MID-CURRITUCK BRIDGE STUDY

AIR QUALITY
TECHNICAL REPORT

WBS ELEMENT: 34470.1.TA1
STIP NO. R-2576
CURRITUCK COUNTY
DARE COUNTY

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NORTH CAROLINA
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January 2010

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1.0 Introduction and Summary

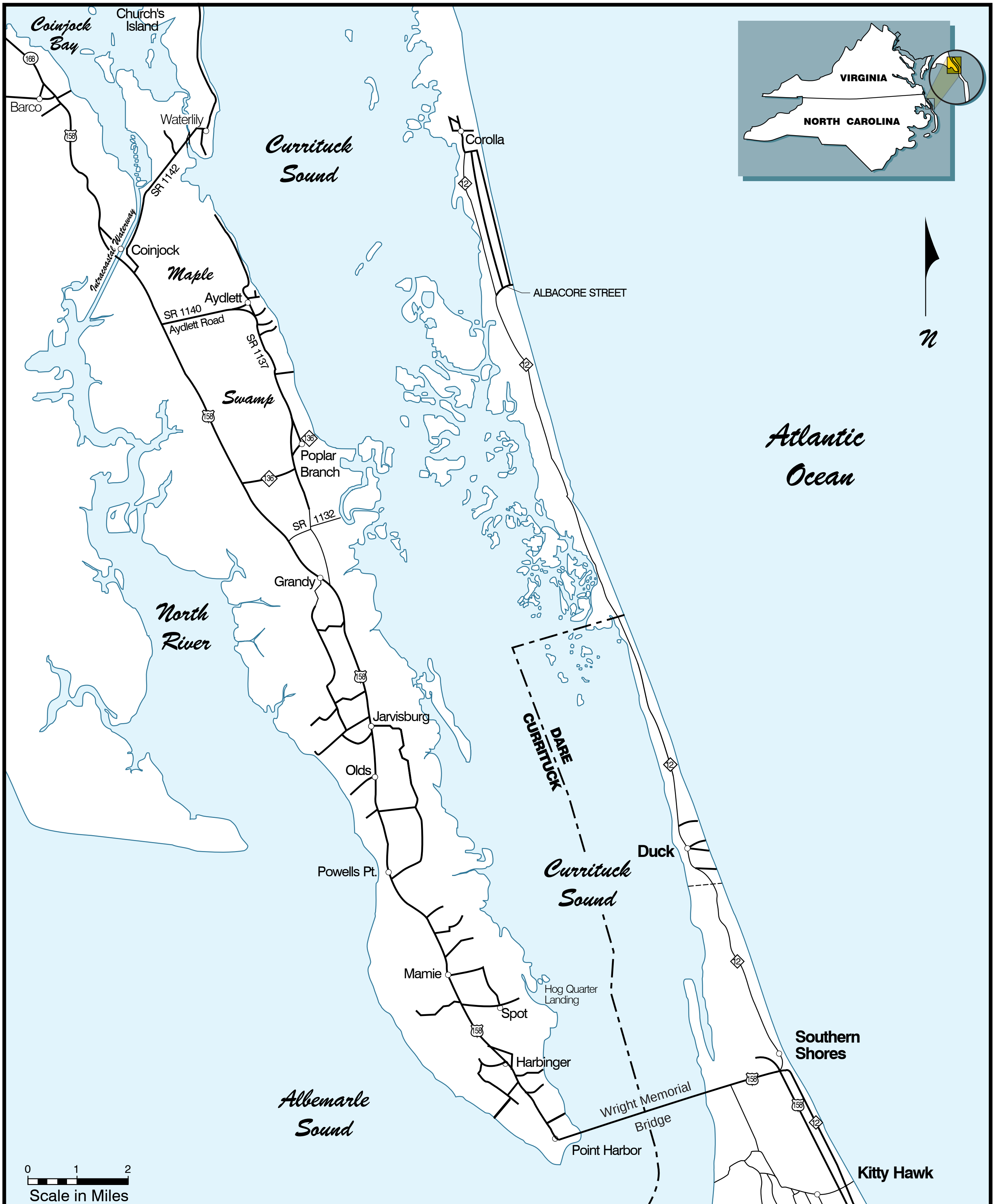
The North Carolina Turnpike Authority (NCTA), a division of the North Carolina Department of Transportation (NCDOT), in cooperation with the Federal Highway Administration (FHWA), is preparing a Draft Environmental Impact Statement (DEIS) to evaluate proposed improvements in the Currituck Sound area. The proposed action is included in NCDOT's 2009-2015 *State Transportation Improvement Program* (STIP), the North Carolina Intrastate System, the North Carolina Strategic Highway Corridor Plan, and the Thoroughfare Plan for Currituck County.

The project area is in northeastern North Carolina and includes the Currituck County peninsula on the mainland and its Outer Banks, as well as the Dare County Outer Banks north of Kitty Hawk (see Figure 1). The project area is south of the Virginia Beach-Norfolk, Virginia (Hampton Roads) metropolitan area. The project area encompasses two thoroughfares, US 158 from NC 168 to NC 12 (including the Wright Memorial Bridge) and NC 12 north of its intersection with US 158 to its terminus in Currituck County. US 158 is the primary north-south route on the mainland. NC 12 is the primary north-south route on the Outer Banks. The Wright Memorial Bridge connects the mainland with the Outer Banks.

1.1 Summary of Impacts

The US Environmental Protection Agency (USEPA) publishes a list of all geographic areas that are in compliance with the National Ambient Air Quality Standards (NAAQS), as well as those areas not in attainment with the NAAQS. The proposed project is in Currituck and Dare counties, which have been determined to comply with the NAAQS. The project is in an attainment area; therefore, 40 CFR, Parts 51 and 93 are not applicable.

The proposed project is predicted to reduce Mobile Source Air Toxics (MSAT) emissions in the overall project area in contrast to the No-Build Alternative. MCB2, with both the greatest reduction in total vehicle-miles traveled (VMT) and the greatest reduction in congested VMT, would reduce MSAT emissions more than any of the three detailed study alternatives. Under each detailed study alternative, there may be localized areas where MSAT concentrations could be higher than others relative to the No-Build Alternative, and in some locations MSAT concentrations could be lower, but current tools and science are not adequate to quantify them.



LEGEND

— - — County Boundaries

Project Area

Figure

1

Construction-related effects of the project would be limited to short-term increased fugitive dust and mobile-source emissions during construction. State and local regulations, as applicable, regarding dust control and other air quality emission reduction controls would be followed.

1.2 Project Description

The proposed action responds to three underlying needs in the project area. These needs are based on the following travel conditions:

- The project area's main thoroughfares (US 158 and NC 12) are becoming increasingly congested, and congestion will become even more severe in the future.

- Increasing congestion is causing travel time between the Currituck County mainland and the Currituck County Outer Banks to increase, especially during the summer.

- Evacuation times for residents and visitors who use US 158 and NC 168 as an evacuation route far exceed the State-designated standard of 18 hours.

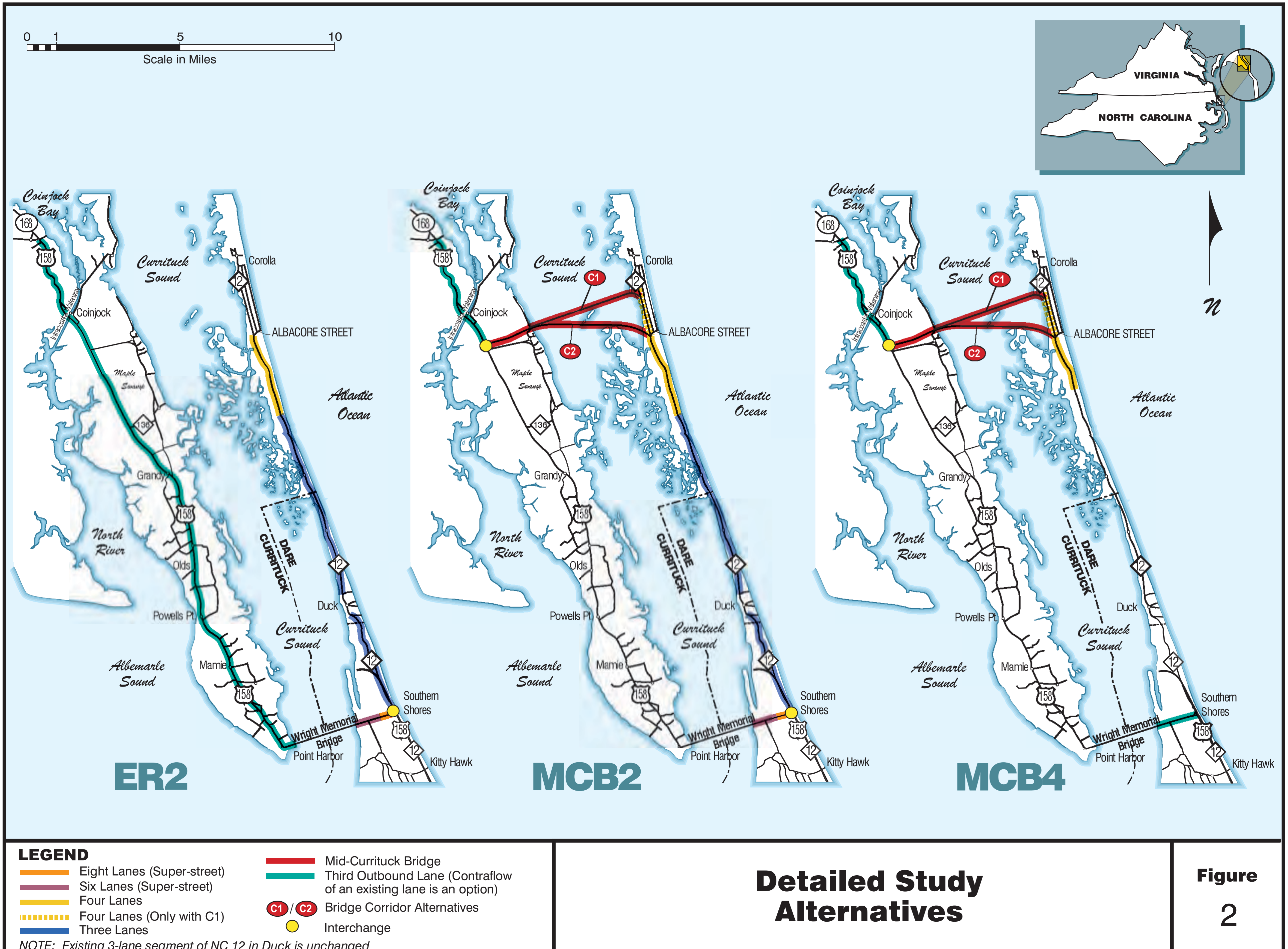
An alternatives screening study was conducted for the project. Its findings were discussed with federal and state environmental resource and regulatory agencies in a series of Turnpike Environmental Agency Coordination (TEAC) meetings in 2006, 2007, 2008, and 2009. Based on discussions at TEAC meetings, and written comments received from the agencies and public, the Alternatives Screening Report (Parsons Brinckerhoff, 2009) for the proposed project identified three alternatives to be carried forward for detailed study in the DEIS along with the No-Build Alternative. The detailed study alternatives identified are ER2, MCB2, and MCB4. The detailed study alternatives are shown on Figure 2 and described below:

- **ER2**

  - Adding for evacuation use only, a third outbound evacuation lane on US 158 between NC 168 and the Wright Memorial Bridge as a hurricane evacuation improvement or using the existing center turn lane as a third outbound evacuation lane; in either case one inbound lane on the Wright Memorial Bridge and on the Knapp (Intracoastal Waterway) Bridge would be used as a third outbound evacuation lane;

  - Widening US 158 to a six-lane super-street between the Wright Memorial Bridge and Cypress Knee Trail that widens to eight lanes between Cypress Knee Trail and the Home Depot driveway;

  - Constructing an interchange at the current intersection of US 158, NC 12, and the Aycock Brown Welcome Center entrance, including six through lanes on US 158 starting at the Home Depot driveway and returning to four lanes just south of Grissom Street; and



Detailed Study Alternatives

Figure 2

- Widening NC 12 to three lanes between US 158 and a point just north of Hunt Club Drive in Currituck County (except where NC 12 is already three lanes in Duck) and to four lanes with a median from just north of Hunt Club Drive to Albacore Street.

- **MCB2**
  - Constructing a two-lane toll bridge across Currituck Sound, as well as approach roads and/or bridges and an interchange at US 158;
  - Adding for evacuation use only, a third outbound evacuation lane on US 158 between NC 168 and the Mid-Currituck Bridge as a hurricane evacuation improvement or using the existing center turn lane as a third outbound evacuation lane; in either case one inbound lane on the Knapp (Intracoastal Waterway) Bridge would be used as a third outbound evacuation lane;
  - Widening US 158 to a six-lane super-street between the Wright Memorial Bridge and Cypress Knee Trail and an eight-lane super-street between Cypress Knee Trail and the Home Depot driveway;
  - Constructing an interchange at the intersection of US 158, NC 12, and the Aycock Brown Welcome Center entrance, including six through lanes on US 158 starting at the Home Depot driveway and returning to four lanes just south of Grissom Street; and
  - Widening NC 12 to three lanes between US 158 and a point just north of Hunt Club Drive in Currituck County (except where NC 12 is already three lanes in Duck) and to four lanes with a median from just north of Hunt Club Drive to NC 12's intersection with the Mid-Currituck Bridge.

- **MCB4**
  - Constructing a two-lane toll bridge across Currituck Sound, as well as approach roads and/or bridges and an interchange at US 158;
  - Adding for evacuation use only, a third outbound evacuation lane on US 158 between NC 168 and the Mid-Currituck Bridge as a hurricane evacuation improvement or using the existing center turn lane as a third outbound evacuation lane; in either case one inbound lane on the Knapp (Intracoastal Waterway) Bridge would be used as a third outbound evacuation lane;
  - Adding for evacuation use only, a third outbound evacuation lane on US 158 between the Wright Memorial Bridge and NC 12 as a hurricane evacuation improvement or using the existing center turn lane as a third outbound evacuation lane; in either case one inbound lane on the Wright Memorial Bridge would be used as a third outbound evacuation lane; and

– Widening NC 12 in Currituck County to four lanes with a median from Seashell Lane to NC 12's intersection with the Mid-Currituck Bridge.

The unique characteristic of a super-street, included along US 158 east of the Wright Memorial Bridge with ER2 and MCB2, is the configuration of the intersections. Side-street traffic wishing to turn left or go straight must turn right onto the divided highway where it can make a U-turn through the median a short distance away from the intersection. After making the U-turn, drivers can then either go straight (having now accomplished the equivalent of an intended left turn) or make a right turn at their original intersection (having now accomplished the equivalent of an intention to drive straight through the intersection).

For MCB2 and MCB4, two design options are evaluated for the approach to the bridge over Currituck Sound, between US 158 and Currituck Sound. Option A would place a toll plaza within the US 158 interchange. The mainland approach road to the bridge over Currituck Sound would include a bridge over Maple Swamp. With Option B, the approach to the bridge over Currituck Sound would be a road placed on fill within Maple Swamp. Aydlett Road would be removed and the roadbed restored as a wetland. Traffic traveling between US 158 and Aydlett would use the new bridge approach road. A local connection would be provided between the bridge approach road and the local Aydlett street system. The toll plaza would be placed in Aydlett east of that local connection so that Aydlett traffic would not pass through the toll plaza when traveling between US 158 and Aydlett. No access to and from the Mid-Currituck Bridge would be provided at Aydlett.

Also, for MCB2 and MCB4, there are two variations of the proposed bridge corridor (see Figure 2) in terms of its terminus on the Outer Banks. Bridge corridor C1 would connect with NC 12 at an intersection approximately two miles north of the Albacore Street retail area, whereas bridge corridor C2 would connect with NC 12 approximately one-half mile south of this area. The length of the proposed Mid-Currituck Bridge would be approximately 7.0 miles with bridge corridor C1, whereas it would be approximately 7.5 miles with bridge corridor C2.

When impacts differ for the three alternatives (ER2, MCB2, and MCB4) between the mainland approach road design options (Option A and Option B) and/or the two bridge corridors (C1 and C2), the names of the alternatives are augmented with suffixes for the mainland approach road design option and/or the bridge corridor. For example, MCB2 with mainland design Option B and the C1 corridor is referred to as MCB2/B/C1. In situations where impacts differ between the bridge corridors but the design option on the mainland is not relevant to the comparison, only the corridor suffix is used (e.g., MCB2/C1). When differences are confined to the mainland design options, only the design option suffix is used (e.g., MCB2/A). If no suffix is provided (e.g., MCB2), then the reader can assume that impacts would be identical irrespective of the mainland design option or corridor terminus alternative used.

2.0 Affected Environment

Air pollution is a general term that refers to one or more chemical substances that degrade the quality of the atmosphere. Individual air pollutants degrade the atmosphere by reducing visibility, damaging property, reducing the productivity or vigor of crops or natural vegetation, or harming human or animal health.

2.1 Clean Air Act Amendments of 1990

The Clean Air Act (CAA) Amendments of 1990 and the Final Transportation Conformity Rule (40 *Code of Federal Regulations* [CFR], Parts 51 and 93) direct the US Environmental Protection Agency (USEPA) to implement environmental policies and regulations that will ensure acceptable levels of air quality.

The CAA and the Final Transportation Conformity Rule affect proposed transportation projects. According to Title I, Section 176 (c) 2: "No federal agency may approve, accept, or fund any transportation plan, program, or project unless such plan, program, or project has been found to conform to any applicable implementation plan in effect under this chapter."

The Final Transportation Conformity Rule establishes the conformity criteria and procedures necessary to meet the requirements of the CAA. Transportation conformity is required under CAA section 176(c) in order to ensure that federally supported highway and transit project activities conform to the purpose of State Implementation Plans (SIPs). A SIP is a collection of regulations and measures used by a state to reduce emissions from stationary, area, and mobile sources, as well as to demonstrate attainment and maintenance of air quality standards. Conformity to the purpose of the SIP means that transportation activities will not cause or contribute to new air quality violations, worsen existing violations, or delay timely attainment of the relevant NAAQS.

2.2 Local Air Quality Regulations

Currituck County has no zoning or land use regulations that govern or control air quality. Dare County follows state regulations for air quality, but also requires burn permits at the county-level for open air burning. The Town of Southern Shores has no local regulations with respect to air quality with the exception of requiring burn permits for open air burning in accordance with US Forest Service rules. The Town of Kitty Hawk also has no specific local requirements regarding air quality. The Town of Duck requires permits for open air burning in accordance with state law, and also has a land disturbance ordinance which requires certain sedimentation and erosion control measures for construction projects for the purpose of dust control. In addition, Duck has a vegetation and tree ordinance that limits clearing certain size trees on lots which do not have building permits, and also requires a certain amount of vegetative cover for residential and commercial properties where building activities are occurring.

2.3 National Ambient Air Quality Standards

As required by the CAA, NAAQS have been established for six principal air pollutants. The NAAQS for these pollutants, known as criteria pollutants, are listed in Table 1. The "primary" standards have been established to protect the public health. The "secondary" standards are intended to protect the nation's welfare, and they account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the general welfare.

2.4 Mobile Source Air Toxics

In addition to the criteria pollutants for which there are NAAQS, USEPA also regulates air toxics. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries).

Mobile Source Air Toxics (MSATs) are a subset of the 188 air toxics defined by the CAA. MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

The USEPA is the lead federal agency for administering the CAA and has certain responsibilities regarding the health effects of MSATs. The USEPA issued a Final Rule on Controlling Emissions of Hazardous Air Pollutants from Mobile Sources (66 Federal Register 17229, March 29, 2001). This rule was issued under the authority in Section 202 of the CAA. In its rule, USEPA examined the impacts of existing and newly promulgated mobile source control programs, including its reformulated gasoline program, its national low emission vehicle standards, its Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and its proposed heavy duty engine and vehicle standards and on-highway diesel fuel requirements. Future emissions likely would be lower than present levels as result of the USEPA's national control programs that are projected to reduce MSAT emission by 72 percent from 1999 to 2050 even if VMT increases by 145 percent, as shown in Figure 3.

On February 9, 2007 and under authority of CAA Section 202(l), USEPA signed a Final Rule, Control of Hazardous Air Pollutants from Mobile Sources, which sets standards to control MSATs from motor vehicles. Under this rule, USEPA is setting standards on fuel composition, vehicle exhaust emissions, and evaporative losses from portable containers. The new standards are estimated to reduce total emissions of MSATs by 330,000 tons in 2030, including 61,000 tons of benzene. Concurrently, total emissions of volatile organic compounds (VOC) will be reduced by over 1 .1 million tons in 2030 as a result of adopting these standards.

Table 1. National Ambient Air Quality Standards

Pollutant		Averaging Time	National Standards	
			Primary	Secondary
Carbon Monoxide (CO)		Eight-Hour[1]	9 ppm (10 mg/m^3)	No Secondary
		One-Hour[1]	35 ppm (40 mg/m^3)	No Secondary
Lead (Pb)		Quarterly Average	1.5 μg/m^3	Same as Primary
		Rolling 3-Month Average[2]	0.15 μg/m^3	Same as Primary
Nitrogen Dioxide (NO_2)		Annual Arithmetic Mean	0.053 ppm (100 μg/m^3)	Same as Primary
Particulate Matter	10 microns or less in diameter (PM_{10})	24-Hour[3]	150 μg/m^3	Same as Primary
	2.5 microns or less in diameter ($PM_{2.5}$)	Annual Arithmetic Mean[4]	15.0 μg/m^3	Same as Primary
		24-Hour[5]	35 μg/m^3	Same as Primary
Ozone (O_3)		Fourth Highest Eight-Hour Daily Maximum[6] (2008 Standard)	0.075 ppm	Same as Primary
		Fourth Highest Eight-Hour Daily Maximum[7] (1997 Standard)	0.08 ppm	Same as Primary
		Maximum Daily One-Hour Average[8] (Applies only in limited areas)	0.12 ppm (235 μg/m^3)	Same as Primary
Sulfur Dioxide (SO_2)		Annual Arithmetic Mean	0.03 ppm (80 μg/m^3)	-
		24-Hour[1]	0.14 ppm (365 μg/m^3)	-
		Three-Hour[1]	-	0.5 ppm (1,300 μg/m^3)

Source: USEPA, "National Primary and Secondary Ambient Air Quality Standards" (40 CFR, Part 50), current as of December 7, 2009.

[1] Not to be exceeded more than once per year.

[2] Final Rule signed October 15, 2008.

[3] Not to be exceeded more than once per year on average over three years.

[4] To attain this standard, the three-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 μg/m^3.

[5] To attain this standard, the three-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35μg/m^3 (effective December 17, 2006).

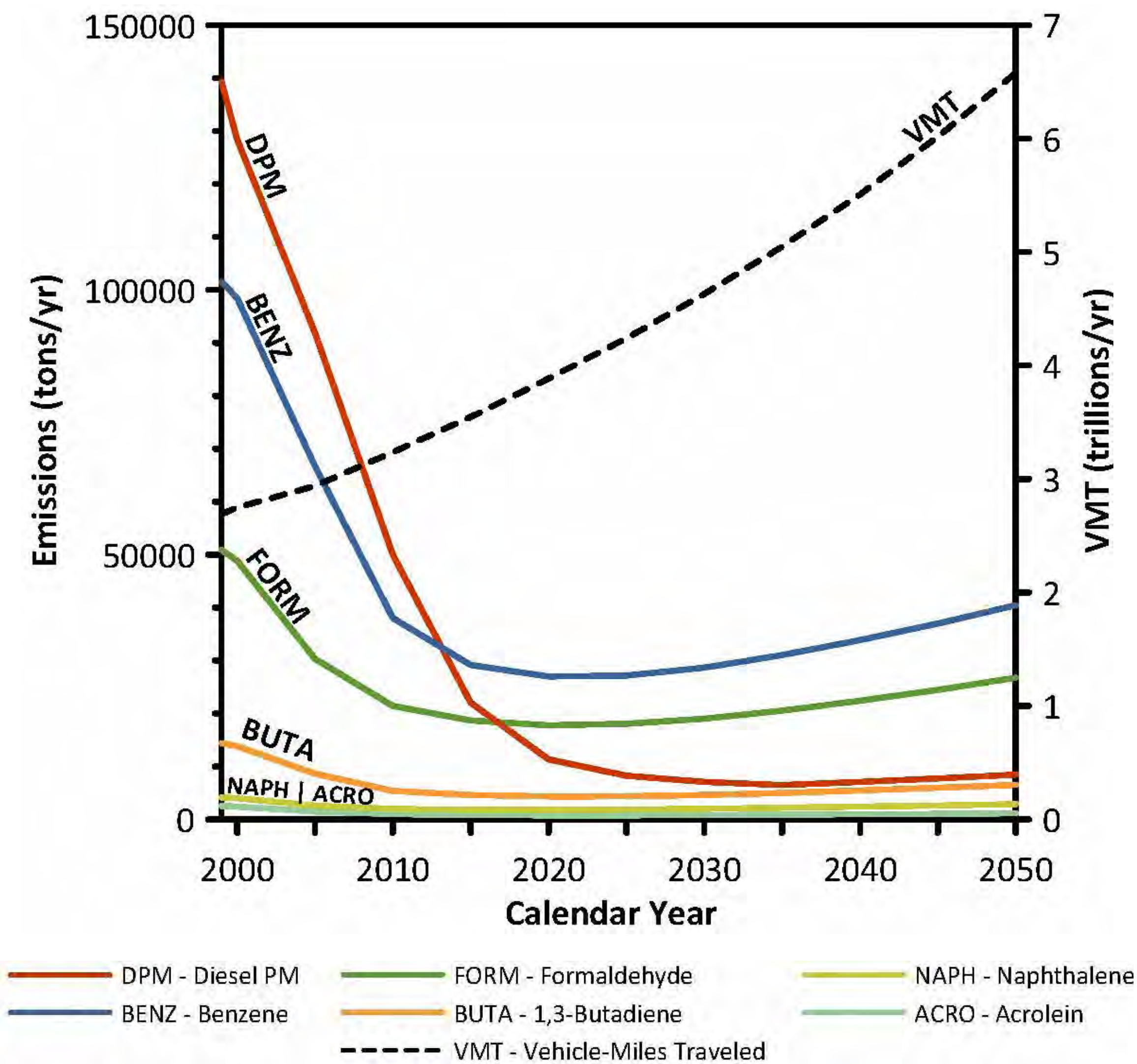
[6] To attain this standard, the three-year average of the fourth-highest daily maximum eight-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective May 27, 2008).

[7] (a) To attain this standard, the three-year average of the fourth-highest daily maximum eight-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
(b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as USEPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.
(c) USEPA is in the process of reconsidering these standards (set in March 2008).

[8] (a) USEPA revoked the 1-hour ozone standard in all areas, although some areas have continuing obligations under that standard ("anti-backsliding").
(b) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is $\leq$ 1.

Abbreviations: ppm = parts per million, μg/m^3 = micrograms per cubic meter, mg/m^3 = milligrams per cubic meter.

Figure 3. National MSAT Emission Trends 1999 – 2050 for Vehicles Operating on Roadways Using USEPA's Mobile6.2 Model



Source: U.S. Environmental Protection Agency. MOBILE6.2 Model run 20 August 2009.
Note:
(1) Annual emissions of polycyclic organic matter are projected to be 561 tons/yr for 1999, decreasing to 373 tons/yr for 2050.
(2) Trends for specific locations may be different, depending on locally derived information representing vehicle-miles traveled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors.

3.0 Environmental Consequences

Pollutants that can be traced principally to motor vehicles are relevant to the evaluation of the project's impacts: these pollutants include carbon monoxide, nitrogen oxides, ozone, particulate matter, and MSATs. Transportation sources account for a small percentage of regional emissions of sulfur oxides and lead; thus, a detailed analysis of these pollutants is not required.

3.1 Regional and Microscale Analyses

The project is in Currituck and Dare counties, which have been determined to comply with the NAAQS. The proposed project is in an attainment area; therefore, 40 CFR, Parts 51 and 93 are not applicable. This project is not anticipated to create any adverse effects on the air quality of this attainment area. Therefore, regional and microscale analyses are not required.

3.2 Mobile Source Air Toxics

On February 3, 2006, the FHWA released "*Interim Guidance on Air Toxic Analysis in NEPA Documents."* This guidance was superseded on September 30, 2009 by FHWA's memorandum "*Interim Guidance Update on Air Toxic Analysis in NEPA Documents.*" The purpose of this memorandum is to update the February 2006 interim guidance that advises FHWA Division offices on when and how to analyze Mobile Source Air Toxics (MSAT) in the NEPA process for highways. This guidance is interim, because MSAT science is still evolving. As the science progresses, FHWA will update the guidance.

A qualitative analysis provides a basis for identifying and comparing the potential differences among MSAT emissions, if any, from the various alternatives. The qualitative assessment presented below is derived in part from a study conducted by the FHWA entitled "*A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives*," found at: www.fhwa.dot.gov/environment/airtoxic/msatcompare/msatemissions.htm. FHWA's Interim Guidance groups projects into the following tier categories:

1. No analysis for projects with no potential for meaningful MSAT Effects;

2. Qualitative analysis for projects with low potential MSAT effects; or

3. Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects.

Based on the recommended tiering approach, the Mid-Currituck Bridge project falls within the Tier 2 approach. Tier 2 is appropriate for this project because it does not fall under the Tier 1 category, which includes:

- Projects qualifying as a categorical exclusion under 23 CFR, Part 771.117(c);
- Projects exempt under the Clean Air Act conformity rule under 40 CFR, Part 93.126; or
- Other projects with no meaningful impacts on traffic volumes or vehicle mix.

The project also does not fall under the Tier 3 category. Tier 3 includes projects that:

- Create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel particulate matter in a single location; or
- Create new or add significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes with traffic volumes where the Average Annual Daily Traffic (AADT) is projected to be in the range of 140,000 to 150,000[1] or greater, by the design year.

  And also:

- Proposed to be located in proximity to populated areas.

As stated in FHWA's guidance, Tier 2 includes projects that "are those that serve to improve operations of highway, transit or freight without adding substantial new capacity or without creating a facility that is likely to meaningfully increase MSA emissions. This category covers a broad range of projects. We anticipate that most highway projects that need an MSAT assessment will fall into this category." Based on this guidance, the project was analyzed using the Tier 2 approach.

3.2.1 Analysis

For each detailed study alternative, the amount of MSATs emitted would be proportional to the vehicle-miles traveled (VMT) assuming that other variables such as

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[1] Using USEPA's MOBILE6.2 emissions model, FHWA staff determined that this range of AADT would be roughly equivalent to the Clean Air Act definition of a major hazardous air pollutant (HAP) source, i.e., 25 tons per year for all HAPs or 10 tons per year for any single HAP. Significant variations in conditions such as congestion or vehicle mix could warrant a different range for AADT; if this range does not seem appropriate for a particular tier 3 project, consultation is encouraged with the contacts from FHWA Headquarters' Office of Natural and Human Environment (HEPN) and Office of Project Development and Environmental Review (HEPE) identified in the September 30, 2009 memorandum.

fleet mix are the same for each detailed study alternative. Table 2 shows the 2035 estimated total VMT and congested VMT for the detailed study alternatives (ER2, MCB2, and MCB4), as well as the No-Build Alternative. The VMT estimated for each of the detailed study alternatives is lower or the same as the No-Build Alternative. As shown in Table 2, the two bridge alternatives (MCB2 and MCB4) would reduce total estimated VMT by 12.9 percent in comparison to the 2035 No-Build Alternative, which would lead to a corresponding reduction in associated MSAT emissions. Estimated VMT would be unchanged with ER2. In the case of the bridge alternatives, the Mid-Currituck Bridge would provide a shorter route to many destinations in the project area. All of the detailed study alternatives would reduce congestion, thereby increasing localized speeds and reducing travel times, with MCB2 reducing congested VMT by 52 percent. According to USEPA's Mobile6.2 emissions model, emissions of all of the priority MSATs except for diesel particulate matter decrease as speed increases.

Table 2. Estimated Total Vehicle-Miles Traveled and Congested Vehicle-Miles Traveled in 2035

	Total Vehicle-Miles Traveled (millions)[1]	Congested Vehicle-Miles Traveled (millions)[1]
Annual Existing (2006)	355.1	5.4
Annual Future (2035)		
• No-Build	663.9	66.1
• ER2	663.9	51.4
• MCB2	578.3	31.4
• MCB4	578.3	40.2

[1] Total and congested vehicle-miles traveled obtained from *2035 Traffic Alternatives Report* (Parsons Brinckerhoff, 2009). Total vehicle-miles traveled were calculated by multiplying the forecast traffic volumes on US 158 and NC 12 roadway links, as well as the proposed bridge for 2035, times the length of the roadway link. This measure (VMT for each link) was computed for non-summer and summer periods, as well as weekday and weekend periods to account for all days of the year. The sum of all of these time periods resulted in an estimate of total annual VMT. Congested VMT was computed by multiplying the number of vehicles on each link that experienced congestion for each time period by the length of each link. The number of vehicles in congestion on each link was estimated by taking the number of forecast trips on each link and subtracting the daily number of vehicles that could be served at an uncongested level of service for the particular link and cross-section. The totals for all links and time periods were used to calculate the annual congested VMT. For this analysis, congested VMT was assumed to represent LOS E and LOS F operations, as defined in the traffic report.

However, the extent to which these speed-related emissions decreases will affect overall MSATs levels cannot be reliably projected because of the inherent deficiencies of technical models.

Based upon these results, the proposed project is predicted to reduce MSATs in the overall project area in contrast to the No-Build Alternative. MCB2, with both the greatest reduction in total VMT and the greatest reduction in congested VMT, would reduce MSAT emissions the most of the three detailed study alternatives. Also, regardless of the alternative chosen, emissions likely would be lower than present levels in the design year as a result of USEPA's national control programs that are projected to reduce annual MSAT emissions by 72 percent between 1999 and 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the USEPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the project area likely would be lower in the future in nearly all cases.

The widening of NC 12 and US 158 on the Outer Banks contemplated as part of ER2 and MCB2 would have the effect of moving some traffic closer to nearby homes, businesses, and recreational paths. NC 12 and US 158 on the Outer Banks are lined with homes, businesses, and/or recreational paths for their full lengths. The distance of US 158 and NC 12 widening would be approximately 20.3 miles and 18.2 miles for MCB2 with bridge corridors C1 and C2, respectively. The distance of US 158 and NC 12 widening would be approximately 18.3 miles with ER2. The moving of traffic closer to nearby homes would be true for the Mid-Currituck Bridge associated with MCB2 and MCB4 at its termini on the mainland and on the Outer Banks, and as it passes through the community of Aydlett for approximately 1,800 feet. Currently, Aydlett is not adjacent to a thoroughfare. The moving of some traffic closer to nearby homes, businesses, and recreational paths also would be true along the limited widening of NC 12 associated with MCB4 (approximately 4.4 miles with bridge corridor C1 and 2.3 miles with bridge corridor C2). Therefore, under each detailed study alternative there may be localized areas along US 158, NC 12, and the Mid-Currituck Bridge where ambient concentrations of MSATs could be higher at some locations than under the No-Build Alternative, but this could be offset as a result of increases in localized speeds and reductions in congestion (which are associated with lower MSAT emissions). In addition, MSAT emissions would be lower in other locations when traffic shifts away from them. For example, a Mid-Currituck Bridge would shift traffic away from US 158 and NC 12 in Dare County. On a regional basis, however, USEPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial MSAT reductions that, in almost all cases, will cause region-wide MSAT levels to be lower than today.

In summary, for all of the detailed study alternatives in the design year, it is expected there would be reduced MSAT emissions in the immediate area of the project, relative to the No-Build Alternative, as a result of the reduced VMT associated with more direct routing and USEPA's MSAT reduction programs. In comparing various project alternatives, MSAT levels could be higher in some locations than others, but current tools and science are not adequate to quantify them. Regardless, on a regional basis, USEPA'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.

This document has provided a qualitative analysis of MSAT emissions relative to the proposed project's detailed study alternatives presented in the *Alternatives Screening Report* (Parsons Brinckerhoff, 2009) and has acknowledged that the detailed study alternatives involving bridge and/or road improvements could increase exposure to

MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain. However, available technical tools do not enable prediction of the project-specific health impacts of the emission changes associated with the detailed study alternatives. Because of these limitations, the following discussion is included in accordance with the President's Council on Environmental Quality (CEQ) regulations (40 CFR, Section 1502.22[b]) regarding incomplete or unavailable information.

3.2.2 Information that is Unavailable or Incomplete

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. 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.

The USEPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are 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 USEPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the Integrated Risk Information System (IRIS), which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (USEPA, http://www.epa.gov/ncea/iris/index.html). 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 also are active in the research and analyses of the human health effects of MSAT, including the Health Effects Institute (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 (HEI, http://pubs.healtheffects.org/view.php?id=282) or in the future as vehicle emissions substantially decrease (HEI, http://pubs.healtheffects.org/view.php?id=306).

3.2.2.1 Emissions

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. The results produced by the USEPA's MOBILE6.2 model, the California EPA's Emfac2007 model, and the USEPA's DraftMOVES2009 model in forecasting MSAT emissions are highly inconsistent. Indications from the development of the MOVES model are that MOBILE6.2 significantly underestimates diesel particulate matter (PM) emissions and significantly overestimates benzene emissions.

3.2.2.2 Dispersion

Regarding air dispersion modeling, an extensive evaluation of USEPA's guideline CAL3QHC model was conducted in an NCHRP study (http://www.epa.gov/scram001/dispersion_alt.htm#hyroad), which documents poor model performance at ten sites across the country—three where intensive monitoring was conducted plus an additional seven with less intensive monitoring. The study indicates a bias of the CAL3QHC model to overestimate concentrations near highly congested intersections and underestimate concentrations near uncongested intersections. The consequence of this is a tendency to overstate the air quality benefits of mitigating congestion at intersections. Such poor model performance is less difficult to manage for demonstrating compliance with National Ambient Air Quality Standards for relatively short time frames than it is for forecasting individual exposure over an entire lifetime, especially given that some information needed for estimating 70-year lifetime exposure is unavailable. It is particularly difficult to forecast reliably MSAT exposure near roadways, and to determine the portion of time that people are actually exposed at a specific location

3.2.2.3 Exposure Levels and Health Effects

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 (http://pubs.healtheffects.org/view.php?id=282). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The USEPA (http://www.epa.gov/risk/basicinformation.htm#g) and the HEI (http://pubs.healtheffects.org/getfile.php?u=395) have not established a basis for quantitative risk assessment of diesel PM in ambient settings.

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the USEPA 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 the USEPA to determine a "safe" or "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 USEPA'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 safe or acceptable

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities plus improved access for emergency response, that are better suited for quantitative analysis.

In this technical report, FHWA has provided a qualitative analysis of MSAT emissions relative to the detailed study alternatives. FHWA also has acknowledged that the project may result in increased exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain, and because of this uncertainty, the health effects from these emissions cannot be estimated.

3.3 Construction Impacts

Construction-related effects of the project would be limited to short-term increased fugitive dust and mobile-source emissions during construction. State and local regulations, as applicable, regarding dust control and other air quality emission reduction controls would be followed.

3.3.1 Open Air Burning

During construction of any of the detailed study alternatives, all materials resulting from clearing and grubbing, demolition, or other operations will be removed from the project site, burned, or otherwise disposed of by the contractor. Any open air burning will be accomplished in accordance with applicable laws, local ordinances, and regulations of the State of North Carolina.

3.3.2 Dust Control

Fugitive dust is airborne particulate matter, generally of a relatively large particulate size. Haul trucks, concrete trucks, delivery trucks, and earth-moving vehicles operating around the construction sites would generate fugitive dust during construction. This fugitive dust would primarily result from particulate matter re-suspended ("kicked-up") by vehicle movement over paved and unpaved roads, dirt tracked onto paved surfaces from unpaved areas at access points, and material blown from uncovered haul trucks.

The distance that particles drift from their source generally depends on their size, the emission height, and the wind speed. Small particles (30 to 100 micron range) can travel several hundred feet before settling to the ground, but most fugitive dust is comprised of relatively large particles (greater than 100 microns in diameter). These particles are responsible for the reduced visibility often associated with this type of construction. Given their relatively large size, these particles tend to settle within 20 to 30 feet of their source.

Measures would be taken to reduce dust generated by construction when the control of dust is necessary for the protection and comfort of motorists and area residents. Dust suppression measures could include watering unpaved work areas; temporary and permanent seeding and mulching, and covering stockpiled materials; and using covered haul trucks.

3.3.3 Mobile Source Emissions

Short-term increases in emissions because of usage of construction equipment and vehicles will occur as a result of construction activity. These impacts would be temporary and limited in duration at any one location. To minimize the amount of emissions generated, efforts would be made during construction to limit disruption to traffic, especially during peak travel periods, and to minimize construction equipment idling and unnecessary engine use.

3.4 Transportation Conformity

The USEPA publishes a list of all geographic areas in compliance with the NAAQS, as well as those areas not in attainment of the NAAQS. The designation of an area is made on a pollutant-by-pollutant basis.

The project is in Currituck and Dare counties, which have been determined to comply with the NAAQS. The proposed project is in an attainment area; therefore, 40 CFR, Parts 51 and 93 are not applicable. This project is not anticipated to create any adverse effects on the air quality of this attainment area.

4.0 References

Federal Highway Administration. September 30, 2009. *Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents*.

Parsons Brinckerhoff. 2009. *Alternatives Screening Report*. Prepared for the North Carolina Turnpike Authority.

Parsons Brinckerhoff. 2009. *2035 Traffic Alternatives Report*. Prepared for the North Carolina Turnpike Authority.

United States Environmental Protection Agency. 1970. "Clean Air Act of 1970." (42 USC §7401 et seq.).

United States Environmental Protection Agency. 2003. *User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model*.

United States Environmental Protection Agency. 2007. *Control of Hazardous Air Pollutants from Mobile Sources*.

United States Environmental Protection Agency. 2009. *National Primary and Secondary Ambient Air Quality Standards*. http://www.epa.gov/air/criteria.html.

United States Environmental Protection Agency. 2008. "Final Transportation Conformity Rule." 40 CFR, Parts 51 and 93.