APPENDIX A

PROJECT PROBLEM STATEMENT AND PURPOSE AND NEED STATEMENT

App-A-1: Project Problem Statement, June 2017
App-A-2: Draft Purpose and Need Statement, December 2018

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)

DRAFT Statement of Purpose and Need

Introduction

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.[1] 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.[2]

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.[2] 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.

Project Purpose

The primary purpose of this project is to create a seismically resilient Burnside Street lifeline crossing of the Willamette River that will remain fully operational and accessible for vehicles and other modes of transportation immediately following a major CSZ earthquake. A seismically resilient Burnside Bridge will 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 and safe crossing for all users.

Project Need

The Earthquake Ready Burnside Bridge project is intended to address the following needs:

Need for a Seismically Resilient River Crossing and Lifeline Route

The Cascadia Subduction Zone: Geologic evidence shows that more than 40 major earthquakes have originated along the CSZ fault over the last 10,000 years. The interval between CSZ earthquakes has ranged from a few decades to over a thousand years. The last major earthquake in Oregon occurred 318 years ago, a timespan that exceeds 75 percent of the intervals between major Oregon earthquakes. The Oregon Resilience Plan predicts extensive casualties, infrastructure damage and economic losses from the next CSZ earthquake.[2]

Seismically Vulnerable Willamette River Bridges and Roads: 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 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).

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 a Regional Emergency Management group, comprised of cities, counties, Metro and the Red Cross, designated the Burnside Corridor as a "Primary East-West Emergency Transportation Route,"[3] a designation reflected in regional plans.[4] 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 92 years old, the bridge is an aging structure requiring increasingly more frequent and significant repairs and maintenance. Like the other aging county and state bridges over the Willamette River, the Burnside Bridge is expected to be unusable immediately following the next CSZ earthquake.

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 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 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 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 crossing within the state highway system would require retrofitting or replacing at least one large state-owned bridge, as well as multiple overpasses and viaducts.[1] By comparison, the Burnside Bridge is the only structure that would need to be upgraded to create a seismically resilient Willamette River crossing for the regional Burnside Street lifeline route.[4]

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 a viable crossing option 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 access to the bridge from downtown. 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 lifeline route.

The 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 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 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.

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.[5] Transportation infrastructure damaged by an earthquake impairs the long-term ability of a region to recover economically and socially after a disaster. The lack of resilient transportation can adversely affect a region's population and economy for many years after a major earthquake.[2,6]

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 like that anticipated with the Earthquake Ready Burnside project. Relevant plans and policies are briefly summarized here.

Metro's Regional Emergency Management 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. Current local plans reflect that group's 1996 report which designated Burnside Street as a "Primary East-West Emergency Transportation Route."[3]

The City of Portland's Citywide Evacuation Plan 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, I-84 is the designated primary east-west evacuation route

while Burnside Street is designated a secondary east-side route due to less consistent capacity.[7] 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 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.[2]

Need for Long-term, Multi-Modal Travel Across the River

In addition to its function as a lifeline route, Burnside Street serves as an important long-term, multi-modal 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 40,000 vehicles per day, while the sidewalks and bike lanes carry over 2,000 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 also address the continued long-term need for a safe, multi-modal crossing.

References

[1]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.
https://pubs.usgs.gov/pp/pp1661f/pp1661f_text.pdf

[2] The Oregon Resilience Plan. Report to the 77th Legislative Assembly. 2013
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[3]Regional Emergency Transportation Routes, Portland Metropolitan Region. Metro Regional Emergency Transportation Routes Task Force. 1996
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[4]Oregon Highways Seismic Plus Report
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[5] National Highway Research Collaborative Program Report 777; Chang, 2000. Transportation Performance, Disaster Vulnerability, and Long-Term Effects of Earthquakes;
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[6] Madhusudan & Ganapathy, 2011. Disaster resilience of transportation infrastructure and ports – An overview
http://www.ipublishing.co.in/jggsvol1no12010/voltwo/EIJGGS3037.pdf

[7] City of Portland Appendix D | Evacuation Plan
https://www.portlandoregon.gov/pbem/article/668061