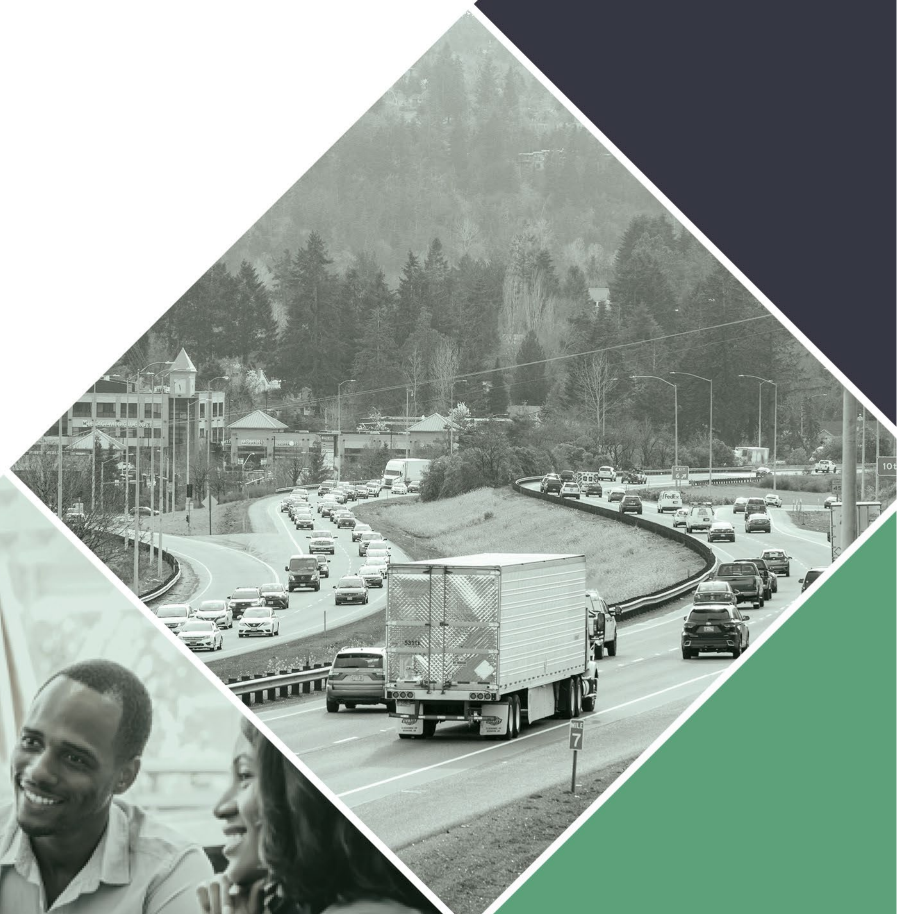
Appendix E I-205 Toll Project Energy and Greenhouse Gas Technical Report

I-205 Toll Project

Energy and Greenhouse Gas Technical Report

February 2023



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Energy and Greenhouse Gas Technical Report

February 2023

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Oregon Department of Transportation

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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
2018 CE	2018 Categorical Exclusion for the I-205 Improvements Project
AADT	average annual daily traffic
API	area of potential impact
Btu	British thermal unit
CE	Categorical Exclusion
C.F.R.	Code of Federal Regulations
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
DEQ	Oregon Department of Environmental Quality
EIA	U.S. Energy Information Administration
FHWA	U.S. Federal Highway Administration
FHWA FAQ	*Frequently Asked Questions (FAQ) Conducting Quantitative MSAT Analysis for FHWA NEPA Documents*
GHG	Greenhouse Gas
I-205	Interstate 205
I-205 Improvements Project	I-205: Stafford Road to OR 213 Improvements Project
mmBtu	million British thermal units
MOVES	MOtor Vehicle Emissions Simulator
MP	mile post
MSAT	mobile source air toxics
MT	metric tons
NEPA	National Environmental Policy Act
OAR	Oregon Administrative Code
ODOT	Oregon Department of Transportation
OR	Oregon Route
Phase 1A	I-205: Phase 1A Project
Project	Variable rate tolls on the Abernethy and Tualatin River Bridges and the toll-funded I-205 improvements between Stafford Road and OR 213
USEPA	U.S. Environmental Protection Agency
VMT	vehicle miles traveled

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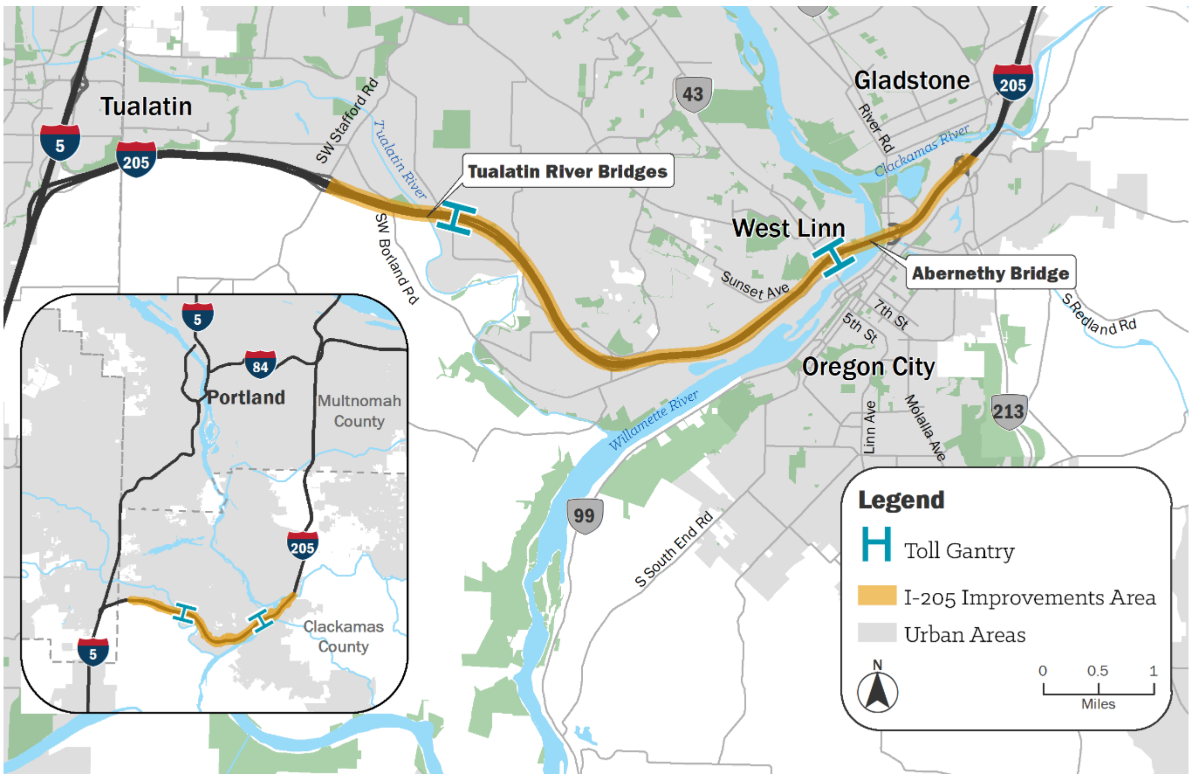
1 Introduction

This technical report supports the I-205 Toll Project Environmental Assessment developed by Oregon Department of Transportation (ODOT) in partnership with the Federal Highway Administration (FHWA). ODOT proposes to use variable-rate tolls[1] on the Interstate 205 (I-205) Abernethy Bridge and Tualatin River Bridges to raise revenue for construction of planned improvements to I-205 from Stafford Road to Oregon Route (OR) 213, including seismic upgrades and widening, and to manage congestion. The Environmental Assessment evaluates the effects of variable rate tolls and toll-funded I-205 Improvements (together, the "Project") on the human and natural environment in accordance with the National Environmental Policy Act (NEPA). The Project area is illustrated in Figure 1-1.

Figure 1-1. Project Area



This technical report describes the existing energy and greenhouse gas (GHG) conditions, discusses the potential impacts and benefits the Project would have on those conditions, and identifies measures to avoid, minimize, and/or mitigate adverse effects.

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[1] Variable-rate tolls are fees charged to use a road or bridge that vary based on time of day and that can be used as a strategy to shift demand to less congested times of day.

2 Project Alternatives

ODOT evaluated two alternatives in the I-205 Toll Project Environmental Assessment and this technical report evaluate two alternatives:

- No Build Alternative
- Build Alternative

Section 2.1 describes the previous environmental review that led up to the Environmental Assessment and associated technical analyses, and Sections 2.2 and 2.3 describe the alternatives in more detail.

2.1 Project Background and Environmental Review

Oregon House Bill 2017 identified improvements on I-205 as a priority project, known as the I-205: Stafford Road to OR 213 Improvements Project (I-205 Improvements Project). The purpose of the improvements was reducing congestion; improving mobility, travel time reliability, and safety; and providing seismic resiliency for I-205 to function effectively as a statewide north-south lifeline route after a major earthquake by widening I-205 and seismically upgrading or replacing 13 bridges. In 2018, ODOT and FHWA determined that, with respect to FHWA regulations implementing NEPA, the I-205 Improvements Project qualified as a categorical exclusion (CE) (Code of Federal Regulations [CFR] 23 771.117[d][13]). In December 2018, FHWA signed a CE Closeout Document (2018 CE) for the I-205 Improvements Project, which demonstrated that it would not involve significant environmental impacts. At that time, the potential locations for tolling on I-205 had not been determined, and tolling of I-205 was not included in any adopted long-term transportation plan;[2] therefore, tolling was not considered part of the I-205 Improvements Project nor analyzed in the 2018 CE.

After FHWA approved the 2018 CE, ODOT advanced elements of the I-205 Improvements Project as multiple phased construction packages; however, efforts to secure construction funding for the entirety of the project were unsuccessful. In 2021, Oregon House Bill 3055 provided financing options that allowed the first phase of the I-205 Improvements Project to be constructed without toll revenue[3]. This first phase, referred to as the I-205: Phase 1A Project (Phase 1A), includes reconstruction of the Abernethy Bridge with added auxiliary lanes and improvements to the adjacent interchanges at OR 43 and OR 99E. ODOT determined that toll revenue would be needed to complete the remaining construction phases of the I-205 Improvements Project as described in the 2018 CE (i.e., those not included in Phase 1A).

In May 2022, FHWA and ODOT reduced the scope of the project to include only Phase 1A and completed a NEPA re-evaluation that reduced the scope of the 2018 CE decision for the scaled back project (ODOT 2022a). Construction of Phase 1A began in summer 2022 and is estimated to be complete in 2025. The toll-funded improvements were removed from the I-205 Improvements Project and accompanying 2018 CE decision and are now included in the I-205 Toll Project. The environmental

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2 Federal regulations require that transportation projects be formally included in state and/or regional long-term transportation plans before they receive NEPA approvals.

3 If tolling is approved upon completion of environmental review of the I-205 Toll Project, tolls could be used to pay back loans for Phase 1A.

effects of the toll-funded improvements are analyzed in the Environmental Assessment and associated technical analyses.

2.2 No Build Alternative

NEPA regulations require an evaluation of a No Build Alternative to provide a baseline to compare with the potential effects of a Build Alternative. The No Build Alternative consists of existing transportation infrastructure and any planned improvements that would occur regardless of the Project. The No Build Alternative includes the I-205: Phase 1A Project (reconstruction of the Abernethy Bridge with added auxiliary lanes and improvements to the adjacent interchanges at OR 43 and OR 99E) as a previously approved project that would be constructed by 2025. Under the No Build Alternative, tolling would not be implemented and the toll-funded widening and seismic improvements on I-205 between Stafford Road and OR 213 would not be constructed.

2.3 Build Alternative

Under the Build Alternative, drivers of vehicles on I-205 would be assessed a toll for crossing the Abernethy Bridge (between OR 43 and OR 99E) and for crossing the Tualatin River Bridges (between Stafford Road and 10th Street). The Build Alternative includes construction of a third through lane in each direction of I-205 between the Stafford Road interchange and the OR 43 interchange, a northbound auxiliary lane between OR 99E and OR 213, toll gantries and supporting infrastructure, as well as replacement of or seismic upgrades to multiple bridges along I-205 (shown schematically in Figure 2-1).

The following sections provide a more detailed description of the Build Alternative.

2.3.1 Bridge Tolls – Abernethy Bridges and Tualatin River Bridges

Two toll gantry areas have been identified for placement of the toll gantries and supporting infrastructure, as shown in Figure 2-2. The gantries and supporting infrastructure would be located entirely within the existing I-205 right-of-way.

Figure 2-1. Schematic Diagrams of No Build and Build Alternatives

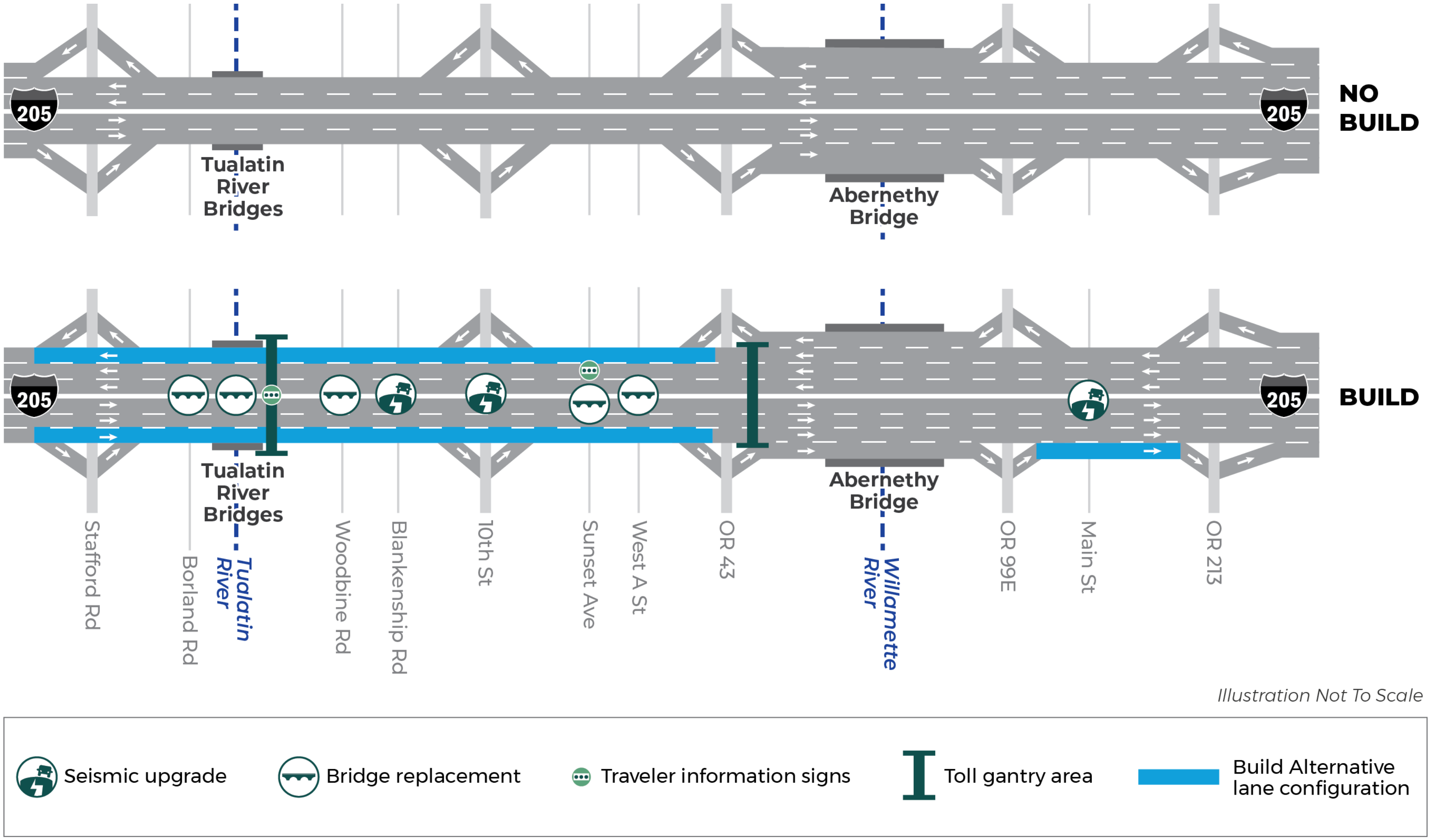
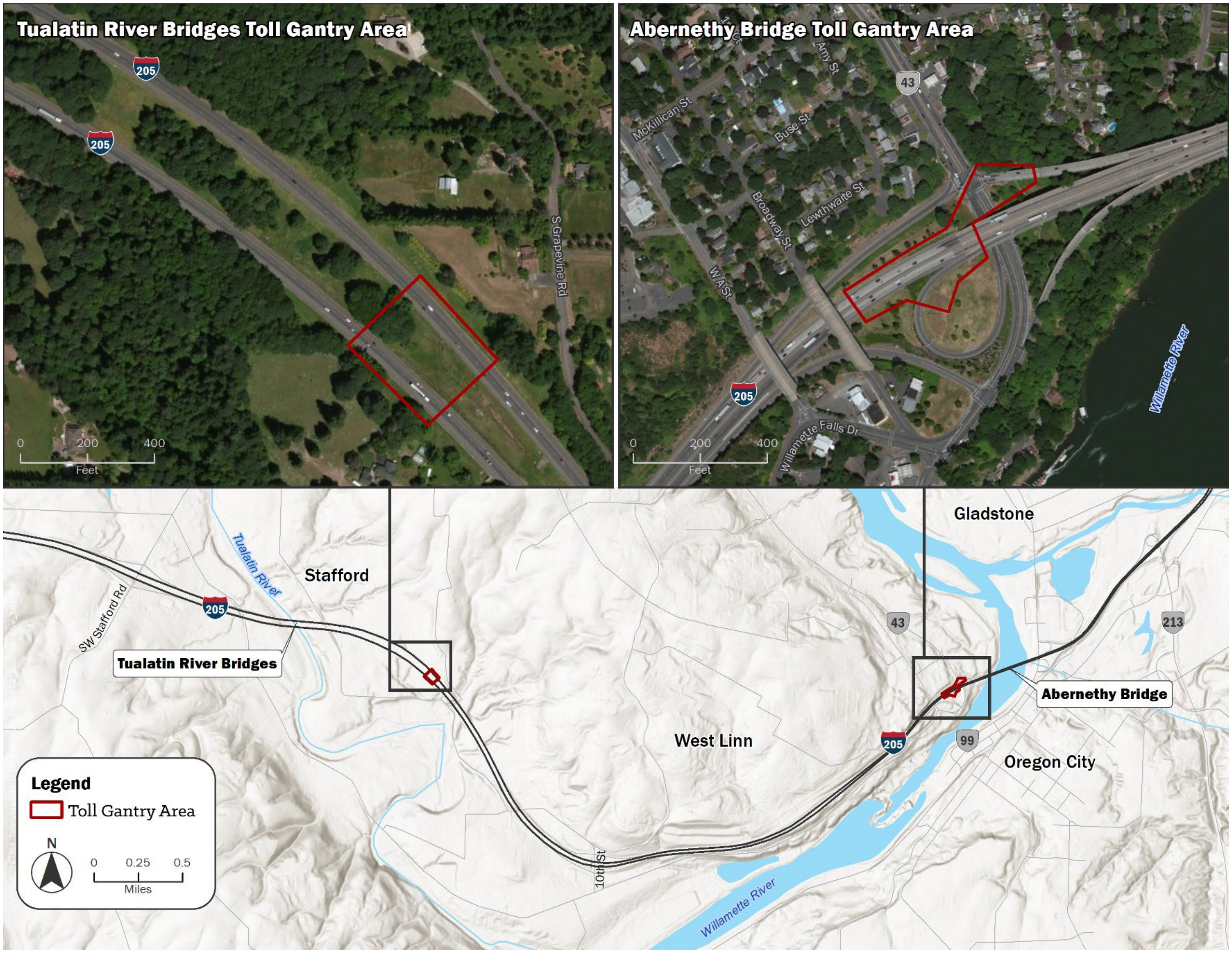


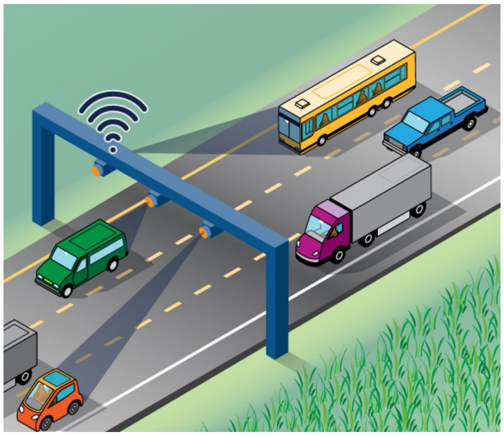
Figure 2-2. Build Alternative: Bridge Tolls – Abernethy Bridge and Tualatin River Bridges



Tolling Technology

Under the Build Alternative, tolling would consist of an all-electronic system that would automatically collect tolls from vehicles traveling on the highway, as shown in Figure 2-3. There would be no toll booths requiring drivers to stop. Rather, antennae, cameras, lights, and other sensors would be mounted on the toll gantries spanning the roadway and would either (1) read a driver's toll account transponder (a small sticker placed on the windshield), or (2) capture a picture of a vehicle's license plate and send an invoice to the registered owner of the vehicle.

Figure 2-3. Electronic Toll System



How electronic tolling works. An all-electronic system would automatically collect tolls from vehicles traveling on the highway. A transponder (a small sticker placed on the windshield) is read and connected to a prepaid account. If a vehicle doesn't have a transponder, a camera captures the car's license plate, and the registered owner is billed. This keeps traffic flowing without stopping to pay tolls.

Tolling Infrastructure

Toll gantries would consist of vertical columns on the outside of the travel lanes and a horizontal structure that would span the travel lanes to which the electronic tolling equipment would be attached. Toll gantries would be constructed of a metal framework with metal or concrete support structures. Gantries and supporting infrastructure would be designed to ensure consistency with other improvements to I-205 included in the Project. The final structure type and design would be determined during the preliminary design of the gantries and would be based on cost, aesthetics, and ease of construction. The toll gantry areas would include paved parking for service vehicles, which would typically be protected by a safety barrier or guard rail.

The toll gantry areas would include paved parking for service vehicles, which would typically be protected by a safety barrier or guard rail. In addition, it is assumed that the toll gantry structures would include catwalks to provide maintenance access to the structures without having to close travel lanes.

In addition to the toll technology mounted overhead on the gantries themselves, the gantries would require some additional toll system equipment for data processing, storage, and network operations. This equipment is generally enclosed within a small, access-controlled concrete structure, from which connections to existing ODOT data fiber and commercial power would be routed. ODOT currently operates a fiber data network with a 48-strand fiber-optic cable along the north side of I-205, to which the toll system equipment would be connected. A backup generator (typically fueled by diesel or natural gas) would be provided so the toll equipment would function during power outages. No relocation of existing utilities to accommodate construction of the gantries or any supporting infrastructure is expected.

The Abernethy Bridge toll gantry area would include three toll gantries: a mainline gantry structure that spans all highway lanes, and gantries over the northbound on-ramp and the southbound off-ramp. Each toll gantry would include a single gantry structure. The on-ramp and off-ramp gantries would likely be cantilevered structures. The Tualatin River Bridges toll gantry area would include two toll gantries: one over the mainline northbound travel lanes and one over the mainline southbound travel lanes. Each toll gantry would include a single gantry structure.

Toll Implementation

As Oregon's toll authority, the Oregon Transportation Commission will set toll rates, policies (including discounts and exemptions), and price escalation. If tolling is approved, the Oregon Transportation Commission would ultimately set toll rates at levels sufficient to meet all financial commitments, fund Project construction and maintenance, and manage congestion. The Oregon Transportation Commission is expected to finalize toll rates in 2024. ODOT could begin tolling as early as December 2024, before the completion of construction of Project improvements to I-205 under the Build Alternative.

Toll Rate Assumptions

Toll rates have not been determined and will be set by the Oregon Transportation Commission if tolling is approved. For environmental analysis and financial planning purposes, a baseline weekday variable-rate toll schedule was identified that balances the objectives of revenue generation sufficient to meet the funding target for capital construction of the I-205 improvements, and alleviating congestion on I-205 during peak travel times. The identified toll rates would provide a sustainable source of revenue for ongoing corridor operations and maintenance and for periodic repair and replacement costs. For environmental analysis and financial planning purposes, the identified baseline toll rate schedule for the year of opening varies as follows:

- During off-peak hours, toll rates are assumed to be lowest, ranging from $0.55 overnight (from 11 p.m. to 5 a.m.) to $0.65 in the midday and evening (from 10 a.m. to 1 p.m. and 8 p.m. to 11 p.m.) to cross a single bridge.
- During peak hours (6 a.m. to 9 a.m. and 3 p.m. to 7 p.m.), toll rates are assumed to be highest during peak hours, varying from $1.65 to $2.20 to cross a single bridge depending on which weekday peak hour.
- During the shoulder period hours just before and after the peak periods (5 a.m. to 6 a.m., 9 a.m. to 10 a.m., 1 p.m. to 3 p.m., 7 p.m. to 8 p.m.), toll rates are assumed to be $1.00 to cross a single bridge.

These assumed rates would apply to each bridge crossing. The rates for a through trip (i.e., crossing both the Abernethy and Tualatin River bridges) would be double the assumed toll rate for only crossing one bridge. The assumed toll rates are provided in state fiscal year (FY) 2025 dollars, indicative of the year of opening, and are assumed to escalate annually with general price inflation, conservatively assumed to be 2.15% per year.

A recent financial analysis confirmed that under the assumed baseline toll rates, there would be sufficient net toll revenues to leverage bonds that would meet the toll funding contribution target for construction of the planned I-205 improvements (ODOT 2022b).

2.3.2 Improvements to I-205

Under the Build Alternative, a 7-mile portion of I-205 would be widened between Stafford Road and OR 213, with added through lanes between Stafford Road and OR 43, and a northbound auxiliary lane from OR 99E to OR 213. Eight bridges between Stafford Road and OR 213 would be replaced or reconstructed to withstand a major seismic event. New drainage facilities would be installed in both directions of I-205.

Bridge Reconstructions and Replacements

The following bridges would be reconstructed with foundation improvements and substructure upgrades for seismic resiliency but would not be replaced:

- Northbound I-205 bridge over Blankenship Road – Mile Post (MP) 5.84
- Southbound I-205 bridge over Blankenship Road – MP 5.90

- Northbound I-205 bridge over 10th Street (West Linn) – MP 6.40
- Southbound I-205 bridge over 10th Street (West Linn) – MP 6.42
- I-205 bridge over Main Street (Oregon City) – MP 9.51

The following bridges would be replaced to meet seismic design standards and to facilitate the widening of I-205:

- Northbound I-205 bridge over SW Borland Road – MP 3.82
- Southbound I-205 bridge over SW Borland Road – MP 3.81
- Northbound I-205 bridge over the Tualatin River – MP 4.1
- Southbound I-205 bridge over the Tualatin River – MP 4.08
- Northbound I-205 bridge over Woodbine Road – MP 5.14
- Southbound I-205 bridge over Woodbine Road – MP 5.19
- Sunset Avenue (West Linn) bridge over I-205 – MP 8.28
- West A Street (West Linn) bridge over I-205 – MP 8.64

The I-205 bridges over 10th Street and Blankenship Road would be widened and raised to meet the proposed new highway grade. The I-205 bridges over the Tualatin River and SW Borland Road would be replaced on a new alignment between the existing northbound and southbound directions to accommodate construction. The I-205 bridges over Woodbine Road would be replaced on the existing alignment and raised to meet the proposed new highway grade. The Broadway Street Bridge over I-205 would be removed to enhance the function of the OR 43 interchange.

2.3.3 Construction

Construction of the Build Alternative is expected to last approximately 4 years, beginning in late 2023 with construction of toll gantries and toll-related infrastructure and continuing from 2024 through 2027 with construction of I-205 widening and seismic improvements. Most toll-related construction would be conducted alongside I-205 within the existing right-of-way. For highway widening, it is anticipated that construction would be sequenced to widen one direction of I-205 at a time, enabling traffic to be moved to a temporary alignment while the remaining widening work is completed. Construction activities would include adding temporary crossover lanes to enable access to the temporary traffic configurations during roadway widening. Staging areas for construction equipment and supplies for the Build Alternative would be located primarily in the median of I-205 in ODOT right-of-way.

3 Regulatory Framework

Federal and state laws require entities emitting GHGs in excess of threshold values to measure, report, and in some instances, obtain permits to emit GHGs. However, most federal, state and local laws regulate energy use or GHG emissions mainly in terms of conserving energy, and providing means to improve the efficiency of energy use and meet long-term GHG emission reduction goals. No regulations set limits on energy use or GHG emissions at a project level. Energy consumption and GHG emissions are estimated for the Project alternatives to demonstrate consistency with the policies described in this section.

3.1 Federal Laws, Regulations, and Policies

3.1.1 National Environmental Policy Act

NEPA (42 United States Code 4332) requires that federal agencies consider environmental effects before taking actions that could substantially affect the human environment. As interpreted by the Council on Environmental Quality, NEPA requires consideration of the "environmental consequences" of a proposed project in the decision-making process, including "energy requirements and conservation potential of various alternatives and mitigation measures" (Sec. 1502.15(e)). On August 1, 2016, the Council on Environmental Quality released Final Guidance for Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. This guidance was withdrawn, and new guidance was issued. This new guidance was rescinded in 2021, and the Council on Environmental Quality is currently reviewing and updating the 2016 guidance. The recommendations included in the 2016 guidance include quantifying direct and indirect GHG emissions related to a proposed action; using available information when assessing the potential state of the affected environment in a NEPA analysis, instead of undertaking new research; and encouraging agencies to use the information developed during the NEPA review to consider alternatives that would make the actions and affected communities more resilient to the effects of a changing climate.

3.1.2 Federal Highway Administration

FHWA Technical Advisory T6640.8A provides guidance on the preparation of environmental documents, including the analysis of energy effects. It states that an environmental impact statement "should discuss in general terms the construction and operational energy requirements and conservation potential of the various alternatives under consideration." The I-205 Toll Project Environmental Assessment incorporates these guidelines for scale of analysis.

3.2 State Laws, Regulations, and Policies

3.2.1 Oregon State Agencies

Executive Order 20-04 directs certain state agencies to take specific actions to reduce emissions and mitigate the impacts of climate change and provides overarching direction to state agencies to exercise their statutory authority to help achieve Oregon's climate goals.

3.2.2 2021 Climate Change Adaptation Framework

The Department of Land Conservation and Development collaborated with multiple agencies to develop the 2021 Climate Change Adaptation Framework, which explores the impacts of climate change in Oregon and identifies how state agencies can effectively respond to them. The Framework builds on a

2010 Framework document and will be adopted as part of Oregon's Natural Hazard Mitigation Plan (Oregon Department of Land Conservation and Development 2021).

3.2.3 Oregon Statewide Transportation Strategy – A Vision for Greenhouse Gas Emission Reduction, Volume 1 (March 20, 2013)

ODOT's Statewide Transportation Strategy examines all aspects of the transportation system and identifies transportation system, vehicle and fuel technology, and urban land use pattern strategies to result in a 2050 with 60% fewer GHG emissions than 1990. The Statewide Transportation Strategy is neither directive nor regulatory, but rather points to promising approaches for further consideration by policymakers at the national, state, regional, and local levels (ODOT 2013).

3.2.4 2021 – 2023 Strategic Action Plan (November 2021)

The Strategic Action Plan, presented by the Oregon Transportation Commission and ODOT, identifies three strategic priorities Equity, Modern Transportation and Sufficient and Reliable Funding) to inform ODOT's work, guide decision-making, and act as objectives against which the agency holds itself accountable. These priorities are interrelated, overlapping, and intended to identify specific actions that lead to concrete, tangible outcomes. Climate Equity and Climate Change are two of the goals associated with these priorities. There are 10 outcomes associated with the goals and priorities. Reducing ODOT's carbon footprint is one of the 10 outcomes (Oregon Transportation Commission 2021).

3.2.5 ODOT Climate Action Plan 2021 – 2026 (July 2021)

The Climate Action Plan is ODOT's 5-year plan for work to address the impacts of climate change and extreme weather on the transportation system. The plan was developed by the ODOT Climate Office and includes actions ODOT is taking between 2021- 2026 to reduce greenhouse gas emissions from transportation, address climate justice and make the transportation system more resilient to extreme weather events (ODOT 2021).

3.2.6 Metropolitan Area

OAR 660 Section 44 outlines specific GHG reduction targets for the years 2040 through 2050, applicable to the Portland metropolitan area, culminating in a reduction target of 35% by the year 2050. Emission reduction targets in this rule are defined as a reduction from 2005 emission levels of per capita GHG emissions from travel in light vehicles. The Portland Metro Council (Metro) adopted the Climate Smart Strategy in 2014 in response to the legislative mandate. The Climate Smart Strategy outlines the region's strategy to realize local visions for land use and transportation, while also reducing greenhouse gas emissions to meet the legislative requirements.

4 Methodology

This section describes the methods used to evaluate energy and GHG impacts from the Project.

4.1 Area of Potential Impact

Figure 4-1 shows the Area of Potential Impact (API) used to evaluate energy and GHG impacts. The API was developed using a methodology established by FHWA to evaluate emissions of mobile source air toxics (MSAT) and includes the Project area and other nearby roadways where changes in traffic could cause changes to energy consumption and GHG. The same methodology was used to develop the API for the air quality analysis for the Project (see *I-205 Toll Project Air Quality Technical Report*.) There is no standard guidance to define a study area for energy use or GHG emissions, and for projects that require a quantitative MSAT analysis, it is common practice to use the MSAT study area (API) for the energy and GHG emissions analysis.

The energy and GHG API encompasses the roadway segments (links) that could experience changes in congestion (e.g., traffic volumes and speed) caused by the Project. Toll projects have the potential to affect vehicle trips at distances from the tolled facility because travelers may choose different routes or times of day to travel. Analyzing a metropolitan area's entire roadway network results in emissions estimates for many roadway links not affected by a project, therefore diluting the results of the analysis and not allowing for a meaningful comparison between alternatives. The energy and GHG emissions analysis is limited to areas expected to experience a meaningful change in emissions based on recommendations outlined in FHWA's *Frequently Asked Questions (FAQ) Conducting Quantitative MSAT Analysis for FHWA NEPA Documents* (FHWA 2016) (referred to herein as FHWA FAQ), consistent with the API used for the *I-205 Toll Project Air Quality Technical Report*.

The MSAT guidance defines a meaningful change in emissions as approximately plus or minus 10% between the No Build and Build conditions, and it includes recommended metrics to define the affected network and emphasizes using project-specific knowledge and consideration of local circumstances. Analysts determined the energy and GHG API using link-level traffic data to compare the change in volumes on each link (roadway segment) between the 2045 No Build Alternative and the 2045 Build Alternative that was expected to result in changes in annual average daily traffic (AADT). This API was determined by first identifying roadway links associated with the Project plus roadway links that have a change in AADT of plus or minus 5% or more.

The analysts further refined the resulting set of links based on Project-specific knowledge and circumstances. The FHWA FAQ acknowledges that it is possible that low-volume links far removed from a project's footprint may appear to show a change in traffic volumes that can be attributed to a modeling artifact. To focus on the API on roadways that are expected to capture a meaningful impact on emissions, census tract boundaries were used to develop the API boundary. South of the Project area, analysts removed census tracts that were rural, had relatively lower traffic volumes, and were not part of a connected network. North of the Project area, analysts removed census tracts that were associated with the downtown Portland area because the modeled changes in traffic are not attributed to the Project, and the high traffic volumes would dilute the analysis results.

Figure 4-1. Energy and Greenhouse Gas Area of Potential Impact

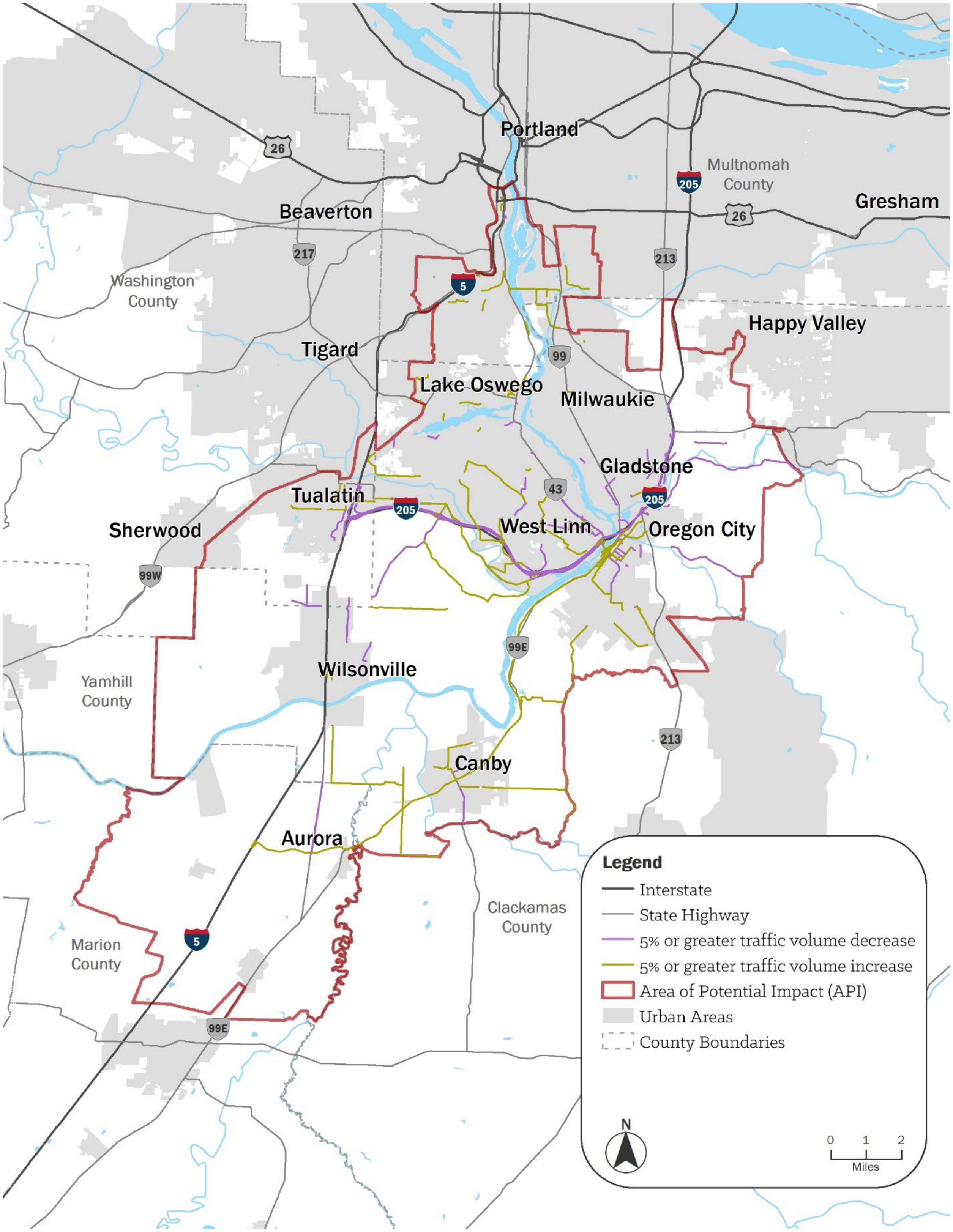


Figure 4-1 shows the API boundary, which includes the segments with a predicted change in AADT of greater than 5% or less than negative 5% that were used to determine the affected network. Only the highlighted links within the boundary are included in emissions calculations. This methodology assumes that for each alternative analyzed in the Environmental Assessment, direct GHG emissions impacts would originate predominantly from within the proposed API boundary. Direct impacts on energy consumption due to fuel use would occur within this boundary. GHG emissions associated with each alternative would be dispersed into the atmosphere.

The API for indirect impacts on energy consumption and GHG emissions is a larger area for which no Project boundary can be defined. Indirect effects encompass upstream production of materials and energy processes and can be considered to include the global atmosphere.

4.2 Describing the Affected Environment

4.2.1 Published Sources and Databases

Data used in the 2018 Documented Categorical Exclusion prepared for the I-205 Improvements Project was reviewed to confirm its relevancy and applicability to this study. The following data sources were used to determine and describe the existing conditions for energy and GHG emissions:

- Metro regional travel demand model output
- Energy consumption statistics from the U.S. Energy Information Administration
- GHG emission trends from the Oregon Global Warming Commission
- Climate change discussion and trends from *Fourth Oregon Climate Assessment Report, State of Climate Science: 2019*
- Metro MOtor Vehicle Emissions Simulator (MOVES) input files
- Oregon's Department of Environmental Quality (DEQ) MOVES input files

4.2.2 Contacts and Coordination

DEQ provided vehicle emission modeling files. DEQ develops MOVES input files for regional emissions analyses, and these files were supplemented with Project-specific data to complete the energy and GHG analysis. The Project traffic analysis team provided additional data, including output from the regional travel demand model that captures volume and speed changes caused by the project alternatives, described in detail in the *I-205 Toll Project Transportation Technical Report*.

4.3 Effect Assessment Methods

The effects analysis identifies the direct, indirect, and construction impacts and benefits to energy consumption and GHG emissions for the Build and No Build alternatives. The analysis includes both the operational and construction activities that would contribute to these effects.

4.3.1 Short-Term Effect Assessment Methods

The analysis of energy and GHG emissions effects from Project construction includes the following:

- GHG emissions and energy consumption from construction equipment during the construction period
- GHG emissions and energy consumption from vehicle delay during construction

The analysis discusses effects from construction activities qualitatively because no planning-level tools are available to estimate emissions and energy use from the construction activities associated with the Project.

4.3.2 Long-Term Effect Assessment Methods

The analysis of long-term direct effects includes the energy use and GHG emissions from the operations of vehicles on the roadway network. The analysis includes an evaluation of projected energy consumption and GHG emissions from the roadway segments expected to experience meaningful changes in emissions as described in Section 4.1, Area of Potential Impact.

This section describes the methods used to calculate total energy consumption and GHG emissions from the API for each of the following scenarios:

- Existing (2015)
- No Build Alternative (2027)
- Build Alternative (2027)
- No Build Alternative (2045)
- Build Alternative (2045)

These methods rely on the same model and data inputs as the air quality analysis.

Model Inputs and Options

The U.S. Environmental Protection Agency's (USEPA) MOVES model version MOVES3.0.2 was used to estimate emissions and energy consumption from vehicle emissions in the API. MOVES is the EPA's state-of-the-art tool for estimating emissions from highway vehicles. The model is based on analyses of millions of emission test results and considerable advances in EPA's understanding of vehicle emissions. Compared to previous versions, MOVES3.0.2 incorporates the latest emissions data, applies more sophisticated calculation algorithms, accounts for new regulations including the Heavy-Duty Greenhouse Gas Phase 2 rule and the Safer Affordable Fuel-Efficient Vehicles Rule, and provides an improved user interface. Table 4-1 summarizes the MOVES run specifications as recommended in the FHWA FAQ.

MOVES input files were developed using data provided by DEQ, output from the traffic analysis, and EPA defaults. MOVES model runs combined data representing regional conditions and Project-specific data characterizing the differences in traffic volumes and speeds. Table 4-2 summarizes specific inputs and their sources, and more details on each item are provided after Table 4-2.

Table 4-1. MOVES Run Specifications Options

MOVES Tab	Model Selections
Scale	• County Scale • Inventory Calculation Type
Time Span	• Hourly time aggregation including all months, days, and hours • Analysis years 2015, 2027, and 2045
Geographic Bounds	• Multnomah County was used to represent the region, consistent with Metro's regional emissions model
Vehicles/Equipment	• All on-road vehicle and fuel type combinations
Road Type	• Rural restricted, rural unrestricted, urban restricted, and urban unrestricted
Pollutants and Processes	• CO_2 equivalent, total energy consumption, and predecessors were selected (predecessor pollutants are atmospheric CO_2, methane, nitrous oxide, and total gaseous hydrocarbons) • Processes included running exhaust, crankcase running exhaust, evaporative permeation, and evaporative fuel leaks
Manage Input Data Sets	• Database provided by Metro was imported to account for adoption of California's Low Emission Vehicle program as well as participation in the Multi-State Zero Emission Vehicle Action Plan
Output	• Output is an annual inventory of pollutant emissions and energy consumption by roadway type and vehicle type

CO_2 = carbon dioxide

Table 4-2. MOVES County Data Manager Inputs

County Data Manager Tab	Data Source
Source Type Population	Oregon Department of Environmental Quality and MOVES defaults
Age Distribution	Oregon Department of Environmental Quality and MOVES defaults
Fuel	Oregon Department of Environmental Quality and MOVES defaults
Inspection/Maintenance Programs	Oregon Department of Environmental Quality
Meteorological Data	MOVES county defaults
Road Type Distribution	Created from Project data
Average Speed Distribution	Created from Project data
Vehicle Type Vehicle-Miles Traveled	Created from Project data

Moves = Motor Vehicle Emissions Simulator

MOVES was run at the county scale, using inputs consistent with Metro's regional emissions modeling. Metro provided input files that were modified for the Project analysis as follows:

- **Source Type Population:** DEQ provided the population of passenger cars, light passenger trucks, and light commercial trucks for analysis year 2019. The population of the remaining vehicle types was estimated using the ratio of MOVES default population to vehicle miles traveled (VMT) by source type. The same population data was used for each analysis year because MOVES uses only the relative distribution in calculations for running emissions, and the absolute population is not needed.
- **Age Distribution:** DEQ provided the age distribution of passenger cars, light passenger trucks, and light commercial trucks for analysis year 2019. MOVES national default age distributions were used for the remaining vehicle types. This data was used with the Age Distribution Project Tool for MOVES3 to develop the age distribution for the analysis years. This tool uses data from the Energy Information Administration to estimate future fleet turnover.
- **Fuel:** MOVES defaults for Multnomah County were used for fuel supply, fuel usage fraction, and fuel type and technology allocations. Default fuel formulation data was adjusted as recommended by DEQ

to reflect the local biodiesel formulation details. The EPA does not provide MOVES defaults for electric vehicle use, and conservatively assumes that no electric vehicles are in the fleet. In the absence of a methodology to predict the future electric vehicle market share, no electric vehicles were considered in this emissions analysis.

- **Inspection/ Maintenance Programs:** DEQ prepared MOVES input files characterizing required vehicle inspection/maintenance programs in the metropolitan area for analysis year 2019. These files were modified for analysis years 2027 and 2045 by adjusting the ending model years as recommended by the EPA to assume the programs would remain in place with consistent grace periods and exemptions based on vehicle age.
- **Meteorological Data:** MOVES defaults for Multnomah County were used for the temperature and humidity profiles.

Link-by-link traffic data developed as part of the traffic analysis was used to create input files to demonstrate the effects of the Project for each scenario analyzed:

- Existing (2015)
- No Build Alternative and Build Alternative (2027)
- No Build Alternative and Build Alternative (2045)

The link-by-link traffic data indicated the link length and roadway type, and it included volume and average modeled speed data for each hour of an average weekday. The data was processed for use in MOVES using the following assumptions:

- **Road Type Distribution:** The roadway types (also called functional class) included in the regional travel demand model were mapped to the four MOVES roadway types: rural restricted, rural unrestricted, urban restricted, and urban unrestricted. The off-network road type was not used for this analysis.
- **Average Speed Distribution:** The link-level traffic data was provided for each of hour of the day. Speeds were mapped to respective MOVES 5-mile-per-hour speed bins. In the absence of weekend speed estimates, the average weekday speed profile was applied to all days in the analysis year.
- **Vehicle Type VMT:** VMT from each hour was added to develop a daily VMT value for each scenario modeled. The link-level volume data was provided by three vehicle types: passenger vehicle, medium truck, and heavy truck. The VMT from these three categories were allocated to the 13 MOVES source types using the MOVES county default to determine the distribution within each vehicle type. For example, the passenger vehicle VMT was divided among the appropriate MOVES source types (e.g., motorcycles, passenger cars, passenger trucks) using the percentages in the MOVES default VMT for Multnomah County. MOVES county defaults were used for the hourly VMT distribution.

MOVES was used to estimate annual on-road GHG emissions in units of tons of carbon dioxide equivalent (CO_2e) and energy consumption in British thermal units (Btu) from the API for each scenario. CO_2e emissions are output directly from MOVES based on the total emissions of CO_2, methane, and nitrous oxide. MOVES incorporates improvements in fuel economy in future analysis years by integrating information about specific federal regulations and their required phase-in timelines. The CO_2e emissions and total energy consumption within the API for the Build Alternative was compared with the No Build Alternative. The implications of the changes in GHG emissions and energy consumption to climate change are discussed in the *I-205 Toll Project Cumulative Impacts Technical Report*.

Quantification of GHG emissions and energy use from equipment performing routine maintenance on a facility is based on the centerline miles of affected roadways. Because the Project will not add roadway capacity, there would be no change in maintenance impacts due to the project, and these were not quantified.

The analysis provides annual CO_2e emissions in tons and energy consumption in million Btu (mmBtu) for each source of operational emissions and energy use (tailpipe, fuel cycle, and maintenance) for each analysis year for the No Build and Build Alternatives.

4.3.3 Indirect Effects Assessment Methods

Indirect GHG emissions from long-term project operations include emissions during fuel extraction, refining, and transport prior to use by vehicles, known as fuel cycle emissions. The analysis calculated fuel cycle emissions by applying the FHWA-recommended fuel cycle factor of 0.27 applied to the tailpipe emissions calculated with MOVES for each analysis year (U.S. Department of Transportation 2010).

Indirect impacts on energy consumption and GHG emissions during construction include upstream activities related to the materials and fuels used during construction of the Project. The analysis describes these indirect impacts qualitatively.

4.3.4 Cumulative Impacts Assessment Methods

The *I-205 Toll Project Cumulative Impacts Technical Report* analyzes the Project's potential to contribute to cumulative impacts on energy and GHG emissions and the potential for those impacts to affect climate change.

4.4 Mitigation Approach

As demonstrated in Section 6, the Build Alternative would contribute fewer GHG emissions and consume less energy than the No Build Alternative. No mitigation specific to the Build Alternative is proposed; however, ODOT implements minimization measures designed to promote operational energy efficiency and minimize GHG emissions for all roadway projects. Section 7 provides qualitative descriptions of methods to minimize operational and construction impacts on energy and GHG emissions. Construction mitigation is based on ODOT Standard Specifications Section 290. This guidance includes air pollution control measures and methods to reduce the impact of construction delays on traffic flow, which also reduce energy consumption and GHG emissions.

5 Affected Environment

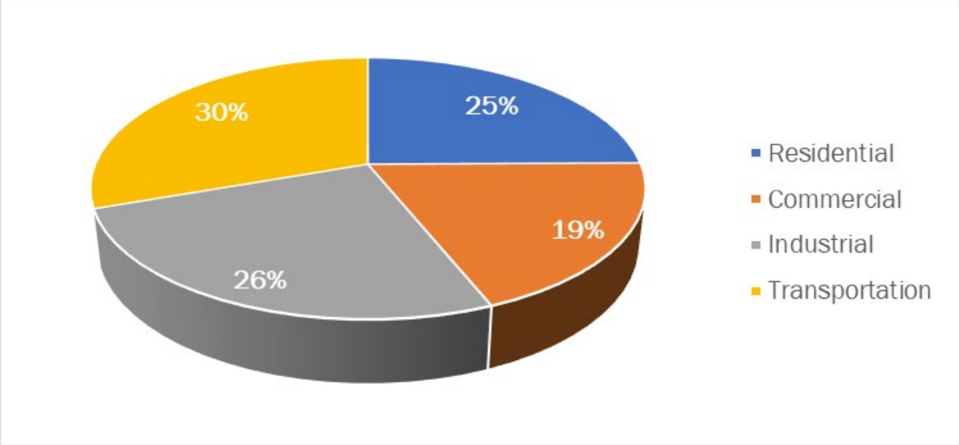
This section describes existing energy and GHG conditions and trends in the API that may be affected by the Project. Trends in GHG and energy use are reported at the state level. Existing GHG emissions and energy consumption from vehicle use within the API is presented for the analysis year 2015.

5.1 Energy Consumption

Energy is consumed while constructing and operating transportation projects. Construction energy consumption involves the non-recoverable, one-time energy expenditure involved in constructing the physical infrastructure associated with a project. After construction, operational energy consumption includes fuel consumed by vehicles using the transportation facility, as energy associated with maintenance of the facility. Energy is commonly measured in terms of Btu, which is defined as the amount of heat required to raise the temperature of 1 pound of water by 1 degree Fahrenheit.

Transportation accounts for a major portion of the energy consumed in Oregon, at approximately 30% (Figure 5-1). Petroleum (e.g., gasoline, diesel fuel, jet fuel) was the predominant source of transportation energy consumption in Oregon in 2019, at approximately 98% (EIA 2021). Natural gas and electric vehicles accounted for the remaining 2% of transportation energy consumption.

Figure 5-1. Oregon Energy Consumption by End-Use Sector (2019)



Source: EIA 2021

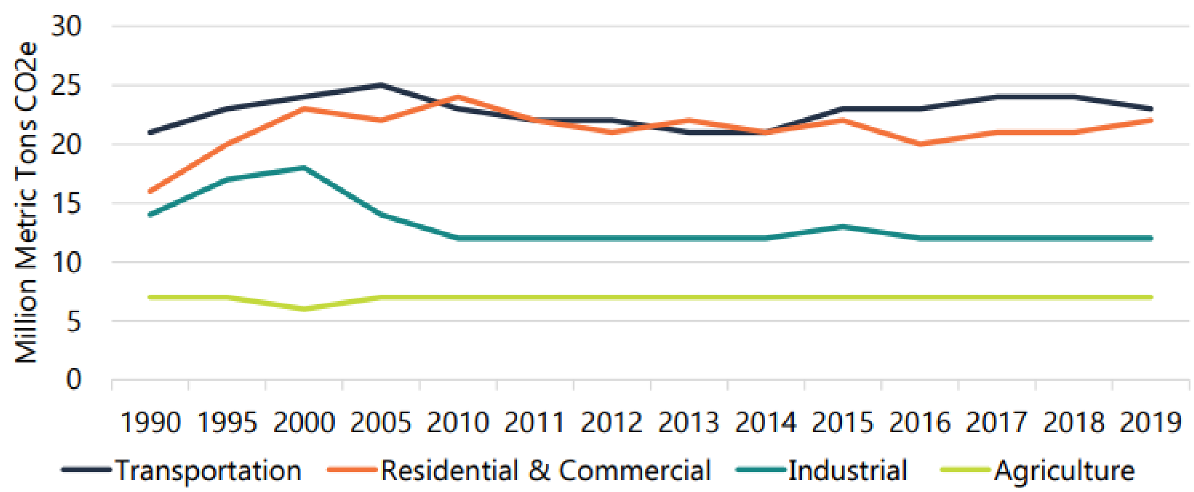
Oregon ranks number 29 of the 50 states in terms of transportation energy consumption, with 312.4 trillion Btu of transportation energy consumed in 2019 (EIA 2021). In comparison, Texas ranked number one with the consumption of approximately 3,334 trillion Btu of transportation energy in 2019. On a per-capita basis, Oregon ranks number 45 of the 50 states in terms of transportation energy consumption, at approximately 74 million Btu consumed per capita in 2019. In comparison, Alaska ranked first at 222 million Btu of transportation energy consumed per capita in 2019.

5.2 Greenhouse Gas Emissions

Vehicles that run on fossil fuels emit a variety of gases during their operation; some of these are GHGs. The GHGs associated with transportation are carbon dioxide (CO_2), methane, and nitrous oxide, and they are often reported as CO_2e. CO_2e is a unit that provides a common scale for measuring the climate effects of different gases based on their global warming potential. GHG concentrations are not routinely measured at air pollutant monitors. However, agencies, companies, and individuals can calculate their emissions of GHG as a way to monitor the contribution to global GHG levels. DEQ develops the sector-based GHG emissions inventory based on the internationally accepted GHG 2006 accounting protocols from the Intergovernmental Plan on Climate Change (IPCC), which are also used by the EPA to generate the U.S. GHG Inventory. The sector-based GHG emissions inventory allows policymakers to compare emissions reduction opportunities across sectors and gases.

Oregon Law requires that the Oregon Global Warming Commission deliver a report to the Legislature every 2 years. Generally, the Commission uses the reports as a platform to educate and inform legislators and the public about current critical climate facts, policies, and strategies. The most recent report indicates that transportation (including highway, rail, and air transport) is the greatest contributor to GHG emissions in Oregon, followed by the residential and commercial sectors (Oregon Global Warming Commission 2020). Figure 5-2 summarizes Oregon's GHG emissions trends through 2019.

Figure 5-2. Oregon Greenhouse Gas Emission Trends by End-Use Sector



Source: Oregon Global Warming Commission 2020

5.3 Existing Conditions in Area of Potential Impact

Table 5-1 summarizes estimated GHG emissions and energy consumption from vehicle operations in the API for 2015.

Table 5-1. Greenhouse Gas Emissions and Energy Consumptions (2015)

Parameter	2015
Energy Consumption (mmBtu)	5,148,048
Direct Tailpipe CO_2e emissions (MT)	393,312
Indirect Fuel Cycle CO_2e emissions (MT)	106,194
Total CO_2e emissions (MT)	**499,506**

Source: USEPA MOVES3.0.2 model

CO_2e = carbon dioxide equivalent; mmBtu = million British thermal units; MT = metric tons

6 Environmental Consequences

This section describes the anticipated beneficial and adverse impacts of the Project with regard to energy and GHG emissions under the No Build Alternative and Build Alternative.

6.1 No Build Alternative

The No Build Alternative consists of existing conditions and any planned actions with committed funding in the API. Under the No Build Alternative, tolling would not be implemented and, without funding from toll revenue, I-205 between the Stafford Road interchange and the OR 213 interchange would remain as two lanes in each direction.

6.1.1 Long-Term Effects

Energy consumption and GHG emissions were estimated for maintenance of the existing roadway (i.e., No Build Alternative) and construction and maintenance of the Build Alternative using the FHWA Infrastructure Carbon Estimator.[4]

Table 6-1 shows the yearly energy use and GHG emissions associated with maintenance of the No Build Alternative. Maintenance calculations include the exhaust and energy from vehicles performing routine maintenance activities such as sweeping, striping, landscaping, and litter pickup, as well as periodic rehabilitation and resurfacing.

Table 6-1. No Build Alternative Annualized Maintenance Energy Use and GHG Emissions

Energy Source	Energy Use (mmBtu/year)	GHG Emissions (MT CO_2e/year)
Direct Energy		
• Maintenance	2,391	233

GHG = greenhouse gas; mmBtu = million British thermal units; $MTCO_2e$ = metric tons carbon dioxide equivalent

Energy consumption and GHG emissions were estimated by modeling affected Project links in the API using the EPA MOVES model. Table 6-2 presents the analysis results for the 2027 and 2045 No Build Alternative. The table also provides existing conditions and annual VMT for context. There would be higher energy consumption in 2045, as compared to 2027, which is consistent with the projected higher VMT. Future CO_2e emissions would be lower than existing emissions, but the emissions in 2045 would be higher compared to 2027 because the impacts from higher VMT would surpass the fuel economy benefits expected from stricter vehicle standards over time.

4 FHWA's Infrastructure Carbon Estimator is a tool that estimates the lifecycle energy and GHG emissions from the construction and maintenance of transportation facilities based on details about the project type and size. The tool provides a planning-level analysis based on a nationwide database of construction bid documents, data collected from state departments of transportation, and consultation with transportation engineers and lifecycle analysis experts (FHWA 2022).

Table 6-2. No Build Alternative Impacts on Energy Consumption and GHG Emissions

Parameter	2015	2027 No Build Alternative	2045 No Build Alternative
Annual Vehicle-Miles Traveled	893,462,632	1,051,694,624	1,222,083,927
Energy Consumption (mmBtu)	5,148,048	4,568,902	4,772,647
Direct Tailpipe CO_{2e} emissions (MT)	393,312	348,397	364,684
Indirect Fuel Cycle CO_{2e} emissions (MT)	106,194	94,067	98,465
Total CO_{2e} emissions (MT)	**499,506**	**442,464**	**463,149**

Source: USEPA MOVES3.0.2 model
CO_2e = carbon dioxide equivalent; GHG = greenhouse gas; mmBtu = million British thermal units; MT = metric tons

6.1.2 Indirect Effects

Table 6-2 includes indirect fuel cycle impacts. The No Build Alternative would result in no additional indirect impacts on energy and GHG emissions.

6.2 Build Alternative

6.2.1 Short-Term Effects

Energy and GHG emissions estimates during construction of the Build Alternative include operation of construction equipment and haul trucks, lifecycle emissions from construction materials, and vehicle delays on roadways during construction. The annualized effects from construction of the Build Alternative are presented in Table 6-3.

Table 6-3. Build Alternative Annualized Construction Energy Use and GHG Emissions

Energy Source	Energy Use (mmBtu/year)	GHG Emissions (MT CO_2e/year)
Upstream Energy		
• Materials	1,479	168
Direct Energy		
• Construction equipment	907	89
• Transportation	180	18
• Construction impacts on vehicle delay	13,916	1,062
Total	**16,482**	**1,337**

Source: FHWA Infrastructure Carbon Estimator
GHG = greenhouse gas; mmBtu = million British thermal units, MT CO_2e = metric tons carbon dioxide equivalent

6.2.2 Long-Term Effects

Table 6-4 shows the annualized energy use and GHG emissions estimates for long-term maintenance of the Build Alternative. The maintenance effects from the Build Alternative would be higher than the No Build Alternative due to the additional lane miles that must be maintained.

Table 6-4. Build Alternative Annualized Maintenance Energy Use and GHG Emissions

Energy Source	Energy Use (mmBtu/year)	GHG Emissions (MT CO_2e/year)
Direct Energy		
• Maintenance	3,834	374

GHG = greenhouse gas; mmBtu = million British thermal units; MT CO_2e = metric tons carbon dioxide equivalent

Table 6-5 compares energy consumption and GHG emissions for the Build Alternative and the No Build Alternative in 2027 and 2045.Under the Build Alternative, energy consumption and GHG emissions would be approximately 6% lower in 2027 and 4% lower in 2045 as compared to the No Build Alternative. These differences are consistent with the projected lower VMT for each analysis year.

Table 6-5. Build Alternative Impacts on Energy Consumption and GHG Emissions

Parameter	2027			2045		
	No Build Alternative	Build Alternative	Percentage Difference	No Build Alternative	Build Alternative	Percentage Difference
Annual VMT	1,051,694,624	965,576,193	-8%	1,222,083,927	1,162,440,219	-5%
Energy Consumption (mmBtu)	4,568,902	4,281,492	-6%	4,772,647	4,572,465	-4%
Direct Tailpipe CO2e Emissions (MT)	348,397	326,604	-6%	364,684	349,473	-4%
Indirect Fuel Cycle CO2e Emissions (MT)	94,067	88,183	-6%	98,465	94,358	-4%
Total CO2e Emissions (MT)	**442,464**	**414,787**	**-6%**	**463,149**	**443,831**	**-4%**

Source: USEPA MOVES3.0.2 model

CO_2e = carbon dioxide equivalent; GHG = greenhouse gas; mmBtu = million British thermal units; MT = metric tons; VMT = vehicle miles traveled

To better understand the energy consumption and emissions results in Table 6-5 and provide detail at the local level, analysts reviewed the VMT in the API by roadway type and vehicle type. Vehicles typically run less efficiently on non-highway roadways because travel on those roadways comprises slower speeds and more stop-and-go activity. Therefore, trips rerouted from highway to non-highway roads could lead to higher GHG emissions.

The VMT values presented in Table 6-6 and Table 6-7 demonstrate that while there would be higher non-highway VMT under the Build Alternative, this difference would be more than offset by lower highway VMT. In addition, the higher non-highway VMT would be primarily from passenger vehicles, and there would be lower non-highway VMT from heavy trucks, which emit GHG at a higher rate, due to the Project. This VMT analysis supports the conclusion that the Project would have the overall effect of net lower GHG emissions and VMT. Despite the potential for trip rerouting onto non-highway roads, implementation of the Build Alternative would result in lower GHG emissions as compared to the No Build Alternative. The *I-205 Toll Project Cumulative Impacts Technical Report* describes the implications of this reduction in GHG emissions for climate change.

Table 6-6. Daily Vehicle Miles Traveled Changes within Area of Potential Impact (2027)

Vehicle Type	No Build Alternative Highway	No Build Alternative Non-Highway	No Build Alternative Total	Build Alternative Highway	Build Alternative Non-Highway	Build Alternative Total
Passenger	1,553,978	1,190,246	**2,744,224**	1,160,118	1,332,361	**2,492,479**
Medium	29,453	10,546	**39,999**	31,214	9,924	**41,139**
Heavy	71,564	25,565	**97,129**	87,873	23,927	**111,799**
All	**1,654,995**	**1,226,357**	**2,881,352**	**1,279,205**	**1,366,212**	**2,645,417**

Source: Metro Regional Travel Demand Model

Table 6-7. Daily Vehicle Miles Traveled Changes within Area of Potential Impact (2045)

Vehicle Type	No Build Alternative Highway	No Build Alternative Non-Highway	No Build Alternative Total	Build Alternative Highway	Build Alternative Non-Highway	Build Alternative Total
Passenger	1,668,131	1,438,642	**3,106,774**	1,362,595	1,546,078	**2,908,673**
Medium	34,034	14,477	**48,513**	40,723	12,499	**53,222**
Heavy	156,628	36,261	**192,888**	191,537	31,337	**222,874**
All	**1,858,795**	**1,489,380**	**3,348,175**	**1,594,856**	**1,589,913**	**3,184,769**

Source: Metro Regional Travel Demand Model

Maintenance Activities

Routine maintenance of the roadway would be similar to the No Build Alternative and would require some energy consumption and GHG emissions. The Build Alternative would have additional energy consumption and GHG emissions as compared with the No Build Alternative due to the maintenance of toll gantries and supporting infrastructure. This analysis did not quantify energy consumption and GHG emissions for these activities because they would not likely be substantial enough to produce an effect on energy consumption or GHG emissions.

6.2.3 Indirect Effects

Table 6-2 includes the indirect fuel cycle effects on GHG emissions from the Build Alternative. The Build Alternative is based on travel demand modeling that includes expected growth and planned projects in the region. The Build Alternative is not expected to create other effects that would cause indirect impacts.

6.3 Summary of Effects by Alternative

Table 6-8 provides a comparison of anticipated energy and GHG emissions impacts and benefits by alternative.

Table 6-8. Summary of Energy and GHG Emissions Impacts and Benefits for the Build Alternative

Impacts	No Build Alternative	Build Alternative
Short-Term Effects	• None	• Temporary effects on energy and GHG emissions from operation of construction equipment and haul trucks, as well as lifecycle emissions from construction materials and vehicle delays on roadways.
Long-Term Direct Effects	• None	• 6% lower total operational energy consumption and GHG emissions in 2027 as compared to No Build Alternative. • 4% lower total operational energy consumption and GHG emissions in 2045 as compared to No Build Alternative.
Indirect Effects	• None	• Indirect effects from upstream sources of GHG emissions are included in GHG emissions estimates as the indirect fuel cycle CO_2e emissions.

CO_2e = Carbon Dioxide Equivalent; GHG = greenhouse gases

7 Avoidance, Minimization, and/or Mitigation Commitments

7.1 Short-Term Impacts

The following measure will be implemented to minimize energy and GHG emissions impacts from construction activities:

- Contractors will be required to comply with ODOT Standard Specifications Section 290, which has requirements for environmental protection and includes air pollution control measures. These control measures include vehicle and equipment idling limitations, which would also reduce energy usage and GHG emissions.

7.2 Long-Term Impacts

Estimated energy consumption and GHG emissions from the Build Alternative would be lower than the No Build Alternative; therefore, no mitigation is proposed for Project operations. The following measures could be implemented to promote energy efficiency and minimize GHG emissions during the construction and operation phases:

- Using recycled and energy-efficient construction materials
- Applying best management practices for maintenance of the toll gantries and supporting infrastructure
- Using energy-efficient electrical systems for toll gantries and technical shelters

8 Preparers

Individuals involved in preparing the Energy and GHG Emissions Technical Report are identified in Table 8-1.

Table 8-1. List of Preparers

Name	Role	Education	Years of Experience
Rebecca Frohning	Energy and GHG Emissions Technical Lead	BS, Earth and Atmospheric Sciences	21
Ginette Lalonde	Energy and GHG Emissions QC Reviewer	BS, Civil Engineering	22

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