category. Under Alternative A, these properties would have direct access to I-93. Under Alternative B, Franklin Street and Folsom Road could provide access for these properties to connect to I-93. These properties would not have access to I-93 under Alternatives C, D, or F. No other changes to zoning would be attributable to or affected by the Build Alternatives.

Public Policy

No Build Alternative

Under the No Build Alternative, the downtown Derry area would continue to experience high traffic volumes, and opportunities for enhanced economic vitality would not occur. Therefore, the No Build Alternative is incompatible with public policy related to the Derry and Londonderry master plans.

Build Alternatives

Alternatives A and B would be compatible with public policy in that they would reduce traffic in downtown Derry and provide opportunities for economic development. Although Alternatives C and D would reduce traffic in downtown Derry, they would not provide additional opportunities for economic development beyond supporting the revitalization of the downtown area. Alternative F would be incompatible with public policy in that it would not reduce through traffic in downtown Derry, would impact street parking in the downtown area, and would not provide opportunities for economic development.

4.3.3 Mitigation Measures

Mitigation measures for potential impacts related to land use, zoning, and public policy have not been proposed. Section 4.7, *Socioeconomics*, discusses mitigation measures related to residential relocations and business displacements.

4.4 Air Quality

4.4.1 Introduction

Transportation projects may affect air quality in the vicinity of a project both temporarily and over the long term. During construction, suppliers and site workers would travel to the Project site by automobile and truck; once the new exit is complete, there is likely to be an increase in normal daily traffic in the immediate area. This increase in vehicular traffic may result in emissions of pollutants such as carbon monoxide (CO), particulate matter (PM), and the precursor pollutants that contribute to the formation of ground-level ozone (O_3).

This section describes the standards used to assess air quality, the attainment status of the Project area, existing air quality monitoring data, potential air quality impacts associated with Project operation and construction, and mitigation measures for air quality impacts. The existing air quality was assessed by compiling measured data for existing and historical air quality conditions in the study area. The measured data compiled for ambient pollutant concentrations were compared to applicable air quality standards.

National and State Air Quality Standards

The Clean Air Act (CAA) and its amendments led to the creation of National Ambient Air Quality Standards (NAAQS) by EPA for six criteria air pollutants: CO, sulfur dioxide (SO_2), O_3, PM, nitrogen dioxide (NO_2), and lead (Pb). NAAQS are set at levels to protect public health.

CO is a colorless, odorless gas that results from the incomplete combustion of gasoline and other fossil fuels. Approximately 80 percent of CO emissions are from motor vehicles. Because CO disperses quickly, concentrations can vary greatly over relatively short distances. Elevated concentrations are usually limited to locations near crowded intersections and along congested roadways and can cause adverse health impacts by reducing oxygen delivery to vital organs.

O_3 is also a colorless gas and a major constituent of photochemical smog at the earth's surface. Precursors in the formation of ozone are volatile organic carbon (VOCs) and nitrogen oxide (NO_x). In the presence of sunlight, ozone is formed through a series of chemical reactions that take place in the atmosphere. Because the reactions occur as the pollutants are diffusing downwind, elevated ozone levels are often found many miles from precursor pollutant sources. Health effects of O_3 exposure include respiratory irritation, reduced lung function, and worsening of diseases such as asthma. People with lung disease, children, older adults, and people who are active outdoors may be particularly sensitive to O_3. Elevated O_3 can also impact sensitive vegetation. For the Project, ground-level O_3 is a consideration within the entire Project area.

NO_2 is a major component of NO_x. In addition to being a precursor to ozone, NO_2 is also a criteria pollutant under NAAQS. Nitrogen dioxides form when fuel is burned at high temperatures. The primary manmade sources are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels. It is one of the main ingredients involved in the formation of ground-level ozone, which can trigger serious respiratory problems. NO_2 forms small particles that penetrate deep in the lungs, and can cause or worsen existing respiratory system problems such as asthma, emphysema, or bronchitis. It also contributes to: formation of acid rain; nutrient loading to waterbodies; atmospheric particles; and visibility impairment in parks. NO_x are also a precursor to the formation of ozone. NO_2 emission sources associated with the Project include cars, trucks, and construction equipment.

PM is a broad class of air pollutants that exist as liquid droplets or solids, with a wide range of size and chemical composition. PM is emitted by a variety of sources, both natural and human-made. Major human-made sources of PM include the combustion of fossil fuels in vehicles, power plants, and homes; construction activities; agricultural activities; and wood-burning fireplaces. Smaller particulates that are smaller than or equal to 10 and 2.5 microns in size (PM_{10} and $PM_{2.5}$) are of particular health concern because they can get deep into the lungs and affect respiratory and heart function. Particulates can also impact visibility; damage soil, plants, and water quality; and stain stone materials. PM emissions at the Project are primarily a concern from heavy-duty trucks and other equipment with diesel engines.

SO_2 is part of a group of reactive gases called oxides of sulfur. Health effects of SO_2 exposure include adverse respiratory effects, such as increased asthma symptoms. The largest sources of SO_2 emissions nationally are from fossil fuel combustion at power plants/industrial facilities, electrical utilities, and residential/commercial boilers. Because mobile sources are not a significant source of SO_2 emissions, SO_2 is not a primary concern at the Project.

Pb is a toxic heavy metal that can have numerous adverse health impacts, including neurological damage to children and cardiovascular effects in adults. Pb emissions can contribute to exposure through the air directly or indirectly by causing soil/water contamination. Prior to the phase out of leaded gasoline in 1980, automobiles were a source of Pb emissions. According to EPA, the major sources of Pb emissions to the air today are ore and metals processing and piston-engine aircraft operating on leaded aviation gasoline. The Project does not involve Pb emissions; therefore, Pb is not discussed further in the air quality analysis.

Table 4.4-1 presents the current NAAQS and NH state standards for criteria pollutants. There are two types of standards, primary standards and secondary standards. Primary standards are designed to protect public health, and represent levels at which there are no known significant effects on human health. The secondary standards are designed to protect the environment from any known or anticipated adverse effects of a pollutant, including the effects on the natural environment (soil, water, vegetation) and the human-made environment (physical structures).

Table 4.4-1. National and New Hampshire Ambient Air Quality Standards

Pollutant	Primary/ Secondary		Averaging Time	Level	Form
Carbon Monoxide (CO)	primary		8-hour	9 ppm	not to be exceeded more than once per year
			1-hour	35 ppm	
Ozone (O_3)	primary & secondary		8-hour	0.070 ppm	annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Nitrogen Dioxide (NO_2)	primary		1-hour	100 ppb	98th percentile, averaged over 3 years
	primary & secondary		Annual	53 ppb	annual mean
	secondary		**Annual**	**100 µg/m^3**	**annual mean**
Particulate matter ($PM_{2.5}$ and PM_{10})	$PM_{2.5}$	primary	Annual	12 µg/m^3 **15 µg/m^3**	annual mean, averaged over 3 years
		secondary	Annual	15 µg/m^3	annual mean, averaged over 3 years
		primary & secondary	24-hour	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary & secondary	24-hour	150 µg/m^3	not to be exceeded more than once per year on average over 3 years
Sulfur dioxide (SO_2)	primary		1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	secondary		3-hour	0.5 ppm	not to be exceeded more than once per year
Lead (Pb)	primary & secondary		Rolling 3-month average	0.15 µg/m^3	not to be exceeded

Note: **Bold** text denotes New Hampshire's deviations from the national standard.
ppm = parts per million; ppb = parts per billion; µg/m3 = micrograms per cubic meter

Source: EPA (2015a); NHDES (n.d.a)

Attainment Status

Areas that do not meet the NAAQS are classified as nonattainment areas for that pollutant. Areas that have never been designated nonattainment for a pollutant and NAAQS are considered attainment areas. Former nonattainment areas currently meeting the NAAQS are designated maintenance areas and must have maintenance plans for 20 years.

The Project location within Rockingham County is in attainment for all six criteria pollutants. Therefore, transportation conformity does not apply.

Mobile Source Air Toxics

In addition to the criteria air pollutants for which there are NAAQS, EPA also regulates air toxics. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries). Mobile Source Air Toxics (MSATs) are compounds emitted from highway vehicles and non-road equipment (e.g., volatile organic compounds, nonvolatile organics, diesel particulate matter/diesel exhaust gases, or metals). Some toxic compounds are present in fuel and emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or impurities in oil or gasoline.

The revised list of current air toxics identified by the CAA Amendments of 1990 includes 187 air toxics (EPA, 1990). In 2007, EPA assessed all 187 air toxics in its Control of Hazardous Air Pollutants from Mobile Sources and identified a group of 93 compounds emitted from mobile sources (Federal Register, 2007). Also, EPA evaluated 180 of the 187 CAA air toxics, plus diesel PM, in its 2015 National Air Toxics Assessment (NATA),[7] identifying nine compounds from mobile sources that are national and regional cancer risk contributors (EPA, 2015b). These compounds include formaldehyde, benzene, polycyclic organic matter, 1, 3-butadiene, acetaldehyde, acrolein, diesel particulate matter (diesel PM), ethylbenzene, and naphthalene and are considered priority MSATs by FHWA (FHWA, 2016a).

Greenhouse Gas Emissions

Greenhouse gases are trace gases that trap heat in the earth's atmosphere. Some greenhouse gases occur naturally and are emitted into the atmosphere through natural processes and human activities. Naturally occurring greenhouse gases include water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and O_3. Other greenhouse gases such as chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs) are created and emitted solely through human activities. Certain human activities can also add to the levels of most of the naturally occurring gases. The principal greenhouse gases that enter the atmosphere because of human activities are CO_2, CH_4, N_2O, and fluorinated gases.

Transportation contributes to global warming through the burning of gasoline and diesel fuel. Any process that burns fossil fuels, such as gasoline and diesel fuel, releases CO_2 into the air. CO_2 from fossil fuel combustion is responsible for almost all greenhouse gas emissions from mobile sources, which include both transportation sources and non-transportation equipment,

[7] The December 17, 2015, National Air Toxics Assessment report contains 2011 emissions data.

such as agricultural and construction equipment. CH_4 and N_2O emissions also result from fuel combustion, while HFC emissions are associated with motor vehicle air conditioners.

In contrast with trends in other air emissions, greenhouse gas emissions from transportation continue to rise, in large part because the demand for travel has outpaced improvements in fuel efficiency. In 2014, the transportation sector contributed 26 percent to the total greenhouse gas emissions, a 17 percent increase from 1990, making transportation the second largest contributor to greenhouse gas emissions and one of the fastest growing economic sectors that produces CO_2 emissions (EPA, 2017a).

To date, no national standards have been established for greenhouse gases, nor has EPA established criteria or thresholds for greenhouse gas emissions applicable to transportation projects.

In December 2007, NH established a Climate Change Policy Task Force and charged the task force with developing a Climate Change Action Plan that establishes climate change goals and recommends meaningful steps to meet those goals, based on Executive Order Number 2007-3. NHDES is designated as the lead agency for the task force. The *2009 New Hampshire Climate Action Plan: A Plan for New Hampshire's Energy, Environmental and Economic Development Future* was published in March 2009. The plan recommends a long-term goal of reducing greenhouse gas emissions by 80 percent below 1990 levels by 2050 and a mid-term goal of reducing greenhouse gas emissions 20 percent below 1990 by 2025 (NHDES, 2009). The plan contains 67 recommended actions for individuals, businesses, and government organized around the following 10 overarching strategies:

1. Maximize energy efficiency in buildings.
2. Increase renewable and low-CO_2-emitting sources of energy in a long-term sustainable manner.
3. Support regional and national actions to reduce greenhouse gas emissions.
4. Reduce vehicle emissions through state actions.
5. Encourage appropriate land use patterns that enable fewer vehicle-miles traveled.
6. Reduce vehicle-miles traveled through an integrated multimodal transportation system.
7. Protect natural resources (land, water, wildlife) to maintain the amount of carbon fixed or sequestered.
8. Lead by example in government operations.
9. Plan for how to address existing and potential climate change impacts.
10. Develop an integrated education, outreach, and workforce training program.

4.4.2 Affected Environment

Ambient air quality is monitored by the New Hampshire Ambient Air Monitoring Program maintained by NHDES, and the study area for air quality is Rockingham County. No existing air quality monitoring sites are located on or adjacent to the Project site. The closest air monitoring station to the Project is located at the Moose Hill School in Londonderry (Weinstock, 2012). The

Londonderry station was activated in 2011 and monitors five of the criteria pollutants. Monitoring for Pb was discontinued on June 30, 2016 (NHDES, 2016a).

Existing monitored criteria air pollutant concentrations in the statistical form comparable to the NAAQS were obtained from EPA's design value reports, which incorporates the monitoring data reported by states (including NHDES). Table 4.4-2 summarizes the available air quality monitoring data for a 3-year period from 2014 through 2016 from the Londonderry station at Moose Hill School (except where stated otherwise).

Table 4.4-2. Londonderry Air Quality Monitoring Data, 2014–2016

Pollutant	Averaging Time	NAAQS/NHAAQS[a] and units	2014	2015	2016
Carbon monoxide (CO)	8-hr	9 ppm	0.5	0.4	0.4
	1-hr	35 ppm	0.6	0.6	0.5
Ozone (O_3)	8-hour	0.070 ppm	0.067	0.065	0.065
Nitrogen dioxide (NO_2)	1-hour	100 ppb	NA	22.7	24.3
	annual	53 ppb	NA	3	3
Particulates ($PM_{2.5}$)[b]	annual	12 μg/m^3 **15 μg/m^3**	8.2 (2012-2014)	8.0 (2013-2015)	6.6 (2014-2016)
	24-hour	35 μg/m^3	18 (2012-2014)	18 (2013-2015)	16 (2014-2016)
Sulfur dioxide (SO_2)	1-hour	75 ppb	5.4	6.0	2.9

Notes: **Bold** text denotes New Hampshire's deviations from the national standard.
ppm – parts per million; ppb – parts per billion; μg/m3 – micrograms per cubic meter

a Sources: EPA (2018a, 2015a)

b Particulates (PM_{10}) data for a 3-year averaging period for the years 2014-2016 were not available at Londonderry nor any nearby station.

All pollutants monitored measured concentrations well below both the NAAQS and NH standards. The measured concentrations of 8-hour O_3 have come close to the standards for this pollutant, but not exceeded them, based on the averaging timeframe and methods used to determine compliance. $PM_{2.5}$ concentrations at the Londonderry station exhibit a downward trend in concentrations over time.

4.4.3 Environmental Consequences

Air Quality

Transportation Conformity

As noted in Section 4.4.1, the Project area is in attainment for all the criteria pollutants. Therefore, the regional and project-level transportation conformity regulations (40 CFR 93 Subpart A) are not applicable to this project.

The Project area is located in a former nonattainment area for the revoked 1997 ozone NAAQS. The 1997 NAAQS were subsequently replaced by the stricter 2008 NAAQS, and the Project area was designated attainment for the 2008 NAAQS. On February 16, 2018, the U.S. Court of Appeals for the District of Columbia issued a decision in *South Coast Air Quality Management District v. EPA et al.* (Case No. 15-1115) that invalidated certain provisions of EPA's rulemaking governing the revoked 1997 NAAQS, including the removal of transportation conformity requirements in former 1997 ozone nonattainment areas. Although the implementation of changes to transportation conformity as a result of this court case was not fully resolved at the time this SDEIS was prepared, if transportation conformity to the 1997 ozone standard is found to be applicable, the Project would need to be included in the SNHPC transportation conformity determination on the long-range transportation plan and transportation improvement program prior to the FHWA approval of the FEIS/ROD. Because ozone is a regional pollutant, there are no potential implications of the court case to the Project in terms of Project-level or hot-spot analysis requirements.

Carbon Monoxide Hot-Spots

Potential impacts on CO concentrations near congested intersections were evaluated based on a worst-case intersection. The worst-case intersection was identified based on ranking the LOS, delay, and traffic volumes for all the intersections in the traffic study area (plus additional intersections considered for the Interchange Justification Report [see Appendix D]).

The NH 102 and Hampton Drive/Garden Lane intersection represents a location with increased volumes and congestion with the Build Alternatives. For this intersection, the No Build is analyzed in comparison to Alternative A (the alternative with the highest volumes and delay) to quantify the maximum potential incremental increase in CO concentrations for all alternatives.

Table 4.4-3. 2040 PM Peak Hour Traffic Volumes, Delay, and LOS for NH 102 and Hampton Drive/Garden Lane

Alternative	LOS	Delay (sec)	Traffic Volume
No Build	D	49.9	5,264
Alternative A	F	83.9	5,821
Alternative B	E	78.1	5,782
Alternative C	D	53.0	5,688
Alternative D	E	55.8	5,781
Alternative F	D	50.9	5,463

A microscale CO analysis was conducted for the NH 102 and Hampton Drive/Garden Lane intersection using MOVES2014a and CAL3QHC. The key MOVES inputs were as follows:

- Analysis year: 2025 (analyzed as a potential opening year, conservatively using the traffic volumes estimated for 2040. Using an analysis year closer to the present is conservative given that the fleet becomes cleaner over time as older and higher-emitting vehicles are retired).
- Links: links were delineated to represent each of the intersection approach, queue, and departure traffic movements for the PM peak hour. Approach links were assumed to have an average speed of 5 mph (which simulates stop/start conditions, with idling), while departure links were assumed to have an average speed of 15 mph. Approach link lengths all exceeded the 95^{th} percentile queue lengths from the traffic analysis. The average grade for each link was calculated based on LIDAR data. All links were defined as the "urban unrestricted access" type, which is the appropriate roadway type for arterials with intersections.
- Vehicle classification: for screening analysis purposes, 100 percent of the vehicles were assumed to be gasoline passenger cars. Diesel heavy-duty vehicles have lower CO emissions than passenger vehicles; therefore, it was not necessary to model heavy-duty vehicles separately.
- Age distribution: for screening purposes, the EPA national default vehicle age distribution for 2025 was used.
- Fuels: for screening purposes, the MOVES default fuel distribution was used.
- Inspection/maintenance purposes: for screening purposes, no credit for inspection/maintenance programs was taken in the emissions modeling.
- Meteorology: based on the analysis hour of 5 p.m. in January, the default temperature of 32.3 degrees F and a relative humidity of 56 percent was used.

CAL3QHC modeling was performed with a dense network of receptors and atmospheric stability class D. Table 4.4-4 provides the CO microscale analysis results for the receptor with the highest concentration. The modeled result for Alternative A and the No Build are the same because CAL3QHC rounds the concentrations to the nearest 10^{th}, meaning that minor differences due to higher volumes under Alternative A do not change the rounded concentration. The 8-hour concentration was estimated from the modeled 1-hour concentration using the default 0.7 persistence factor. The results show predicted maximum CO concentrations would be well under the 1-hour and 8-hour NAAQS at the worst-case intersections. This means that CO impacts at other intersections in the study area with lower volumes and/or less congestion would similarly not have adverse impacts on CO concentrations under Alternative A or any of the other Build Alternatives.

Table 4.4-4. Microscale CO Analysis Results for NH 102 and Hampton Drive/Garden Lane (2040 PM Peak Hour Traffic)

	NAAQS	No Build and Alternative A modeled concentration	Background concentration	Total concentration
1-hour concentration (ppm)	35	0.4	0.6	1.0
8-hour concentration (ppm)	9	0.28	0.5	0.78

Fine Particulate Matter Hot-Spots

Although not subject to transportation conformity requirements, the transportation conformity regulations were used for NEPA purposes to determine if a PM2.5 hot-spot analysis was necessary. The transportation conformity regulations are relevant to use for this purpose because they are intended to prevent violations of the NAAQS or worsening of existing violations. A transportation project that is located in a “nonattainment” or “maintenance” area for PM10 or PM2.5, and meets one of the following conditions, is referred to as a “project of local air quality concern”, and requires a quantitative PM hotspot analysis under transportation conformity.

1. New highway projects that have a significant number of diesel vehicles, and expanded highway projects that have a significant increase in the number of diesel vehicles; (40 CFR 93.123(b)(1)(i))
2. Projects affecting intersections that are at LOS D, E, or F with a significant number of diesel vehicles, or those that will change to LOS D, E, or F because of increased traffic volumes from a significant number of diesel vehicles related to the project; (40 CFR 93.123(b)(1)(ii))
3. New bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location; (40 CFR 93.123(b)(1)(iii)).
4. Expanded bus and rail terminals and transfer points that significantly increase the number of diesel vehicles congregating at a single location; (40 CFR 93.123(b)(1)(iv)) and

Projects in or affecting locations, areas, or categories of sites which are identified in the PM10 or PM2.5 applicable state implementation plan, as sites of violation or possible violation. (40 CFR 93.123(b)(1)(v)) The types of projects that would require PM hot-spot analysis were further clarified through a series of examples provided in the preamble of the March 2006 Final Rule. Some examples of projects of local air quality concern that **would** be covered by 40 CFR 93.123(b)(1)(i) and (ii) are:

- a project on a new highway or expressway that serves a significant volume of diesel truck traffic, such as facilities with greater than 125,000 AADT and 8 percent or more of such AADT is diesel truck traffic;
- new exit ramps and other highway facility improvements to connect a highway or expressway to a major freight, bus, or intermodal terminal;

- expansion of an existing highway or other facility that affects a congested intersection (operated at LOS D, E, or F) that has a significant increase in the number of diesel trucks; and,
- similar highway projects that involve a significant increase in the number of diesel transit busses and/or diesel trucks.

The following are examples of projects that **are not** a local air quality concern under 40 CFR 93.123(b)(1)(i) and (ii):

- any new or expanded highway project that primarily services gasoline vehicle traffic (i.e., does not involve a significant number or increase in the number of diesel vehicles), including such projects involving congested intersections operating at LOS D, E, or F;
- an intersection channelization project or interchange configuration project that involves either turn lanes or slots, or lanes or movements that are physically separated. These kinds of projects improve freeway operations by smoothing traffic flow and vehicle speeds by improving weave and merge operations, which would not be expected to create or worsen PM NAAQS violations; and,
- intersection channelization projects, traffic circles or roundabouts, intersection signalization projects at individual intersections, and interchange reconfiguration projects that are designed to improve traffic flow and vehicle speeds, and do not involve any increases in idling. Thus, they would be expected to have a neutral or positive influence on PM emissions.

The proposed new alignment connector roads under Alternatives A, B, C, and D would have AAWDT (Average Annual Weekday Traffic) volumes in the range of 36,728 (Alternative D) to 54,523 (Alternative B) immediately east of I-93. The heavy-duty vehicle percent for the connector roads is 2.3 percent to 2.6 percent during the AM peak hour and to 1.0 percent to 2.5 percent during the PM peak hour based on the traffic analysis. These volumes are well under the EPA suggested AADT threshold of 10,000 heavy duty vehicles for a project of local air quality concern (8 percent of 125,000 AADT). In addition, the proposed connector roads would not connect to major freight, bus, or intermodal terminals. The traffic data shows that the proposed connector roads would not have the potential for significant adverse impacts on $PM_{2.5}$ concentrations and further detailed analysis is not warranted.

The potential for $PM_{2.5}$ impacts at intersections was also reviewed based on the traffic study. There are less than 350 heavy duty vehicle approaching any of the intersections in the Project area during the AM and PM peak hours. Therefore, the alternatives would not affect intersections with a substantial volume of heavy-duty vehicle traffic.

Mobile Source Air Toxics

A qualitative analysis provides a basis for identifying and comparing the potential differences among MSAT emissions, if any, from the various alternatives. The qualitative assessment presented below is derived in part from a study conducted by FHWA entitled *A Methodology for Evaluating Mobile Source Air Toxic Emissions among Transportation Project Alternatives* (FHWA, 2017b).

For each Alternative, the amount of mobile source air toxics (MSAT) emitted would be proportional to the vehicle miles traveled (VMT), assuming that other variables such as fleet mix are the same for each Alternative. The VMT estimated for Alternatives A and B is slightly higher than that for the No Build Alternative, because the interchange facilitates new development that attracts trips that would not otherwise occur in the area (see Table 4.4-3). This increase in VMT means MSAT under the Alternatives A and B would probably be higher than the No Build Alternative in the study area. There could also be localized differences in MSAT from indirect effects of the project such as associated access traffic, emissions of evaporative MSAT (e.g., benzene) from parked cars, and emissions of diesel particulate matter from delivery trucks associated with land development. Alternative D would result in a slight increase in VMT, although to a lesser extent than Alternatives A and B. Alternatives C and F would result in a decrease in total VMT compared to the No Build and thus would be expected to decrease overall MSAT emissions.

Because the estimated VMT under each of the Build Alternatives are nearly the same, varying by less than 1.64 percent compared to the No Build, it is expected there would be no appreciable difference in overall MSAT emissions among the various Build Alternatives. For all alternatives, emissions are virtually certain to be lower than present levels in the design year as a result of the Environmental Protection Agency’s (EPA) national control programs that are projected to reduce annual MSAT emissions by over 90 percent from 2010 to 2050 (Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents, FHWA, October 12, 2016). Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future than they are today.

In locations along existing roads, the improvements contemplated as part of the project alternatives will have the effect of moving some traffic closer to nearby homes, schools and businesses; therefore, under each alternative there may be localized areas where ambient concentrations of mobile source air toxics (MSAT) would be higher under certain alternatives than others. However, the magnitude and the duration of these potential increases cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific MSAT health impacts. Further, under all alternatives, overall future MSAT are expected to be substantially lower than today due to implementation of the Environmental Protection Agency’s (EPA) vehicle and fuel regulations.

In sum, under all Build Alternatives in the design year it is expected there would be either slightly higher or lower MSAT emissions in the study area relative to the No Build Alternative. There also could be increases in MSAT levels in a few localized areas where VMT increases. However, EPA's vehicle and fuel regulations will bring about significantly lower MSAT levels for the area in the future than today.

Table 4.4-5. 2040 SNHPC Model Wide Vehicle Miles Traveled

Functional Class	No Build	Alternative A	Alternative B	Alternative C	Alternative D	Alternative F
1 (Interstate)	3,673,155	3,751,514	3,752,621	3,705,076	3,699,371	3,678,589
2 (Other Freeways and Expressways)	1,158,441	1,155,931	1,160,018	1,151,498	1,154,379	1,153,307
3 (Other Principal Arterial)	1,343,582	1,377,420	1,389,936	1,340,840	1,339,339	1,342,044
4 (Minor Arterial)	1,293,208	1,284,638	1,291,845	1,292,279	1,305,777	1,290,478
5 (Major Collector)	1,085,570	1,120,288	1,095,701	1,070,866	1,071,633	1,082,510
6 (Minor Collector)	131,656	134,291	134,591	131,610	134,748	130,126
7 (Local)	543,985	556,786	544,999	536,275	537,041	543,637
Total	**9,229,597**	**9,380,868**	**9,369,711**	**9,228,444**	**9,242,288**	**9,220,691**

Source: SNHPC (2018)
Note: The SNHPC travel demand model encompasses 15 communities: Auburn, Bedford, Candia, Chester, Deerfield, Derry, Francestown, Goffstown, Hooksett, Londonderry, Manchester, New Boston, Raymond, Weare, and Windham.

Greenhouse Gas Emissions

A quantitative greenhouse gas analysis was conducted to provide a relative comparison of the alternatives in terms of carbon dioxide-equivalent (CO2e) emissions from the motor vehicle travel in the region. The scale of the analysis is the SNHPC travel demand model region, which encompasses 15 communities: Auburn, Bedford, Candia, Chester, Deerfield, Derry, Francestown, Goffstown, Hooksett, Londonderry, Manchester, New Boston, Raymond, Weare, and Windham. The SNHPC model was used as part of the traffic analyses conducted for the Project (see Section 4.2), and the model was used to estimate the total VMT under each Alternative. The SNHPC VMT data were broken down by roadway functional class. For the greenhouse gas emissions analysis, the VMT data were further stratified by vehicle classification using NH-specific data reported to FHWA's Highway Performance Monitoring System (HPMS) (FHWA, 2016b).

The key assumptions used in the development of the greenhouse gas emissions analysis emission factors are as follows:

- Emissions Model: MOVES2014a (latest EPA-approved model at time of analysis)
- Scale: National scale, using EPA-default data for Rockingham County, New Hampshire. This level of detail is appropriate given the scale and objectives of the analysis.
- Analysis Year: 2040

- Month: January (January-based emission factors were applied to annual VMT because sensitivity testing of multiple months showed negligible seasonal variation in emission rates)
- Hour: AM Peak, 7am-8am
- Road types: Urban restricted (e.g., highways with access control/interchanges) and Urban unrestricted (e.g., arterials with intersections)
- Vehicle types: motorcycles, passenger cars, light trucks, buses, single-unit trucks and combination trucks (e.g., tractor trailers)
- Fuels: All fuel types per default percentage of vehicles using each fuel type (e.g., percent of diesel vs. gasoline light duty trucks)
- Speed: Simplified average speed assumptions were used given the regional scale and comparative nature of the analysis. Interstate and other freeways/expressways (Functional classes 1 and 2) = 65 mph, other principal arterials, and minor arterials (Function classes 3 and 4) = 55 mph, collectors and other local roads (functional classes 5, 6, and 7) = 30 mph

Table 4.4-6 summarizes the emission factors generated for each roadway type and vehicle type.

Table 4.4-6. MOVES CO2e Emission Factors (grams/veh-mile) by Roadway Type and Functional Class

MOVES Road Type	Road functional class	Ave. speed (mph)	Motorcycle	Passenger car	Light truck	Buses	Single-unit trucks	Combination trucks
Urban Restricted Access	1 and 2	65	404.11	476.11	837.70	3,711.05	1,352.54	1,479.53
Urban Unrestricted Access	3 and 4	55	381.09	495.31	846.67	3,877.78	1,757.63	1,420.15
	5, 6, and 7	30	335.26	552.25	935.00	5,114.91	2,318.47	1,919.08

Table 4.4-7 summarizes the greenhouse gas emissions analysis results in terms of tons of CO2e per day within the SNHPC model region. Alternatives A and B result in an increase of approximately 1.5 percent relative to the No Build Alternative, and this result is likely due in part to the substantial increase in employment and economic activity added to the SNHPC model for these alternatives based on the analysis presented in the Land Use Scenarios Technical Report. The remaining alternatives result in differences in emissions from the No Build of 1/10th of one percent or less. It is important to note that the analysis does not take into account the impacts of potential changes in speeds as a result of the alternatives and associated emission reductions associated with congestion relief. The emissions shown are based on the change in VMT only and provide an order-of-magnitude disclosure of potential impacts for comparative purposes.

Table 4.4-7 summarizes the greenhouse gas emissions analysis results.

Table 4.4-7. Summary of Greenhouse Gas Analysis Results, 2040

	CO2e Emissions (Tons/day)	Change from No Build	Percent Change from No Build
No Build	6,447.74	-	-
Alternative A	6,556.40	108.66	1.69%
Alternative B	6,543.99	96.24	1.49%
Alternative C	6,443.63	-4.12	-0.06%
Alternative D	6,453.75	6.01	0.09%
Alternative F	6,441.04	-6.70	-0.10%

4.4.4 Construction Impacts and Mitigation

Construction activities would result in emissions from equipment exhaust and fugitive dust from earthwork/ground disturbance. To minimize the potential impacts of construction on air quality at sensitive receptors, the following mitigation commitments would be incorporated in construction contracts.

- Mitigation measures for controlling fugitive dust emissions during construction would include wetting and stabilization of all work areas, cleaning paved roadways, and scheduling construction to minimize the amount and duration of exposed earth.
- The Towns would require that contractors involved with the construction of the Project include air pollution control devices on heavy diesel construction equipment in accordance with applicable state and federal laws at the time of construction.
- The merits and practicality of more stringent or voluntary specification measures would be considered during the final design process and in consultation with the contracting community at large.

4.5 Noise

Transportation projects may affect ambient noise levels both directly and indirectly. Direct noise effects may include introducing a new roadway segment, and indirect effects may include the increase or decrease of traffic on an existing roadway due to the modification of a nearby roadway. The study area for noise is a 500-foot buffer of the Build Alternative alignments (Figure 4.5-1).

To provide a baseline for assessing potential noise impacts, locations within noise sensitive areas (NSAs) were selected where monitored noise would be representative of conditions along the proposed alignment. Generally, NSAs should correspond to existing or future planned noise sensitive developments (or groups of noise sensitive receptors as defined in 23 CFR Part 772), which are likely to be affected by changes in traffic volumes and where roadway, ramp, and interchange improvements are proposed. Figure 4.5-1 shows the five monitoring locations: Sites A, B, C, D, and E.