Earthquake Ready Burnside Bridge:
Combined Final Environmental Impact Statement/Record of Decision

Chapter 6

Selected Preferred Alternative

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U.S. Department of Transportation
Federal Highway Administration

Multnomah County

6 Selected Preferred Alternative

6.1 Introduction

The February 2021 EQRB Draft EIS identified the Long-span Alternative with no temporary bridge as the Preferred Alternative based on a range of engineering factors including seismic resiliency, environmental factors, and input received through public stakeholders, the City of Portland, and coordination with state and federal participating and cooperating agencies. The Draft EIS includes detailed analysis and rationale for identification of the Replacement Long-span Alternative as the Preferred Alternative. This analysis is presented in Chapters 2 and 3 of the Draft EIS.

The April 2022 EQRB Supplemental Draft EIS (SDEIS) evaluated potential design refinements to the Draft EIS Preferred Alternative intended to reduce construction costs while still meeting the Project's purpose and need. Based on the analysis documented in the SDEIS, additional input received from agency and public Draft EIS and SDEIS comments, and supplementary analysis conducted as part of this Final EIS (see Chapter 4, Supplementary Analysis and Discussion), the Refined Long-span Alternative has been identified as the Selected Preferred Alternative for the EQRB Project.

This chapter describes the Selected Preferred Alternative (used synonymously with Preferred Alternative or Final EIS Preferred Alternative in this chapter), the elements that define it, and why it was chosen. The selection of the Preferred Alternative is finalized in the Record of Decision (Chapter 7).

6.2 Description of the Preferred Alternative

The following outlines the major elements of the Preferred Alternative. See Table 6-1 for a summary of these major elements.

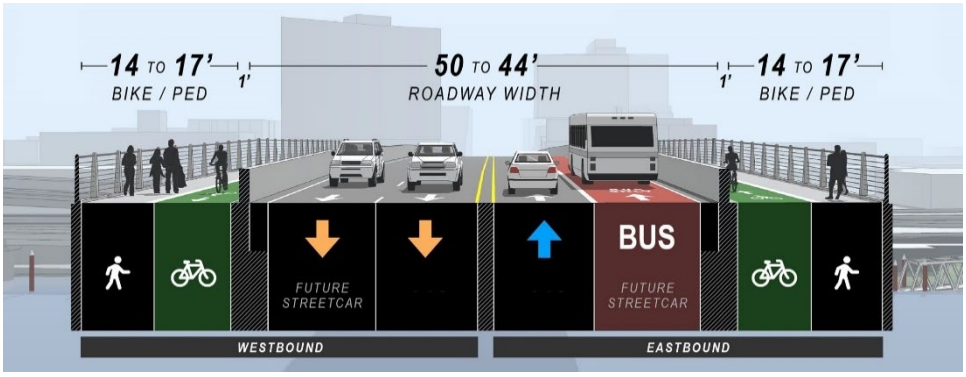
6.2.1 Bridge Geometry

The proposed replacement bridge is placed at approximately the same location as the existing bridge. The total bridge length is approximately 2,290 feet, which is comparable to the existing bridge. The West Approach abutment is located approximately 80 feet east of the current abutment, and the East Approach abutment is located approximately 30 feet east of the existing abutment.

The height of the bridge deck is at approximately the same elevation as the existing bridge, and the proposed vertical profile grade is set to approximately 4.6 percent, which is slightly steeper than the existing bridge vertical profile grade of 3.86 percent.

The Preferred Alternative would accommodate approximately 78 feet for vehicle lanes, bicycle lanes, and pedestrians (see Figure 6-1); this width is comparable to the existing bridge (see Figure 3.1-3 in the Draft EIS). The Preferred Alternative would accommodate four vehicle lanes. As the road authority, the City of Portland, on July 20, 2022, declared its preferred lane configuration as the SDEIS Lane Option 1 (Balanced), which includes two westbound lanes (general-purpose) and two eastbound lanes (one general-purpose and one bus-only lane). The SDEIS evaluated a range of widths for the travel lanes, sidewalks, and bicycle lanes (see Figure 6-1; the precise widths of each lane would be determined in the Final Design phase. The analysis showed that within the range of a combined sidewalk and bicycle lane space (determined as 14 to 17 feet in each direction) and vehicle lane widths (10 to 12 feet) being considered, the differences in impacts would be insignificant. Physical barriers between vehicle lanes and the bicycle lanes would be included and would be in addition to the lane dimensions provided above. For the East Approach span, additional width would be required for the above-deck superstructure members.

Figure 6-1. Preferred Alternative Lane Configuration Options (West Approach Shown)



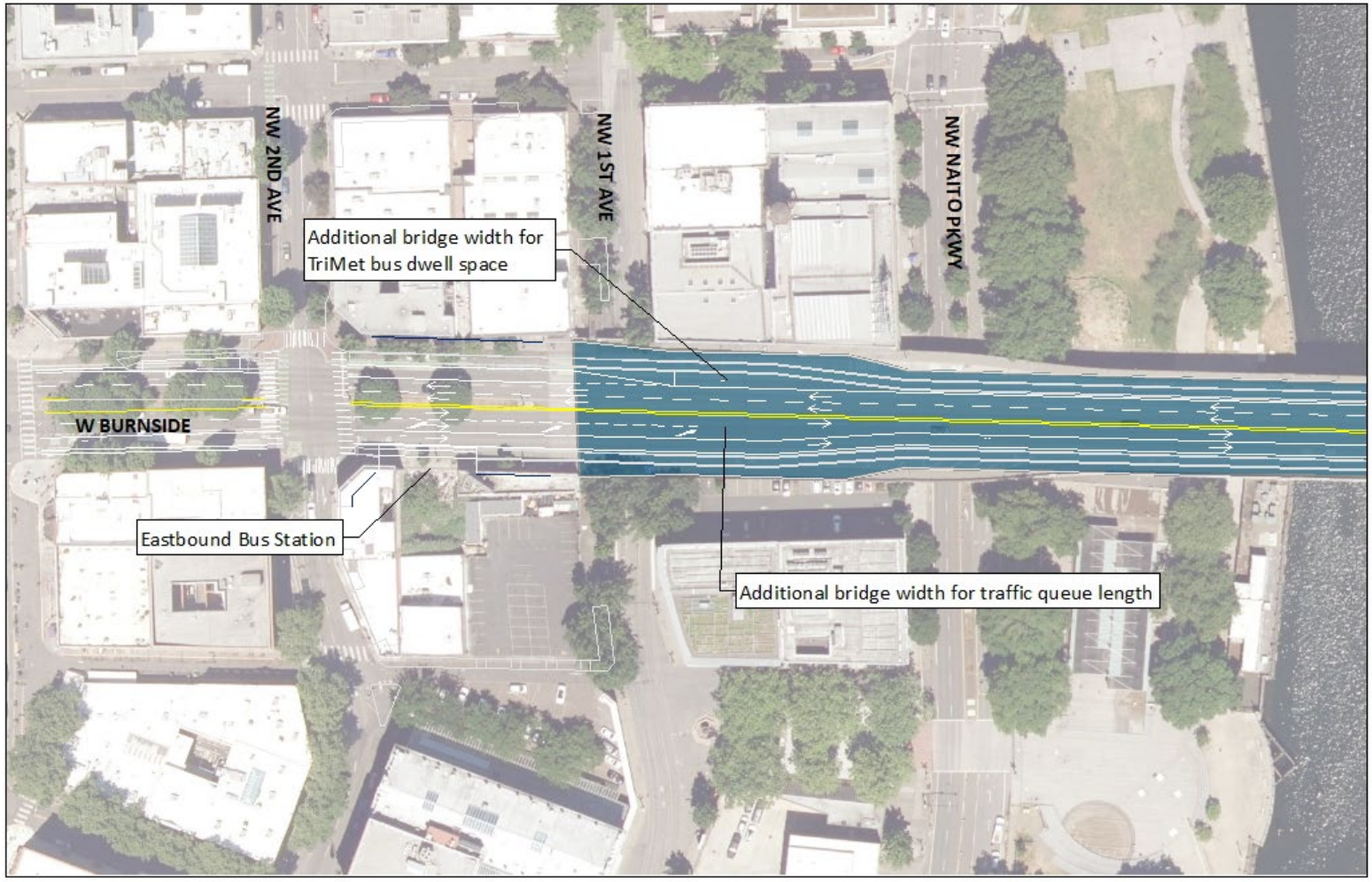
Option 1 – Two Westbound Lanes | One Eastbound + One Bus Lane

The Preferred Alternative would accommodate bus dwell space on the west end of the bridge for westbound buses on the West Approach between Bent 1 and Bent 3 (see Figure 6-2). While this dwell space would fit within the footprint of the existing bridge, this portion of the West Approach is wider than what was included in the SDEIS Refined Long-span Alternative. Similarly, additional vehicular lane queue length in the eastbound direction has been added to enable smoother merging. The inclusion of the bus dwell space and additional queue length in the Preferred Alternative would cause no additional impacts over those analyzed in the Draft EIS and SDEIS.

Table 6-1. Bridge Width per Location

Bridge Element	Approximate Bridge Width
West Approach	• Span 1: Varies from approximately 112 feet to 103 feet • Span 2: Approximately 103 feet • Spans 3 and 4: Approximately 82 feet
Main River Spans	• Span 5 (girder span): Approximately 82 feet (although additional width is provided at Piers 6 and 7 for overlooks and operator houses) • Span 6 (bascule movable span): Approximately 82 feet (although additional width is provided at the fixed portions of Piers 6 and 7 for overlooks and operator houses)
East Approach (Tied-Arch Bridge Option)	• Span 7 (tied-arch span): Varies from approximately 82 feet to 93 feet • Span 8 (girder span): Varies from approximately 93 feet to 104 feet • Span 9 (girder span): Varies from approximately 104 feet to 112 feet
East Approach (Cable-Stayed Bridge Option)	• Span 7 (cable-stayed span): Varies from approximately 82 feet to 112 feet • Span 8 (cable-stayed span): Varies from approximately 90 feet to 112 feet • Span 9 (girder span): Varies from approximately 112 feet to 115 feet

Figure 6-2. Preferred Alternative with TriMet Bus Dwell Space and Eastbound Traffic Queue Length



6.2.2 Bridge Type

West Approach

The view of the existing bridge from Gov. Tom McCall Waterfront Park is shown in Figure 6-3 (looking south) and in Figure 6-4 (looking north). The Preferred Alternative includes a girder bridge for the West Approach (see Figure 6-5 and Figure 6-6), which would be about the same width as the existing bridge. It avoids an adverse effect on the Skidmore/Old Town National Historic Landmark District. The Preferred Alternative would require two sets of larger bridge columns in the park (versus five with the existing bridge). They are located to provide the necessary horizontal offsets from Naito Parkway and the Willamette Greenway Trail that each traverse under the bridge.

Figure 6-3. Existing View – Looking South from the Japanese American Historical Plaza in Gov. Tom McCall Waterfront Park

Figure 6-4. Existing View – Looking North in Gov. Tom McCall Waterfront Park

Figure 6-5. Preferred Alternate West Approach Girder – Looking South from the Japanese American Historical Plaza in Gov. Tom McCall Waterfront Park

Figure 6-6. Preferred Alternative West Approach Girder – Looking North in Gov. Tom McCall Waterfront Park

Movable Span

The Preferred Alternative has a bascule bridge as the movable span (see Figure 6-7 and Figure 6-8). The movable span would satisfy the required USCG horizontal and vertical navigational clearances for the main span; the requirements include enabling 100 percent of vessel traffic to safely transit under the bridge. The minimum clearances that would allow all vessel traffic to safely transit the bridge are as follows:

- Minimum Vertical Clearance (movable span in the closed position) would provide a minimum vertical clearance of 51.1 feet above mean high water and 65.8 feet above Columbia River Datum.
- Minimum Vertical Clearance (movable span in the raised position) would provide unlimited vertical clearance through a reduced horizontal clearance of 130 feet at either water surface elevation.
- Minimum Horizontal Clearance for the permanent bridge at either water surface elevation would be 205 feet.
- Minimum Horizontal Clearance during construction of the permanent bridge at either water surface elevation would be 165 feet. Existing minimum vertical clearances for the raised and fully closed positions would be maintained during construction except for temporary periods of 180 days or less, which would be reviewed and approved by USCG.

The movable span would be supported by “delta piers,” or trapezoid-shaped piers sized to accommodate a bascule counterweight within the interior void of the pier. The piers would also be equipped with starlings, which are in-water structures that divide and deflect river water and floating debris on the upstream (south) side of the bridge. They would also assist ships with pivoting away from the piers. While these are currently anticipated to be formed starlings, they may alternatively be

a smaller structure of equivalent function, such as a dolphin.[1] See Chapter 4 of this Final EIS, Supplementary Analysis and Discussion, for an analysis of impacts related to the use of the starlings or dolphins. Any pier protection structures would need to include protective features such as rub rails to avoid or reduce damage to vessels that may come into contact with the pier protection structures. All such structures would need to be reviewed and approved by USCG.

Figure 6-7. Preferred Alternative with Bascule Movable Span (Tied-Arch East Approach)

Figure 6-8. Preferred Alternative with Bascule Movable Span (Cable-Stayed East Approach)

East Approach

The Draft EIS Preferred Alternative identified a long-span bridge type for the East Approach but left open the decision for a cable-stayed or tied-arch bridge type option. The SDEIS further evaluated a refined tied-arch option and a cable-stayed option as part of the Refined Long-span Alternative (see Figure 6-7 and Figure 6-8). The Refined Long-span Alternative included 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 place the eastern pier of the tied-arch span farther east. Increasing the length of the tied-arch span would reduce the length and depth of the subsequent girder span to the east, which would reduce the overall cost of the tied-arch option. Two options were analyzed. Option 1 terminates on the east side of 2nd Avenue and was ultimately eliminated from further consideration because it would severely impact freight access to the adjacent

[1] In this instance, a dolphin is a group of pilings used as a protective structure in a waterway. https://azdot.gov/sites/default/files/media/2020/04/Parts-of-a-Bridge-Structure.pdf

businesses and have other permanent adverse impacts to SE 2nd Avenue. Option 2 is slightly shorter and terminates just west of SE 2nd Avenue (see Figure 6-9).

The SDEIS analysis determined that the impacts from a cable-stayed or tied-arch option would be very similar and any significant impacts could be avoided or minimized. The primary differentiator between the two bridge types could be construction cost, which is influenced by the construction approach for each. Preliminary cost analysis suggests that the cable-stayed option could have a lower construction cost, but there is uncertainty because the construction approach and experience of the selected bridge contractor would be important cost factors. Therefore, the Preferred Alternative does not make a selection regarding a cable-stayed or tied-arch option and carries both bridge type options forward into the Final Design phase so that the bridge type decision can be informed by more detailed cost information and estimates developed by a future contractor. This reduces the current cost uncertainty associated with these significant bridge structures.

Figure 6-9. Refined Tied-Arch Option 2 – West Side of East 2nd Avenue

6.2.3 Ancillary Elements

West Side Access to 1st Avenue

Near the west end of the existing bridge, there are County-owned stairs on both sides of the bridge that connect the existing on-bridge bus stop to West 1st Avenue (under the bridge) where the existing Skidmore Fountain MAX station is located. The Draft EIS evaluated stair and ramp options at this location. The SDEIS evaluated replacing the stairs with ADA-accessible elevators combined with stairs, a ramp, and improving the sidewalks between the end of the bridge and West 1st Avenue to create a safer and more ADA-accessible surface-level pedestrian route. In addition to improving the sidewalks, the range of supplemental connection options includes no additional connection (i.e., using the improved sidewalks to access the bridge); stairs on one or both sides of the bridge; a ramp on the south side of the bridge; or elevators on one or both sides of the bridge. There could also be combinations of these connection types. As stated in the SDEIS, TriMet is considering permanently relocating the bus stop off the Burnside Bridge, and TriMet is studying a proposal to close the existing Skidmore Fountain MAX station located under the bridge. The potential bus stop

relocation and the potential MAX station closure would substantially reduce the purpose of any ADA and pedestrian stair, ramp, or elevator connection to 1st Avenue at this location. There is a possibility that the stairs would, therefore, not be replaced. In that case, the ADA, pedestrian, and bicycle access from the bridge to 1st Avenue would be via improved sidewalks connecting the west end of the bridge at 2nd Avenue to 1st Avenue just one block east. Therefore, the Preferred Alternative does not include a final selection of access to West 1st Avenue; a decision on the need for and type of access at this location would be made during the Final Design phase.

Vera Katz Eastbank Esplanade Access

The Preferred Alternative would maintain the existing City of Portland–owned staircase that currently connects the south side of the bridge by permit to the Vera Katz Eastbank Esplanade located about 50 feet below the bridge. The staircase would be protected in place during the demolition of the existing bridge and the reconstruction of the new bridge. Access to the existing stairs would be provided after the bridge construction phase is completed. A new, independent connection could be pursued as a separate project with its own purpose, funding, and permitting.

Table 6-2. Preferred Alternative Major Bridge Structural Elements

Structural Element	Preferred Alternative
West Approach	• One abutment and two supports west of Naito Parkway; two supports, each with two columns, in Waterfront Park. • Slab/girder bridge type between Abutment 1 and Bent 5, consisting of a slab span over 1st Avenue and girder spans over a City-owned parking lot, Naito Parkway, and Waterfront Park. • Bents to be supported by columns founded on drilled shafts.
Main River Spans	• Two in-river pier supports. • Girder bridge type for Span 5, starting over Waterfront Park and landing on Pier 6 (the west in-river pier). • Bascule bridge type for Span 6. • Replace all in-river piers with deep foundations, likely consisting of large-diameter drilled shafts.

East Approach	• One, two-column support east of the UPRR tracks, one, four-column support on the west side of SE 3rd Ave, and one abutment east of SE 3rd Ave.
	• Long-span bridge type consisting of either a cable-stayed or tied-arch type, starting at the east in-river pier and extending as follows:
	  ○ One-Span Tied-Arch Bridge Option – Support located to the west of SE 2nd Ave with girder spans continuing eastward to the abutment.
	  ○ Two-Span Cable-Stayed Bridge Option – Support tower located between the UPRR tracks and SE 2nd Ave and the end of the second cable-stayed span located on the west side of SE 3rd Ave; a girder/slab span continuing eastward to the abutment.
	• Bents to be supported by columns founded on drilled shafts.
	• Likely need to stabilize soils below the cable-stayed option tower support located in the geologic hazard zone (between the UPRR tracks and SE 2nd Ave).

Westside Access to 1st Avenue	Range of options including multiple possible configurations of stairs and ramps, ADA-accessible elevators, and sidewalk improvements on both sides (north and south) of the bridge. Conversely, options may include no additional connection (i.e., using improved sidewalks to access the bridge). Decision on the need for and type of access at this location to be made during the Final Design phase.

Structural Element	Preferred Alternative
Vera Katz Eastbank Esplanade Access	Maintain existing City of Portland–owned staircase connecting south side of the bridge to the Eastbank Esplanade. Staircase to be protected in place during demolition of the existing bridge and reconstruction of the new bridge. Access to existing stairs would be provided after bridge construction phase completed. New, independent connection could be pursued as separate project with its own purpose, funding, and permitting.

6.2.4 Preferred Alternative Evaluation

The following summarizes the primary advantages of the Preferred Alternative relative to the Draft EIS Preferred alternative and all other Draft EIS build alternatives as described in the Draft EIS. It also summarizes why the SDEIS Refined Long-span Alternative was selected as the Preferred Alternative in the Final EIS. Overall, the Preferred Alternative would perform very similarly to the Draft EIS Long-span, including for the core purpose of the Project (seismic resiliency) and for impacts and benefits to parks and equity. Because it would have one less motor vehicle lane, it would not perform quite as well for peak period traffic or transit. However, the Preferred Alternative would substantially reduce project costs and would reduce impacts to historic, natural, and visual resources. The following also summarizes how the refined versions (narrower bridge with four lanes) of the Short-span and Couch Extension Alternatives presented in the SDEIS compare with the Preferred Alternative and other alternatives.

- Seismic Resiliency – All the build alternatives would be seismically resilient, but the Preferred Alternative (and Draft EIS Long-span Alternative) would carry the least risk and cost for doing so. The Preferred Alternative (and Draft EIS Long-span Alternative) would place the fewest piers in the East Approach geologic hazard zones (one, compared to four to five with the Short-span Alternative and eight with the Couch Extension Alternative). A large earthquake is expected to liquefy the East Approach from the Willamette River to SE 2nd Avenue and a small portion of the West Approach within Waterfront Park. This liquefaction would cause lateral spread (essentially a localized landslide or mudslide directed towards the Willamette River) that would exert massive lateral forces on any piers in those zones (the closer to Willamette River, the greater the force). The other alternatives would require significant jet grouting at multiple locations to stabilize the slope, but the Preferred Alternative (and Draft EIS Long-span Alternative) would largely avoid this risk by installing a long approach span on the east side that would require only one pier near the upper portion of the zone. With the Preferred Alternative tied-arch option, that pier would be a little farther east than with the Draft EIS Long-span. On the west side, the Draft EIS Long-span would possibly have no piers in the geologic hazard zone, and the Preferred Alternative would have up to one.
- Parks and Recreation – With only one set of columns (the fewest of any alternative) in Gov. Tom McCall Waterfront Park, the Draft EIS Long-span Alternative would have opened the most new space in the park, created views to the river from the park space under the bridge, and improved personal security in the public spaces under the bridge. The Preferred Alternative (girder bridge) would need two sets of columns in the park (the same as the Short-span and Couch Extension Alternatives, and three fewer than existing). All the replacement alternatives, including the Preferred Alternative, would avoid permanent impacts to the Burnside Skatepark, which would be removed with the Retrofit Alternative. The Preferred Alternative (and Draft EIS Long-span Alternative) would have the shortest-duration closure (intermittent, multi-month closures that sum to a total of up to 18 months) of the Vera Katz Eastbank Esplanade during construction, whereas the Short-span and Couch Extension Alternatives would close the facility for 30 months. The

protection of the existing stairs to the Esplanade would not extend the 18-month closure of the Esplanade. The ramp options evaluated in the Draft EIS were estimated to close the Esplanade for 3.5 to 4.5 years in total with any of the bridge alternatives.

- Historic Resources – The Preferred Alternative, as well as the Short-span and Couch Extension Alternatives, with a girder bridge for the West Approach would avoid causing an adverse effect on the Skidmore/Old Town Historic District (a National Historic Landmark). Analysis and agency input received after publication of the Draft EIS indicates that the other bridge types (cable-stayed, tied-arch, or through-truss) that were considered for the Draft EIS Long-span in the West Approach would be expected to have an adverse effect on the historic district. All build alternatives would have an adverse effect on the bridge as a historic property. Only the Retrofit Alternative would avoid removing the historic Burnside Bridge, but the extent of work needed for the Retrofit Alternative would compromise the bridge's historic integrity and make it no longer eligible for listing on the National Register. The Retrofit Alternative is also the only alternative that would remove the Burnside Skatepark, which has been determined to be eligible for listing in the National Register of Historic Places. None of the alternatives would impact any previously recorded archaeological sites. The Preferred Alternative (and Draft EIS Long-span Alternative) would have the least soil disturbance in archaeologically sensitive areas.
- Social Services and Equity – As with the other replacement alternatives, the Preferred Alternative (and Draft EIS Long-span Alternative) would maintain the operations of the Portland Rescue Mission during construction (which would be temporarily displaced by the Retrofit Alternative). Like all build alternatives, after the next major CSZ earthquake the Preferred Alternative would provide the only seismically resilient crossing in downtown Portland – a significant resource for post-disaster emergency aid and services. The Draft EIS Long-span would provide wider bicycle and pedestrian facilities on the bridge than the Preferred Alternative, but both the Draft EIS and the Preferred Alternative, as well as the Short-span and Couch Extension Alternatives, would improve comfort and safety for bicyclists, pedestrians, and ADA users compared with the existing bridge.
- Natural Resources – The Preferred Alternative has the smallest permanent footprint in the river including avoiding placing any piers in shallow water habitat. The Draft EIS Long-span Alternative has the second smallest. The Short-span and the Couch Extension Alternatives (four- and five-lane versions) would require an additional pier in the river and would place more total fill in the river compared with the Long-span Alternative.
- Visual – Because the Preferred Alternative is proposed to have a girder bridge on the West Approach and a bascule bridge for the center movable span, it would avoid the Draft EIS Long-span adverse visual impacts associated with the tall, above-deck structures (tied-arch, cable-stayed, or through-truss) on the West Approach. Similarly, a bascule movable span would avoid the visual impacts associated with the lift towers required for the vertical lift option of the movable span. The girder and bascule bridge type options for these segments would maintain many of the existing, important views of the west side for travelers and park users including the iconic view of the historic White Stag sign. Also, by avoiding any large above-deck structures for the main river span and West Approach, a bascule bridge would better maintain the open character of the existing bridge that has been identified as an important visual as well as social amenity.
- Cost – The Draft EIS Long-span Alternative was the lowest-cost of the build alternatives in the Draft EIS, and the cost of the Preferred Alternative would be substantially lower still thus reducing the risk that the Project could not be adequately funded. The Couch Extension Alternative would be the highest cost, followed by the Short-span Alternative.

Chapter 3 of both the Draft EIS and SDEIS provides more detailed impact analysis of all alternatives considered. Supplementary analysis conducted for the Preferred Alternative can be found in Chapter 4 of this FEIS.

6.3 Seismic Performance

The following information draws from the *EQRB Seismic Design Criteria Report*[2] and is in addition to the summary discussion of seismic design criteria included in the Draft EIS. The seismic criteria apply to all alternatives.

The relevant seismic design and guidelines that are the basis of the Refined Long-span Alternative can be found in the *EQRB Seismic Design Criteria Report*. These seismic design criteria were used to identify the level of seismic design needed to adequately perform conceptual bridge designs and ultimately evaluate and compare alternatives in the National Environmental Policy Act phase. Seismic assessment was based on two hazard assessment methods and corresponding minimum target performance as follows:

- Full Operation Design Earthquake – This performance target is full operation of the bridge for the full rupture from a CSZ earthquake. Damage sustained is negligible. Only minimal, superficial repairs and maintenance activities that would not interrupt traffic is required post earthquake. All traffic modes are able to use the bridge immediately after the earthquake. Full operation of a movable span is possible within weeks of the CSZ seismic event.
- Limited Operation Design Earthquake – This performance target is limited operation of the bridge for a design-level probabilistic earthquake with 7 percent probability of exceedance in 75 years (1,000-year return period). Damage sustained is minimal to moderate. The bridge allows for emergency vehicle use (after inspection and removal of debris). Movable components may not be operable without repairs. Damage is repairable but may have short-term traffic impacts. The limited operation performance objective will exceed the typical AASHTO-standard “no-collapse” criteria typically identified for the 1,000-year return period event.

6.4 Construction Approach

The construction approach for the Preferred Alternative is as presented for the Refined Long-span Alternative in the SDEIS with the exception that the Vera Katz Eastbank Esplanade would only require an 18-month closure due to re-attaching the existing stairs versus constructing a new Esplanade access. Key assumptions are summarized in Table 6-3, and the footprint of anticipated construction impacts is shown in Figure 6-10.

Table 6-3. Construction Impacts, Closure Extents, and Timeframes

Facility Impacted	Description of Impact
Gov. Tom McCall Waterfront Park	4.5-year closure within boundary of potential construction impacts
Willamette River Greenway Trail	Portion of trail within Waterfront Park closed for same duration as park; detours in place for construction duration
Japanese American Historical Plaza	Southern portion of plaza would be closed for the same duration as Waterfront Park
Ankeny Plaza Structure	Plaza structure would not be closed or impacted during construction

[2] https://multco-web7-psh-files-usw2.s3-us-west-2.amazonaws.com/s3fs-public/EQRB%20Seismic%20Design%20Criteria%20Report.pdf

Facility Impacted	Description of Impact
Bill Naito Legacy Fountain	No closure of fountain and associated hardscape
Vera Katz Eastbank Esplanade	Intermittent closures for a total of 18 months; detours in place for construction duration
Burnside Skatepark	Two, 2-month full closures that sum to a total of 4 months
River Crossing on Burnside Street	4- to 5-year closure
Portland Saturday Market Location	4.5-year closure or use of alternative location (ideally, it would be located close to the Burnside Bridge)
Skidmore Fountain MAX station	Approximately 5-week closure
Navigation Channel/Willamette River Water Trail	Intermittent closures; 2 to 10 closures; each closure up to 3 weeks[1]
Overall Construction Duration	**4.5 to 5.5 years**

1 Any closures to the waterway will require approval from USCG.

6.5 Cost Estimate

The current cost estimates range from $830 to $915 million for the Preferred Alternative. Given the current level of design, these preliminary cost estimates are expressed as a probable range, which means that a final cost is expected to be within that cost range. The cost range for the Preferred Alternative (see Attachment N, Cost Risk Assessment Cost Estimate Summaries of the SDEIS) reflects the chosen bridge type assumed and an assessment of risks. As part of the FHWA Major Project process, a risk analysis was also performed for the refinements with the Preferred Alternative in July 2022. As the project design advances, the cost range would narrow. The final cost will be influenced by design details, bridge type selection, risk mitigation, market conditions at the time of construction, and exploring the use of a construction manager/general contractor contracting method to identify cost-saving opportunities.

Figure 6-10. Preferred Alternative Areas of Temporary Construction Impacts