Mobile Source Air Toxics (MSAT) Quantitative Technical Report

North Houston Highway Improvement Project

From US 59/I-69 at Spur 527

To I-45 at Beltway 8 North

Harris County
TxDOT Houston District
CSJ: 0912-00-146

August 2020

The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been, carried-out by TxDOT pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated December 9, 2019, and executed by FHWA and TxDOT.

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1.0 Background Information

The Texas Department of Transportation (TxDOT) proposes to construct improvements to Interstate Highway 45 (I-45) in the northern portion of the City of Houston. The proposed project, referred to as the North Houston Highway Improvement Project (NHHIP), begins at the interchange of I-45 and Beltway 8 North and continues south along I-45 to Downtown Houston where it terminates at the interchange of U.S. Highway (US) 59/I-69 and Spur 527 south of Downtown Houston. The project area also includes portions of I-10 and US 59/I-69 near Downtown Houston. The project area is composed of three study segments, Segments 1 through 3.

This mobile source air toxics quantitative technical report supports the Final Environmental Impact Statement (Final EIS) that evaluates the social, economic, and environmental impacts potentially resulting from the Preferred Alternative for the proposed project.

Existing Facility

Segment 1: I-45 from Beltway 8 North to north of I-610 (North Loop)

I-45 within this segment consists of eight general purpose lanes (i.e., mainlanes; four lanes in each direction), four to six frontage road lanes (two to three lanes in each direction), and a reversible high occupancy vehicle (HOV) lane in the middle, all within a variable right-of-way (ROW) width of 250 to 300 feet. The existing posted speed limit along the general purpose lanes and reversible HOV lane is 60 miles per hour (mph). The existing posted speed limit for the frontage roads is 45 mph. The length of Segment 1 is approximately 8.8 miles, and the area of the existing ROW is approximately 349 acres.

Segment 2: I-45 from north of I-610 (North Loop) to I-10

I-45 within this segment primarily consists of eight at-grade general purpose lanes (four lanes in each direction), four to six frontage road lanes (two to three lanes in each direction), and a reversible HOV lane in the middle, all within a variable ROW width of 300 to 325 feet. Segment 2 also includes a depressed section that consists of eight general purpose lanes (four lanes in each direction) and a reversible HOV lane in the middle, all below grade, within a 245-foot ROW. The frontage road lanes associated with the depressed section are located at-grade. The existing posted speed limit is 60 mph along the general purpose lanes, 55 mph along the reversible HOV lane, and 40 mph along the frontage road lanes. The I-45 and I-610 frontage roads are discontinuous at the I-45/I-610 interchange. The length of Segment 2 is approximately 4.5 miles, and the area of the existing ROW is approximately 220 acres.

Segment 3: Downtown Loop System (I-45, US 59/I-69, and I-10)

The Downtown Loop System consists of three interstate highways that create a loop around Downtown Houston. I-45 forms the western and southern boundaries of the loop and is known locally as the Pierce Elevated because it partially follows the alignment of Pierce Street. I-10 forms the northern boundary of the loop, and US 59/I-69 forms the eastern boundary of the loop. The loop includes three major interchanges: I-45 and I-10, I-10 and US 59/I-69, and US 59/I-69 and I-45. The interchange of US 59/I-69 and Spur 527 is located southwest of Downtown Houston.

I-45 along the western and southern sides of Downtown consists of six elevated general purpose lanes (three lanes in each direction) within a variable ROW that is typically 205 feet to 320 feet wide. I 10 north of Downtown, between I-45 and US 59/I-69, consists of six general purpose lanes (three lanes in each direction) within an existing ROW width of 420 feet. US 59/I-69 along the east side of Downtown consists of six general purpose lanes (three lanes in each direction) within an existing ROW width of 225 feet. US 59/I-69 south of Downtown from I-45 to Spur 527 has eight general purpose lanes (four in each direction). Generally, local streets serve as one-way frontage roads within Segment 3, except near the I-10 and US 59/I-69 interchange, where the frontage roads are discontinuous. The length of Segment 3, which includes the Downtown Loop System, is approximately 13.1 miles, and the existing ROW is approximately 638 acres.

Proposed Facility

The Preferred Alternative for the proposed project is described below, by study segment. The Preferred Alternative includes changes to the Recommended Alternative (for each segment) presented and evaluated in the Draft Environmental Impact Statement. Section 2.0 of the Final EIS discusses the design changes, including the proposed locations of storm water detention areas.

Segment 1: I-45 from Beltway 8 North to north of I-610 (North Loop)

The Preferred Alternative would widen the existing I-45 primarily on the west side of the roadway to accommodate four managed express (MaX) lanes. The proposed typical section would include eight to ten general purpose lanes (four to five lanes in each direction), four MaX lanes (two lanes in each direction), and four to six frontage road lanes (two to three lanes in each direction). The general purpose lanes and MaX lanes would be at-grade except at major cross streets, where they would be elevated over the intersecting streets. Approximately 200 to 225 feet of new ROW would be required for the roadway widening, mostly to the west of the existing I-45. New ROW would also be required on the west side of I-45 for proposed storm water detention areas. New ROW would be required to the east of the existing I-45 ROW at intersections with major streets and between Crosstimbers Street and I-610. Approximately 246 acres of new ROW would be required in Segment 1.

Segment 2: I-45 from north of I-610 (North Loop) to I-10 (including the interchange with I-610)

The Preferred Alternative would widen the existing I-45 to accommodate four MaX lanes. The proposed typical section would include ten general purpose lanes (five lanes in each direction), four MaX lanes (two lanes in each direction), and four to six frontage road lanes (two to three lanes in each direction). From north of Cottage Street to Norma Street, the general purpose lanes and the Max lanes would be depressed, while the frontage road lanes would be at-grade. The proposed I-45 and I-610 frontage roads would be continuous through the I-45/I-610 interchange. New ROW would be required from both the east and west sides of the existing I-45. The new ROW would include proposed storm water detention areas on the east side of I-45, south of Patton Street. Approximately 44 acres of new ROW would be required in Segment 2.

The Preferred Alternative provides a structural "cap" over a portion of the depressed lanes of I-45 from north of Cottage Street to south of N. Main Street. Future use of the structural cap area for another purpose would require additional development and funding by entities other than TxDOT.

Segment 3: Downtown Loop System (I-45, US 59/I-69, and I-10)

The Preferred Alternative would reconstruct all the existing interchanges in the Downtown Loop System and reroute I-45 to be parallel to I-10 on the north side of Downtown and parallel to US 59/I 69 on the east side of Downtown. Access to the west side of Downtown would be provided via "Downtown Connectors" that would consist of entrance and exit ramps for various Downtown streets. A section of the Downtown Connectors would be below-grade (depressed) between approximately W. Dallas Street to Andrews Street. The existing elevated I-45 roadway along the west and south sides of Downtown would be removed. The portion of I-45 (Pierce Elevated) between Brazos Street and US 59/I-69 could be left in place for future use and redevelopment by others; however, an alternative use for the structure is not proposed by TxDOT and is not evaluated in this Final EIS.

To improve safety and traffic flow in the north and east portions of Segment 3, portions of both I-10 and US 59/I 69 would be realigned (straightened) to eliminate the current roadway curvature. I-45 and US 59/I-69 would be depressed along a portion of the alignment east of Downtown. South of the George R. Brown Convention Center, the rerouted I-45 would begin to elevate to tie to existing I-45 southeast of Downtown, while US 59/I-69 would remain depressed as it continues southwest toward Spur 527. US 59/I-69 would be widened from eight to twelve general purpose lanes between I 45 and SH 288, and would be reconstructed to ten general purpose lanes from SH 288 to Spur 527.

The four proposed I-45 MaX lanes in Segments 1 and 2 would terminate/begin in Segment 3 at Milam Street/Travis Street, respectively. I-10 express lanes (two lanes in each direction) would be located generally in the center of the general purpose lanes within the proposed parallel alignment of I-10 and I-45 on the north side of Downtown. The I-10 express lanes would vary between being elevated and at-grade.

New ROW to the east of the existing US 59/I-69 along the east side of Downtown would be required to accommodate the proposed realigned I-45. A new continuous southbound access road would be provided adjacent to US 59/I-69 and would tie to existing Hamilton Street on the south side of the Convention Center. The existing St. Emanuel Street would serve as a northbound access road. The project ROW would include areas to be developed as storm water detention. Approximately 160 acres of new ROW would be required, the majority of which would be for the I-10 and US 59/I 69 realignments (straightening) and to construct the proposed I-45 lanes adjacent to US 59/I-69 along the east side of Downtown.

The Preferred Alternative provides a structural "cap" over the proposed depressed lanes of I-45 and US 59/I-69 from approximately Commerce Street to Lamar Street. There would also be a structural cap over the depressed lanes of US 59/I-69 between approximately Main Street and Fannin Street, and in the area of the Caroline Street/Wheeler Street intersection. Future use of the structural cap

areas for another purpose would require additional development and funding by entities other than TxDOT.

Projects Subject to a Quantitative MSAT Analysis

Projects may be subject to a quantitative mobile source air toxics (MSAT) analysis if the project is adding capacity, the design year annual average daily traffic (AADT) is over 140,000 vehicles per day (vpd), there is public concern over air quality, or the project will affect the intermodal facility.[1] Since the project would add capacity and the design year traffic volume is above 140,000 vpd, a quantitative MSAT is required to assess the level at which MSAT would increase or decrease as a result of this project. A conference call to discuss the appropriate methodology and years of analysis was held on July 31, 2017 (see Appendix A). The call participants consisted of representatives from TxDOT ENV, TxDOT Houston District, the Houston-Galveston Area Council (H-GAC), and the consultant teams.

All quantitative MSAT analyses include a qualitative MSAT analysis. The qualitative MSAT analysis is based on FHWA's national analysis of MSAT trends in the interim MSAT guidance. Part of the quantitative MSAT analysis is to identify whether the local quantitative MSAT analysis is consistent with FHWA's national MSAT analysis trends (i.e., qualitative MSAT analysis). The quantitative MSAT analysis for this project is found in Sections 3.0 and 4.0 of this Technical Report.

2.0 Qualitative MSAT Analysis

Background

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments (CAAA) of 1990, whereby Congress mandated that the Environmental Protection Agency (EPA) regulate 188 air toxics, also known as hazardous air pollutants. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007), and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS)[2]. In addition, EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 2011 National Air Toxics Assessment (NATA)[3]. These are 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (DPM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter (POM). While the Federal Highway Administration (FHWA) considers these the priority MSAT, the list is subject to change and may be adjusted in consideration of future EPA rules.

[1] https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/msat/
[2] The Environmental Protection Agency (EPA) has a program titled the Integrated Risk Information System (IRIS) that characterizes the health hazards of chemicals found in the environment, including MSAT. IRIS has a process (https://www.epa.gov/iris/basic-information-about-integrated-risk-information-system) for developing these assessments, which allows for the for the public and scientific community to submit relevant information for inclusion in them."
[3] See: https://www.epa.gov/national-air-toxics-assessment

Motor Vehicle Emissions Simulator (MOVES)

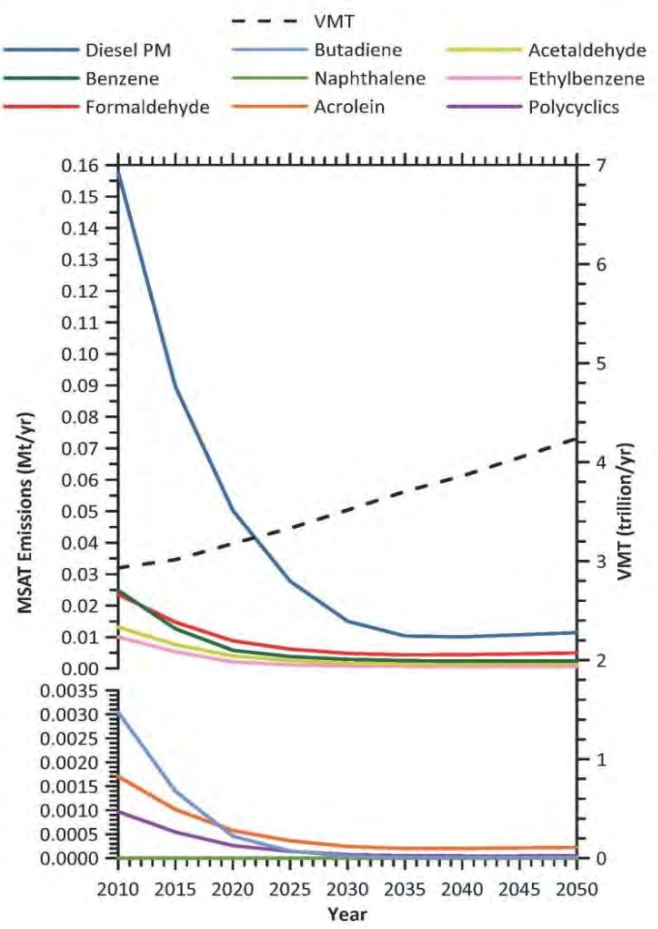
According to EPA, MOVES2014 is a major revision to MOVES2010 and improves upon it in many respects. MOVES2014 includes new data, new emissions standards, and new functional improvements and features. It incorporates substantial new data for emissions, fleet, and activity developed since the release of MOVES2010. These new emissions data are for light- and heavy-duty vehicles, exhaust and evaporative emissions, and fuel effects. MOVES2014 also adds updated vehicle sales, population, age distribution, and vehicle miles traveled (VMT) data. MOVES2014 incorporates the effects of three new Federal emissions standard rules not included in MOVES2010. These new standards are all expected to impact MSAT emissions and include Tier 3 emissions and fuel standards starting in 2017 (79 FR 60344), heavy-duty greenhouse gas regulations that phase in during model years 2014–2018 (79 FR 60344), and the second phase of light duty greenhouse gas regulations that phase in during model years 2017–2025 (79 FR 60344).

Since the release of MOVES2014, EPA has released MOVES2014a. In the November 2015 MOVES2014a Questions and Answers Guide[4], EPA states that for on-road emissions, MOVES2014a adds new options requested by users for the input of local VMT, includes minor updates to the default fuel tables, and corrects an error in MOVES2014 brake wear emissions. The change in brake wear emissions results in small decreases in PM emissions, while emissions for other criteria pollutants remain essentially the same as MOVES2014. Using EPA's MOVES2014a model, as shown in **Figure 1**, FHWA estimates that even if VMT increases by 45 percent from 2010 to 2050 as forecast, a combined reduction of 91 percent in the total annual emissions for the priority MSAT is projected for the same time period.

DPM is the dominant component of MSAT emissions, making up 50 to 70 percent of all priority MSAT pollutants by mass, depending on calendar year. Users of MOVES2014a will notice some differences in emissions compared with MOVES2010b. MOVES2014a is based on updated data on some emissions and pollutant processes compared to MOVES2010b, and also reflects the latest Federal emissions standards in place at the time of its release. In addition, MOVES2014a emissions forecasts are based on lower VMT projections than MOVES2010b, consistent with recent trends suggesting reduced nationwide VMT growth compared to historical trends.

[4] See: MOVES2014a Questions and Answers Guide

Figure 1: Projected National MSAT Emissions Trends For Vehicles Operating on Roadways (2010–2050)



Source: EPA MOVES2014a model runs conducted by FHWA, September 2016.
Note: Trends for specific locations may be different, depending on locally derived information representing vehicle-miles traveled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorological, and other factors.

MSAT Research

Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how the potential health risks posed by MSAT exposure should be factored into project level decision-making within the context of the National Environmental Policy Act (NEPA). The FHWA, EPA, Health Effects Institute (HEI), and others have funded and conducted research studies to try to more clearly define potential risks from MSAT emissions associated with highway projects. The FHWA will continue to monitor the developing research in this emerging field.

Project-Specific MSAT Information

A quantitative analysis provides a basis for identifying and comparing the potential differences among MSAT emissions, if any, from the various alternatives. The quantitative assessment presented below is derived in part from a study conducted by the FHWA entitled A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives.[5]

The VMT estimated for the Build Alternative is slightly higher than that for the No Build Alternative, because the additional capacity increases the efficiency of the roadway and attracts rerouted trips from elsewhere in the transportation network. The additional travel lanes contemplated as part of the Build Alternative would have the effect of moving some traffic closer to nearby homes and businesses; therefore, there may be localized areas where ambient concentrations of MSAT could be higher under the Build Alternative than the No Build Alternative. The localized increases in MSAT concentrations would likely be most pronounced along the expanded roadway sections at Beltway 8, I-610, I-10, US 59/I-69 and SH 288. However, the magnitude and the duration of these potential increases compared to the No Build Alternative cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific MSAT health impacts. Also, MSAT would be lower in other locations when traffic shifts away from them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels to be significantly lower than today.

Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts Analysis

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives[6]. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.[7] Consistent with this guidance and 40 CFR 1502.22 (regarding incomplete and unavailable information), TxDOT does not conduct MSAT health impacts for the reasons described below.

The EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. The EPA is the lead authority for administering the Clean Air Act and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks

[5] http://www.fhwa.dot.gov/environment/air_quality/air_toxics/research_and_analysis/mobile_source_air_toxics/msatemissions.pdf.

[6] FHWA Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents, October 18, 2016.
[7] FHWA Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents, October 18, 2016.

posed by air pollutants. They maintain IRIS, which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects"[8]. Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSAT, including HEI. Two HEI studies are summarized in Appendix D of FHWA's Interim Guidance Update on Mobile source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are: cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations[9] in the future as vehicle emissions substantially decrease.

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts – each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways; to determine the portion of time that people are actually exposed at a specific location; and to establish the extent attributable to a proposed action, especially given that some of the information needed is unavailable.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI[10]. As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, in particular for DPM. The EPA states that with respect to diesel engine exhaust, "[t]he absence of adequate data to develop a sufficiently confident dose-response relationship from the epidemiologic studies has prevented the estimation of inhalation carcinogenic risk (EPA IRIS database, Diesel Engine Exhaust, Section II.C[11]).

[8] See: http://www.epa.gov/iris/
[9] See: HEI, https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects
[10] See: https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects
[11] See: https://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/0642.htm#quainhal)

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the Clean Air Act to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine an "acceptable" level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA's approach to addressing risk in its two-step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable[12].

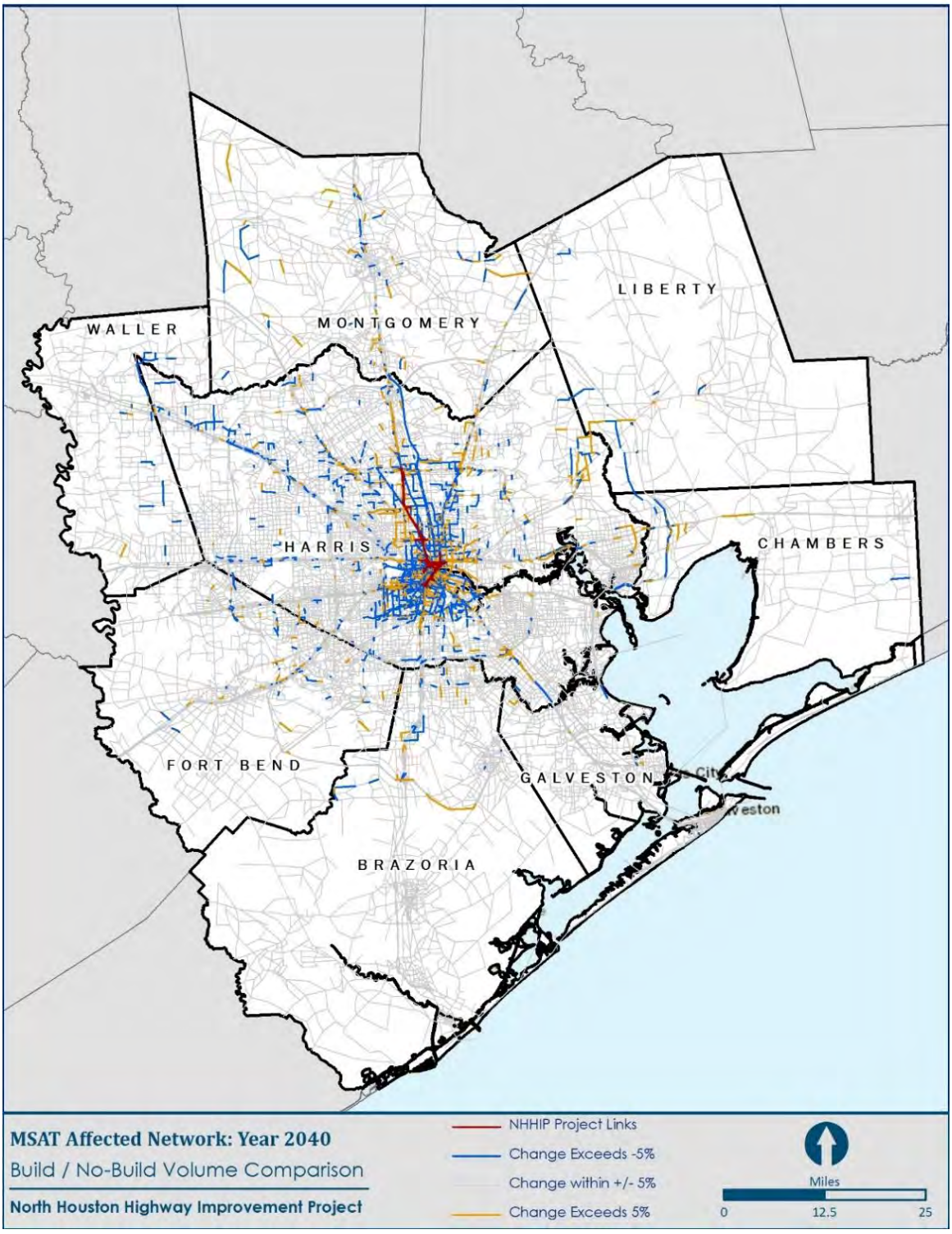
3.0 Quantitative MSAT Analysis Methodology

The approach used in the analysis of MSATs within the NHHIP study area considers the on-road sources for the nine priority MSATs. An affected transportation network was derived for the design year of 2040 by comparing the roadway link traffic volumes for the No Build to Build Alternative, to determine which roadway links in the model achieve a ±5 percent volume change due to the Build Alternative. The same roadway links identified through this process were used as the affected network links for the base year of 2018 and interim year of 2035 for consistency; however, since not all links identified in the design year affected network exist in 2018, the base year affected network contains less links than the design year. See **Figure 2** for the road links in the affected network for this analysis. Additional maps zoomed to the county level can be found in **Appendix B**.

The base year (2018), interim year no-build and build (2035), and design year no-build and build (2040) travel demand model scenarios were generated by H-GAC for this analysis. These scenarios are based on H-GAC's amended 2040 Regional Transportation Plan (RTP) and its associated conformity networks. These models take into account all future projects expected to be completed by each year, as well as projected traffic. For the No Build Alternatives, the proposed NHHIP facilities were removed from the model to generate new projected traffic volumes.

[12]See: https://www.cadc.uscourts.gov/internet/opinions.nsf/284E23FFE079CD59852578000050C9DA/$file/07-1053-1120274.pdf

Figure 2: Affected Network Roadway Links



The analysis utilizes the TxDOT-approved emissions factors (ERLT for MSAT, January 2017), which are based on the MOVES2014[13] [14] model for each of the priority MSATs for the corresponding analysis years and associated roadway link speeds, urban or rural designation, and roadway classification of restricted or unrestricted. The complete data tables used for the analysis are on file at TxDOT.

On March 30, 2020, EPA signed a Final Rule updating the Corporate Average Fuel Economy (CAFE) standards (85 FR 24174). The Final Rule went into effect June 29, 2020. EPA has not yet incorporated these new standards into MOVES2014; however, as indicated in the Final Rule (85 FR 25061), "it is expected that incremental impacts on criteria and air toxic pollutant emissions would be too small to observe under any of the regulatory alternatives under consideration." Therefore, it is not anticipated that these new standards will have any significant impact on project-level analyses for the area. The new standards will still result in "year-over-year improvements in fleetwide fuel economy, resulting in energy conservation that helps address environmental concerns, including criteria pollutant, air toxic pollutant, and carbon emissions." 85 FR 24176.

4.0 Quantitative MSAT Analysis Results

The resulting emission inventory for the nine priority MSATs for the NHHIP affected network is summarized in **Tables 1-2** and **Figures 3-4**. The analysis indicates that a decrease in MSAT emissions can be expected for both the Build and No Build Alternatives in 2040, compared to the existing year of 2018. Under the Build Alternative, emissions of total MSAT are predicted to decrease by 72 percent from 2018 to 2040, even though VMT is expected to rise by 58 percent.

The analysis determines similar results for the interim year of 2035. A decrease in MSAT emissions can be expected for both the Build and No Build Alternatives in 2035, compared to the existing year of 2018. Under the Build Alternative, emissions of total MSAT are predicted to decrease by 73 percent from 2018 to 2035, even though VMT is expected to rise by 46 percent. As shown in **Figure 4**, if total emissions are plotted over time and scenario, a decreasing level of MSAT emissions can be seen from the base year (2018), although overall VMT continues to rise.

Of the nine priority MSAT compounds, DPM contributes the most to the emissions total for all scenarios, followed by formaldehyde and benzene. In future years, a large reduction in DPM emissions is predicted, with a calculated 80 to 81 percent decrease from 2018 to 2040 in both scenarios.

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[13] On August 28, 2018, EPA released MOVES2014b. However, EPA indicates that MOVES2014b does not significantly change the on road criteria pollutant emissions results of MOVES2014a and is not considered a new model for State Implementation Plan (SIP) and transportation conformity purposes. Therefore, no updates to the project modeling are required by this MOVES update.

[14] EPA has indicated in an April 9, 2018 email: "MOVES2014 includes the impact of 2017-2025 Light-Duty GHG standards on direct emissions from vehicles. The emission impacts of any new GHG standards cannot be quantified until they are proposed, and MOVES official releases include new standards only after they have been finalized. Note that because the 2017-2025 GHG standards were projected to have a very small impact on criteria and toxic emissions from vehicles and because the vehicles affected by the 2017-2025 GHG standards would still need to meet applicable criteria pollutant emissions standards (e.g., Tier 3), we expect the impact of changes in GHG standards on direct criteria and toxic pollutant emissions from vehicles to be very small."

Table 1: MSAT Emission Inventory by Scenario (2018 – 2040)

Compound	Year/Scenario				
	2018 Base	2040 Design			
	Total (tons/year)	No-Build Total (tons/year)	Percent Change from 2018	Build Total (tons/year)	Percent Change from 2018
Benzene	12.43	3.86	-69%	3.98	-68%
Naphthalene	1.32	0.49	-63%	0.51	-61%
Butadiene	0.83	0.02	-98%	0.02	-98%
Formaldehyde	11.59	5.72	-51%	5.93	-49%
Acrolein	0.75	0.27	-64%	0.28	-62%
DPM	55.79	10.62	-81%	11.08	-80%
POM	0.52	0.13	-75%	0.14	-74%
Acetaldehyde	4.58	1.89	-59%	1.96	-57%
Ethylbenzene	4.96	2.15	-57%	2.22	-55%
Total MSAT (tons/year)	92.78	25.15	-73%	26.12	-72%
Total VMT (Miles/Year)	6,475,031,847	9,357,483,485	45%	10,235,911,998	58%

Table 2: MSAT Emission Inventory by Scenario (2018 – 2035)

Compound	Year/Scenario				
	2018 Base	2035 Interim			
	Total (tons/year)	No-Build Total (tons/year)	Percent Change from 2018	Build Total (tons/year)	Percent Change from 2018
Benzene	12.43	3.65	-71%	3.84	-69%
Naphthalene	1.32	0.47	-65%	0.49	-62%
Butadiene	0.83	0.02	-98%	0.02	-98%
Formaldehyde	11.59	5.41	-53%	5.74	-50%
Acrolein	0.75	0.26	-66%	0.27	-64%
DPM	55.79	10.05	-82%	10.76	-81%
POM	0.52	0.12	-76%	0.13	-75%
Acetaldehyde	4.58	1.79	-61%	1.90	-59%
Ethylbenzene	4.96	2.03	-59%	2.14	-57%
Total MSAT (tons/year)	92.78	23.79	-74%	25.30	-73%
Total VMT (Miles/Year)	6,475,031,847	8,867,118,887	37%	9,479,348,571	46%

Figure 3: Projected MSAT Emissions vs. VMT by Scenario

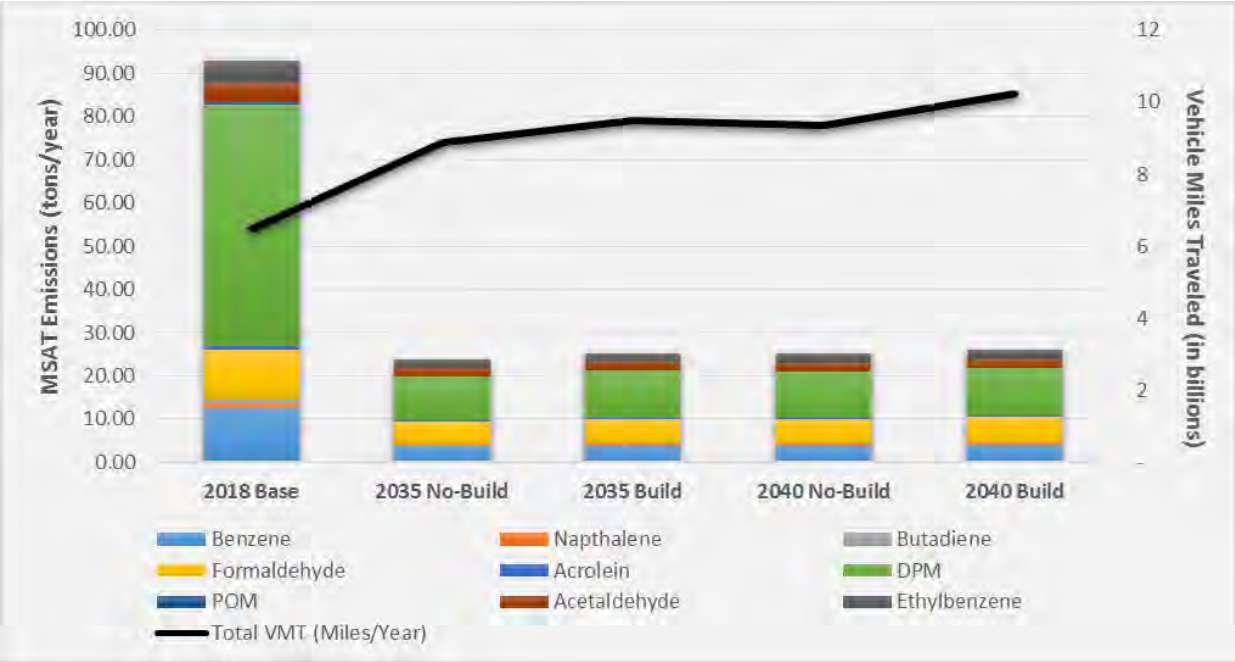


Figure 4: Comparison of Total MSAT Emissions vs. VMT by Scenario

5.0 Conclusion

In sum, both the Build and No Build Alternative in the interim and design years are expected to be associated with lower levels of MSAT emissions compared to the base year. There is a minor increase in MSAT emissions expected between the No Build and Build Alternatives for both the interim and design years, due to slightly higher VMT. Under all alternatives, MSAT levels are likely to decrease over time due to nationally mandated cleaner vehicles and fuels.

Based upon public comment, TxDOT provided additional information in Appendix C of this Technical Report and in Appendix D of the CO TAQA Technical Report, regarding: 1) overall status of air quality in the greater Houston area, 2) mobile source air emission projections for Harris County, 3) ambient air monitoring for national ambient air quality standards (NAAQS) and air toxics for the greater Houston area, 4) TCEQ toxicology assessment of air toxics monitoring for the greater Houston area, 5) national near-road monitoring data and 6) an EPA Study Assessing Outdoor Air Near Schools. In particular, the EPA school study was conducted to protect children's health. It covered 62 schools including 14 schools abutting major roadways across the U.S. For these 14 schools, EPA found monitored MSAT were less than thresholds for assessing short-term or long-term health risks. Young Scholars' Academy was part of this EPA study and is on the IH45 corridor. With these results, EPA concluded additional studies or controls for the schools for MSAT were not warranted. The CO TAQA and MSAT Technical Reports and associated additional information do not identify adverse impacts associated with air quality.

6.0 Additional Information

Additional information related to air toxics is available in **Appendix C** to:

- describe TCEQ's Air Pollutant Watch List (APWL) program and provide TCEQ air toxics information;
- elaborate on the Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts Analysis section above; and
- provide a summary of an EPA outdoor school study, which included schools in the county.

APPENDIX A
MSAT Conference Call Meeting Minutes

Meeting Minutes

Highway or Project Name: IH 45 NHHIP

Control Section Job Number (CSJ): 0912-00-146

Date of Meeting: 07/31/17

Meeting Description: Coordinate Quantitative MSAT Analysis between TxDOT, H-GAC, and contractor

Meeting Attendees

Tim Wood (TxDOT)
Pat Henry (TxDOT)
Kelly Lark (TxDOT)
Lisa Mitchell (TxDOT)
Christine Bergren (TxDOT)
Lisa Mitchell (TxDOT)
Chi Lam (H-GAC)
Patty Matthews (AECOM)
Miranda Maldonado (AECOM)
Andy Atlas (CP&Y)
Dave Young (CP&Y)
Angela Gillmeister (CP&Y)

Decisions Reached

- Andy Atlas provided a project description overview by segment.
- Atlas stated that due to the project adding capacity and having AADT over 140,000 vpd, a quantitative MSAT is required. Tim Wood concurred with this statement.
- Atlas asked the participants if there was any update on the project being added to H-GAC's RTP, as the current understanding is that the project is in neither the RTP or TIP.
  a. The TxDOT Houston District team and Chi Lam believe that the project will be in the next plan update
- Angela Gillmeister continued the discussion by asking TxDOT the anticipated environmental decision and estimated year of completion (ETC).
  a. The TxDOT Houston District team confirmed that the anticipated date of environmental decision is June 2018; however, ETC is unknown at this time since funding has not been identified outside of Segment 3,
  b. Tim Wood asked H-GAC if the project will be added to the travel demand model (TDM) network in time to meet an anticipated environmental clearance date of June 2018.
  c. Lam stated that he would confirm with his modeling team, but he believes that the project should be already added or is currently being added to the TDM network. However, the TDM network is currently being edited. Many other projects, including those projects being requested by TxDOT, have not been added to the TDM network yet. The final TDM network for the next plan and conformity would be very different than the current network in progress. He indicated that currently the network years of analysis include 2017, 2018, 2025, 2035.
  d. Wood indicated that if the H-GAC modelers are inputting the project into the TDM network, they need to know the accurate ETC year for the inputs. ETC year is important for an interim year analysis, which is recommended for this project.
  e. Wood indicated that the likely years of analysis would be 2018 (base year) and 2040 (design year), but the interim year would depend on the ETC or the first year that H-GAC codes the

project in the TDM network as being “open to traffic”. If the project is not expected to be open to traffic until 2040, an interim analysis is not required.

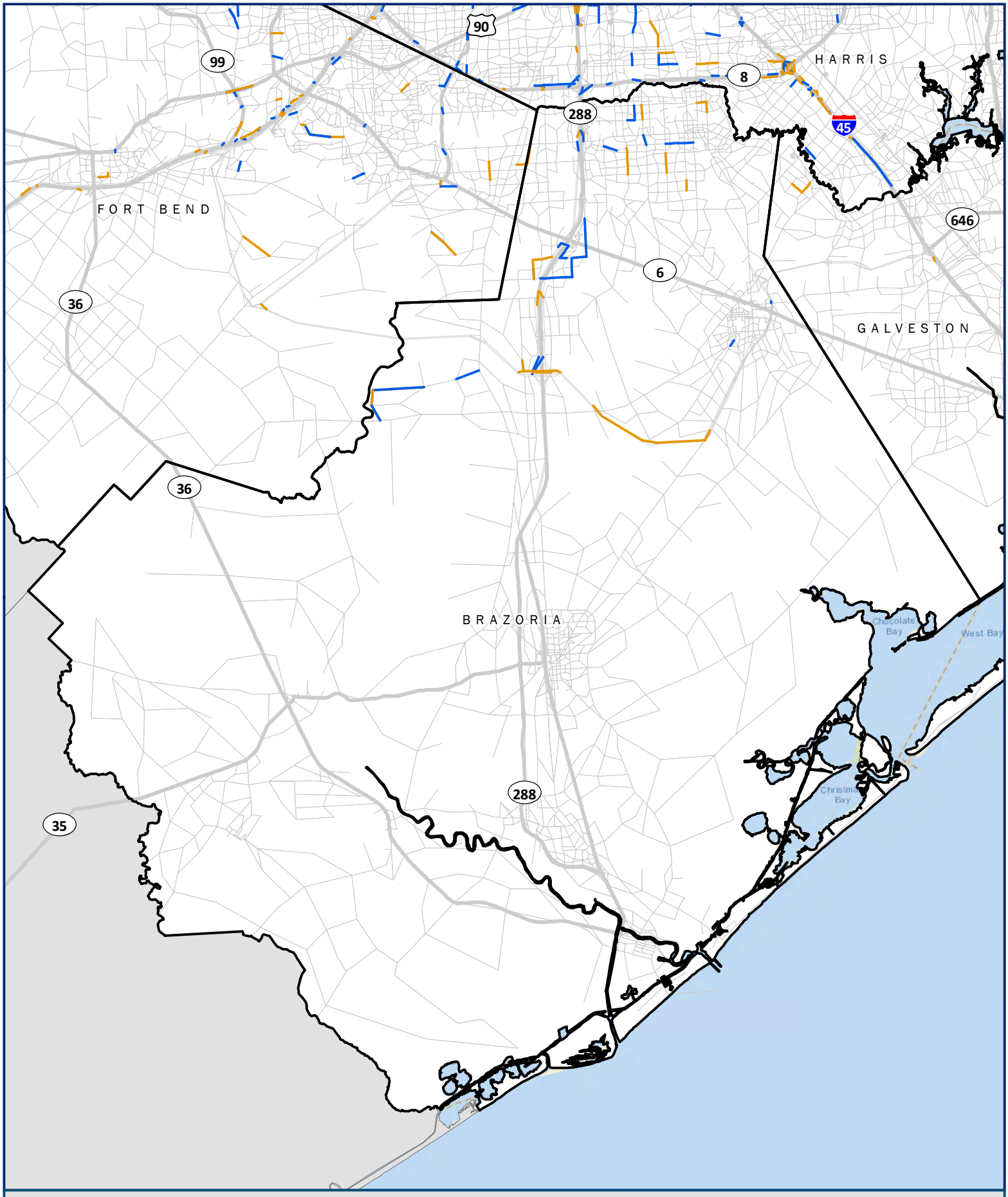
f. Pat Henry stated that TxDOT will have an internal meeting to determine the ETC.

- Gillmeister explained that the methodology that will be used in the standard +/- 5% change in traffic volumes from no-build to build in the design year. Furthermore, the TxDOT emission rates in the Air Quality toolkit, which utilizes the updated MOVES2014 model, will be used in the analysis.
  a. Miranda Maldonado asked if this methodology includes all affected network links in the region. Both Wood and Gillmeister confirmed this to be true.
  b. Wood stated that based on the updated October 2016 regulations and guidelines, there are nine priority MSATs that should be used for this analysis.
- Gillmeister stated that a CO TAQA was completed on all alternatives (9 total, 3 for each segment) as part of the DEIS and asked for confirmation that the analysis should be updated for the FEIS.
  a. Wood stated that if there is a change on the alignments, an updated analysis would be necessary.
  b. The preferred action alternatives had not been widely changed since the original analysis, but the last analysis was based on data from H-GAC’s 2035 TDM, so Wood confirmed that due to the outdated traffic utilized, and updated CO TAQA will be required with updated traffic numbers and updated emission rates.
  c. Kelly Lark and Patty Matthews said that updated traffic is currently awaiting approval by TP&P and is expected within 1-2 weeks.

Action Items

- TxDOT Houston District to confirm ETC year.
- Lam to confirm status of project in TDM network, as well as the coded network year.
- TxDOT Houston District to provide updated traffic data for CO TAQA upon receipt so CP&Y can being analysis.
- Lam to provide base (2018), interim (if applicable, TBD, both build and no-build), and design year (2040, both build and no-build) TDM network data in GIS format.

APPENDIX B
Affected Network Maps



MSAT Affected Network: Year 2040

Build / No-Build Volume Comparison

North Houston Highway Improvement Project

BRAZORIA COUNTY

NHHIP Project Links

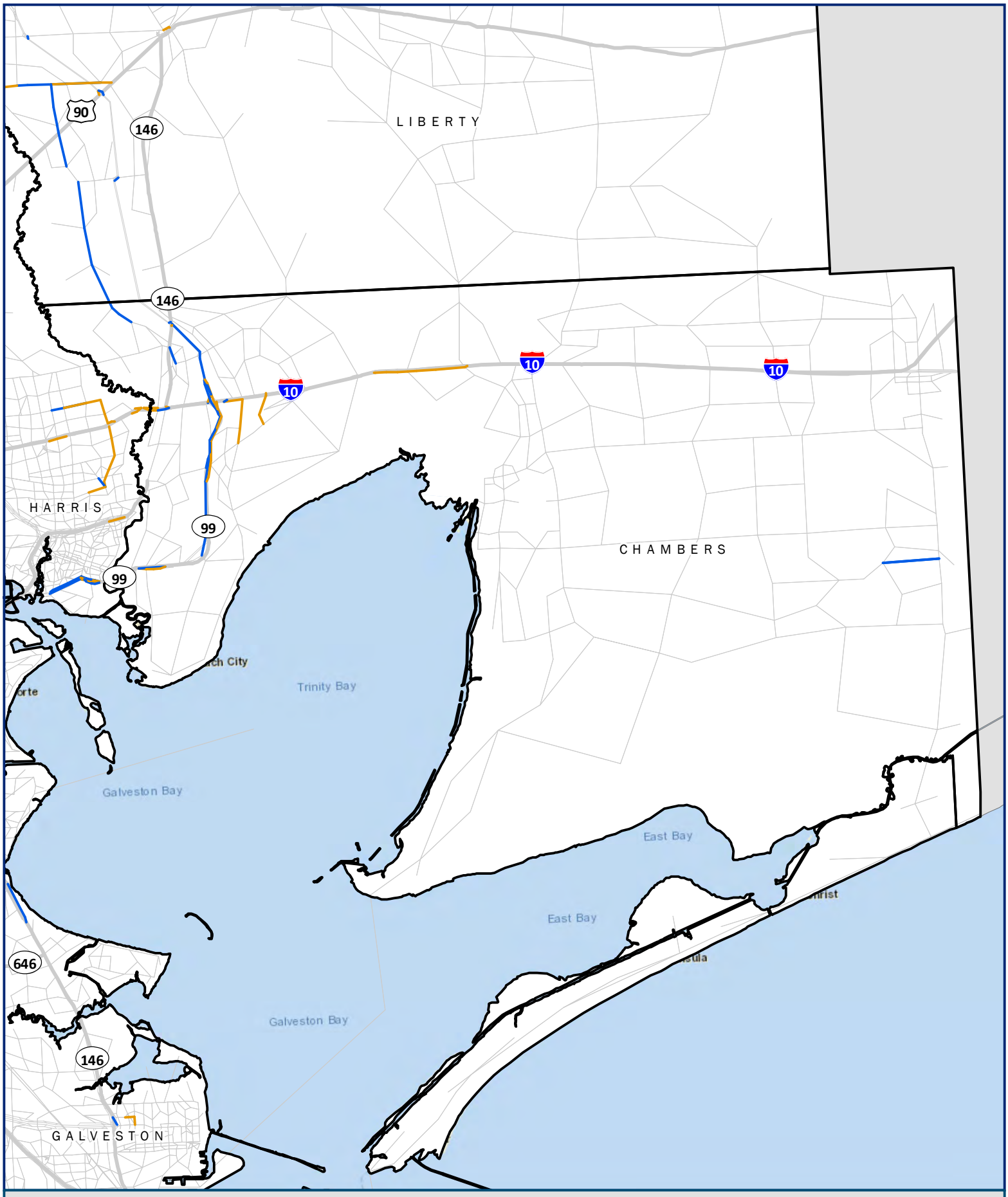
Change Exceeds -5%

Change within +/- 5%

Change Exceeds 5%

Miles

0 3.25 6.5



MSAT Affected Network: Year 2040

Build / No-Build Volume Comparison

North Houston Highway Improvement Project

CHAMBERS COUNTY

NHHIP Project Links

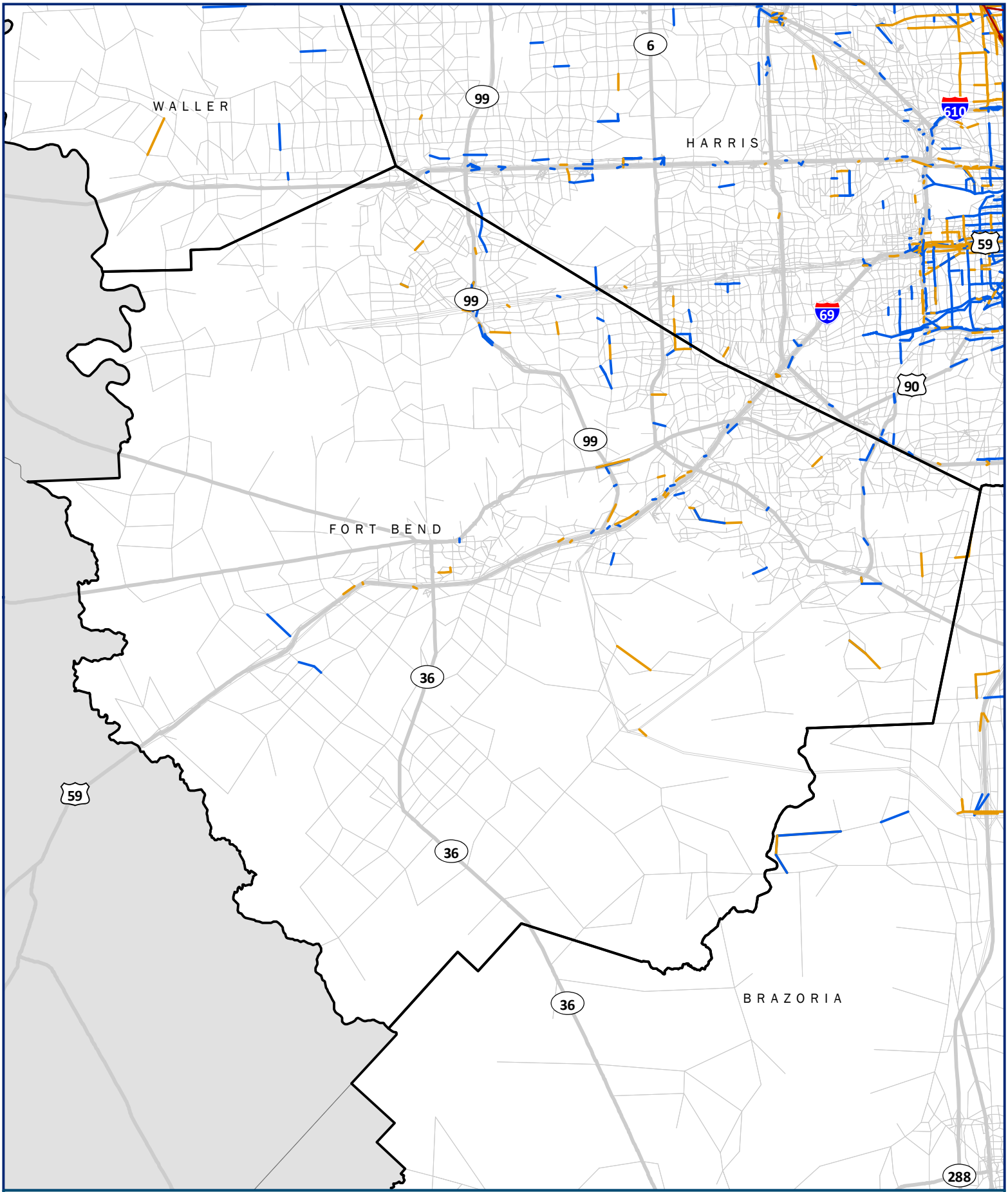
Change Exceeds -5%

Change within +/- 5%

Change Exceeds 5%

Miles

0 2.5 5



MSAT Affected Network: Year 2040

Build / No-Build Volume Comparison

North Houston Highway Improvement Project

FORT BEND COUNTY

NHHIP Project Links

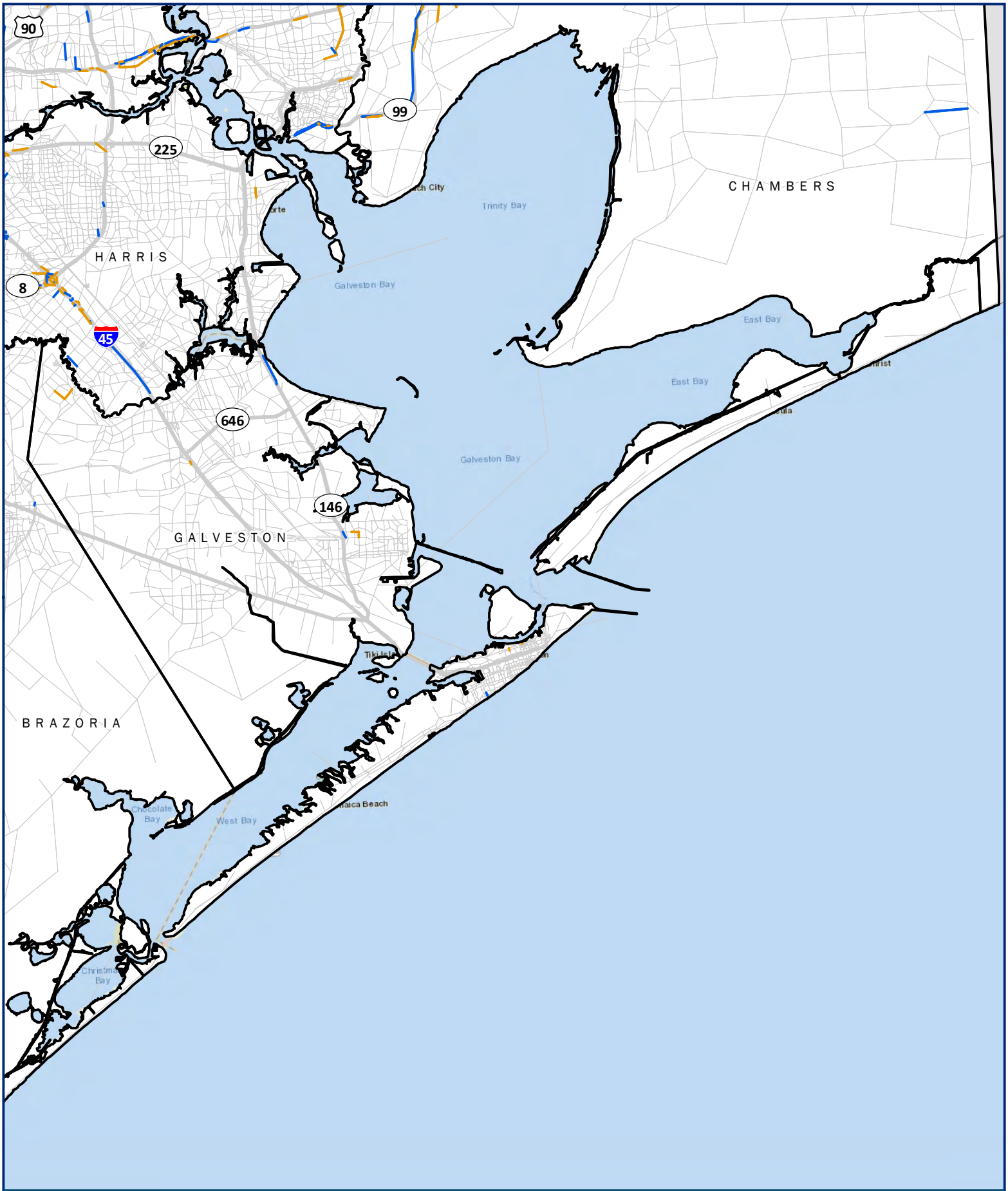
Change Exceeds -5%

Change within +/- 5%

Change Exceeds 5%

Miles

0 2.5 5



MSAT Affected Network: Year 2040

Build / No-Build Volume Comparison

North Houston Highway Improvement Project

GALVESTON COUNTY

NHHIP Project Links

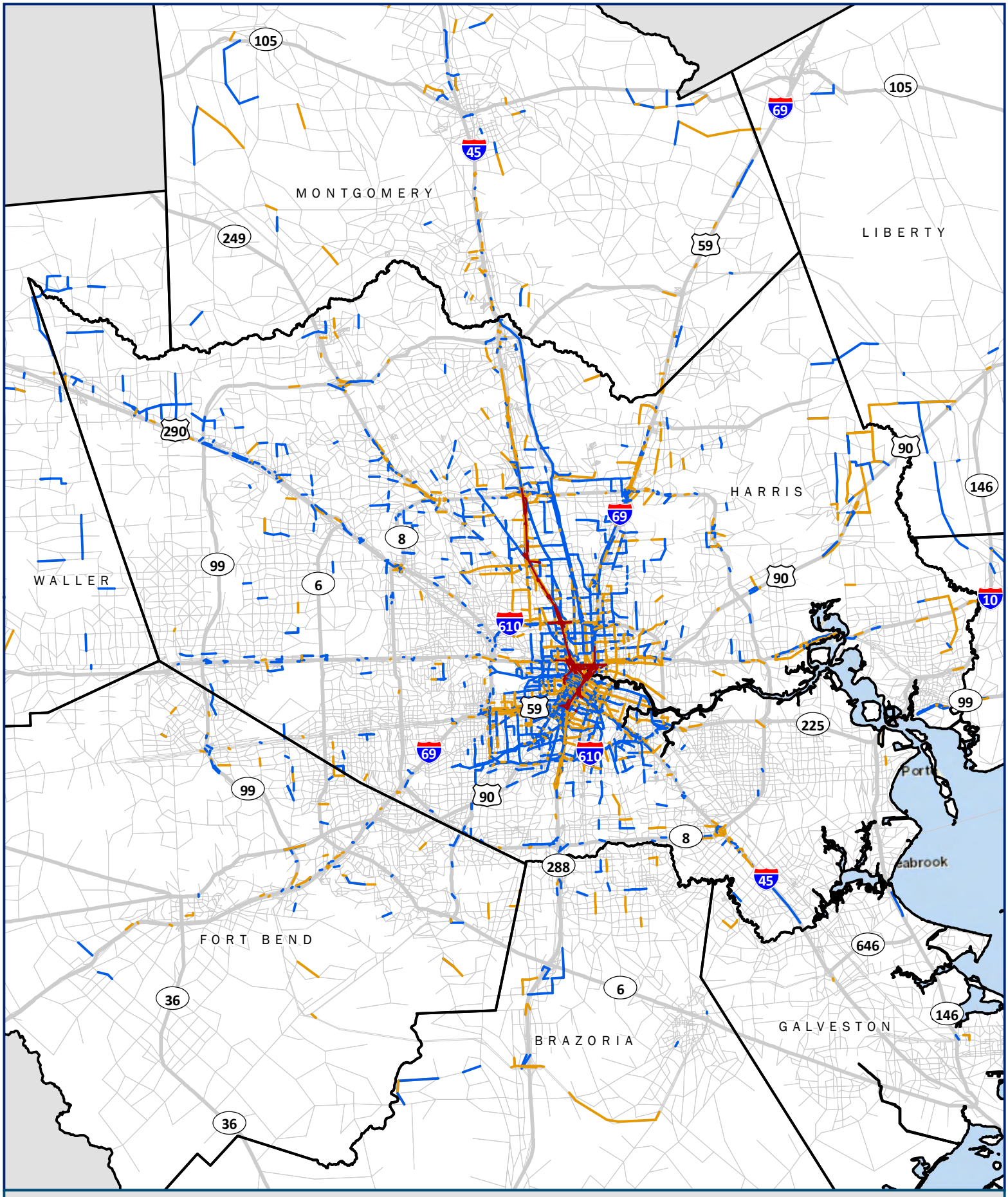
Change Exceeds -5%

Change within +/- 5%

Change Exceeds 5%

Miles

0 3.5 7



MSAT Affected Network: Year 2040

Build / No-Build Volume Comparison

North Houston Highway Improvement Project

HARRIS COUNTY

NHHIP Project Links

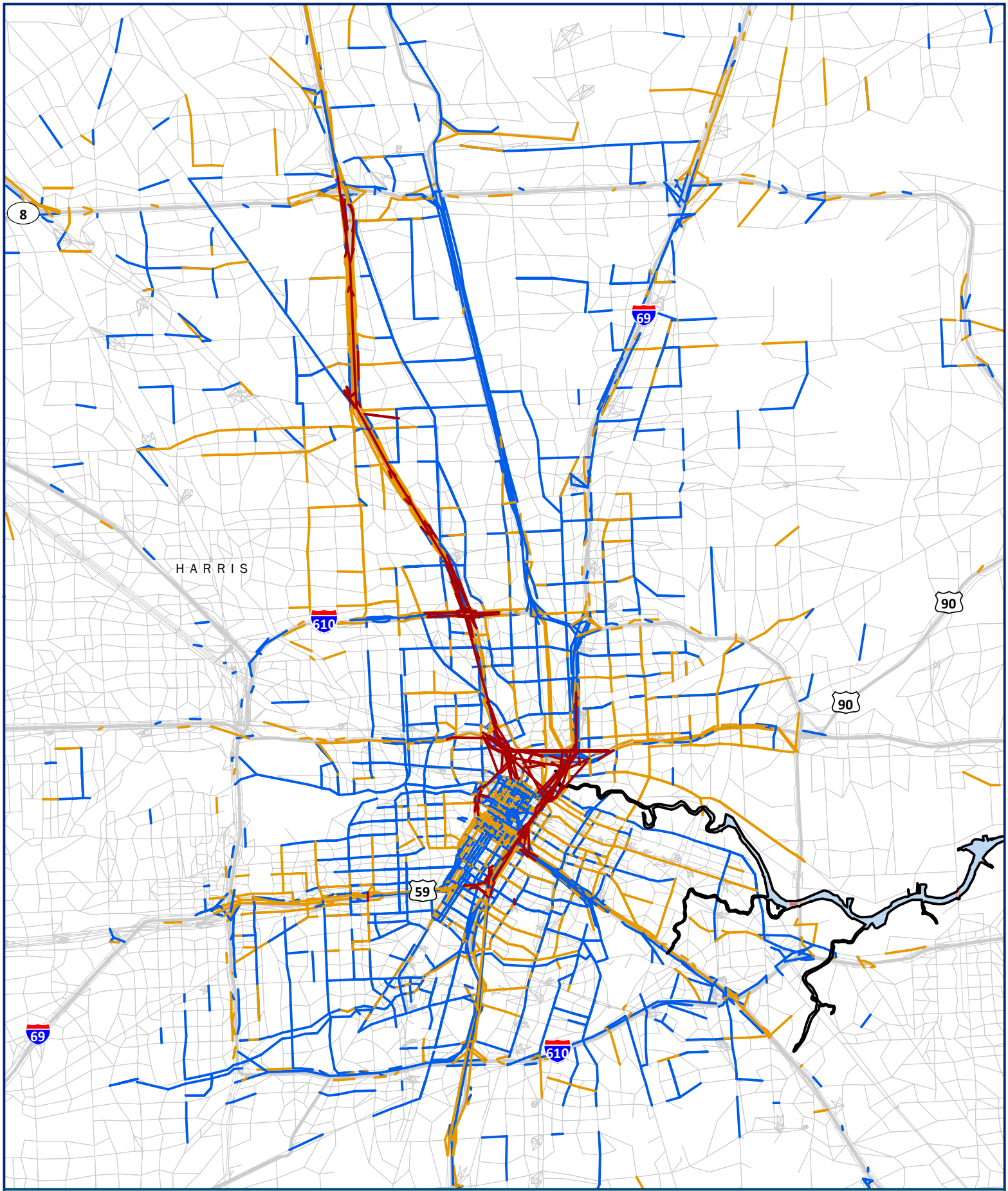
Change Exceeds -5%

Change within +/- 5%

Change Exceeds 5%

Miles

0 4 8



MSAT Affected Network: Year 2040

Build / No-Build Volume Comparison

North Houston Highway Improvement Project

HARRIS COUNTY - PROJECT DETAIL

NHHIP Project Links

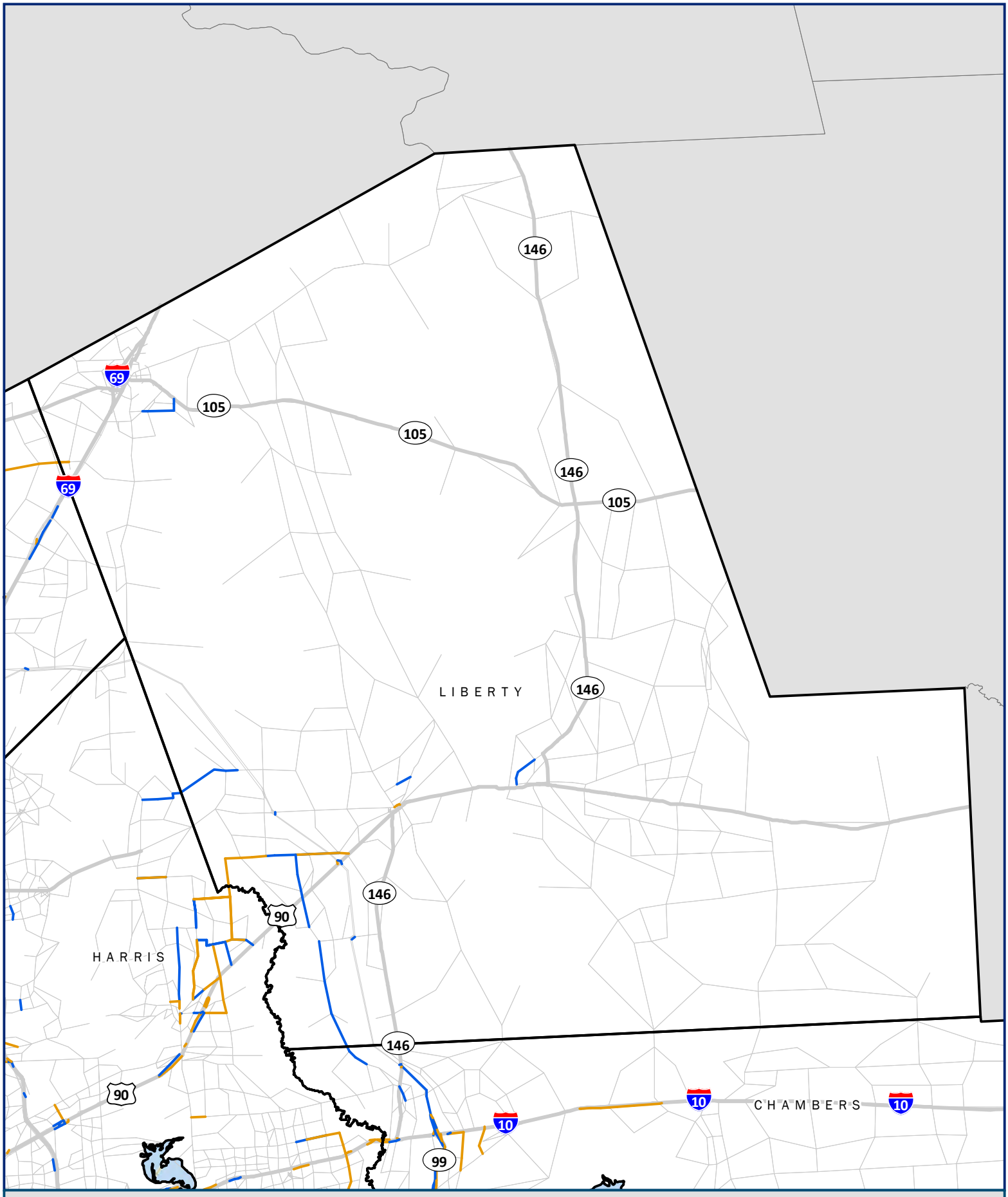
Change Exceeds -5%

Change within +/- 5%

Change Exceeds 5%

Miles

0 1.25 2.5



MSAT Affected Network: Year 2040

Build / No-Build Volume Comparison

North Houston Highway Improvement Project

LIBERTY COUNTY

NHHIP Project Links

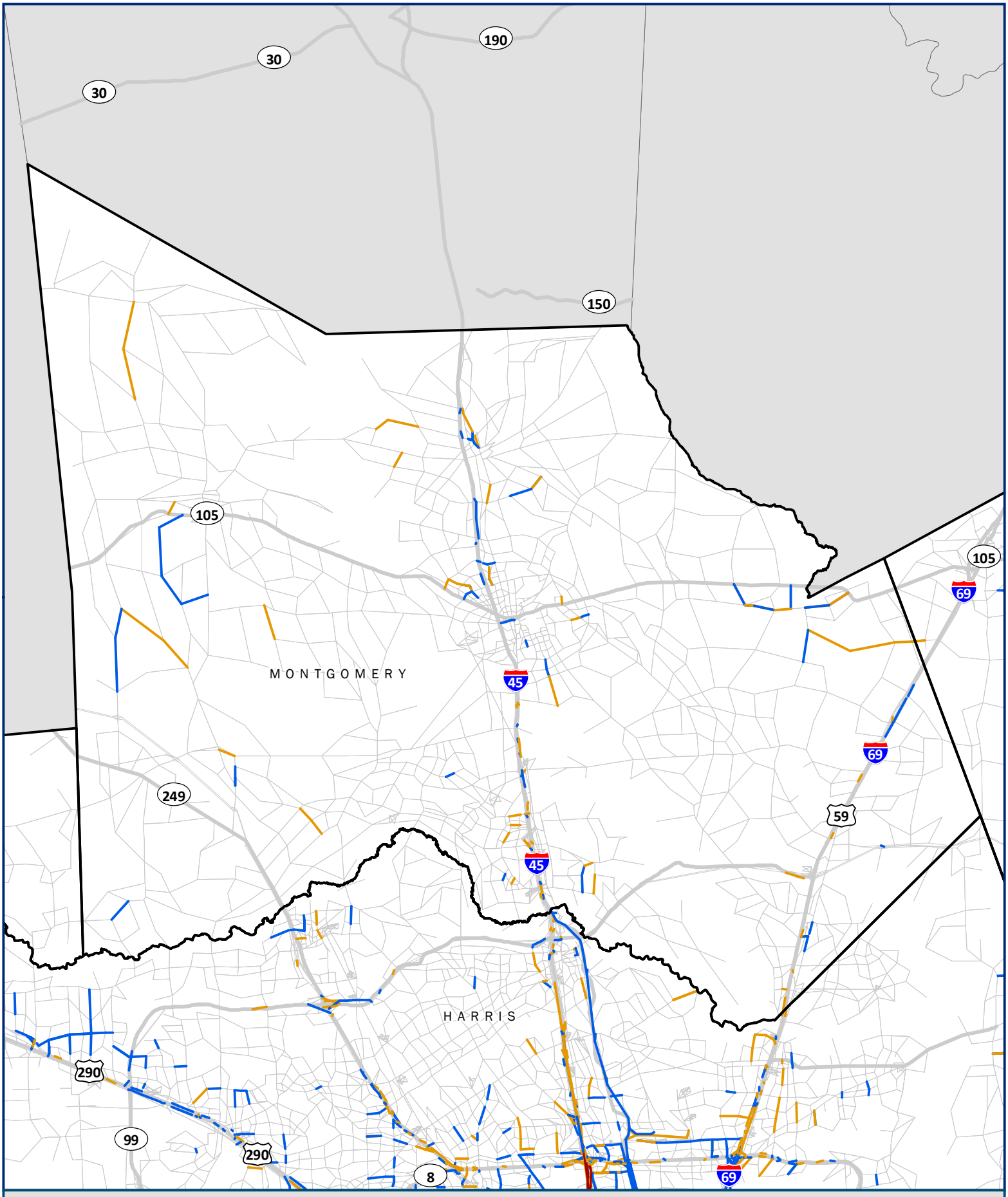
Change Exceeds -5%

Change within +/- 5%

Change Exceeds 5%

Miles

0 3 6



MSAT Affected Network: Year 2040

Build / No-Build Volume Comparison

North Houston Highway Improvement Project

MONTGOMERY COUNTY

NHHIP Project Links

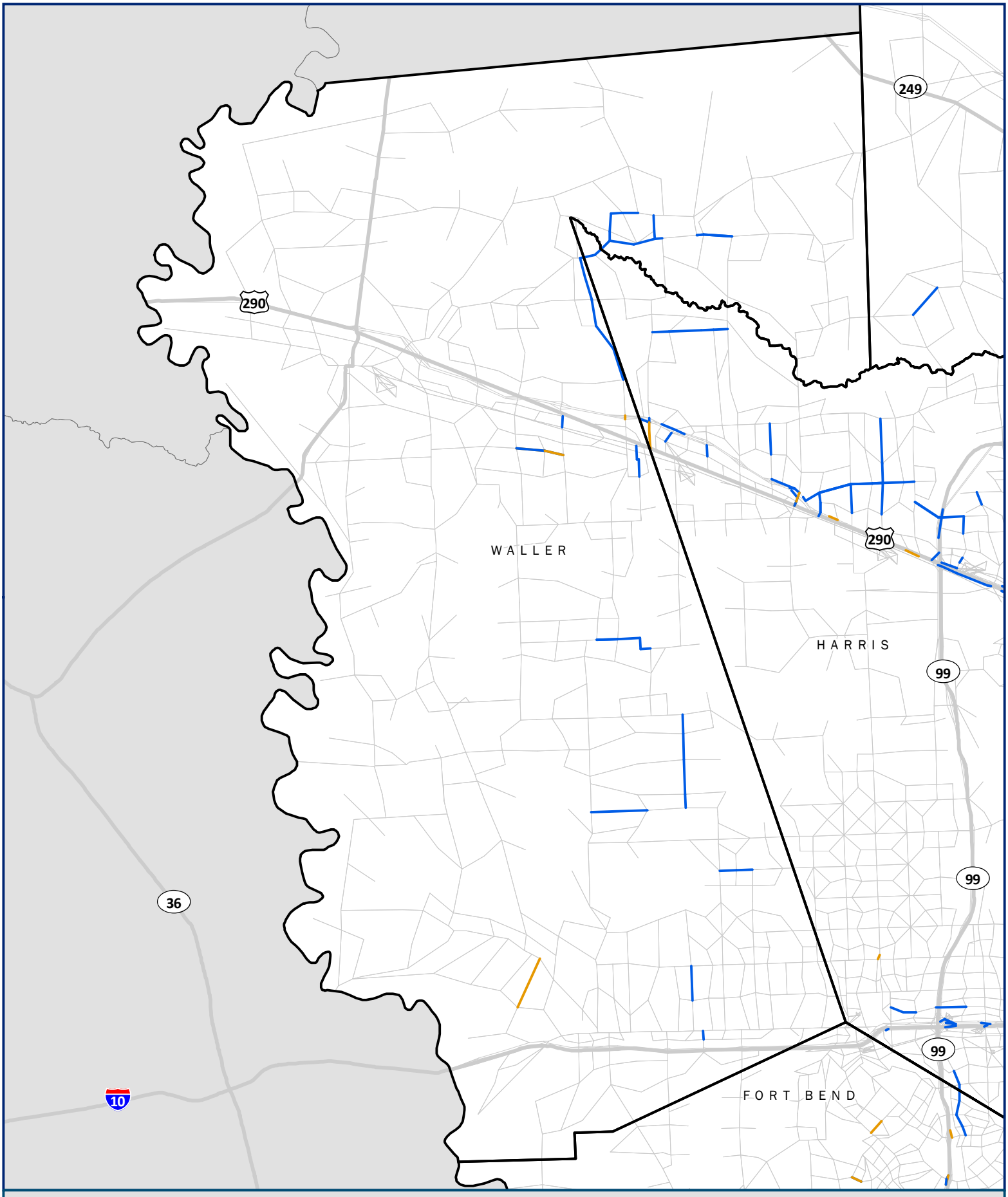
Change Exceeds -5%

Change within +/- 5%

Change Exceeds 5%

Miles

0 3 6



MSAT Affected Network: Year 2040

Build / No-Build Volume Comparison

North Houston Highway Improvement Project

WALLER COUNTY

NHHIP Project Links

Change Exceeds -5%

Change within +/- 5%

Change Exceeds 5%

Miles

0 2 4

APPENDIX C
Additional Information

Appendix C

Based upon public comment, TxDOT examined additional information regarding localized air toxics including: 1) the TCEQ Air Pollutant Watch List for air toxics, 2) air toxics monitoring in Texas and Houston including reduced emissions over time, 3) TCEQ toxicology review of air toxics monitoring for the area, 4) elaboration on the role of air toxics health risk assessments for transportation projects that included EPA's forecast that their MSAT rule will reduce MSAT health risks to acceptable levels and 5) the results of an EPA study Assessing Outdoor Air Near Schools that found all monitored MSAT were less than short-term or long-term health risk thresholds.

Air Pollutant Watch List

As described on TCEQ's website (https://www.tceq.texas.gov/toxicology/apwl#what):

> "The Air Pollutant Watch List (APWL) is the TCEQ's program to address areas in Texas where monitoring data show persistent, elevated concentrations of air toxics. The TCEQ uses the APWL process to focus its resources, notify the public, engage stakeholders, and develop strategic actions to reduce emissions. Each year the TCEQ collects an extensive amount of ambient air monitoring data and evaluates the potential for adverse short- and long-term health effects and odors.
>
> The TCEQ uses air permitting, ambient air monitoring, and the APWL to ensure that ambient air toxic concentrations are at levels that are protective of public health and welfare."

Historically there have been some APWL sites in Harris County, all of which have been successfully managed and delisted[1], which include:

APWL MAP ID	Location	Year Added	Year Delisted	Emission of Interest
APWL1204	Lynchburg Ferry Area	2003	2014	styrene
APWL1204	Lynchburg Ferry Area	2002	2010	benzene
APWL1206	Galena Park	2000	2017	benzene
APWL1207	Houston (Milby Park area)	1999	2009	1,3 butadiene

There are currently no APWL sites in Harris County although TCEQ continues to maintain a significant monitoring network within the area.

The APWL program is an important resource for several reasons. The first is that it identifies that there is a program in place to identify and reduce emissions of air toxics. The second is that the process to address these APWL sites is working, as is indicated by the success stories identified above. Third, it is important to be able to identify existing areas of concern within a project area, although in this case, there are no active APWL sites in the county.

[1] Source: https://www.tceq.texas.gov/toxicology/apwl/list.html

TCEQ Air Toxics Activities

Unlike the criteria pollutants, MSAT do not have National Ambient Air Quality Standards (NAAQS), but TCEQ does have Air Monitoring Comparison Values (AMCVs) that are "screening levels for ambient air set to protect human health and welfare"[2]. These are used in the evaluation of TCEQ's APWL program described above. TCEQ's Interoffice Memorandum titled *Health Effects Review of 2016 Ambient Air Network Monitoring Data in Region 12, Houston*[3], indicates that, out of 4,512,670 1-hour volatile organic compound (VOC) measurements, 99.9998% of them (all but eight) were below short-term, health-based AMCVs. The remaining eight instances were individually analyzed by TCEQ toxicology, concluding that "these hourly concentrations would not be expected to cause short-term, adverse health effects."[4] All of the 4,012 3-hour carbonyl concentrations were less than their respective AMCVs. All of the 24-hour chemical-specific measurements were below their health-based AMCVs. For the seventh-consecutive year, all annual averages were below their respective long-term AMCVs except for hexachloro-1,3-butadiene at three Texas City/La Marque Sites (2nd Ave, Avenue A, and North Site) and acetaldehyde at Avenue A.[5] Again, TCEQ toxicology reviewed these exceptions individually and determined that "no long-term, adverse health or vegetation effects would be expected due to exposure to those concentrations."[6]

Below are charts from TCEQ showing air quality toxic successes in Texas. The first chart shows how many monitoring sites TCEQ maintains in relation to other states, with Texas having the most extensive program in the country. The second is a chart showing benzene trends in Houston: concentrations declined between 2000 and 2014 and none of the values above the applicable TCEQ long-term AMCV have occurred since 2007. The aggressive monitoring and detailed analyses performed by TCEQ demonstrates that air toxics levels continue to improve in Texas.

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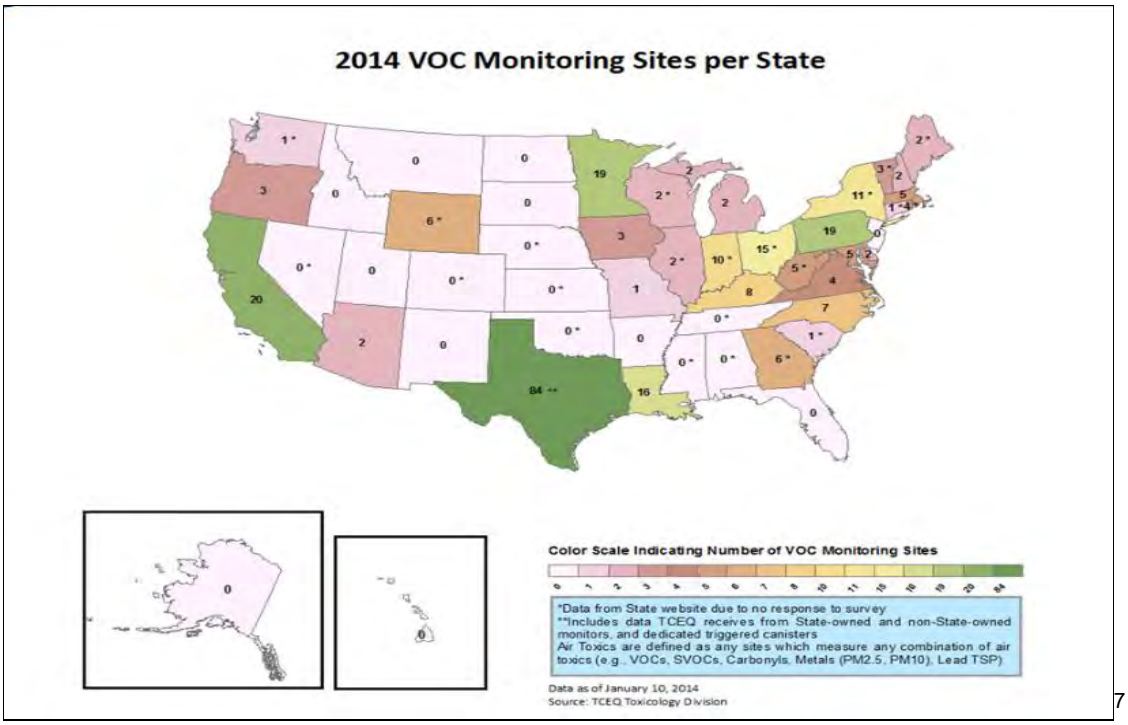
[2] https://www.tceq.texas.gov/toxicology/amcv/about

[3] https://www.tceq.texas.gov/assets/public/implementation/tox/monitoring/evaluation/2016/reg12.pdf

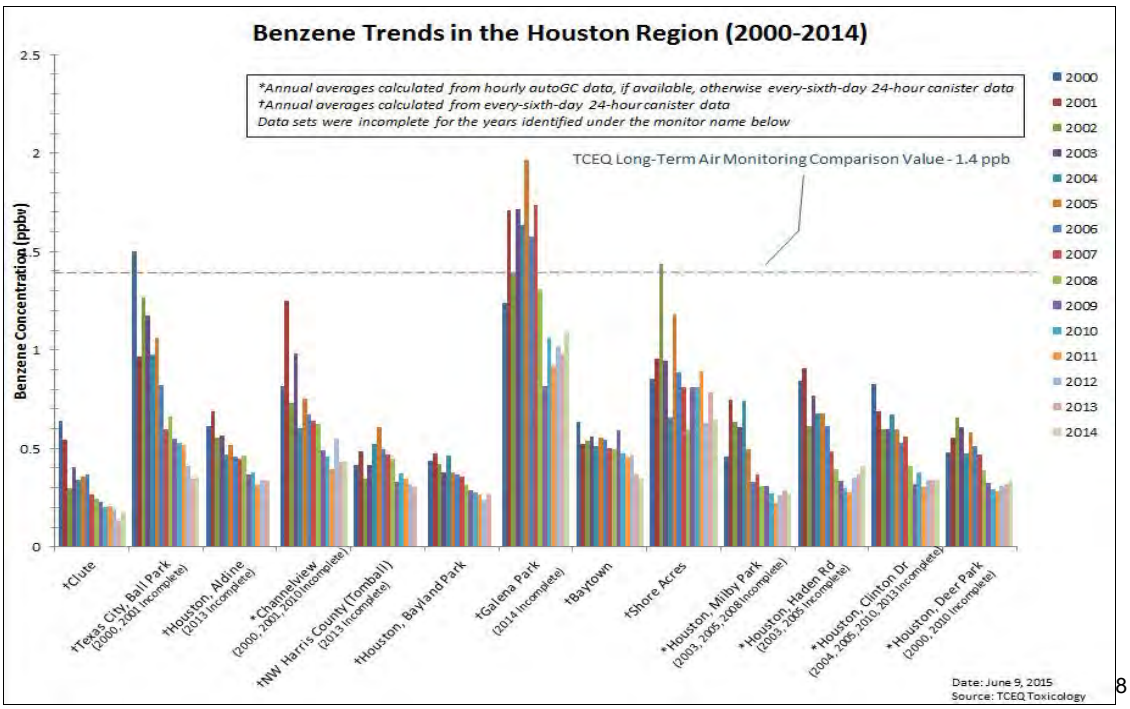
[4] Health Effects Review, p. 7

[5] *Id.* at 9.

[6] *Id.* at 10.



[7]



[8]

[7] TCEQ, Air Quality Successes - Air Toxics, Monitoring Sites (https://www.tceq.texas.gov/airquality/airsuccess/airsuccesspermits/airsuccesstoxics#)

[8] TCEQ, Air Quality Successes - Air Toxics, Benzene Trends (https://www.tceq.texas.gov/airquality/airsuccess/airsuccesspermits/airsuccesstoxics#)

The Role of Health Risk Assessment in a National Environmental Policy Act Context for Highway Projects

The issue of health risk assessments (HRAs) has arisen in NEPA consultation for many highway projects around the country and is not unique to this project. FHWA previously reviewed two HRAs provided by EPA for port-related projects in California, another for a roadway expansion project related to the relocation of several thousand U.S. Marines to the island of Guam, and a fourth analysis for a hypothetical roadway under a National Cooperative Highway Research Program (NCHRP) research project. FHWA's review focused on the methodologies used in the studies and the findings related to any incremental health risk due to the projects[9].

All four of the HRAs involved very conservative assumptions regarding emissions and exposure. For example, each of the studies assumes constant near-term emissions rates, even though national projections by EPA and the emissions analysis for this project show that there will be a large decline in emissions over the lifetime of the project. Likewise, all four of the modeling studies assume constant breathing of outdoor air at a fixed location for either 30 years (one study) or 70 years (three studies). They assume that people will not change residence (which occurs every 8 years on average in the US), change jobs (which occurs every 3 years on average), or travel to different parts of a metropolitan area over the course of a given day (even though people travel 26 miles per day, on average). The studies even assume that students will remain at elementary schools 24 hours a day for 30 or 70 years. These assumptions are not realistic and introduce a considerable amount of uncertainty into the results.

Even with these conservative assumptions, the four studies all report a very low risk to health. Estimated incremental cancer risk from vehicle traffic at the worst-case location in each study ranged from 0.08 cases of cancer per million people to 2 cases per million people. As a point of reference, the risk management framework in EPA's Air Toxics Risk Assessment Reference Library defines risk levels between one in a million and 100 in a million as "acceptable." (A risk level of "one in a million" is frequently mentioned in discussions of cancer risk, but under EPA risk assessment guidelines, this represents a level below which risk is considered "negligible," and is not a standard or other type of pass/fail threshold.) For non-cancer health risks, EPA uses a metric known as the "hazard quotient," where the estimated risks for each pollutant are added together, and a total of less than 1 is considered acceptable. Each of the locations modeled in three of the studies had hazard quotients from vehicle emissions of less than 1, in most cases much less; the remaining study did not calculate a hazard quotient. In short, none of these health risk assessments for major roadway projects (including the two examples provided by EPA) identified health risks in excess of the "acceptable" thresholds in EPA's risk management framework.

To help put these low health risks from roadway emissions into perspective, FHWA compared them to health risks from traffic fatalities. In 2010, there were 2.47 million deaths in the US, and 32,728 of these were due to traffic fatalities, meaning that the risk of dying in a traffic accident in 2010 was 0.0106%. Converted to terms of risk per million people, this represents a risk of 106 in a million (per year), or 7420 in a million (70-year lifetime risk, consistent with cancer risk estimation). While this risk is very high and FHWA is actively working to improve highway safety, it means that the incremental risk of cancer from breathing air near a major roadway is several hundred times lower than the risk of a fatal accident from using a major roadway.

EPA must make decisions regarding acceptable risk when it develops regulations to control hazardous air pollutants (air toxics) under Titles II and III of the Clean Air Act. EPA's NESHAPs standard for benzene emissions is based on attaining a risk level of no more than 100 cases of cancer per million people. EPA's 2007 mobile source air toxics rule, covering vehicles, fuels, and fuel containers, is designed to

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[9] Harbor Bridge FEIS, Appendix K - Public Involvement Materials, pgs. 751-754, https://ccharborbridgeproject.files.wordpress.com/2012/02/appendix-k-public-involvement.pdf

result in a remaining risk of approximately 5 in a million[10]. The estimated risk from the highway projects that FHWA reviewed are much lower than both of these risk levels, considered acceptable by EPA as an outcome of their rulemaking processes. .

FHWA's NEPA documents are developed under two guiding regulations: the Council on Environmental Quality's (CEQ)'s NEPA regulations applicable to all federal agencies (40 C.F.R. Parts 1500–1508) and FHWA's implementing regulations governing FHWA NEPA documents (23 C.F.R. Part 771). In its MSATs guidance, FHWA discusses 40 C.F.R. Part 1502.22 and acknowledges that while much work has been done to assess the overall health risk of MSATs, analytical tools and techniques for assessing project-specific health outcomes as a result of lifetime exposures to MSATs remain limited. These limitations impede the ability to evaluate the potential health risks attributable to exposure to MSATs as part of the decision-making process in the NEPA context. However, as with any analysis that FHWA conducts for NEPA purposes, FHWA's approach for MSAT analysis in NEPA documents is informed not just by 40 C.F.R. Part 1502.22, but by all applicable CEQ requirements. The appropriateness of an air toxics HRA as an analysis method for NEPA documents is discussed below, in the context of CEQ requirements for these documents.

40 C.F.R. § 1500.1(b) states that information for decision making must be of high quality and based on accurate scientific analysis. Air toxics HRAs can involve large uncertainties. The MSAT HRA uncertainty builds on itself—each step of the analysis involves uncertainties, including modeling traffic and then modeling emissions, and using this estimated output to model dispersion concentrations, which provide information for estimating or assuming exposures to those concentrations, and finally predicting health outcomes. Major uncertainties are associated with traffic and emissions projections over a 70-year period, and dispersion models are typically held to a "factor of 2" performance standard. Health impacts of MSAT in the EPA Integrated Risk Information System (IRIS) are based on a 70-year lifetime exposure, which introduces significant uncertainty (e.g., on average, people in the United States change residence approximately once every 8 years and change jobs once every 3). Finally, as noted above, EPA's IRIS provides toxicity (risk) values for various pollutants and routes of exposure; in a HRA, FHWA would compare calculated concentrations of MSAT pollutants to the IRIS values to estimate health risk. In IRIS, EPA states the toxicity values are believed to be accurate to within an order of magnitude (a factor of 10). The total cumulative uncertainty involved in a highway project HRA is much larger than the change in emissions attributable to projects (typically a few percentage points). Accordingly, the information would not meet the requirements for high-quality information and accurate scientific analysis used to establish significance.

Section 1500.1(b) also directs agencies to focus their NEPA analysis and documentation on issues that are truly significant to the action in question. In the context of MSAT, FHWA must consider whether changes in MSAT emissions attributable to a project have the potential for significant health risk. Using cancer risk as an example, EPA estimates that air toxics (from all sources) are responsible for an average national risk of approximately 30 in a million (or 1 in 33,000)[11] and approximately 40 in a million (or 1 in 25,000) for this part of Harris county specifically[12]. The risk factor assumes exposure to 2014 outdoor levels of air toxics concentrations over the course of his or her lifetime. In its most recent MSATs rule-making, EPA estimated MSAT cancer risk, after implementation of emissions controls, at approximately 5

[10] Table 3.2-14, Final Regulatory Impact Analysis, Control of Hazardous Air Pollutants from Mobile Sources, February 2007

[11] 2014 National Air Toxics Assessment: Fact Sheet, https://www.epa.gov/sites/production/files/2018-08/documents/2014_nata_overview_fact_sheet.pdf

[12] 2014 National Air Toxics Assessment: Map Application: https://gispub.epa.gov/NATA/

in a million (or 1 in 200,000). As indicated above, EPA's Air Toxics Risk Assessment Reference Library defines risk levels between one in a million and 100 in a million (1 in 10,000) as "acceptable." Most highway projects estimate less than a 5 percent change in MSAT emissions compared with the No-Action Alternative. For the Preferred Alternative, the MSAT emissions analysis for the Study Area found little difference in total annual emissions of MSAT emissions between the Preferred and No-Action Alternatives (less than 3.8 percent in 2040). With the Preferred Alternative in 2040, modeled MSAT emissions would decrease by more than 72% percent, depending on the pollutant, despite a 58 percent increase in VMT in the Study Area compared with 2018. As explained in the MSAT Technical Report, emissions will decrease even as VMT increases due to improvements in fuel standards and automobile technology.

In summary, available information from EPA indicates that MSATs are a small component of overall cancer risk, and the analysis for the FEIS indicates both that the Preferred Alternative would result in only a small change in the emissions that contribute to this risk and that emissions will decline by a large amount regardless of alternative.

As explained above and in the Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts Analysis section of this technical report, results from an HRA would be influenced more by the uncertainty introduced into the process through assumptions and speculation rather than by genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a project. Therefore, outcomes of such an assessment do not provide useful information for decision makers, as required by Section 1502.1. The FHWA approach is consistent with the CEQ's direction in Section 1502.2(b) to discuss impacts in proportion to their significance.

Results of Recent Application of Methodologies and Tools used in Health Assessments

The following information provides a real world example of EPA study results that indicate that, with regards to MSAT, health assessment methodologies do not provide data with sufficient accuracy to be used by NEPA decision-makers or shared with the public.

EPA Study "Assessing Outdoor Air Near Schools[13]"

EPA conducted this study (2009-2012) as part of ongoing efforts to protect children's health. EPA developed a list of 62 priority schools throughout the U.S. as locations for an initial round of 60 to 90 day ambient monitoring, 14 of which were near major roads. This monitoring targeted the site-specific air emissions concentrations of particular interest and gave a rationale for why certain emissions were not monitored. The monitors were sited on school grounds. The following includes excerpts from this study.

EPA used "sample screening levels" for each air emission monitored at the school. EPA developed these screening levels to provide the Agency and the community an early understanding of what the data were showing. "The sample screening level is a level of pollution in the air that is below what [EPA expects] to cause health problems from short-term exposures – all day, every day over a period ranging up to at least a couple of weeks (longer, for some pollutants). To use the screening level, compare it to each sample result:

- a sample result at or below the sample screening level is not a concern for risk of health problems from short-term exposures.
- a sample result above the screening level does not mean that there is a risk to children and adults at the school. It is a signal for EPA to further evaluate those and subsequent results for that pollutant."[14]

For this study addressing children's health, EPA did not measure diesel exhaust because it cannot be measured directly. . However, as a result of EPA's aggressive action to reduce emissions of mobile source air toxics, EPA projected that mobile source air toxic emissions, would decrease substantially between 1999 and 2020, including reductions of over 90% in emissions of diesel particulate matter from motor vehicles.[15]

In their risk analysis, EPA predicted that ambient emissions would be above one or more emission level thresholds used to assess short-term and/or long-term health impacts. The project objectives were to:

- yield location-specific ambient air quality data sufficient to initially screen for potential impacts from toxic air pollution at our nation's schools[16], and

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[13] Website for the EPA Study Assessing Outdoor Air Near Schools is at: https://www3.epa.gov/air/sat/index.html

[14] Website for the EPA Study Assessing Outdoor Air Near Schools, citation is from: https://www3.epa.gov/air/sat/FeltonElemResults.html

[15] This information is provided on the sample results page for each school that was monitored. The example provided is for Felton Elementary School at: https://www3.epa.gov/air/sat/FeltonElemResults.html

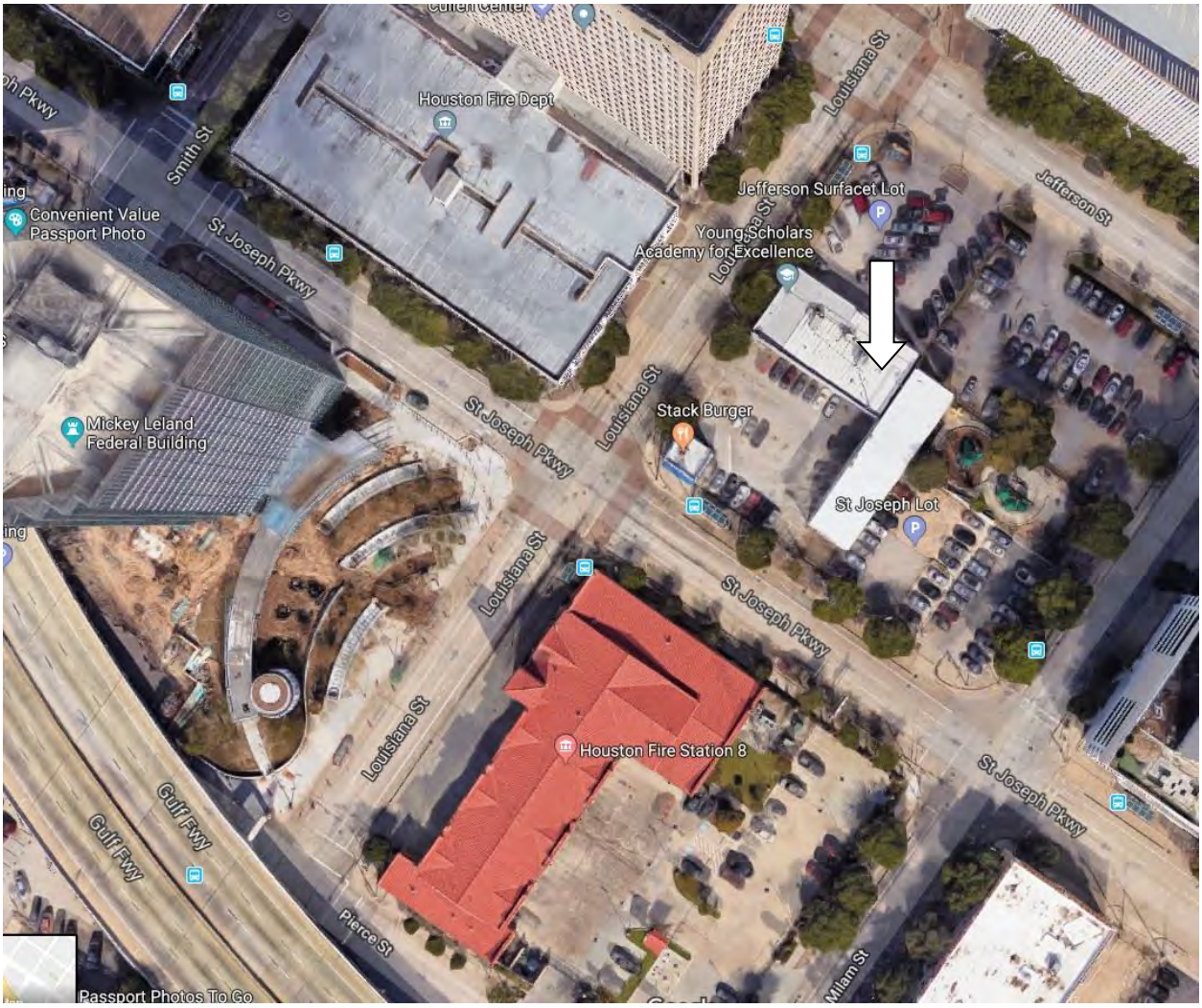
[16] Website for the EPA Study Assessing Outdoor Air Near Schools is at: https://www3.epa.gov/air/sat/index.html

- provide a basis for additional actions by EPA, state, and local agencies including, but not limited to, additional monitoring and/or enforcement or other risk mitigation efforts[17].

EPA did not monitor for any criteria pollutant associated with mobile source emissions. For the 14 schools near roads, the highest monitored level of mobile source related emissions (MSRE) was < 31% of the "sample screening level". Using the average of all monitor data for each air emission monitored, results in average monitored MSRE levels < 8% of the "sample screening level." EPA also evaluated the average of all monitor data for each air emission compared to long-term non-cancer health risks and long-term cancer health risks. The average MSREs ranged from less than 2% to less than or equal to 20% of any long-term risk threshold for mobile source related emissions, even though the methodologies EPA used indicated one or more air emissions would exceed thresholds for evaluating short-term and/or long-term health impacts. See below table for air emission monitor data for all schools near major roads.

[17] Website for the EPA Study Assessing Outdoor Air Near Schools is at: https://www3.epa.gov/air/sat/index.html

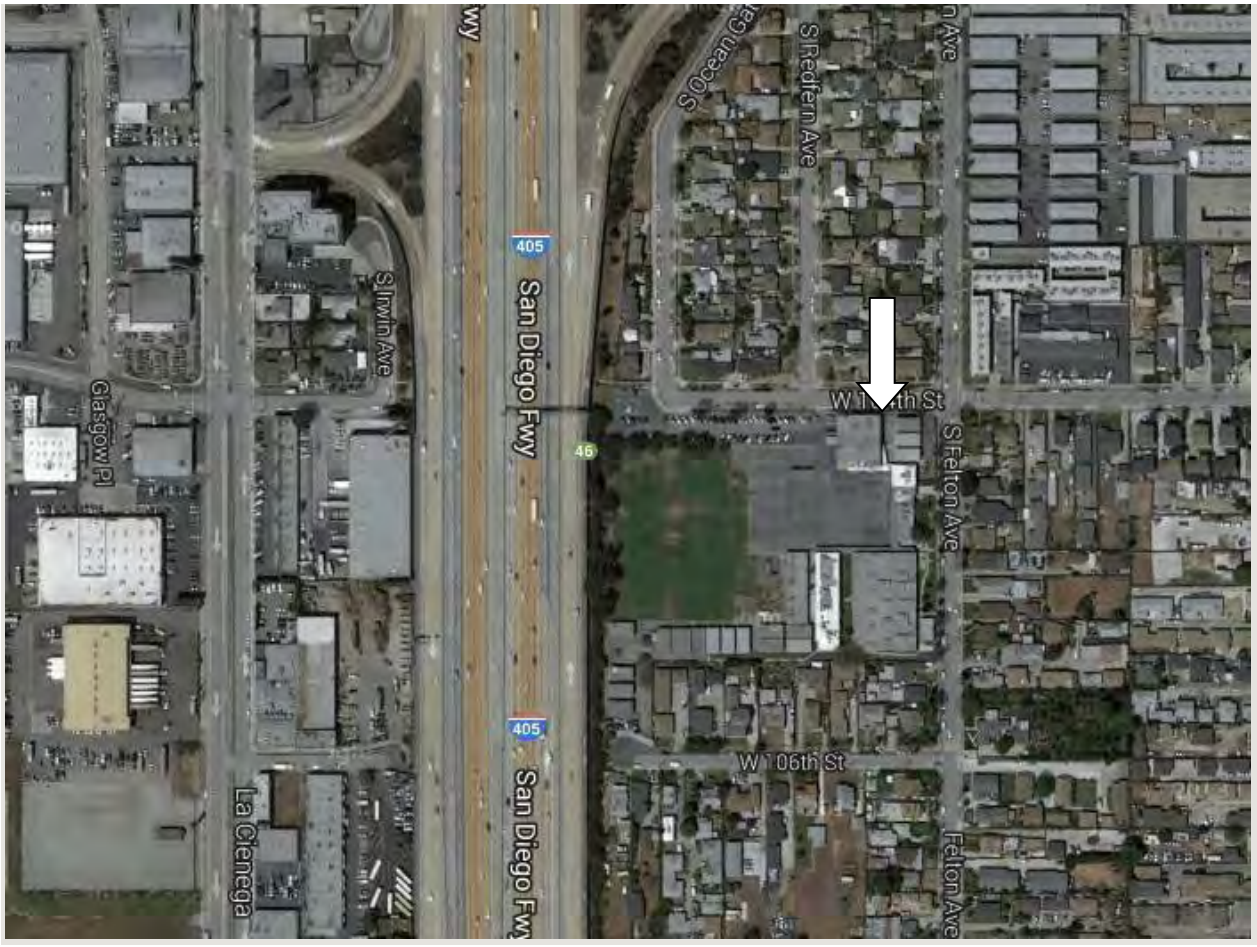
Young Scholars Academy, in Houston, Texas, was also included in this study. It is located in the vicinity of IH 45 and this project specifically. EPA selected this school because of its proximity to major roadways and they used modeling to determine which air toxics (benzene and 1,3-butadiene) they believed would be present at elevated levels near the school. Monitor samples were collected from October 21, 2009 through December 15, 2009. After monitoring was complete, EPA analyzed the results for potential long-term exposures (over a lifetime). To quote EPA, "Measured levels of benzene and 1,3-butadiene and associated longer-term concentration estimates were not as high as was suggested by modeling information."[18] Based on the low monitored values, EPA decided not to extend air toxics monitoring at the school.



https://www3.epa.gov/air/sat/map.html

[18] https://www3.epa.gov/air/sat/YoungSchol.html

Felton Elementary School: The school closest to the largest roadway was Felton Elementary School in Los Angeles, California, so it is provided as an example of what the study evaluated. The playground abuts I.H. 405 which consists of 20 lanes of traffic. EPA indicated the school was selected for monitoring because it is in a community that is impacted by several major highways. The highest monitored level of mobile source related emissions (MSRE) was less than 12% of the "sample screening level". The average monitored MSRE levels were less than 5% of the "sample screening level." The average monitored MSREs ranged from less than 0.25% to less than or equal to 4.83% of any long-term risk threshold for mobile source related emissions. Caltrans indicated the 2012 Annual Average Daily Traffic (AADT) for this IH 405 north and south of Felton Elementary School is between: 245,000 – 336,000[19]. A map showing Felton Elementary School and IH 405 is below.



https://www3.epa.gov/air/sat/map.html

[19] Caltrans, Traffic Operations Materials, statewide excel spreadsheet of 2012 AADT.

Lamkin Elementary School, in Cypress, Texas (in the greater Houston area) was also a school monitored by EPA. It is adjacent to U.S. 290. The cross-section of US 290 in this area consists 14 lanes composed of main-lanes, frontage roads and HOV lanes. In 2010, the AADT for this section of US 290 was approximately 149,000 vehicles/day, based upon TxDOT District Traffic Count Maps (the count information was taken just NW of the 290-Beltway 6 interchange). However, EPA monitored this location not due to its proximity the freeway, but rather, its proximity to one large industry that is a source of air toxics emissions for chromium VI. Monitor samples were collected from September through December 2009. EPA performed a risk analysis (using NATA and other data) and chose not to monitor for mobile source related emissions despite the fact that the school that abutted a roadway with high traffic volumes. This study was conducted to protect children's health, yet EPA did not suggest this school needed to monitor for any mobile source related emissions. A map for Lamkin Elementary School in proximity to U.S. 290 is provided below.

https://www3.epa.gov/air/sat/map.html

Summary

In summary, EPA conducted this study for the protection of children's health. EPA chose not to evaluate diesel particulate as a fraction of $PM_{2.5}$ since diesel particulate emission reductions are predicted to drop by over 90% between 1999 and 2020. For one school in Houston in proximity to IH 45, EPA assumed a significant amount of air toxics would be present due to roadway emissions. It turns out that their monitor data at the school was significantly lower than what they modeled. For another school in the greater Houston area abutting U.S. 290, EPA performed a risk analysis (using NATA and other data) and did not choose to monitor for mobile source related emissions for that school despite its proximity to the freeway. TxDOT and FHWA believe this EPA risk assessment lends additional support to the determination that

further HIA/HRA analysis for the project is not necessary. Even though EPA analytical methods predicted that monitored emissions would exceed one or more thresholds for short-term or long-term health thresholds, the monitored air emission results for mobile source related emissions were all less than any short-term or long-term health impact threshold. The results of this EPA study completed to protect children's health support FHWA's MSAT guidance statement that "the outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable with a proposed action".[20] When EPA did conduct ambient air monitoring, the actual results were lower than the models had predicted, suggesting a lower potential risk to children.. NEPA does not require studies based upon speculation, precisely because such results could be misleading to the public and/or decision-makers.

[20] FHWA Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA - Appendix C

EPA Assessing Outdoor Air Near Schools: Ambient Monitoring (2009-2012)
Worksheet: Averge of Monitored Concentration Compared to Long-Term Health Effects Threshold

Data Source for EPA School Study: https://www3.epa.gov/air/sat/index.html

Data extracted 8/8/13 - 8/14/13 and March

School Background Information								Long Term Noncancer Risk (LTNC) Threshold (µg/m3)	2	30	3	9	7	6.4	Project Team Calculated Value: Average Monitored Concentration % of LTNC Threshold						Project Team Calculated Value: Average Monitored Concentration % of LTC Threshold						Near Roads, AADT, # lanes, distance from school to roads	Results
								Long Term Cancer Risk (LTC) Threshold (µg/m3)	3.3	13	2.9	45														
Near Road Monitoring Nexus	School Name	City	State	Address	Pollutants Monitored 1	Add'l Monitoring		1,3 Butadiene EPA Avg Monitored Conc.	Benzene (µg/m3) EPA Avg Monitored Conc.	Naphthalene (µg/m3) EPA Avg Monitored Conc.	Acetaldehyde (µg/m3) EPA Avg Monitored Conc.	Acrolein (µg/m3) EPA Avg Monitored Conc.	Benzo[a]pyrene (µg/m3) EPA Avg Monitored Conc.	1,3 Butadiene	Benzene	Naphthalene	Acetaldehyde	Acrolein	Benzo[a]pyrene	1,3 Butadiene	Benzene	Naphthalene	Acetaldehyde	Acrolein	Benzo[a]pyrene		
Yes	Felton Elementary School	Lennox	CA		Metals in TSP, PAH, VOC	no		0.25	1.45	0.09				12.50	4.83	3.00	0.00	0.00	0.00	7.58	11.15	3.10		n/a	n/a	playground within 300 m of IH 405 (1 HOV, 6 FR, 12 ML + bus lane) and may abut the 405, and approx 4000 ft from IH 105 (elevated 2-4 FR/3-5 + 3-5 ML/2-4 FR) and Imperial Hwy (3+3 ML underneath)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants are below the levels of significant concern & < than those suggested by the information that helped identify this school for monitoring (from tech report this was via computer modeling and NATA data). Adverse short term and long term health impacts not anticipated from monitored pollutant levels. EPA calculated averages and ranges for long term levels were below levels of risk concern.
Yes	Bright Kids Montessori Academy (formerly Santa Anita Christian Academy)	Los Angeles	CA		Metals in TSP, PAH, VOCs	no				0.177						5.90						6.10		n/a	n/a	abuts Santa Anita Ave (3+3ML)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants are below the levels of significant concern & < than those suggested by the information that helped identify this school for monitoring (from tech report this was via computer modeling and NATA data). Adverse short term and long term health impacts not anticipated from monitored pollutant levels. EPA calculated averages and ranges for long term levels were below levels of risk concern.
Yes	Soto Street Elementary School	Los Angeles	CA		Metals in TSP, PAH, VOCs	no		0.32	1.82					16.00	6.07					9.70	14.00			n/a	n/a	chosen for small industrial and large roads15 lanes between US 101 and IH 5, within 75 feet of IH5 and US 101	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants are below the levels of significant concern & < than those suggested by the information that helped identify this school for monitoring (from tech report this was via computer modeling and NATA data). Adverse short term and long term health impacts not anticipated from monitored pollutant levels. EPA calculated averages and ranges for long term levels were below levels of risk concern.
Yes	Spain Elementary School	Detroit	MI		VOCs	no		0.07	0.62					3.50	2.07					2.12	4.77			n/a	n/a	500 ft from IH 75 (2-4 FR; 4+4ML, 2-4 FR)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants are below the levels of significant concern & < than those suggested by the information that helped identify this school for monitoring (from tech report this was via computer modeling and NATA data). Adverse short term and long term health impacts not anticipated from monitored pollutant levels. EPA calculated averages and ranges for long term levels were below levels of risk concern.
Yes	Mabel Holmes Middle School	Elizabeth	NJ		VOCs, Carbonyls, Metals in PM10	no		0.14	1.05		1.8			7.00	3.50		20.00			4.24	8.08		4.00	n/a	n/a	about 500 ft from NJ turnpike US95 (4ML, 3ML, 3ML, 4ML = 14 ML total)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants are below the levels of significant concern & < than those suggested by the information that helped identify this school for monitoring (from tech report this was via computer modeling and NATA data). Adverse short term and long term health impacts not anticipated from monitored pollutant levels. EPA calculated averages and ranges for long term levels were below levels of risk concern.
Yes	Intermediate School 143	New York	NY		VOCs	no		0.21	1.27					10.50	4.23					6.36	9.77			n/a	n/a		Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants are below the levels of significant concern & < than those suggested by the information that helped identify this school for monitoring (from tech report this was via computer modeling and NATA data). Adverse short term and long term health impacts not anticipated from monitored pollutant levels. EPA calculated averages and ranges for long term levels were below levels of risk concern.
Yes	Elm Street Elementary School	Wauseon	OH		Diisocyanates, VOCs,	no				0.62						2.07					4.77			n/a	n/a		Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants are below the levels of significant concern & < than those suggested by the information that helped identify this school for monitoring (from tech report this was via computer modeling and NATA data). Adverse short term and long term health impacts not anticipated from monitored pollutant levels. EPA calculated averages and ranges for long term levels were below levels of risk concern.
Yes	Harriet Tubman Middle School	Portland	OR		Carbonyls, Metals in PM10, VOCs	yes / school		0.12	1.07		1.56			6.00	3.57		17.33			3.64	8.23		3.47	n/a	n/a	less than 100 feet from IH 5 (7 mainlanes), major distribution just west of IH 5	School is near a mix of industrial sources and is near an interstate highway and other roadways sources. Mobile source emissions monitored were below levels of concern for short or long term impacts. Cadmium indicated a potential for long-term continuous exposure. Additional sample results and analysis not yet posted.
Yes	Chicora Elementary School	Charleston Heights	SC		Carbonyls, Cr+6, Metals in PM10, VOCs	no		0.11	1.1		0.8			5.50	3.67		8.89			3.33	8.46		1.78	n/a	n/a	about 1000 ft from US 78 and US 52 (6 ML + left turn, undivided) and 3000 ft from Charleston Naval Complex	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants are below the levels of significant concern & < than those suggested by the information that helped identify this school for monitoring (from tech report this was via computer modeling and NATA data). Adverse short term and long term health impacts not anticipated from monitored pollutant levels. EPA calculated averages and ranges for long term levels were below levels of risk concern.
No, plywood fiberboard	Temple Elementary School	Diboll	TX		VOCs	yes / school																		n/a	n/a	approx 2000 ft from US 59	School near a plywood manufacturing facility. Additional monitoring of acrolein, since first set results had concerns on consistency and reliability of ambient monitoring results. Follow-up indicated acrolein and VOC concentrations were within the range of estimated levels without appreciable risk of adverse effects.
Yes, paper processing and interstate	NW Harllee Elementary School	Dallas	TX		Carbonyls, VOCs	no		0.09	0.79		1.75			4.50	2.63		19.44			2.73	6.08		3.89	n/a	n/a	IH 35 about 1000 ft, 8 M, 2-3FR, 2 HOV, it's IH 35 S of IH 30	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants are below the levels of significant concern & < than those suggested by the information that helped identify this school for monitoring (from tech report this was via computer modeling and NATA data). Adverse short term and long term health impacts not anticipated from monitored pollutant levels. EPA calculated averages and ranges for long term levels were below levels of risk concern.
No, metal forging	Lamkin Elementary	Cypress	TX		Cr+6	no																		n/a	n/a	Did not test for mobile source related pollutants although school is within 400 Ft of US 290, by CyF air High School, school property abuts 290, (from W to E - RR track 3FR, 3ML, 1+1 HOV, 3ML, 3FR)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants are below the levels of significant concern & < than those suggested by the information that helped identify this school for monitoring (from tech report this was via computer modeling and NATA data). Adverse short term and long term health impacts not anticipated from monitored pollutant levels. EPA calculated averages and ranges for long term levels were below levels of risk concern.
Yes, petrochemical and mjr roads	San Jacinto Elementary School 5 Deer Park Junior High School					yes/school		0.39	2.37					19.50	7.90					11.82	18.23			n/a	n/a	both schools are colocated - 1000 - 2000 ft from 225 (e of beltway 8)	Initial Sampling stated: in a community that is impacted by several major highways.Initial analysis stated: near a large petrochemical complex, as well as other industries which are sources of air toxics emissions)Final results stated: near a large petrochemical complex, as well as other industries which are sources of air toxics emissions) Followup additional monitoring for 1,3-butadiene, benzene, and other VOCs were conducted from October 13, 2011 to May 28, 2012. Results: Measured values of 1,3-butadiene and benzene indicate influence of the source at this school location. However, results of 1,3-butadiene, benzene and other VOCs are below levels of significant concern.
Yes	Young Scholars Academy	Houston	TX		VOCs	no		0.14	0.97					7.00	3.23					4.24	7.46			n/a	n/a	chosen because close to highways, 8 ML, no FR or HOV, slightly elevated near school, within 500 ft of IH45 S (Gulf Freeway)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants are below the levels of significant concern & < than those suggested by the information that helped identify this school for monitoring (from tech report this was via computer modeling and NATA data). Adverse short term and long term health impacts not anticipated from monitored pollutant levels. EPA calculated averages and ranges for long term levels were below levels of risk concern.
No	I C Evans Elementary School	Burkburnett	TX		4,4-Methylenedianiline	no																		n/a	n/a	ISD shows up on map, but not elementary school	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants are below the levels of significant concern & < than those suggested by the information that helped identify this school for monitoring (from tech report this was via computer modeling and NATA data). Adverse short term and long term health impacts not anticipated from monitored pollutant levels. EPA calculated averages and ranges for long term levels were below levels of risk concern.
Yes	Concord Elementary School	Seattle	WA		Cr+6, Metals in TSP, VOCs	no		0.12	1.03					6.00	3.43					3.64	7.92			n/a	n/a	track within 300 ft from SH 99 (2+2 divided ML+ bike), school within 500 ft from SH 99, SH 509 (4ML +2 ML?) within 2500 ft	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants are below the levels of significant concern & < than those suggested by the information that helped identify this school for monitoring (from tech report this was via computer modeling and NATA data). Adverse short term and long term health impacts not anticipated from monitored pollutant levels. EPA calculated averages and ranges for long term levels were below levels of risk concern.
Yes	Lapwai High School (School in Tribal Area	Nez Perce	Lapwai, ID		VOCs, Carbonyls, Metals in PM10	no		0.043	0.55		1.33			2.15	1.83		14.78			1.30	4.23		2.96	n/a	n/a	track is within 50 ft of US95 (2 lanes + left turn lane)	Wind patterns generally similar. No disruption in typical roadway activity. Levels of acetaldehyde, benzene and 1,3-butadiene in the air at the school were not as high as was suggested by information available prior to monitoring and are below the levels of concern. Adverse short term and long term health impacts not anticipated from monitored pollutant levels, but seasonal differences appear to exist. No further studies proposed.

1 - Pollutants measured were selected based on emission sources in the vicinity of each school.

4,4-Methylenedianiline: A chemical compound used mainly for making polyurethane foams

Carbonyls: Also known aldehydes (e.g., formaldehyde and acetaldehyde).

Cr+6: Hexavalent chromium

Diisocyanates: Chemical compounds used in manufacturing foam-containing products; three of these compounds will be measured.

Metals in PM10: Toxic metals contained in particulate matter that is 10 micrometers in diameter or smaller (e.g., lead, nickel and manganese).

Metals in TSP: Toxic metals contained in total suspended particulate matter (e.g., lead, nickel and manganese).

PAH: Polycyclic Aromatic Hydrocarbons (e.g., naphthalene, benzo(a)pyrene).

VOC: Volatile Organic Compounds (e.g., benzene, vinyl chloride).

Note: The groups of chemicals identified for each school as "pollutants monitored" include both the specific individual pollutants within the group that our current information indicates may present at each school at levels of potential concern (i.e., the "driver pollutants") and some other pollutants that can be inexpensively measured at the same time. While we analyzed air samples for both sets of pollutants in each chemical group and reviewed all the data in drawing conclusions for each school, we focused our data analysis activities primarily on the individual "driver pollutants".

3 - The March 31, 2009, verson of the list indicated that Metals in PM10 would be monitored. This was a typographical error. Metals in PM10 were not be monitored at this school.

5 - These schools are located close to each other. Our goal was to use one monitor to characterize both schools.

EPA Assessing Outdoor Air Near Schools: Ambient Monitoring (2009-2012)
Worksheet: Averge of Monitored Concentration Compared to Short-Term Health Effects Threshold

Data Source for EPA School Study: http://www.epa.go Data extracted 8/8/13 - 8/14/13 and March 2014.

School Information							EPA Provided Sample Screening Level (evaluates short term impacts)	20	30	30	90	0.7	6.4	Project Team Calculated Value: Percent: Highest Monitor Conc to Sample Screening Level (mobile source related emissions + other sources for products of incomplete combustion)						Project Team Provided: Near Roads, AADT, # lanes, distance from school to roads	EPA Results
Near Road Monitoring Nexus	School Name	City	State	Address	Pollutants Monitored 1	Add'l Monitoring		1,3 Butadiene (µg/m3) EPA Avg Monitored Conc.	Benzene (µg/m3) EPA Avg Monitored Conc.	Naphthalene (µg/m3) EPA Avg Monitored Conc.	Acetaldehyde (µg/m3) EPA Avg Monitored Conc.	Acrolein (µg/m3) EPA Avg Monitored Conc.	Benzo[a]pyrene (µg/m3) EPA Avg Monitored Conc.	1,3 Butadiene	Benzene	Naphthalene	Acetaldehyde	Acrolein	Benzo[a]pyrene		
Yes	Felton Elementary School	Lennox	CA		Metals in TSP, PAH, VOC	no		0.25	1.45	0.09				1.25	4.83	0.30				playground within 300 m of IH 405 (1 HOV, 6 FR, 12 ML + bus lane) and may abut the 405, and approx 4000 ft from IH 105 (elevated 2-4 FR/3-5 + 3-5 ML/2-4 FR) and Imperial Hwy (3+3 ML underneath)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants in the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes	Bright Kids Montessori Academy (formerly Santa Anita Christian Academy)	Los Angeles	CA		Metals in TSP, PAH, VOCs	no				0.177						0.59				abuts Santa Anita Ave (3+3ML)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants in the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes	Soto Street Elementary School	Los Angeles	CA		Metals in TSP, PAH, VOCs	no		0.32	1.82					1.60						chosen for small industrial and large roads15 lanes between US 101 and IH 5, within 75 feet of IH5 and US 101	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants in the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes	Spain Elementary School	Detroit	MI		VOCs	no		0.07	0.62					0.35	2.07					500 ft from IH 75 (2-4 FR, 4+4ML, 2-4 FR)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants in the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes	Mabel Holmes Middle School	Elizabeth	NJ		VOCs, Carbonyls, Metals in PM10	no		0.14	1.05		1.8			0.70	3.50		2.00			about 500 ft from NJ turnpike US95 (4ML, 3ML, 3ML, 4ML = 14 ML total)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants in the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes	Intermediate School 143	New York	NY		VOCs	no		0.21	1.27					1.05	4.23					less than 500 ft from Washington Bridge, and within 750-1000 ft of IH 95	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants in the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes	Elm Street Elementary School	Wauseon	OH		Diisocyanates, VOCs,	no			0.62						2.07					within 500 ft of SH 108	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants in the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes	Harriet Tubman Middle School	Portland	OR		Carbonyls, Metals in PM10, VOCs	yes / school		0.12	1.07		1.56			0.60	3.57		1.73			less than 100 feet from IH 5 (7 mainlanes), major distribution just west of IH 5	School is near a mix of industrial sources and is near an interstate highway and other roadways sources. Mobile source emisions monitored were below levels of concern for short or long term impacts. Cadmium indicated a potential for long-term continuous exposure. Additional sample results and analysis not yet posted.
Yes	Chicora Elementary School	Charleston Heights	SC		Carbonyls, Cr+6, Metals in PM10, VOCs	no		0.11	1.1		0.8			0.55	3.67		0.89			about 1000 ft from US 78 and US 52 (6 ML + left turn, undivided) and 3000 ft from Charleston Naval Complex	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants in the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
No, plywood fiberboard	Temple Elementary School	Diboll	TX		VOCs	yes / school														approx 2000 ft from US 59	School near a plywood manufacturing facility. Additional monitoring of acrolein, since first set results had concerns on consistency and reliability of ambient monitoring results. Follow-up indicated acrolein and VOC concentrations were within the range of estimated levels without appreciable risk of adverse effects.
Yes, paper processing and interstate	NW Harllee Elementary School	Dallas	TX		Carbonyls, VOCs	no		0.09	0.79		1.75			0.45	2.63		1.94			IH 35 about 1000 ft, 8 M, 2-3FR, 2 HOV, it's IH 35 S of IH 30	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants in the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
No, metal forging	Lamkin Elementary	Cypress	TX		Cr+6	no							0.05						0.78	Did not test for mobile source related pollutants although school is within 400 Ft of US 290, by CyFair High School, school property abuts 290, (from W to E - RR track 3FR, 3ML, 1+1 HOV, 3ML, 3FR)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants in the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes, petrochemical and mjr roads	FINAL SAMPLING San Jacinto Elementary School 5 Deer Park Junior High School					yes/school		0.39	2.37					1.95	7.90					both schools are co-located - 1000 - 2000 ft from 225 (e of Beltway 8)	Initial Sampling stated: in a community that is impacted by several major highways. Inital analysis stated: near a large petrochemical complex, as well as other industries which are sources of air toxics emissions. Final results stated: near a large petrochemical complex, as well as other industries which are sources of air toxics emissions. Initial results: Levels of 1,3-butadiene in the air at the school indicate a potential for concern for long-term, continuous exposure, due primarily to one elevated result. Levels of benzene and benzo(a)pyrene are below levels of concern for short-term and long-term exposure. Although the longer-term concentration estimate for benzene is below the cancer-based comparison level for benzene, in combination with the results for 1,3-butadiene, there is a potential concern for long-term, continuous exposure to the pollutant mixture. Followup additional monitoring for 1,3-butadiene, benzene, and other VOCs were conducted from October 13, 2011 to May 28, 2012. Results: Measured values of 1,3-butadiene and benzene indicate influence of the source at this school location. However, results of 1,3-butadiene, benzene, and other VOCs are below levels of significant concern. Avg of benzene samples was 2.37.
Yes	Young Scholars Academy	Houston	TX		VOCs	no		0.14	0.97					0.70	3.23					chosen because close to highways, 8 ML, no FR or HOV, slightly elevated near school, within 500 ft of IH45 S (Gulf Freeway)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants in the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
No	I C Evans Elementary School	Burkburnett	TX		4,4-Methylenedianiline	no														ISD shows up on googlemap, but not elementary school. US 77 2FR, 2ML, divided 2ML, 2FR, not sure where school is - closest to it looks like a car dealership. EPA map shows what looks to be a residence.	Monitors located at the school did not detect 4,4-methylenedianiline in any samples. The key source has reported no emissions of this pollutant since 2007.
Yes	Concord Elementary School	Seattle	WA		Cr+6, Metals in TSP, VOCs	no		0.12	1.03					0.60	3.43					track within 300 ft from SH 99 (2+2 divided ML+ bike), school within 500 ft from SH 99, SH 509 (4ML +2 ML?) within 2500 ft	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants in the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes	Lapwai High School (School is in Tribal Area	Nez Perce	Lapwai, ID		VOCs, Carbonyls, Metals in PM10	no		0.043	0.55		1.33			0.22	1.83		1.48			track is within 50 ft of US95 (2 lanes + left turn lane)	Wind patterns generally similar. No disruption in typical roadway activity. Acetaldehyde, benzene and 1,3-butadiene in the air at the school were not as high as was suggested by information available prior to monitoring and are below the levels of concern.

1 - Pollutants measured were selected based on emission sources in the vicinity of each school.

4,4-Methylenedianiline: A chemical compound used mainly for making polyurethane foams

Carbonyls: Also known aldehydes (e.g., formaldehyde and acetaldehyde).

Cr+6: Hexavalent chromium

Diisocyanates: Chemical compounds used in manufacturing foam-containing products; three of these compounds will be measured.

Metals in PM10: Toxic metals contained in particulate matter that is 10 micrometers in diameter or smaller (e.g., lead, nickel and manganese).

Metals in TSP: Toxic metals contained in total suspended particulate matter (e.g., lead, nickel and manganese).

PAH: Polycyclic Aromatic Hydrocarbons (e.g., naphthalene, benzo(a)pyrene).

VOC: Volatile Organic Compounds (e.g., benzene, vinyl chloride).

Note: The groups of chemicals identified for each school as "pollutants monitored" include both the specific individual pollutants within the group that our current information indicates may be present at each school at levels of potential concern (i.e., the "driver pollutants") and some other pollutants that can be inexpensively measured at the same time. While we analyzed air samples for both sets of pollutants in each chemical group and reviewed all the data in drawing conclusions for each school, we focused our data analysis activities primarily on the individual "driver pollutants".

3 - The March 31, 2009, verson of the list indicated that Metals in PM10 would be monitored. This was a typographical error. Metals in PM10 were not be monitored at this school.

5 - These schools are located close to each other. Our goal was to use one monitor to characterize both schools.

EPA Assessing Outdoor Air Near Schools: Ambient Monitoring (2009-2012)
Worksheet: Highest Monitored Concentration Compared to Short-Term Health Effects Threshold

Data Source for EPA School Study: http://www.epa.gov, Data extracted 8/8/13 - 8/14/13 and March 2014.

School Information							EPA Provided Sample Screening Level (evaluates short term impacts)	20	30	30	90	0.7	6.4	Percent: Highest Monitor Conc to Sample Screening Level (mobile source related emissions + other sources for products of incomplete combustion)						Near Roads, AADT, # lanes, distance from school to roads	Results
Near Road Monitoring Nexus	School Name	City	State	Address	Pollutants Monitored 1	Add'l Monitoring		1,3 Butadiene (µg/m3) EPA Highest Monitored Conc.	Benzene (µg/m3) EPA Highest Monitored Conc.	Naphthalene (µg/m3) EPA Highest Monitored Conc.	Acetaldehyde (µg/m3) EPA Highest Monitored Conc.	Acrolein (µg/m3) EPA Highest Monitored Conc.	Benzo[a]pyrene (µg/m3) EPA Highest Monitored Conc.	1,3 Butadiene (µg/m3)	Benzene (µg/m3)	Naphthalene (µg/m3)	Acetaldehyde (µg/m3)	Acrolein (µg/m3)	Benzo[a]pyrene (µg/m3)		
Yes	Felton Elementary School	Lennox	CA		Metals in TSP, PAH, VOC	no		0.73	3.58	0.119				3.65	11.93	0.40				playground within 300 m of IH 405 (1 HOV, 6 FR, 12 ML + bus lane) and may abut the 405, and approx 4000 ft from IH 105 (elevated 2-4 FR/3-5 + 3-5 ML/2-4 FR) and Imperial Hwy (3+3 ML underneath)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes	Bright Kids Montessori Academy (formerly Santa Anita Christian Academy) 3	Los Angeles	CA		Metals in TSP, PAH, VOCs	no				0.356						1.19				abuts Santa Anita Ave (3+3ML)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes	Soto Street Elementary School	Los Angeles	CA		Metals in TSP, PAH, VOCs	no		0.584						2.92						chosen for small industrial and large roads15 lanes between US 101 and IH 5, within 75 feet of IH5 and US 101	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes	Spain Elementary School	Detroit	MI		VOCs	no		0.16	1.3					0.80	4.33					500 ft from IH 75 (2-4 FR, 4+4ML, 2-4 FR)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes	Mabel Holmes Middle School	Elizabeth	NJ		VOCs, Carbonyls, Metals in PM10	no		0.288	1.92		6.26			1.44	6.40		6.96			about 500 ft from NJ turnpike US95 (4ML, 3ML, 3ML, 4ML = 14 ML total)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes	Intermediate School 143	New York	NY		VOCs	no		0.46	2.05					2.30	6.83					less than 500 ft from Washington Bridge, and within 750-1000 ft of IH 95	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes	Elm Street Elementary School	Wauseon	OH		Diisocyanates, VOCs,	no			1.15						3.83					within 500 ft of SH 108	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes	Harriet Tubman Middle School	Portland	OR		Carbonyls, Metals in PM10, VOCs	yes / school		0.272	2.25		2.45			1.36	7.50		2.72			less than 100 feet from IH 5 (7 mainlanes), major distribution just west of IH 5	School is near a mix of industrial sources and is near an interstate highway and other roadways sources Mobile source emisions monitored were below levels of concern for short or long term impacts. Cadmium indicated a potential for long-term continuous exposure. Additional sample results and analysis not yet posted.
Yes	Chicora Elementary School	Charleston Heights	SC		Carbonyls, Cr+6, Metals in PM10, VOCs	no		0.246	2.17		1.39			1.23	7.23		1.54			about 1000 ft from US 78 and US 52 (6 ML + left turn, undivided) and 3000 ft from Charleston Naval Complex	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
No, plywood fiberboard	Temple Elementary School	Diboll	TX		VOCs	yes / school														approx 2000 ft from US 59	School near a plywood manufacturing facility. Additional monitoring of acrolein, since first set result had concerns on consistency and reliability of ambient monitoring results. Follow-up indicated acrolein and VOC concentrations were within the range of estimated levels without appreciable risk of adverse effects.
Yes, paper processing and interstate	NW Harllee Elementary School	Dallas	TX		Carbonyls, VOCs	no		0.301	2.27		3.7			1.51	7.57		4.11			IH 35 about 1000 ft, 8 M, 2-3FR, 2 HOV, it's IH 35 S of IH 30	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
No, metal forging	Lamkin Elementary	Cypress	TX		Cr+6	no							0.424						6.63	Did not test for mobile source related pollutants although school is within 400 Ft of US 290, by CyFair High School, school property abuts 290, (from W to E - RR track 3FR, 3ML, 1+1 HOV, 3ML, 3FR)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes, petrochemical and mjr roads	FINAL SAMPLING San Jacinto Elementary School 5 Deer Park Junior High School					yes/school		1.8	9.1			0.00002		9.00	30.33					both schools are co-located - 1000 - 2000 ft from 225 (e of Beltway 8)	Initial Sampling stated: in a community that is impacted by several major highways.Inital analysis stated: near a large petrochemical complex, as well as other industries which are sources of air toxics emissions. Final results stated: near a large petrochemical complex, as well as other industries which are sources of air toxics emissions Initial results: Levels of 1,3-butadiene in the air at the school indicate a potential for concern for long-term, continuous exposure, due primarily to one elevated result. Levels of benzene and benzo(a)pyrene are below levels of concern for short-term and long-term exposure. Although the longer-term concentration estimate for benzene is below the cancer-based comparison level for benzene, in combination with the results for 1,3-butadiene, there is a potential concern for long-term, continuous exposure to the pollutant mixture. Followup additional monitoring for 1,3-butadiene, benzene, and other VOCs were conducted from October 13, 2011 to May 28, 2012. Results: Measured values of 1,3-butadiene and benzene indicate influence of the source at this school location. However, results of 1,3-butadiene, benzene, and other VOCs are below levels of significant concern. Avg of benzene samples was 2.37.
Yes	Young Scholars Academy	Houston	TX		VOCs	no		0.228	1.46					1.14	4.87					chosen because close to highways, 8 ML, no FR or HOV, slightly elevated near school, within 500 ft of IH45 S (Gulf Freeway)	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
No	I C Evans Elementary School	Burkburnett	TX		4,4-Methylenedianiline	no														ISD shows up on googlemap, but not elementary school. US 77 2FR, 2ML, divided 2ML, 2FR, not sure where school is - closest to it looks like a car dealership. EPA map shows what looks to be a residence.	Monitors located at the school did not detect 4,4-methylenedianiline in any samples. The key source has reported no emissions of this pollutant since 2007.
Yes	Concord Elementary School	Seattle	WA		Cr+6, Metals in TSP, VOCs	no		0.281	1.74					1.41	5.80					track within 300 ft from SH 99 (2+2 divided ML+ bike), school within 500 ft from SH 99, SH 509 (4ML +2 ML?) within 2500 ft	Wind patterns generally similar. No disruption in typical roadway activity. Measured levels of pollutants the air are below the levels of significant concern suggested by previously available information (from tech report this was via computer modeling). Adverse short term and long term health impacts not anticipated based upon monitored pollutant concentrations and calculated long-term impacts.
Yes	Lapwai High School (School is in Tribal Area	Nez Perce	Lapwai, ID		VOCs, Carbonyls, Metals in PM10	no		0.1	1.04		2.9			0.50	3.47		3.22			track is within 50 ft of US95 (2 lanes + left turn lane)	Wind patterns generally similar. No disruption in typical roadway activity. Acetaldehyde, benzene and 1,3-butadiene in the air at the school were not as high as was suggested by information available prior t monitoring and are below the levels of concern.

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Disocyanates: Chemical compounds used in manufacturing foam-containing products; three of these compounds will be measured.
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Metals in TSP: Toxic metals contained in total suspended particulate matter (e.g., lead, nickel and manganese).
PAH: Polycyclic Aromatic Hydrocarbons (e.g., naphthalene, benzo(a)pyrene).
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