# 4 Affected Environment, Environmental Consequences, and Mitigation

## 4.13 Air Quality

### 4.13.1 Introduction

This section assesses the potential effects of the No Build Alternative and Build Alternative on air quality. This section also identifies mitigation measures that will be implemented to alleviate any potential adverse effects on the local environment and to minimize exposure of construction-related emissions to the public and the environment.

#### 4.13.1.1 Resource Descriptions

Air quality describes the degree to which the ambient air is pollution-free, which is assessed by the measured or calculated amount of air pollution the public is exposed to in the environment.

#### 4.13.1.2 Regulatory Context

##### Clean Air Act – National Ambient Air Quality Standards

The Clean Air Act of 1970[1] is the primary federal law that regulates air quality in the United States and is administered by the U.S. Environmental Protection Agency (EPA). The Clean Air Act requires the EPA to establish, and states to adopt, National Ambient Air Quality Standards (NAAQS) for major pollutants known as "criteria pollutants."[2] The EPA regulates six criteria pollutants:

- Carbon monoxide (CO)
- Lead
- Nitrogen dioxide
- Particulate matter:
  - Particulate matter with a diameter less than or equal to 10 microns (PM10)
  - Particulate matter with a diameter less than 2.5 microns (PM2.5)
- Ozone
- Sulfur dioxide (SO2)

The NAAQS are two-tiered:

- First tier (primary) is intended to protect public health.
- Second tier (secondary) is intended to protect public welfare and prevent degradation of the environment.

[1] 42 United States Code 7401 et seq

[2] 40 Code of Federal Regulations part 50

**Table 4.13-1** presents the primary and secondary NAAQS established by the EPA for the six criteria pollutants.

Table 4.13-1. National Ambient Air Quality Standards

| Pollutant | | Primary/ Secondary | Averaging Ti | Level | Form |
|---|---|---|---|---|---|
| Carbon Monoxide | | Primary | 8 hours | 9 ppm | Not to be exceeded more than once per year |
| | | | 1 hour | 35 ppm | |
| Lead | | Primary and Secondary | Rolling 3-month averag | 0.15 µg/m$^3$ [1] | Not to be exceeded |
| Nitrogen Dioxide | | Primary | 1 hour | 100 ppb | 98th percentile of 1-hour daily maximum concentrations, averaged over 3 years |
| | | Primary and Secondary | 1 year | 53 ppb[2] | Annual Mean |
| Ozone | | Primary and Secondary | 8 hours | 0.070 ppm[3] | Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years |
| Particulate Matter (PM) | PM2.5 | Primary[5] | 1 year | 9.0 µg/m$^3$ | Annual mean, averaged over 3 years |
| | | Secondary | 1 year | 15.0 µg/m$^3$ | Annual mean, averaged over 3 years |
| | | Primary and Secondary | 24 hours | 35 µg/m$^3$ | 98th percentile, averaged over 3 years |
| | PM10 | Primary and Secondary | 24 hours | 150 µg/m$^3$ | Not to be exceeded more than once per year on average over 3 years |
| Sulfur Dioxide | | Primary | 1 hour | 75 ppb[4] | 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years |
| | | Secondary | 3 hours | 0.5 ppm | Not to be exceeded more than once per year |

Source: U.S. Environmental Protection Agency. 2025. NAAQS table. https://www.epa.gov/criteria-air-pollutants/naaqs-table.

Notes: ppm = parts per million; ppb = parts per billion; µg/m$^3$ = microgram per cubic meter

[1] In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m$^3$ as a calendar quarter average) also remain in effect.

[2] The level of the annual $NO_2$ standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

[3] Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) $O_3$ standards are not revoked and remain in effect for designated areas. Additionally, some areas may have certain continuing implementation obligations under the prior revoked 1-hour (1979) and 8-hour (1997) $O_3$ standards.

[4] The previous $SO_2$ standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous $SO_2$ standards or is not meeting the requirements of a State Implementation Plan call under the previous $SO_2$ standards (40 CFR 50.4(3)). A State Implementation Plan call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

The EPA has designated specific areas as NAAQS attainment or non-attainment areas. Attainment areas are those areas that meet all NAAQS criteria pollutant standards. Non-attainment areas are those areas that exceed the NAAQS for one or more criteria pollutants. If an area is designated as "non-attainment," a state or region must develop a State Implementation Plan to demonstrate how they will attain and maintain the NAAQS. Once an area has attained the relevant standard, the EPA may redesignate the area as an attainment/maintenance area, which are typically referred to as "maintenance areas."

The EPA promulgated a Transportation Conformity Rule pursuant to requirements of the Clean Air Act.[3] The rule applies only in EPA-designated non-attainment or maintenance areas.[4]

### 4.13.1.3 Methodology and Study Areas

#### Microscale (Localized) Carbon Monoxide Analysis

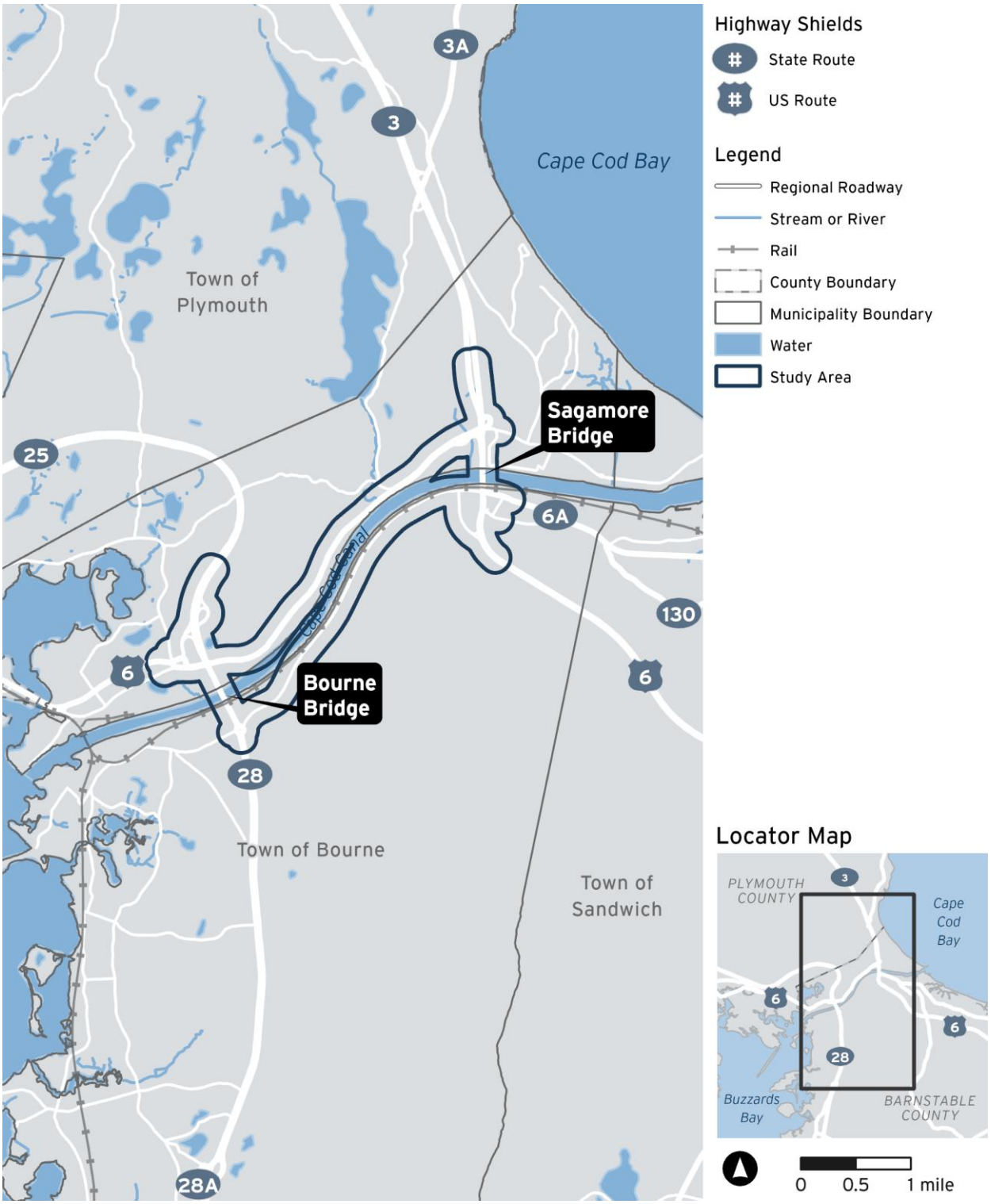
EPA project-level ("hot-spot") transportation conformity requirements for CO do not apply because the Cape Cod Bridges Program (Program) is in a region that is in attainment of the NAAQS. However, a qualitative analysis was conducted to evaluate potential CO impacts from the Build Alternative compared to the No Build Alternative.

The Microscale (Local) Air Quality Study Area corresponds to the Transportation and Traffic Study Area described in **Section 4.2, Transportation, Traffic, and Safety**, and consists of the major roadways, interchanges, and intersections within a 2-mile area centered around the Sagamore and Bourne Bridges (**Figure 4.13-1**).

[3] 40 Code of Federal Regulations Parts 51 and 93

[4] 40 Code of Federal Regulations 93.102(b)

Figure 4.13-1. Microscale (Local) Air Quality Study Area



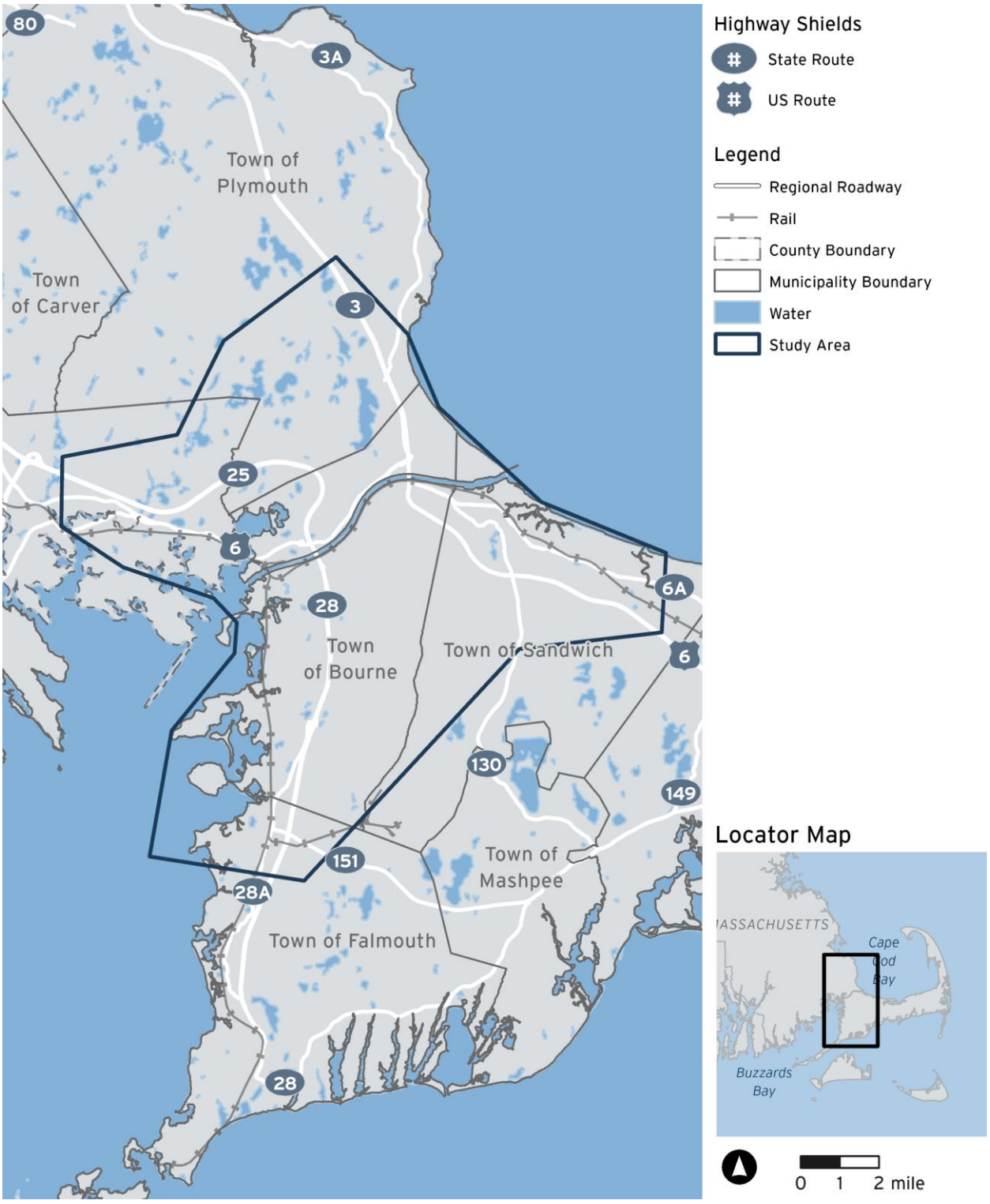

Source: Massachusetts Department of Transportation, 2024

### Mesoscale (Regional) Emission Analysis

The Massachusetts Department of Transportation (MassDOT) conducted a mesoscale analysis to evaluate the potential regional air quality effects of the Build Alternative from motor vehicles as a measure of the total daily emissions of volatile organic compounds (VOC), nitrogen oxides, CO, PM10, and PM2.5, and SO2. Mobile-source emission calculations were performed for nearby affected roadway segments utilizing the traffic data and roadway speeds, and the EPA Motor Vehicle Emissions Simulator (MOVES, latest version of MOVES4) emission factors.

The Mesoscale (Regional) Air Quality Study Area includes freeway, arterial, and collector roadways within an approximate 5-mile radius of the bridges (**Figure 4.13-2**).

Figure 4.13-2. Mesoscale (Regional) Air Quality Study Area




Source: Massachusetts Department of Transportation, 2024

### Mobile-Source Air Toxics

MassDOT conducted a qualitative assessment of mobile-source air toxics (MSAT) impacts in accordance with the Federal Highway Administration's Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents.[5] According to this guidance, the Program would qualify as a "Project with Low Potential MSAT Effects" because design year traffic is projected to be less than 140,000 to 150,000 annual average daily traffic.

### Construction Emissions

MassDOT conducted a qualitative assessment of the potential adverse construction period effects of the Build Alternative on local air quality, including identification of measures to mitigate those effects.

## 4.13.2 Affected Environment

### 4.13.2.1 Air Quality Attainment Status

The Microscale (Localized) and Mesoscale (Regional) Air Quality Study Areas are in Plymouth and Barnstable Counties, which are designated as attainment areas for all criteria pollutants with the EPA NAAQS.[6]

### 4.13.2.2 Project Status in a Regional Transportation Plan and Program

Federal conformity requirements at 40 Code of Federal Regulations (CFR) 93.114[7] and 40 CFR 93.115[8] (as incorporated by reference into the Massachusetts conformity State Implementation Plan) apply because the area where the Program is located is under a federal court decision affecting former maintenance areas nationwide for the 1997 ozone NAAQS.[9] Accordingly, there must be a currently conforming transportation plan (i.e., Transportation Improvement Plan and a Long Range Transportation Plan) at the time of issuance of the National Environmental Policy Act Record of Decision, and the Program must come from a conforming plan or otherwise meet the criteria specified in 40 CFR 93.109(b).[10] As of the date of preparation of this analysis, Phase 1 of the Program (Replacement of Sagamore Bridge) is currently included in the Fiscal Year 2025-2029 Transportation Improvement Program Amendment 2.[11] The Program is also included in the Draft Fiscal Year 2026-2030 Transportation Improvement Program, currently being reviewed by the Cape Cod Metropolitan

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5 https://www.fhwa.dot.gov/environMent/air_quality/air_toxics/policy_and_guidance/msat//fhwa_nepa_msat_memorandum_2023.pdf

6 https://www3.epa.gov/airquality/greenbook/anayo_ma.htm

7 https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-93#93.114

8 https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-93#93.115

9 Per a 2/16/2018 court decision (South Coast Air Quality Management District v. EPA), all areas in the country that were in nonattainment or maintenance for the 1997 eight-hour ozone NAAQS before its revocation by EPA in 2015 were again made subject to conformity for that standard. This decision in part affects "orphan areas" (as defined in the ruling), which in Virginia include Fredericksburg, Richmond/Tri-Cities, and Hampton Roads. https://law.justia.com/cases/federal/appellate-courts/cadc/15-1115/15-1115-2018-02-16.html

10 https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-93#93.109

11 https://www.capecod.gov/2024/11/19/public-review-notice-transportation-improvement-program/)

Planning Organization as of April 2025.[12] The Program is also included in the Regional Air Conformity Assessment for the Cape Cod 2024 Regional Transportation Plan 2024-2044, which received approval from the Cape Cod Metropolitan Planning Organization dated July 24, 2023.[13]

#### 4.13.2.3 Ambient Air Quality Data and Trends

MassDEP issues an annual report summarizing air quality monitoring data for the previous year, covering criteria pollutants (those for which the EPA has established NAAQS) and other pollutants, including air toxics. The 2023 annual report was reviewed for the criteria pollutants, and the monitoring results show that ambient pollutant concentrations measured by MassDEP are below the NAAQS. In addition, the trends over the past 10 years show that ambient concentrations have been decreasing. This decrease is primarily attributed to the implementation of more stringent vehicle emissions and fuel quality standards.

### 4.13.3 Environmental Consequences

#### 4.13.3.1 Microscale (Localized) Carbon Monoxide Analysis

Based upon the design year 2050 traffic analysis, the Build Alternative is expected to substantially improve traffic operations compared to the No Build Alternative. Study Area intersections, expressway mainline, and merging-diverging segments are expected to operate at improved levels of service during the weekday fall PM design periods. Travel times between major origin-destination points along major routes within the study area are also estimated to improve for the Build Alternative compared to the No Build Alternative. Despite processing more vehicles, the Build Alternative model recorded less total travel time (2,240 hours) in the network roadway than the No Build Alternative (2,879). Improved traffic operations and mobility within the Study Area for the 2050 Build Alternative is anticipated to reduce CO emission rates compared to the 2050 No Build Alternative. Refer to **Section 4.2, Transportation, Traffic, and Safety,** and the supporting **Appendix 4.2, Traffic Engineering Technical Report,** for detailed information on the traffic analyses conducted for the 2019 Base Year and 2050 Design Year.

#### 4.13.3.2 Mesoscale (Regional) Emission Analysis

**Table 4.13-2** presents the 2050 forecast vehicle miles traveled (VMT), vehicle hours traveled (VHT), daily trips, and average vehicle speeds for roadway segments within the regional mesoscale study area. **Table 4.13-3** presents the corresponding air quality reductions associated with the Build Alternative compared to the No Build Alternative. A reduction in VMT, VHT, daily trips, and vehicle speeds is expected with the Build Alternative when compared to the No Build Alternative due to more efficient

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12 https://www.capecodcommission.org/resource-library/file/?url=/dept/commission/team/tr/ccmpo/Outreach/OUTREACH%202025/Documents%20for%20Public%20Review/Cape_Cod_2026%202030_Transportation_Improvement_Program_draft%20for%20CCMPO%20review.pdf

13 https://www.capecodcommission.org/resource-library/file/?url=/dept/commission/team/tr/Transportation%20Plans/RTP/2024_RTP/Report/FINAL%20PDF/Cape%20Cod%202024%20Regional%20Transportation%20Plan_Endorsed%2007242023%20With%20Appendix.pdf

traffic flow within the study area. Correspondingly, emissions are also expected to decrease with fewer VMT and higher speeds for the Build Alternative compared to the No Build Alternative.

Table 4.13-2 2050 Projected Daily Vehicle Miles Traveled, Vehicle Hours Traveled, Daily Trips, Average Vehicle Speeds (Mesoscale [Regional] Air Quality Study Area)

| Category | 2050 No Build Alternative | 2050 Build Alternative | Difference (No Build vs. Build) |
|---|---|---|---|
| Daily Vehicle Miles Traveled | 3,476,000 | 3,416,153 | -59,847 |
| Daily Vehicle Hours Traveled | 94,715 | 86,788 | -7,927 |
| Daily Trips | 421,866 | 421,686 | 0 |
| Average Speed | 37 mph | 39 mph | +2 mph |

Source: Massachusetts Department of Transportation, 2025

Table 4.13-3. Projected Daily Pollutant Emissions (tons per day) (Mesoscale [Regional] Air Quality Study Area)

| Category | 2050 No Build Alternative | 2050 Build Alternative | Change (No Build to Build) |
|---|---|---|---|
| Vehicle Miles Traveled (VMT) (millions of miles per day) | 3.476 | 3.416 | -0.06 |
| Carbon Monoxide | 3.24 | 2.99 | -0.25 |
| Volatile Organic Compounds | 0.07 | 0.07 | -0.01 |
| Nitrogen Oxides | 0.11 | 0.10 | -0.01 |
| Sulfur Dioxide | 0.004 | 0.004 | -0.0020 |
| PM10 | 0.18 | 0.14 | -0.04 |
| PM2.5 | 0.03 | 0.02 | -0.01 |

Source: Massachusetts Department of Transportation, 2025
Notes: Totals may not exactly match due to rounding.
PM10/PM2.5 = particulate matter with a diameter less than or equal to 10/2.5 microns

### 4.13.3.3 Mobile-Source Air Toxics

Technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions and effects of the Build Alternative. While it is possible that localized increases in MSAT emissions may occur as a result of the Build Alternative, emissions in the 2050 Build Alternative would likely be lower than present levels as a result of the EPA's national control programs that are projected in Federal highway Administration guidance (2023) to reduce annual MSAT emissions by 76% between 2020 and 2060 even as VMT increases nationally by 31%. Although local conditions may differ from these national projections in

terms of fleet mix and turnover, VMT growth rates (and local control measures), the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the Microscale (Localized) and Mesoscale (Regional) Air Quality Study Areas are likely to be lower in the future in nearly all cases.

#### 4.13.3.4 Construction Emissions

During construction, there is potential for short-term increases in particulate matter emissions (airborne dust) due to site preparation and roadway reconstruction activities, including land clearing, demolition, excavation, grading, compaction, removing or improving existing roadways, and paving roadway surfaces. In addition to airborne dust, the operation of diesel-fueled off-road equipment and heavy-duty trucks have the potential to adversely affect air quality due to direct emissions of CO, nitrogen oxides, and VOCs. MassDOT's Standard Specifications for Road and Bridge Construction includes construction-related specifications and contract special provisions for dust control, use of cleaner diesel fuel, idling reduction requirements, and installation of emission control devices on contractor vehicles. MassDOT's contractors will comply with all air quality contract specifications to minimize impacts of fugitive dust and construction equipment and vehicle exhaust, including ozone precursors VOCs and nitrogen oxides). **Section 4.13.4** outlines specific measures that will be implemented to reduce air quality impacts during construction.

Demolition of the Sagamore and Bourne Bridges would involve lead paint disturbance, which can generate airborne lead dust and fumes. The contractor will be required to comply with MassDOT specifications for proper removal of bridge components coated with lead-based paint. These specifications will require the contractor(s) to develop a Lead Abatement Plan—including containment measures, lead paint removal methods, worker protection measures, waste disposal procedures, and post-abatement protocols—for review and approval by MassDOT. Any demolition activities with the potential to disturb identified or suspected lead-based paint would be performed in accordance with the Occupational Safety and Health Administration Lead in Construction Standard.[14]

## 4.13.4 Mitigation

The Build Alternative is expected to improve traffic operations and reduce air quality impacts compared to the No Build Alternative in the future 2050 Design Year. Therefore, no mitigation is required for the operational phase of the Build Alternative. Further, the Build Alternative would improve bicycle and pedestrian accommodations and connectivity within the Program Limits. Increased opportunities for walking and bicycling would help to reduce traffic-related air pollution and improve public health.

During construction, MassDOT will implement emission reduction measures to minimize air quality impacts of criteria pollutants, including ozone precursors to surrounding sensitive receptors and the environment in accordance with MassDOT Contract Specifications and applicable laws and regulations.

[14] https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.62

Such measures will include, but not be limited to, the following:

- Use ultra-low-sulfur diesel fuel in construction equipment (mitigate sulfur dioxide and particulates).
- Use alternative-fueled or electric equipment where feasible (mitigate all criteria pollutants, including ozone precursors).
- Maintain construction equipment in proper working order (mitigate criteria pollutants, including ozone precursors).
- Install on-site anti-idling signage at loading and drop-off/pick-up/waiting areas, requiring that engines idle for no more than five minutes (mitigate criteria pollutants, including ozone precursors).
- Use dust suppression wetting agents where needed on a routine basis (mitigate particulate matter).
- Apply seeding or soil stabilizers to the surface of inactive stockpiles (mitigate particulate matter).
- Adjust work schedules when weather conditions, such as dry soil or high wind speeds, could lead to dust impacts (mitigate particulate matter).
- Cover active stockpiles with plastic tarps or other suitable containment measures (mitigate particulate matter).
- Cover and wet all transported loads of dust-producing materials (e.g., dirt or demolition debris) prior to hauling operations on public roadways (mitigate particulate matter emissions).
- Locate stationary construction equipment as far as possible from sensitive receptors (mitigate pollutant concentrations to nearby neighborhoods).
- Conduct frequent construction site inspections (mitigate all criteria pollutants, including ozone precursors).
- Designate construction truck routes through areas that would cause the least disturbance to sensitive receptors (mitigate pollutant concentrations to nearby neighborhoods).
- Evaluate cleaner fuels for marine vessels, such as marine gas oil, which is cleaner than heavy fuel oil. Other options could be very low sulfur fuel oil, ultra-low sulfur fuel oil, biofuels, and liquid natural gas (mitigate all criteria pollutants, including ozone precursors).
- Prepare and implement a Lead Abatement Plan to mitigate lead emissions during bridge demolition.