Problem Statement

Multnomah County is undertaking a feasibility study to evaluate and recommend seismically resilient alternatives for the Burnside Bridge river crossing. The following summarizes the project background, the problem being addressed, and the project's intent.

Background

- Burnside Street, which extends from Washington County to Gresham and crosses the Willamette River via the Burnside Bridge, has been designated as a "lifeline" transportation route, meaning it will be expected to enable emergency response, evacuation, and recovery after a major disaster.[1]
- The Burnside Bridge carries approximately 40,000 vehicles and over 2,000 bikes and pedestrians per day.[2] Built in 1926, the Burnside Bridge is an aging structure requiring increasingly more frequent and significant repairs and maintenance.

The Problem

- Geologically, Oregon is located in the Cascadia Subduction Zone (CSZ), making it subject to some of the world's most powerful, recurring earthquakes. The last major quake in Oregon occurred 317 years ago, a timespan that exceeds 75% of the intervals between the major quakes to hit Oregon over the last 10,000 years. There is a significant risk that the next event will occur soon. Such an earthquake will cause major ground shaking, settling and landslides, and is expected to result in thousands of deaths and widespread damage to buildings, utilities, and transportation facilities.[3]
- The next major earthquake is expected to cause moderate to significant damage to the aging downtown bridges, including the existing Burnside Bridge, rendering them unusable immediately following the earthquake. In their current condition, all of the downtown bridges and/or approaches will fail to provide communities and the region with timely and critical emergency response, evacuation, and recovery functions.

Project Intent

- This project would address the regional need for a seismically resilient Burnside Street lifeline crossing of the Willamette River that will remain fully operational and accessible for vehicles and other modes immediately following a major CSZ earthquake. It will enable:
  - Emergency medical, fire and life safety response
  - Evacuation of survivors to safe locations
  - Reunification of families and households
  - Post-disaster restoration of services, and
  - Regional recovery.
- The project would help to implement specific and general recommendations for seismic resilience outlined in relevant local, regional and state plans and policies.[4]
- The project would be compatible with existing major infrastructure.
- The project would provide long-term, low-maintenance, multi-modal transportation functions over the Burnside Street Willamette River crossing consistent with Multnomah County's values.

ADDITIONAL INFORMATION AND SOURCES

Sources of Information Cited in the Problem Statement

[1] Regional Emergency Transportation Routes, Portland Metropolitan Region. Metro Regional Emergency Transportation Routes Task Force. 1996
[2] PBOT Portland Bicycle Count Report 2013-3014
[3] The Oregon Resilience Plan. Report to the 77th Legislative Assembly. 2013
[4] Regional Emergency Transportation Routes, Portland Metropolitan Region. Metro Regional Emergency Transportation Routes Task Force. 1996; Portland Citywide Evacuation Plan (draft); The Oregon Resilience Plan. Report to the 77th Legislative Assembly. 2013

Additional Information Supporting the Problem Statement

Existing Burnside Bridge and Lifeline Route

Burnside Street was designated as a "Primary East-West Emergency Transportation Route" in a 1996 report to Metro's Regional Emergency Management Group. This group was formed by intergovernmental agreement among the region's cities, counties, Metro and Red Cross to improve disaster preparedness, response, recovery and mitigation plans and programs. (Source: Regional Emergency Transportation Routes, Portland Metropolitan Region. Metro Regional Emergency Transportation Routes Task Force. 1996)

The Burnside Street lifeline route is approximately 18.7 miles in length and extends from Highway 26 in Washington County to Gresham, crossing the Willamette River via the Burnside Bridge.

Other agency plans have also identified Burnside Street as an important lifeline route. For example, the City of Portland's Citywide Evacuation Plan addresses evacuation needs for general disasters. The Plan identifies Burnside Street as the primary east-west evacuation route in downtown Portland west of the river. On the east side, I-84 is the Evacuation Plan's designated primary east-west evacuation route; east of the river Burnside Street is designated a secondary route due to less consistent capacity. (Source: Portland Citywide Evacuation Plan (draft). City of Portland Bureau of Emergency Management. 2014). However, while I-84 has greater capacity, it would likely be impassable following a major earthquake due to the collapse of multiple overpasses (18 overpasses cross I-84 between the river and 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 statewide Oregon Resilience Plan does not make specific recommendations for seismic resilience of locally owned roads or bridges. The plan's specific roadway and bridge recommendations focus on state-owned facilities. However, the statewide plan does acknowledge and emphasize the importance of creating seismically resilient local bridges and roads, particularly to support lifeline functions in urban areas. Relevant statements in the Oregon Resilience Plan include:

- "Enhance the proposed (state) Highway Lifeline Maps by considering the use of highway segments owned by cities and counties to provide access to critical facilities. Prioritize local routes to provide access to population centers and critical facilities from the identified (state) Tier-1 routes." (Transportation Chapter, page 54)

- "When developing projects for seismic retrofit of (state) highway facilities, consider whether a local agency roadway may offer a more cost effective alternative for all or part of a lifeline route." (Transportation Chapter, page 54)
- Recommendation for "Seismically upgrading lifeline transportation routes into and out of major business centers statewide by 2030" (Executive Summary).

Burnside Bridge traffic counts are from 2014. The Burnside Bridge currently has five general traffic lanes, two bike lanes and sidewalks. (Source: Multnomah County)

Earthquake Risk and Expected Damage

Geologic evidence shows that more than 40 major earthquakes have originated along the CSZ fault over the last 10,000 years. The time interval between CSZ quakes has ranged from a few decades to over a thousand years. The last major quake in Oregon occurred 317 years ago, a timespan that exceeds 75% of the intervals between major Oregon quakes. (Source: USGS Professional Paper 1661-F: Earthquake Hazards of the Pacific Northwest Coastal and Marine Regions, Robert Kayen, Editor. Turbidite Event History—Methods and Implications for Holocene Paleoseismicity of the Cascadia Subduction Zone. 2012. Chris Goldfinger, et. al.)

"Oregon's buildings, transportation network, utilities, and population are simply not prepared for such an event. Were it to occur today, thousands of Oregonians would die, and economic losses would be at least $32 billion. In their current state, our buildings and lifelines (transportation, energy, telecommunications, and water/wastewater systems) would be damaged so severely that it would take three months to a year to restore full service in the western valleys, more than a year in the hardest-hit coastal areas, and many years in the coastal communities inundated by the tsunami. Experience from past disasters has shown that businesses will move or fail if services cannot be restored in one month; so Oregon faces a very real threat of permanent population loss and long-term economic decline." (Source: The Oregon Resilience Plan. Report to the 77th Legislative Assembly. 2013)

"Urban areas…face a large geographic barrier in the Columbia, Willamette, Deschutes, and Rogue Rivers and Bear Creek. These weak links in the urban transportation network create a potential for longer-term impacts because of the amount of time it is likely to take to restore traffic over large river bridges and to address problems". (Source: The Oregon Resilience Plan)

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. In addition, the east side access roads to all of the downtown bridges, except the Burnside Bridge, pass under and/or travel on aging I-5 overpasses that are expected to collapse in a major quake, thereby blocking access to those river crossings (Hawthorne, Morrison, Steel and Broadway bridges).

The state-owned bridges (Ross Island, Marquam, Fremont and St. Johns), like the other older bridges crossing the Willamette River, were designed and built before the Cascadia Subduction Zone had been identified and understood. ODOT expects that all bridges would be unusable immediately following a CSZ earthquake, and have classified expected damage ranging from "collapse" for the Ross Island Bridge, "extensive" for the St. Johns Bridge, and "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 four weeks after a CSZ earthquake. However, because the I-5 viaducts/ramps

on the east side are expected to suffer "extensive" damage, there may be no way to access the Marquam crossing. 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 Oregon Highways Seismic Plus Report indicates that the state-owned Willamette River crossings are not the first priorities for the state system, in part because of the high cost of retrofitting or replacing these bridges. (Oregon Highways Seismic Plus Report
https://www.oregon.gov/ODOT/HWY/BRIDGE/docs/2014_Seismic_Plus_Report.pdf)

The two new bridges over the Willamette River (Sellwood and Tilikum) are not expected to collapse in a CSZ earthquake. The Sellwood Bridge was designed to survive a CSZ earthquake and be back in service quickly after the event. The County also mitigated a landslide prone area near the west end of the bridge. However, landslides could be an issue in the hills above Highway 43 on the west side away from the bridge area, and, access to the downtown core and Burnside lifeline route would require approximately ten miles of out-of-direction travel via the Sellwood Bridge. The Sellwood Bridge could serve a lifeline function following a major earthquake but would not serve the same broad area, population or downtown core that is served by the Burnside Bridge and Burnside lifeline route.

The transit oriented Tilikum Crossing Bridge, serving light rail transit, street car, buses, bikes and pedestrians, is also expected to survive and be serviceable following a CSZ earthquake. However, because it is not 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 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 I-405 viaducts that, in their current condition, would be likely to suffer severe damage in a major earthquake and block the route to the bridge. It must also be recognized that the Tilikum Crossing is not connected to any identified Priority 1, 2 or 3 seismic lifeline route."

In addition to bridge and overpass damage, roads could be blocked by debris from collapsed or damaged Unreinforced Masonry (URM) buildings following a major earthquake. The City of Portland's URM Seismic Retrofit Project is developing policy that would require owners to seismically retrofit their URM buildings over the next 5 to 25 years, depending on the building classification and type of retrofit. (see http://pdx.maps.arcgis.com/apps/Viewer/index.html?appid=a920f2a1fd2746f1a7efad1262aa1312 for a map locating URM buildings; Retrofit Project sources include: https://www.portlandoregon.gov/pbem/66306 and https://www.portlandoregon.gov/pbem/article/596312).

Role of Resilient Transportation in Disaster Recovery

"A resilient transportation network is critical for re-establishing other lifelines, such as water, electricity, fuel, communication, and natural gas, after the earthquake. For example, a resilient transportation system allows repair crews to access and reconnect water pipes and power lines more quickly, and it provides access to much needed fuel and supplies. Given the transportation system's current state of vulnerability to ground shaking and tsunami inundation, initial damage from a Cascadia subduction zone earthquake is expected to be devastating to the parts of the system located along the coast and in western Oregon. The resulting lack of mobility will have direct impacts that severely limit rescue operations, inspection of critical infrastructure, restoration activities, and the state's ability to restore services leading to recovery. The widespread damage and lack of access to many parts of western Oregon will be partially mitigated by disaster preparedness planning, but that effort will be hampered by the lack of access to disaster areas after the event, which could limit the ability of emergency responders to save lives, facilitate evacuation, and manage critical infrastructure." (Source: The Oregon Resilience Plan.)

Serious disruption to transportation infrastructure can have a catastrophic impact on the ability of an economy and community to recover from a disaster. Creating a seismically resilient river crossing and lifeline roadway across the river and region will help reduce long-term economic and societal impacts following a disaster and will promote a faster recovery both immediately after the disaster (facilitates a more effective emergency response) and also in the long term (helps economy recover faster and gets people back to work/school). The cost to build resilient infrastructure is lower than the cost to a community of losing access to and rebuilding infrastructure following a disaster. (Sources: National Highway Research Collaborative Program Report 777; Chang, 2000. Transportation Performance, Disaster Vulnerability, and Long-Term Effects of Earthquakes; Madhusudan & Ganapathy, 2011. Disaster resilience of transportation infrastructure and ports – An overview)