3.19 Climate Change

According to the U.S. Environmental Protection Agency (EPA), multiple lines of evidence show changes in weather, oceans, and ecosystems (EPA 2022b) across the world. Examples include:

- Changing temperature and precipitation patterns.
- Increases in ocean temperatures, sea level, and acidity.
- Melting of glaciers and sea ice.
- Changes in the frequency, intensity, and duration of extreme weather events.
- Shifts in ecosystem characteristics, like the length of the growing season, timing of flower and algal blooms, water temperatures for fish, and migration of birds.

These changes to the earth's climate are due to a recent buildup of greenhouse gases (GHGs) in the atmosphere, which has resulted in dangerous effects on human health and welfare and to ecosystems (EPA 2022a). Climate change may result in localized effects in the study area.

The developed world's transportation systems are reducing reliance on fossil fuels and increasing use of electric and renewable fuels energy production and vehicles. Along the I-5 corridor, California, Oregon, and Washington have regulations to reduce fossil fuel use over time. These regulations are expected to reduce GHG emissions associated with transportation sources.

This section identifies the climate conditions in the region, highlights federal and state policy and regulation on climate, identifies the potential long-term climate impacts from the Modified LPA, and provides potential mitigation measures for unavoidable effects. In addition to considering climate effects from the Modified LPA, this section considers the potential effects or influence of changing climate conditions on the Modified LPA. The information presented in this section is based on the technical reports for climate, transportation, and energy.

The IBR Program aims to accelerate the local reduction of GHG emissions by developing alternatives to driving, managing transportation demand, and minimizing emissions associated with construction. Through design, the IBR Program also intends to minimize the expected GHG associated with the long-term maintenance of the proposed new infrastructure.

Actions to reduce or reverse impacts associated with transportation emissions require a holistic approach that considers patterns in land use and regional travel flows, in addition to major infrastructure. Both Oregon and Washington have among the strongest land use laws in the nation, and both have recently passed statewide legislation to end single-family zoning to increase housing supply and limit sprawl. These laws will enable more diverse housing development, supporting compact growth and multimodal transportation that will further reduce transportation emissions.

3.19.1 Changes or New Information Since 2013

Although there have been changes in design and operations between the Modified LPA and the CRC LPA, the general location and scale of many components are similar. Since 2013, there have been regional and local changes in the built environment, population and employment, transportation, climate modeling, demographics, human health, and other aspects of the existing conditions, which are reflected in this analysis.

The CRC project's Cumulative Effects Technical Report included a chapter on climate change that used the best available science to evaluate project-level GHG emissions and assess the project's resiliency to the effects of climate change. This analysis builds on that work and is consistent with Presidential Executive Order

14008: Tackling the Climate Crisis at Home and Abroad, as outlined by the interim Council on Environmental Quality (CEQ) guidance on consideration of greenhouse gas emissions and climate change (CEQ 2023).

Important changes related to climate since 2013 include major policy actions to reduce emissions from all sectors and specifically from the transportation sector. Both Oregon and Washington have an array of climate policies, strategies, and executive orders that guide state agencies' efforts to reduce emissions and increase the resilience of the transportation system. Executive actions and legislation in both Washington and Oregon are now in place to manage the transition to clean fuels for transportation and vehicle electrification, as well as a transition to 100% clean energy generation. These policies and other state-level changes are described later in this section. Highlights include:

- Washington has established statewide GHG reduction targets with benchmarks at 2030 (45% below 1990 levels), 2040 (70% below 1990 levels), and 2050 (95% below 1990 levels).
- State agencies in Washington, particularly WSDOT, are charged with leading by example and reducing transportation emissions when making investments and spending decisions.
- The ODOT Climate Action Plan (2021) guides ODOT to reduce emissions from the transportation system and improve resilience to extreme weather events.
- Oregon has established statewide GHG reduction targets with benchmarks at 2035 (45% below 1990 levels) and 2050 (80% below 1990 levels).
- Oregon's updated statewide planning rules require metropolitan communities to take steps to reduce emissions, including to plan for increased transit service to the key corridors and centers, prioritize investments that make it easier to travel without reliance on a personal vehicle, plan and manage parking to avoid oversupply, plan for electric vehicle (EV) charging, and increase monitoring.

At the city level, both Portland and Vancouver have strong political support for climate action and have established citywide policies to address the impacts of climate change for their communities. Highlights include:

- Portland's Climate Emergency Workplan (City of Portland 2022) establishes emission reductions targets with benchmarks at 2030 (50% below 1990 levels) and 2050 (reach net zero).
- Portland's Transportation System Plan (City of Portland 2020) aims to implement projects that shift travel behavior to increase trips to active and low-carbon modes of travel and projects that reduce vehicle miles traveled (VMT) to meet emissions-reduction targets.
- Portland's Pricing Options for Equitable Mobility Strategy (City of Portland n.d.) provides specific guidance for making mobility in the city more equitable using community engagement, pricing strategies, and reinvestment of revenues generated toward equity and climate goals.
- The City of Vancouver's Climate Action Framework (City of Vancouver 2022) supports a just and equitable transition to communitywide carbon neutrality by 2040, with support for low-income residents and communities of color. It establishes four near-term next steps: (1) ongoing engagement, (2) climate risk assessment, (3) continued focus on high-priority areas, and (4) increasing capacity for implementation and evaluation.

The IBR Program has tracked all partner agency climate plans and policies and their alignment with the Modified LPA. A summary of the Modified LPA's consistency with these plans and policies is included in Section 3.19.7, and detailed information can be found in Appendix B to the Climate Change Technical Report.

Table 3.19-1 compares the impacts and benefits of the CRC LPA with those of the IBR Modified LPA. There are no impacts from the Modified LPA that would differ substantially from those of the CRC LPA. Based on the analysis described in this section, the climate effects of the Modified LPA, such as GHG reduction and improved resiliency, would be the same as or similar to those of the CRC LPA.

Table 3.19-1. Comparison of CRC LPA Effects and IBR Modified LPA Effects

Technical Considerations	CRC LPA Effects as Identified in the 2011 Final EIS	Modified LPA[a] Effects Identified in this Section	Explanation of Differences
Consistency with federal, state, and Local Goals, Policies, and Plans	Consistent with applicable policies.	Same as for CRC LPA (see analysis of consistency in Section 3.19.7).	N/A
VMT	• Less than 1% reduction in regional VMT. [b]	Similar to CRC LPA for regional VMT • Less than 1% reduction in VMT for traffic subarea. [b]	Although methods for estimating VMT have changed since 2011, both analyses show a predicted reduction of less than approximately 1%.
Transit trips in Design Year (2030 for CRC, 2045 for IBR)	• Increase in transit trips over No-Build Alternative.	• Increase in transit trips by approximately 1.75% over No-Build Alternative.	Both CRC LPA and Modified LPA would lead to an increase in transit trips. The CRC Final EIS did not quantify the LPA's effects on transit trips.
Pedestrian and bicycle trips in Design Year (2030 for CRC, 2045 for IBR)	• Increase in pedestrian and bicycle trips over No-Build Alternative.	• Increase in daily active transportation trips across the bridge from 400 under No Build to between 740 and 1,600 by 2045. [c]	Both CRC LPA and Modified LPA would lead to an increase in active transportation trips. The CRC Final EIS did not quantify the LPA's effects on active transportation trips.
Operational GHG Emissions in Design Year (2030 for CRC, 2045 for IBR)	Reduction in GHG emissions: • Regional emissions (macroscale): approximately 1% reduction from No Build in CO_2e emissions (MT) in 2030. [d] • Local emissions (microscale): approximately 5% reduction from No Build in CO_2e emissions (MT) in 2030. [e]	Reduction in GHG emissions: • Less than 1% reduction from No Build in total CO_2e emissions (MT CO_2e/day) in 2045.	The differences in the reported reduction metrics are due to changes in methodology. It is anticipated that both the CRC LPA and Modified LPA would reduce GHG emission compared to the No Build Alternative.

Technical Considerations	CRC LPA Effects as Identified in the 2011 Final EIS	Modified LPA[a] Effects Identified in this Section	Explanation of Differences
Construction Energy and GHG Emissions	• 11,477,104 MMBtu total energy consumption. • 871,265 MT CO_2e emissions.	• 2,601,017 MMBtu total energy consumption. • 469,444 MT CO_2e emissions (MT).	The reductions in the estimated consumption and emissions are due to changes in methodology and assumptions. It is anticipated that actual energy use and emissions during construction would be similar between the CRC LPA and Modified LPA. [f]
Resiliency	Improved resiliency to Columbia River sea-level rise, greater variation in high- and low-water flow due to changes in snowpack, severe weather events, and other changes in the environment.	Same as CRC LPA.	N/A

a In this context, "Modified LPA" refers collectively to all design options evaluated in this Draft SEIS. Differences among the IBR design options are discussed in Section 3.19.8.

b The CRC Final EIS VMT estimates are from the transportation analysis, as they were not included in the energy section or the climate section under cumulative effects.

e.

c Estimate of daily active transportation crossings of the Columbia River bridge in 2045 using methods and range of conservative, moderate, and optimistic growth; methods are described in the Transportation Technical Report.

d Includes interstates, highways, and principal arterials within Washington, Clackamas, Multnomah, and Clark Counties as well as light--rail related emissions. Emissions are reported as daily estimates.

e Includes a 12.2-mile segment of I-5 between Portland and Vancouver. Emissions are reported for a 4-hour AM peak period and 4-hour PM peak period.

f The IBR Program method used updated tools available from FHWA and supplemental calculations for the estimate reported in this document; these estimates vary substantially from the cost-based estimate produced for the CRC LPA.

CO_2e = carbon dioxide equivalent; CRC = Columbia River Crossing; EIS = Environmental Impact Statement; GHG = greenhouse gas; I-5 = Interstate 5; LPA = locally preferred alternative; MMBtu = million British thermal units; MT = metric tons; N/A = not applicable; VMT = vehicle miles traveled

3.19.2 Expected Future Conditions Resulting from Climate Change

Designing infrastructure intended to be part of the transportation system for 100 or more years requires consideration of climate change. The following describes a range of possible climate conditions based on global actions to curb emissions. For more information on potential future conditions, see Chapter 4 of the Climate Change Technical Report.

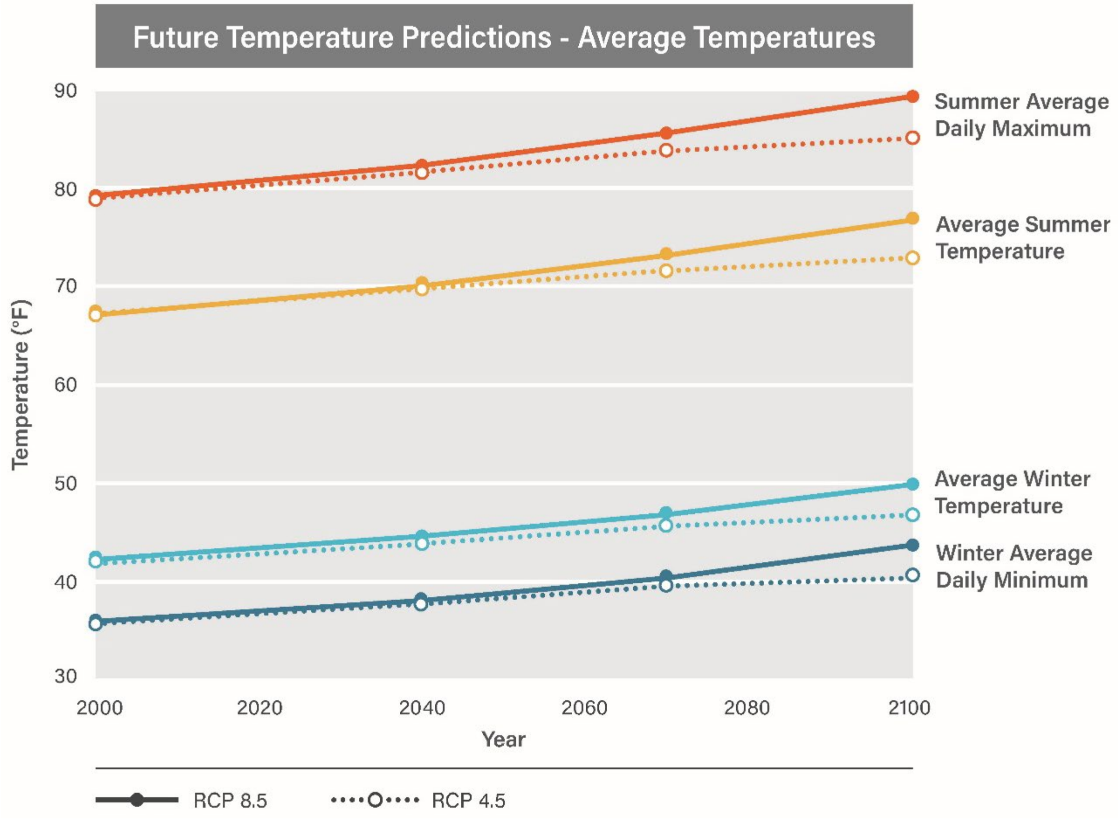
In the next century, the region is projected to experience an increase in average temperature (Figure 3.19-1) and in the number of extremely hot days. Additionally, changes to patterns of heavy precipitation are expected. While the region will experience roughly the same overall volume of rain, it is expected to come in more severe storm events (for example, atmospheric rivers). Increasing global temperatures may yield more precipitation falling as rain rather than snow, particularly in the Cascade Mountains and other areas of the lower Columbia River Basin. Rain falling on snow can further reduce accumulated snowpack, which would result in higher river flows during the rainy season and lower flows during the summer. Increased winter river flows and prevalence of severe storms result in a higher chance of flooding, which could impact low-lying land in the study area.

The expected future conditions in the study area were derived from two future scenarios representing a range of potential climate action between now and 2100. Climate change scenarios are often expressed as a Representative Concentration Pathway (RCP), which is a measure of the concentration of GHGs in the atmosphere, not the rate of emissions. Projections regarding precipitation and temperature are derived from the Climate Mapping for Resilience and Adaptation Assessment Tool, part of the U.S. Climate Resilience Toolkit (CMRA n.d.).

- **Strong Climate Action Scenario: RCP 4.5.** As shown in Figure 3.19-1, RCP 4.5 represents strong climate action to decrease atmospheric GHG concentrations, resulting in a leveling out of the warming effects by 2100 and a global average temperature increase of roughly 2 to 3 degrees Celsius (°C). This is commonly used as an optimistic scenario, although it still corresponds to significant climate disruption.
- **Weak Climate Action Scenario: RCP 8.5.** Also shown in Figure 3.19-1, RCP 8.5 represents the high end of plausible emissions through 2100 and a global average temperature increase of 4.3°C.

These expected future conditions have implications for design and operation of the Modified LPA.

Figure 3.19-1. Projected Average Temperature Changes over the Next 80 Years



Source: CMRA n.d.

3.19.3 Designing for Resilience in a Changing Climate

Temperature Changes

The average temperatures in the Program area are expected to increase between 5°F and 8°F by the end of the century. The increase in temperature is anticipated to be most evident in the summer months, where the average temperature is likely to climb between 5.5°F and 9.5°F, with an increase in average daily maximum temperatures between 6°F and 10°F. Extreme temperatures are expected to increase in the future. Currently, the Portland-Vancouver metropolitan area experiences mild summer weather, where days with a heat index over 90°F happen only 5 to 6 days per year and where days with a heat index over 100 may happen once per year. In the future, the number of days over 90°F is predicted to occur between 30 and 60 days each year and days over 100°F are likely to become at least as common as days over 90°F are now. Finally, days with heat indices over 105°F are expected to occur from a once-in-a-decade phenomenon to up to 10 days every year (Merced n.d.).

To address long-term temperature increases, infrastructure designs should withstand regular air temperatures well over 100 degrees Fahrenheit during the summer months. Under excessive heat, the performance of light-rail transit rails and road surfaces are known to decrease. Active transportation commuters on the Columbia River bridges and users of public transit stations may need respite from the heat and sun in the summer.

Considerations for Climate Resilient Design

- Heat tolerance of materials
- Reflectivity and shading for active transportation and transit users
- Measures to minimize contribution to urban heat islands
- Designing stormwater systems with sensitivity to future storms
- Evaluating potential for sea level rise and saltwater intrusion at bridge site
- Worker safety during construction; air quality and heat effects

Precipitation Changes

Because the proportion of rain to snow precipitation is expected to increase, infrastructure design should plan for a wider range of water volumes and the possibility of higher and more frequent floods. Although the study area is not predicted to see a significant increase in overall precipitation, climate models predict an increase in the intensity of precipitation, specifically during the winter months. One-hour precipitation volumes are likely to increase, especially in the fall months.

Stormwater facilities should be sized to accommodate anticipated future storm frequencies and volumes. During construction, cut slopes should be protected from small landslides, especially during the winter months. Transit commuters may need additional shelter when waiting for trains, and active transportation commuters may need shelter on the bridge crossing. Infrastructure design should also consider the need for snow and ice removal, as increased winter storms may bring higher frequencies of freezing precipitation. Greater changes in river levels may also pose challenges to navigation, as there will likely be days when the Columbia River may be too high to accommodate vessels that might otherwise pass underneath fixed-span bridges; movable-span bridges may require more bridge openings if water levels are higher.

Other Climatic Factors

In addition to temperature and precipitation changes, climate change also has implications for wildfire risk and sea-level rise.

Wildfire Risk

While the wildfire risk is unlikely to damage infrastructure associated with the Modified LPA, because of its materials and location, landscape designs should consider the possibility of sparks from vehicles igniting plantings during dry, hot summer weather.

Exposure to wildfire smoke is a health threat, particularly to people directly exposed to the elements such as active transportation users, transit passengers, or construction workers (Grant and Runkle 2022).

Sea-Level Rise

Sea-level rise is a consideration on the coast, and the Columbia River is tidally influenced at the Interstate Bridge location. Sea-level rise at the mouth of the Columbia River is projected to range from 1.5 feet to 5 feet by 2150 (Miller 2018). The changes at the Interstate Bridge are expected to be much smaller and controlled by tides and precipitation. The resulting changes in water level are expected to be dwarfed by the seasonal changes from precipitation; the highest tidal swings are likely to occur when the Columbia River is relatively low (e.g., during the summer months) (USACE 2022). Saltwater intrusion is also not a cause for concern, as it is not expected to reach the Program area at river mile 106 according to the latest modeling from the Oregon Health and Science University Center for Coastal Margin Observation and Prediction, which estimates that saltwater will not be found upriver of approximately river mile 45 (Baptista 2018).

3.19.4 Federal Policy Context for Climate

Federal regulations and policies guide the development and evaluation of transportation projects and local communities' management of GHG emissions. The federal government has issued direction to address climate in NEPA documents. Consistent with Executive Order 13990, Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis and in recognition of NEPA's important role in providing critical information to decision-makers and the public, CEQ issued interim guidance to agencies involved in federal actions in January 2023. The CEQ guidance directs federal agencies to do the following:

- Consider GHG emissions in the identification of proposed actions and alternatives.
- Quantify a proposed action's projected GHG emissions or reductions for the expected lifetime of the action.
- Place GHG emissions in context and disclose relevant GHG emissions and climate impacts.
- Identify alternatives and mitigation measures to avoid or reduce GHG emissions.
- Provide additional context for GHG emissions to allow decision-makers and the public to understand tradeoffs associated with an action, including through the use of the best available social cost of GHG estimates.
- Incorporate environmental justice considerations into their analysis of climate-related effects.
- Use the information developed during the NEPA review to consider reasonable alternatives that would make the actions and affected communities more resilient to the effects of changing climate.

The IBR Program has followed the CEQ guidance and outlined a strategy for addressing climate change in the planning, design, construction, and operation of the Modified LPA. Data used to support the greenhouse gas emissions estimates were derived from the analysis in the Transportation Technical Report (for VMT and mode shift estimates) and the Energy Technical Report for estimates of GHG emissions associated with construction and operation of the Modified LPA.

3.19.5 Washington and Oregon Policy Context for Climate

Washington and Oregon, along with their local agency partners, have policy directives to reduce GHG emissions from transportation and other activities and have developed energy transition plans. Reducing emissions to the targets established by these entities will require aggressive action at all levels of government and by private industry.

Washington and Oregon have policies intended to promote a shift away from GHG emissions in the transportation sector. These transportation-related transition policies are summarized in Table 3.19-2.

Table 3.19-2. Washington and Oregon Transportation Transition Policies

Policy	Policy Directives
WSDOT Strategic Plan: Resilience Goal (WSDOT n.d.)	WSDOT will plan and/or invest resources to improve the ability to mitigate, prepare for, and respond to emergencies; combat climate change; and build a transportation system that provides equitable services, improves multimodal access, and supports Washington's long-term resilience.
Washington Governor's Executive Order 20-01: State Efficiency and Environmental Performance (2020)	When making purchasing, construction, leasing, and other decisions that affect state government's emissions of GHGs or other toxic substances, agencies shall explicitly consider the benefits and costs (including the social costs of carbon) of available options to avoid those emissions.
Climate Commitment Act – Washington State Department of Ecology (Ecology n.d.)	Directed by Washington State Legislature to design and implement a cap-and-invest program to reduce statewide GHG emissions. This program works by setting an emissions limit, or cap, and then lowering that cap over time to ensure Washington meets the GHG reduction commitments set in state law (95% reduction of GHGs by 2050).
Washington Clean Vehicles Program (Chapter 173-423 WAC)	Adopt California's Heavy-Duty Engine and Vehicle Omnibus rules. 100% of sales of light-duty vehicles sold in Washington will be electric by 2035. Requires increasing the number of new ZEVs sold in Washington until all new vehicles meet the ZEV standard starting in 2035.
Washington Clean Fuels Program (RCW 70A.535)	Requires fuel suppliers to reduce the carbon intensity of transportation fuels to 20% below 2017 levels by 2038.
Washington Clean Energy Transition Act (UTC n.d.)	100% of electricity sold in Washington will be renewable by 2045.
Oregon Climate Protection Program (DEQ 2021a)	50% reduction by 2035 and 90% reduction by 2050 in emissions for covered fossil fuel suppliers (from 2017–2019 average emissions).
Oregon Clean Fuels Program (DEQ 2022)	10% reduction in average carbon intensity for transportation fuels by 2025; 20% reduction by 2030; 37% reduction by 2035. In March 2020, Governor Brown issued Executive Order 20-04 to amend low-carbon fuel standards and schedule to phase in implementation with the goal of 20% below 2015 levels by 2030, 25% below 2015 levels by 2035. (The Oregon Clean Fuels Program Expansion was adopted by the Environmental Quality Commission in October 2022 and is effective as of January 1, 2023.)
Oregon Clean Energy Targets (DEQ n.d. d)	Targets for reducing GHG emission from electricity in Oregon from baseline (average annual emissions for 2010, 2011, and 2012): • 80% below baseline emissions by 2030. • 90% below baseline emissions by 2035. • 100% below baseline emissions by 2040.
Oregon Zero-Emission Vehicle (ZEV) (Senate Bill 1044) (ODOE n.d.)	At least 250,000 registered motor vehicles will be ZEV by 2025. At least 25% of registered motor vehicles, and at least 50% of new motor vehicles sold annually, will be ZEV by 2030. At least 90% of new motor vehicles sold annually will be ZEV by 2035.

Policy	Policy Directives
Oregon Clean Car Standards (DEQ n.d. c) and Advanced Clean Cars II (DEQ n.d. a)	The Oregon Department of Environmental Quality is beginning a rulemaking process to adopt California's Advanced Clean Cars II rule, which would require all light-duty vehicle sales in Oregon to be zero emission by 2035.
Oregon Clean Truck Rules 2021 (DEQ n.d. b) and Advanced Clean Trucks (DEQ 2021b)	Requires manufacturers of medium- and heavy-duty vehicles to sell a certain percentage of ZEVs beginning with 2024 vehicle model year: • 75% zero-emission sales for Class 4-8 rigid trucks by 2035. • 55% zero-emission sales for Class 2b-3 pickup trucks and vans by 2035. • 40% zero-emission sales for Class 7-8 tractor trucks by 2035.

GHG = greenhouse gas; WSDOT = Washington State Department of Transportation; ZEV = zero emissions vehicle

3.19.6 Existing Emissions Sources

User Emissions

Emissions from vehicles using transportation facilities comprise the transportation sector's majority of GHG emissions. In a case study of six state departments of transportation, the National Cooperative Highway Research Program found that user emissions by passenger and freight vehicles make up approximately 94% of transportation-related emissions, while 6%comes from construction and maintenance of the system. The remaining fraction (approximately 0.2%) results from administrative functions (e.g., operation of office buildings). Thus, reducing user emissions provides the greatest potential to make large reductions in total transportation-related emissions.

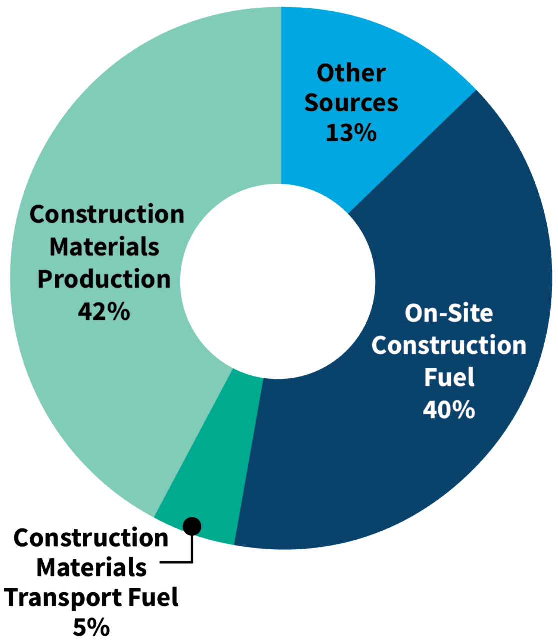
Across the U.S. transportation sector, roadway users account for over 80% of transportation emissions, with light-duty vehicles (passenger cars and trucks) producing the majority (57%) and medium- and heavy-duty trucks adding 26%. Of vehicle types, single-occupant light-duty trucks (which include the sport-utility vehicle class) are the least efficient mode, and they are a continuously growing share of the personal vehicle fleet.

Construction Emissions

Although construction emissions represent a smaller proportion of transportation sector GHG emissions, construction still produces substantial quantities. Figure 3.19-2 represents the average proportion of GHG emissions by category for the construction of transportation structures, highways, and streets per dollar spent.

The two largest categories of emissions are fuels used by construction equipment and production of construction materials (EPA 2023b). These categories provide the greatest opportunities for minimizing GHG emissions from construction activities. Construction material production includes concrete, asphalt, and steel products. The largest emissions in this category come from cement and concrete products and asphalt concrete pavement, including binders and aggregate. The remainder of construction-related GHG emissions come from fuel used in transporting materials and from other sources (e.g., engineering services, waste disposal).

Figure 3.19-2. Sources of Greenhouse Gas Emissions from Construction (EPA)



Source: NCHRP 2022. For data sources, see footnote.[1]

3.19.7 Summary of Climate Benefits

Modified LPA and GHG Emissions

The IBR Program proposes changes to the regional transportation system with the Modified LPA that would expand transit and institute tolling, which could encourage people to choose transportation modes other than driving alone (referred to as "mode shift"), and the Program would also reconfigure highway and local connections to improve the efficiency of the transportation network. Collectively, these changes could result in a decrease in regional GHG emissions. Compared to the No-Build Alternative, the Modified LPA is expected to reduce GHG emissions by affecting travel choices and traffic operations in the following ways:

- Encouraging mode shift to transit by providing an extension of TriMet's Metropolitan Area Express (MAX) light-rail between Portland and Vancouver and three new stations, expanded express bus service, and park and rides.
- Using demand management methods such as variable-rate tolling of the highway to reduce travel demand, promote mode shifts, and reduce travel during peak commuting periods.
- Improving traffic operations with ramp metering, auxiliary lanes, and roadway shoulders, which reduce idling by reducing congestion and disruptions due to vehicle crashes and other incidents.
- Encouraging mode shift from cars to active transportation (walking and bicycling) with facility

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[1] Figure data notes: The values for this graphic are provided by the EPA U.S. Environmentally Extended Economic Input-Output Model. This model considers emissions for a wide variety of sectors in the U.S. economy, as categorized by the North American Industry Classification System (NAICS). The NAICS sector most closely aligned with Department of Transportation construction is 237310: Transportation Structures, Highways, and Streets. The model provides GHG emissions factors per U.S. dollar of purchase price (kilograms of CO_2e/$) and details about the largest sources of emissions for each industry.

improvements that provide a safe, comfortable, and direct path for walking, biking, and rolling.

IBR Program Climate Framework

The IBR Program has drafted a Climate Framework (see Appendix A of the Climate Change Technical Report) with two main objectives to guide processes and desired outcomes for climate: (1) reduce climate impacts and (2) improve climate adaptation and resilience through deliberate actions. The framework is intended to be applied during design, construction, and long-term operation and maintenance, with a goal of accounting for environmental impacts throughout the infrastructure life cycle. Evaluation of the IBR Program's performance related to climate objectives will be conducted at different stages. Table 3.19-3 provides an overview of the objectives for each stage.

Table 3.19-3. Climate-Related Objectives by IBR Program Phase

IBR Program Objective	Program Phase: Design/Refinement	Program Phase: Program Development and NEPA	Program Phase: Construction	Program Phase: Opening Day and Long-Term Operation
Design for resilience and adaptation	Avoid design choices that would restrict resilience to future climate conditions.	Assess future climate conditions, evaluate adaptability of design, develop climate-resilient design, and establish mitigation commitments.	Evaluate on-site needs regarding flooding, stormwater, heat tolerance, etc.; plan for and manage worker safety.	N/A; design and construction would be complete.
Reduce operational emissions	Design to support mode shift and VMT reduction. Develop high-capacity transit, improve active transportation, and implement roadway pricing.	Evaluate reasonable alternatives and design options in the NEPA process. Establish best management practices to reduce impacts.	N/A	Consider adaptive management and partner support. Consider air quality or temperature monitoring.
Reduce emissions during operations and maintenance activities	Design to support low or lower maintenance needs. Consider using on-site renewable energy for signage or other electricity needs.	Evaluate alternatives and design options in the NEPA process.	N/A	Consider adaptive management and requirements for lower GHG approaches to ongoing operations and maintenance. Optimize transit fuel use and equipment investments.
Minimize construction emissions and embodied carbon	Maintain options to use innovative approaches in construction	Evaluate and establish baseline.	Track equipment and materials.	N/A; construction would be complete.

IBR Program Objective	Program Phase: Design/Refinement	Program Phase: Program Development and NEPA	Program Phase: Construction	Program Phase: Opening Day and Long-Term Operation
	equipment and materials.			

N/A = not applicable; NEPA = National Environmental Policy Act; VMT = vehicle miles traveled.

Consistency with Goals, Policies, and Plans

ODOT, WSDOT, and the eight local agency partners have numerous climate-related goals, policies, and plans. Through an interagency working group, these agencies have been engaged with the IBR Program throughout the planning efforts to date. IBR Program staff and local agency partners developed a comprehensive database of local plans and climate initiatives, including specific climate commitments and emissions-reduction goals.

The IBR Program is consistently aligned with the climate aims of partner agencies. Important aspects of this alignment include:

- **Reducing emissions from the transportation system** – The Modified LPA would shift travel demand to lower GHG-emitting modes of travel and improve transportation efficiency. The Modified LPA would reduce vehicle-based GHG emissions by expanding transportation options for non-automobile trips, one of the most significant methods of reducing driving trips. New and improved transportation options include high-capacity transit and safe, comfortable bicycle and pedestrian infrastructure.
- **Reducing construction emissions and operations and maintenance emissions** – Construction goals for the IBR Program center on reducing construction-based emissions. The Program aims to reduce emissions associated with maintenance and operations by using an EV maintenance fleet.
- **Community resiliency** – The IBR Program includes climate resiliency goals such as designing for performance in a range of environmental conditions resulting from climate change. Equity in processes and outcomes for the community is prioritized by the IBR Program.

3.19.8 Long-Term Benefits and Effects

This section evaluates GHG emissions for the No-Build Alternative and the Modified LPA. Most of the Modified LPA design options would have similar emissions; those for which emissions may differ are discussed in the text. GHG emissions were estimated as a function of VMT, vehicle hours of travel (VHT), and vehicle hours of delay (VHD). Potential changes in travel behavior and VMT were estimated using the regional travel demand model that was jointly developed by Metro and Southwest Washington Regional Transportation Council (RTC) for use in the 2018 Regional Transportation Plan[2] (RTP), adopted by Metro in 2018 and RTC in 2019. The Transportation Technical Report, the Climate Change Technical Report, and the Energy Technical Report provide additional information on the modeling approach and the relationship between vehicle travel and GHG emissions.

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[2] The transportation analysis for the No-Build Alternative and Modified LPA is based on the anticipated regional highway and transit networks and service levels for 2045 as informed by the regional transportation plans for both Metro (Metro 2018) and RTC (RTC 2019). The traffic model applied to this analysis reflects pre-COVID conditions. New surveys and model development efforts that include post-COVID travel behavior are planned to be incorporated in the 2028 RTP update.

Table 3.19-4 summarizes the effects of the No-Build Alternative, Modified LPA, and design options on climate. Detailed analysis of the effects is provided in the following sections.

No-Build Alternative

Daily travel and delay information for the No-Build Alternative is shown in Table 3.19-5, and daily trips by mode in the region and the traffic subarea are shown in Table 3.19-6. These figures are shown alongside the Modified LPA results for comparison.

Roadway Operations, Transit, and Multimodal Trips

Table 3.19-5 presents modeled weekday results of VMT, VHT, and VHD. Together with vehicle types and fuel sources, these traffic measures are used to estimate GHG emissions from travel behavior. Results are presented for the Modified LPA with one auxiliary lane and with two auxiliary lanes. None of the other Modified LPA design options would result in a measurable difference in VMT, VHT, or VHD.

Table 3.19-6 presents data on daily trips through the I-5 corridor in the study area as estimated by the regional travel demand model. These trip estimates, in combination with information on vehicle fuel sources, are used to calculate transportation emissions. The regional model assumes the same number of person-trips in the No--Build and Modified LPA alternatives; however, the distribution of these trips varies based on proposed system changes. A more detailed analysis of trip generation and distribution is presented in the Transportation Technical Report.

Table 3.19-6 shows that, although the number of regional person-trips is held constant between the Modified LPA and the No-Build Alternative, the models predict the Modified LPA would lead to shifts between modes and destinations. Modeling results indicate that there would be a mode shift to transit and a decrease in the number of total trips across the Columbia River with the Modified LPA. The regional transit mode share would increase slightly, with the Modified LPA generating 12,500 daily new transit trips as a result of variable-rate tolling on the Columbia River bridges, the extension of light-rail transit between the Expo Center and near Evergreen Boulevard, new park and rides, and improvements to the speed and frequency of express buses.

Table 3.19-7 shows that, on a regional basis, the Modified LPA would result in small but measurable reductions in energy consumption and GHG emissions. This is the result of reductions in VMT, VHT, and VHD and a mode shift to transit under the Modified LPA.

Active Transportation

In addition to shifting trips to transit, the Modified LPA would include bicycle and pedestrian improvements on the Columbia River bridges, as well as facilities to access these bridges, which are expected to increase bicycle and pedestrian trips. In 2022, approximately 410 daily bicycle and pedestrian trips were estimated to use the existing path to cross the Columbia River; the Modified LPA is expected to increase this total to between 740 and 1,600 trips per day in 2045 (see the Transportation Technical Report for more information).

Considering the increasingly hot conditions expected in the future, active transportation users could experience discomfort (and potentially health risks), which could discourage the use of the facilities. The different design options for the main bridge crossing could produce different user experiences. If the active transportation path were on the lower deck of the double-deck bridge, that would provide cover for users, which would be beneficial for shading during summer heat events and providing protection from the rain in other months. Opportunities to provide shade or rain protection would not be exclusive to a double-deck option, as measures to provide shade (e.g., canopies, shade panels) could be incorporated on single-deck options.

Table 3.19-4. Summary of No-Build Alternative and Modified LPA Effects on Climate

1	2	3	4	5	6
No-Build Alternative	Modified LPA with Double-Deck Fixed-Span Configuration, One Auxiliary Lane, C Street Ramps, Centered I-5 or I-5 Westward Shift, all Park-and-Ride Site Options	Modified LPA with Double-Deck Fixed-Span Configuration, Two Auxiliary Lanes, C Street Ramps, Centered I-5, all Park-and-Ride Site Options	Modified LPA with Single-Level Fixed-Span Configuration,[a] One Auxiliary Lane, C Street Ramps, Centered I-5, all Park-and-Ride Site Options	Modified LPA with Single-Level Movable-Span Configuration, One Auxiliary Lane, C Street Ramps, Centered I-5, all Park-and-Ride Site Options	Modified LPA with Double-Deck Fixed-Span Configuration, One Auxiliary Lane, Without C Street Ramps, Centered I-5, all Park-and-Ride Site Options
• Substantially lower energy consumption and greenhouse gas (GHG) emissions in 2045 due to increased electric vehicles in fleet and decarbonized electricity sources.	• Lower energy consumption and GHG emissions in 2045, similar to No-Build Alternative. • Increased mode share of low and no emissions modes (transit, active transportation). • Improvements in climate resilience with materials and design.	• Similar to effects listed in Column 2, but would slightly reduce emissions due to improved congestion.	• Similar to effects listed in Column 2, but would slightly reduce operational emissions due to the reduced profile grade of the new Columbia River bridges.	• Similar to effects listed in Column 2, but would increase GHG due to the longer construction duration, additional materials required for the larger bridge foundations, and electricity required to raise and lower the bridge and as a result of idling during bridge closures.	• Similar to effects listed in Column 2, but would increase GHG due to increased congestion and volumes on the Mill Plain/15th Street couplet. Additionally, VMT and GHG would increase for trips with an origin or destination in downtown Vancouver south of Mill Plain Boulevard.

a The effects associated with the single-level fixed-span configuration would be the same for all bridge type options, unless otherwise specified. Differences in user emissions between the design options and the Modified LPA were not quantified because they are too small to be measurable at the scale of the region or the analysis area.

Table 3.19-5. 2045 Weekday Daily Vehicle Miles of Travel, Vehicle Hours of Travel, and Vehicle Hours of Delay

Alternative	Area	Vehicle Miles of Travel	Vehicle Hours of Travel	Vehicle Hours of Delay
No-Build Alternative	Portland Metropolitan Region	59,042,000	1,803,600	65,500
	Traffic Subarea [a]	14,349,500	439,600	24,900
Modified LPA with one auxiliary lane	Portland Metropolitan Region	58,950,700	1,792,300	58,300
	Traffic Subarea	14,270,500	428,000	17,400
Modified LPA with two auxiliary lanes	Portland Metropolitan Region	58,960,800	1,791,900	58,000
	Traffic Subarea	14,279,300	427,400	17,000
Change between No Build and Modified LPA with one auxiliary lane	Regional Difference	-91,300(<-1%)	-12,100 (<-1%)	-7,300 (-11%)
	Subarea Difference	-79,000 (<-1%)	-11,600 (-3%)	-7,500 (-30%)
Change between No Build and Modified LPA with two auxiliary lanes	Regional Difference	-83,300(<-1%)	-12,600 (-1%)	-7,600 (-11%)
	Subarea Difference	-70,900 (<-1%)	-12,200 (-3%)	-7,900 (-32%)
Change between Modified LPA with one auxiliary lane and two auxiliary lanes	Regional Difference	10,100 (<-1%)	-400 (<-1%)	-300 (<-1%)
	Subarea Difference	8,800 (<-1%)	-600 (<-1%)	-400 (-2%)

Source: Metro/RTC Travel Demand Model

a The traffic subarea is a subset of the region used to capture potential impacts and diversion of trips related to the IBR Program. This subarea includes an extent between the I-5 and I-205 split in Vancouver, south of I-84 in Portland, west of I-5 and east of I-205 in both Portland and Vancouver. See the Transportation Technical Report for more information.

Table 3.19-6. 2045 Weekday Daily Corridor Trips and Systemwide Transit Trips

Measure	No-Build Alternative	Modified LPA (One aux. lane)	Modified LPA (Two aux. lanes)
Regional Person-Trips (all modes)	11,905,000	Same as No Build	Same as No Build
Work Trips (all modes)	2,165,500	Same as No Build	Same as No Build
Non-Work Trips (all modes)	9,739,500	Same as No Build	Same as No Build
Total Regional Transit Trips [a]	626,300	638,800	638,700
Regional Transit Mode Share	5.26%	5.37%	5.36%
Regional New Transit Trips	N/A	12,500	12,400
Percentage Change from No Build	N/A	+2.00%	+1.98%

Source: 2022 Metro, RTC, C-TRAN, TriMet, and IBR Analysis

a Transit trips count each passenger only once between the origin and destination of their trip. Transit trips include all trips on any transit mode.

aux = auxiliary; LPA = locally preferred alternative; N/A = not applicable

Operational GHG Emissions

GHG emissions by gas- and diesel-powered passenger and freight vehicles are directly related to VMT, the age and type of vehicle, and the time spent traveling (e.g., travel efficiency, or speed, and congestion). Other factors, such as the amount of time vehicles idle in traffic congestion, also influence their GHG emissions. When people switch to more efficient modes of transportation—such as transit, carpooling, walking, or biking—GHG emissions are reduced. Depending in part on the composition of the electricity grid, GHG reductions will also occur as people switch to EVs.

Section 3.12, Energy, describes potential GHG emissions associated with VMT, transit trips, and emissions from routine maintenance. As shown in Table 3.19-7, energy consumption and GHG emissions in 2045 under the No-Build Alternative are expected to be substantially lower than existing values for the region due to requirements in existing regulations and voluntary low-emission vehicle commitments made by private sector automobile manufacturers. This means that even as the regional population grows, and VMT increases an expected 40% in the study area compared to existing conditions, the additional miles driven will generate substantially fewer GHG emissions over that same time period because of new regulations and a shift toward EVs.

Table 3.19-7. Daily Regional Energy Consumption and CO_2e Emissions (with Electric Vehicle Assumptions)

Parameter	Existing (2015)	No-Build Alternative (2045) (with EV Assumptions)	Modified LPA (2045) (with EV Assumptions)	Modified LPA Difference from No-Build (with EV Assumptions)
Total Energy Consumption (MMBtu/day)	290,732	190,771	190,302	-0.25%
CO_2e Exhaust Emissions (MT CO_2e/day)	22,273	11,440	11,409	-31 MT/day -0.26%
CO_2e Fuel Cycle Emissions (MT CO_2e/day)	6,014	6,668	6,653	-15 MT/day -0.22%
Total CO_2e Emissions (MT CO_2e/day)	28,286	18,108	18,063	-45 MT/day -0.25%

Notes: Table sourced from the Energy Technical Report; Emissions estimates produced using EPA MOVES model. Fleet assumptions listed in the Energy Technical Report.
CO_2e = carbon dioxide equivalent; EPA = U.S. Environmental Protection Agency; EV = electric vehicle; LPA = locally preferred alternative; MMBtu = million British thermal units; MT = metric tons

Modified LPA

As shown in Table 3.19-5, the Modified LPA would reduce regional VMT, VHT, and VHD compared to the No-Build Alternative. Daily VMT in the region would decrease by nearly 100,000 miles with the Modified LPA, which is due either to mode shift or to people choosing to make shorter trips or otherwise adjusting their travel patterns. Although the decreases for VMT and VHT are quite small at the regional scale, local reductions in the traffic study subarea represent a more substantial decrease. Total reductions in VHD compared to the No-Build Alternative are more significant both regionally and in the study area at 11% and 29%, respectively. This highlights the improvement in congestion reduction resulting from the Modified LPA and the influence of I-5 on overall delay in the region.

Analysis of the long-term effects of the two auxiliary lane design option using the regional travel demand model shows no statistically significant difference in GHG emissions compared to the single auxiliary lane option in the traffic assignment subarea, as shown in Table 3.19-8. However, an additional analysis using operational model outputs (modeling that provides more sensitivity to changes in speed and congestion) in the traffic subarea shows that GHG emissions associated with the Modified LPA could be approximately 2.5% lower those emission under the No-Build Alternative. In addition, the Modified LPA option with two auxiliary lanes could have approximately 2.9% lower emissions compared to emissions under the No-Build Alternative. This analysis shows that improving traffic speeds (i.e., reducing congestion) through the addition of a second auxiliary lane would have an effect on I-5 that translates into lower GHG in the whole study area.

The single-level fixed-span configuration would have slightly lower operational emissions than the double-deck configuration due to the reduced profile grade of the new Columbia River bridges (approximately 29 feet lower than the Modified LPA's double-deck configuration). The reduced profile grade is also characteristic of the single-level movable-span configuration, except that this option would increase energy consumption due to additional materials required for the larger bridge foundations, and electricity required to raise and lower the bridge, and as a result of idling by queued vehicles on the freeway during bridge closures. These emission differences were not quantified because they are too small to be measurable at the scale of the region or the traffic sub area, and as such, are unlikely to be useful in differentiating between alternatives.

The elimination of C Street ramps at the SR 14 interchange would result in additional congestion on local streets, which in turn would result in failing operations at 19 intersections, compared to 10 intersections for the Modified LPA with C Street ramps. This additional congestion and idling would decrease vehicle efficiency, resulting in increased GHG emissions compared to the Modified LPA with C Street ramps. As with the bridge design options, these emission differences were not quantified because they are too small to be measurable at the scale of the region or the analysis area, and as such, are unlikely to be useful in differentiating between alternatives.

Table 3.19-8. Comparison of Energy Consumption and GHG Emissions, Traffic Assignment Subarea

Parameter	Existing (2015)	No Build (2045)	Modified LPA with One Auxiliary Lane (2045)	Modified LPA with Two Auxiliary Lanes (2045)	One Auxiliary Lane Difference from No-Build	Two Auxiliary Lanes Difference from No-Build
Daily Vehicle Miles Traveled	11,267,296	14,349,500	14,270,500	14,279,300	-0.55%	-0.49%
Total Energy Consumption (MMBtu/day)	76,557	47,863	47,380	47,371	-1.01%	-1.03%
CO_2e Exhaust Emissions (MT CO_2e/day)	5,864	2,886	2,854	2,853	-1.01%	-1.14%
CO_2e Fuel Cycle Emissions (MT CO_2e/day)	1,583	1,644	1,630	1,630	-0.85%	-0.84%

Parameter	Existing (2015)	No Build (2045)	Modified LPA with One Auxiliary Lane (2045)	Modified LPA with Two Auxiliary Lanes (2045)	One Auxiliary Lane Difference from No-Build	Two Auxiliary Lanes Difference from No-Build
Total CO_2e Emissions (MT CO_2e/day)	7,447	4,530	4,484	4,483	-1.01%	-1.03%

Note: Values in this table represent emissions and energy consumption within the traffic assignment area. CO_2e emissions are calculated assuming an EV adoption rate consistent with Oregon and Washington state goals. If the adoption rates are less than the rates assumed in this analysis (52% EVs by 2045), GHG from both No-Build and the Modified LPA would be proportionately higher.
CO_2e = carbon dioxide equivalent; EV = electric vehicle; LPA = locally preferred alternative; MMBtu = million British thermal units; MT = metric tons

Emissions from Operations and Maintenance

GHG emissions from operations and maintenance activities include the emissions from vehicles performing routine maintenance activities to roadways, transit vehicles, and light-rail tracks, activities such as sweeping, restriping, and landscaping. Table 3.19-9 summarizes the energy and GHG emissions from maintenance activities under the Modified LPA. These would be similar to or lower than the annual maintenance activities with the No-Build Alternative because the facilities built for the Modified LPA would be new. There would also be several years where only light to minimal maintenance activity would be needed after construction is complete. Maintenance needs for a lift span would be higher than for the other bridge configurations because of the need for regular inspections and maintenance of the lift mechanism and other moving parts.

Table 3.19-9 Modified LPA Annualized CO_2e Emissions from Maintenance Activities

Project Element	Energy Consumption (mmBtu/year)	CO_2e Emissions (MT/year)
Annualized Value [a]	11,078	1,088

Source: ICE model output (available in Appendix A of the Energy Technical Report).
a Annualized value assumes a 30-year project life.
CO_2e = carbon dioxide equivalent; LPA = Locally Preferred Alternative; mmBtu = million British thermal units; MT = metric tons

3.19.9 Construction Effects

Modified LPA Components

Construction of the Modified LPA would include construction of the new bridges and removal of the existing Interstate Bridge. GHG emissions would be produced from construction equipment and the emissions embodied in construction materials. Construction impacts to energy consumption and GHG emissions from the Modified LPA are presented in Table 3.19-10. FHWA's Infrastructure Carbon Estimator (ICE) spreadsheet tool (ICF 2020) provided the basis for the calculation, which incorporates project features and construction traffic delays to calculate energy consumption from construction equipment, materials, and routine maintenance. The ICE tool was used for all elements of the Modified LPA except the main Columbia River bridges structure, which was evaluated using a material-based approach and is presented separately in Table 3.19-10. The Climate Change and Energy Technical Reports present a range of potential emissions to reflect the uncertainty associated with final bridge design and specific construction materials. The high range of estimates for the Columbia River bridges is presented below.

These values represent the sum of the total impacts over the construction period. Emissions generated from the construction of any of the Modified LPA design options would be similar.

For more information, including a description of the methods used to develop this estimate, see the Energy Technical Report.

Table 3.19-10. Modified LPA Energy Consumption and GHG Emissions from Construction Activities

Construction Element	Modified LPA, Excluding Columbia River Bridge Structure[a] (MT CO_2e)	Columbia River Bridge Structure[b] (MT CO_2e)	Modified LPA Construction, Total Emissions (MT CO_2e)
Materials (e.g., embodied emissions in construction materials)	299,518	121,373	420,891
Transportation (e.g., transport of materials to the project site)	10,045	4,070	14,115
Construction (e.g., operation of equipment on site)	18,423	16,015	34,438
Total	**327,986**	**141,459**	**469,444**

Source: ICE model output (available in Appendix A of the Energy Technical Report)

a Values calculated from the Federal Highway Administration's Infrastructure Carbon Estimator Model.

B Values calculated using a material quantity-based estimate for materials using environmental product declarations and scaled factors for transportation and construction fuel usage.

CO_2e = carbon dioxide equivalent; LPA = Locally Preferred Alternative; MT = metric tons

Design Options

While it is expected that certain design options would require a greater volume of materials, and that a greater volume of materials would contribute more GHG emissions, design data to determine those volumes will not be available until the final design process. GHG emissions from construction of the Modified LPA were estimated as a range to reflect the uncertainty associated with construction material quantities for a single-level fixed-span configuration. The high value of the range is presented in Table 3.19-10.[3] The double-deck fixed-span or single-level movable-span configuration and the two auxiliary lane option would require a slightly greater volume of materials, which would contribute more GHG emissions compared to the same type of bridge in the single-span configuration with one auxiliary lane.

Emissions and energy consumption were estimated for the Modified LPA using the ICE planning-level model, which does not have the granularity to differentiate between the design options associated with roadway configurations. Estimates could be refined by using material quantity data similar to the bridge construction analysis, which would not be available until final design.

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[3] For more information on the methods used to create this range, see the Energy Technical Report.

Traffic Delay Due to Construction

Construction of the Modified LPA is anticipated to last 9 to 15 years, impacting all modes of transportation within the study area as well as adjacent corridors. The Modified LPA could require nighttime closure of regional roadways, interchanges, and local roads during construction. Construction-related truck traffic for delivery of materials, equipment and for removal of materials/debris from demolition could also increase congestion and delays, particularly during periods of major construction. Closures during construction of the Modified LPA could temporarily affect transit operations and/or access to transit within the study area, sidewalks, bicycle facilities, and/or shared-use paths. Increased congestion due to temporary closures of roadways, transit facilities, and active transportation facilities could result in elevated vehicle emissions of CO_2e. Closures would be limited to off-peak hours to minimize impacts to regional travel during peak travel periods.

3.19.10 Indirect Effects

In the context of climate change, indirect impacts include potential growth-inducing effects and other effects related to project-induced changes in patterns of land use, population density, or population growth rate. As documented in Section 3.4, Land Use and Economic Activity, the Modified LPA is likely to facilitate growth within portions of the study area currently designated for denser development; however, it is not expected to result in unplanned growth or urban sprawl. This is because the transit improvements in the Modified LPA, in conjunction with tolling, will encourage growth and development along the new transit line while disincentivizing automobile trips.

Indirect impacts could also occur on the federal navigational channel of the Columbia River; climate change induced sea-level rise could have effects to the channel in two circumstances:

- Below Water – Increased water depth due to sea-level rise within the federal navigation channel could impose a residual future benefit for the federal navigation channel future operations and maintenance and utility (less dredging required).
- Above Water – Increased river stage along the federal navigation channel could reduce the vertical clearance available for vessels to transit under the new Columbia River bridges.

However, evaluation of the latest climate change data indicate that sea-level rise at the mouth of the Columbia River would likely have little effect on water surface elevations around the new Columbia River bridges. Based on the most likely future scenario, the 50% probability projection for 2150, a water surface elevation change of less than 8 inches could occur at the bridges, but this would only occur during high tide events that coincide with atmospheric river storm events in November, December, and January. Therefore, the risk to federal navigation channel operations and maintenance and navigation clearance as a result of climate induced sea-level rise is expected to be very low.

3.19.11 Cumulative Greenhouse Gas Changes and the Social Cost of Carbon

This section evaluates how the reduction in GHG emissions due to the Modified LPA's reduced VMT and improved traffic performance would be balanced by unavoidable new GHG emissions from project construction, operations and maintenance, and transit operations. These estimates reflect the difference between the Modified LPA and the No-Build Alternative. Table 3.19-11 summarizes the inputs used in the estimate of the social cost of carbon from the beginning of construction through 11 years of operation.

Table 3.19-11. Cumulative Emissions Estimates

Parameter	Annual Difference Between the Modified LPA and No Build (MT CO_2e)	Years	Total Over Evaluation Period (MT CO_2e)	Note
Construction Emissions	+46,944	2025–2034	469,444	A range of emissions was estimated; this value is the "high" estimate is 469,444 MT CO_2e over a 10-year construction period. [a]
Operations and Maintenance Emissions	0	2040–2045	0	Annual emissions of 1,088 MT CO_2e would be lower or similar to No-Build.
Transit Operational Emissions	+2,653	2035–2045	26,530	Emissions reflect expanded transit system.
Roadway User Emissions [b]	-15,802	2035–2045	- 158,017	Estimate based on daily reduction of 45 MT CO_2e/day in the region.

a A range of emissions was estimated and presented in Section 3.19.9. The value presented in this table is the "high" value, which assumes higher carbon intensity bridge design and materials for the main river crossing under the single-level bridge configuration with one auxiliary lane.

b Roadway user emissions were assumed to be constant over each year between 2035 and 2045. Due to shifts in the share of electric vehicles in the fleet over time, the 2035–2045 benefits may be underestimated (i.e., those years have more gasoline vehicles than expected in 2045). Changes to travel demand based on population, employment and land use after 2045 are not forecast at this time. Benefits from the Modified LPA would extend well beyond 2045.

MT = metric tons

The climate damages from the combination of construction emissions, transit operations, and benefits accruing from the decrease in roadway use compared to the No-Build Alternative were monetized using the updated SC-GHG values published by the EPA in the *Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances.*[4] Table 3.19-12 shows the present value in 2024 of the monetized climate costs for the 2025-2045 period under each discount rate. The present value of the monetized damages of the GHG emissions from the IBR Program range from $41 to $116 million in 2020 dollars.[5] The equivalent annualized costs of the emissions over the 20-year period range from $2.56 million to $6.46 million. The estimates presented in Table 3.19-12 reflect emissions reductions through 2045, the end of the traffic

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[4] U.S. Environmental Protection Agency. (2023, November) Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances. https://www.epa.gov/system/files/documents/2023-12/epa_scghg_2023_report_final.pdf. All files related to EPA's updated estimates are available on EPA's webpage (https://www.epa.gov/environmental-economics/scghg), including the final technical report, all replication instructions and computer code for the estimates, a link to the public comments received and EPA's responses to the comments within the Oil and Gas rule docket, and all files related to the peer review process, including EPA's response to the peer reviewer recommendations. It also includes a link to a Microsoft Excel "Workbook for Applying SC-GHG Estimates" spreadsheet to assist analysts in applying the updated SC-GHG estimates in policy analysis, such as to monetize project SC-GHG emissions in an EIS.

[5] The EPA's social cost of carbon tool provides values for CO_2, CH_4 and N_2O. However, the construction, maintenance, and user emissions are presented in the body of this SEIS in CO_2e. Estimates of CO_2e were disaggregated into specific speciation of constituent chemicals (e.g., CO_2, CH_4 and N_2O) for vehicle operations, fuel cycle emissions, and fuel used during construction and transportation of construction materials. Data were not available to disaggregate embodied CO_2e from construction materials or transit operations, and CO_2e was input as CO_2. Using CO_2e in place of CO_2, CH_4 and N_2O to estimate the social cost of carbon for transit operations and construction materials may result in an overestimate of the social cost of the construction-related emissions.

forecast period. However, benefits from the Modified LPA would extend well beyond 2045 because the transit, active transportation, and roadway improvements are expected to last for many years.

Table 3.19-12. Social Cost of All Greenhouse Gas Emission Changes Associated with IBR Program Cumulative Emissions (2025–2045)

Value	Discount Rate 2.5%	Discount Rate 2.0%	Discount Rate 1.5%
Present Value in 2024 (millions 2020$)	$41.47	$67.67	$115.63
Annualized Value (20 years; millions 2020$)	$2.56	$3.98	$6.46

Source: EPA 2024. Additional detail on the methods and annual estimates of benefits are provided in the Climate Change Technical Report.

3.19.12 Potential Avoidance, Minimization, and Mitigation Measures

Regulatory Requirements

State-level legislation and policy in Oregon and Washington support reducing emissions from transportation to minimize contributions to climate change. There are no specific requirements for mitigation actions in federal, state, or local regulations.

Program-Specific Mitigation

As noted above, there are no specific requirements for mitigation actions in federal, state, or local regulations. However, the IBR Program supports state, regional, and local goals to reduce GHG emissions. The Program is improving and adding multimodal transportation options (to facilitate mode shift), including the extension of light-rail, and the expansion of active transportation facilities; implementing demand management (e.g., variable-rate tolling); and implementing operation and maintenance efficiencies (e.g., using renewable energy for bridge operation needs, using zero-emission transit vehicles). Best management practices and mitigation measures will be considered in coordination with IBR Program partners, subject to developing regulations and standards for transportation projects.

Long-Term Effects

The IBR Program would reduce GHG emissions in support of local, regional, and state goals. This section outlines concepts to further reduce or minimize GHG emissions associated with the construction or operations and maintenance of the Modified LPA. In developing these concepts, the IBR Program collaborated with ODOT, WSDOT, and the eight local agency partners. The IBR Program team will continue to consider and incorporate mitigation and minimization measures during the development of the EIS and through final design and construction.

User Emissions and User Experience: Design and Implementation Considerations

The following concepts address future climate conditions:

- To increase resiliency, the design will consider future conditions, including more frequent and severe winter storms, lower low-water conditions in the dry season, and an increase in the number and intensity of hot days during summer months.
- In consideration of the effects of changing future climate conditions on users of the transportation system, the design considers the provision of shade and other treatments, with a focus on active

transportation and transit users.

Operation and Maintenance

The GHG emissions anticipated as a result of the long-term operation and maintenance of the Modified LPA (as opposed to user emissions) are relatively minor. However, they represent an additional opportunity to improve climate outcomes and progress toward shared GHG reduction goals. As Program design and planning continue, ODOT and WSDOT will work together to develop plans for long-term operation and maintenance of the infrastructure.

Options for reducing GHGs through infrastructure maintenance include:

- Minimizing energy use (e.g., LED lights) and using green energy sources.
- Providing energy storage on the bridges for operations if power is interrupted.
- Maximizing the renewable electricity supply for operations (lights, signs, transit, toll collection) toward 100% as soon as practical.
- Exploring potential for wind generation, solar panels for energy needs, or piezoelectric energy harvesters to generate energy from traffic vibration.
- Using an all-electric or hydrogen maintenance fleet (anticipated by 2045).
- Establishing guidelines for replacement equipment, alternative fuel use, and materials standards.

Measures outlined in the Energy Technical Report are as follows:

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

Construction Effects

Strategies to reduce the GHG emissions associated with the construction of the Modified LPA would include a range of options. Oregon and Washington have standard specifications that would reduce GHG emissions during construction, including:

- ODOT Standard Specifications Section 290, which has requirements for environmental protection, and include air pollution control measures. These control measures include vehicle and equipment idling limitations, which would also reduce energy usage and GHG emissions.
- Many of WSDOT’s standards specifications to minimize air quality impacts would also reduce energy use and GHG emissions, including:
  - Minimizing delays to traffic during peak travel times.
  - Minimizing unnecessary idling of on-site diesel construction equipment.
  - Educating vehicle operators to shut off equipment when not in active use to reduce emissions from idling.
  - Preparing a traffic control plan with detours and strategic construction timing (such as night work) to continue moving traffic through the area and reduce backups and delays to the traveling public, to the extent possible.

As construction packages and plans are developed, the IBR Program will evaluate the potential to further reduce GHGs associated with construction. This could be implemented through construction bid document specifications or performance requirements, and could include:

- Construction materials.
    - Design specifications for materials to reduce embodied emissions; use Environmental Product Declarations to evaluate various material choices and options.
    - Minimize lengthy supply chains for materials by using local sources where possible while still maintaining acceptable quality levels for materials.
    - Use cleaner production methods for cement and concrete (e.g., consider different mixes, fuel specifications for kiln and manufacture), and if found viable, incorporate into material specifications.
    - Maximize inclusion of recycled material to reduce virgin material production and inclusion. This would include recycling existing concrete and asphalt pavements within Program limits to be used as aggregate base, subbase, backfill materials, etc.
    - Consider prioritizing suppliers that document accountability to their sustainable practices, such as by participating and reporting to EPA's Energy StarChallenge for Industry.
- Fuel and energy use.
    - Specify emissions targets for contractors and encourage use of renewable fuels and electric equipment.
    - Specify improved diesel emissions standards for construction and vehicles.
    - Use renewable diesel, renewable propane, or other lower-carbon fuels in construction equipment and transport of materials.
    - Select specified electrical equipment (e.g., lighting) to maximize for energy efficiency, as long as the equipment meets safety and other project needs and requirements.
    - Seek to prioritize the use of battery-powered equipment and limit the use of diesel equipment operating under less stringent emissions standards than EPA's Tier 4.[6]
- Waste reduction.
    - Minimize construction waste.
    - Consider adopting or establishing a zero-waste demolition plan, including a recycling plan, to maximize the recycling or reuse of old bridge components.
- Traffic management during construction.[7]
- Support and encourage alternative modes during construction, such as transit subsidies or elimination of fares during construction period.
- Other approaches as suggested by interested parties, agencies, and the public.

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[6] EPA has adopted a comprehensive national program to reduce emissions from nonroad (construction equipment) diesel engines by integrating engine and fuel controls as a system to gain the greatest emission reductions. To meet these Tier 4 emission standards, engine manufacturers will produce new engines with advanced emission control technologies.

[7] Measures for minimizing the effects of construction-related traffic congestion (and thus emissions) are described in the Transportation Technical Report.