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 Final 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

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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.

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CHAPTER 7 LIST OF PREPARERS

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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.

References

California Air Resources Board (CARB). 2005. Comparison of Asphalt Paving Emission Factors.

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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	79,495
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	Emission Factors Diesel Fuel [a, b] < 447 kW or < 600 hp
	lb/hp-hr	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

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