Earthquake Ready Burnside Bridge: Draft Environmental Impact Statement

Chapter 1

Purpose and Need for the Project

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Multnomah County

1 Purpose and Need for the Project

1.1 Why are we considering the Burnside Bridge Project?

Oregon is located in the Cascadia Subduction Zone (CSZ), making it subject to some of the world's most powerful, recurring earthquakes. Studies show that the most recent CSZ earthquake occurred just over 300 years ago, and that there is a significant risk that the next major earthquake will occur within the lifetimes of the majority of Oregon residents (Goldfinger et al. 2012). The best available science warns that given current conditions, the next major CSZ event is expected to result in thousands of deaths, widespread damage to our region's critical infrastructure, and long-term adverse social and economic impacts (OSSPAC 2013).

The effects of the next CSZ earthquake can be reduced through preparation, including creating seismically resilient transportation "lifeline routes," particularly to provide access to critical facilities in urban areas. Such lifeline routes will facilitate post-earthquake emergency response, rescue, and evacuation, as well as enable post-disaster regional recovery and help prevent permanent population loss and long-term economic decline (OSSPAC 2013). The importance of having a seismically resilient lifeline route across the Willamette River is why Multnomah County has proposed to make the Burnside Bridge earthquake ready.

1.2 Location, Setting, and History

The Burnside Bridge is located in the center of Portland, Oregon (see Figure 1.3-1). Burnside Street is Portland's north-south street address baseline, and the Willamette River is the east-west baseline. The bridge provides daily connection across the Willamette River for about 35,000 vehicle trips and over 3,000 pedestrian and bicycle trips per day. Burnside Street is a designated east-west regional lifeline route.

The current Burnside Bridge was built in 1926 in response to a growing population and the increasing use of motor vehicles; it replaced the original 1892 bridge. The current bridge initially supported six lanes of traffic, but in 1995, one traffic lane was converted into bicycle lanes. The bridge now has bicycle lanes and sidewalks in both directions, and it has five motor vehicle lanes: two westbound and two eastbound general traffic lanes plus one eastbound transit-only lane.

The bridge has had minor modifications since it was constructed: electric streetcar service ended in the late 1940s, lighting and traffic control devices were updated in the 1950s, automobile traffic gates were installed in 1971, and the bascule pier fenders were replaced on the upstream side in 1983. Multiple deck resurfacing projects and expansion joint repairs have been conducted over the years. Most recently, Multnomah County implemented the Burnside Bridge Maintenance Project in 2017 that will provide limited additional service life for the existing structure. Maintenance work included improvements and repairs to the main bridge span, approaches, and other elements such as mechanical and electrical repairs related to drawbridge operation.

1.3 Purpose of the Project

The primary purpose of the Earthquake Ready Burnside Bridge (EQRB) Project (Project) is to create a seismically resilient Burnside Street lifeline crossing of the Willamette River that would remain fully operational and accessible for vehicles and other modes of transportation immediately following a major CSZ earthquake. A seismically resilient Burnside Bridge would support the region's ability to provide rapid and reliable emergency response, rescue, and evacuation after a major earthquake, as well as enable post-earthquake economic recovery. In addition to ensuring that the crossing is seismically resilient, the purpose is also to provide a long-term, low-maintenance safe crossing for all users.

Figure 1.3-1. Project Area

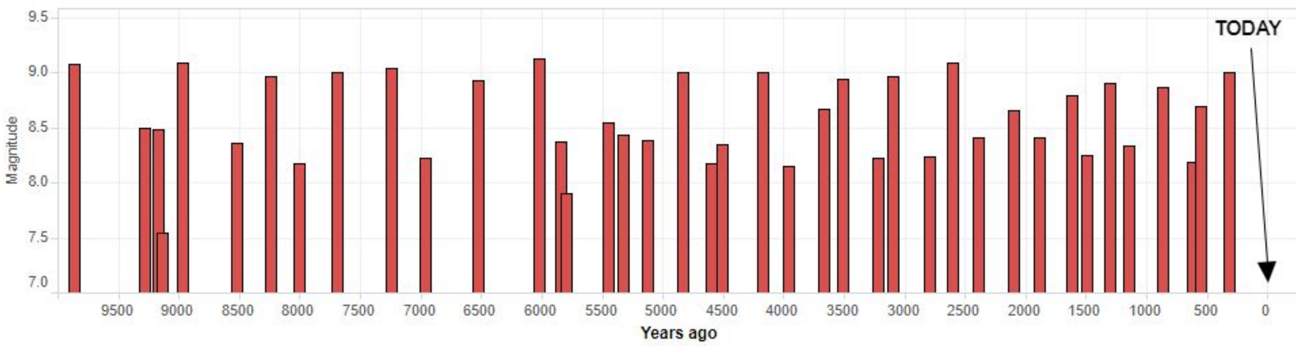
1.4 Need for the Project

The Project is intended to address the following needs.

Need for a Seismically Resilient River Crossing and Lifeline Route

Geologic evidence shows that more than 40 major earthquakes have originated along the CSZ fault over the last 10,000 years (Figure 1.4-1). The intervals between CSZ earthquakes have ranged from a few decades to over a thousand years. The last major earthquake in Oregon occurred 320 years ago, a timespan that exceeds 75 percent of the intervals between major Oregon earthquakes (see Figure 1.4-1). *The Oregon Resilience Plan* predicts extensive casualties, infrastructure damage, and economic losses from the next CSZ earthquake (OSSPAC 2013).

Figure 1.4-1. Frequency and Magnitude of CSZ Earthquakes

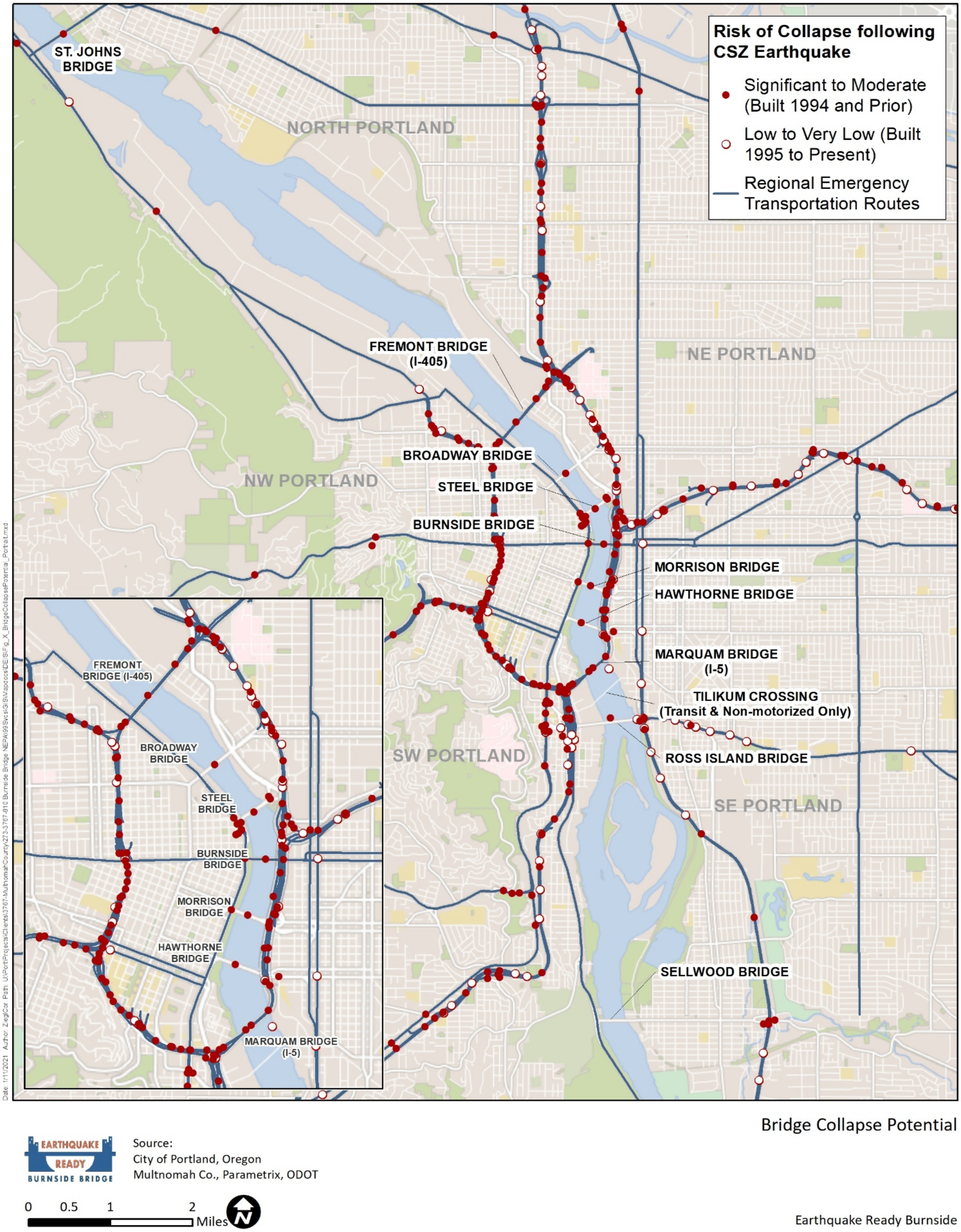


Source: Oregon Live n.d.
Note: Earthquake magnitude (strength) numbers are approximate and based on the Richter scale.

All of the older bridges crossing the Willamette River are expected to suffer seismic damage in a major earthquake. Some are expected to collapse, and none are expected to be usable immediately following the earthquake (see Figure 1.4-2). In addition, the east side access roads to all of the downtown bridges, except to the Burnside Bridge, pass under and/or travel on aging Interstate 5 (I-5) overpasses that are expected to collapse in a major earthquake, thereby blocking access to those river crossings (Hawthorne, Morrison, Steel and Broadway Bridges). See Figure 22 in Attachment G.

In addition to having no I-5 overpasses that would block access to the Burnside Bridge, Burnside Street extends 17 miles from Washington County to Gresham with very few overpasses vulnerable to collapse. This is one of the reasons that the Regional Disaster Preparedness Organization, composed of cities, counties, Metro, and the Red Cross, designated the Burnside Corridor as a “Primary East-West Emergency Transportation Route” (Task Force 1996), a designation reflected in regional plans (ODOT 2014). The Burnside Bridge provides a key link in the Burnside Street lifeline route connecting two sides of our region across the Willamette River, and yet in its current condition the Burnside Bridge is far from able to live up to its lifeline designation. At 94 years old, the bridge is an aging structure requiring increasingly more frequent and significant repairs and maintenance. As with the other aging County- and State-owned bridges crossing the Willamette River, the Burnside Bridge is expected to be unusable immediately following the next CSZ earthquake.

Figure 1.4-2. Risk of Bridge and Overpass Collapse



The State-owned bridges (Ross Island, Marquam, Fremont, and St. Johns Bridges) were also designed and built before the CSZ had been identified and understood. The Oregon Department of Transportation (ODOT) expects that all of the State-owned bridges crossing the Willamette River near downtown Portland would be unusable immediately following a CSZ earthquake and has classified expected damage ranging from “collapse” for the Ross Island Bridge and “extensive” for the St. Johns Bridge, to “moderate” for the Fremont and Marquam Bridges. ODOT anticipates that the main river portion of the Marquam Bridge, following inspection and repairs, could potentially be serviceable 4 weeks after a CSZ earthquake. However, because the I-5 viaducts/ramps on the east side are expected to suffer extensive damage, there could be no way to access the bridge.

ODOT has identified seismic retrofit needs and priorities for the state highway system from the coast to east of the Cascades. Estimated costs are in the billions, and ODOT has suggested that implementation could occur in five phases over several decades. The State-owned Willamette River crossings are not the first priorities for the state system, in part because of the high cost to replace or retrofit multiple vulnerable structures. Creating a regionally continuous, seismically resilient Willamette River crossing within the state highway system would require retrofitting or replacing at least one large State-owned bridge and its associated multiple overpasses and viaducts (Goldfinger et al. 2012). By comparison, upgrading the County-owned Burnside Bridge would be a smaller-scale project with no associated overpasses or viaducts, and it is integral to the regional Burnside Street lifeline route (ODOT 2014). See Figure 1.4-3 for a comparison of seismic vulnerability for downtown bridge approaches.

The two newest bridges over the Willamette River (Sellwood Bridge and Tilikum Crossing) are not expected to collapse in a CSZ earthquake, but are also not expected to provide the downtown core or the Burnside lifeline route with viable crossing options after a major seismic event. The Sellwood Bridge was designed to survive a CSZ earthquake and be back in service quickly after the event, and the County mitigated a landslide-prone area near the west end of the bridge. However, the hills above Highway 43 north of the bridge area could slide and block downtown bridge access. Even without such landslides, access to the downtown core and the Burnside lifeline route via the Sellwood Bridge would require approximately 10 miles of out-of-direction travel. The Sellwood Bridge could serve a lifeline function following a major earthquake, but it would not serve the same broad area, population, or downtown core that is served by the Burnside Bridge and Burnside Street lifeline route.

The Tilikum Crossing, serving light rail transit, streetcar, buses, bicyclists, and pedestrians, is also expected to survive and be serviceable following a CSZ earthquake. However, because it is not on or connected to a designated lifeline route, nor intended for general vehicular usage, the approaches to the bridge were designed to “life safety” standards and not intended to provide lifeline functions. Life safety standards result in a structure that will preserve lives by avoiding collapse in a major earthquake, but the structure is not necessarily expected to be usable immediately following such an event. In addition, the west side access to the bridge crosses under several seismically vulnerable I-5 and Interstate 405 (I-405) viaducts that, in their current conditions, would likely suffer severe damage in a major earthquake and block the route to the bridge.

Need for Post-Earthquake Emergency Response

Absent significant and targeted infrastructure resiliency improvements, the next CSZ earthquake is expected to render all of the downtown Portland Willamette River crossings unusable (either because of damage to each crossing’s bridge, its approaches, or both). This means that none of the designated lifeline routes or evacuation routes across the river will be available for emergency response, rescue, or evacuation immediately following the earthquake.

Figure 1.4-3. Seismic Vulnerability of Downtown Bridge Approaches

Need for Post-Earthquake Recovery

While the cost to build resilient infrastructure is high, it is lower than the cost to a community of losing access to and attempting to rebuild infrastructure following a disaster (Chang 2000). Transportation infrastructure damaged by an earthquake impairs a region's long-term ability to recover economically and socially after a disaster, adversely affecting a region's population and economy for many years after a major earthquake (OSSPAC 2013; Madhusudan and Ganapathy 2011).

Need for Emergency Transportation Routes and Seismic Resiliency as Stated in Plan and Policy Directives

Local plans and policies that designate Burnside Street as a lifeline and evacuation route help describe the need for this Project. In addition, statewide policy describes the need through recommendations for creating seismically resilient transportation routes such as that anticipated with this Project. Relevant plans and policies are briefly summarized below.

Metro's Regional Emergency Management Group was formed by intergovernmental agreement among the region's cities, counties, Metro, and the Red Cross to improve disaster preparedness, response, recovery, and mitigation plans and programs. Current local plans reflect that group's 1996 report which designates Burnside Street as a "Primary East-West Emergency Transportation Route" (Task Force 1996).

The City of Portland's *Evacuation Plan* (BEM 2017) addresses evacuation needs for general disasters including flooding, hazardous materials spills, fires, etc. The plan identifies Burnside Street both as a possible evacuation route east of the river and as a primary east-west evacuation route in downtown Portland west of the river. On the east side, Interstate 84 (I-84) is the designated primary east-west evacuation route while Burnside Street is designated a secondary eastside route due to less consistent capacity. However, while I-84 has greater capacity, it would likely be impassable following a major earthquake because of the collapse of multiple overpasses (18 overpasses cross I-84 between the Willamette River and Interstate 205 [I-205]). Burnside Street has no overpasses or bridges through this segment, which is a significant advantage for a lifeline transportation route following a major earthquake.

The Oregon Resilience Plan's specific roadway and bridge recommendations focus on State-owned rather than locally owned facilities. However, this statewide plan emphasizes the importance of creating seismically resilient local bridges and roads, particularly to support lifeline functions in urban areas (OSSPAC 2013).

Need for Long-Term Multimodal Travel Across the River

In addition to its function as a lifeline route, Burnside Street serves as an important long-term multimodal (multiple modes of travel such as pedestrians, bicyclists, cars, and transit) connection between the east and west sides of the Willamette River in downtown Portland and between Gresham and Washington County. The existing Burnside Bridge's five vehicular traffic lanes carry approximately 35,000 vehicles per day, while the sidewalks and bike lanes carry over 3,000 bicyclists and pedestrians per day. The bridge also carries multiple bus routes and is planned to carry a streetcar line. Any changes to the existing crossing should serve not only the post-earthquake lifeline need, but should also address the continued long-term need for a safe multimodal crossing.

1.5 Application of the Purpose and Need in Alternatives Identification and Screening

Prior to initiating the Draft EIS, the project team conducted a feasibility study and evaluation process[1] to identify and screen potential alternatives. The criteria used in that study and the screening reflected the Project's purpose as well as feasibility considerations, environmental impacts, and costs. This screening process, which is discussed in Chapter 2 and documented in detail in the *EQRB Alternatives Screening Technical Memorandum* (Multnomah County 2018), included three steps:

1. Pass/Fail Screening
2. Preliminary Screening
3. Alternatives Evaluation

Each step added increasingly detailed analysis of how well the alternatives being considered could or could not achieve the project purpose; screening also considered the fundamental feasibility of alternatives as well as environmental impacts and costs of the alternatives. These considerations were used to eliminate poorly performing alternatives from further consideration and to help identify the range of reasonable alternatives to study in detail in the Draft EIS.

Pass/Fail Step

The pass/fail analysis was based on yes/no questions that reflected the core purpose of seismic resilience and the need for alternatives to meet basic feasibility/constructability criteria. Alternatives had to pass the basic threshold for each of these criteria to advance to the next screening step. Four pass/fail criteria were developed to eliminate alternatives that would not meet fundamental requirements of being "seismically resilient" after the next major earthquake:

- Alternatives need to be fully operable following a CSZ 8+ earthquake. This means that they need to be usable for all modes immediately after the earthquake without requiring repairs.
- Alternatives cannot have two or more earthquake-related blockages (e.g., seismically vulnerable overpasses or viaducts) on the access route to them.
- Crossing locations have to be within 4 minutes by motor vehicle (travelling 30 mph) of the Burnside Street lifeline route. This is to maximize emergency response travel time for vehicles using the Burnside Street lifeline route since it is expected to be the least affected east-west lifeline route after the next major earthquake.
- Alternatives need to provide at least three travel lanes, or equivalent, after a major earthquake.

In addition, a pass/fail criterion was included to eliminate alternatives that would have unacceptable impacts to major public infrastructure. This eliminated alternatives that would cause long-term full closures of interstate highways, major arterials, the Union Pacific Railroad mainline, commercial river traffic, or the MAX light rail line.

Preliminary Screening Step

The criteria topics in this step were similar to those in Step 1, but rather than being pass/fail, the remaining alternatives received a score for each criterion, and the total scores were used to determine the more promising alternatives and drop those that scored substantially lower. The preliminary screening criteria

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[1] The informal scoping process, conducted consistent with Planning and Environment Linkages requirements, is discussed in the Draft EIS Summary.

included a more detailed evaluation of seismic resiliency than was in the pass/fail criteria of Step 1, and the added consideration of how well alternatives could meet the other purpose of the Project – long-term functionality for multiple modes, independent of a seismic event.

Alternatives Evaluation Step

Step 3 included yet more detailed analysis of seismic resiliency, more detailed analysis of how well the alternatives would meet the long-term needs of specific modes, and added criteria to help screen out alternatives that would have extraordinary environmental impacts or costs. The criteria were organized into six categories:

1. Seismic Resiliency
2. Non-Motorized Transportation
3. Connectivity
4. Built Environment
5. Environmental Justice/Equity
6. Financial Stewardship

Additional discussion of screening is in Chapter 2 of the Draft EIS, and full details of this screening process, criteria, findings, and results can be found in the *EQRB Alternatives Screening Technical Memorandum* (Multnomah County 2018).

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