3.19 Climate

According to the U.S. Environmental Protection Agency (EPA), multiple lines of evidence show changes in weather, oceans, and ecosystems (EPA 2022b). 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 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 from human activities, which has resulted in dangerous effects on human health and welfare and to ecosystems (EPA 2022a). Climate changes may result in localized effects in the study area.

The developed world's transportation systems are changing rapidly toward reduced reliance on fossil fuels and increased use of electric and renewable fuels energy production and vehicles. California, Oregon, Washington, and British Columbia, Canada have regulations to reduce fossil fuel use over time, which are expected to reduce the 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 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 follows 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 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. This information can be found as Appendix B to the Climate Technical Report.

Table 3.19-1 compares the impacts and benefits of the CRC LPA (as presented in the 2011 Final EIS) with those of the IBR Modified LPA. The IBR Program did not identify any 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 Modified LPA Effects

Technical Considerations	CRC LPA Effects as Identified in the 2011 Final EIS	Modified LPA 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 Climate Technical Report, Appendix B).	N/A
Vehicle miles traveled (VMT)	Less than 1% reduction in regional VMT.[a]	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 CO2e 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 emissions compared to the No-Build Alternative.

Technical Considerations	CRC LPA Effects as Identified in the 2011 Final EIS	Modified LPA 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.	• 2,595,850 MMBtu total energy consumption. • 355,741 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 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.
b Although both the CRC project and IBR Program prepared estimates for GHG emissions associated with their LPAs, the methodologies and assumptions differ to such an extent that a numerical comparison is not possible.
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 for the estimate reported in this document; these estimates vary substantially from the cost-based estimate produced for the CRC LPA.
N/A = not applicable

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 Technical Report.

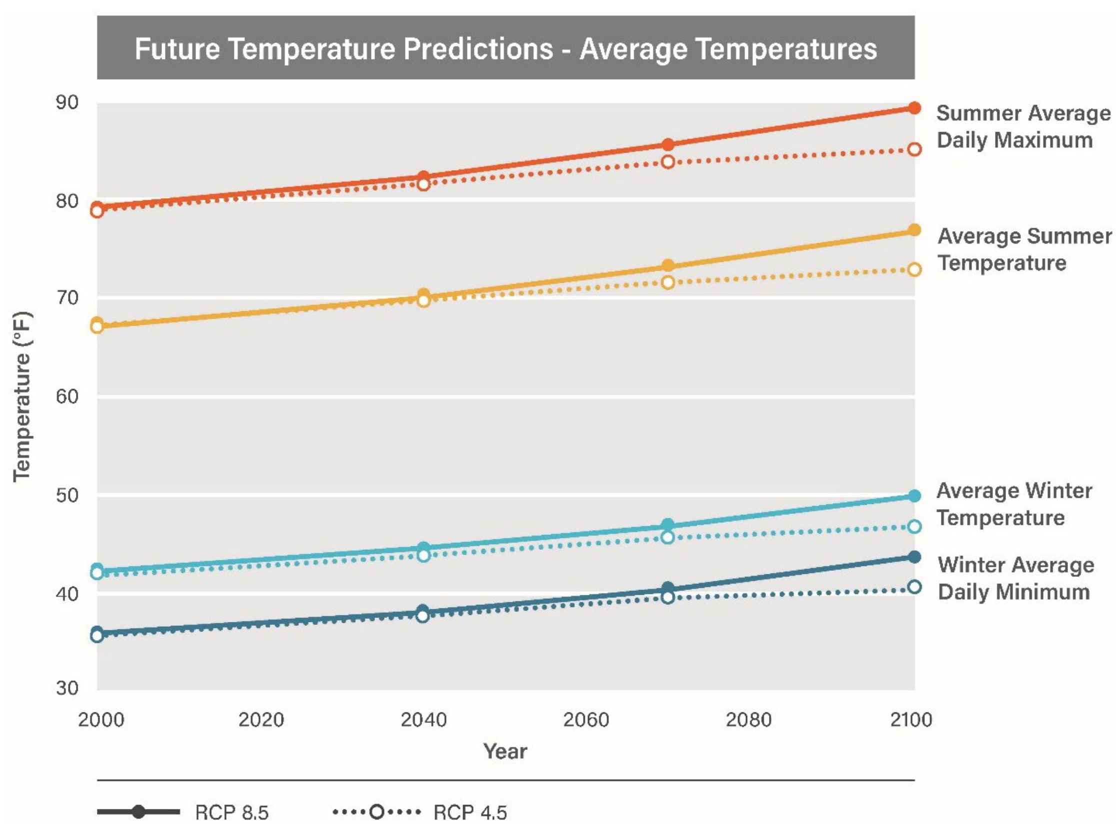
In the next century, the region is projected to experience an increase in average temperature (Figure 3.19-1) and in the number of extremely hot days. Additionally, changes to patterns of heavy precipitation are expected. While the region will experience roughly the same overall volume of rain, it is 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, including in the Cascade Mountains and 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 degrees 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

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.

Precipitation Changes

Because precipitation is expected to come in the form of in more severe storms, infrastructure design should plan for a wider range of water volumes and the possibility of higher and more frequent floods. 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. 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 is a consideration on the coast, and the Columbia River is tidally influenced at the Interstate Bridge location. However, 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. Saltwater intrusion is also not a cause for concern, according to the latest modeling from the OHSU Center for Coastal Margin Observation and Prediction (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. In recognition of the urgency of the climate crisis and 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 climate analyses were derived from the analysis in the Transportation Technical Report (for vehicle miles traveled [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 – Washington State Department of Transportation (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).

Policy	Policy Directives
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.
Oregon Clean Car Standards (DEQ n.d. c) and Advanced Clean Cars II (DEQ n.d. a)	The Oregon Department of Environmental Quality (DEQ) 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

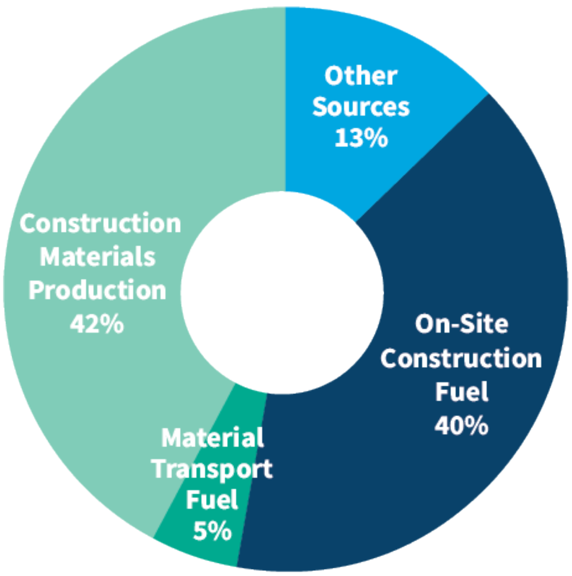
Emissions from vehicles using transportation facilities comprise the transportation sector's majority of GHG emissions. In a case study of six state departments of transportation, the National Cooperative Highway Research Program found that user emissions by passenger and freight vehicles made up approximately 94% of transportation-related emissions, compared with only 6% percent and 0.2% coming from construction and maintenance of the system and administrative functions (e.g., office buildings), respectively. 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.

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



Source: NCHRP 2023. For data sources, see footnote. [1]

The two largest categories of emissions are fuels used by construction equipment and production of construction materials (EPA 2023). 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).

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:

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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 DOT construction is 237310: Transportation Structures, Highways, and Streets. The model provides GHG emissions factors per U.S. dollar of purchase price (kg CO2e/$) and details about the largest sources of emissions for each industry.

- Encouraging mode shift to transit by providing an extension of TriMet's 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.
- Eliminating bridge lifts and the associated congestion and idling for fixed-span bridge options, or reducing the number of movable-span openings.
- Encouraging mode shift from cars to active transportation (walking and bicycling) with facility 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 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.

IBR Program Objective	Program Phase: Design/Refinement	Program Phase: Program Development and NEPA	Program Phase: Construction	Program Phase: Opening Day and Long-Term Operation
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 equipment and materials.	Evaluate and establish baseline.	Track equipment and materials.	N/A; construction would be complete.

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

3.19.8 Long-Term 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 Oregon Metro/Southwest Washington Regional Transportation Council regional travel demand model. The Transportation Technical Report, the Climate Technical Report, and the Energy Technical Report provide additional information on the modeling approach and the relationship between vehicle travel and GHG emissions.

No-Build Alternative

Daily travel and delay information for the No-Build Alternative is shown in Table 3.19-4, and daily trips by mode in the region and the traffic subarea are shown in Table 3.19-5. These figures are shown alongside the Modified LPA results for comparison.

Roadway Operations, Transit, and Multimodal Trips

Table 3.19-4 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 3.19-4. 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	58,835,800	1,793,400	64,000
	Traffic Subarea [a]	14,291,000	436,400	24,300
Modified LPA with one auxiliary lane	Portland Metropolitan Region	58,743,200	1,782,300	57,000
	Traffic Subarea	14,211,400	424,900	17,000
Modified LPA with two auxiliary lanes	Portland Metropolitan Region	58,751,200	1,781,800	56,700
	Traffic Subarea	14,219,500	424,300	16,600
Change between No-Build and Modified LPA with one auxiliary lane	Regional Difference	-92,700 (<-1%)	-11,100 (-1%)	-7,000 (-11%)
	Subarea Difference	-79,600 (-1%)	-11,500 (-3%)	-7,300 (-30%)
Change between No-Build and Modified LPA with two auxiliary lanes	Regional Difference	-84,600 (<-1%)	-11,600 (-1%)	-7,300 (-11%)
	Subarea Difference	-71,400 (-1%)	-12,100 (-3%)	-7,700 (-32%)
Change between Modified LPA with one auxiliary lane and two auxiliary lanes	Regional Difference	8,000 (<-1%)	-500 (<-1%)	-300 (<-1%)
	Subarea Difference	8,200 (<-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 3.19-5 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 3.19-5. 2045 Weekday Daily Corridor Trips and Systemwide Transit Trips

Measure	No-Build Alternative	Modified LPA
Regional Person Trips (all modes)	11,905,000	Same as No-Build
Work Trips (all modes)	2,165,500	Same as No-Build
Non-Work Trips (all modes)	9,739,500	Same as No-Build
Total Regional Transit Trips [a]	684,850	696,850
Regional Transit Mode Share	5.75%	5.85%
Regional New Transit Trips	N/A	12,000
Percentage Change from No-Build	N/A	+1.75%

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.
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 electric vehicles.

Section 3.12, Energy, describes potential GHG emissions associated with VMT, transit trips, and emissions from routine maintenance. As shown in Table 3.19-6, energy consumption and GHG emissions in 2045 under the No-Build scenario 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 towards EVs.

Table 3.19-6. Daily Regional Energy Consumption and CO_2e Emissions (with Electric Vehicle Assumptions)

Parameter	Existing (2015)	No-Build (2045)	Modified LPA (2045)	Modified LPA Difference from No-Build
Total Energy Consumption (MMBtu/day)	290,732	155,446	155,037	-0.28%
CO_2e Exhaust Emissions (MT CO_2e/day)	22,273	11,402	11,372	-31 MT/day -0.26%
CO_2e Fuel Cycle Emissions (MT CO_2e/day)	6,014	6,645	6,630	-15 MT/day -0.22%

Parameter	Existing (2015)	No-Build (2045)	Modified LPA (2045)	Modified LPA Difference from No-Build
Total CO_2e Emissions ($MT\ CO_2e$/day)	28,286	18,047	18,002	-46 MT/day -0.25%

Table 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; LPA = locally preferred alternative; MMBtu = million British thermal units; MT = metric tons

Modified LPA

As shown in Table 3.19-4, 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, as shown in Table 3.19-7. An additional analysis using operational model outputs for changes in speed and congestion in the traffic subarea shows that GHG emissions reduction could be up to 0.4% lower for the Modified LPA option with two auxiliary lanes option compared to the option with one auxiliary lane. This analysis shows that improving traffic speeds (i.e., reducing congestion) through the addition of a second auxiliary lane has an effect on I-5 that translates into lower GHG in the whole study area. The subset of roadway considered in the analysis is a small component of overall regional traffic.

The single-level fixed-span bridge design option would slightly reduce operational emissions compared to 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 bridges). The reduced profile grade is also characteristic of the single-level movable-span bridge design, 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 analysis area.

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.

Table 3.19-7. Comparison of Energy Consumption and CO_2e Emissions

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	Two Auxiliary Lanes Difference from One Auxiliary Lane
Daily Vehicle Miles Traveled	11,267,296	14,278,275	14,199,184	14,207,389	-0.55%	-0.50%	0.06%
Total Energy Consumption (MMBtu/day)	76,557	39,312	38,879	38,860	-1.15%	-1.10%	-0.03%
CO_2e Exhaust Emissions (MT CO_2e/day)	5,864	2,875	2,843	2,842	-1.11%	-1.15%	-0.05%
CO_2e Fuel Cycle Emissions (MT CO_2e/day)	1,583	1,637	1,623	1,624	-0.86%	-0.85%	0.01%
Total CO_2e Emissions (MT CO_2e/day)	7,447	4,513	4,467	4,466	-1.02%	-1.05%	-0.02%

Note: Values is this table represent emissions and energy consumption within the traffic assignment area. CO2e emissions are calculated assuming an electric vehicle adoption rate consistent with Oregon and Washington state goals. If the adoption rates are less than the rates assumed in this analysis (52% electric vehicles by 2045), GHG from both No-Build and the Modified LPA would be proportionately higher.

CO_2e = carbon dioxide equivalent; LPA = locally preferred alternative; MMBtu = million British thermal units; MT = metric tons

Table 3.19-5 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 12,000 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 3.19-6 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 bridge connections, 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.

3.19.9 Construction (Temporary) Effects

Emissions from temporary construction activities are considered in this section. GHG emissions would be produced from construction equipment and the emissions embodied in construction materials. Impacts during construction were calculated using FHWA's Infrastructure Carbon Estimator spreadsheet tool (ICF 2020), which incorporates project features and construction traffic delays to calculate energy consumption from construction equipment, materials, and routine maintenance. Table 3.19-8 presents the estimated GHG emissions associated with construction of the Modified LPA. 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 3.19-8. Energy Consumption and GHG Emissions from Modified LPA Construction Activities

Project Element	Total Energy Consumption (MMBtu)	CO_2e Emissions (MT)
Materials	2,240,745	320,958
Transportation	107,670	10,546
Construction	247,435	24,236
Total	2,595,850	355,741

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

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, no indirect impacts are anticipated related to unanticipated growth as a result of the IBR Program.

3.19.11 Cumulative GHG Changes and the Social Cost of Carbon

The Modified LPA would reduce regional VMT and corresponding GHG compared to the No-Build Alternative. The estimates in Table 3.19-7 are presented as daily averages. Implementation of the IBR Program could result in over 16,000 metric tons of GHG reduction in 2045. Given that those savings would occur in each year once the Program becomes operational, over 200,000 metric tons of GHG emissions could be avoided between the 2032 opening year and 2045. These cumulative emissions savings would correspond to a social benefit of between $6.8 and $25.4 million, using a range of the USEPA's current and proposed social cost of carbon ($51 to $191/ton), discounted to the present value of those benefits. These social benefits from the Program improvements would continue to accrue beyond 2045.

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 climate change. However, there are no specific requirements for mitigation actions in federal, state, or local regulations.

Project-Specific Mitigation

The following measures can be implemented to reduce GHG emissions from construction and transportation operations. 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

- Strategies to reduce operational GHG emissions are those that reduce vehicle travel demand, increase transit and nonmotorized mode shares, use transit technology that eliminates or reduces the use of fossil fuels (e.g., battery electric buses, light-rail), and improve traffic flow along I-5 between Vancouver and Portland.
- Considering the increasingly hot conditions expected in the future, the design could consider providing shade, and other treatments, for active transportation users.

Temporary Effects

- Strategies taken to reduce the energy consumed by the construction of the Modified LPA would encompass conservation of construction materials and fuels used during construction and implementing best management practices. Section 3.12, Energy, of this Draft SEIS includes a discussion of potential best management practices and their expected benefits.