ offices had been contacted about possible ground contamination concerns. The DLPR staff has conducted a cursory review of its database files under zip code 23824 including a VEGIS database search (within a 0.5 mile radius) of the project site and identified the information below. DEQ's Federal Facilities Program was contacted for a review of this determination and staff comments are included in our review. The sites identified are for reference as their proximity to the subject site is unknown.

RCRA/Hazardous Waste Facilities - fifteen in zip code 23824, five in close proximity to the identified parcels

1) BRAC Property Fort Pickett, 403 Military Road, Blackstone, VA 23824. ID# 0213720931. Contact: Francis Gilmore at 434-292-3317.
2) Fort Pickett USARC AMSA No. 88, Bldg 564 Kemper Avenue, Blackstone, VA 23824. ID# VAR000005553. Contact: Michele Brown at 804-233-6473.
3) MTC Fort Pickett, VAARNG-FM-E, Bldg 234, Blackstone, VA 23824. ID# VAD988228359. Contact: David K. Short at 434-292-2144.
4) VAARNG-ARMORY-Blackstone, N. High Street, Blackstone, VA 23824. ID# VAD982677429. Contact: Pamela W. Coleman at 434-298-6445.
5) VIP & SU Southern Piedmont AES, Highway 40 East, Blackstone, VA 23824. ID# 988224937. Contact: Jack Nunes at 540-231-8758.

C2-MMM

GSA Response

C2-MMM
Refer to response C2-N.

CERCLA Sites – one

Fort Pickett, Kemper Avenue, Blackstone, VA 23824. EPA ID 2210020705. Not NPL.

The following websites may prove helpful in locating additional information for these identification numbers: http://www.epa.gov/superfund/sites/cursites/index.htm or http://www.epa.gov/enviro/html/rcris/rcris_query_java.html.

FUDs Sites – two

FUDS#	FFID	Property Name	Locality	INPR Results	Hazards Found
C03VA0028	VA9799F7770	Fort Picket Mil Resv	Blackstone,	E	N
C03VA0220	VA9899F1674	Ft Pickett A ARPT	Blackstone	E	Y

C2-MMM

The DEQ's Federal Facilities Restoration Program reviewed this submittal and it appears that the project will not impact any sites at Fort Pickett (Environmental Restoration Program, Base Realignment and Closure, and Formerly Used Defense Sites). If the project manager or engineer has questions, they should contact Mr. Jerry Hoover, Regional Project Manager, at (215) 814-2077 for information concerning Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) obligations at Fort Pickett's Main Post. Mr. Hoover, or his designee, should be contacted to establish the nature and extent of any known environmental contamination at or near Fort Pickett, or other Areas of Concern (AOCs) which may be in close proximity to the proposed project.

Solid Waste Facilities – one

SWP333 – U.S. Army Fort Pickett, Closed Sanitary Landfill, Rives Road at 9th Street, Blackstone, VA 23824.

VRP Sites -none

Petroleum Release Sites – one

ID# 20112039 – Grant Residence, 39 Maple Lane, Blackstone, VA 23824. Event Date: 10/25/2010. Status: Closed.

GENERAL COMMENTS

Soil, Sediment, and Waste Management

Any soil that is suspected of contamination or wastes that are generated must be tested and disposed of in accordance with applicable Federal, State, and local laws and regulations. Some of the applicable state laws and regulations are: Virginia Waste Management Act, Code of Virginia Section 10.1-1400 *et seq.*; Virginia Hazardous Waste Management Regulations (VHWMR) (9VAC 20-60); Virginia Solid Waste Management Regulations (VSWMR) (9VAC 20-81); Virginia Regulations for the Transportation of Hazardous Materials (9VAC 20-110). Some of the applicable Federal laws and regulations are: the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Section 6901 *et seq.*, and the applicable regulations contained in Title 40 C2-NNN

GSA Response

C2-MMM
(Response provided on previous page.)

C2-NNN
Refer to Response C2-P.

of the Code of Federal Regulations; and the U.S. Department of Transportation Rules for Transportation of Hazardous Materials, 49 CFR Part 107. C2-NNN Also, all structures being demolished/renovated/ removed should be checked for asbestos-containing materials (ACM) and lead-based paint (LBP) prior to demolition. If ACM or LBP are found, in addition to the federal waste-related regulations mentioned above, State regulations 9VAC 20-80-640 for ACM and 9VAC 20-60-261 for LBP must be followed. The local DEQ office contact for questions is Mr. Kyle Winter at (804) 527-5052. C2-OOO Please note that any contaminated media which is generated from the facility project site is the responsibility of the subject site facility which must ensure that contaminated media undergoes proper management, storage, treatment, and disposal in accordance with the above noted State Regulations. Questions regarding the proper management of solid and/or hazardous waste as well as dredge spoils should be directed to the DEQ's Piedmont Regional Office (http://www.deq.virginia.gov/regions/piedmont.html). C2-PPP **Pollution Prevention – Reuse - Recycling** Please note that DEQ encourages all construction projects and facilities to implement pollution prevention principles, including the reduction, reuse, and recycling of all solid wastes generated. All generation of hazardous wastes should be minimized and handled appropriately. C2-QQQ If you have any questions or need further information, please contact Steve Coe at (804) 698-4029.	**GSA Response** **C2-NNN** (Response provided on previous page.) **C2-OOO** Refer to Response C2-O. **C2-PPP** Sections 4.2.11.1 and 6.15 of the Draft and Supplemental Draft EIS discuss measures for the storage, handling, and disposal of hazardous materials. **C2-QQQ** Refer to response C2-SS.

Douglas W. Domenech
Secretary of Natural Resources

David A. Johnson
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

203 Governor Street
Richmond, Virginia 23219-2010
(804) 786-1712

MEMORANDUM

DATE: November 14, 2012

TO: Julia Wellman, DEQ

FROM: Roberta Rhur, Environmental Impact Review Coordinator

SUBJECT: DEQ 12-189F, Foreign Affairs Training Center, Fort Pickett

Division of Natural Heritage

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information we have currently in our files, the Fort Pickett Impact Area is within the project vicinity. Conservation sites are tools for representing key areas of the landscape that warrant further review for possible conservation action because of the natural heritage resources and habitat they support. Conservation sites are polygons built around one or more rare plant, animal, or natural community designed to include the element and, where possible, its associated habitat, and buffer or other adjacent land thought necessary for the element's conservation. Conservation sites are given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain; on a scale of 1-5, 1 being most significant. Fort Pickett Impact Area Conservation Site has been given a biodiversity significance ranking of B1, which represents a site of outstanding significance. The natural heritage resource of concern at this site is:

Rhus michauxii	Michaux's sumac	G2G3/S1/LE/LT

Michaux's sumac is a dioecious shrub that grows from 0.3 – 0.6 m tall (NatureServe 2011). This plant occurs in sandy or rocky, open, hardwood-dominated forests and savannas (Van Alstine and Smith, 1995), sometimes in association with circumneutral soils. It is dependent upon some form of disturbance to maintain its open habitat (NatureServe 2011). Periodic, naturally occurring fires provided such disturbance historically; however, today many of this plant's occurrences are in areas artificially disturbed such as highway, powerline and railroad rights-of-way, edges of cultivated fields, and other cleared lands. In Virginia, all but one of the known occurrences are located within Fort Pickett in the southern Piedmont where it is maintained by frequent fires. The major threats to Michaux's sumac include fire suppression and habitat degradation (NatureServe 2011). The optimal survey time period for Michaux's sumac is C2-RRR

State Parks • Stormwater Management • Natural Heritage • Outdoor Recreation Planning
Dam Safety and Floodplain Management • Land Conservation

GSA Response

C2-RRR
Refer to response C2-S.

during the period of flowering / fruiting from June 1 – October 31 when the plant has higher visibility, but the plant can be identified as long as the leaves are present from May 1 – October 31. C2-RRR

Please note that this species is currently classified as endangered by the United States Fish and Wildlife Service (USFWS) and listed as threatened by the Virginia Department of Agriculture and Consumer Services (VDACS).

Due to the potential for this site to support populations of Michaux's sumac, DCR recommends an inventory for the resource in the study area. With the survey results we can more accurately evaluate potential impacts to natural heritage resources and offer specific protection recommendations for minimizing impacts to the documented resources.

DCR-Division of Natural Heritage biologists are qualified and available to conduct inventories for rare, threatened, and endangered species. Please contact J. Christopher Ludwig, Natural Heritage Inventory Manager, at chris.ludwig@dcr.virginia.gov or 804-371-6206 to discuss arrangements for field work. A list of other individuals who are qualified to conduct inventories may be obtained from the USFWS. C2- SSS

Under a Memorandum of Agreement established between the VDACS and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. Survey results should be coordinated with DCR-DNH and USFWS. Upon review of the results, if it is determined the species is present, and there is a likelihood of a negative impact on the species, DCR-DNH will recommend coordination with VDACS to ensure compliance with Virginia's Endangered Plant and Insect Species Act.

There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity. C2-TTT

New and updated information is continually added to Biotics. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

The Virginia Department of Game and Inland Fisheries (VDGIF) maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Gladys Cason (804-367-0909 or Gladys.Cason@dgif.virginia.gov).

Division of Stormwater Management

Stormwater Management:
The applicant and their authorized agents conducting regulated land disturbing activities on private and public lands in the state must comply with the Virginia Erosion and Sediment Control Law and Regulations (VESCL&R), Virginia Stormwater Management Law and Regulations including coverage under the general permit for stormwater discharge from construction activities, and other applicable federal nonpoint source pollution mandates (e.g. Clean Water Act-Section 313, Federal Consistency under the Coastal Zone Management Act). Clearing and grading activities, installation of staging areas, parking lots, roads, buildings, utilities, borrow areas, soil stockpiles, and related land-disturbance activities that result in the land-disturbance of equal to or greater than 10,000 square feet would be regulated by VESCL&R. Accordingly, the applicant must prepare and implement erosion and sediment control (ESC) plan to ensure compliance with state law and regulations. The applicant is ultimately responsible for achieving project compliance through oversight of on site contractors, regular field inspection, prompt action against non-compliant sites, and other mechanisms consistent with agency policy. [Reference: VESCL §10.1-567;]. C2- UUU

GSA Response

C2-RRR
(Response provided on previous page.)

C2-SSS
Refer to Response C2-T.

C2-TTT
Comment noted.

C2-UUU
Refer to responses C2-G and C2-H.

The operator or owner of construction activities involving land disturbing activities equal to or greater than one acre are required to register for coverage under the General Permit for Discharges of Stormwater from Construction Activities and develop a project specific stormwater pollution prevention plan (SWPPP). Construction activities requiring registration also includes the land-disturbance of less than one acre of total land area that is part of a larger common plan of development or sale if the larger common plan of development will ultimately disturb equal to or greater than one acre. The SWPPP must be prepared prior to submission of the registration statement for coverage under the general permit and the SWPPP must address water quality and quantity in accordance with the Virginia Stormwater Management Program (VSMP) Permit Regulations. General information and registration forms for the General Permit are available on DCR's website at C2-VVV
http://www.dcr.virginia.gov/soil_and_water/index.shtml
[Reference: Virginia Stormwater Management Law Act §10.1-603.1 et seq.; VSMP Permit Regulations §4VAC-50 et seq.]

The remaining DCR divisions have no comments regarding the scope of this project. Thank you for the opportunity to comment.

CC: Kim Smith, USFWS

Literature Cited

NatureServe. 2011. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: November 29, 2011).

Van Alstine, N.E. and T.L. Smith. 1995. Distribution of *Rhus michauxii* of Fort Pickett, Virginia. Natural Heritage Technical Report 95-15. Virginia Department of Conservation and Recreation, Division

GSA Response

C2-VVV
Refer to responses C2-H.

of Natural Heritage, Richmond, VA. Unpublished report submitted to the U.S. Army. October 1995. 65 pp.	**GSA Response** No response necessary on this page.

Wellman, Julia (DEQ)

From: Ewing, Amy (DGIF)
Sent: Friday, November 16, 2012 12:42 PM
To: Wellman, Julia (DEQ)
Cc: Cason, Gladys (DGIF); nhreview (DCR)
Subject: ESSLog# 33324_12-189F_Foreign Affairs Training Center at Ft. Pickett

We have reviewed the subject project that proposes to construct a training center on approximately 1500 acres on Ft. Pickett in Nottoway County, VA.

According to our records, state Threatened barking treefrogs have been documented from the project area. However, we believe these specimens to have been moved to this site in agricultural supplies and not to be a native population of the species. Therefore, we have determined this project is not likely to result in adverse impacts upon this species. C2-WWW

This project is located within 2 miles of a documented occurrence of a state or federal threatened or endangered plant or insect species and/or other Natural Heritage coordination species. Therefore, we recommend coordination with VDCR-DNH regarding the protection of these resources. C2-XXX

To minimize overall impacts to wildlife and our natural resources, we offer the following comments about development activities: We recommend that the applicant avoid and minimize impacts to undisturbed forest, wetlands, and streams to the fullest extent practicable. Avoidance and minimization of impact may include relocating stream channels as opposed to filling or channelizing as well as using, and incorporating into the development plan, a natural stream channel design and wooded buffers. We recommend maintaining undisturbed naturally vegetated buffers of at least 100 feet in width around all on-site wetlands and on both sides of all perennial and intermittent streams. We recommend maintaining wooded lots to the fullest extent possible. We generally do not support proposals to mitigate wetland impacts through the construction of stormwater management ponds, nor do we support the creation of in-stream stormwater management ponds. We are willing to assist the applicant in developing a plan that includes open-space, wildlife habitat, and natural stream channels which retain their wooded buffers. C2-YYY

We recommend that the stormwater controls for this project be designed to replicate and maintain the hydrographic condition of the site prior to the change in landscape. This should include, but not be limited to, utilizing bioretention areas, and minimizing the use of curb and gutter in favor of grassed swales. Bioretention areas (also called rain gardens) and grass swales are components of Low Impact Development (LID). They are designed to capture stormwater runoff as close to the source as possible and allow it to slowly infiltrate into the surrounding soil. They benefit natural resources by filtering pollutants and decreasing downstream runoff volumes.

We recommend that all tree removal and ground clearing adhere to a time of year restriction protective of resident and migratory songbird nesting from March 15 through August 15 of any year.

We recommend adherence to erosion and sediment controls during ground disturbance.

Thanks, Amy

Amy Ewing | Environmental Services Biologist | VDGIF - Richmond HQ | 4010 West Broad St. Richmond, VA 23230 | 804-367-2211 | www.dgif.virginia.gov

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GSA Response

C2-WWW
Comment noted.

C2-XXX
Refer to Response C2-T.

C2-YYY
Refer to response C2-Y.

COMMONWEALTH of VIRGINIA

Randall P Burdette
Director

Department of Aviation
5702 Gulfstream Road
Richmond, Virginia 23250-2422

V/TDD • (804) 236-3624
FAX • (804) 236-3635

November 14, 2012

Ms. Julia Wellman
Department of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, Sixth Floor
Richmond, Virginia 23219

RE: GSA Foreign Affairs Training Center, Nottoway County Virginia, **DEQ Project # 12-189F**

Dear Ms. Wellman:

The Virginia Department of Aviation has reviewed the information included in the link to the project provided in Ms. Fulcher's October 26, 2012 e-mail. Based on our review, staff has the following comments.

Comments

1. The Virginia Department of Aviation does not object to the project. However, due to the proximity of the proposed transmission lines that will be erected as part of this project to the Allen C. Perkinson /Blackstone Airfield, the project sponsor is required to submit a 7460 form to the Federal Aviation Administration (FAA) to determine if the proposed development would constitute a hazard to air navigation. If the FAA deems the proposed development to be hazard to air navigation, the Department would not object to mitigation measures, such as obstruction lights, provided there are no negative impacts to the approach minimums to the airport and the measures will not result in the reduction of runway length. C2-ZZZ

2. All efforts should be taken by the project sponsor to limit the dust/glare generated from this project that could potentially negatively impact aircraft operations. C2-AAAA

If you have any questions regarding these comments please contact me at (804) 236-3632.

Sincerely,

S. Scott Denny
Senior Aviation Planner

100 DOAVAS 20121114 BKT DEQ Comments 12-189F

GSA Response

C2-ZZZ
Refer to Response C2-NN.

C2-AAAA
Refer to Response C2-OO.

Wellman, Julia (DEQ)

From: Kampinen, Andrea (DHR)
Sent: Wednesday, November 14, 2012 3:15 PM
To: Wellman, Julia (DEQ)
Cc: Donna Andrews (3PCMC)
Subject: Foreign Affairs Training Center, Nottoway County, DHR File No. 2012-1921

DHR has been in consultation with the GSA regarding this project. We request that the GSA continue to consult directly with DHR pursuant to Section 106 of the National Historic Preservation Act (as amended) and its implementing regulations codified at 36 CFR Part 800 which require Federal agencies to consider the effects of their undertakings on historic properties. C2-BBBB

Andrea Kampinen
Architectural Historian, Office of Review and Compliance
Virginia Department of Historic Resources
2801 Kensington Avenue
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(804) 482-6084
Fax: (804) 367-2391
andrea.kampinen@dhr.virginia.gov

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GSA Response

C2-BBBB
Refer to Response C2-GG.

Wellman, Julia (DEQ)

From: Kampinen, Andrea (DHR)
Sent: Wednesday, November 28, 2012 2:38 PM
To: Donna Andrews (3PCMC)
Cc: kkulis@achp.gov; Susan Smead (susan.e.smead@us.army.mil); Gallagher.Theresa@epamail.epa.gov; Wellman, Julia (DEQ)
Subject: FASTC, Nottoway Co., VA - DHR File No. 2010-1921/DEQ#12-189F

Dear Ms. Andrews,

Please see the attached letter for the above referenced project. A hard copy will not follow so please print the attachment for your records. Should you have any additional information, I can be reached at the phone number or email address listed below.

Regards,

Andrea Kampinen

Letter Andrews - 112812.pdf

Andrea Kampinen
Architectural Historian, Office of Review and Compliance
Virginia Department of Historic Resources
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GSA Response

No response necessary on this page.

COMMONWEALTH of VIRGINIA

Douglas W. Domenech
Secretary of Natural Resources

Department of Historic Resources
2801 Kensington Avenue, Richmond, Virginia 23221

Kathleen S. Kilpatrick
Director

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www.dhr.virginia.gov

November 28, 2012

Donna Andrews
U.S. General Services Administration, Mid-Atlantic Region
The Strawbridge's Building
20 North Eighth Street
Philadelphia, PA 19107 - 3191

Re: Land Acquisition and Development at Fort Pickett by the Department of State Foreign Affairs Security Training Center – Phase I and II Cultural Resource Surveys, revisions and addendums
Nottoway County, Virginia
DHR File No. 2010-1921

Dear Ms. Andrews,

On October 2, 2012, the Virginia Department of Historic Resources (DHR) received additional information regarding the above-referenced project for our review and comment pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended. DHR understands that the U.S. General Services Administration (GSA) and the Department of State (DOS) are proposing to acquire and develop several parcels of land for a Foreign Security Affairs Training Center (FASTC) at Fort Pickett, Nottoway County, Virginia. The FASTC will provide training for a variety of law enforcement and security disciplines managed by the DOS Bureau of Diplomatic Security. The project is partially funded through the American Recovery and Reinvestment Act (ARRA), but GSA will assume lead agency responsibilities under Section 106.

Following GSA's initiation of Section 106 consultation in October 2011, DHR understands that the property being sought for the facility has further changed in configuration. At this time, three parcels within Fort Pickett are under consideration: Local Reuse Authority (LRA) Parcel 9, 750 acres; LRA Parcel 10, 135 acres; and Parcel 21/20, 660 acres. Four additional parcels, 80 acres in total, are also being considered for additional space, if needed: Grid Parcel, 70 acres; range 8 Classroom R05, 5 acres; Parcel 10 Access Road; and Officer's Club Parking Lot. The most recent Cultural Resource Survey reports submitted to our office not only address DHR's comments from our July 2, 2012 letter, but also address comments from other consulting parties, and account for the additional four parcels under consideration. The two Build Alternatives being evaluated in the EIS incorporate these updated parcel configurations.

Architectural Resources
We have received for review the revised report, *Phase II Architectural Survey and Evaluation for the Proposed Foreign Affairs Security Training Center, Nottoway County, Virginia*, prepared by Cardno TEC in September 2012; and the new report, *Draft Addendum Phase II Architectural Survey for Additional*

Administrative Services
10 Courthouse Ave.
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Salem, VA 24153
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Northern Region Office
5357 Main Street
P.O. Box 519
Stephens City, VA 22655
Tel: (540) 868-7029
Fax: (540) 868-7033

GSA Response

No response necessary on this page.

Page 2
November 28, 2012
DHR File No. 2010-1921

Parcels at the Proposed Foreign Affairs Security Training Center, Nottoway County, Virginia, prepared by Cardno TEC on September 24, 2012. We are pleased to report that the survey forms met our Data Sharing System (DSS) Quality Control Standards on November 14, 2012. C2-CCCC

As you know, the Fort Pickett Historic District (DHR ID#067-0110) was recommended as not eligible for listing in the Virginia Landmarks Register (VLR) or the National Register of Historic Places (NRHP) by our staff in October 2010. The *Phase II Architectural Survey* (also known as DHR's Reconnaissance Level Survey) identified five (5) resources within LRA Parcel's 9 and 10 (DHR ID#067-0110-0417, 0418, 0419, 0420, and 067-5034), and DHR still concurs with the consultant's recommendation that the resources are not recommended individually eligible for listing in the VLR/NRHP. There were no resources identified within Parcel 21/20. Furthermore, we feel the resources along Military Road and West Entrance Road have been adequately accounted for at this time. The one previously surveyed resource along West Entrance Road, Farley's (DHR ID#067-0183) should be considered potentially eligible for the purposes of this project. C2-DDDD

The *Draft Addendum Report* identified 44 previously surveyed architectural resources within/adjacent to the GRID Parcel; two (2) newly recorded resources within/adjacent the Range 8 Classroom R05 parcel; and no previously surveyed or newly identified resources within/adjacent the Parcel 10 Access Road or the Officer's Club Parking Lot. DHR concurs with the consultant that the two resources within the Range 8 Classroom R05 parcel (DHR ID#067-0110-0421 and 0422) are not eligible. No further survey work is recommended for these four additional parcels. C2-EEEE

Archaeological Resources
We have received for review three archaeological reports, *Phase I Archaeological Survey and Phase II Evaluation for the Proposed Foreign Affairs Security Training Center, Nottoway County, Virginia, revised,* prepared by Kimberly M. Sebestyen, M.A., *et al.* of Cardno Tech in September 2012 ; *Draft Addendum Phase I Survey for Additional Parcels at the Proposed Foreign Affairs Security Training Center, Nottoway County, Virginia* prepared by Kimberly M. Sebestyen, M.A. of Cardno Tech in August 2012; *Draft Addendum Phase II Evaluation for the Proposed Foreign Affairs Security Training Center, Sites 44NT0207 and 44NT0218, Nottoway County, Virginia* prepared by Kimberly M. Sebestyen, M.A and David Jenkins, M.A. of Cardno Tech in September 2012. We are pleased to inform you that the reports meet the federal *Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation* (48 FR 44716-44742, September 1983) and our state *Guidelines for Conducting Cultural Resource Survey in Virginia* (rev. 2011). Please see our comments for each of the reports below: C2-FFFF

Phase I Archaeological Survey and Phase II Evaluation for the Proposed Foreign Affairs Security Training Center, Nottoway County, Virginia
It is our understanding that this report has been revised to address the comments made in our letter of July 2, 2012, as well as those of other consulting parties. We appreciate your willingness to conduct parallel investigations on Site 44NT0220 if additional investigation is warranted at Site 44NT0219. We understand, however, that no additional survey at these sites is planned at the present time as the tank trail route has been revised to avoid both sites. C2-GGGG

The report also includes the results of additional research conducted on Site 44NT0045. The revised historic context for this site now includes consideration of all four National Register criteria. Our Department's National Register Evaluation Committee met on October 25, 2012, to consider the eligibility of Site 44NT0045. Based upon the additional documentation provided, the committee finds C2-HHHH

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Northern Region Office
5357 Main Street
P.O. Box 519
Stephens City, VA 22655
Tel: (540) 868-7029
Fax: (540) 868-7033

GSA Response

C2-CCCC
Comment noted.

C2-DDDD
Comment noted.

C2-EEEE
Comment noted.

C2-FFFF
Comment noted.

C2-GGGG
Comment noted

C2-HHH
Comment noted.

Page 3
November 28, 2012
DHR File No. 2010-1921

that Site 44NT0045 does not meet the National Register criteria. As such, we concur with the consultant's recommendation that no further archaeological investigations are warranted at this site. C2-HHHH

I regret to inform you, however, that we do not agree that sufficient research has been conducted in connection with the isolated grave stone. While we can agree that the stone is not likely to be *in situ*, given the weight of the stones, they do not seem likely to have been deposited at any considerable distance from the, as yet, unidentified burial place. The issue is the stones suggest that the unmarked grave in the vicinity may be affected by future activities. We will reiterate that the grave stone does contain the name Smith. To avoid potential delays from post review discovery of the grave, we recommend conducting background research to identify the ownership of the Smith gravestone with adjacent property. As family cemeteries are common in Virginia, dependent on the results of the research, stripping of the area to locate grave shafts may be warranted. C2-IIII

Draft Addendum Phase I Survey for Additional Parcels at the Proposed Foreign Affairs Security Training Center, Nottoway County, Virginia
No intact archaeological levels or features were identified during the survey. The level of effort documented in the report was sufficient to identify archaeological resources, if any were present. Based upon the results of the survey, we concur with the consultant's recommendation that no further archaeological investigations are warranted on the four additional parcels surveyed. C2-JJJJ

Draft Addendum Phase II Evaluation for the Proposed Foreign Affairs Security Training Center, Sites 44NT0207 and 44NT0218, Nottoway County, Virginia
This report presents the results of the Phase II evaluation of two historic period sites identified during the Phase I survey for the FASTC project. The archaeological subcommittee of our Department's National Register Evaluation Committee met on October 25, 2012, to consider the eligibility of Sites 44NT0207 and 44NT0218. I regret to inform you that the committee finds that the report does not represent a level of effort sufficient to evaluate these sites. The scale of the map of Site 44NT207 provided in Figure 6 (page 12) makes it difficult to distinguish positive from negative shovel tests. For this reason it is not clear how the site boundaries were determined. In some cases it appears that positive shovel tests, for example, M1+ 10S, were not bracketed with additional shovel tests. C2-KKKK

Moreover, additional background research is needed to develop a more thorough historic context. Research on the ownership of the property appears to be limited to historic maps. We cannot agree that the number of properties incorporated into Fort Pickett preclude deed and tax record research that would assist in determining ownership and the social and economic status of the property's inhabitants. Apparently a 1944 map of the properties encompassed by Fort Pickett exists which shows the owner's name and size of the property; deed research could proceed back from that owner. C2-LLLL

The Committee expressed similar concerns with respect to Site 44NT0218. Positive shovel tests appear to have been excavated outside of the site boundary as depicted on Figure 22 (page 47). In the conclusions section it is stated that "although portions of the southeastern area of the site have been disturbed due to structure demolition and/or military activities, the former structures associated with this site appear to be outside of the site boundary as well as the APE." It is not clear to us how the site is defined if structures associated with the site are not included within the site boundaries. Evaluation of a site requires that its nature and extent be determined. C2-MMMM

We look forward to receiving more detailed information about Sites 44NT0207 and 44NT0218, including a more thorough historic context as well as defensible boundary definition. At this time, we are not

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Fax: (540) 868-7033

GSA Response

C2-HHHH
(Response provided on previous page.)

C2-IIII
Refer to Response C2-FF

C2-JJJJ
Comment noted.

C2-KKKK
Refer to Response C2-FF

C2-LLLL
Refer to Response C2-FF

C2-MMMM
Refer to Response C2-FF

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November 28, 2012
DHR File No. 2010-1921

commenting on effects to historic properties until we receive your determination of effects as you state in your letter.

For questions regarding archaeology, please contact Ethel Eaton at (804) 482-6088 or ethel.eaton@dhr.virginia.gov. For architectural questions and any other questions, please contact me at (804) 482-6084, or via email at andrea.kampinen@dhr.virginia.gov.

Sincerely,

Andrea Kampinen

Andrea Kampinen
Architectural Historian, Office of Review and Compliance

Cc: Kirsten Brinker Kulis, ACHP
Susan Smead, Virginia Army National Guard - Fort Pickett
Theresa Gallagher, EPA
Julia Wellman, VDEQ

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GSA Response

No response necessary on this page.

Carl E. Garrison III
State Forester

COMMONWEALTH of VIRGINIA

DEPARTMENT OF FORESTRY
900 Natural Resources Drive, Suite 800
Charlottesville VA 22903
434.977.6555 ~ Fax: 434.296.2369
www.dof.virginia.gov

November 29, 2012

Ms. Julia H. Wellman
Department of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, Sixth Floor
Richmond, VA 23219

Dear Ms. Wellman:

Per your request to the Virginia Department of Forestry (DOF) for input on the proposed construction of the Foreign Affairs Training Facility (FATC) at Fort Pickett, DEQ project Number 12-189F, by the General Services Administration, below is our response.

The DOF finds that this project will have a significant impact on the forest resources of the Commonwealth from the removal of 525 acres of heavily forested land. This includes areas within identified project parcels LRA 10 and 21/20 that have been determined to have a high forest conservation value [FCV] (4 out of possible 5 ranking). This determination was made using the web-based application InFOREST (http://inforest.frec.vt.edu/). Therefore, the DOF recommends that a forest mitigation plan be put in place to both support the Governor's goal to conserve 400,000 acres of land by the end of his administration and DOF policy objectives for limiting the rate and degree of forestland loss in the Commonwealth as the project moves forward. This plan would be developed in a way that identifies opportunities for Department of Defense (DoD) to address their environmental concerns also. The DOF would welcome discussions with the FATC sponsors concerning potential mitigation plan options for this project. C2-NNNN

These options could be structured to help meet DOF forest conservation objectives and complement DoD and DGIF species habitat considerations, while simultaneously further enhancing forested national security buffers around sensitive areas within the FATC's development footprint. Given these objectives, potential opportunities for mitigation include but are not limited to the following:

1. LRA parcel 9, the Grid and 21/20: DOF recommends that the development of the footprints for each parcel be designed to maximize the amount of forested area between the sections to be developed and the surrounding undeveloped forest. This suggestion is made to keep forest fragmentation to a minimum and to support DoD and DGIF objectives that the value of the retained forest to interior species is optimized. Of particular interest to DOF is the forest block located on the westernmost portion of LRA Parcel 9 that is considered in the DEIS to be large enough to have moderate value to forest interior species and areas within 21/20 that have been determined to have high forest conservation value[FCV] as determined by the InFOREST application.

Mission: We Protect and Develop Healthy, Sustainable Forest Resources for Virginians.

GSA Response

C2-NNNN
Refer to response C2-AA.

2. LRA parcel 10: The Department of Forestry would like to better understand what the proposed development footprint will be before it can offer specific comments. The DEIS offers only very general guidance on development plans and LRA parcel 10 contains high FCV areas. The forest conservation value of LRA parcel 10 is considered high because it is a second growth mixed forest that has been subject to very little previous development, it is part of a larger contiguous forest, and its western edge abuts a wetland area that may have water quality value for the adjacent residential areas. C2-NNNN

3. State to federal land conversion: Since LRA parcel 9 and LRA parcel 10 will convert to federal land under the FATC's proposed preferred build option, The Department would welcome the opportunity to consult with federal representatives on the outline of the parcel footprints as the project proceeds through its various phases so forest mitigation efforts can be optimized. C2-OOOO

4. Buffer extension: The Department of Forestry would also like to discuss with Ft. Pickett representatives the possibility of extending the current ACUB buffer north of Lunenburg County to provide additional protection for existing forest as well as providing additional security for the FATC. C2-PPPP

5. Forest replacement: Virginia has been losing approximately 16,000 acres of forestland annually based on a 10 year average ending in 2010. Urbanization and development represent the single biggest factor in the loss of this forestland acreage. Under the FATC preferred build option, 525 acres of heavily forested land will be lost and the DOF would like to see that loss mitigated. Potential opportunities for mitigation include but are not limited to the following recommendations: C2-QQQQ

   a) Project sponsors could reforest and protect open federal lands within the Commonwealth of Virginia to create forestlands.

   b) US Army Fort Pickett as the landlord installation for the proposed FATC, could work with the DOF or another Virginia conservation agency or group to create a forest land conservation fund that would be used for the purchase or donation of conservation easements, reforestation, or property acquisition of forestlands. These activities could be within the impacted area or statewide and would ensure that the forested lands are managed and retained as forest lands in perpetuity.

Thank you for the opportunity to comment.

Sincerely,

Gregory C. Evans
Voluntary Mitigation Program Manager
VA Department of Forestry
900 Natural Resources Drive, Suite 800
Charlottesville, VA 22903
434-220-9020

cc: B. Kline

GSA Response

C2-NNNN
(Response provided on previous page.)

C2-OOOO
Refer to Response C2-BB.

C2-PPP
Refer to Response C2-CC.

C2-QQQQ
Refer to Response C2-DD.

Wellman, Julia (DEQ)

From: Forsgren, Diedre (VDH)
Sent: Tuesday, November 13, 2012 2:41 PM
To: Wellman, Julia (DEQ)
Subject: (12-189F) EIS: Foreign Affairs Training Center

DEQ Project #: 12-189F
Name: Foreign Affairs Training Center
Sponsor: U. S. General Services Training Center
Location: Nottoway County

Please note an error in Chapter 3.2.8.1 of this Draft EIS, under "Utilities and Infrastructure/Potable Water". The report says that the Town of Blackstone's Water Treatment Plant is permitted by DEQ. This is in error. The withdrawal from the river is permitted by DEQ; however, the public water treatment plant (Blackstone, Town of; Waterworks ID #VA5135100) is permitted through the primacy agency, the Virginia Department of Health - Office of Drinking Water, under the requirements of the Safe Drinking Water Act and the provisions of the *Virginia Waterworks Regulations*. C2-RRRR

VDH – Office of Drinking Water has reviewed DEQ Project Number 12-189F. Below are our comments as they relate to proximity to public drinking water sources (groundwater wells, springs and surface water intakes). Potential impacts to public water distribution systems or sanitary sewage collection systems must be verified by the local utility.

No groundwater wells are within a 1 mile radius of the project site.

No surface water intakes are located within a 5 mile radius of the project site.

Project does not fall within Zone 1 (up to 5 miles into the watershed). Project falls within Zone 2 (greater than 5 miles into the watershed) of one public surface water source, but is outside of our review area.

There are no apparent impacts to public drinking water sources due to this project. C2-SSSS

Please don't hesitate to contact Barry E. Matthews (804.864.7515; Barry.Matthews@vdh.virginia.gov) or myself should you have any questions.

Diedre Forsgren
Office Services Specialist
VIRGINIA DEPARTMENT OF HEALTH
Office of Drinking Water, Room 622-A
109 Governor Street
Richmond, VA 23219
Phone: (804) 864-7241
email: diedre.forsgren@vdh.virginia.gov

1

GSA Response

C2-RRRR
Refer to comment C2-KK.

C2-SSSS
Comment noted.

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NOTTOWAY COUNTY

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DEQ-Office of Environmental Impact Review

October 30, 2012

Virginia Department of Environmental Quality
Office of Environmental Impact Review
629 E. Main Street 6th Floor
Richmond, Virginia 23219

Attention: Julia Wellman

Dear Ms. Wellman,

All members of the Nottoway County Board of Supervisors have received and reviewed the draft Environmental Impact Statement for the proposed United States Department of State's Foreign Affairs Security Training Center.

As this facility will be entirely contained within our county, its impacts are of special interest to its citizens and their elected leaders. Despite the size and complexity of the project, our review of the document has not shown any potential impacts to be problematic for Nottoway County. It also appears neither to hold any negative impacts to the surrounding area. C2-TTTT

The Board of Supervisors is unanimous in its support of the draft EIS document and the described project as presented in it.

Respectfully,

Jack J. Green
Chairman, Nottoway County Board of Supervisors

GSA Response

C2-TTTT
Comment noted.

Richmond Regional

Planning District Commission — Metropolitan Planning Organization

Town of
Ashland
Counties of
Charles City
Chesterfield
Goochland
Hanover
Henrico
New Kent
Powhatan
City of
Richmond

Executive Director
Robert A. Crum, Jr.

MEMORANDUM

TO: Julia H. Wellman
Department of Environmental Quality

FROM: Barbara V. Jacocks, AICP
Principal Planner

DATE: November 14, 2012

SUBJECT: **ENVIRONMENTAL REVIEW AND COMMENT**

Project Title: **Foreign Affairs Training Center**

CCN: VA13-1114-3172-015-00135

The RRPDC received a request for comment concerning this proposal on October 26, 2012. RRPDC staff sent the request to staff of planning district member localities on October 30, 2012 in order to solicit comments to include in a comment letter. Any documents associated with the request were made available to locality staff. Response comments from locality staff were requested on or before close of business November 12, 2012.

RRPDC did not receive comments from locality staff.

RRPDC staff has reviewed the Draft Environmental Impact Statement. Since construction of the proposed project will occur outside of the RRPDC boundary and no RRPDC localities have expressed concerns, RRPDC staff defer to comments submitted by Planning District Commissions and other jurisdictions closer to the project site. C2-UUUU

Signature
Barbara V. Jacocks, AICP
Principal Planner

BVJ/sgs

9211 Forest Hill Avenue, Suite 200 • Richmond, Virginia 23235 • Telephone: (804) 323-2033 • Fax: (804) 323-2025
www.richmondregional.org

GSA Response

C2-UUUU
Comment Noted.

Wellman, Julia (DEQ)

From: Mark Bittner [mbittner@craterpdc.org]
Sent: Tuesday, October 30, 2012 10:00 AM
To: Wellman, Julia (DEQ)
Cc: 'Dennis Morris'
Subject: GSA: Foreign Affairs Training Center, Nottoway County, VA, DEQ #12-189F

Dear Ms. Wellman:

Thank you for submitting the GSA: Foreign Affairs Training Center, Nottoway County, VA for review **(DEQ # 12-189F)**.

Based upon the Crater Commission's staff review, we find the proposal to be in full accord with the Crater Planning District Commission's environmental policy directives. C2-VVVV

We look forward to implementation of the proposal.

Sincerely,

Mark Bittner

Mark Bittner
Crater Planning District Commission
Director of Planning & Information Technology
CPDC
(804) 861-1666 x237
mbittner@craterpdc.org
1964 Wakefield Street
Monument Professional Building
Petersburg, VA 23805
http://www.craterpdc.org

1

GSA Response

C2-VVVV
Comment Noted.

Wellman, Julia (DEQ)

From: Wade Bartlett [wbartlett@co.prince-edward.va.us]
Sent: Wednesday, December 05, 2012 5:25 PM
To: Wellman, Julia (DEQ)
Subject: RE: ENVIRONMENTAL IMPACT REVIEW REQUEST

Prince Edward County has no comments. Thanks for asking C2-WWWW

From: Wellman, Julia (DEQ) [mailto:Julia.Wellman@deq.virginia.gov]
Sent: Wednesday, December 05, 2012 11:53 AM
To: Wade Bartlett
Subject: RE: ENVIRONMENTAL IMPACT REVIEW REQUEST

I did not receive comments from Prince Edward, so I am just double checking that you all did not submit comments.

Julia Wellman
Environmental Impact Review Coordinator
Virginia Department of Environmental Quality
Office of Environmental Impact Review
PO Box 1105
Richmond, VA 23218
Phone: (804) 698-4326
Fax: (804) 698-4319
E-mail: Julia.Wellman@deq.virginia.gov

From: Wade Bartlett [mailto:wbartlett@co.prince-edward.va.us]
Sent: Wednesday, October 31, 2012 12:33 PM
To: Wellman, Julia (DEQ)
Subject: RE: ENVIRONMENTAL IMPACT REVIEW REQUEST

Thank you

From: Wellman, Julia (DEQ) [mailto:Julia.Wellman@deq.virginia.gov]
Sent: Wednesday, October 31, 2012 9:22 AM
To: Wade Bartlett
Subject: RE: ENVIRONMENTAL IMPACT REVIEW REQUEST

Hi Mr. Bartlett,

It is up to the discretion of the county and board as to what is reviewed. The draft EIS discusses regional impacts that I thought may be of interest to nearby counties.

If you can get back to me with comments by November 20, I would appreciate it.

Thank you.

Regards, Julia

Julia Wellman
Environmental Impact Review Coordinator
Virginia Department of Environmental Quality
Office of Environmental Impact Review
PO Box 1105

1

GSA Response

C2-WWWW
Comment Noted.

Wellman, Julia (DEQ)

From: Tracy Gee [tgee@lunenburgva.net]
Sent: Thursday, December 06, 2012 1:18 PM
To: Wellman, Julia (DEQ)
Subject: RE: NEW PROJECT GSA 12-189F

Lunenburg County is in favor of the project and mailed a Letter of Support. I hope that it has been filed with your comments. C2-XXXX

Tracy M. Gee
County Administrator
Lunenburg County Administration
11413 Courthouse Road
Lunenburg, VA 23952

Voice: 434-696-2142
Fax: 434-696-1798
tgee@lunenburgva.net

From: Wellman, Julia (DEQ) [mailto:Julia.Wellman@deq.virginia.gov]
Sent: Wednesday, December 05, 2012 12:04 PM
To: Tignor, Keith (VDACS); Ray, Alfred C. (VDOT); Cromwell, James R. (VDOT); Spears, David (DMME); mhickman@virginiasheartland.org; gmoody@southsidepdc.org; planning@chesterfield.gov; John.Cavan@southside.edu; cwooldridge@brunswickco.com; phillipv@townofblackstoneva.com; taylor.harvie@ameliacova.com; wbartlett@co.prince-edward.va.us; Massengill, kevin k w; tgee@lunenburgva.net; willki@vt.edu; murphybr@vt.edu; Rice, Ronald (VSP); cotton.puryear@us.army.mil
Subject: RE: NEW PROJECT GSA 12-189F

Regarding the project referenced below, if you plan to comment, please email me your comments ASAP today. Thank you.

Julia Wellman
Environmental Impact Review Coordinator
Virginia Department of Environmental Quality
Office of Environmental Impact Review
PO Box 1105
Richmond, VA 23218
Phone: (804) 698-4326
Fax: (804) 698-4319
E-mail: Julia.Wellman@deq.virginia.gov

From: Fulcher, Valerie (DEQ)
Sent: Friday, October 26, 2012 2:10 PM
To: Cason, Gladys (DGIF); Tignor, Keith (VDACS); Rhur, Robbie (DCR); odwreview (VDH); Coe, Stephen (DEQ); Narasimhan, Kotur (DEQ); Cholko, Michael (DEQ); Ray, Alfred C. (VDOT); Cromwell, James R. (VDOT); Watkinson, Tony (MRC); Kirchen, Roger (DHR); Spears, David (DMME); Kline, Everette (DOF); mhickman@virginiasheartland.org;

1

GSA Response

C2-XXXX
Comment Noted.

TRIBES

EBCI THPO comments regarding the Department of State FASTC - Draft EIS Notification and Public Meeting

Tyler B. Howe <tylehowe@nc-cherokee.com> Mon, Oct 29, 2012 at 2:05 PM
To: "fastc.info@gsa.gov" <fastc.info@gsa.gov>
Cc: Russell Townsend <RussellT@nc-cherokee.com>

To whom it may concern:

The Eastern Band of Cherokee Indians Tribal Historic Preservation Office (EBCI THPO) has reviewed the materials provided for the proposed Draft Environmental Impact Statement for Planning Activities at Fort Pickett, Blackstone, Nottaway County, Virginia. Nottaway County, Virginia, is outside the traditional aboriginal territory of the Cherokee people. As such, the EBCI THPO wishes to defer this federal undertaking to those federally recognized Indian Nations whose traditional aboriginal territory falls within the expected Area for Potential Effect. T1-A

Please do not hesitate to contact me should you have additional questions.

Sincerely,

Tyler B. Howe

Tribal Historic Preservation Specialist

Eastern Band of Cherokee Indians

From: Russell Townsend
Sent: Friday, October 26, 2012 11:56 AM
To: Tyler B. Howe
Subject: FW: Department of State FASTC - Draft EIS Notification and Public Meeting

GSA Response

T1-A
Comment noted.

HAUDENOSAUNEE

TUSCARORA NATION
2006 MT. HOPE ROAD — VIA: LEWISTON, NEW YORK 14092

October 31, 2012

Abkgail Low
Project Executive
U.S. General Service Admimistration
Correspondence Symbol 3PAC
The Strawbridge Building
20 North Eighth Street
Philadelphia, PA 19107-3191

Dear Ms. Low:

The Tuscarora Nation wish to inform you that they are unable to attend the meeting to be held November 7, 2012 at at the Blackstone Conference & Retreat Center in Blackstone, Virginia on the EIS. The Nation request at written copy be sent to the Nation for review and thus we can send a written comment. T2-A

Your cooperation in regards to this request will be greatly appreciated.

ONEH:
Chief Leo R. Henry

Chief Leo R. Henry, Clerk
Tuscarora Nation

GSA Response

T2-A
A paper copy of the Draft EIS was delivered to the Tuscarora Nation on November 21, 2012. A paper copy of the Supplemental Draft EIS was sent on January 9, 2014.

LOCAL OFFICIALS AND AGENCIES

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LUNENBURG COUNTY VIRGINIA

Lunenburg County Administration
11412 Courthouse Road
Lunenburg, VA 23952

Tracy M. Gee
County Administrator

Telephone: (434) 696-2142
Facsimile: (434) 696-1703

November 8, 2012

Ms. Abigail Low
Project Manager
U. S. General Services Administration
20 N 8th Street
Philadelphia, PA 19107

RE: Letter of Support

Dear Ms. Low,

The Lunenburg County Board of Supervisors is glad to submit this letter of support for the possible location of the United States, Department of State, Foreign Affairs Security Training Center in Nottoway County, Virginia. As a neighboring county to the location being considered, we hope to enjoy some of the positive economic impact such a facility will provide; a variety of jobs for our citizens and newcomers alike, increased need of services, increased retail business, and the possibility of new businesses developing. We foresee that the development of this facility will reach far beyond its footprint in many ways; the economic impact, increased knowledge of our communities, trainees that may return as tourists, and increased educational benefits that may be offered locally. L1-A

We understand that this has been a long and involved process and that thus far your findings have been very positive. We look forward to an approval of the Nottoway County location sometime in Spring 2013.

Again, Lunenburg County is in full support of the location of FASTC on the Fort Pickett and adjoining properties. If we can be of any help, or provide information, please do not hesitate to call on us. Thank you for all of your efforts in this project.

Sincerely,

T. Wayne Hoover
Chairman

GSA Response

L2-A
Comment noted.

FOREIGN AFFAIRS SECURITY TRAINING CENTER [FASTC]

An American Recovery and Reinvestment Act of 2009 Project

GSA

Comment Form

FASTC Draft Environmental Impact Statement

The U.S. General Services Administration (GSA) has prepared a Draft Environmental Impact Statement (EIS) for the proposed U.S. Department of State FASTC in Nottoway County. The Draft EIS is available at local libraries and on the project website: **www.state.gov/recovery/fastc.** Please submit your comments on the Draft EIS no later than December 10, 2012 by:

1. Filling out this form and dropping it in the comment box at the public meeting
2. Talking to our stenographer who can record your comments at the public meeting
3. Submitting comments electronically via email to: **FASTC.info@gsa.gov**
4. Mailing your comment form to: Ms. Abigail Low, GSA Project Manager, 20 N 8th Street, Philadelphia, PA 19107

Please provide comments no later than December 10, 2012 to ensure they are considered during preparation of the Final EIS.

Please Note: The information and comments provided are published in the Final EIS and become part of the administrative record associated with this proposed action.

*Please check here if you would **NOT** like to be on the Email/mailing list* _____

Please check here if you would like your name and Email/mailing address kept private (i.e., not published in the Final EIS documents) _____

PLEASE PRINT CLEARLY AND LEGIBLY

Name: H. Wayne Carter Date: November 14 2012

Organization/Affiliation: Mecklenburg County / County Administrator

Email/Mailing Address: wayne.carter@mecklenburgva.com / P.O. Box 307

City, State, Zip Code: Boydton, Va. 23917

Comments: On behalf of the Mecklenburg County Board of Supervisors, I want to fully support the FASTC project being studied for Nottoway County. This project would be a tremendous boost to the economy of all of the surrounding localities in the report. Mecklenburg County is relatively close to Fort Pickett & will benefit from the construction jobs as well as the long term employment opportunities. L2-A

(Use reverse side for more space)

1

GSA Response

L2-A
Comment noted.

FOREIGN AFFAIRS SECURITY TRAINING CENTER [FASTC]
An American Recovery and Reinvestment Act of 2009 Project

Comment Form
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Please check here if you would like your name and Email/mailing address kept private (i.e., not published in the Final EIS documents) _____

PLEASE PRINT CLEARLY AND LEGIBLY

Name: Stephen Power Date: 11-7-12

Organization/Affiliation: Nottoway County Board of Supervs.

Email/Mailing Address: 1605 Orchard Rd

City, State, Zip Code: Burkeville, Va. 23922

Comments: I support this project wholeheartedly & am very thankful it will be located in Nottoway County. L3-A

Respectfully,

Steve Power

(Use reverse side for more space)

1

GSA Response

L3-A
Comment noted.

FOREIGN AFFAIRS SECURITY TRAINING CENTER [FASTC]
An American Recovery and Reinvestment Act of 2009 Project

Comment Form
FASTC Draft Environmental Impact Statement

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Please check here if you would like your name and Email/mailing address kept private (i.e., not published in the Final EIS documents) _____

PLEASE PRINT CLEARLY AND LEGIBLY

Name: Phil Miskovic Date: 11-7-12

Organization/Affiliation: Councilman, Town of Crewe

Email/Mailing Address: philmiskovic@gmail.com 100 Oliver Ave

City, State, Zip Code: Crewe, VA 23930

Comments: The Town of Crewe and it's citizens are very excited about this proposed plan. We look forward to a long, healthy regional partnership with all parties involved and to welcoming DoS personnel with open arms. L4-A

(Use reverse side for more space)

1

GSA Response

L4-A
Comment noted.

FOREIGN AFFAIRS SECURITY TRAINING CENTER [FASTC]
An American Recovery and Reinvestment Act of 2009 Project

Comment Form
FASTC Draft Environmental Impact Statement

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Please check here if you would like your name and Email/mailing address kept private (i.e., not published in the Final EIS documents) _____

PLEASE PRINT CLEARLY AND LEGIBLY

Name: LAFAYETTE DICKENS Date: 11-7-12

Organization/Affiliation: DOWNTOWN BLACKSTONE INC.

Email/Mailing Address: manager@downtownblackstone.org 107 W. Broad St

City, State, Zip Code: Blackstone, VA 23824

Comments: My main emphasis is in the area of economic development. As such I am curious to know how Blackstone can position itself to be more competitive or attractive to those who will be working at the facility. It seems like the EIS indicates that Chesterfield County is positioned to benefit more than Nottoway with almost no stake in the facility and absolutely no investment or negative impacts. What can we best offer those who train at the facility versus those who will work there. Which will we need most to prepare for? L5-A

1 (Use reverse side for more space)

GSA Response

L5-A

Through GSA's Urban Development/Good Neighbor program and USEPA's Community Assistance and Research expertise, GSA and USEPA, in a joint effort with the town, county, Fort Pickett, and the Virginia Economic Development Partnership, will assist Blackstone and Nottoway County in preparing for FASTC-related economic effects.

CITY OF EMPORIA

December 10, 2012

Ms. Abigail Low
Project Manager
U. S. General Services Administration
20 N 8th Street
Philadelphia, PA 19107

RE: Letter of Support

Dear Ms. Low:

The City of Emporia is glad to submit this letter of support for the possible location of the United States, Department of State, Foreign Affairs Security Training Center in Nottoway County, Virginia. As a participating locality within the Virginia Growth Alliance regional economic development organization along with Nottoway County and other neighboring jurisdictions, we hope to enjoy some of the positive economic impact such a facility will provide: a variety of jobs for our citizens and newcomers alike, increased need of services, increased retail business, and the possibility of new businesses developing. We foresee that the development of this facility will reach far beyond its footprint in many ways; the economic impact, increased knowledge of our communities, trainees that may return as tourists, and increased educational benefits that may be offered locally. L6-A

We understand that this has been a long and involved process and that thus far your findings have been very positive. We look forward to an approval of the Nottoway County location sometime in Spring 2013.

Again, the City of Emporia is in full support of the location of FASTC on the Fort Pickett and adjoining properties. If we can be of any help, or provide information, please do not hesitate to call on us. Thank you for all of your efforts in this project.

Sincerely,

Brian S. Thrower
City Manager

PO BOX 511, 201 SOUTH MAIN ST., EMPORIA, VA 23847 TELEPHONE: (434) 634 3332 FAX: (434) 634 0003
Visit Our Website at: www.ci.emporia.va.us

L6-A
Comment noted.

INDIVIDUALS

From: sonnyabbott@aol.com
Date: October 29, 2012, 11:35:05 AM EDT
To: abby.low@gsa.gov
Subject: *FastC EIS Proposal*

Ms. Low,

A quick review of the EIS suggests that the program is under utilizing the area to house prospective training candidates. At full operation, estimated to be the year 2020, there would be 450 students residing on-site while attending the program with 250 students residing in hotels, off-site, while attending the program. Using,$25.00 per night, per person, yields a cost of $6,250 per night or $31,250 per week for those residing off-site. The $25 per night, per person, is an extremely low estimate for any hotel in the greater Fort Picket area so the potential savings is substantial despite the initial cost of constructing three additional 90-person units on-site. Housing all trainees on-site eliminates the needs for supplemental transportation and other associated per-diem costs. I1-A

The EIS suggests an estimated employment level of 1070 when in full operation. Phase one was broken down to 248 already filled and 285 filled locally. Phase 2 is to add 229 employees and Phase 3 is to add 308 employees. Is there a breakdown of Phase 2 and Phase 3 as to the number that would be hired "locally" and those hired outside the local area? I1-B

Thank you, in advance, for your time. I trust you and the team are safe from the current weather pattern headed in your direction.

Respectfully,

Sonny Abbott

GSA Response

I1-A
Dormitories are no longer included in the Proposed Action and all overnight accommodations would be in local/regional motels/hotels. Refer to Supplemental Draft EIS Section 4.2.5.1 and Appendix J for the updated analysis.

I1-B
Potential local hires by phase may be determined by subtracting the number of transfer employees (refer to Table 4.2-10) from the total full time equivalent employment, including direct jobs generated by spending = 783 total (Table 4.2-9). Refer to Supplemental Draft EIS Section 4.2.5.1 and Appendix J for the updated analysis.

November 12, 2012

Ms. Abigail Low
GSA Project Manager
20 N 8th Street
Philadelphia, PA 10107

Re: FASTC Draft Environmental Impact Statement
Proposed U.S. Department of State FSTC in Nottoway County

Dear Ms. Low:

I support FASTC! I believe the facilities should be **totally contained within the geographic boundaries outlined in the Environmental Impact Study or what is commonly known as Picket Park and Fort Picket Military Base.** The current and future Department of State employees, those highly skilled (former military) and others selected to serve in the employ of the Government need the privacy, seclusion, and limited public access the Military Base offers. These personnel are the face of the United States of America in foreign lands, all around the world, and the Base offers an additional modicum of security during their stay. I1-C

My concerns revolve around the most effective or productive use of Tax Dollars in delivering an outcome that will meet the needs of the Department of State and provide an ongoing positive impact on local economies.

My questions and concerns are:

1. *What is the estimate number of TRAINING DAYS required for instruction of the professionals attending the facility?* I1-D
   - Training of 8,000 to 10,000 persons per year.
   - Training ranging from 5 days to 112 days. Without a breakdown it is impossible to understand why the use of local Hotel-Motels are required. The simplistic use of math cannot be an effective tool in determining this answer. Ten thousand professionals trained over 50 weeks equates to 200 per week to achieve the end result (10,000/50=200).

2. *Is 112,500 room nights adequate to house those professionals attending the training programs?* I1-E
   - Calculations of available on-site room nights is 112,500, (50 weeks x 5 days per week x 450 rooms = 112,500 room nights).
   - Documents outline purchase of 200+ hotel room nights per night for each year from 2020 and beyond.

3. *If 112,500 room nights are inadequate is it more cost effective to build additional on-site dormitories or contract off-site hotel rooms?* I1-F
   - The cost of an off-site hotel, estimate $50 per night, is $5000 per night ($50 x 100 rooms = $5000), or $25,000 per week or $1,250,000 per 50 week year. At completion, in 2020, that figure is in excess of $2,500,000. Estimate: 38,700 sq. ft. 90-room dormitory at $125 per sq. ft. = $4,837,500. A relative quick return of initial investment.

4. *Is it possible to achieve a $1.2 million economic impact each and every year at completion in 2020?* I1-G
   - A disproportionate number of projected employees (professionals currently within the employ of the Government) will reside outside Nottoway County. Unknown are those military or government employees currently assigned to Fort Picket, if any.
   - Those hired locally may come from outside Nottoway County and therefore reside outside Nottoway County.
   - The facility will have an on-site cafeteria. Local eateries will not see significant foot traffic, morning, noon or night.
   - Students will be bused to the facility limiting travel off-site.
   - The facility will have an on-site medical activity.

GSA Response

I1-C

Comment noted

I1-D

An average of 600 students would be on-site on an average training day. Training schedules and the number of trainees on-site in a given week would vary, as would the number of hotel-motel nights required. Refer to Supplemental Draft EIS Section 4.2.5.1 *Economic Impacts* and Appendix J *Economic and Fiscal Impacts Technical Studies* for updates to the economic impact analysis for Build Alternative 3. The estimate of hotel room nights is a best estimate used for planning purposes; the actual number may vary.

I1-E

Please refer to Response I1-A

I1-F

Dormitories are no longer included in the Proposed Action. Refer to Supplemental Draft EIS Section 4.2.5.1 and Appendix J for the updated analysis. Please also refer to Response I1-A.

I1-G

Refer to Supplemental Draft EIS Section 4.2.5.1 and Appendix J for the updated analysis. Revenue to Nottoway County was generated by the IMPLAN model using the following inputs, which would stimulate local tax collections: personal expenditures, local FASTC contract expenditures (non-payroll expenditures), and visiting trainee expenditures. Personal expenditures are derived from operational payrolls and are based on a measure of Personal Consumption Expenditures as provided by the Government Printing Office. Contract expenditures are associated with spending in categories such as vehicle and track maintenance, food services, off-site lodging, technology maintenance, and utilities. Trainee expenditures include incidentals, gifts and other miscellaneous purchases calculated based on the estimated time trainees would be expected to be free to frequent local business. All expenditure categories are provided in the Approach to Analysis section of the Economic and Fiscal Impact Studies Technical Report provided in Appendix J of the Supplemental Draft EIS.

- The facility will have a fitness center.
- Local schools are not over crowded, in Nottoway or Chesterfield County. Early, middle or high school students moving with their parents can be absorbed within existing schools.
- Blackstone, Crewe and Burkeville do not have a movie theater.
- The proposed number of employees at 1070 (presume 50% are related to training delivery), the number of school aged children can be considered minimal.
- Those that are hired from the local workforce with children are already "in the school system," and their economic impact is the variance form current to the incremental increase caused by their new employment.
- Nottoway is projected to lose population from the 2010 Census to the Census that will be taken for 2020. I1-G
- An unknown number of trainees will remain on-site over weekends (not training) and might venture off the FASTC site. This potential positive economic impact might be off-set by the adverse impact on the operation on-site at FASTC (especially food service).
- Those that are fortunate to gain employment or service contracts, in support of FASTC will generate a positive economic impact to the area.

The local area is fortunate to have the Foreign Affairs Security Training Center in our community. I appreciate the opportunity to reduce to writing my concerns voiced at the public forum and look forward to responses in the final package.

Again, I support FASTC!

Respectfully,

Erwin B. Abbott, Jr.
(Sonny)
2149 Little Creek Road
Crewe, Virginia 23930
434-774-7556
Email: sonnyabbott@aol.com

GSA Response

I1-G

(Response provided on previous page.)

COURIER-RECORD NEWS <news@courier-record.com> Fri, Oct 26, 2012 at 2:57 PM To: FASTC Team <fastc.info@gsa.gov> Thanks for the update....I've looked at report. RATHER EXTENSIVE. Well done. Most of my readers would prefer the cliff note version of the answer to this question: "Y'ALL COMIN' or NOT?" I2-A :-) --Billy Coleburn, Courier-Record, Blackstone	**GSA Response** **I2-A** Comment noted.

In Re: Foreign Affairs Security Training Center in Nottoway County, Virginia
Public Meeting for the Draft Environmental Impact Statement November 7, 2012

Page 3

P R O C E E D I N G S

MR. DUNCANSON: You're just going to love it here. And FASTC is a perfect fit. It's a military town. We love Pickett. And we love all the noise that comes with Pickett; the planes and the tanks and the 50 cal guns. We love it. It's just what we do here. I3-A

And FASTC, we're not even going to hear your pistols and your squealing tires. You don't need to worry about that. What you need to do is get busy and come on in.

MS. HASBROUCK: I've been attending all these meetings from the beginning, and I continue to fully support the project. And I'm looking forward to the impact it's going to have on our community.

(Hearing concluded, 8:30 p.m.)

* * * * *

(434) 975-5400 Cavalier Reporting & Videography (434) 293-3300
www.cavalier-reporting.com production@cavalier-reporting.com

GSA Response

I3-A
Comment noted.

FOREIGN AFFAIRS SECURITY TRAINING CENTER [FASTC]
An American Recovery and Reinvestment Act of 2009 Project

Comment Form
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Please check here if you would like your name and Email/mailing address kept private (i.e., not published in the Final EIS documents) ✓

PLEASE PRINT CLEARLY AND LEGIBLY

Name: JOHN GLANCY Date: 11/7/12

Organization/Affiliation:

Email/Mailing Address: JTRK57@AOL.COM 402 TUNSTALL AVE

City, State, Zip Code: BLACKSTONE, VA. 23824

Comments: VERY INTERESTED IN GETTING IN ON GROUND FLOOR FOR CONST. TO LEAD INTO MAINTENANCE POSITION FOR FACILITY. I4-A

1 (Use reverse side for more space)

GSA Response

I4-A
Comment noted.

Comment page repeated to maintain alphabetical order.

In Re: Foreign Affairs Security Training Center in Nottoway County, Virginia
Public Meeting for the Draft Environmental Impact Statement November 7, 2012

Page 3

P R O C E E D I N G S

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(Hearing concluded, 8:30 p.m.)

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www.cavalier-reporting.com

Cavalier Reporting & Videography

(434) 293-3300
production@cavalier-reporting.com

GSA Response

I5-A
Comment noted

PUBLIC COMMENT ON FEDERAL REGISTER Fwd: why is the us govt spending out tax dollars on new buildings when so many buildings are vacant? and cheap to rent?

jean public <jeanpublic1@gmail.com> Sun, Oct 28, 2012 at 9:17 AM
To: FASTC.INFO@gsa.gov, president@whitehouse.gov, speakerboehner@mail.house.gov
Cc: info@theteaparty.org, INFO@themorristownteaparty.org, NCOLEMAN25@comcast.net

TAXPAYERS THINK THEY SHOULD RENT OR USE OPEN FACILITIES AT A MILITARY FORT. SEE NO NEED TO BUILD AND SPEND MILLIONS ON THIS FACILITY. GSA WAS THE ONE WHO SPENT LIKE DRUNKEN SAILOR AT CONFERENCE IN CALIFORNIA RECENTLY. WE NEED TO CUT COSTS. THIS IS NOT NECESSARY IN THIS SPENDING SPREE. THIS COMMENT IS FOR THE PUBLIC RECORD. JEAN PUBLIC I6-A

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[Federal Register Volume 77, Number 208 (Friday, October 26, 2012)]
[Notices]
[Pages 65382-65383]
From the Federal Register Online via the Government Printing Office [www.gpo.gov]
[FR Doc No: 2012-26199]

GENERAL SERVICES ADMINISTRATION

[Notice-R03-2012-01; Docket No. 2012-0002; Sequence 23]

Notice of Public Meeting for the Draft Environmental Impact Statement for the Foreign Affairs Security Training Center in Nottoway County, VA

AGENCY: United States General Services Administration.

ACTION: Notice.

[[Page 65383]]

SUMMARY: Pursuant to the Council on Environmental Quality (CEQ) regulations, implementing the procedural provisions of the National Environmental Policy Act (NEPA), the U.S. General Services Administration (GSA) has prepared and filed a Draft Environmental Impact Statement (EIS) with the U.S. Environmental Protection Agency (EPA). GSA is the lead agency; cooperating agencies are U.S. Department of State (DOS), U.S. Army Corps of Engineers, EPA, and National Guard Bureau. The Draft EIS was prepared to evaluate the environmental impacts of site acquisition and development of the DOS, Bureau of Diplomatic Security, Foreign Affairs Security Training Center (FASTC) at the Virginia Army National Guard's Maneuver Training Center at Fort Pickett and Nottoway County's Pickett Park in Nottoway County, Virginia. The project would be developed on land currently operated or owned by the Virginia Army National Guard and Nottoway County. The purpose of the proposed FASTC in Nottoway County is to consolidate existing dispersed training functions into a single suitable location to improve training efficiency and enhance training operations. More detailed information on the FASTC program is available at http://www.state.gov/recovery/fastc.

DATES: Comment date: The public may submit comments on the Draft EIS during a 45-day public review and comment period beginning October 26, 2012 with publication of this notice and ending on December 10, 2012. Instructions for submitting comments may be found under the heading

GSA Response

I6-A

Diplomatic Security hard skills training is currently conducted at up to 11 different geographically dispersed leased and contracted facilities nationwide. A May 2008 report to Congress identified the need for a consolidated facility that would improve training efficiency and provide priority access to training venues that meet current facility standards.

Through an extensive site selection process, GSA and DOS have explored possible options for the use of existing government facilities. This process determined that the Fort Pickett/Nottoway County site was the only suitable location for FASTC. This determination was reaffirmed in 2013 by two independent federal government panels.