Climate Change Supplemental Memorandum

Multnomah County | Earthquake Ready Burnside Bridge Project

Portland, OR

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EARTHQUAKE READY BURNSIDE BRIDGE

Earthquake Ready Burnside Bridge Climate Change Supplemental Memorandum

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Acronyms, Initialisms, and Abbreviations

API	Area of Potential Impact
CO_2e	Carbon Dioxide Equivalent
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EQRB	Earthquake Ready Burnside Bridge
GHG	greenhouse gas
ICE	Infrastructure Carbon Estimator
MOVES	Motor Vehicle Emissions Simulator
UNFCCC	United Nations Framework Convention on Climate Change

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Executive Summary

As a part of the Supplemental Draft Environmental Impact Statement (SDEIS) for the Earthquake Ready Burnside Bridge (EQRB) Project (Project), this Supplemental Climate Change Technical Report has been prepared to compare the Refined Long-span Alternative to the Draft EIS Long-span Alternative and No-build Alternative evaluated in the Draft Environmental Impact Statement (Draft EIS). The Draft EIS Climate Change Technical Report was prepared to analyze impacts from the Project that would contribute to climate change and to discuss potential impacts to the Project from future climate change conditions.

Based on the on-road (operational) emissions analysis for the No-Build Alternative, the Draft EIS Long-span Alternative, and the Refined Long-span Alternative, the Project will not increase global or regional greenhouse gas emissions in a meaningful way because traffic patterns are not expected to change significantly based on the Project design. The elimination of one traffic lane with the refinements would result in fewer GHG emissions from the traffic on the Burnside Bridge; but it could slightly increase regional GHG emissions due to delays and detours caused by one less travel lane on the bridge. Over the lifetime of the bridge, however, this difference in emissions is not significant.

The construction emissions resulting from the Project, as well as emissions resulting from the maintenance and operations of the Project, were analyzed for the Refined Long-span Alternative using project-level appropriate methods. Delays and detours resulting from construction were also considered in the analysis. The Refined Long-span alternative would result in fewer GHG emissions than the Draft EIS Long-span alternative because this Alternative would require less construction material and fewer construction activities due to the elimination of one traffic lane. Over the lifetime of the Project, construction and operations and maintenance of the Draft EIS Long-span Alternative and the Refined Long-span Alternative would likely result in fewer GHG emissions than the No-Build Alternative because of the ultimate need for a replacement bridge within the next 50 years.

The report also addresses the impact of future climate change-related conditions that could affect the Project and the Project Area, including the Willamette River and the preparedness and ability of local jurisdictions to effectively respond to extreme and catastrophic weather events. However, the degree to which these future impacts of climate change may be experienced remains uncertain, as well as the extent to which they will occur in the Project Area. The Refined Alternative, as well as the other Replacement alternatives, would be designed with climate change in mind and are anticipated to be less severely affected by climate change than the No-Build Alternative.

1 Introduction

In support of the Supplemental Draft Environmental Impact Statement (SDEIS) for the Earthquake Ready Burnside Bridge (EQRB) Project, this supplemental technical memorandum has been prepared to evaluate the potential impacts of potential refinements to the Preferred Alternative on climate change within the project's Area of Potential Impact (API). The intent of the design modifications is to reduce the overall cost and improve the affordability of the EQRB Project. This technical memorandum is a supplement to the Draft EIS technical reports and as such does not repeat all of the information in those reports, but instead focuses on the impacts of the design modification options, how they compare to each other, and how they compare to the version of the Preferred Alternative that was evaluated in the EQRB Draft EIS.

Much of the information included in the Draft EIS and Draft EIS technical reports, including project purpose, relevant regulations, analysis methodology and affected environment, is incorporated by reference because it has not changed, except where noted in this technical memorandum.

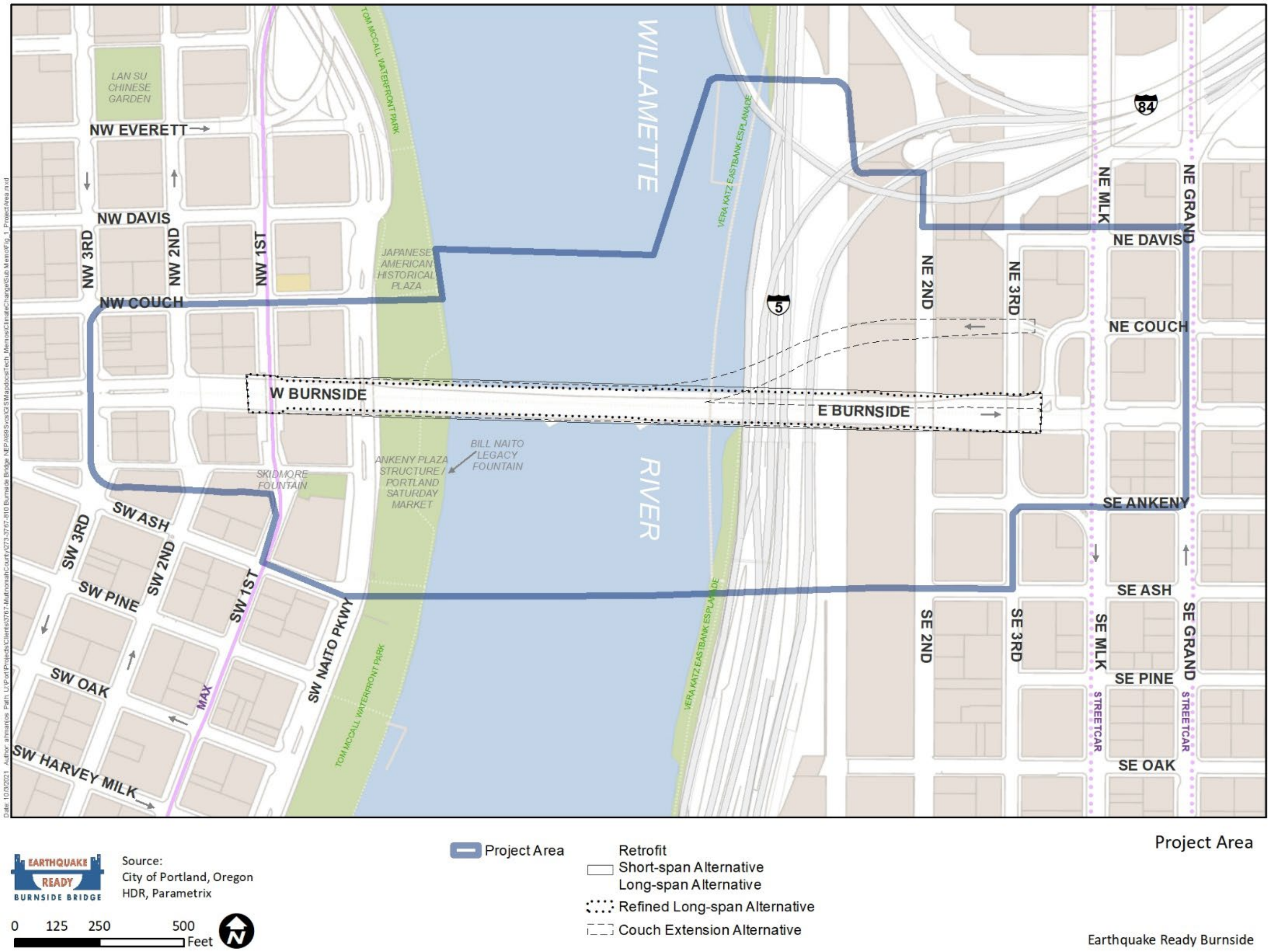
1.1 Project Location

The Project Area is located within the central city of Portland. The Burnside Bridge crosses the Willamette River connecting the west and east sides of the city. The Project Area encompasses a one-block radius around the existing Burnside Bridge and W/E Burnside Street, from NW/SW 3rd Avenue on the west side of the river and NE/SE Grand Avenue on the east side. Several neighborhoods surround the area including Old Town/Chinatown, Downtown, Kerns, and Buckman. Figure 1 shows the Project Area.

1.2 Project Purpose

The primary purpose of the Project is to build a seismically resilient Burnside Street lifeline crossing over the Willamette River that will remain fully operational and accessible for vehicles and other modes of transportation following a major Cascadia Subduction Zone earthquake. The Burnside Bridge will provide a reliable crossing for emergency response, evacuation, and economic recovery after an earthquake. Additionally, the bridge will provide a multimodal, long-term safe crossing with low maintenance needs. The full project purpose and need can be found in the EQRB Draft EIS, Chapter 1.

Figure 1. Project Area



2 Project Alternatives

This technical memorandum evaluates potential design refinements to the Draft EIS Preferred Alternative. All of the Project Alternatives evaluated in the Draft EIS are summarized in Chapter 2 of the Draft EIS and described in detail in the *EQRB Description of Alternatives Report* (Multnomah County 2021a). Briefly, the Draft EIS evaluated a No-Build Alternative and four Build Alternatives. One of the Build Alternatives, the Long-span Alternative, was identified as the Preferred Alternative. The potential refinements evaluated in this technical memorandum are collectively referred to as the Refined Long-span Alternative (Four-lane Version) or the Refined Long-span. The Refined Long-span includes project elements that were studied in the Draft EIS but have been modified as well as new options that were not studied in the Draft EIS. These potential refinements and new options are intended to provide lower cost and, in some cases, lower impact designs and ideas that could be adopted to reduce the cost of the Draft EIS Preferred Alternative while still achieving seismic resiliency. The potential design refinements, and how they differ from the Draft EIS Long span Alternative, are described below.

- Bridge width – The total width of the bridge over the river would be approximately 82 to 93 feet (the range varies depending on the bridge type and segment). For comparison, the Draft EIS Replacement Alternatives were approximately 110 to 120 feet wide over the river. The refined bridge width would accommodate approximately 78 feet for vehicle lanes, bike lanes, and pedestrians, which is comparable to the existing bridge.
  - The refined bridge design would accommodate four vehicle lanes (rather than five as evaluated in the Draft EIS). The following lane configuration options are being evaluated:
    - Lane Option 1 (Balanced) – Two westbound lanes (general-purpose) plus two eastbound lanes (one general-purpose and one bus-only lane)
    - Lane Option 2 (Eastbound Focus) – One westbound lane (general-purpose) plus three eastbound lanes (two general purpose and one bus only)
    - Lane Option 3 (Reversible Lane) – One westbound lane (general-purpose) plus two eastbound lanes (one general-purpose and one bus-only) plus one reversible lane (westbound AM peak and eastbound PM peak)
    - Lane Option 4 (General Purpose with Bus Priority) – Two westbound general-purpose lanes plus two eastbound general-purpose lanes, plus bus priority access (e.g., queue bypass) at each end of the bridge.
  - The width of the vehicle lanes would be, at minimum, 10 feet and could vary depending on how the total bridge width is allocated between the different modes.
  - The total width of the bicycle lanes and pedestrian sidewalks would be approximately 28 to 34 feet. This is wider than the existing bridge but narrower than what was described in the Draft EIS for the replacement alternatives.

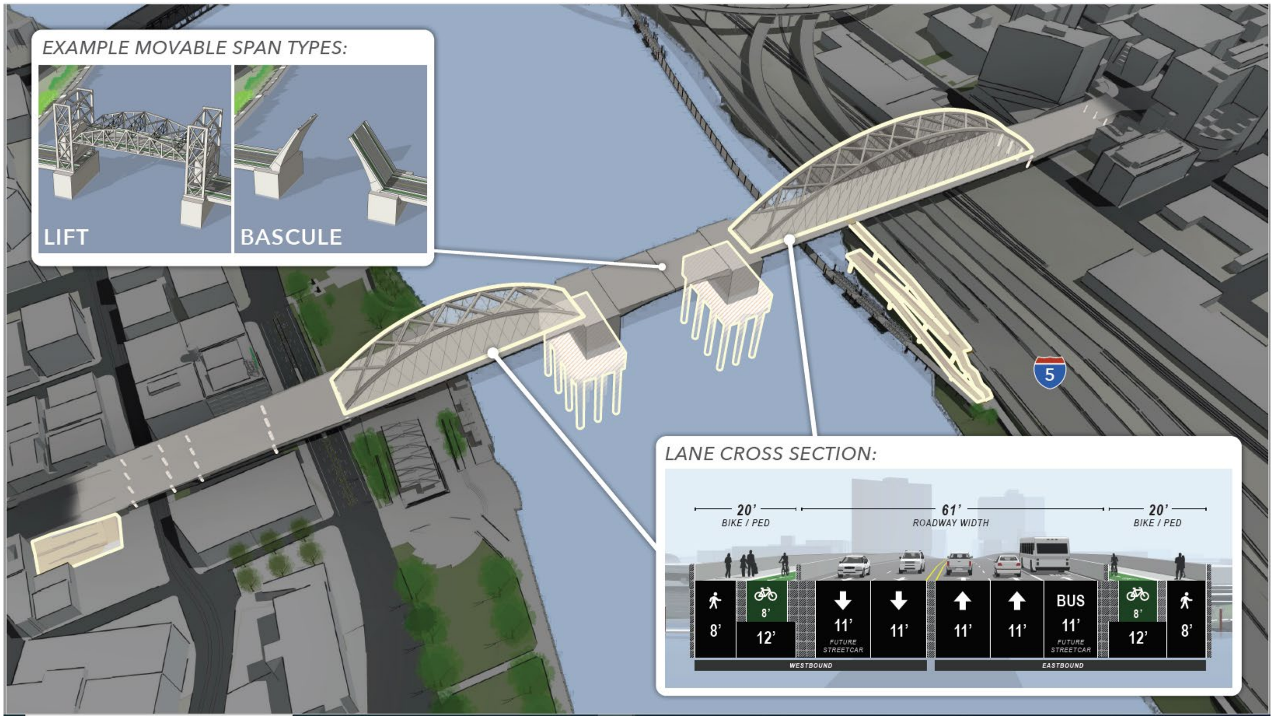
Physical barriers between vehicle lanes and the bicycle lanes would be in addition to the above dimensions.

- The refined bridge would allow narrower in-water piers, due to less weight needing to be transferred to the in-water supports.

- Other design refinements being evaluated:
  - West approach – This memorandum evaluates a refined girder bridge type for the approach over the west channel of the river, Tom McCall Waterfront Park, and Naito Parkway. Compared to the cable-stayed and tied-arch options evaluated in the Draft EIS, this option would not only reduce costs but also avoid an adverse effect to the Skidmore/Old Town National Historic Landmark District. It would have two sets of columns in Tom McCall Waterfront Park compared to just one with the Draft EIS tied-arch option and five with the existing bridge.
  - East approach – This memorandum evaluates a potential span length change for the east approach tied-arch option that would minimize the risks and reduce costs associated with placing a pier and foundation in the geologic hazard zone that extends from the river to about E 2nd Avenue. The refined tied-arch option would be about 720 to 820 feet long and approximately 150 feet tall (the Draft EIS Long-span Alternative was the same height and 740 feet long). The refined alternative would place the eastern pier of the tied-arch span either on the east side of 2nd Avenue (Option 1) or just west of 2nd Avenue (Option 2). Increasing the length of the tied-arch span would also reduce the length and depth of the subsequent girder span to the east.
  - Americans with Disabilities Act (ADA) access – This memorandum evaluates a refined approach for providing direct ADA access between the bridge and the Eastbank Esplanade, as well as between the bridge and W 1st Avenue and the Skidmore Fountain MAX station. The Draft EIS evaluated multiple ramp, stair, and elevator options for these locations. This SDEIS memo evaluates a refined option that would provide enhanced ADA access at both locations using both elevators and stairs. These facilities would also provide pedestrian and potentially bicycle access. For the west end, there is also the potential for replacing the existing stairs with improved sidewalk access from the west end of the bridge to 1st Avenue.

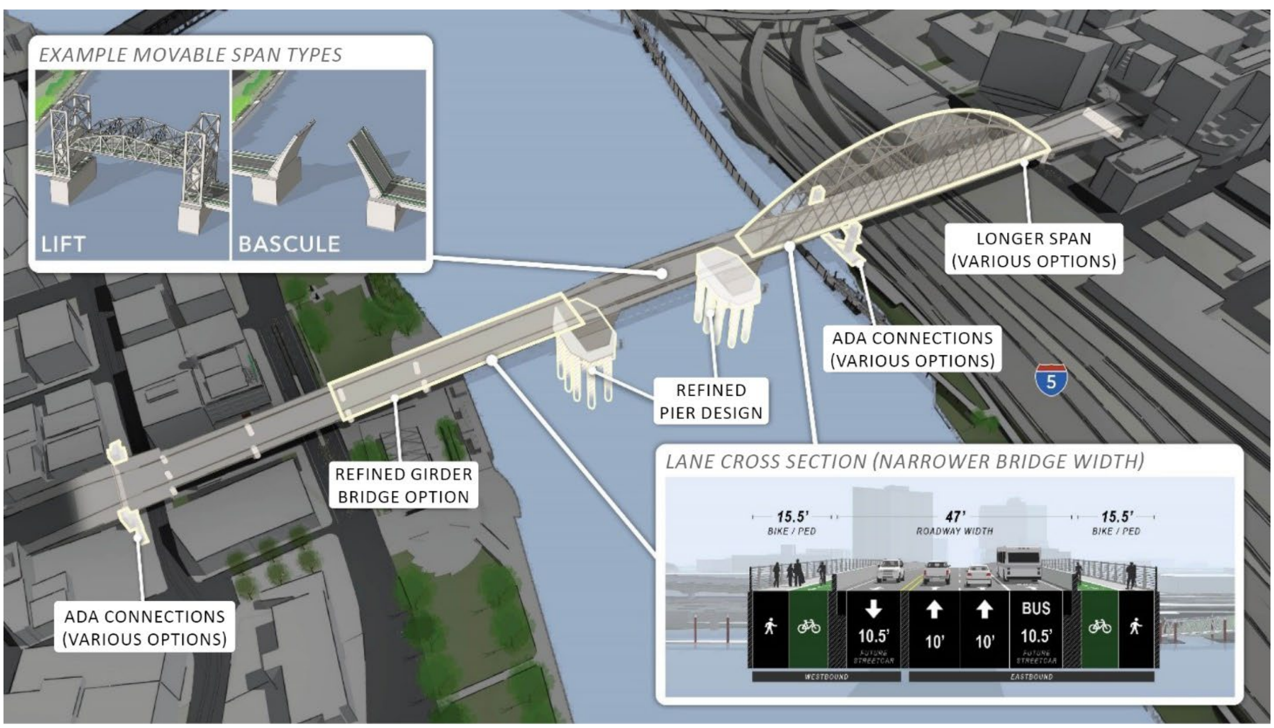
Figure 3 highlights the elements of the Draft EIS Long-span Alternative that have been modified to create the Refined Long-span Alternative, as described above. Figure 2 shows the Draft EIS Long-span Alternative and Figure 3 shows the Refined Long-span Alternative. Both figures include the tied-arch option for the east approach and the bascule option for the center movable span, but the east span could also be a cable-stayed bridge and the movable span could be a vertical lift bridge. For the west approach, the Draft EIS Long-span Alternative shows the tied-arch option while the Refined Long-span Alternative shows the refined girder bridge. The Refined Long-span Alternative image shows just one of the four possible lane configuration options being studied. All four configuration options, as well as many more graphics of the Refined Long-span Alternative, and how it compares to the Draft EIS Long-span Alternative, can be found in Chapter 2 of the *EQRB Supplemental Draft Environmental Impact Statement* (Multnomah County 2022). Figure 3 also shows just one of the possible ways to allocate the bridge width between vehicle lanes, bicycle lanes and sidewalks; the total width of the bicycle and pedestrian facilities could range from approximately 28 to 34 feet.

Figure 2. Draft EIS Long-Span Alternative



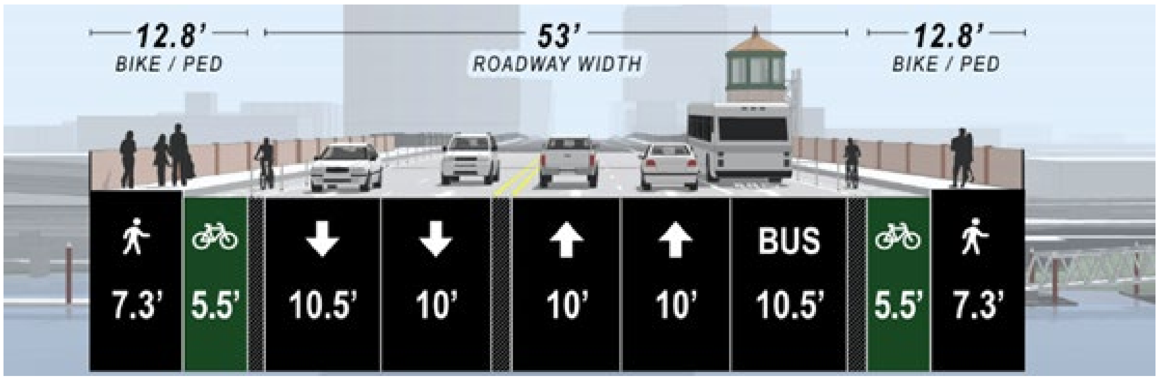
Note: The Draft EIS Long-span Alternative included multiple bridge types for both the east and west approaches. This figure shows only the tied arch option.

Figure 3. Refined Long-Span Alternative

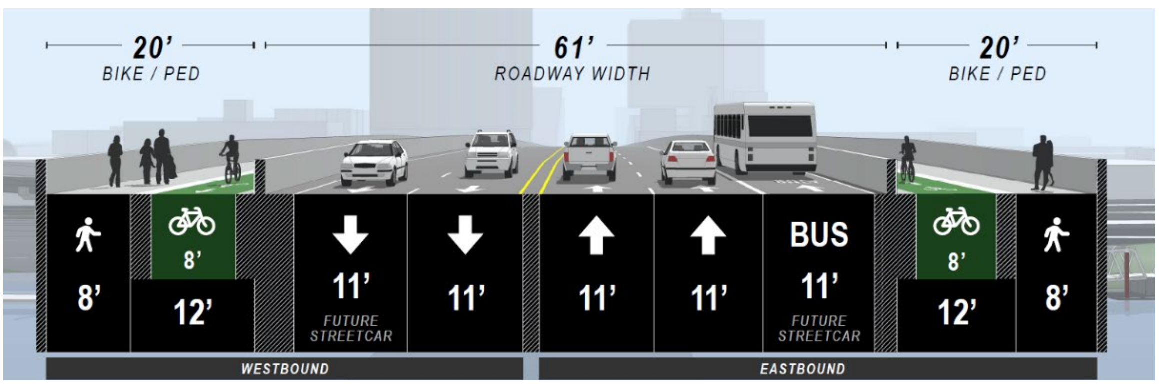


Notes: The Refined Long-span Alternative evaluated in this SDEIS includes both cable-stayed and tied-arch options for the east span. This figure shows only the tied-arch option. The Draft EIS studied, and SDEIS further studies, a bascule option and vertical lift option for the center movable span. The inset shows both options but the main figure shows the bascule option. This figure also shows just one of the lane configuration options considered in the SDEIS.

Figure 4. Bridge Width – Cross Section Over River

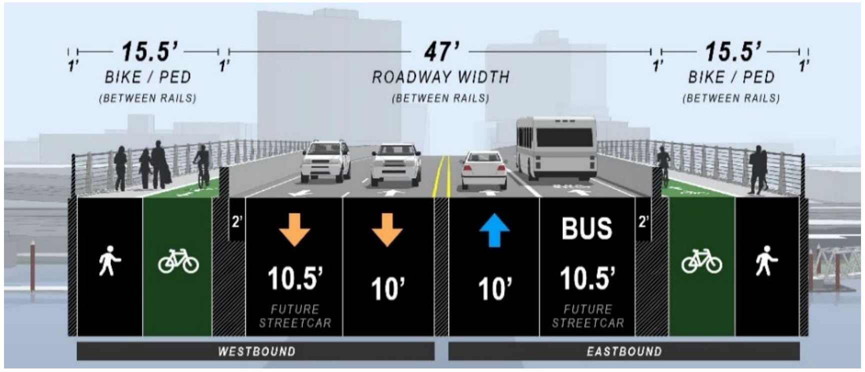


Existing Bridge Width

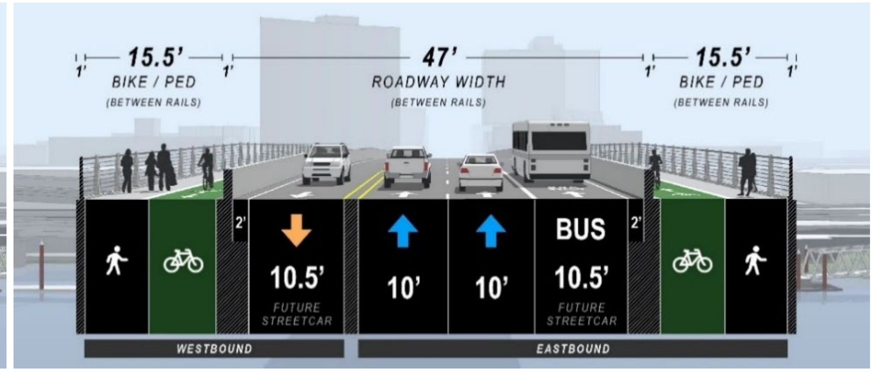


Draft EIS Long-Span Bridge Width

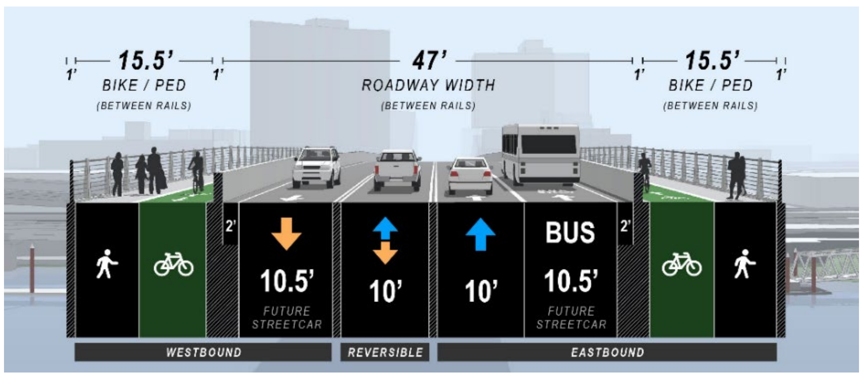
Figure 5. Refined Long-Span Lane Configuration Options



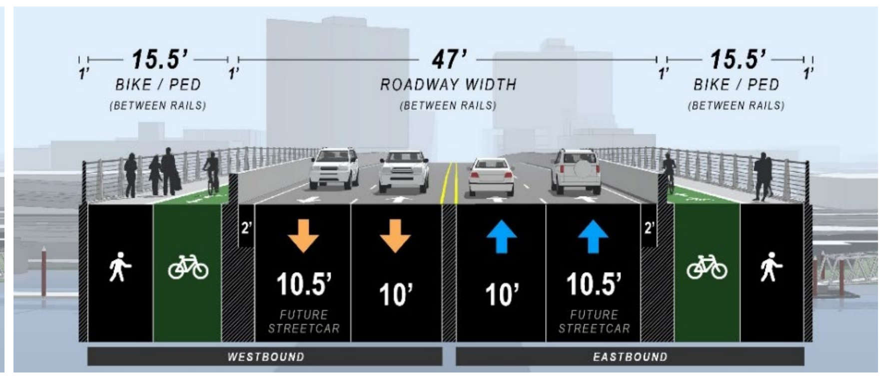
Option 1: Two Westbound Lanes | One Eastbound + One Bus Lane



Option 2: One Westbound Lane | Two Eastbound + One Bus Lane



Option 3: Reversible Lane



Option 4: Two Westbound Lanes | Two Eastbound Lanes (Bus Queue Jump)

- Construction assumptions:
  - Construction duration – The expected duration of project construction is 4.5 to 5.5 years, dependent upon the design option. See Table 1 for more information regarding construction impact extent and closure timeframes.
  - Construction area – Compared to the Draft EIS Long-span Alternative, the main refinement is that the construction area would be smaller for the west approach south of the bridge, including a smaller area within Tom McCall Waterfront Park south of the bridge.
  - Construction access and staging – The construction access and staging is expected to be the same as that described in the Draft EIS.
  - Vegetation – The Refined Long-span Alternative would remove slightly fewer trees and vegetation impacts than the Draft EIS Long-span Alternative, primarily within Tom McCall Waterfront Park south of the bridge.
  - In-water work activity – The in-water work would be similar to that described in the Draft EIS, except that the replacement bridge in-water foundations would consist of a perched footing cap and a group of drilled shafts. Whereas the Draft EIS discusses the use of cofferdams to isolate in water work, the Refined Long-span Alternative would use a temporary caisson lowered to an elevation about mid height of the water column to construct footing caps, avoiding additional disturbance of the riverbed that would needed for a cofferdam. Additionally, the existing Pier 4 would be fully removed, Pier 1 would be partially removed below the mudline, and Piers 2 and 3 would be removed to below the mudline. Existing in water piles would be removed, subject to the design option advanced.
  - Temporary freeway, rail, street, and trail closures – Temporary closures are expected to be the same as those described in the Draft EIS.
  - Access for pedestrians and vehicles to businesses, residences, and public services – Access is expected to be the same as that described in the Draft EIS.
  - On-street parking impacts – On-street parking impacts are expected to be the same as those described in the Draft EIS.
  - Property acquisitions and relocations – Property acquisitions and relocations are similar to those listed in the Draft EIS, except that they have been modified to reflect a narrower set of bridge design options.
  - Temporary use of Governor Tom McCall Waterfront Park – The park area that would be temporarily closed for construction has changed since the Draft EIS. On the north side of the bridge, the closure area has been reduced to avoid removing 10 cherry trees and a berm that are part of the Japanese American Historical Plaza; this change would apply to all of the build alternatives. On the south side of the bridge, the park closure area has also been reduced to include only the area north of the Tom McCall Waterfront Park trellis; this revision applies only to the Refined Long-span Alternative.

Table 1. Construction Impacts, Closure Extents, and Timeframes by Build Alternative

Facility Impacted	Draft EIS Long-Span Alternative	Refined Long-Span Alternative
Gov. Tom McCall Waterfront Park	4.5-year closure within boundary of potential construction impacts	Same; Smaller closure area south of the bridge
Willamette River Greenway Trail	Portion of trail within Tom McCall Waterfront Park closed for same duration as park; detours in place for construction duration	Same
Japanese American Historical Plaza	Southern portion of plaza would be closed for same duration as Tom McCall Waterfront Park	Same
Ankeny Plaza Structure	Closure for duration of construction but no impacts to Ankeny Plaza structure	Plaza structure would not be closed during construction or impacted
Bill Naito Legacy Fountain	No closure of fountain and associated hardscape	Same
Vera Katz Eastbank Esplanade	18 months (this could extend to 3.5 to 4.5 years if project builds ramps rather than elevators and stairs for the ADA/bicycle/pedestrian connection); detours in place for construction duration	Same
Burnside Skatepark	4-month full closure	Same
River Crossing on Burnside Street	4- to 5-year closure	Same
Saturday Market Location	4.5-year closure or use of alternative location	Same
Skidmore Fountain MAX Station	Approximately 5 weeks	Same
Navigation Channel/Willamette River Water Trail	Intermittent closures; 2 to 10 closures; each closure up to 3 weeks	Same
Overall Construction Duration	**4.5 to 5.5 years**	**Same**

3 Definitions

The following terminology is used when discussing geographic areas in the EIS:

- **Project Area** – The area within which improvements associated with the Project Alternatives would occur and the area needed to construct these improvements. The Project Area includes the area needed to construct all permanent infrastructure, including adjacent parcels where modifications are required for associated work such as utility realignments or upgrades. For the EQRB Project, the Project Area includes approximately a one-block radius around the existing Burnside Bridge and W/E Burnside Street, from NW/SW 3rd Avenue on the west side of the river and NE/SE Grand Avenue on the east side.
- **Area of Potential Impact (API)** – This is the geographic boundary within which physical impacts to the environment could occur with the Project Alternatives. The API is resource-specific and differs depending on the environmental topic being

addressed. For all topics, the API will encompass the Project Area, and for some topics, the geographic extent of the API will be the same as that for the Project Area; for other topics (such as for transportation effects) the API will be substantially larger to account for impacts that could occur outside of the Project Area. The API for climate change is defined in Section 5.1 of the *EQRB Climate Change Technical Report*.

- **Project vicinity** – The environs surrounding the Project Area. The project vicinity does not have a distinct geographic boundary but is used in general discussion to denote the larger area, inclusive of the Old Town/Chinatown, Downtown, Kerns, and Buckman neighborhoods.
- **Climate change –** The United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." Although the UNFCCC makes a distinction between climate change attributable to human activities altering the atmospheric composition and climate variability attributable to natural causes, this analysis focuses on GHG emissions and climate change effects attributed primarily to human activity (IPCC 2018).

  The term *climate change*, as used in this analysis, refers to a global effect whereby GHG emissions trap extra heat in the atmosphere which leads to increases in average global temperatures, extreme weather events, and other changes in the global climate. According to scientists, retained heat affects global climate in ways that adversely impact humans and natural ecosystems, with effects that can last millennia. Global climate change can lead to extended warm spells and drought, as well as more frequent flooding and sea-level rise. These changes are not evenly distributed geographically, and some regions will experience greater consequences and more frequent extreme weather events than others. In Oregon, agriculture, hydropower, public health, and infrastructure are vulnerable to climate change, as is watershed and forest health (ODOT 2013).
- **Greenhouse gas emissions** are GHGs that are naturally and anthropogenically produced and discharged into the global atmosphere. The GHGs absorb heat and radiate it back toward the Earth's surface. The principal GHGs emitted by human activities are carbon dioxide, methane, nitrous oxide, and fluorinated gases. These GHG emissions result in large part from the combustion of fossil fuels such as petroleum, coal, and natural gas. In Oregon and nationwide, the transportation sector is the largest contributor to GHG emissions, followed by the residential and commercial electricity sector, industrial sector, and lastly the agricultural sector.
- **Base flood** is the regulatory standard also referred to as the 100-year flood. The base flood is the standard used by the National Flood Insurance Program and all federal agencies for the purposes of requiring the purchase of flood insurance and regulating new development (FEMA n.d.a).
- **Base flood elevation** is the computed elevation to which floodwater is anticipated to rise during the base flood. Base flood elevations are shown on Flood Insurance Rate Maps and on the flood profiles. The base flood elevation is the regulatory minimum

requirement for the elevation or flood-proofing of structures. The relationship between the base flood elevation and a structure's elevation determines the flood insurance premium (FEMA n.d.b).

4 Relevant Regulations

Regulations that were updated since the Draft EIS, as well as additional regulations added, are outlined in this section but do not ultimately alter the conclusions made in the Draft EIS.

4.1 State

- 2021 Oregon Climate Change Adaptation Framework – This framework was prepared by a work group of 24 state agencies and provides recommendations to reduce GHG emissions and to address the impacts of climate change across all sectors (Department of Land Conservation and Development, 2021).
    - The recommendations are designed to strengthen interagency coordination and consideration of action and investment towards protecting people and the environment, using emerging opportunities as well as existing state resources. Adaptation strategies in the Built Environment and Infrastructure (Chapter 3) section include updating design standards for culverts, dams and levees, bridges, and utilities to accommodate new peak storm flows and energy demand.
- Department of Land Conservation and Development: Oregon Planning Goal 7 – Goal 7 requires local comprehensive plans to address Oregon's natural hazards. Protecting people and property from natural hazards requires knowledge, planning, coordination, and education.

4.2 Local

- City of Portland 2035 Comprehensive Plan (as amended through March 2020):
    - Goal 7.A Climate: Carbon emissions are reduced to 50 percent below 1990 levels by 2035.
    - Goal 7.C Resilience: Portland's built and natural environments function in complementary ways and are resilient in the face of climate change and natural hazards.
    - Policy 7.4 Climate change: Update and implement strategies to reduce carbon emissions and impacts and increase resilience through plans and investments and public education.
        - 7.4.a. Carbon sequestration: Enhance the capacity of Portland's urban forest, soils, wetlands, and other water bodies to serve as carbon reserves.
        - 7.4.b. Climate adaptation and resilience: Enhance the ability of rivers, streams, wetlands, floodplains, urban forest, habitats, and wildlife to limit and adapt to climate-exacerbated flooding, landslides, wildfire, and urban heat island effects.

- Portland City Code, Title 24 Building Regulations, Chapter 24.50 Flood Hazard Areas:
  - City Title 24 requires balanced cut and fill in all flood management areas of the City not addressed by Section 24.50.060 G. All fill placed at or below the base flood elevation will be balanced with at least an equal amount of soil material removal. Soil material removal will be within the same flood hazard area identified in Section 24.50.050 A. through I.
- City of Portland Bureau of Development Services, Title 33 (Planning and Zoning) – The zoning code is intended to implement Portland's Comprehensive Plan and related land use plans in a manner which protects the health, safety, and general welfare of the citizens of Portland.
- 1996 Flood Inundation Area (Metro Title 3) Map: Due to a record peak flow in February of 1996 that caused the Willamette River and its major tributaries to flood, this map was created to delineate the inundated areas near the mainstem and major tributaries of the Willamette River.

5 GHG Analysis Methodology

The long-term and short-term climate change impact assessment methods have not changed from the *EQRB Climate Change Technical Report* (Multnomah County 2021c) other than the use of the next iteration of the Motor Vehicle Emission Simulator (MOVES version 3.0.2, [MOVES3]) model, some inputs into the model, and emission rates for delay GHG calculations.

EPA MOVES

The MOVES (EPA n.d.) is an emission modeling system used to estimate air pollutant and GHG emissions for mobile sources at the national, county, and project levels. As with the Draft EIS, EPA MOVES was used to estimate Project GHG emissions from operation and delays associated with the reduction in capacity that the potential refinements to the Preferred Alternative would impose. The various lane configuration options under consideration (see Section 2) result in varying levels of capacity reduction and system delays. Regional traffic data for each option were calculated using Metro's regional demand model. GHG emission rates were calculated in MOVES3 using county-level input datasets from Metro that were adjusted via Oregon Department of Transportation preferences in the following ways:

- Fuel data used MOVES defaults with the exception of biodiesel which was updated to 10 percent in the fuel formulation input.
- Inspection/Maintenance Data was provided by DEQ for 2019. The 2019 file was modified for other years by adjusting the ending model year as recommended by the EPA Meteorological Data uses the defaults from MOVES3.0.2.
- DEQ provided the age distribution for passenger cars, trucks, and light commercial vehicles for analysis year 2019. The MOVES Age Distribution Tool was used to develop the other vehicle classes.

- Alternate Vehicle and Fuel Technology adjusted electric vehicles to zero since there is not a way to predict future electric vehicle usage with sufficient precision for this analysis.

6 Affected Environment

The affected environment for GHG emissions for the potential refinements to the Preferred Alternative has a minor change from the *EQRB Climate Change Technical Report* (Multnomah County 2021c). In short, the affected environment is defined by the Project footprint, including construction staging and detour routes. This accounts for the construction materials used for the Project and their origins. The revised construction area along the south side of the west end of the bridge within Waterfront Park has a smaller footprint than the Long-span alternative described in the Draft EIS. This was taken into account in the assessment of GHG emissions from construction impacts.

While Project GHG emissions would disperse into the global atmosphere, and, thus, contribute to the cumulative or global GHG emissions, this analysis focuses on the Project impacts to the Portland metropolitan region. The API is defined this way to provide a meaningful analysis of the Project's contribution of GHG emissions.

7 Impacts from the Design Modifications and Comparison to Draft EIS Alternatives

As discussed in the *EQRB Climate Change Technical Report* (Multnomah County 2021c), the on-road EPA MOVES analysis demonstrated that the CO_2e emissions from vehicles crossing the Burnside Bridge for the 2045 No-Build and all Build Alternatives assessed in the Draft EIS showed no measurable difference in emissions among the Alternatives. This was due to no change in bridge capacity (5 travel lanes) and hence traffic and vehicle mix would be the same for each alternative. Relative to these conditions the Refined Long-span Alternative would carry slightly less traffic across the bridge (four travel lanes). Capacity with the Refined Long-span Alternative (four-lane version) would vary from existing conditions by a decrease of one lane of traffic.

7.1 Impacts to Regional On-Road Operational GHG Emissions

Regionally, the elimination of one traffic lane in the Refined Long-span Alternative (four lanes, instead of the five-lane bridge described in the Draft EIS) would increase travel times, congestion, and diversion to differing extents, depending on the utilization of the four travel lanes. Congestion and slower traffic speeds could increase traffic air emissions; however, since capacity improvements are not significantly decreased by the elimination of one traffic lane, the increase in future GHG emissions in the potential refinements to the Preferred Alternative is not significant. The results from the MOVES analysis for projected regional on-road GHG emissions in year 2045 for the No-Build Alternative and the four different lane configuration options (shown in Figure 5 of

Section 2 of this report) of the Refined Long-span Alternative are shown in Table 2 below, including the assumptions made during the travel demand modeling. All lane configuration options of the Refined Long-span Alternative resulted in less than a one percent increase in year 2045 in regional GHG emissions from the No-Build Alternative because of the regional traffic effect of the elimination of one traffic lane.

Table 2. Projected Regional On-Road Operational GHG Emissions

Condition	CO_2e Metric Tons per year [b]	Change in GHG Emissions Relative to No-Build
Existing Conditions [a] • 2 WB GP lanes • 2 EB GP lanes • 1 EB BAT lane	732,598	N/A
No-Build (year 2045) • 2 EB BAT lanes on W Burnside from Park to 2nd Ave • 2 EB BAT lanes on E Burnside from Grand to 12th Ave • 1 WB BAT lane on NE Couch from 14th Ave to 7th Ave	530,085	N/A
Option 1 (year 2045) • 2 WB GP lanes • 1 EB GP lane • 1 EB BAT lane (all day)	535,321	+ 5,236
Option 2 (year 2045) • 1 WB GP lane • 2 EB GP lanes • 1 EB BAT lane (all day)	535,552	+ 5,467
Option 3 (year 2045) Reversible Lane Option: <u>5:00am to 10:00am</u> • 2 WB GP lanes • 1 EB GP lane • 1 EB BAT lane <u>10:00am to 5:00am</u> • 1 WB GP lane • 2 EB GP lanes • 1 EB BAT lane	535,531	+ 5,446
Option 4 (year 2045) • 2 WB GP lanes • 2 EB GP lanes • Bus Queue Jump	535,337	+ 5,253

[a] Traffic data source: 2019 Metro Regional Travel Demand Model
[b] (metric tons CO2e) per year, calculated by HMMH
EB = eastbound; WB = westbound; GP = general purpose; BAT = business access and transit

7.2 Impacts to On-Road Operational GHG Emissions for Bridge Only

Under the No-Build Alternative the Project would not be built and emissions would continue to occur as they do from traffic on and around the existing bridge. However, as advancements in vehicle technologies continue and regulations on fuel economy standards become more stringent, traffic-related GHG emissions in the Project Area are expected to lessen over time. Additionally, the expansion of public transportation in the region is expected to reduce single-occupancy vehicles from the road, reducing transportation-related GHG emissions. As stated in the *EQRB Climate Change Technical Report* (Multnomah County 2021c), the estimated long-term (2045) operational GHG emissions for the No-Build Alternative and the preferred alternative in the Draft EIS were projected to be approximately 41 percent lower than the existing (2019) annual emission total based on factors unrelated to the Project. This accounts for GHG emissions only on the Burnside Bridge based on traffic modeling and does not address the area-wide or region-wide emissions as discussed above.

The total 2045 GHG emissions for the Refined Long-span are projected to be approximately 43 percent lower than the existing (2019) annual emission total. These reductions were semi-qualitatively assessed based on vehicle miles traveled, average speeds, vehicle mix on the bridge, and traffic, as well as the emission rates developed in MOVES. As with the No-Build Alternative, the reduction in projected GHG emissions is due to advancements in expanded public transportation options and increased use of public transportation, advancement in vehicle technologies, and more stringent fuel economy standards and emission-reduction efforts on a federal, state, and local level. Additionally, the elimination of one traffic lane in the potential refinements to the Preferred Alternative (four lanes, instead of the five-lane bridge described in the Draft EIS) would slightly decrease capacity on the bridge and lessen projected 2045 GHG emissions more than the No-Build and Preferred Alternatives assessed in the Draft EIS. Table 3 shows the projected (year 2045) on-road GHG emissions decrease (percentage) from existing traffic conditions based on 2019 Metro traffic data for the Draft EIS Long-span Alternative and No-Build Alternative as well as the Refined Long-span Alternative.

Table 3. 2045 Projected Operational On-Road GHG Emissions Percentage Decrease from Existing Conditions

Alternative	Number of Traffic Lanes	Percentage Decrease of GHG Emissions in year 2045 from Existing Conditions (year 2019)[a]
No-Build Alternative	5 traffic lanes	41% less than existing conditions
Draft EIS Long-Span Alternative	5 traffic lanes	41% less than existing conditions
Refined Long-Span Alternative	4 traffic lanes	43% less than existing conditions

[a] Traffic data source: 2019 Metro Regional Travel Demand Model

7.3 Construction Impacts

The Federal Highway Administration Infrastructure Carbon Estimator (ICE) tool (version 2.1) evaluates the Project-level energy use and GHG emissions associated with the construction and maintenance of transportation facilities (roadways, bridges, and multimodal paths). The ICE tool accounts for impacts over the lifecycle of transportation facilities including construction, maintenance, and ongoing rehabilitation needs. The tool also accounts for upstream emissions from material mining and production for routine resurfacing. ICE is not accurate for bridges with spans longer than 1,000 feet; however, absent other tools it does provide a useful estimate for comparison purposes.

The tool is designed for new build projects, but a calculation was completed for the No-Build Alternative using estimates of roadway and bridge maintenance. For the No-Build Alternative, immediately, no construction emissions would occur as there would be no construction associated with the No-Build Alternative; however, bridge maintenance and roadway rehabilitation are assumed to occur on an ongoing basis, and to be more frequent and intense than with Refined Long-span Alternative.

The GHG emissions associated with traffic delays and detours resulting from the Burnside Bridge crossing closure have been estimated using existing and projected traffic data from the Portland metropolitan region (Metro 2019). Table 4 shows the difference from the baseline conditions for the full closure option and the partial closure option. Delays and detours would be limited to the geographical area from the Fremont Bridge to the Ross Island Bridge; areas extending beyond those bridges were not found to be affected by the Burnside Bridge traffic patterns. Bridge closure due to construction would cause traffic delays and detours which could increase GHG emissions from vehicle traffic. The existing traffic conditions were analyzed to create a baseline of existing GHG emissions from the region with the current Burnside Bridge conditions. Predicted traffic conditions were modeled to estimate GHG emissions from on-road vehicles.

Table 4. Annual Traffic Delay and Detour[a] GHG Emissions[b] During Construction

Condition	MT CO_2e[b]	Difference (delta) in MT CO_2e[b]
Baseline (existing conditions)	732,597.91	N/A
Full closure (no temporary bridge, 4.5 years)	734,033.63	1,435.73

[a] Traffic data source: 2019 Metro Regional Travel Demand Model
[b] (metric tons CO2e) per construction year

Calculations were completed for all alternatives in the Draft EIS. The results of the calculations for the Preferred Alternative in the Draft EIS are presented in Table 5 (expanded table shown in Appendix B, by construction year). Additionally, calculations were completed for the potential refinements to the Preferred Alternative during this SDEIS, and the results are also shown in Table 5. Construction timeframe assumptions are listed below Table 5. Maintenance-related emissions would be generated periodically over the lifetime of the bridge and are incorporated into the bridge and roadway construction emissions totals.

Table 5. Total Construction and Delay/Detour GHG Emissions[a] for All Alternatives

Alternative	Total Emissions ($MT\ CO_2e$) (No temp bridge)
No-Build Alternative	***709***
Roadway on bridge	687
Pathways rehab	22
Long-Span Alternative (Draft EIS)	***8,928***
Bridge construction	768
Roadway on bridge [e]	1,622
Pathways rehab [e]	76
Delays/detours (delta from baseline) [c]	6,462 [c]
Refined Long-Span Alternative	***8,513***
Bridge construction	614
Roadway on bridge [e]	1,361
Pathways rehab [e]	76
Delays/detours (delta from baseline) [c]	6,462 [c]

[a] Based on a fuel cycle factor of 0.27.

[b] (metric tons CO2e) per year.

[c] The duration of the construction of the Draft EIS Long-span Replacement Alternative is estimated to be 4.5 years.

[d] The duration of the construction of the Refined Long-span Replacement Alternative is estimated to be 5 years (4.5 to 5.5 years, dependent on design option).

[e] The lifecycle of the bridge (maintenance calculations) for Build Alternatives was set to 100 years.

7.3.1 No-Build Alternative

Repairs, improvements, and maintenance of the existing bridge (No-Build Alternative) would be more frequent and more extensive than for the Refined Long-span alternative and would still result in the high probability of the need for replacement within 50 years. The GHG emissions of the maintenance and upkeep of the existing bridge would be less than those associated with construction of the Refined Long-span alternative in the short term (approximately 709 metric tons CO_2e per year), but when added to the high probability of the need for a replacement bridge in less than 50 years, the construction of the Refined Long-span alternative would amount to lower total (or cumulative) GHG emissions. However, construction materials and methods could be developed in the future that would change this conclusion if they generated substantially less GHG emissions.

7.3.2 Draft EIS Long-Span Alternative and Refined Long-Span Alternative

GHG emissions associated with the construction phase of the EQRB Project are expected to be consistent with other projects of this scale. The major source of GHG emissions would be mobile and stationary fossil-fuel construction equipment and heavy trucks. Construction fuel consumption is based on recent experience in building bridges in the Portland metropolitan area and provides an order-of-magnitude estimate of GHG emissions.

The construction of the Refined Long-span Alternative is expected to take between 4.5 and 5.5 years. For the purposes of this report, an average of 5 years was used for inputs for the ICE tool and calculations of delays and detours due to bridge closure. The total CO_2e emissions associated with construction, maintenance, and traffic-related detours and delays for the Refined Long-span Alternative are approximately 8,513 metric tons. This is less than the total CO_2e emissions associated with construction, maintenance, and traffic-related detours and delays for the Draft EIS Long-span Alternative which was approximately 8,928 metric tons. The decrease in construction GHG emissions in the Refined Long-span Alternative compared to the Draft EIS Long-span Alternative is likely due to the reduced width of the bridge in the Refined Long-span Alternative which would result in less construction material and fewer construction activities.

7.4 Impacts from Climate Change on the Project

With regard to potential impacts from climate change such as an increase in base flood elevation as described in detail in Section 5 of the *EQRB Climate Change Technical Report* (Multnomah County, 2021c), the No-Build Alternative would not increase flood elevations but would be more vulnerable to damage from higher flood levels caused by a changing climate. The Refined Long-span Alternative, like the Draft EIS Long-span Alternative, would be designed with climate change in mind. Coupled with the limited lifespan remaining with the No-Build Alternative and the projected long-term changes related to climate change, the Refined Long-span Alternative is anticipated to be less severely affected by climate change than the No-Build Alternative because of the specific design for resiliency against earthquakes and extreme weather events. The same conclusion was drawn for all Build Alternatives assessed in the Draft EIS Climate Change Technical Report.

8 Potential Mitigation

The project team would continue to consider and incorporate mitigation and minimization measures during the development of the Preferred Alternative through the EIS, final design, and construction. Ultimately, the Project would comply with all applicable GHG and climate change regulations.

Mitigation measures for minimizing the effects of construction-related traffic congestion (and thus emissions) are in the *EQRB Transportation Technical Report* (Multnomah County 2021g). Additional mitigation measures for reducing emissions from construction equipment and activities would be achieved by following the Multnomah County Clean

Air Construction guidance. Mitigation measures for minimizing changes in base flood elevations are described in more detail in the *EQRB Hydraulic Impact Analysis Technical Report* (Multnomah County 2021f).

Construction materials and methods and the duration of construction can affect GHG emissions including emissions embedded in the development and manufacturing of materials, emissions from construction equipment, and emissions from traffic affected by temporary road or lane closures and detours. The Project initiated a GreenRoads assessment that would evaluate the sustainability of construction-related choices and activities. As the Project progresses through the National Environmental Policy Act phase and into final design and construction contracting, the GreenRoads assessment would be able to provide increasingly detailed analysis of the potential benefits and costs of such measures, with the intent of identifying feasible ways to reduce GHG emissions associated with construction materials, means and methods.

9 Agency Coordination

Agency coordination remains unchanged from the *EQRB Climate Change Technical Report* (Multnomah County 2021c).

10 Preparers

Name	Professional Affiliation [firm or organization]	Education [degree or certification]	Years of Experience
Kelly Carini	Parametrix	Environmental Studies	6

11 References

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Appendix A. Annual Construction and Delay/Detour GHG Emissions for No-Build, Long-Span Replacement Bridge, and Refined Long-Span Replacement Bridge Alternatives

Table A-1. Emissions (MT CO_2e) by Construction Year[b]

Alternative	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
No-Build Alternative							**709**
Roadway on Bridge							*687*
Pathways Rehab							*22*
Draft EIS Replacement Long-Span Bridge Alternative (no temp bridge)[c]							**8,928**
Bridge Construction							*768*
Roadway on Bridge[g]							*1,622*
Pathways Rehab[g]							*76*
Delays/Detours	*1,436*	*1,436*	*1,436*	*1,436*	*718*		*6,462*
SDEIS Refinements to the Replacement Long-Span Bridge Alternative (no temp bridge)[d]							***8,513***
Bridge Construction							*614*
Roadway on Bridge[g]							*1,361*
Pathways Rehab[g]							*76*
Delays/Detours	*1,436*	*1,436*	*1,436*	*1,436*	*718*		*6,462*

[a] Based on a fuel cycle factor of 0.27.
[b] (metric tons CO_2e) per year.
[c] The duration of the construction of the Long-span Replacement Alternative is estimated to be 4.5 years.
[d] The duration of the construction of the Refined Long-span Replacement Alternative is estimated to be 5 years (4.5 to 5.5 years, dependent on design option).
[e] The lifecycle of the bridge (maintenance calculations) for Build Alternatives was set to 100 years.

Appendix B. MOVES Input Assumptions

Table B-1. MOVES RUNSPEC Selections

Input Name	Selection
Scale & Calculation Type	County, Emission Rates
Time Spans	Analysis Year: design year (2045)
	Time Aggregation: All hours, Weekdays
Months of Analysis	January and July
Geographic Bounds	Oregon, Portland Metro Area (note: Metro defined their geography as only Multnomah County)
Vehicles/Equipment	Combination long-haul truck, combination short-haul truck, light commercial truck, passenger car, passenger truck, single unit long-haul truck, single unit short-haul truck
Road Types	Urban and rural restricted (freeway), urban and rural unrestricted (surface streets), off-network
Pollutants	CO_2e, CO_2, NH_4, N_2O
Processes	Criteria pollutants and MSATs, roadway emissions only - running exhaust, crankcase running exhaust, evaporative permeation, and evaporative fuel leaks.
Output	Units: grams, million Btu, miles Activity: distance traveled By: day, county, pollutant, road type

Notes: Btu = British thermal unit; MOVES = Motor Vehicle Emissions Simulator; CO_2e = carbon dioxide equivalents; CO_2 = carbon dioxide; NH_4 = methane; N_2O = nitrous oxide
County Data Manager Inputs provided by Metro and adjusted per ODOT instructions see methods section.

Appendix C. FHWA ICE Input Assumptions

Table C-1. FHWA ICE Inputs for Reduced Long-Span Alternative

Input Name	Selection
Tool Use	Project
Lifetime of Project	30 years
Infrastructure Features	Bridges_Overpasses, pathways,
Bridge Inputs	Bridge or Overpass Structure: Multi-Span Bridge (over water) Construction Type: Construct New Bridge Number of Spans: 2 Number of Lanes: 4
Pathways Inputs	New Construction: 1.06 on-street bicycle lane – lane miles 1.06 on-street sidewalk - miles
Roadway Inputs	New Roadway: 2.12 lane miles Include Roadway Rehabilitation Activities (reconstruct and resurface): Yes Percent of Roadway on Rocky/Mountainous Terrain: 0%

Appendix D. Regional VMT by Analysis Year

Table D-1. Regional VMT by Analyzed Condition

Condition	VMT	Percent Change Relative to Existing Conditions
Existing 2019	3,861,791.11	N/A
No Build 2045	4,235,969.91	9.69%
Build Reduced Long-Span Option 1 2045	4,235,871.15	9.69%
Build Reduced Long-Span Option 2 2045	4,236,087.48	9.69%
Build Reduced Long-Span Option 3 2045	4,236,275.18	9.69%
Build Reduced Long-Span Option 4 2045	4,236,177.63	9.69%