

FINAL



Air Quality Technical Report

I-5 Rose Quarter Improvement Project

Oregon Department of Transportation

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I-5 ROSE QUARTER
IMPROVEMENT PROJECT



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Acronyms and Abbreviations

°F	degrees Fahrenheit
AADT	annual average daily traffic
API	Area of Potential Impact
CO	carbon monoxide
DEQ	Oregon Department of Environmental Quality
DPM	diesel particulate matter
EB	eastbound
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
FR	<i>Federal Register</i>
HPMS	Highway Performance Monitoring System
I/M	inspection and maintenance
I-405	Interstate 405
I-5	Interstate 5
I-84	Interstate 84
LOS	level of service
MOVES	Mobile Vehicle Emission Simulator
MSAT	Mobile Source Air Toxics
MTIP	Metropolitan Transportation Improvement Plan
mvmt	million vehicle miles traveled
NAAQS	National Ambient Air Quality Standard(s)
NB	northbound
NEPA	National Environmental Policy Act
NOx	oxides of nitrogen
OAR	Oregon Administrative Rules
ODOT	Oregon Department of Transportation
PM ₁₀	Coarse particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
PM _{2.5}	Fine particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers
POM	polycyclic organic matter
ppm	parts per million
Project	I-5 Rose Quarter Improvement Project
RTP	<i>Regional Transportation Plan</i>



SAC	Stakeholder Advisory Committee
SB	southbound
SO ₂	sulfur dioxide
SPIS	Safety Priority Index System
VMT	vehicle miles traveled
VOC	volatile organic compound(s)
WB	westbound

Executive Summary

The I-5 Rose Quarter Improvement Project (Project) is located in Portland, Oregon, along the 1.7-mile segment of Interstate 5 (I-5) between Interstate 405 (I-405) to the north (milepost 303.2) and Interstate 84 (I-84) to the south (milepost 301.5). The Project also includes the interchange of I-5 and N Broadway and NE Weidler Street (Broadway/Weidler interchange) and the surrounding transportation network, from approximately N/NE Hancock Street to the north, N Benton Avenue to the west, N/NE Multnomah Street to the south, and NE 2nd Avenue to the east.

The purpose of the Project is to improve the safety and operations on I-5 between I-405 and I-84, the Broadway/Weidler interchange, and adjacent surface streets in the vicinity of the Broadway/Weidler interchange. In achieving the purpose, the Project would also support improved local connectivity and multimodal access in the vicinity of the Broadway/Weidler interchange.

This *Air Quality Technical Memorandum* analyzes possible impacts to air quality that could result from the Project by comparing existing conditions (2017) to the potential air quality effects for no action (No-Build Alternative) and the proposed action (Build Alternative) for design year 2045. The Area of Potential Impact for this analysis is the same as the Project Area, plus roadway links meeting specific criteria.

The Portland area is currently in attainment of (complies with) all National Ambient Air Quality Standards (NAAQS). In addition to the criteria air pollutants for which NAAQS have been established, the U.S. Environmental Protection Agency (EPA) regulates air toxics, which are pollutants known or suspected to cause cancer or other serious health effects. Most air toxics originate from human-made sources, including on-road mobile sources, nonroad mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories). Mobile source air toxics (MSAT) are those emitted by on-road vehicles and mobile nonroad equipment.

The Build Alternative is included in the current Metropolitan Transportation Improvement Plan (MTIP) for planning and funding purposes. All projects that receive federal funds are subject to a federally required action; projects that are regionally significant need to be included in the MTIP. The MTIP must be financially constrained and must be updated at least every 4 years.

A MSAT analysis was performed following Federal Highway Administration guidance and using the EPA Mobile Vehicle Emission Simulator (MOVES) emissions model, version 2014a. Input data for the model were developed by Metro for regional emissions analysis and as project-specific input from project-specific traffic analysis results.

Based on the results of the MSAT modeling analysis, the Build Alternative is not expected to have air quality impacts. The analysis shows future air pollutant

emissions are estimated to be substantially lower (79 percent) than existing conditions and virtually identical between the No-Build and Build conditions, with Build conditions slightly benefiting air pollutant emissions and air quality. These Project-specific results show a continued trend of decreases in pollutant concentrations that has been ongoing since the 1970s. Table ES-1 shows the estimated MSAT emissions from affected project area roadways for existing conditions and the future No-Build and Build Alternatives.

Table ES-1. MSAT Emissions for Operations (tons per year)

Pollutant	Total Pollutant Emissions (tons per year)			Percent Change (%)		
	2017 Existing	2045 No-Build	2045 Build	2017 to 2045 No Build	2017 to 2045 Build	2045 No Build to 2045 Build
DPM	12.9	2.4	2.3	-81	-82	-4
Acetaldehyde	1.4	0.4	0.4	-73	-74	-6
Acrolein	0.2	0.1	0.0	-68	-70	-6
Benzene	2.7	0.4	0.4	-87	-87	0
1,3-Butadiene	0.3	0.0	0.0	-99	-99	-7
Ethylbenzene	1.5	0.4	0.4	-73	-74	-3
Formaldehyde	2.5	1.1	1.1	-55	-58	-6
Naphthalene	0.3	0.1	0.1	-70	-72	-6
POM	0.2	0.0	0.0	-87	-87	1
Total MSAT	22.0	4.9	4.7	-78	-79	-4

Notes: DPM = diesel particulate matter; MSAT = Mobile Source Air Toxics; POM = polycyclic organic matter

Rounding causes addition to appear inconsistent in table.

Results are for all affected roadway links in the Project Area, both the highway and surface streets.

Because of heightened public concern surrounding MSAT emissions near the Harriet Tubman Middle school, a review of the highway-only emissions was performed. Air quality at the site has been a concern because of the site's proximity to a highly congested area of I-5.

Table ES-2 compares estimated MSAT emissions from highway operations for the existing (2017), No-Build (2045), and Build (2045) conditions. The data show a large decrease in estimated emissions over time and almost no change in emissions (a very slight decrease) between the No-Build and Build conditions in 2045. The projected decrease in emissions over time is expected to benefit the school by the

reduced exposure to MSAT. The small difference between the No-Build and Build Alternatives is not likely to provide much benefit, although emissions would decrease slightly with the Build Alternative.

Table ES-2. MSAT Emissions for Highway Operations (tons per year)

Pollutant	Highway Pollutant Emissions (tons per year)			Percent Change (%)		
	2017 Existing	2045 No-Build	2045 Build	2017 to 2045 No Build	2017 to 2045 Build	2045 No Build to 2045 Build
DPM	9.4	1.8	1.7	- 81	-82	-6
Acetaldehyde	0.8	0.3	0.2	- 64	-68	-10
Acrolein	0.1	0.0	0.0	-63	-67	-10
Benzene	1.1	0.2	0.2	-84	-84	-2
1,3-Butadiene	0.1	0.0	0.0	-98	-98	-11
Ethylbenzene	0.6	0.2	0.2	- 71	-74	-10
Formaldehyde	1.5	0.8	0.7	-45	-51	-10
Naphthalene	0.2	0.1	0.1	- 63	-67	-10
POM	0.1	0.0	0.0	-87	-87	-1

Notes: DPM = diesel particulate matter; MSAT = Mobile Source Air Toxics; POM = polycyclic organic matter

Rounding causes addition to appear inconsistent in table.

Construction effects to air quality from fugitive dust and construction equipment exhaust would be temporary and would not continue after Project construction is completed. Effects would be localized and would vary throughout the construction process. Control measures would be implemented to address short-term construction effects. Construction contractors are required to comply with Division 208 of Oregon Administrative Rule 340, which addresses visible emissions and nuisance requirements. Additionally, Oregon Department of Transportation Standard Specifications Section 290 has requirements for environmental protection that include air pollution control measures. These measures would be documented in the erosion and sediment control plan that the contractor is required to submit before the preconstruction conference.

1 Introduction

1.1 Project Location

The I-5 Rose Quarter Improvement Project (Project) is located in Portland, Oregon, along the 1.7-mile segment of Interstate 5 (I-5) between Interstate 405 (I-405) to the north (milepost 303.2) and Interstate 84 (I-84) to the south (milepost 301.5). The Project also includes the interchange of I-5 and N Broadway and NE Weidler Street (Broadway/Weidler interchange) and the surrounding transportation network, from approximately N/NE Hancock Street to the north, N Benton Avenue to the west, N/NE Multnomah Street to the south, and NE 2nd Avenue to the east.

Figure 1 illustrates the Project Area in which the proposed improvements are located. The Project Area represents the estimated area within which improvements are proposed, including where permanent modifications to adjacent parcels may occur and where potential temporary impacts from construction activities could result.

1.2 Project Purpose

The purpose of the Project is to improve the safety and operations on I-5 between I-405 and I-84, of the Broadway/Weidler interchange, and on adjacent surface streets in the vicinity of the Broadway/Weidler interchange and to enhance multimodal facilities in the Project Area.

In achieving the purpose, the Project would also support improved local connectivity and multimodal access in the vicinity of the Broadway/Weidler interchange and improve multimodal connections between neighborhoods located east and west of I-5.

1.3 Project Need

The Project would address the following primary needs:

- **I-5 Safety:** I-5 between I-405 and I-84 has the highest crash rate on urban interstates in Oregon. Crash data from 2011 to 2015 indicate that I-5 between I-84 and the merge point from the N Broadway ramp on to I-5 had a crash rate (for all types of crashes²) that was approximately 3.5 times higher than the statewide average for comparable urban interstate facilities (ODOT 2015a).

² Motor vehicle crashes are reported and classified by whether they involve property damage, injury, or death.

- Seventy-five percent of crashes occurred on southbound (SB) I-5, and 79 percent of all the crashes were rear-end collisions. Crashes during this 5-year period included one fatality, which was a pedestrian fatality. A total of seven crashes resulted in serious injury.
- The Safety Priority Index System (SPIS) is the systematic scoring method used by the Oregon Department of Transportation (ODOT) for identifying potential safety problems on state highways based on the frequency, rate, and severity of crashes (ODOT 2015b). The 2015 SPIS shows two SB sites in the top 5 percent and two northbound (NB) sites in the top 10 percent of the SPIS list.
- The 2015 crash rate on the I-5 segment between I-84 and the Broadway ramp on to I-5 is 2.70 crashes per million vehicle miles. The statewide average for comparable urban highway facilities is 0.77 crashes per million vehicle miles travelled (mvmt).
- The existing short weaving distances and lack of shoulders for accident/incident recovery in this segment of I-5 are physical factors that may contribute to the high number of crashes and safety problems.
- **I-5 Operations:** The Project Area is at the crossroads of three regionally significant freight and commuter routes: I-5, I-84, and I-405. As a result, I-5 in the vicinity of the Broadway/Weidler interchange experiences some of the highest traffic volumes in the State of Oregon, carrying approximately 121,400 vehicles each day (ODOT 2017), and experiences 12 hours of congestion each day (ODOT 2012a). The following factors affect I-5 operations:
 - Close spacing of multiple interchange ramps results in short weaving segments where traffic merging on and off I-5 has limited space to complete movements, thus becoming congested. There are five on-ramps (two NB and three SB) and six off-ramps (three NB and three SB) in this short stretch of highway. Weaving segments on I-5 NB between the I-84 westbound (WB) on-ramp and the NE Weidler off-ramp, and on I-5 SB between the N Wheeler Avenue on-ramp and I-84 eastbound (EB) off-ramp, currently perform at a failing level-of-service during the morning and afternoon peak periods.
 - The high crash rate within the Project Area can periodically contribute to congestion on this segment of the highway. As noted with respect to safety, the absence of shoulders on I-5 contributes to congestion because vehicles involved in crashes cannot get out of the travel lanes.
 - Future (2045) traffic estimates indicate that the I-5 SB section between the N Wheeler on-ramp and EB I-84 off-ramp is projected to have the most critical congestion in the Project Area, with capacity and geometric constraints that result in severe queuing.
- **Broadway/Weidler Interchange Operations:** The complexity and congestion at the I-5 Broadway/Weidler interchange configuration is difficult to navigate for vehicles (including transit vehicles), bicyclists, and pedestrians, which impacts

access to and from I-5 as well as to and from local streets. The high volumes of traffic on I-5 and Broadway/Weidler in this area contribute to congestion and safety issues (for all modes) at the interchange ramps, the Broadway and Weidler overcrossings of I-5, and on local streets in the vicinity of the interchange.

- The Broadway/Weidler couplet provides east-west connectivity for multiple modes throughout the Project Area, including automobiles, freight, people walking and biking, and Portland Streetcar and TriMet buses. The highest volumes of vehicle traffic on the local street network in the Project Area occur on NE Broadway and NE Weidler in the vicinity of I-5. The N Vancouver Avenue/N Williams couplet, which forms a critical north-south link and is a Major City Bikeway within the Project Area with over 5,000 bicycle users during the peak season, crosses Broadway/Weidler in the immediate vicinity of the I-5 interchange.
- The entire length of N/NE Broadway is included in the Portland High Crash Network—streets designated by the City of Portland for the high number of deadly crashes involving pedestrians, bicyclists, and vehicles.³
- The SB on-ramp from N Wheeler and SB off-ramp to N Broadway experienced a relatively high number of crashes per mile (50-70 crashes per mile) compared to other ramps in the Project Area during years 2011-2015. Most collisions on these ramps were rear-end collisions.
- Of all I-5 highway segments in the corridor, those that included weaving maneuvers to/from the Broadway/Weidler ramps tend to experience the highest crash rates:
 - SB I-5 between the on-ramp from N Wheeler and the off-ramp to I-84 (SB-S5) has the highest crash rate (15.71 crashes/mvmt).
 - NB I-5 between the I-84 on-ramp and off-ramp to NE Weidler (NB-S5) has the second highest crash rate (5.66 crashes/mvmt).
 - SB I-5 between the on-ramp from I-405 and the off-ramp to NE Broadway (SB-S3) has the third highest crash rate (4.94 crashes/mvmt).
- **Travel Reliability on the Transportation Network:** Travel reliability on the transportation network decreases as congestion increases and safety issues expand. The most unreliable travel times tend to occur at the end of congested areas and on the shoulders of the peak periods. Due to these problems, reliability has decreased on I-5 between I-84 and I-405 for most of the day. Periods of congested conditions on I-5 in the Project Area have grown over time from morning and afternoon peak periods to longer periods throughout the day.

³ Information on the City of Portland's High Crash Network is available at <https://www.portlandoregon.gov/transportation/54892>.

1.4 Project Goals and Objectives

In addition to the purpose and need, which focus on the state's transportation system, the Project includes related goals and objectives developed through the joint ODOT and City of Portland N/NE Quadrant and I-5 Broadway/Weidler Interchange Plan process, which included extensive coordination with other public agencies and citizen outreach. The following goals and objectives may be carried forward beyond the National Environmental Policy Act (NEPA) process to help guide final design and construction of the Project:

- Enhance pedestrian and bicycle safety and mobility in the vicinity of the Broadway/Weidler interchange.
- Address congestion and improve safety for all modes on the transportation network connected to the Broadway/Weidler interchange and I-5 crossings.
- Support and integrate the land use and urban design elements of the Adopted N/NE Quadrant Plan (City of Portland et al. 2012) related to I-5 and the Broadway/Weidler interchange, which include the following:
 - Diverse mix of commercial, cultural, entertainment, industrial, recreational, and residential uses, including affordable housing
 - Infrastructure that supports economic development
 - Infrastructure for healthy, safe, and vibrant communities that respects and complements adjacent neighborhoods
 - A multimodal transportation system that addresses present and future needs, both locally and on the highway system
 - An improved local circulation system for safe access for all modes
 - Equitable access to community amenities and economic opportunities
 - Protected and enhanced cultural heritage of the area
 - Improved urban design conditions
- Improve freight reliability.
- Provide multimodal transportation facilities to support planned development in the Rose Quarter, Lower Albina, and Lloyd.
- Improve connectivity across I-5 for all modes.

2 Project Alternatives

This technical report describes the potential effects of no action (No-Build Alternative) and the proposed action (Build Alternative).

2.1 No-Build Alternative

NEPA regulations require an evaluation of the No-Build Alternative to provide a baseline for comparison with the potential impacts of the proposed action. The No-Build Alternative consists of existing conditions and any planned actions with committed funding in the Project Area.

I-5 is the primary north-south highway serving the West Coast of the United States from Mexico to Canada. At the northern portion of the Project Area, I-5 connects with I-405 and the Fremont Bridge; I-405 provides the downtown highway loop on the western edge of downtown Portland. At the southern end of the Project Area, I-5 connects with the western terminus of I-84, which is the east-west highway for the State of Oregon. Because the Project Area includes the crossroads of three regionally significant freight and commuter routes, the highway interchanges within the Project Area experience some of the highest traffic volumes found in the state (approximately 121,400 average annual daily trips). The existing lane configurations consist primarily of two through lanes (NB and SB), with one auxiliary lane between interchanges. I-5 SB between I-405 and Broadway includes two auxiliary lanes.

I-5 is part of the National Truck Network, which designates highways (including most of the Interstate Highway System) for use by large trucks. In the Portland-Vancouver area, I-5 is the most critical component of this national network because it provides access to the transcontinental rail system, deep-water shipping and barge traffic on the Columbia River, and connections to the ports of Vancouver and Portland, as well as to most of the area's freight consolidation facilities and distribution terminals. Congestion on I-5 throughout the Project Area delays the movement of freight both within the Portland metropolitan area and on the I-5 corridor. I-5 through the Rose Quarter is ranked as one of the 50 worst freight bottlenecks in the United States (ATRI 2017).

Within the approximately 1.5 miles that I-5 runs through the Project Area, I-5 NB connects with five on- and off-ramps, and I-5 SB connects with six on- and off-ramps. Drivers entering and exiting I-5 at these closely spaced intervals, coupled with high traffic volumes, slow traffic and increase the potential for crashes. Table 1 presents the I-5 on- and off-ramps in the Project Area. Table 2 shows distances of the weaving areas between the on- and off-ramps on I-5 in the Project Area. Each of the distances noted for these weave transitions is less than adequate per current highway design standards (ODOT 2012b). In the shortest weave section, only 1,075 feet is available for drivers to merge onto I-5 from NE Broadway NB in the same area where drivers are exiting from I-5 onto I-405 and the Fremont Bridge.



Table 1. I-5 Ramps in the Project Area

I-5 Travel Direction	On-Ramps From	Off-Ramps To
Northbound	<ul style="list-style-type: none"> I-84 N Broadway/N Williams Avenue 	<ul style="list-style-type: none"> NE Weidler Street/NE Victoria Avenue I-405 N Greeley Avenue
Southbound	<ul style="list-style-type: none"> N Greeley Avenue I-405 N Wheeler Avenue/N Ramsay Way 	<ul style="list-style-type: none"> N Broadway/N Vancouver Avenue I-84 Morrison Bridge/Highway 99E

Notes: I = Interstate

Table 2. Weave Distances within the Project Area

I-5 Travel Direction	Weave Section	Weave Distance
Northbound	I-84 to NE Weidler Street/NE Victoria Avenue	1,360 feet
Northbound	N Broadway/N Williams Avenue to I-405	1,075 feet
Southbound	I-405 to N Broadway	2,060 feet
Southbound	N Wheeler Avenue/N Ramsay Way to I-84	1,300 feet

Notes: I = Interstate

As described in Section 1.3, the high volumes, closely spaced interchanges, and weaving movements result in operational and safety issues, which are compounded by the lack of standard highway shoulders on I-5 throughout much of the Project Area.

Under the No-Build Alternative, I-5 and the Broadway/Weidler interchange and most of the local transportation network in the Project Area would remain in its current configuration, with the exception of those actions included in the Metro 2014 *Regional Transportation Plan* (RTP) financially constrained project list (Metro 2014).⁴ One of these actions includes improvements to the local street network on the Broadway/Weidler corridor within the Project Area. The proposed improvements include changes to N/NE Broadway and N/NE Weidler from the Broadway Bridge to NE 7th Avenue. The current design concept would remove and reallocate one travel lane on both N/NE Broadway and N/NE Weidler to establish protected bike lanes and reduce pedestrian crossing distances. Proposed improvements also include

⁴ Metro Regional Transportation Plan ID 11646. Available at: https://www.oregonmetro.gov/sites/default/files/Appendix%201.1%20Final%202014%20RTP%20%20Project%20List%208.5x11%20for%20webpage_1.xls

changes to turn lanes and transitions to minimize pedestrian exposure and improve safety. The improvements are expected to enhance safety for people walking, bicycling, and driving through the Project Area. Implementation is expected in 2018-2027.

2.2 Build Alternative

The Project alternatives development process was completed during the ODOT and City of Portland 2010-2012 N/NE Quadrant and I-5 Broadway/Weidler Interchange planning process. A series of concept alternatives were considered following the definition of Project purpose and need and consideration of a range of transportation-related problems and issues that the Project is intended to address.

In conjunction with the Stakeholder Advisory Committee (SAC) and the public during this multi-year process, ODOT and the City of Portland studied more than 70 design concepts, including the Build Alternative, via public design workshops and extensive agency and stakeholder input. Existing conditions, issues, opportunities, and constraints were reviewed for the highway and the local transportation network. A total of 19 full SAC meetings and 13 subcommittee meetings were held; each was open to the public and provided opportunity for public comment. Another 10 public events were held, with over 100 attendees at the Project open houses providing input on the design process. Of the 70 design concepts, 13 concepts advanced for further study based on SAC, agency, and public input, with six concepts passing into final consideration.

One recommended design concept, the Build Alternative, was selected for development as a result of the final screening and evaluation process. The final I-5 Broadway/Weidler Facility Plan (ODOT 2012a) and recommended design concept, herein referred to as the Build Alternative, were supported by the SAC and unanimously adopted in 2012 by the Oregon Transportation Commission and the Portland City Council.⁵ The features of the Build Alternative are described below.

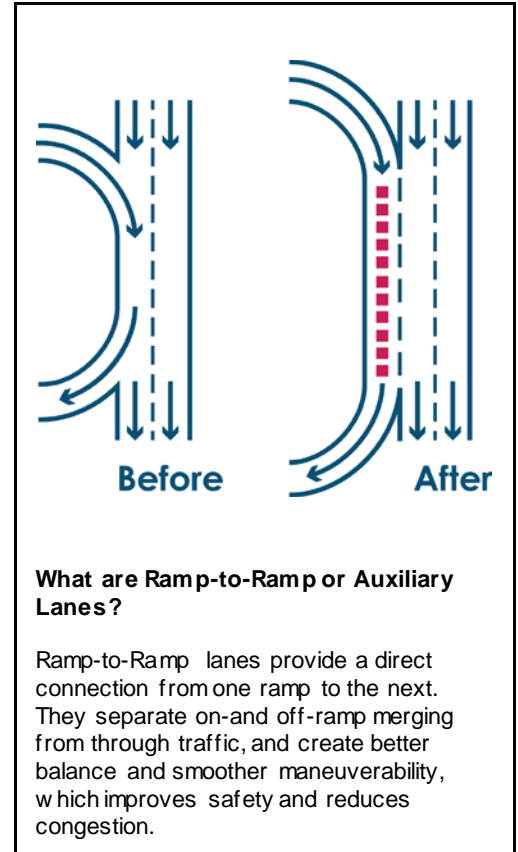
The Build Alternative includes I-5 mainline improvements and multimodal improvements to the surface street network in the vicinity of the Broadway/Weidler interchange. The proposed I-5 mainline improvements include the construction of auxiliary lanes (also referred to as ramp-to-ramp lanes) and full shoulders between I-84 to the south and I-405 to the north, in both the NB and SB directions. See Section 2.2.1 for more detail.

Construction of the I-5 mainline improvements would require the rebuilding of the N/NE Weidler, N/NE Broadway, N Williams, and N Vancouver structures over I-5.

⁵ Resolution No. 36972, adopted by City Council October 25, 2012. Available at: <https://www.portlandoregon.gov/citycode/article/422365>

With the Build Alternative, the existing N/NE Weidler, N/NE Broadway, and N Williams overcrossings would be removed and rebuilt as a single highway cover structure over I-5 (see Section 2.2.2). The existing N Vancouver structure would be removed and rebuilt as a second highway cover, including a new roadway crossing connecting N/NE Hancock and N Dixon Streets. The existing N Flint Avenue structure over I-5 would be removed. The I-5 SB on-ramp at N Wheeler would also be relocated to N/NE Weidler at N Williams, via the new Weidler/Broadway/Williams highway cover. A new bicycle and pedestrian bridge over I-5 would be constructed at NE Clackamas Street, connecting Lloyd with the Rose Quarter (see Section 2.2.4.3).

Surface street improvements are also proposed, including upgrades to existing bicycle and pedestrian facilities and a new center-median bicycle and pedestrian path on N Williams between N/NE Weidler and N/NE Broadway (see Section 2.2.4.4).



2.2.1 I-5 Mainline Improvements

The Build Alternative would modify I-5 between I-84 and I-405 by adding safety and operational improvements. The Build Alternative would extend the existing auxiliary lanes approximately 4,300 feet in both NB and SB directions and add 12-foot shoulders (both inside and outside) in both directions in the areas where the auxiliary lane would be extended. Figure 2 illustrates the location of the proposed auxiliary lanes. Figure 3 illustrates the auxiliary lane configuration, showing the proposed improvements in relation to the existing conditions. Figure 4 provides a cross section comparison of existing and proposed conditions, including the location of through lanes, auxiliary lanes, and highway shoulders.

A new NB auxiliary lane would be added to connect the I-84 WB on-ramp to the N Greeley off-ramp. The existing auxiliary lane on I-5 NB from the I-84 WB on-ramp to the NE Weidler off-ramp and from the N Broadway on-ramp to the I-405 off-ramp would remain.

The new SB auxiliary lane would extend the existing auxiliary lane that enters I-5 SB from the N Greeley on-ramp. The existing SB auxiliary lane currently ends just south of the N Broadway off-ramp, in the vicinity of the Broadway overcrossing structure.

Figure 2. Auxiliary Lane/Shoulder Improvements

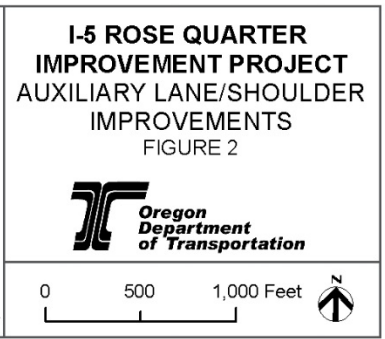
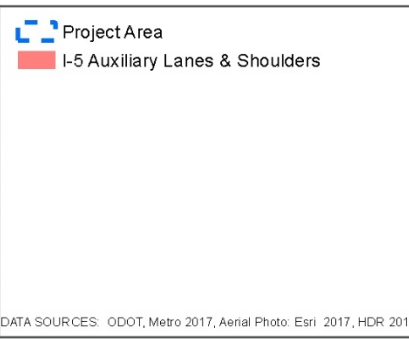
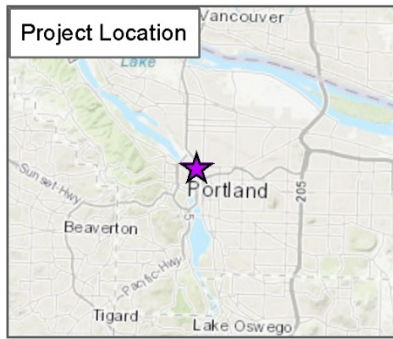
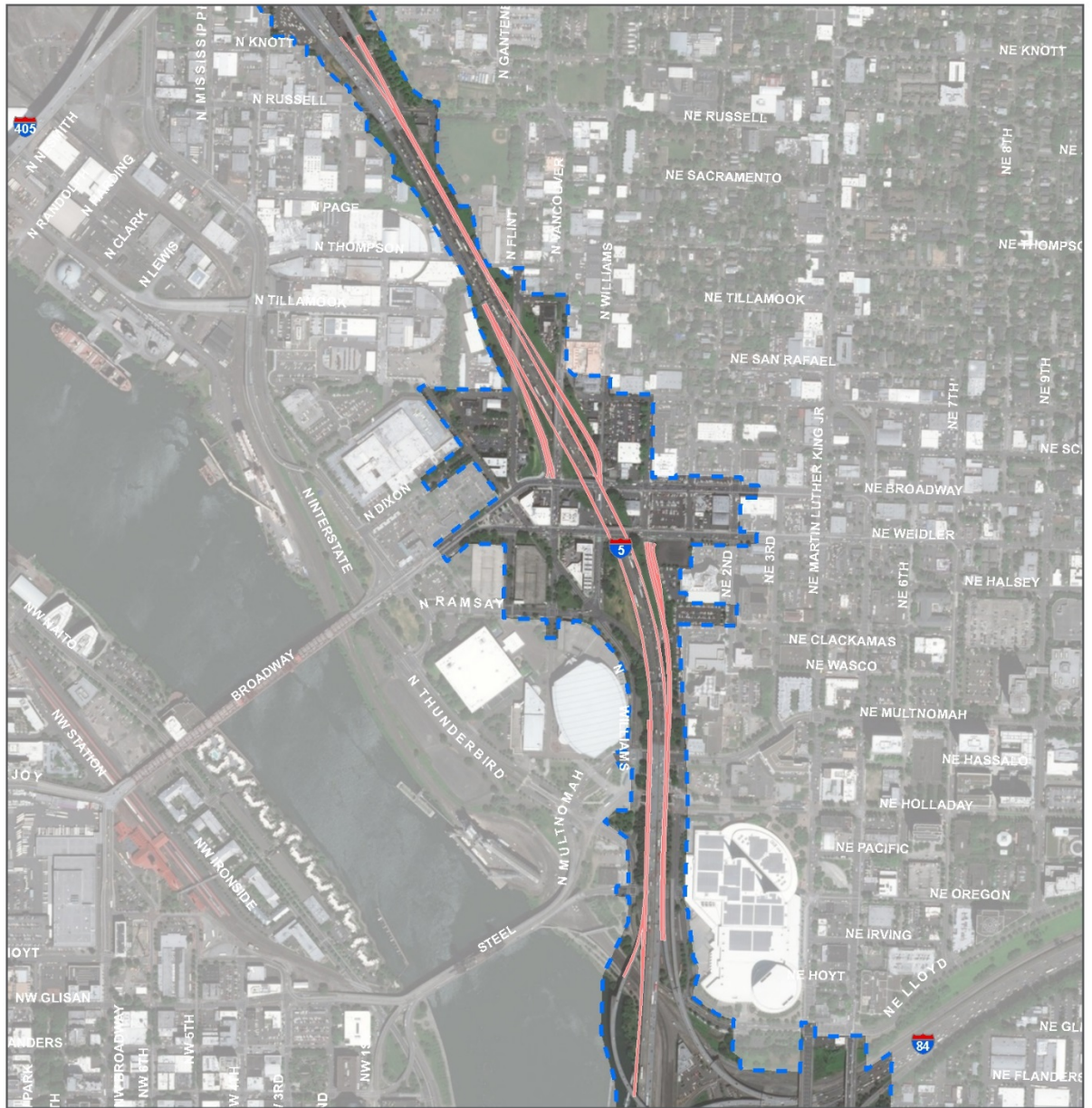


Figure 3. I-5 Auxiliary (Ramp-to-Ramp) Lanes – Existing Conditions and Proposed Improvements

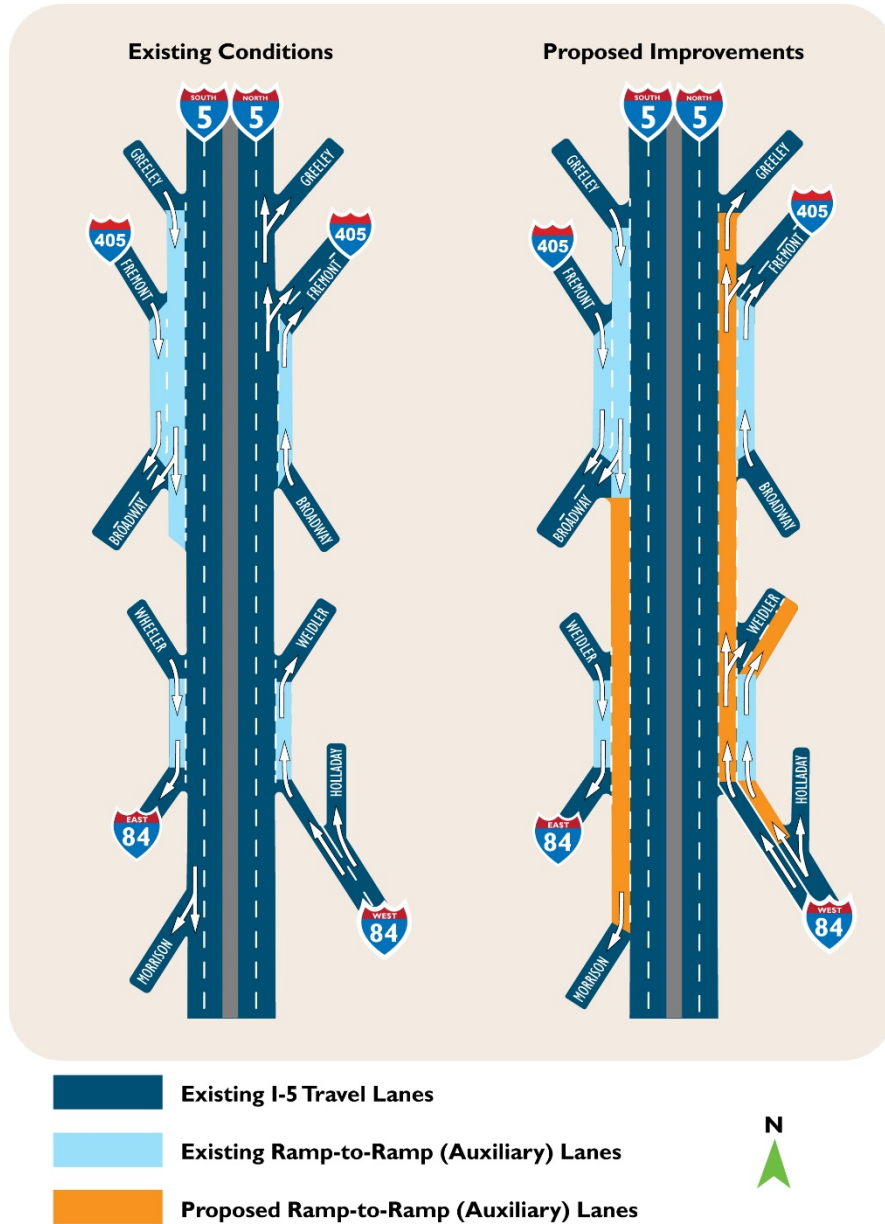
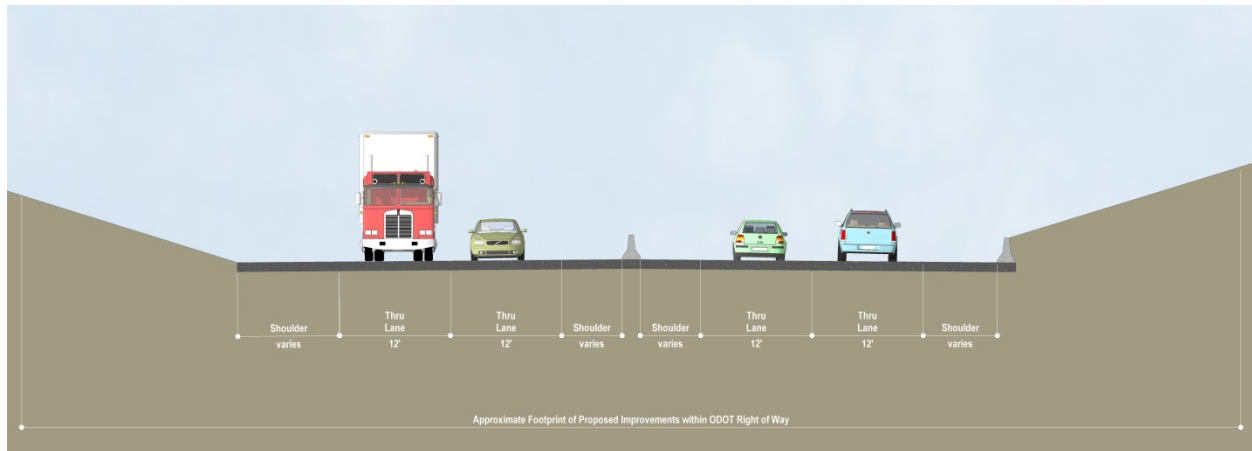
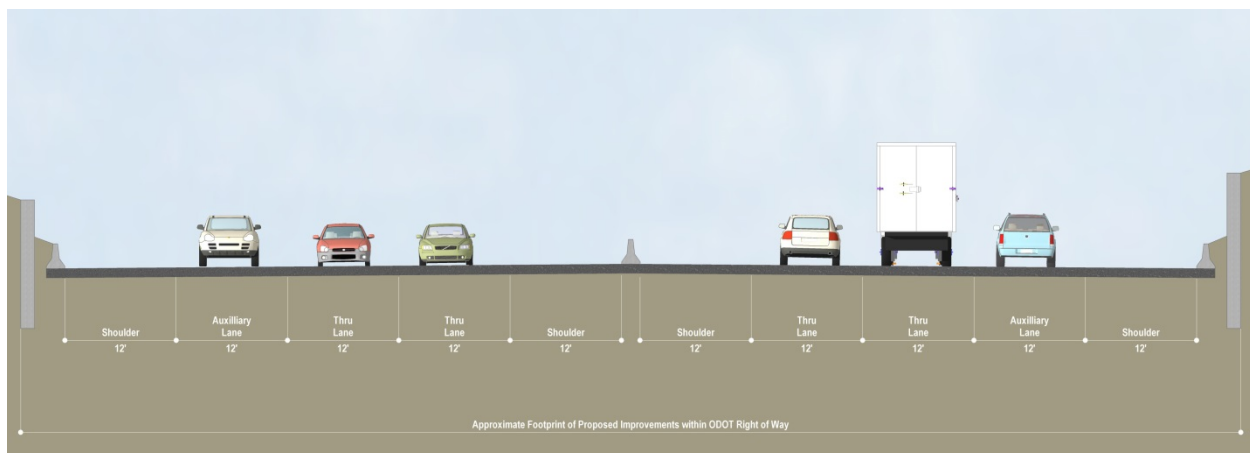


Figure 4. I-5 Cross Section (N/NE Weidler Overcrossing) – Existing Conditions and Proposed Improvements



Existing Lane Configuration



Proposed Lane Configuration

Under the Build Alternative, the SB auxiliary lane would be extended as a continuous auxiliary lane from N Greeley to the Morrison Bridge and the SE Portland/Oregon Museum of Science and Industry off-ramp. Figure 4 presents a representative cross section of I-5 (south of the N/NE Weidler overcrossing within the Broadway/Weidler interchange area), with the proposed auxiliary lanes and shoulder, to provide a comparison with the existing cross section.

The addition of 12-foot shoulders (both inside and outside) in both directions in the areas where the auxiliary lanes would be extended would provide more space to allow vehicles that are stalled or involved in a crash to move out of the travel lanes. New shoulders would also provide space for emergency response vehicles to use to access an incident within or beyond the Project Area.

No new through lanes would be added to I-5 as part of the Build Alternative; I-5 would maintain the existing two through lanes in both the NB and SB directions.

2.2.2 Highway Covers

2.2.2.1 Broadway/Weidler/Williams Highway Cover

To complete the proposed I-5 mainline improvements, the existing structures crossing over I-5 must be removed, including the roads and the columns that support the structures. The Build Alternative would remove the existing N/NE Broadway, N/NE Weidler, and N Williams structures over I-5 to accommodate the auxiliary lane extension and new shoulders described in Section 2.2.1.

The structure replacement would be in the form of the Broadway/Weidler/Williams highway cover (Figure 5). The highway cover would be a wide bridge that spans east-west across I-5, extending from immediately south of N/NE Weidler to immediately north of N/NE Broadway to accommodate passage of the Broadway/Weidler couplet. The highway cover would include design upgrades to make the structure more resilient in the event of an earthquake.

Figure 5. Broadway/Weidler/Williams and Vancouver/Hancock Highway Covers



The highway cover would connect both sides of I-5, reducing the physical barrier of I-5 between neighborhoods to the east and west of the highway while providing additional surface area above I-5. The added surface space would provide an opportunity for new and modern bicycle and pedestrian facilities and public spaces when construction is complete, making the area more connected, walkable, and bike friendly.

2.2.2.2 N Vancouver/N Hancock Highway Cover

The Build Alternative would remove and rebuild the existing N Vancouver structure over I-5 as a highway cover (Figure 5). The Vancouver/Hancock highway cover would be a concrete or steel platform that spans east-west across I-5 and to the north and south of N/NE Hancock. Like the Broadway/Weidler/Williams highway cover, this highway cover would provide additional surface area above I-5. The highway cover would provide an opportunity for public space and a new connection across I-5 for all modes of travel. A new roadway connecting neighborhoods to the east with the Lower Albina area and connecting N/NE Hancock to N Dixon would be added to the Vancouver/Hancock highway cover (see element “A” in Figure 6).

2.2.3 Broadway/Weidler Interchange Improvements

Improvements to the Broadway/Weidler interchange to address connections between I-5, the interchange, and the local street network are described in the following subsections and illustrated in Figure 6.

2.2.3.1 Relocate I-5 Southbound On-Ramp

The I-5 SB on-ramp is currently one block south of N Weidler near where N Wheeler, N Williams, and N Ramsay come together at the north end of the Moda Center. The Build Alternative would remove the N Wheeler on-ramp and relocate the I-5 SB on-ramp north to N Weidler. Figure 6 element “B” illustrates the on-ramp relocation.

2.2.3.2 Modify N Williams between Ramsay and Weidler

The Build Alternative would modify the travel circulation on N Williams between N Ramsay and N Weidler. This one-block segment of N Williams would be closed to through-travel for private motor vehicles and would only be permitted for pedestrians, bicycles, and public transit (buses) (Figures 6 and 7). Private motor vehicle and loading access to the facilities at Madrona Studios would be maintained.

2.2.3.3 Revise Traffic Flow on N Williams between Weidler and Broadway

The Build Alternative would revise the traffic flow on N Williams between N/NE Weidler and N/NE Broadway. For this one-block segment, N Williams would be converted from its current configuration as a two-lane, one-way street in the NB direction with a center NB bike lane to a reverse traffic flow two-way street with a 36-foot-wide median multi-use path for bicycles and pedestrians. These improvements are illustrated in Figures 6 and 7.

Figure 6. Broadway/Weidler Interchange Area Improvements



Figure 7. Conceptual Illustration of Proposed N Williams Multi-Use Path and Revised Traffic Flow



The revised N Williams configuration would be designed as follows:

- Two NB travel lanes along the western side of N Williams to provide access to the I-5 NB on-ramp, through movements NB on N Williams, and left-turn movements onto N Broadway.
- A 36-foot-wide center median with a multi-use path permitted only for bicycles and pedestrians. The median multi-use path would also include landscaping on both the east and west sides of the path.
- Two SB lanes along the eastern side of N Williams to provide access to the I-5 SB on-ramp or left-turn movements onto NE Weidler.

2.2.4 Related Local System Multimodal Improvements

2.2.4.1 New Hancock-Dixon Crossing

A new roadway crossing would be constructed to extend N/NE Hancock west across and over I-5, connecting it to N Dixon (see Figure 6, element “E”). The new crossing would be constructed on the Vancouver/Hancock highway cover and would provide a new east-west crossing over I-5. Traffic calming measures would be incorporated east of the intersection of N/NE Hancock and N Williams to discourage use of NE Hancock by through motor vehicle traffic. Bicycle and pedestrian through travel would be permitted (see Figure 6, element “F”).

2.2.4.2 Removal of N Flint South of N Tillamook and Addition of New Multi-Use Path

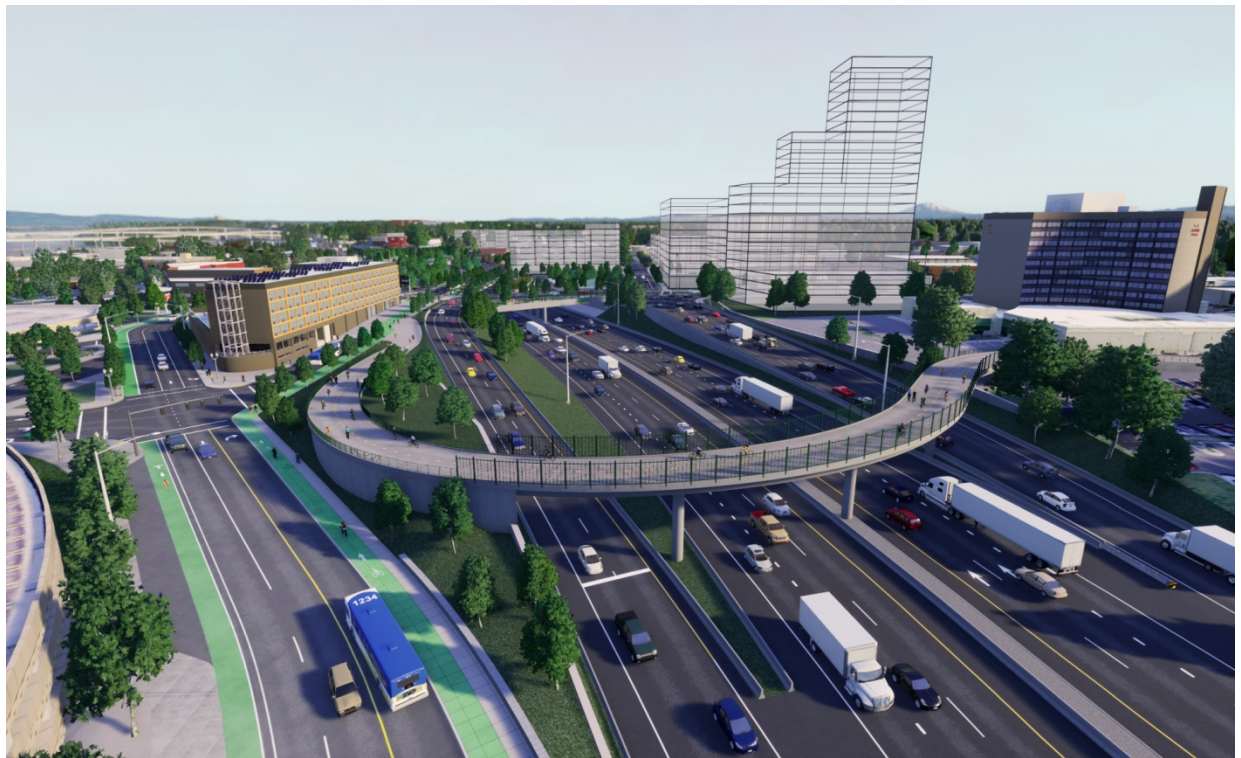
The existing N Flint structure over I-5 would be removed, and N Flint south of N Russell Street would terminate at and connect directly to N Tillamook (see Figure 6, element “G”). The portion of Flint between the existing I-5 overcrossing and Broadway would be closed as a through street for motor vehicles. Driveway access would be maintained on this portion of N Flint to maintain local access.

A new multi-use path would be added between the new Hancock-Dixon crossing and Broadway at a grade of 5 percent or less to provide an additional travel route option for people walking and biking. The new multi-use path would follow existing N Flint alignment between N Hancock and N Broadway (see Figure 6, element “G”).

2.2.4.3 Clackamas Bicycle and Pedestrian Bridge

South of N/NE Weidler, a new pedestrian- and bicycle-only bridge over I-5 would be constructed to connect NE Clackamas Street near NE 2nd Avenue to the N Williams/ N Ramsay area (see Figure 6, element “H,” and Figure 8). The Clackamas bicycle and pedestrian bridge would offer a new connection over I-5 and would provide an alternative route for people walking or riding a bike through the Broadway/Weidler interchange.

Figure 8. Clackamas Bicycle and Pedestrian Crossing



2.2.4.4 Other Local Street, Bicycle, and Pedestrian Improvements

The Build Alternative would include new widened and well-lit sidewalks, Americans with Disabilities Act-accessible ramps, high visibility and marked crosswalks, widened and improved bicycle facilities, and stormwater management on the streets connected to the Broadway/Weidler interchange.⁶

A new two-way cycle track would be implemented on N Williams between N/NE Hancock and N/NE Broadway. A two-way cycle track would allow bicycle movement in both directions and would be physically separated from motor vehicle travel lanes and sidewalks. This two-way cycle track would connect to the median multi-use path on N Williams between N/NE Broadway and N/NE Weidler.

The bicycle lane on N Vancouver would also be upgraded between N Hancock and N Broadway, including a new bicycle jug-handle at the N Vancouver and N Broadway intersection to facilitate right-turn movements for bicycles from N Vancouver to N Broadway.

Existing bicycle facilities on N/NE Broadway and N/NE Weidler within the Project Area would also be upgraded, including replacing the existing bike lanes with wider, separated bicycle lanes. New bicycle and pedestrian connections would also be made between the N Flint/N Tillamook intersection and the new Hancock-Dixon connection.

These improvements would be in addition to the new Clackamas bicycle and pedestrian bridge, upgrades to bicycle and pedestrian facilities on the new Broadway/Weidler/Williams and Vancouver/Hancock highway covers, and new median multi-use path on N Williams between N/NE Broadway and N/NE Weidler described above and illustrated in Figure 6.

⁶ Additional details on which streets are included are available at <http://i5rosequarter.org/local-street-bicycle-and-pedestrian-facilities/>

3 Regulatory Setting

3.1 Criteria Pollutants

The Clean Air Act as amended in 1990 is the federal law that governs air quality. This law sets National Ambient Air Quality Standards (NAAQS) for pollutant concentrations that are protective of human health and public welfare. NAAQS have been established for the following six criteria pollutants that have been linked to potential health and welfare effects: carbon monoxide (CO), nitrogen dioxide, ozone, particulate matter, lead, and sulfur dioxide (SO₂). Particulate matter is further divided into coarse (PM₁₀) and fine (PM_{2.5}) particulate matter for regulation. A region is designated by the U.S. Environmental Protection Agency (EPA) as a nonattainment area when one or more monitoring stations in the region fail to demonstrate compliance with the relevant standard. Areas that were previously designated as nonattainment areas but that since have met the standard are called maintenance areas. The Portland area was a maintenance area for CO and ozone. However, the Portland area is currently in attainment of all NAAQS.

Under the 1990 Clean Air Act Amendments, the U.S. Department of Transportation cannot fund, authorize, or approve federal actions to support programs or projects that are not first found to conform to the State Implementation Plan. Conformity with the Clean Air Act is analyzed at the regional level and at the project level. This program is referred to as Transportation Conformity. Transportation Conformity does not apply after the revocation date for pollutants for which the EPA has revoked a standard. In 2005, the EPA revoked the 1979 1-hour ozone NAAQS for which Portland was a "maintenance area." Additionally, Transportation Conformity generally does not apply after the Clean Air Act Section 175A 20-year maintenance planning period. The maintenance planning period for the Portland CO maintenance area ended on October 2, 2017 (62 *Federal Register* [FR] 46208).

The analysis for the Project was prepared after October 2, 2017. Transportation Conformity no longer applies to projects in the Portland metropolitan area because the area is an attainment area for all pollutants and has passed the 20-year maintenance planning period (EPA 2018). Transportation control measures in place to reduce emissions for both ozone and CO will continue to apply unless the state submits a revision to the State Implementation Plan and the EPA approves the revision.

3.2 Mobile Source Air Toxics

In addition to the criteria air pollutants for which NAAQS have been established, the EPA regulates air toxics, which are pollutants known or suspected to cause cancer or other serious health effects. Most air toxics originate from human-made sources, including on-road mobile sources, nonroad mobile sources (e.g., airplanes), area sources (e.g., dry cleaners) and stationary sources (e.g., factories). Mobile source air

toxics (MSAT) are those that are emitted by on-road vehicles and mobile nonroad equipment.

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments of 1990, when Congress mandated that the EPA regulate 188 air toxics, also known as hazardous air pollutants. The EPA assessed this expansive list in its rule on the Control of Hazardous Air Pollutants from Mobile Sources [72 FR 72 8430] and identified a group of 93 compounds emitted from mobile sources that are part of EPA's Integrated Risk Information System. In addition, EPA identified nine compounds with significant contributions from mobile sources that are among the national- and regional-scale cancer risk drivers or contributors and noncancer hazard contributors from the 2011 National Air Toxics Assessment. These are 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (DPM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter (POM). DPM is currently the dominant component of MSAT emissions, making up 50 to 70 percent of all priority MSAT pollutants by mass, depending on calendar year.

Based on updated interim guidance provided by the Federal Highway Administration (FHWA), projects that meet both of the following criteria have a higher potential for MSAT effects:

- The project creates new capacity or adds significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes where projected average annual daily traffic (AADT) volumes are in the range of 140,000 to 150,000 or greater by the design year.
- The project affects urban highways near populated areas (FHWA 2016a).

3.3 Oregon State Toxics Benchmarks

The Oregon Department of Environmental Quality (DEQ) has developed ambient benchmark concentrations for air toxics. DEQ benchmarks are not standards but are used as goals for evaluation and planning. Historically, the toxic benchmarks were set at the level representing the concentration at which an individual has a one in a million chance of developing cancer if exposed over a lifetime. DEQ is in the process of re-evaluating this approach to setting benchmarks and, in the future, benchmarks may not follow this principle.

4 Methodology and Data Sources

The methodology used for analysis of air quality impacts was developed in review and consultation with FHWA and ODOT. A general methodology coordination meeting occurred on October 5, 2017. Following the meeting, a written draft methodology was reviewed by both agency's staff.

4.1 Project Area and Area of Potential Impact

The Area of Potential Impact (API) for air quality is the same as the Project Area (Figure 1) plus roadways that could experience changes in congestion (e.g., traffic volumes and speed) sufficient to expect a meaningful change in emissions (approximately ± 10 percent) between the No-Build and Build conditions. To analyze the air quality effects of the Project, roadway links in the Project Area plus roadway links that meet the following criteria between No-Build and Build conditions were included:

- \pm Five percent or more change in AADT
- \pm Five percent or more change in travel time (determined based on speed change)
- \pm Five percent or more change in travel time delay resulting from intersection delay (determined based on speed change with delay included in speed)

Figure 9 illustrates the extent of the area where there are roadway links meeting the inclusion criteria.

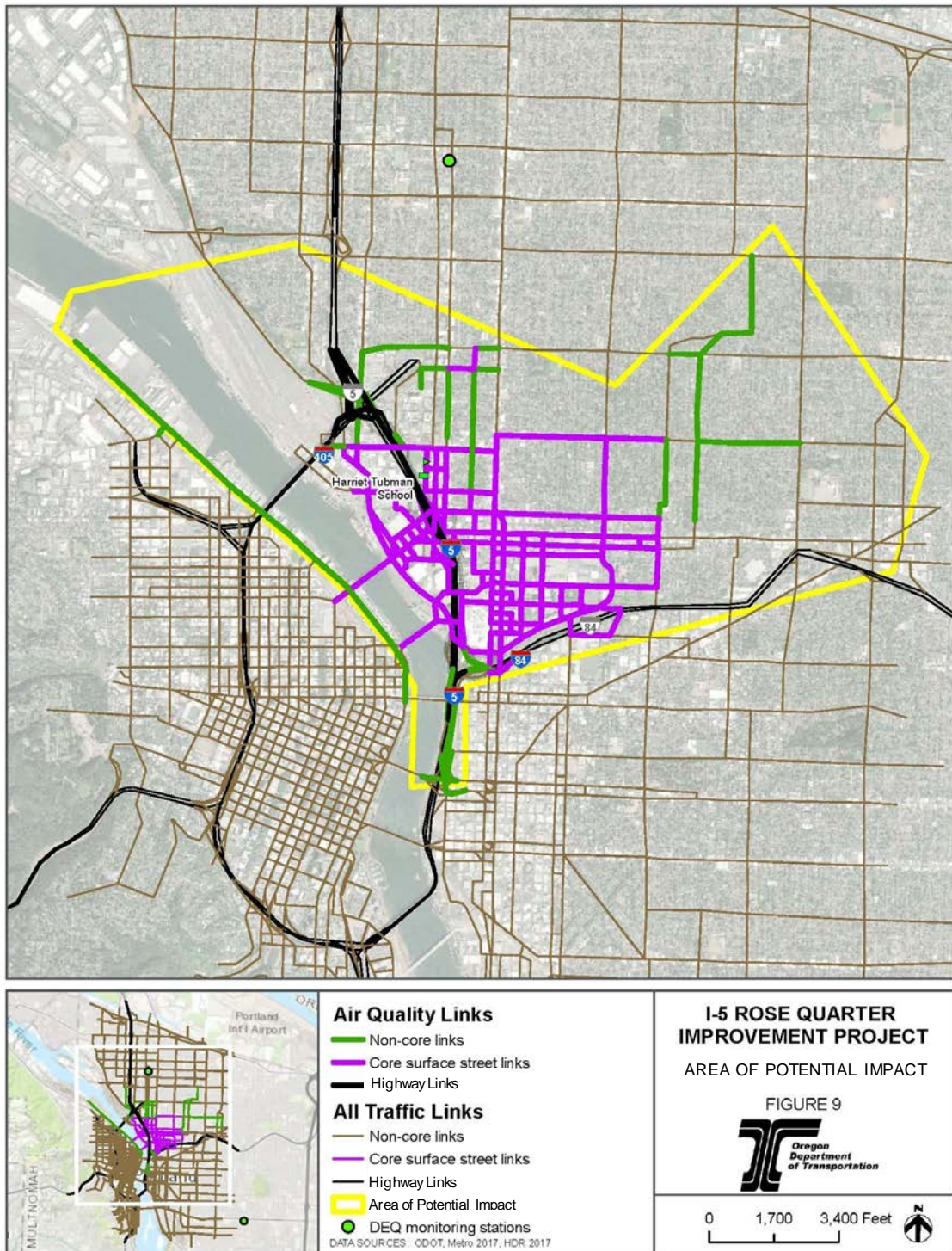
4.2 Resource Identification and Assessment

The Project does not add new capacity or increase existing capacity but would affect traffic on I-5 and may meet the criteria of having a higher potential for MSAT effects. A quantitative analysis of MSAT emissions has therefore been performed for the Project. The quantitative analysis generally follows the recommendations in the document *Frequently Asked Questions (FAQ) - Conducting Quantitative MSAT Analysis for FHWA NEPA Documents* (FHWA 2016b).

4.2.1 Analysis Years

Air pollutant emissions were analyzed for three cases: existing conditions (2017) and for the Build and No-Build Alternatives for future conditions (2045).

Figure 9. Area of Potential Impact



4.2.2 Traffic Data

The traffic data used in the MSAT analysis were provided by the City of Portland (May 29, 2018, 2:57 PM dataset) and included roadway identifiers, traffic volumes, vehicle miles traveled (VMT), speeds, and allocation of volumes to light-duty vehicles, medium trucks, and heavy trucks for each roadway link. Traffic data were broken out into a data set representing expected traffic operations for four analysis periods: AM peak period (7 AM–9 AM), PM peak period (4 PM–6 PM), daytime off-peak period (6 AM–7 PM, excluding peak periods), and nighttime off-peak period (7 PM–6 AM). These periods were used to calculate daily and annual traffic parameters. Raw traffic data were supplied for the years 2015 and 2040 for the No-Build and Build Alternatives. These raw data were used to analyze changes between No-Build and Build conditions and to allocate traffic volumes to speed bins, and aggregate VMT. The aggregated VMT were then escalated, using growth factors to extrapolate the existing analysis year of 2017 (from 2015) and the future analysis year of 2045 (from 2040).

The traffic data were supplied in three data sets: the core Project Area surface street links, secondary surface street links outside of the core Project Area, and highway links. Core area surface street links were included in the MSAT emissions analysis for all cases without screening because they are directly affected by the Project. Secondary (non-core area) surface street links and all highway links were compared on a link-by-link basis between the 2040 No-Build and Build conditions to determine if they met the ± 5 percent criteria defined in Section 4.1 of this report. Secondary surface street links and highway links meeting the criteria were included in the emissions analysis for all cases (existing, future Build, and future No-Build). Core and secondary surface street links were combined prior to developing emissions model input files.

The VMT traffic data for links selected for inclusion in the emissions analysis were totaled for each period and case by road type. Link vehicle allocations were used to allocate vehicle volumes to vehicle types (Highway Performance Monitoring System [HPMS] vehicle type) for calculation of emissions for each case. The emissions model used can receive input for up to 13 HPMS categories if data for all categories are available. Traffic data were supplied only for light duty vehicles, medium trucks and heavy trucks. These three groupings aggregate HPMS vehicle types. A summary table of the VMT is included in Appendix A.

Traffic speed data for the selected links were processed by roadway type into 5-mile per hour speed bins by vehicle type for calculation of project emissions for each case. This approach is consistent with the Mobile Vehicle Emission Simulator (MOVES) model guidance.

4.2.3 Emission Model

The EPA-approved model MOVES calculates emissions for a variety of roadway vehicles and fuels (EPA 2015, 2016). Version 2014a of the MOVES model was used for the Project analysis. MOVES accounts for progressively more stringent tailpipe

emission standards across the vehicle model years evaluated. The MOVES input files include the applicable climate data, fuel characteristics, local vehicle mix, and vehicle inspection and maintenance (I/M) programs for the Project Area. The traffic data were processed as described in the previous report sections and were consistent with MOVES model guidance for input data.

The MSAT analysis used MOVES input files developed by Metro where possible. The databases from Metro included fuel supply, fuel formulation, I/M program, and source type age distribution (Metro 2016). Using the MOVES database provided by Metro ensures consistency between project-level and regional analyses. Tables 3 and 4 summarize the MOVES Runspec inputs and MOVES database sources used in the analysis and identify what modifications, if any, were made to Metro input data files.

The following assumptions were made:

- Consistent with analyses performed by Metro for Transportation Conformity, input data files for vehicle type, road type, source type, and fuel do not vary by year.
- I/M program assumptions do vary by year but were assumed not to change between 2040 and 2045. Metro input data that are consistent with regional emissions analyses are available for 2040.
- A single vehicle I/M program input was used to estimate emissions. Based on a review of Metro input files, approximately 78 percent of VMT in the Portland area are from the Oregon I/M program, and this program was used to estimate emissions for comparison between cases. When Metro models regional emissions, the emissions characteristics of the Washington I/M program and vehicles not subject to an I/M program are also modeled.
- The effects of low-emitting vehicle and zero-emitting vehicle evaporative emissions were included in the analysis. Oregon has an active program to promote and support ownership of zero-emitting vehicles. Zero-emitting vehicles include pure battery electric vehicles, plug-in hybrid electric vehicles, and hydrogen fuel cell electric vehicles. Low- and zero-emitting vehicles are slated to be an increasing share of the vehicle fleet and would contribute to reduced emissions from mobile sources over time.



Table 3. MOVES Runspec Selections

Input Name	Selection
Scale	County
Calculation Type	Inventory
Time Spans	Analysis Years: 2017–existing, 2045–design year Time Aggregation: All hours, weekdays
Months of Analysis	January, April, July, October
Region	County
Geographic Bounds	Oregon, Multnomah County
Vehicles/Equipment	<p>Diesel Fuel: combination long-haul truck, combination short-haul truck, light commercial truck, passenger car, passenger truck, single unit long-haul truck, single unit short-haul truck</p> <p>Ethanol (E-85): light commercial truck, passenger car, passenger truck</p> <p>Gasoline: combination short-haul truck, light commercial truck, passenger car, passenger truck, single unit long-haul truck, single unit short-haul truck</p> <p>Electric vehicles</p>
Road Types	Urban restricted (highway), urban unrestricted (surface streets). Rural restricted, rural unrestricted, and off-network input would be excluded from runs.
Processes	MSAT only, roadway emissions only—running exhaust, crankcase running exhaust, evaporative permeation, and evaporative fuel leaks. This includes evaporative emissions for zero and low emitting vehicles.
Pollutants	Acetaldehyde, acrolein, benzene, 1,3-butadiene, DPM as primary exhaust PM ₁₀ , ethylbenzene, formaldehyde, naphthalene (gas and particulate), POM as 30 specific polycyclic aromatic hydrocarbons per FHWA guidance
Input Data Sets	Oregon Low Emitting Vehicle data set
Output	Units: grams, million Btu, miles Activity: distance traveled By: day, county, pollutant, road type

Notes: Btu = British thermal unit; DPM = diesel particulate matter; FHWA = Federal Highway Administration; MSAT = Mobile Source Air Toxics; MOVES = Mobile Vehicle Emission Simulator; PM₁₀ = coarse particulate matter; POM = polycyclic organic matter

Table 4. MOVES County Data Manager Inputs

MOVES Database Name	Data Source	Source File Name-Date
Vehicle Type VMT	Input files provided by Metro, except HPMS TypeYear file was developed for Project by year and case	HPMSTypeYear_YEAR_CASE monthVMTFraction_OR-10/7/2014 dayVMTFraction_OR-10/25/2013 hourVMTFraction_OR-10/25/2013
IM Programs	Input files provided by Metro	IMcoverage_2017_OR-3/17/2014 IMCoverage_2040_OR-3/19/2014, updated to 2045 as analysis year
Road Type Distribution	Input files provided by Metro	RoadTypeDistribution_OR-12/18/2013
Source Type Distribution	Input files provided by Metro	SourceTypeDistribution_YEAR_OR-3/17/2014
Average Speed Distribution	Developed for Project by year, road type and vehicle type for four daily periods for each case	AvgSpeedDistribution_YEAR_CASE
Fuel	Input files provided by Metro	fuelSupply_YEAR_OR-11/21/2014 fuelFormulation_OR-11/21/2014 fuelUsageFraction_YEAR_OR-8/31/2016 fuelAVFT_OR-11/21/2014 fuelAVDT_OR_ZEV-8/19/2016
Meteorological Data	Input files developed from MOVES default data	ZoneMonthHour_YEAR

Notes: HPMS = Highway Performance Monitoring System; IM = inspection and monitoring; MOVES = Mobile Vehicle Emission Simulator; VMT = vehicle miles traveled

All input files remain unchanged between 2017 and 2045 except for the IM program and files developed for the Project.

It is assumed that the IM program input will not change between the 2040 and 2045 analysis years, with the Metro 2040 input files used for the 2045 analysis.

4.3 Assessment of Impacts

4.3.1 Criteria Pollutants

The Portland metropolitan area is past the maintenance planning period for CO; as a result, Transportation Conformity does not apply to the Project. Therefore, criteria pollutant emissions are discussed qualitatively. The discussion focuses on emission trends in the Portland metropolitan area and goals and guidelines for reducing emissions. The traffic analysis was reviewed, and the relation between congestion, changing vehicle emission standards, and emissions is discussed. In addition, CO

concentrations at poorly performing intersections are discussed in the context of the results of recent analyses of CO hot spots in the Portland area.

4.3.2 Mobile Source Air Toxics

MSAT emissions were estimated for the existing and future Build and No-Build cases, using MOVES (EPA 2015, 2016). The purpose of the analysis was to compare local emissions trends of the priority MSAT emissions and how they may be affected by the Project.

The MOVES daily emissions results were post-processed by aggregating data, as follows, to calculate total or roadway type emissions in tons per year:

- Evaporative permeation emissions for zero-emitting vehicles were added to daily running emissions by daily operating period.
- Emission rates were averaged seasonally on a pollutant-by-pollutant basis by road type for each daily operating period.
- POM emission rates were aggregated to a single value by road type.
- Aggregated emissions were multiplied by 365 and converted from grams to tons to calculate annual emissions for each road type by pollutant.

Total Project emissions were calculated for each of the nine MSAT by summing emissions for each road type. The analysis discloses if meaningful differences in MSAT emissions resulting from the Project should be expected.

4.3.3 Quality Control

The MSAT analysis involved extensive calculations. The process used to maintain data quality and quality of results used peer and senior review as follows:

- Overall methods were reviewed with senior staff at key points in the analysis.
- Senior staff performed review of the spreadsheets and spot-checked equations and calculation methods for all calculations.
- Calculations and spreadsheets received detailed peer review at each progressive step in the analysis.
- Dates of reviews and dates of correction were recorded.

4.4 Cumulative Impacts

The cumulative impacts analysis considered the Project's impacts combined with other past, present, and reasonably foreseeable future actions that would result in environmental impacts in the Project Area. Because transportation impacts typically occur on a broader, system-wide scale, the cumulative impact assessment qualitatively assessed the magnitude of impacts associated with projects listed in the financially constrained element of Metro's RTP (Metro 2014) and other shorter-term projects identified by the City of Portland and TriMet, in combination with anticipated Project impacts.

5 Affected Environment

5.1 Introduction

The Portland metropolitan area currently meets all NAAQS. The primary pollutants of concern for transportation projects are oxides of nitrogen (NO_x), volatile organic compounds (VOC), CO, PM₁₀, PM_{2.5}, and MSAT.

The Portland-Vancouver metropolitan area has a relatively mild climate with temperatures ranging from an average minimum monthly temperature of 35 degrees Fahrenheit (°F) in January to an average maximum monthly temperature of 80°F in August. The winters are the wettest part of the year, with approximately 75 percent of the annual precipitation falling between October and March.

5.2 Monitoring Data

5.2.1 Air Quality Trends—Criteria Pollutants

During the 1970s, pollutant concentrations in the Portland metropolitan area exceeded the NAAQS for CO on one out of every three days, and ozone levels were often as high as 50 percent over the federal standard. Programs and regulations put into effect to control air pollutant emissions have been effective, and the air quality in the area has improved. The area was redesignated from a nonattainment area to a maintenance area for CO in 1997. In October 2017, the 20-year CO maintenance planning period ended. Although the area is still considered a maintenance area, it is recognized that it is not likely to revert to nonattainment, and the analysis and tracking provisions of the regulations have eased. Additionally, in 2005, EPA revoked the 1997 1-hour ozone standard and implemented reduced 8-hour ozone standards that are more protective of human health. The Portland metropolitan area has always complied with the 8-hour standard. The Portland metropolitan area now meets all NAAQS.

Most pollutants have shown continuing patterns of reductions over time. Figures 10 and 11 depict air quality trends for the criteria pollutants PM₁₀ and ozone (NO_x and VOC are precursors for ozone formation) (DEQ 2017). The data for PM₁₀ are the highest concentrations from Portland area monitoring stations. Ozone data are from Carus, Oregon, which has the highest ozone concentrations in the Portland metropolitan area. The DEQ has collected PM_{2.5} data since 1999; no trend is apparent in the collected data.

All monitored concentrations are well below levels that would exceed state and national ambient air quality standards. Statistical criteria for determining compliance with the standards varies depending on the pollutant. For example, the ozone standard is attained (complied with) when the fourth-highest 8-hour concentration in a year (averaged over 3 years) is equal to or less than the standard. For PM₁₀, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 micrograms per cubic meter is

equal to or less than one, as a 3-year average. Therefore, the one measurement over the standard in 1991 (Figure 10) is not an exceedance of the overall standard. Similarly, the measurement higher than the standard for ozone in 1992 (Figure 11) did not cause an exceedance of the ozone standard once the statistical values were calculated.

Figure 10. Particulate Matter Trends

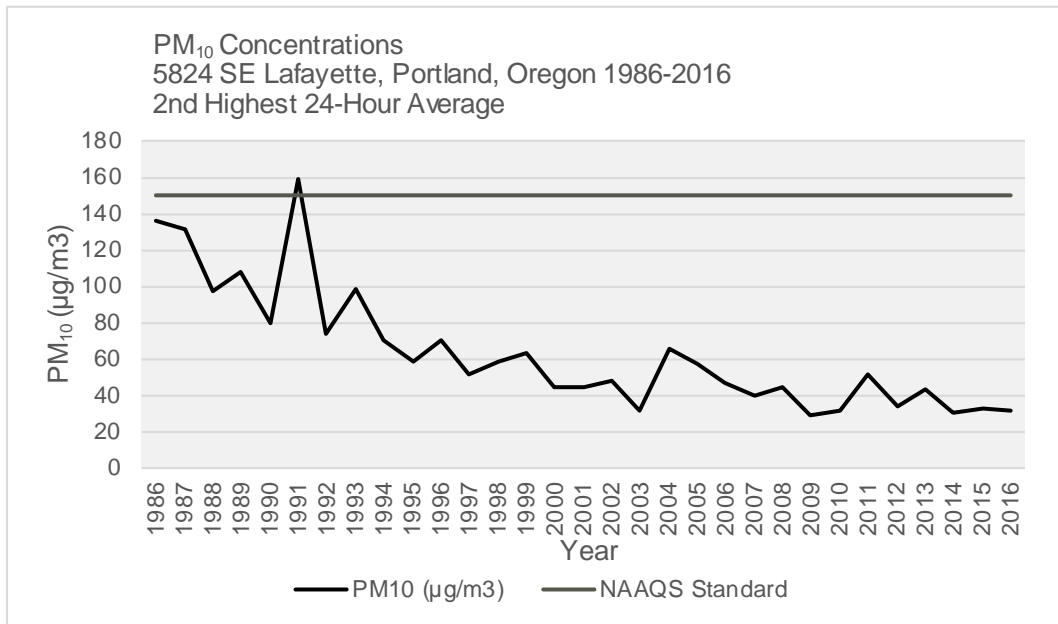
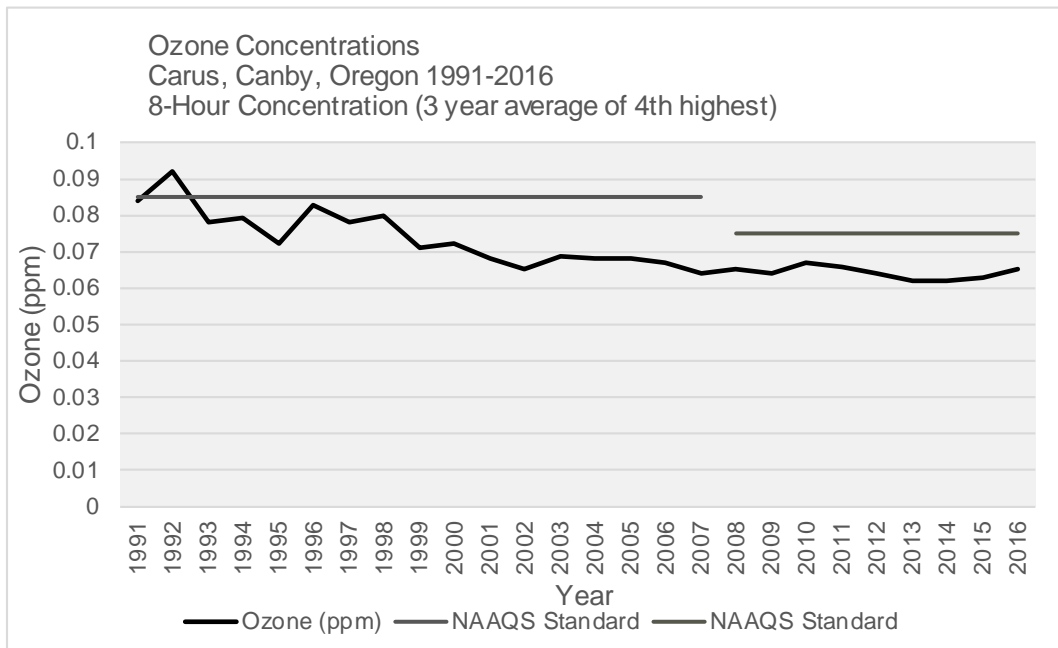


Figure 11. Ozone Trends



5.2.2 Air Quality Trends—Air Toxics

The DEQ has monitored air toxics in the Portland area since 1999. Air toxic trends generally follow the criteria pollutant trend of decreasing over time, although some variability between pollutants is shown and measurements span fewer years. Some pollutants remain above the DEQ health benchmark representing the concentration at which an individual has a one in a million chance of developing cancer if exposed over a lifetime. DEQ benchmarks are not standards, but instead are used as guidelines for evaluation and planning.

MSAT emissions are projected to continue to decrease as tighter tailpipe emission standards are implemented over time (refer to Appendix B). Figures 12 and 13 show the concentration trends from the North Portland monitoring station (shown on Figure 9) for formaldehyde and benzene, two pollutants associated with vehicle emissions (DEQ 2016).

Figure 12. Formaldehyde Trends

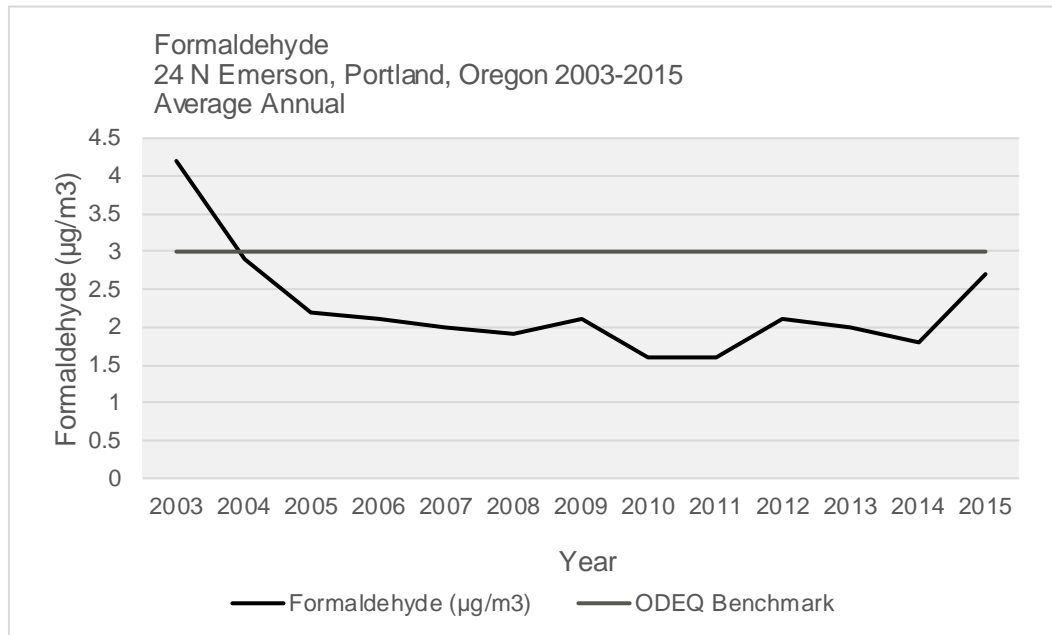
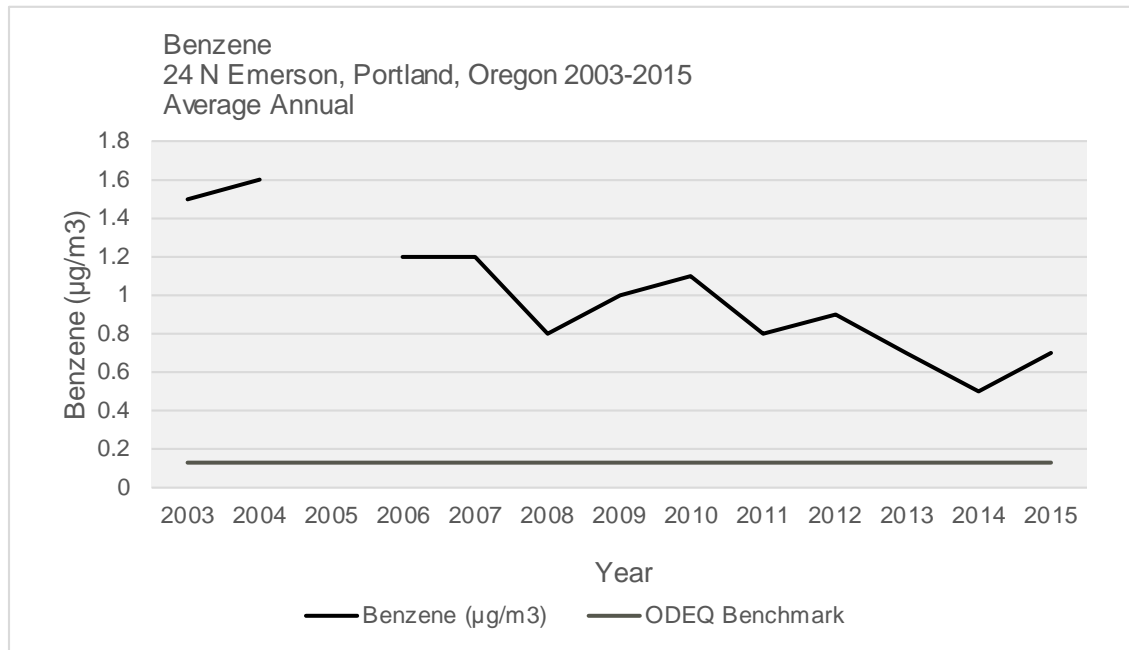


Figure 13. Benzene Trends



6 Environmental Consequences

This section discusses the anticipated beneficial and adverse impacts of the Project with regards to air quality for the No-Build and Build Alternatives.

6.1 No-Build Alternative

As described in Section 2.1, the No-Build Alternative consists of existing conditions and other planned and funded transportation improvement projects that would be completed in and around the Project Area by 2045.

6.1.1 Direct Impacts

Under the No-Build Alternative, the proposed I-5 mainline and Broadway/Weidler interchange area improvements would not be constructed, and the current road system would remain in place. The estimated No-Build Alternative emissions for the nine MSAT are summarized in Table 5. Emissions are shown separately for both highway and surface streets. In all cases, the magnitude of the MSAT emissions is small and is significantly lower in 2045 than the 2017 existing conditions. By 2045, emissions of most pollutants are less than 1 ton per year (apart from DPM, with emissions of 2.4 tons per year and formaldehyde with emissions of 1.1 tons per year). DPM and formaldehyde emissions show an 81 percent reduction and a 55 percent reduction, respectively, between 2017 and 2045.

Overall, the results of the Project-level MSAT analysis are consistent with the national MSAT emission trends (refer to Appendix B). More details of the emissions results calculations are included in Appendix C.

6.1.2 Indirect Impacts

No indirect air quality impacts from the No-Build Alternative are expected.

6.2 Build Alternative

6.2.1 Short-Term (Construction) Impacts

Construction effects to air quality would be temporary and would not continue after Project construction is completed. Effects would be localized and would vary throughout the construction process.

Construction air quality effects would include the release of particulate (fugitive dust) emissions generated from soil by excavation, grading, hauling, and various other activities such as demolition of structures. Emissions from construction equipment also are anticipated and would include CO, NO_x, VOC, directly emitted particulate matter (PM₁₀ and PM_{2.5}), and toxic air contaminants such as DPM.

Table 5. MSAT Emissions for No-Build Alternative (tons per year)

Pollutant	Pollutant Emissions (tons per year)					
	Highway		Surface Streets		Total	
	2017	2045 No-Build	2017	2045 No-Build	2017	2045 No-Build
DPM	9.4	1.8	3.5	0.6	12.9	2.4
Acetaldehyde	0.8	0.3	0.6	0.1	1.4	0.4
Acrolein	0.1	0.0	0.1	0.0	0.2	0.1
Benzene	1.1	0.2	1.6	0.2	2.7	0.4
1,3-Butadiene	0.1	0.0	0.2	0.0	0.3	0.0
Ethylbenzene	0.6	0.2	0.9	0.2	1.5	0.4
Formaldehyde	1.5	0.8	1.0	0.3	2.5	1.1
Naphthalene	0.2	0.1	0.1	0.0	0.3	0.1
POM	0.1	0.0	0.1	0.0	0.2	0.0

Notes: MSAT = Mobile Source Air Toxics
Rounding causes addition to appear inconsistent in table.

Construction-related effects on air quality are greatest during the site preparation phase because most engine emissions are associated with the excavation, handling, and transport of soils to and from the site. These activities would generate temporary emissions of PM₁₀, PM_{2.5} and small quantities of CO, SO₂, NO_x, and VOC.

In addition to fugitive dust, heavy trucks and construction equipment would generate exhaust emissions. If construction activities were to increase traffic congestion in the area, CO and other emissions from traffic would increase slightly while those vehicles are delayed. These emissions would be temporary and limited to the immediate area surrounding the construction site and are not expected to exceed ambient air quality standards.

Construction of concrete structures may have associated dust-emitting sources, such as demolition and concrete mixing operations.

6.2.2 Long-Term and Operational Direct Impacts

6.2.2.1 CO Analysis

CO is typically the criteria pollutant of greatest local concern for transportation projects. Traditionally, compliance with the CO NAAQS has been demonstrated by



modeling CO concentrations near poorly performing intersections affected by project actions. Although quantitative CO hot spot analysis is no longer required for projects in the Portland metropolitan area, a summary of CO hot spots modeling results from recent Portland area projects is shown in Table 6. These results demonstrate that recently modeled CO concentrations near poorly performing intersections are below the NAAQS throughout the Portland metropolitan area. Violations of the CO NAAQS have not been shown for any project in recent years because CO emissions from newer vehicles are substantially lower than older vehicles, and emissions are decreasing as the vehicle fleet turns over. These results are consistent with the Portland area’s emergence from active maintenance status. Build Alternative modeling would be expected to show similar results.

Table 6. CO Concentrations from Previous Analyses of Portland Intersections (ppm)

Project	Broadway		Foster		Outer Powell		SE Powell	
	1-Hour	8-Hour	1-Hour	8-Hour	1-Hour	8-Hour	1-Hour	8-Hour
No Build	2.6	2.0	2.2	1.8	2.8	2.1	2.1	1.7
Build	2.6	2.0	2.1	1.7	2.7	2.1	2.1	1.7

Notes: ppm = parts per million. NAAQS 1-hour standard is 35 ppm. NAAQS 8-hour Standard is 9 ppm.

Broadway analysis year was 2036—intersection analyzed: I-5 SB off-ramp at Broadway

Foster analysis year was 2035—intersection analyzed: SE Foster Road and SE 82nd Avenue

Outer Powell analysis year was 2020—intersection analyzed: SE 174th Avenue and SE Powell Boulevard

SE Powell analysis year was 2040—intersection analyzed: SE 21st Avenue and SE Powell Boulevard

A project-level hot spot analysis estimates the highest CO concentration adjacent to an intersection, which results from the project-affected intersection operations. The analysis must demonstrate that the highest CO concentration is below the CO NAAQS. If the modeled worst-case scenario does not show a violation of the NAAQS, then it is assumed that no other project scenarios would cause a violation. High CO concentrations and impacts from mobile sources typically occur at intersections where traffic queues. The location of probable highest impact is selected based on the traffic performance at the intersections affected by a project. Intersections are ranked based on traffic volume and level of service (LOS). The poorest performing intersection with the highest traffic volume will have the highest probable CO concentrations.

Modeling results for other projects in the Portland metropolitan area were used to establish that the Build Alternative is unlikely to result in CO impacts. CO impacts no longer occur in the Portland metropolitan area in general. Four project-level CO hotspot analyses performed for other projects in Portland were considered: the I-5 Southbound Off-Ramp at North Broadway Project (ODOT 2015c), the US 26 Outer Powell Transportation Safety Project (ODOT 2016a), the Foster Road Streetscape—Southeast 50th to Southeast 84th Avenue (ODOT 2016b), and the US 26 Southeast

20th to Southeast 34th Avenue Project (ODOT 2016c). Data from the previous analyses are shown in Table 6.

In all cases, the worst-case intersections had CO concentrations well below the 8-hour CO NAAQS of 9 parts per million (ppm) and the 1-hour NAAQS of 35 ppm for all modeled scenarios. All intersections were projected to operate at LOS of F (failing operations). One of the analyzed intersections is in the Project Area, and all represent typical Portland area CO analysis results. CO concentrations near poorly performing intersections in the Project Area are expected to remain well below the CO NAAQS.

6.2.2.2 Mobile Source Air Toxics Analysis

Estimated emissions for the nine MSAT are summarized in Table 7. Emissions were compared for both highway and surface streets. MSAT emissions for the 2045 Build condition from operations on the highway are lower than or equal to emissions for the No-Build condition. This reduction is due to the higher speeds that congestion reduction allows. MSAT emissions also show a slight decrease or remain the same for operations on surface streets. Overall, estimated emissions of MSAT from operations in the Project-affected area are small.

Table 7. MSAT Emissions for Build Alternative (tons per year)

Pollutant	Highway		Surface Streets		Total	
	2045 No-Build	2045 Build	2045 No-Build	2045 Build	2045 No-Build	2045 Build
DPM	1.8	1.7	0.6	0.6	2.4	2.3
Acetaldehyde	0.3	0.2	0.1	0.1	0.4	0.4
Acrolein	0.0	0.0	0.0	0.0	0.1	0.0
Benzene	0.2	0.2	0.2	0.2	0.4	0.4
1,3-Butadiene	0.0	0.0	0.0	0.0	0.0	0.0
Ethylbenzene	0.2	0.2	0.2	0.2	0.4	0.4
Formaldehyde	0.8	0.7	0.3	0.3	1.1	1.1
Naphthalene	0.1	0.1	0.0	0.0	0.1	0.1
POM	0.0	0.0	0.0	0.0	0.0	0.0

Note: Rounding causes addition to appear inconsistent in table.

6.2.2.3 Harriet Tubman Middle School

In November 2017, the Portland School Board voted to reestablish a middle school at the Harriet Tubman school site. Air quality at the site has been a concern because of the site's proximity to a highly congested area of I-5.

From August 23, 2009, through November 3, 2009, EPA installed a monitor and collected air samples for acetaldehyde, benzene, 1,3-butadiene, acrolein, manganese, nickel, and other metals in PM₁₀; and other VOCs. EPA's analysis found that measured levels of toxics were below levels of concern for both short-term and long-term exposures for adults and children, with the exception of cadmium. Follow-up measurements were made for cadmium and industrial sources were identified as the probable source. Measured levels of acetaldehyde, benzene, and 1,3-butadiene at this school were not as high as suggested by the modeling information available prior to monitoring. Although they were below the levels of significant concern that had been suggested by the modeling information, the results indicated the influence of mobile source pollutants of concern that are the focus of EPA actions nationwide (EPA n.d.).

Because of heightened public concern surrounding MSAT emissions near the school, highway-only emissions were analyzed. Table 8 compares estimated Project-specific MSAT emissions from highway operations for the existing (2017), No-Build (2045), and Build (2045) conditions. The data show a large decrease in estimated emissions over time and almost no change in emissions (a very slight decrease) between the No-Build and Build conditions in 2045. The projected decrease in emissions over time is expected to benefit the school by the reduced exposure to MSAT. The small difference between the No-Build and Build Alternatives is not likely to provide much benefit, although emissions would decrease slightly with the Build Alternative.

Overall emissions from the highway would contribute to pollutant concentrations from dispersion in the general area. However, the Build Alternative is not expected to contribute to a change in conditions relative to the No-Build Alternative. Emissions reductions with time would provide the most benefit to the school.

6.2.3 Long-Term and Indirect (Operational) Impacts

The direct air pollution effects of the Build Alternative are minor. Indirect air pollution effects are not expected to result from implementation of the Build Alternative. The Build Alternative is a safety improvement project that does not substantially improve highway capacity and is not expected to induce growth or create other effects that would cause indirect impacts.

Table 8. MSAT Emissions for Highway Operations (tons per year)

Pollutant	Highway Pollutant Emissions (tons per year)			Percent Change (%)		
	2017 Existing	2045 No-Build	2045 Build	2017 to 2045 No Build	2017 to 2045 Build	2045 No Build to 2045 Build
DPM	9.4	1.8	1.7	- 81	-82	-6
Acetaldehyde	0.8	0.3	0.2	- 64	-68	-10
Acrolein	0.1	0.0	0.0	-63	-67	-10
Benzene	1.1	0.2	0.2	-84	-84	-2
1,3-Butadiene	0.1	0.0	0.0	-98	-98	-11
Ethylbenzene	0.6	0.2	0.2	- 71	-74	-10
Formaldehyde	1.5	0.8	0.7	-45	-51	-10
Naphthalene	0.2	0.1	0.1	- 63	-67	-10
POM	0.1	0.0	0.0	-87	-87	-1

Notes: DPM = diesel particulate matter; MSAT = Mobile Source Air Toxics; POM = polycyclic organic matter

Rounding causes addition to appear inconsistent in table.

6.3 Cumulative Effects

Cumulative impacts are environmental effects that result from the incremental effect of the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes those other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (Title 40 Code of Federal Regulations [CFR] 1508.7).

The analysis of cumulative impacts involves a series of steps conducted in the following order:

- Identify the resource topics that could potentially experience direct or indirect impacts from construction and operation of the proposed project.
- Define the geographic area (spatial boundary) within which cumulative impacts will be assessed, as well as the time frame (temporal boundary) over which other past, present, and reasonably foreseeable future actions will be considered.
- Describe the current status or condition of the resource being analyzed, as well as its historical condition (prior to any notable change) and indicate whether the status or condition of the resource is improving, stable, or in decline.

- Identify other actions or projects that are reasonably likely to occur within the area of potential impact during the established time frame and assess whether they could positively or negatively affect the resource being analyzed.
- Describe the combined effect on the resource being analyzed when the direct and indirect impacts of the project are combined with the impacts of other actions or projects assumed to occur within the same geographic area during the established time frame.

6.3.1 Spatial and Temporal Boundaries

The geographic area used for the cumulative impact analysis is the same as the API described in Section 4.1 and shown on Figure 9. The time frame for the cumulative impact analysis extends from the beginning of large-scale urban development in and around the Project Area to 2045, the horizon year for the analysis of transportation system changes.

6.3.2 Past, Present, and Reasonably Foreseeable Future Actions

The past, present, and reasonably foreseeable future actions that were considered in assessing cumulative effects are summarized in the following subsections.

6.3.2.1 Past Actions

Past actions include the following:

- Neighborhood and community development
 - Historical development of the Portland area and accompanying changes in land use
 - Development of the local transportation system (including roads, bicycle and pedestrian facilities, and bus transit)
 - Utilities (water, sewer, electric, and telecommunications)
 - Parks, trails, bikeways
- Commercial and residential development in and around the Project Area
 - Veterans Memorial Coliseum (1960)
 - Lloyd Center (1960)
 - Legacy Emanuel Medical Center (1970)
 - Oregon Convention Center (1990)
 - Rose Garden (1995)
- Regional transportation system development
 - Marine terminal facilities on the Willamette River
 - Port of Portland (1892)

- Commission of Public Docks (1910)
- Port of Portland (1970; consolidation of Port of Portland and Commission of Public Docks)
- Freight rail lines (late 1800s and early 1900s)
- Highways
 - I-84 (1963)
 - I-5 (1966)
 - I-405 (1973)
- Rail transit system
 - MAX light rail (1986)
 - Portland Streetcar (2001)

6.3.2.2 Present Actions

Present actions include ongoing operation and maintenance of existing infrastructure and land uses, including the following:

- Ongoing safety improvements for bicycles and pedestrians
- Local and regional transportation system maintenance
- Utility maintenance

6.3.2.3 Reasonably Foreseeable Future Actions

Reasonably foreseeable future actions include projects listed in the financially constrained element of Metro's RTP (Metro 2014) and other shorter-term projects and service improvements identified by the City of Portland and TriMet (Appendix D). These projects were assumed to be in place under the No-Build Alternative. It was also assumed that these projects would be designed according to applicable agency standards.

6.3.3 Results of Cumulative Impact Analysis

Air quality analysis is inherently cumulative in that the analysis compares the overall effects of air pollution in an airshed to ambient air quality standards, or benchmarks, that apply overall to the ambient air. The Build Alternative would result in emissions increases during construction and virtually no effect on emissions for operations. The Build Alternative is not expected to cause long-term air quality impacts and is not expected to contribute to cumulative effects on air quality beyond construction effects.

7 Avoidance, Minimization, and Mitigation Measures

There would be no long-term air quality impacts from the Build Alternative; therefore, there are no proposed measures to avoid, minimize, or mitigate future air pollutant emissions. Avoidance and minimization measures would be implemented to address short-term (i.e., temporary) construction effects.

7.1 Construction Mitigation

Construction contractors are required to comply with Division 208 of Oregon Administrative Rule (OAR) 340, which addresses visible emissions and nuisance requirements and places limits on fugitive dust that causes a nuisance or violates other regulations. Violations of the regulations can result in enforcement action and fines. The regulation requires that the following reasonable precautions be taken to avoid dust emissions (OAR 340-208, Subsection 210):

- Use water or chemicals, where possible, for the control of dust in the demolition of existing buildings or structures, construction operations, the grading of roads, or the clearing of land.
- Apply asphalt, oil, water, or other suitable chemicals on unpaved roads, materials stockpiles, and other surfaces that can create airborne dust.
- Enclose (fully or partially) materials stockpiled in cases where application of oil, water, or chemicals is not sufficient to prevent particulate matter from becoming airborne.
- Install and use hoods, fans, and fabric filters to enclose and vent the handling of dusty materials.
- Provide adequate containment during sandblasting or similar operations.
- Always cover open-bodied trucks when they are in motion during transport of materials that are likely to become airborne
- Promptly remove earth or other material from paved streets that does or may become airborne.

In addition, contractors are required to comply with ODOT standard specifications Section 290, which includes air pollution control measures for environmental protection. These measures, which include vehicle and equipment idling limitations, are designed to minimize vehicle track-out and fugitive dust. These measures would be documented in the erosion and sediment control plan that the contractor is required to submit before the preconstruction conference. To reduce the impact of construction delays on traffic flow and resultant emissions, road or lane closures should be restricted to non-peak traffic periods when possible.

8 Conclusion

The air quality API is in an area that is in attainment for all NAAQS, and the Build Alternative is included in the current MTIP for planning and funding purposes. Following the trend of decreases in pollutant concentrations that have occurred since the 1970s, future air pollutant emissions are estimated to be substantially lower than existing conditions and nearly identical between the No-Build and Build Alternatives, with air quality improving slightly under the Build Alternative. These emissions conclusions are supported by the results of MSAT emissions modeling for existing (2017), future No-Build (2045), and future Build (2045) conditions, as shown in Table 9. The Build Alternative is not expected to impact air quality.

Table 9. MSAT Emissions for Operations (tons per year)

Pollutant	Total Pollutant Emissions (tons per year)			Percent Change (%)		
	2017 Existing	2045 No-Build	2045 Build	2017 to 2045 No Build	2017 to 2045 Build	2045 No Build to 2045 Build
DPM	12.9	2.4	2.3	-81	-82	-4
Acetaldehyde	1.4	0.4	0.4	-73	-74	-6
Acrolein	0.2	0.1	0.0	-68	-70	-6
Benzene	2.7	0.4	0.4	-87	-87	0
1,3-Butadiene	0.3	0.0	0.0	-99	-99	-7
Ethylbenzene	1.5	0.4	0.4	-73	-74	-3
Formaldehyde	2.5	1.1	1.1	-55	-58	-6
Naphthalene	0.3	0.1	0.1	-70	-72	-6
POM	0.2	0.0	0.0	-87	-87	1

Notes: DPM = diesel particulate matter; MSAT = Mobile Source Air Toxics; POM = polycyclic organic matter



9 Preparers

Name	Discipline	Education	Years of Experience
Martha Moore, P.E., Maul Foster Alongi	Air Quality and Climate Change	B.S., Environmental Resources Engineering	33
Leslie Riley, Maul Foster Alongi	Air Quality and Climate Change	B.S., Civil Engineering	3
Natalie Liljenwall (Reviewer), ODOT	Air Quality and Climate Change	B.S. and M.S., Environmental Engineering	21

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