Economic Impacts Technical Report

Multnomah County | Earthquake Ready Burnside Bridge Project

Portland, OR

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Earthquake Ready Burnside Bridge Economic Impacts Technical Report

Prepared for

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CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, as a professional economist.

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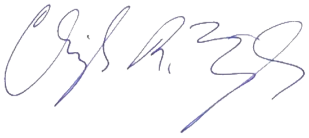

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Acronyms, Initialisms, and Abbreviations

AMR	American Medical Response Ambulance Service
API	Area of Potential Impact
CMF	Crash modification factor
CSZ	Cascadia Subduction Zone
EQRB	Earthquake Ready Burnside Bridge
NAICS	North American Industry Classification System
PIT	Point-in-time
PCFC	Pacific Coast Fruit Company
PRM	Portland Rescue Mission
PSM	Portland Saturday Market
RCT	Rose City Transportation
UO	University of Oregon

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Executive Summary

The Project proposes to build a seismically resilient Burnside Bridge that would become a lifeline crossing over the Willamette River and remain fully operational and accessible for vehicles and other modes of transportation following a major Cascadia Subduction Zone earthquake. The Burnside Bridge would provide a reliable crossing for emergency response, evacuation, and economic recovery after an earthquake.

Socio-economic characteristics of the Area of Potential Impact (API) around the Burnside Bridge were identified, and the No-Build and Build Alternatives were reviewed for their potential effects on those socio-economic characteristics and local and regional economy.

Under the No-Build Alternative, the Burnside Bridge is not expected to survive a major earthquake. The Burnside Bridge likely would be seriously damaged or collapse altogether. Bridge debris would fall into the Willamette River, roads, rail tracks, and MAX tracks below and likely result in severe disruptions to transportation of people and goods. With no usable crossing of the Willamette River in downtown Portland, emergency response, evacuation, and long-term recovery would all be impaired.

The long-term, pre-earthquake impacts of the Build Alternatives are relatively moderate. In particular, no residential displacements or traffic impacts are anticipated. However, five businesses would be displaced, including the AMR, an ambulance service for the Multnomah, Clackamas, and Clark counties.

The short-term negative impacts of the Build Alternatives include various construction-related disruptions, including detours and travel delays to auto, transit, and commercial traffic that uses the Burnside Bridge; impediments in access to certain buildings, businesses and services in Project vicinity; displacements to three business operations; closures of parks and amenities in Project vicinity; noise from construction activities; and disruptions to traffic on infrastructure under the bridge (interstates, UPRR rail tracks, TriMet MAX light rail transit, and the Willamette River navigational channel).

Infrastructure disruptions under the bridge would be short in duration a few times over the construction period, which is estimated at 3.5 to 5 years for the Retrofit Alternative and 4.5 to 6.5 years for the Replacement Alternatives (with longer construction periods for the alternatives with a temporary bridge). Other disruptions can be expected to last for most of the construction period.

A multi-modal Temporary Bridge option can partially mitigate travel delays and travel costs to traffic that normally uses the Burnside Bridge, although it cannot eliminate the delays completely.

During the construction period, the Project would provide a boost to the local, regional, and state economies through construction activities. The Project is expected to cause some disruptions in access and potential economic losses to local businesses. However, overall the former effect will likely be much higher than the latter. Some negative impacts could be mitigated through measures such as scheduling, advanced information and signage, or relocation assistance.

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1 Introduction

As a part of the preparation of the Environmental Impact Statement (EIS) for the Earthquake Ready Burnside Bridge (EQRB) Project, this technical report has been prepared to identify and evaluate economic impacts in the Project's Area of Potential Impact (API).

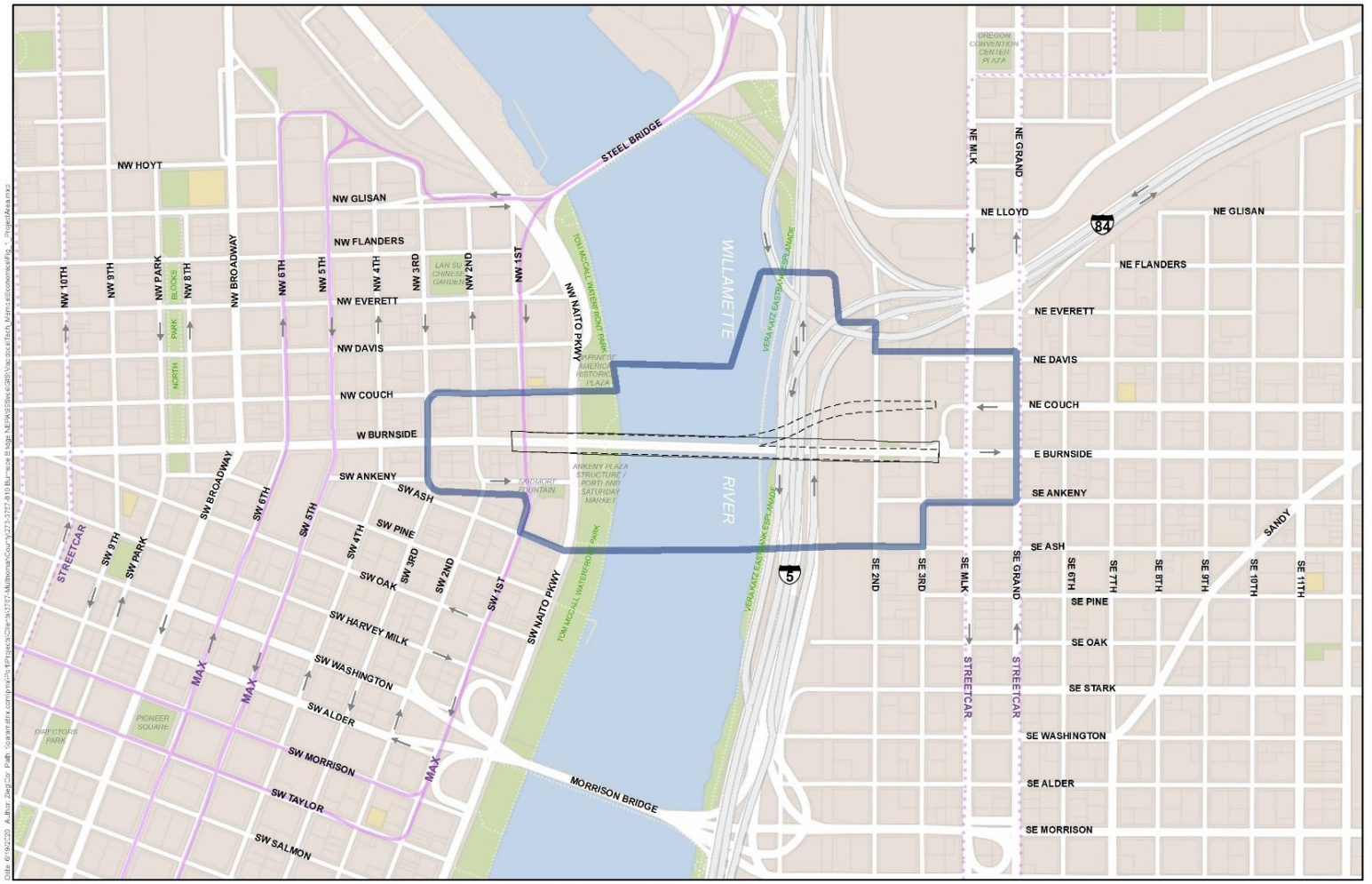
1.1 Project Location

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

1.2 Project Purpose

The primary purpose of the Project is to build a seismically resilient Burnside Street lifeline crossing over the Willamette River that will remain fully operational and accessible for vehicles and other modes of transportation following a major Cascadia Subduction Zone (CSZ) earthquake. The Burnside Bridge will provide a reliable crossing for emergency response, evacuation, and economic recovery after an earthquake. Additionally, the bridge will provide a long-term safe crossing with low-maintenance needs.

Figure 1. Project Area



Source:
City of Portland, Oregon
HDR, Parametrix

0 250 500 1,000 Feet

Direct Impact API

Retrofit
Short-span Alternative
Long-span Alternative
Couch Extension Alternative

Figure 1
Direct Impact API
Economics

Earthquake Ready Burnside

2 Project Alternatives

The project alternatives' design, operations, and construction assumptions are described in detail in the draft *EQRB Description of Alternatives Report* (Multnomah County 2021d).

Briefly, the EIS evaluates the No-Build Alternative and four Build Alternatives. Among the Build Alternatives, there is an Enhanced Seismic Retrofit Alternative that would replace certain elements of the existing bridge and would retrofit other elements. There are three Replacement Alternatives that would completely remove and replace the existing bridge. In addition, the EIS considers options for managing traffic during construction. Nomenclature for the alternatives/options are:

- No-Build Alternative
- Build Alternatives:
  - Enhanced Seismic Retrofit (Retrofit Alternative)
  - Replacement Alternative with Short-span Approach (Short-span Alternative)
  - Replacement Alternative with Long-span Approach (Long-span Alternative)
  - Replacement Alternative with Couch Extension (Couch Extension Alternative)
- Construction Traffic Management Options
  - Temporary Detour Bridge Option (Temporary Bridge) includes three modal options:
    - Temporary Bridge: All modes
    - Temporary Bridge: Transit, Bicycles and Pedestrians only
    - Temporary Bridge: Bicycles and Pedestrians only
  - Without Temporary Detour Bridge Option (No Temporary Bridge)

3 Definitions

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

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

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

- **Project vicinity –** The environs surrounding the Project Area. The Project vicinity does not have a distinct geographic boundary but is used in general discussion to denote the larger area, inclusive of the Old Town/Chinatown, Downtown, Kerns, and Buckman neighborhoods.

4 Legal Regulations and Standards

4.1 Laws, Plans, Policies, and Regulations

The following is a list of federal, state, and local laws, regulations, plans, and policies that guide or inform the assessment of economic impacts:

- U.S. Department of Transportation Federal Highway Administration, Community Impact Assessment. A Quick Reference for Transportation, 2018 Update. – Identification of factors and characteristics to consider, data sources, and type of impacts.

4.2 Design Standards

Not applicable to this resource.

5 Affected Environment

5.1 Area of Potential Impact

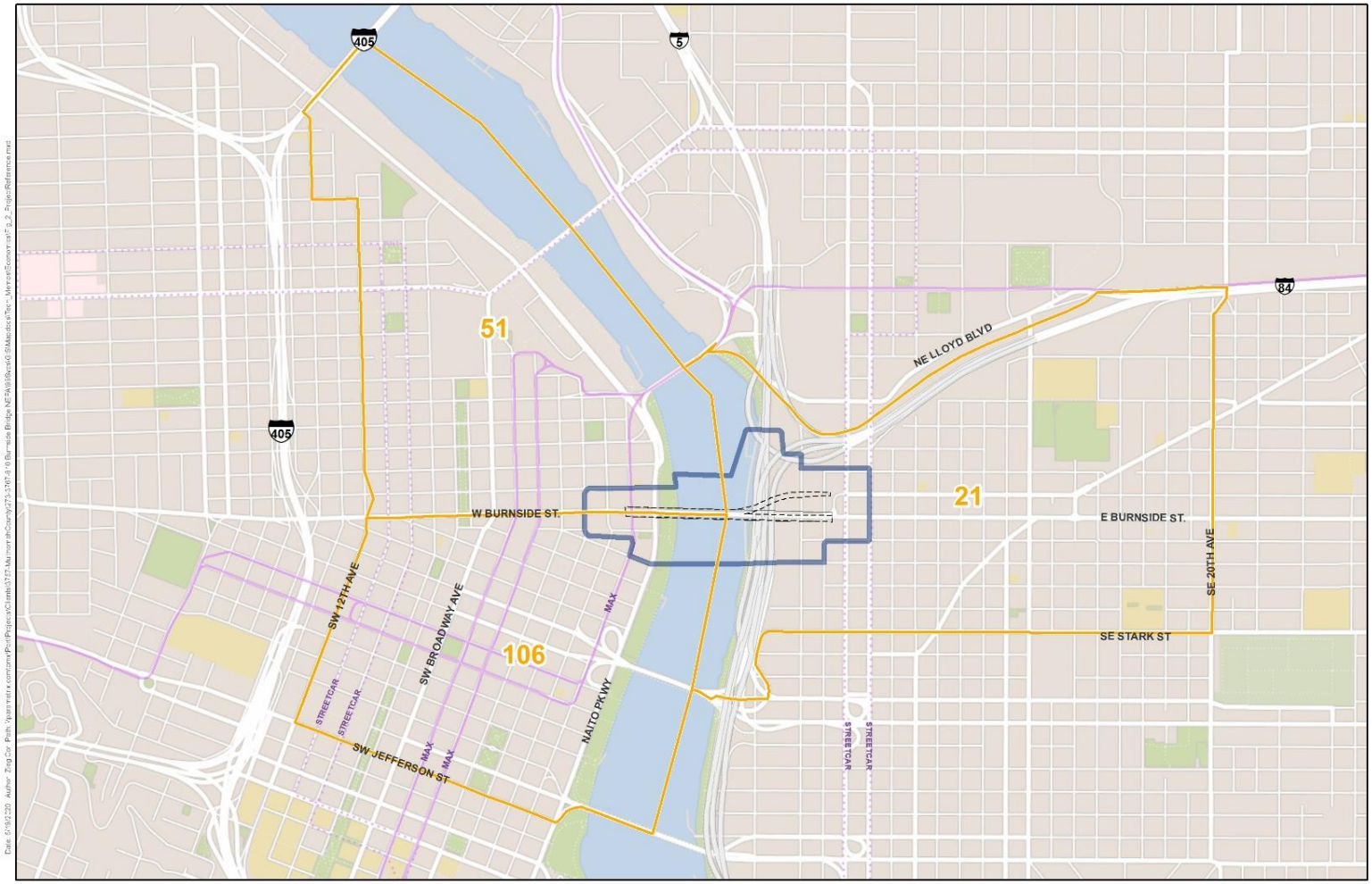
In general, for economic resources direct impacts of bridge construction are expected to be experienced primarily in the Project Area and Project vicinity. The API for economic resources is the Project vicinity.

However, many economic impacts, including indirect or secondary impacts, could be more far-reaching beyond the API. For example, the Burnside Bridge construction process will affect transportation flows. In the post-earthquake scenario, Build Alternatives will enable transportation flows that would not be possible with the No-Build Alternative. These effects on transportation flows could have implications on the movement of people and goods and related economic costs.

Construction work related to the Burnside Bridge will also likely require major resources in the form of labor and materials going beyond the levels that can be provided from within the Project Area. Construction-related expenditures and resulting demand for materials, supplies, equipment, and services will likely extend to the entire City of Portland, Multnomah County, and even the entire State of Oregon. These geographic areas are thus considered in the analysis of impacts.

To facilitate the collection of data for a well-defined geographic area, the API is represented here by three U.S. census tracts intersected by the proposed project: Census Tract 21, Census Tract 51, and Census Tract 106 (Figure 2). Census Tract 21 is located on the east side of the Burnside Bridge while the other two census tracts are located on the west side. Census Tract 51 encompasses the area to the north of W Burnside Street while Census Tract 106 covers the area to the south. The three census tracts are considered individually and in aggregate.

Figure 2. Census Tracts Intersecting API



EARTHQUAKE READY BURNSIDE BRIDGE

Source:
City of Portland, Oregon
HDR, Parametrix

0 500 1,000 2,000 Feet

Direct Impact API
Census Tracts

Retrofit
Short-span Alternative
Long-span Alternative
Couch Extension Alternative

Figure 2
Project Reference
Economics

Earthquake Ready Burnside

5.2 Resource Identification and Evaluation Methods

5.2.1 Published Sources and Databases

The following is a list of the data and data sources that were used to determine and describe the resources/existing conditions in the Project vicinity and API for the technical report:

- Historical population counts from U.S. Census Bureau, American Fact Finder
- Population demographic profile (share of minorities, age distribution) from U.S. Census Bureau, American Fact Finder
- Population economic profile (employment, unemployment, income, percent of population that is low income, poverty status, median home value) from Bureau of Economic Analysis and U.S. Census Bureau, American Fact Finder
- Business community profile (businesses by industrial categories) based on Google Maps, local business directories, municipal planning documents, purchased business data, and other relevant documents
- Portland Bureau of Planning and Sustainability, Comprehensive Plan Update, Growth Scenarios Report, July 2015, PCS Recommended Draft
- Metro 2060 forecasts website at https://www.oregonmetro.gov/2060-growth-forecast (accessed June 2019)
- InfoUSA data on businesses in the Project Area (2018; with information such as industrial classification, employment, revenue)

5.2.2 Field Visits and Surveys

Field visits were not conducted specifically for this resource. Interviews and outreach with project stakeholders conducted in summer 2019 were used in impact assessment to provide additional context and detail as relevant.

5.3 Existing Conditions

5.3.1 Existing Conditions Analysis and Assessment

In general, the existing environment is described in terms of population characteristics, economic conditions and economic activity in the API represented here by the three census tracts shown in Figure 2, also referred to here as the "study area." Specifically, these characteristics include the following:

- Demographics (i.e., population, population growth, age distribution, number of households)
- Housing (housing stock, property values)
- Employment and unemployment
- Household income (average and median income, poverty levels)

- Business community profile (number of businesses in the Project vicinity, by category)
- Roadway network and travel patterns

Socioeconomic data was collected and analyzed at the county, municipal, API or Project vicinity levels, as well as the state level to identify notable trends over time and characteristics of the API as compared to relevant benchmark areas. This involved compiling data into tables, calculations of rates of growth, shares of total or ratios of related variables, and comparisons between the areas for which data was collected. The analysis focused on the last 5 to 10 years, with the assumption that this period of time is sufficient to assess the current situation and identify emerging trends.

5.3.2 Population Characteristics

General Population Trends

Table 1 presents the population of the study area, by Census Tract. As of 2017, the study area population amounted to nearly 13,700. Approximately 58 percent of this population, or nearly 8,000, was comprised of residents of Census Tract 51. Census Tract 106 had a population of about 3,000, or 22 percent of total. Similarly, Census Tract 21 had a population of between 2,000 and 3,000, accounting for almost 18 percent of the total population.

Table 1. Study Area 2017 Population

Census Tract	Population	Share of Total
Census Tract 21	2,417	17.7%
Census Tract 51	7,948	58.1%
Census Tract 106	3,007	22.0%
Total Census Tracts (Study Area)	**13,672**	**100.0%**

Source: U.S. Census Bureau (accessed April 2019), data based on American Community Survey 5-year estimates.

Table 2 examines trends in population growth in the study area and compares these trends with trends across Portland, Multnomah County, and all of Oregon. The upper panel of the table shows the population for 2017 and 2012 for the three census tracts of the study area, study area total, and other relevant geographical areas. The lower panel of the table shows percentage change in population over the 2012-2017 period and average annual rate of growth over this period.

The table demonstrates that over the 2012-2017 period, total population in the study area increased by more than 10 percent from about 12,000 to nearly 13,700. This compares with population growth of less than 5 percent over the same period across the entire state of Oregon. In other words, the study area grew at a rate twice as high as the state, and at a higher rate overall than the City of Portland and Multnomah County.

Census Tract 51 experienced the highest growth rate over the period examined at approximately 17 percent while Census Tract 21 grew by about 10 percent. However,

Census Tract 106 experienced negative growth, with its population declining at a rate of about 7.5 percent. This translates into an average annual rate of growth of 1.98 percent for Census Tract 21, 3.14 percent for Census Tract 51, -1.54 percent for Census Tract 106, and 0.96 percent for all of Oregon.

Table 2. Population Trends

Metric of Change	Census Tract 21	Census Tract 51	Census Tract 106	Total Study Area	Portland	Multnomah County	Oregon
Population (Number)							
2017 Population	2,417	7,948	3,007	13,672	630,331	788,459	4,025,127
2012 Population	2,191	6,810	3,249	12,250	585,888	737,110	3,836,628
Change and Growth (Percent)							
2012 - 2017 Population Change	10.31%	16.71%	-7.45%	11.6%	7.59%	6.97%	4.91%
2012 - 2017 Average Annual Growth Rate	1.98%	3.14%	-1.54%	2.22%	1.47%	1.35%	0.96%

Source: U.S. Census Bureau (accessed April 2019), calculated based on American Community Survey 5-year estimates.

Population Median Age and Age Distribution

Table 3 shows median age of the population in the study area and the change in this metric over the five year period. In 2017, the median age in Census Tract 21 amounted to 32.3 years. However, in Census Tracts 51 and 106, median ages are much higher at 48.4 years and 52.2 years, respectively. This compares against the Oregon-wide median population age of 39.2 years and Portland/Multnomah County median age of 36.8 which are in the range between Census Tract 21 and Census Tract 51.

Over the 2012-2017 period, median age increased in all jurisdictions, except for Census Tract 21, which saw a decrease in median age from 32.9 to 32.3 years. In Census Tract 106, the median age increased considerably from 45.9 to 52.2, and even more so in Census Tract 51 from 38.1 to 48.4 years. This compares against the Oregon-wide increase in median age from 38.4 to 39.2 and in Portland from about 36.0 to 36.8 years.

Table 3. Population Median Age

Year	Census Tract 21	Census Tract 51	Census Tract 106	Portland	Multnomah County	Oregon
2017	32.3	48.4	52.2	36.8	36.8	39.2
2012	32.9	38.1	45.9	36.0	35.9	38.4
2012-2017 Change, Years	**-0.7**	**10.3**	**6.3**	**0.8**	**0.9**	**0.8**

Source: U.S. Census Bureau (accessed April 2019), calculated based on American Community Survey 5-year estimates.

Table 4 examines population age distribution and its change between 2012 and 2017 in the study area and across the benchmark geographies. The key observations regarding the population age characteristics are as follows:

- Except for Census Tract 106, the largest single population group in 2012 and 2017 was represented by younger working age adults age 25-44 with the following shares of total in 2012: 46 percent in Census Tract 21, 48.7 percent in Census Tract 51, 36.9 percent in Census Tract 106. By 2017, the share of this population group increased in Census Tract 21 to represent more than half of the entire population in that census tract. The other two census tracts experienced a reduction in the share of this population group to 37.1 percent in Census Tract 51 and 29.6 percent in Census Tract 106.
- Across all three census tracts, children 14 years or younger represented the smallest population age group and their percent share of the population decreased over the 2012-2017 period.
- In 2017, the share of seniors 65 years of age and older in Census Tract 51 and 106 was higher than across Portland, Multnomah County and state-wide. Compared to 2012, this share increased considerably and grew larger than the share of population 24 years of age and younger. Census Tract 21 has a much lower share of seniors that is actually below the city, county, and state average shares.

Table 4. Population Age Distribution, Shares of Total

Age Group	Census Tract 21	Census Tract 51	Census Tract 106	Portland	Multnomah County	Oregon
			2017			
14 years or less	7.9%	4.0%	1.1%	15.6%	16.5%	17.8%
15 to 24 years	9.9%	5.4%	12.8%	11.1%	11.4%	12.7%
25 to 44 years	59.0%	37.1%	29.6%	36.6%	34.7%	27.0%
45 to 64 years	14.2%	30.8%	38.0%	24.7%	25.0%	26.3%

Table 4. Population Age Distribution, Shares of Total

Age Group	Census Tract 21	Census Tract 51	Census Tract 106	Portland	Multnomah County	Oregon
65 years and over	9.1%	22.9%	18.7%	12.0%	12.2%	16.4%
2012						
14 years or less	8.4%	4.9%	2.1%	16.4%	17.3%	18.6%
15 to 24 years	15.8%	6.4%	8.6%	12.3%	12.7%	13.3%
25 to 44 years	46.0%	48.7%	36.9%	35.5%	33.9%	26.8%
45 to 64 years	21.3%	28.3%	40.1%	25.0%	25.4%	27.3%
65 years and over	8.5%	11.7%	12.1%	10.6%	10.7%	14.1%

Source: U.S. Census Bureau (accessed April 2019), calculated based on American Community Survey 5-year estimates.

5.3.3 Households and Housing Trends

Housing Stock and Property Values

Trends in housing stock are examined in terms of the number of housing units in all types of structures: single detached, structures with multiple units, mobile homes and other types.

Table 5 shows that over the 2012-2017 period, the number of housing units in the study area increased from 9,254 to 10,090, or by 836 units (about 9 percent). This increase is due almost entirely to the increase in housing units in Census Tract 51 and Census Tract 21. Housing units in Census Tract 106 increased by less than 50 units, or just 1.5 percent.

Table 5. Number of Housing Units

Year	Census Tract 21	Census Tract 51	Census Tract 106	Total
2017	1,569	6,409	2,112	10,090
2012	1,414	5,759	2,081	9,254
Change 2012-2017	**11.0%**	**10.1%**	**1.5%**	**9.0%**

Source: U.S. Census Bureau (accessed April 2019), data based on American Community Survey 5-year estimates.

Trends in housing stock are frequently compared against trends in household formation. The relative magnitude and changes in the two series can provide some insights

regarding housing market situation and possible pressures on demand or supply side. Table 6 shows that the number of households in each study geography was smaller than the number of housing units. Over the 2012-2017 period, the number of households increased by a smaller percentage than the number of housing units in Census Tract 21 and the total area of study. In Census Tracts 51 and 106, the percentage increase in households was greater than the percentage increase in housing units. Table 6 also shows that overall, the number of households in the total area of study increased at a higher rate than the number of households in Portland and in Oregon as a whole. However, for Census Tract 106, the opposite was the case.

Table 6. Number of Households

Year	Census Tract 21	Census Tract 51	Census Tract 106	Total	Portland	Oregon
2017	1,408	5,342	1,964	8,714	260,949	1,571,631
2012	1.344	4.760	1.924	8.028	248.549	1.512.718
Change 2012-2017	**4.8%**	**12.2%**	**2.1%**	**8.5%**	**5.0%**	**3.9%**

Source: U.S. Census Bureau (accessed April 2019), data based on American Community Survey 5-year estimates.

Table 7 shows trends in the average property prices (ownership residential housing units) in the study area, in Portland, Multnomah County, and all of Oregon. The table shows that the study area had much higher property prices than the benchmark areas. Specifically, median price in Census Tract 106, which had the lowest prices of the three census tracts of the study area, was higher than median price in Portland by over $90,000. Median price in Census Tract 51, which had the highest prices of the three census tracts of the study area, was higher than median price in Portland by over $127,000.

Over the 2012-2017 period, property values increased in all geographies examined here. It is notable that the study area, Portland and Multnomah County experienced greater increases than Oregon on average, between 20 and 28 percent compared to about 8 percent in Oregon.

Table 7. Median Ownership Residential Property Value Dollars

Year	Census Tract 21	Census Tract 51	Census Tract 106	Portland	Multnomah County	Oregon
2017	$470.700	$480.500	$443.100	$352.700	$330.900	$265.700
2012	$370.400	$400.000	$365.200	$288.300	$276.900	$246.100
Change 2012-2017	**27.1%**	**20.1%**	**21.3%**	**22.34%**	**19.50%**	**7.96%**

Source: U.S. Census Bureau (accessed April 2019), data based on American Community Survey 5-year estimates.

Vacancy Rates

Housing vacancy rates are examined separately for ownership housing and rental housing. Table 8 shows trends in vacancy rates in each census tract of the study area as well as overall trends across all of Oregon.

Across all geographies examined here, rental vacancy rates were higher than home-owner vacancy rates. Home-owner vacancy rates in each census tract, with the notable exception of Census Tract 51 in 2012, were virtually zero percent; compared to vacancy rates of 0.9 to 2.5 percent in the benchmark regions of Portland, Multnomah County, and Oregon overall. Regarding rental vacancy rates, city-, county-, and state-wide values exceeded nearly all those from the study area, with the exception of the Census Tract 21 where rental vacancy rate in 2017 was slightly higher than in Portland. Rental vacancy rates decreased over the 2012-2017 period in Census Tract 21 and Oregon, but increased in Census Tracts 51 and 106.

Table 8. Vacancy Rates, by Tenure of Housing and Year

Year	Census Tract 21	Census Tract 51	Census Tract 106	Portland	Multnomah County	Oregon
Home Ownership Units						
2017	0.0%	0.0%	0.0%	1.0%	0.9%	1.5%
2012	0.0%	12.8%	0.0%	2.5%	2.3%	2.2%
Rental Units						
2017	2.5%	1.9%	1.7%	2.4%	2.9%	3.7%
2012	3.6%	0.0%	1.2%	3.9%	4.1%	5.3%

Source: U.S. Census Bureau (accessed April 2019), data based on American Community Survey 5-year estimates.[1]

Other Households Characteristics

Table 9 shows trends in the proportion of households owning zero vehicles across all levels of geographies analyzed here and illustrates a prevalent declining trend in the proportion of such households.

All three census tracts had a far greater proportion of zero-vehicle households than in Portland, Multnomah County, or Oregon. In 2017, this share amounted to over 20 percent in Census Tract 21, over 44 percent in Census Tract 51, and more than 75 percent in Census Tract 106.

[1] It is noted here that vacancy rates shown in this table for the census tract geographies may seem inconsistent with the number of households and housing units. Based on the source data, these estimates have a relatively large margin of error.

Table 9. Zero-Vehicle Households, Shares of Total

Year	Census Tract 21	Census Tract 51	Census Tract 106	Portland	Multnomah County	Oregon
2017	21.0%	44.5%	75.5%	14.0%	12.9%	7.7%
2012	35.8%	47.7%	84.8%	15.2%	13.9%	7.9%
Change 2012-2017	**-41.5%**	**-6.6%**	**-10.9%**	**-8.0%**	**-26.4%**	**-2.6%**

Source: U.S. Census Bureau (accessed April 2019), data based on American Community Survey 5-year estimates.

5.3.4 Employment and Unemployment

Total Employment and Unemployment Rate

Table 10 shows trends in total employment of population residing in the study area and across the state of Oregon. Over the 2010-2017 period, total employment in the study area increased from 5,278 to 6,788, or about 28.6 percent. In comparison, the state-wide increase was approximately 15 percent, the county-wide increase was 18.6 percent, and the city-wide increase was 14.7 percent over the same period. The largest increase was in Census Tract 51 at 1,220 jobs, or 41.8 percent.

However, it is notable that the job growth in the individual census tracts of the study area was not continuous over the years analyzed. For example, employment decreased in 2011 and 2013 in Census Tracts 21 and 106 compared to the year before.

Table 10. Employment

Year	Census Tract 21	Census Tract 51	Census Tract 106	Total Study Area	Portland	Multnomah County	Oregon
2010	1,454	2,922	902	5,278	298,428	549,232	2,174,324
2011	1,418	2,931	798	5,147	301,504	561,920	2,201,553
2012	1,450	3,157	817	5,424	304,297	572,781	2,219,899
2013	1,333	3,561	803	5,697	308,589	586,517	2,259,714
2014	1,317	3,987	835	6,139	314,575	606,462	2,322,003
2015	1,431	3,863	834	6,128	323,832	624,659	2,388,647
2016	1,545	4,062	915	6,522	332,358	639,464	2,447,178
2017	1,675	4,142	971	6,788	342,306	651,616	2,501,057
Change 2010-17, Number of Jobs	**221**	**1,220**	**69**	**1,510**	**43,878**	**102,384**	**326,733**
Change 2010-17, Percent	**15.2%**	**41.8%**	**7.6%**	**28.6%**	**14.7%**	**18.6%**	**15.0%**

Table 10. Employment

Year	Census Tract 21	Census Tract 51	Census Tract 106	Total Study Area	Portland	Multnomah County	Oregon
Change 2012-17, Number of Jobs	**225**	**985**	**154**	**1,364**	**38,009**	**78,835**	**281,158**
Change 2012-17, Percent	**15.5%**	**31.2%**	**18.8%**	**25.1%**	**12.5%**	**13.8%**	**12.7%**

Source: Bureau of Economic Analysis, U.S. Census Bureau (accessed April 2019); data based on American Community Survey 5-year estimates.

Table 11 shows the trends in unemployment rate within the study area and across the benchmark geographies of Portland, Multnomah County, and Oregon. Over the 2010-2017 period, Census Tract 21 had the lowest unemployment rate in the range of less than 9 percent; below city-, county-, and state-wide rates. Over the same period, Census Tract 106 had the highest rates – much higher than the other geographies studied – in excess of 20 and even 30 percent.[2] Unemployment rates in Portland, Multnomah County, and Oregon remained at a level of between 7 and 11 percent and within about 1.1 percent range of each other in any given year.

The trends in unemployment rate within the study area were broadly similar to state-wide trends: typically increasing over the years 2010-2013 and decreasing after that period.

The table shows that in 2017, the highest unemployment rate was in Census Tract 106 at 12.9 percent compared to 4.2 percent in Census Tract 21, 6.2 percent in Census Tract 51, and 6.8 percent on average across the state of Oregon.

Table 11. Unemployment Rate Trends

Year	Census Tract 21	Census Tract 51	Census Tract 106	Portland	Multnomah County	Oregon
2010	4.4%	13.4%	38.8%	8.8%	8.8%	8.7%
2011	6.9%	20.9%	27.5%	9.4%	9.7%	9.8%
2012	7.1%	20.8%	30.6%	10.1%	10.4%	10.8%
2013	8.1%	18.2%	32.6%	10.3%	10.6%	11.3%
2014	8.3%	14.5%	26.5%	9.4%	9.8%	10.5%
2015	7.0%	14.7%	22.3%	8.4%	8.8%	9.3%
2016	5.4%	8.3%	17.6%	7.5%	7.8%	8.1%

[2] The high unemployment rates in Census Tract 106 could be a result of the low educational attainment of its residents. Census Tract 106 had the highest proportion of population with no high school diploma and lowest proportion of population with a bachelor's degree in Multnomah County. Low educational attainment may limit employment opportunities, in particular in jobs and professions characterized by relative employment stability.

Table 11. Unemployment Rate Trends

Year	Census Tract 21	Census Tract 51	Census Tract 106	Portland	Multnomah County	Oregon
2017	4.2%	6.2%	12.9%	6.6%	6.8%	6.8%

Source: U.S. Census Bureau (accessed April 2019), data based on American Community Survey 5-year estimates.

Employment by Industry

Table 12 shows employment shares (percent of total employment) of key industry groups in the three census tracts of the study area and across Portland. While there are some similarities in the structure/shares in all four areas, there are also some differences in levels and trends. The key characteristics and changes over time are outlined below.

- The largest share of employment was in educational services, health care, and social assistance. In 2017, the share of this industry amounted to almost 29 percent in Census Tract 51, nearly 20 percent in Census Tract 21, and almost 25 percent in Census Tract 106, compared to 25 percent in Portland on average. Compared to 2012, the share of this sector increased somewhat across all geographies examined here.
- The second largest employment was in retail trade or professional, scientific, management, administrative, and waste management services industry. Each of these industries accounted for 10 percent or more of total employment (with the exception of retail trade in Census Tract 51 in 2017). Between 2012 and 2017, the share of professional, scientific, management, administrative, and waste management services grew in all geographies. However, the share of total employment in retail trade increased only in Census Tracts 21 and 106, decreasing in the other geographic entities studied.
- The share of the arts, entertainment, recreation, accommodation, and food services industries in Census Tracts 21 and 106 was higher than the shares of this industry in Portland. However, for Census Tract 51 the opposite was the case. Across all census tracts, this industry's share of employment decreased, while its share in Portland overall increased somewhat.
- The share of the construction industry in Portland was larger than in the census tracts of the study area. It decreased slightly from 4.1 percent in 2012 to 4 percent in 2017. In the census tracts studied, the share of construction ranged between 0.9 to 2.3 percent.
- The share of manufacturing industries in the study area increased by a few percentage points between 2012 and 2017 to 12.7 percent in Census Tract 21, 9.5 percent in Census Tract 51, and 7.5 percent in Census Tract 106. At the same time, the share of manufacturing industries in Portland decreased somewhat from 9.7 percent to 9.1 percent.

Table 12. Industrial Distribution of Employment, 2012 versus 2017, Percent of Total Employment

	Census Tract 21		Census Tract 51		Census Tract 106		Portland	
Industry	2012	2017	2012	2017	2012	2017	2012	2017
Agriculture, forestry, fishing and hunting, and mining	0.0%	0.8%	0.0%	0.5%	1.2%	2.1%	0.60%	0.70%
Construction	0.9%	1.7%	1.7%	2.9%	2.3%	2.3%	4.10%	4.00%
Manufacturing	9.4%	12.7%	7.1%	9.5%	5.4%	7.5%	9.70%	9.10%
Wholesale trade	3.1%	0.6%	3.7%	1.9%	3.3%	2.1%	3.30%	3.10%
Retail trade	10.3%	13.2%	10.0%	7.2%	17.1%	17.6%	10.70%	10.50%
Transportation, warehousing, and utilities	2.9%	3.2%	5.7%	3.8%	3.3%	0.3%	4.30%	4.30%
Information	2.3%	4.9%	7.1%	1.1%	9.0%	2.9%	2.80%	2.60%
Finance and insurance, real estate, rental, and leasing	7.9%	3.8%	7.9%	9.6%	3.5%	3.6%	6.30%	6.00%
Professional, scientific, management, administrative, and waste management services	13.7%	19.0%	17.0%	21.2%	10.7%	17.7%	13.50%	14.90%
Educational services, health care, and social assistance	17.6%	19.5%	23.6%	28.8%	16.8%	24.7%	24.90%	25.00%
Arts, entertainment, recreation, accommodation, and food services	17.6%	14.7%	11.3%	6.8%	22.6%	17.1%	11.20%	11.40%
Other services, except public administration	7.4%	5.5%	3.0%	4.7%	4.8%	0.7%	5.40%	5.20%
Public administration	6.7%	0.5%	1.9%	1.9%	0.0%	1.4%	3.30%	3.40%

Source: U.S. Census Bureau (accessed April 2019), data based on American Community Survey 5-year estimates.

5.3.5 Household Income, Poverty, and Homelessness

Table 13 shows the average and median income of households within the study area and benchmark areas in 2017 and 2012.

In 2017, Census Tract 51 had the highest average household income among the geographies shown in the table at $87,503 and exceeded the average household income in all of Portland by over $2,000. The average household income in the other two census tracts of the study area was much lower at $51,925 in Census Tract 21 and $32,781 in Census Tract 106. Compared to 2012, the average household income increased across all areas studied with the highest increase experienced in Census Tract 51 at over 30 percent and the smallest in Census Tract 21 at just 9.4 percent. In Census Tract 106, the average household income increased by almost 18 percent, a rate somewhat lower than for all of Portland, but similar to that for the Multnomah County.

When looking at the median household income, a somewhat different picture emerges. In 2017, Census Tract 51 had the highest median household income in the study area at $47,895. However, this income was lower than in any other benchmark area shown in the table. In particular, it was lower by more than $13,000 compared to all of Portland and by more than $16,000 compared to all of Multnomah County. Compared to 2012, the median household income increased across all geographies shown in the table, except for Census Tract 106 where median income decreased by more than 6 percent from $13,699 in 2012 to $12,773 in 2017. The percent changes in Census Tracts 21 and 51 exceeded those seen at the city, county, and state levels; growing by about 48 and almost 36 percent, respectively.

Table 13. Household Income

Year	Census Tract 21	Census Tract 51	Census Tract 106	Portland	Multnomah County	Oregon
Average Income						
2017	$51,926	$87,503	$32,781	$85,335	$83,642	$75,851
2012	$47,448	$67,212	$27,823	$71,290	$70,516	$66,161
Change 2012-2017	**9.4%**	**30.2%**	**17.8%**	**19.7%**	**18.6%**	**14.6%**
Median Income						
2017	$42,407	$47,895	$12,773	$61,532	$63,974	$56,119
2012	$28,563	$35,240	$13,699	$51,238	$51,582	$50,036
Change 2012-2017	**48.47%**	**35.91%**	**-6.76%**	**20.09%**	**24.02%**	**12.16%**

Source: U.S. Census Bureau (accessed April 2019), data based on American Community Survey 5-year estimates.

Table 14 shows the proportion of households and individuals below the poverty line in 2017 and 2012.[3] In 2017, Census Tract 51 had the lowest proportion of family households below poverty line at 3.3 percent.[4] Census Tract 21 had 8.6 percent of family households below poverty line, while Census Tract 106 had 12.7 percent of family households below poverty line. For comparison, in the benchmark areas the poverty rate amounted to about 10 percent. Across all geographic entities shown in the table, the share of poor households decreased over the 2012-2017 period. It is notable that the study area had the largest decrease, 46 percent to 64 percent compared to about 9 to 15 percent in the benchmark areas.

When looking at statistics on the number of people below the poverty line, a somewhat different picture emerges suggesting a greater extent of poverty. In all geographic areas included in the table, the proportion of people below the poverty line was greater than proportion of family households below poverty line. This suggests that a high proportion of large families and single individuals were poor. In particular, in 2017 nearly half of the population in Census Tract 106 was below the poverty line. In Census Tract 51 and 21 these proportions were much lower at around 20 percent, but they exceed the level for all of Portland and Multnomah County of around 16 percent. Between 2012 and 2017, the number of people below poverty line decreased in all geographic areas shown in the table except for Census Tract 106, where it increased from 44.5 percent in 2012 to 48.2 percent in 2017.

Table 14. Households and People below Poverty Line

Time Period	Census Tract 21	Census Tract 51	Census Tract 106	Portland	Multnomah County	Oregon
Family Households below Poverty Line (Percent)						
2017	8.6%	3.3%	12.7%	10.0%	10.5%	9.8%
2012	16.0%	8.2%	35.2%	11.8%	12.1%	10.8%
Change 2012-2017	**-46.2%**	**-59.8%**	**-63.9%**	**-15.2%**	**-13.2%**	**-9.3%**

[3] The U.S. Census Bureau uses a set of money income thresholds that vary by family size and composition (number of children and adults) to determine who is in poverty. The official poverty thresholds do not vary geographically, but are updated for inflation using the Consumer Price Index (CPI-U; see How the Census Bureau Measures Poverty at https://www.census.gov/topics/income-poverty/poverty/guidance/poverty-measures.html). Poverty thresholds can be found on U.S. Census Bureau website at Poverty Thresholds (census.gov).

[4] In U.S. census, a family household is defined as a group of two or more people living together consisting of a householder and one or more people who are related to the householder by birth, marriage, or adoption. A household can contain only one family for purposes of census tabulations. Not all households contain families since a household may comprise a group of unrelated people or one person living alone. See U.S. Census Glossary https://www.census.gov/glossary/#term_Familyhousehold (accessed July 2019).

Table 14. Households and People below Poverty Line

Time Period	Census Tract 21	Census Tract 51	Census Tract 106	Portland	Multnomah County	Oregon
People below Poverty Line (Percent)						
2017	21.7%	20.3%	48.2%	16.2%	16.4%	14.9%
2012	20.7%	26.9%	44.5%	17.2%	17.1%	15.5%
Change 2012-2017	**4.8%**	**-24.5%**	**8.3%**	**-5.8%**	**-4.1%**	**-3.9%**

Source: U.S. Census Bureau (accessed April 2019), data based on American Community Survey 5-year estimates.

Table 15 shows recent trends in homelessness in Multnomah County, based on biennial point-in-time (PIT) surveys. In 2017, the number of homeless individuals amounted to 4,177. This number represents an increase of about 10 percent compared to the previous count in 2015 and a reversal of a declining trend from a peak of homelessness in 2011.

About 40 percent of the homeless were unsheltered; meaning that on the night the count was conducted they were sleeping in places not meant for habitation. These places included streets and sidewalks, other private property, bridges and overpasses, woods or open space, and cars and trucks. It was also estimated that about 20 percent of the unsheltered homeless, or 345 individuals, were located in the Downtown/Old Town/Pearl area that correspond to Census Tract 51 and 106.[5]

Table 15. Homelessness Trends in Multnomah County

Category	2009	2011	2013	2015	2017
Unsheltered	1,591	1,818	1,895	1,887	1,668
Emergency Shelter	864	1,009	974	872	1,752
Transitional Housing	1,690	1,928	1,572	1,042	757
Total	**4,145**	**4,755**	**4,441**	**3,801**	**4,177**
Proportion Unsheltered	38.4%	38.2%	42.7%	49.6%	39.9%

Source: Population Research Center, Portland State University, "2017 Point-In-Time: Count of Homelessness in Portland/Gresham/Multnomah County, Oregon", October 2017.

It should also be pointed out that the PIT homelessness statistics likely underestimated the true number of homeless individuals, in particular the unsheltered homeless. This was because the PIT survey was voluntary and target respondents had the right to refuse participation. In 2017, 456 individuals did not wish to participate in the street count

[5] Population Research Center, Portland State University, "2017 Point-In-Time: Count of Homelessness in Portland/Gresham/Multnomah County, Oregon", October 2017.

portion of the PIT survey; 37 percent of these non-respondents, or 170 individuals, were located in the Downtown/Old Town/Pearl area.[6]

5.3.6 Business Activity

Business activity in the study area was analyzed in terms of the number of establishments, average number of employees, and revenues per establishment, by industry. Datasets concerning the businesses and establishments in and around the area of direct impact of the Burnside Bridge site were obtained by the study team from InfoUSA. The data provided was filtered to include only classified, for-profit establishments and the ZIP codes in Project vicinity. The ZIP codes were matched to their corresponding U.S. census tracts, and the Standard Industrial Classification industry codes originally provided with the data were matched to the North American Industry Classification System (NAICS) sector codes and titles.[7] Then, the businesses were aggregated by the 2-digit NAICS codes to determine the number of establishments, average employee size, and average revenue for each broad industry sector in the pertinent geography.

The results for the entire study area are shown in Table 16.

[6] The 2017 PIT survey report also points out that the number of refusals is not fully additive to the number of completed surveys as non-participants could have been counted across more than one location or even be included in the sheltered count on another day during the week of the count.

[7] Standard Industrial Classification codes do not convert seamlessly to NAICS codes. Therefore, the initial conversion results were reviewed for consistency with NAICS classification framework. Corrections were made based on a combination of factors such as business name, Standard Industrial Classification industry description, company information available on their websites, and actual physical location.

Table 16. Business Activity in the Study Area by Industry

NAICS Code	Industry Name	Number of Establishments	Average Number of Employees	Total Employment	Average Revenue ($M)	Share of Total Number	Share of Total Employment
11	Agriculture, Forestry, Fishing, and Hunting	2	6.5	13	$0.4	0.1%	0.1%
23	Construction	43	9.9	427	$2.8	3.2%	2.7%
31-33	Manufacturing	45	33.6	1,511	$13.7	3.4%	9.4%
42	Wholesale Trade	46	9.3	426	$12.6	3.4%	2.7%
44-45	Retail Trade	188	9.1	1,718	$2.1	14.0%	10.7%
48-49	Transportation and Warehousing	13	4.6	60	$0.9	1.0%	0.4%
51	Information	51	20.9	1,064	$5.7	3.8%	6.6%
52	Finance and Insurance	49	17.8	874	$3.6	3.7%	5.5%
53	Real Estate, Rental, and Leasing	59	10.3	605	$1.4	4.4%	3.8%
54	Professional, Scientific, and Technical Services	220	12.9	2,830	$2.3	16.4%	17.7%
56	Administrative and Support Services	17	14.6	248	$1.5	1.3%	1.5%
62	Health Care and Social Assistance	278	7.3	2,032	$0.8	20.7%	12.7%
71	Arts, Entertainment, and Recreation	29	6.0	174	$0.4	2.2%	1.1%
72	Accommodation and Food services	212	16.7	3,530	$1.6	15.8%	22.0%
81	Other Services	88	5.7	505	$0.6	6.6%	3.2%
	Total/Overall Average	**1,340**	**12.0**	**16,017**	**$2.5**	**--**	**--**

Source: Developed by HDR based on InfoUSA (data for March 2018)

Table 16 shows that there were 1,340 businesses in the study area that employed a total of over 16,000 people. The largest industry was health care and social assistance with 278 establishments accounting for over 20 percent of total. This was followed by professional, scientific, and technical services with 220 establishments accounting for about 16 percent of total and accommodation and food services with 212 establishments accounting for about 15 percent of total.

Average employment per establishment amounted to 12 and varied across industries from less than 5 in transportation and warehousing to 37.6 in manufacturing. Some of the largest businesses included the following:

- Henry's Tavern (160 employees)[8]
- Lattice Semiconductors (986 employees)
- Multnomah County (Family Services – 300 employees)
- Oregon Anesthesiology Group (250 employees)
- Powell's City of Books (220 employees)
- Primerica Financial Services (400 employees)
- Wentworth Chevrolet (130 employees)
- Whole Foods Market (150 employees)

Average revenue across all industries amounted to $2.5 million, but varied substantially among industries: from $0.4 million in agricultural-related businesses and arts, entertainments, and recreation industry to $13.7 million in manufacturing and $12.6 million in wholesale trade establishments.

Table 17 shows the same information, but broken down by census tract. The table shows that the business activity was roughly equally distributed across the three census tracts. However, it is notable that Census Tract 106 had the largest average employment per establishment (at 16 per establishment), highest average revenue per establishment (at $3.3 million), and much higher value of manufacturing operations. Some of the largest employers captured in the InfoUSA data, including Lattice Semiconductors, are located in this census tract. On the other hand, Census Tract 21 had the smallest average employment per establishment (at 8.3), but the largest total number of establishments, including over half of establishments from the health care and social assistance industry.

[8] This business closed in 2019.

Table 17. Business Activity in the Study Area by Industry, by Census Tract

NAICS Code	Industry Name	Census Tract 21			Census Tract 51			Census Tract 106		
		Number of Est.	Average Empl.	Average Revenue	Number of Est.	Average Empl.	Average Revenue	Number of Est.	Average Empl.	Average Revenue
11	Agriculture, Forestry, Fishing, and Hunting	--	--	--	--	--	--	2	6.5	$0.4
23	Construction	14	5.6	$1.6	14	6.8	$2.2	15	16.9	$4.7
31-33	Manufacturing	12	22.2	$11.5	18	5.4	$1.1	15	76.5	$30.6
42	Wholesale Trade	31	9.8	$14.4	4	4.3	$4.2	11	9.5	$10.2
44-45	Retail Trade	77	7.0	$1.8	62	13.7	$2.9	49	6.8	$1.4
48-49	Transportation and Warehousing	5	4.4	$0.9	4	4.0	$0.9	4	5.5	$1.0
51	Information	19	16.7	$4.1	12	6.8	$1.8	20	33.3	$9.6
52	Finance and Insurance	12	40.5	$5.0	8	14.1	$3.5	29	9.5	$3.1
53	Real Estate, Rental, and Leasing	15	8.1	$1.2	14	5.9	$1.0	30	13.4	$1.7
54	Professional, Scientific, and Technical Services	65	7.4	$1.2	45	18.2	$3.2	110	13.9	$2.5
56	Administrative and Support Services	3	2.7	$0.5	5	6.6	$0.6	9	23.0	$2.2
62	Health Care and Social Assistance	161	4.2	$0.4	42	7.2	$1.0	75	14.0	$1.4
71	Arts, Entertainment, and Recreation	17	4.8	$0.3	7	9.7	$0.9	5	4.8	$0.2
72	Accommodation and Food Services	67	12.1	$0.9	58	18.4	$2.7	87	19.0	$1.5
81	Other Services	42	7.1	$0.9	20	5.3	$0.4	26	3.8	$0.4
Total		**540**	**8.3**	**$2.1**	**313**	**12.0**	**$2.1**	**487**	**16.0**	**$3.3**

Source: Developed by HDR based on InfoUSA (data for March 2018)

5.3.7 Population and Employment Forecasts

Metro, Portland's regional government and planning agency, is responsible for forecasting long-term population and employment growth for the Portland-Vancouver-Hillsboro Metropolitan Statistical Area that encompasses the City of Portland.

In 2013, Metro forecasted for Portland growth of approximately 260,000 people, 123,000 households, and 142,000 new jobs between 2010 and 2035.[9] Given Portland's 2010 population of about 584,000 people, 248,000 households, and employment of 298,000, these forecasts implied average annual rates of growth of 1.5 to 1.6 percent for the above metrics.

In 2016, Metro updated its regional forecasts. These forecasts were lower than its previous ones, implying lower growth rates for the region. For example, for 2030 the regional population forecast was reduced from about 3.05 million to 2.81 million, or by 7.7 percent.[10] The agency noted that there were several factors that contributed to the lower regional growth outlook including slower population growth during the 2009 recession, lower birth rates, and reduced immigration.[11] Forecast updates specific for the City of Portland were not identified in published sources.

5.3.8 Road Network

On the west side of the Willamette River, the Project vicinity is bordered by NW Naito Parkway after passing the Steel Bridge to the north of the Burnside Bridge.

The road network forms grids of perpendicularly laid-out streets spanning between arterial roads that extend west from the Burnside Bridge and the bridges to the north and south of it (the Steel Bridge and the SE Morrison Bridge, respectively): W Burnside Street, NW Glisan Street and NW Everett, and SW Washington Street and SW Alder Street. The streets are mostly one-way running across commercial central business districts and residential areas.

Further to the west (and beyond the Project vicinity), the arterials provide access to Interstate 405 (Stadium Freeway).

On the east side along the Willamette River, the Project vicinity (and specifically Census Tract 21) is bordered by Interstate 5 and to the north by Interstate 84 (also called Vietnam Veterans Memorial Highway and Banfield Expressway).

The road network of Census Tract 21 is composed mostly of residential streets that form a grid network of streets running in the east-west or north-south direction. Many of these streets are one-way streets including the E Burnside Street that extends from the Burnside Bridge to the east. The bridge can be accessed via NE Couch Street, which

[9] Portland Bureau of Planning and Sustainability, Comprehensive Plan Update, Growth Scenarios Report, July 2015, PCS Recommended Draft.

[10] Frequently Asked Questions: Metro 2060 Population Forecast; https://www.oregonmetro.gov/2060-growth-forecast (accessed June 2016).

[11] See https://www.oregonmetro.gov/2060-growth-forecast (accessed June 2019).

turns south to merge with E Burnside Street on the bridge approach about 800 feet before the river shores. Sandy Boulevard represents one of the major arterials cutting diagonally across the grid network.

6 Impact Assessment Methodology and Data Sources

The impacts analysis addresses the direct long-term and short-term economic impacts of the Project Alternatives.

6.1 Long-Term Impact Assessment Methods

The analysis of direct long-term economic impacts considered effects due to the Project compared to the existing conditions that will likely persist for a period of time after Project completion. The following effects were considered:

- Impacts on traffic and travel
- Impacts on safety
- Impacts on businesses, community facilities, and community services
- Impacts on land use in Project vicinity (availability of new developable parcels of land)
- Noise impacts
- Impacts of bridge seismic resiliency in the post-earthquake scenario

The methods for each of the above category of effects are outlined below.

6.1.1 Traffic and Travel Patterns

Changes in traffic operating performance between No-Build and Build conditions, in particular, differences in travel times and vehicle operating costs may affect motorists' welfare, business production costs, and productivity in the Project Area and the API.

As stated in the *EQRB Transportation Technical Report* (Multnomah County 2021l), the Project is not expected to affect long-term traffic volumes, traffic circulation, and average speeds. In other words, for all key modes using the bridge (i.e. autos, trucks, transit, bikes, and pedestrians), the number of trips and average speed is the same under No-Build and Build scenarios. Therefore, economic impacts stemming from the volume and traffic performance are expected to be negligible and were not analyzed further in this study.

6.1.2 Impacts on Traffic Safety

The *EQRB Transportation Technical Report* (Multnomah County 2021l) conducted safety analysis in the Project Area by examining the accident data for the last seven years, a period from 2011 to 2017. In the economic analysis for this Technical Report, these data were used to calculate the average annual number of accidents in the Project Area by

mode and severity (i.e. fatal, injury, and property-damage-only accidents), which was assumed as the current average annual number of accidents. The future average annual number of accidents under No-Build was forecasted from that number assuming that it will be growing at the same rate as the general traffic. This methodology assumes that accident rates remain unchanged in the future.

The *EQRB Transportation Technical Report* (Multnomah County 2021l) also included an impact assessment of the Build scenario on traffic safety using a Crash Modification Factor (CMF) methodology. Traffic safety improvements are expected in the Project Area where the road geometry is improved in a way that improves the driving conditions. Specifically, that analysis identified CMFs by bridge section and Build Alternative. These CMFs were used in the economic analysis to estimate the expected number of accidents under a Build scenario and the reduction in the number of accidents compared to No-Build. These were then multiplied by the unit value of social accident costs recommended by the US Department of Transportation to obtain the economic value of accident cost avoided.

6.1.3 Impacts on Businesses, Community Facilities, and Community Services

Impacts on businesses, community facilities, and services may stem from changes in the footprint of the bridge and right-of-way (ROW) implications compared to the existing bridge. The proposed Project Alternatives were analyzed in terms of permanent ROW requirements, business and residential displacements, changes in road configuration, and changes in access to existing buildings and facilities. The results of this assessment, as outlined in the *EQRB Transportation Technical Report* (Multnomah County 2021l) and *EQRB Description of Alternatives Technical Report* (Multnomah County 2021d), were used here to identify the specific impacts. The impacts were then analyzed to highlight their economic implications and costs. The stakeholder interviews conducted by the study team in summer 2019 were used where relevant to provide additional context. This analysis was conducted in qualitative terms.

6.1.4 Impacts on Land Use/Developable Parcels

New parcels of developable land available after construction is completed could contribute to economic activity in the Project Area generating economic benefits. However, the real estate analysis concluded that the Build scenario will not generate any new parcels of developable land. The economic impacts of changes in other aspects of land use, such as the conversion of use in some areas from non-transportation to transportation use, were covered under impacts on businesses, community facilities, and services. Therefore, any additional economic impacts stemming from changes in land use were considered to be negligible and were not further analyzed in this study. The *EQRB Land Use Technical Report* (Multnomah County 2021e) provides a detailed assessment of land use impacts.

6.1.5 Noise Impacts in Project Vicinity

High levels of noise have impact on human health and quality of life. As reported in the *EQRB Noise and Vibration Technical Report* (Multnomah County 2021f), the Project is

not expected to affect the prevailing level of noise because the alignment of the bridge is similar to the existing conditions, and traffic volume with the Build Alternatives is not expected to differ from the No-Build volumes. Therefore, there are minimal economic impacts of the Project related to the level of noise.

6.1.6 Bridge Seismic Resiliency in Case of an Earthquake

Burnside Bridge will be designed to withstand a major CSZ earthquake. The improved bridge resiliency was analyzed in terms of avoidance or reduction in various socioeconomic disruptions and facilitation of recovery efforts after an earthquake. This analysis was conducted in qualitative terms.

6.2 Short-Term Impact Assessment Methods

The analysis of direct short-term economic impacts considered effects due to the Project that may affect the local communities and local and regional economies, but which are temporary, likely to persist only during project construction. The following effects were considered:

- Construction-related disruptions in various forms, including
  - Disruptions, detours, and delays to traffic using the Burnside Bridge
  - Disruptions and delays to other transportation in the API
  - ROW, impeded access, and displacement impacts
  - Increased noise
- Business and employment opportunities related to Project construction, supply of input materials and other services (directly and indirectly).
- Impacts of temporary closures of parks and trails on Park department revenue (pending – not yet included in this draft).

The methods for each of the above category of effects are outlined below.

6.2.1 Disruptions, Detours and Delays to Traffic Using the Burnside Bridge

During construction, the ability of traffic to cross the Burnside Bridge will be limited or eliminated for a period of time (which will vary depending on the construction traffic management option). Travelers will be forced to detour incurring additional travel time and cost.

Transportation modeling conducted for the *EQRB Transportation Technical Report* (Multnomah County 2021l) considered the regular routes and likely detours for each mode and estimated the travel times for each. For autos specifically, the modeling was conducted for a sample of origin-destination pairs that would be expected to use the Burnside Bridge on their travel route. For each of these pairs, a few alternate travel paths were determined that could be taken instead. Simulations were then conducted for AM Peak hour westbound and PM Peak hour eastbound trips, the main peak directional traffic flows, to estimate travel times for the regular route and each alternate path. The

implied additional travel times and travel miles were then used as inputs in the economic analysis to estimate the additional travel time per trip. Additional details regarding calculations of delays per trip are provided in Appendix A.

6.2.2 Disruptions and Delays to Other Transportation in the API

Construction activities may cause disruptions to transportation on facilities surrounding the bridge, including I-5 and I-84, the UPRR rail track, and navigation on the Willamette River. The specific disruptions were identified based on the analysis in the *EQRB Description of Alternatives Report* (Multnomah County 2021d), which considers the economic implications and costs of these disruptions and is mostly qualitative.

6.2.3 Right-of-Way, Impeded Access, and Displacement Impacts

The proposed Project Alternatives were analyzed in terms of temporary ROW requirements, business and residential displacements, and changes in access to existing buildings and facilities. The results of this assessment, as outlined in the *EQRB Transportation Technical Report* (Multnomah County 2021l) and *EQRB Description of Alternatives Report* (Multnomah County 2021d), were further analyzed to highlight their economic costs. The stakeholder interviews conducted by the study team in summer 2019 were used where relevant to provide additional context. This analysis was conducted in qualitative terms.

6.2.4 Increased Noise

The impacts of construction-related noise were analyzed in terms of its effects on property prices. The *EQRB Noise and Vibration Technical Report* (Multnomah County 2021f) is referenced as to the estimated noise levels during various stages of construction. This analysis is qualitative based on literature review and reported findings in other jurisdictions.

6.2.5 Business and Employment Opportunities Impacts

Business and employment opportunities related to the Project were evaluated based on Project expenditures (construction costs) and assumptions regarding procurement plans using an input-output approach and RIMS II multipliers from the Bureau of Economic Analysis (2020), which are widely used in economic impact modeling to forecast the effect of a given change in the economy's activity (such as an infrastructure construction project) on the local, regional, and national economy. The change is specified in terms of incremental expenditures on construction, equipment, supplies, maintenance, or operations (or reduction in these expenditures). The results are typically presented as estimates of incremental employment, business output (or business revenue), employment income, and value added attributable to the project analyzed, all in terms of direct, indirect, and induced impacts.

Direct impacts are the immediate effects of project expenditures such as employment of construction workers and business revenues of the construction company. Indirect impacts are employment of workers and business revenues of firms supplying input

materials and services to the construction company. Induced impacts capture the effects of re-spending of workers' income on consumption goods and services.[12]

The Bureau of Economic Analysis RIMS II multipliers used here were for the transportation structures, highways, and streets construction industry for 2017 (and based on 2012 Benchmark Input-Output National Tables). For the purpose of this analysis, project costs were therefore de-escalated to 2017 dollars to match them to the year of the multipliers. Because ROW expenditures do not generate rounds of expenditures and economic impacts the same way as construction expenditures, they were deducted from total project costs.

Simulation of economic impacts also requires assumptions regarding the percentage of total expenditures that would be spent in the area for which the impacts are estimated. It is acknowledged that procurement plans have not been developed yet and contracts have not been awarded to suppliers. For this analysis, it was assumed that 75 percent of Project expenditures would be spent in Multnomah County and 90 percent within the state of Oregon.

This analysis was conducted at the county and state levels to illustrate local impacts as well as broader impacts in a larger geographic area. The results were also interpreted in terms of impacts on communities in the Project vicinity.

6.3 Indirect Impact Assessment Methods

Future indirect impacts could include displacements or attracted economic development resulting from reasonably foreseeable projects around the Project Area. Municipal planning and forecasting documents were considered to identify the scope for such impacts in the Project Area and any existing forecasts. These were reviewed from the perspective of the impacts (negative and positive) on existing residents and businesses in the Project Area. This analysis was conducted in qualitative terms.

6.4 Cumulative Impact Assessment Methods

The cumulative impacts analysis considered the Project's impacts combined with other past, present, and reasonably foreseeable future actions that would have environmental impacts in the Project Area. Based on the list of foreseeable transportation and other development projects that are anticipated to occur in the Project Area within the same time frame, as well as relevant past actions that have defined the Project Area, potential

[12] In input-output analysis, the direct, indirect, and induced impacts are defined as follows. Direct impacts refer to the initial economic effects occurring as the result of capital or operating expenditures directly related to the project or event being evaluated. Direct spending results in the employment of workers, business output, and sales of locally produced goods or services. Indirect impacts refer to the "spin-off" economic activities that result from purchases of production inputs, goods and services, by businesses that are impacted by the initial expenditures. The spending by the supplier firms on their labor, production inputs, goods and services that they require creates output of other firms further down the production chain, bringing about additional business output, employment, and earnings. Induced impacts represent the increase in business output, employment, and earnings over and above the direct and indirect impacts, generated by household re-spending of employment income derived from direct and indirect employment on consumption goods and services.

economic cumulative effects were identified and assessed. This analysis was conducted in qualitative terms.

7 Environmental Consequences

7.1 Introduction

The description of long-term Impacts is divided into (a) pre-earthquake impacts, and (b) impacts that would occur after the next CSZ earthquake (emergency response and longer-term recovery). Each of these is then considered within No-Build and Build scenarios.

7.2 Pre-Earthquake Impacts

7.2.1 No-Build

NEPA regulations require an evaluation of the No-Build Alternative to provide a baseline for comparison with the potential impacts of the proposed action. The No-Build Alternative consists of existing conditions and any planned actions with committed funding in the Project Area.

Under the No-Build Alternative, the Burnside Bridge and the local transportation network in the Project Area would remain in their current configuration with the addition of projects included in the Regional Transportation Plan and the Central City in Motion 2035 Plan (2018). The bridge would not be retrofitted or reconstructed, and the lane assignments would be based on currently adopted plans, including the recent conversion of one of the existing eastbound travel lanes into a transit-only lane, consistent with the Enhanced Transit Corridor study (City of Portland 2018).

Actions implemented under the No-Build Alternative would involve primarily maintenance and repairs to ensure that the bridge is fully operational. Depending on the scope of these repairs and maintenance, they could also cause some economic disruptions, including traffic disruptions, impeded access to businesses, social services, and amenities in the local and regional economies.

As outlined in the *EQRB Transportation Technical Report* (Multnomah County 2021l), traffic across the Burnside Bridge is forecast to decrease slightly in the future compared to existing conditions, from current 35,000 AADT to 34,000 AADT in 2040. Daily traffic volumes are forecast to decrease even as overall demand for travel into Portland's Central Business District is forecasted to increase. The decrease in demand is due to increased parking prices and supply constraints, transit projects geared toward reducing transit travel times and increasing throughput, large investments in bicycle and pedestrian facilities, and increased housing supply in the Central Business District and close-in neighborhoods.

In fact, total ridership on transit bus lines 12, 19, and 20 that cross the Burnside Bridge is forecasted to increase from the 2019 level of nearly 32,000 daily trips to over 71,000 daily trips by 2045. Applying the same rates of growth to bus transit trips that start or finish in the Project vicinity implies an increase from about 3,400 daily trips to over 8,700

by 2045. The number of bike trips across the bridge is forecasted to increase from 1,350 in 2019 to 2,300 in 2045, and the number of pedestrian trips across the bridge is forecasted to increase from 1,050 to 2,050 over the same period. The daily travel information is summarized in Table 18.[13]

Table 18. Daily Traffic Crossing Burnside Bridge (No-Build and Build)

Mode	Existing Volume 2019	Future Volume 2045	Average Annual Rate of Growth (Percent)
Auto & Truck			
ADT	35,000	34,000	-0.14%
Transit Bus - Daily Trips			
Line 12 Total	11,054	11,074	0.01%
Line 19 Total	8,096	13,473	1.98%
Line 20 Total	12,823	46,815	5.11%
Grand Total	31,973	71,362	2.93%
Line 12 Boarding & Alighting in Project Area	765	767	0.01%
Line 19 Boarding & Alighting in Project Area	830	1,381	1.98%
Line 20 Boarding & Alighting in Project Area	1,806	6,593	5.11%
Total Boarding & Alighting in Project Area	3,401	8,741	3.52%
Active Transportation - Daily Trips			
Bike	1,350	2,300	2.07%
Walk	1,050	2,050	2.61%

Sources: Auto & Truck obtained from Oregon Department of Transportation (2019) and City of Portland (2019). Transit and active transportation were obtained from Metro. Bus ridership was extrapolated to the years shown in table from 2015 and 2040 forecasts. Future Volumes for bus lines in Project Area were estimated by HDR from 2015 numbers assuming the same rate of growth as those for the entire ridership on the respective bus lines.

7.2.2 Enhanced Retrofit

Direct

Traffic volumes are expected to remain the same as under the No-Build scenario as shown in Table 18. Long-term impacts are outlined below.

Traffic Safety Impacts

The Retrofit Alternative includes some improvements to road geometry at the bridge west approach and intersections within the Project Area that are expected to improve

[13] As reported in the *EQRB Transportation Technical Report*, the Project is not expected to affect the traffic volume. Traffic volumes presented in the table apply to both No-Build and Build scenarios.

safety for motor vehicles, bicyclists, and pedestrians. The *EQRB Transportation Technical Report* (Multnomah County 2021l) provides an assessment of these improvements using a CMF methodology. No quantifiable CMFs were identified for the additional intersection improvements. Therefore, the positive impact of these improvements is considered qualitatively.

For the bridge west approach, the CMF for all crashes was determined at the level of 0.73 while the CMF for bike and pedestrian crashes was 0.93. These figures translate into 27 percent and 7 percent reductions in crashes, respectively. For the bridge mid-section and the east approach, CMF was determined to equal about 1 (unity), which is indicative of no impact on accident frequency. Table 19 shows the results of the analysis conducted using the methodology outlined in Section 6.1. The analysis uses an evaluation period of 2029-2048, which covers a 20-year period following completion of the construction. Since the expected number of accidents varies from year to year depending on traffic, the table shows the expected number of accidents for 2040 as a way of illustration of annual impacts. The table shows that the Build scenario is expected to reduce injury accidents for auto and active transportation. Overall, the total monetary value of these impacts is estimated at about $0.47 million in 2017 constant dollars.

Table 19. Safety Analysis of Retrofit Alternative

Accidents by Mode and Severity	Annual Number of Accidents - 2040		Accidents Reduced over 20 Years (2029-2048)	Unit Cost of Accidents ($)	Total Accident Costs Reduced ($M)
	No-Build	Build			
Auto & Truck					
Fatal	0.00	0.00	0.00	$9,600,000	$0.00
Injury A	0.00	0.00	0.03	$459,100	$0.01
Injury B &C	0.42	0.30	2.41	$94,450	$0.23
PDO	0.42	0.30	2.47	$4,300	$0.01
Bike and Pedestrians					
Fatal	0.00	0.00	0.00	$9,600,000	$0.00
Injury A	0.24	0.22	0.33	$459,100	$0.15
Injury B &C	0.48	0.45	0.66	$94,450	$0.06
			Total Accident Cost Reduced		**$0.47**

Note: Monetary values are in 2017 dollars.
Source: Analysis conducted by HDR. Unit accident costs are based on recommendations from US Department of Transportation for benefit-cost analysis (US Department of Transportation. "Benefit-Cost Analysis Guidance for Discretionary Grant Programs", December 2018.) Injury A refers to incapacitating injury, Injury B refers to non-incapacitating injury, while injury C refers to possible injury.

Right-of-Way and Business Displacements Impacts

In order to construct the Project, some properties will have to be acquired for ROW, some buildings will have to be demolished, and tenants relocated. While there will be no impacts to residential properties, a few business tenants will be displaced.

The Retrofit Alternative will displace six businesses: Portland Saturday Market Administration and Billboard (PSM), University of Oregon (UO; area of White Stag), two parking lots operated by Diamond Parking Service, Rose City Transportation (RCT) parking lot and building, and American Medical Response Ambulance Service (AMR). This alternative would also require construction staging on Pacific Coast Fruit Company (PCFC) property, which would displace the current use for more than 12 months, thereby qualifying this business for displacement compensation.

Stakeholder interviews and briefings conducted in July 2019 revealed that PSM has about 300 fee-paying members, and 240 vendors on average participate in the weekend market. PSM has a lease on the building used for administration and the park space is used for the weekly market (with the building lease expiring in 2020). PSM indicated that they had no intention of staying in the current building. Their office space requirements are relatively small and could be potentially accommodated through a lease agreement with another organization in the area. Therefore, the impacts on PSM administration can be expected to be very small. However, PSM also needs storage space for vendor equipment. Finding suitable storage near the area where the market takes place may be challenging with possibly moderate cost impacts.

The UO leases a classroom space in a city-owned lot under the west side of the bridge. If this space is closed, UO will have to assess their current options for class scheduling and space. The inability to find an alternate space for the classes taking place at the affected location could translate into a loss of course offerings to students and course fee revenue to UO.

RCT is a freight brokerage firm with about 15 employees. Stakeholder interviews conducted in July 2019 pointed out that RCT is a sister company to Pacific Coast Fruit Company located next door and benefits from co-location with it. The company had some office expansion plans for the current location scheduled for late 2019/2020. Assuming that the expansion plans do not actually start before EQRB construction begins, the move will likely have a relatively small impact on RCT as they do not own trucks, do not employ drivers, and thus do not need property for truck storage, loading or unloading.

AMR has communications/call center and ambulance dispatch operations at the Burnside Bridge location from which it serves Multnomah, Clackamas, and Clark Counties on a 24/7 basis. It employs about 290 people and operates 100 vehicles. The location close to a bridge over the Willamette River is an operational advantage for AMR. Displacement could thus pose a challenge of finding another suitable location with similar advantages. Development of a new replacement communication center would present an additional cost of moving to an alternate location.

The displacement of parking lots operated by Diamond Parking Services will likely represent a permanent loss of parking spaces in this area of the city and a revenue loss to the operator (but with a reduction in corresponding operating costs). Relocation opportunities will be limited to empty or underutilized lots only, which may be limited in this part of the city.

PCFC is a produce processing company, the biggest in the central city. Its current location provides PCFC logistical advantages due to easy access to a bridge over the Willamette River, I-5, I-84, and other major routes. PCFC warehouses and processing

facilities are Safe Quality Foods Level 2.0 Certified and operate with a Hazard Analysis and Critical Control Points plan. The company is also Certified Organic by Oregon Tilth under the U.S. National Organic Program 7 CFR Part 205. Relocation of a company such as PCFC create costs related to the physical move, re-certification of the new facilities, and re-optimization of its supply and distribution network.

Other Right-of-Way and Access Impacts

The Burnside Skatepark located directly beneath the bridge on the east side of the Willamette River will have to be demolished for construction and pier strengthening in that location. It will not be possible to rebuild the skatepark in the same place after construction is finished. The closure of the park would mean a loss of enjoyment and recreational benefits for its users.

In addition to the above ROW impacts, some street-level doors/access points to garages and facilities will have to be closed. For the Retrofit Alternative, this includes one garage door on W Burnside Street to the City of Portland garage under the bridge and four other access points for pedestrian access to facilities around SW 1st Avenue under the bridge, including Skidmore Fountain MAX Station, Old Town, and PSM. In particular, the existing Burnside Street entryway to PSM will have to be closed and relocated to the east side of the building. The above access points provide a convenient shortcut for pedestrians who may be on or around the Burnside Bridge (or who want to get there from under the bridge). Their closures will require longer walk times around 2nd Avenue to reach the same destinations. There is little business activity in this area and thus business impacts are not expected to be large.

EQRB Right-of-Way Technical Report (Multnomah County 2021j) and *EQRB Acquisitions and Displacements Technical Report* (Multnomah County 2021a) provide more details regarding the number and type of property displacements and impacts.

Indirect

Recent editions of the planning documents for the City of Portland and the Metro Region recognize the API as central city, business and cultural hub, with intensive development potential for housing and employment.[14] The planning documents also recognize Burnside Street as a major arterial within the regional motor vehicle network, an enhanced transit corridor, and a bicycle and pedestrian parkway.

In fact, over the last several years the east side of the Burnside Bridge has been undergoing extensive redevelopment with construction of new residential, office, and mixed use multi-story buildings.

An earthquake-resilient Burnside Bridge may further increase the attractiveness of potential development and redevelopment sites in the API as those locations would suffer relatively small disruptions in transportation connectivity after an earthquake. The

[14] Relevant planning documents in question include Metro Regional Transportation Plan (2018), Central City 2035 Plan, and City of Portland 2035 Comprehensive Plan/Transportation System Plan, Metro 2040 Growth Concept.

EQRB Project could thus encourage or accelerate development and redevelopment projects in the vicinity of the bridge.

With intensive new development there is also a risk of gentrification and a loss of affordable housing stock which would have a negative impact on current residents given that a relatively large share of population is below the poverty line.[15]

7.2.3 Replacement, Short-span

Direct

Most impacts, except for safety impacts and some ROW impacts, are expected to be the same under this alternative as under the Retrofit Alternative.

Traffic Safety

Safety impacts are expected to be greater with a higher number of accidents prevented and greater accident cost savings, compared to the Retrofit Alternative. This is because the Short-span Alternative allows a change in the road geometry of the mid-span of the bridge and the east approach where there were serious accidents in the past, including fatalities and serious injuries. The CMF for all crashes was determined at the level of 0.89 for west approach, 0.93 for mid-span, and 0.91 for the east approach. The CMF for bike and pedestrian crashes was determined at the level of 0.34 for west approach, 0.36 for mid-span, and 0.38 for the east approach.

Table 20 shows that the Build scenario is expected to reduce fatalities for active transportation and injury accidents for auto and active transportation. For autos, the Build scenario is expected to reduce the number of injury B and injury C accidents by 4.9 cases and the number of property only accidents by 3.7 cases. For active transportation, the Build scenario is expected to prevent 5.8 fatalities, 6.0 injury A accidents, and 18 injury B and injury C accidents. Overall, the monetary value of these effects is estimated at over $61 million in 2017 constant dollars.

Table 20. Safety Analysis of Short-span Alternative

Accidents by Mode and Severity	Annual Number of Accidents - 2040		Accidents Reduced over 20 Years (2029-2048)	Unit Cost of Accidents ($)	Total Accident Costs Reduced ($M)
	No-Build	Build			
Auto & Truck					
Fatal	0.00	0.00	0.00	$9.600.000	$0.00
Iniurv A	0.28	0.25	0.44	$459.100	$0.20
Iniurv B &C	2.08	1.90	3.58	$94.450	$0.34
PDO	2.77	2.54	4.66	$4,300	$0.02

[15] Refer to Section 5.3.5 and Table 14. As an example, nearly 50 percent of population in Census Tract 106 are below the poverty line.

Table 20. Safety Analysis of Short-span Alternative

Accidents by Mode and Severity	Annual Number of Accidents - 2040		Accidents Reduced over 20 Years (2029-2048)	Unit Cost of Accidents ($)	Total Accident Costs Reduced ($M)
	No-Build	Build			
Bike and Pedestrians					
Fatal	0.48	0.18	5.84	$9.600.000	$56.10
Iniurv A	0.48	0.17	6.03	$459.100	$2.77
Iniurv B &C	1.45	0.51	18.19	$94.450	$1.72
			Total Accident Cost Reduced		**$61.15**

Note: Monetary Values are in 2017 dollars. Source: Analysis conducted by HDR. Unit accident costs are based on recommendations from US Department of Transportation for benefit-cost analysis (U.S. Department of Transportation. "Benefit-Cost Analysis Guidance for Discretionary Grant Programs", December 2018.) Injury A and Injury B&C accidents are defined as in Table 19.

Right-of-Way and Access Impacts

The Burnside Skatepark would be relatively unaffected by this alternative and could remain in its current location. All other impacts are expected to be the same as under the Retrofit Alternative.

Indirect

Indirect impacts expected under this alternative would be the same as under the Retrofit Alternative.

7.2.4 Replacement, Long-span

Direct

The Long-span Alternative would require fewer permanent easements because it would not require footings within Tom McCall Waterfront Park at the west bridgehead or within the Oregon Department of Transportation or Oregon Department of State Lands ROW near the east bridgehead.

Other impacts are expected to be the same as under the Short-span Alternative.

Indirect

The same indirect impacts are expected as under the Short-span Alternative.

7.2.5 Replacement with Couch Extension

Direct

Most impacts are expected to be the same as for the Short-span Alternative. The differences are discussed below.

Traffic Safety

For the Couch Extension Alternative, the transportation analysis did not identify quantifiable CMFs for the couplet on the east approach. Therefore, the impact on accidents on the east approach is not quantified. For the west approach and the bridge mid-section, the identified CMFs are the same as for the Short-span Alternative. The results of the analysis are shown in Table 21. The table indicates a somewhat lower reduction in the number of accidents and total accident costs compared to the Short-span Alternative. This is because, historically, most accidents took place on the mid-section of the bridge, including fatal accidents and accidents with a serious injury, which will benefit from improved road geometry under this alternative. Overall, the monetary value of reduction in accident costs is estimated at $60 million in 2017 constant dollars.

Table 21. Safety Analysis of Replacement with Couch Extension

Accidents by Mode and Severity	Annual Number of Accidents - 2040		Accidents Reduced over 20 Years (2029-2048)	Unit Cost of Accidents ($)	Total Accident Costs Reduced $M)
	No-Build	Build			
Auto & Truck					
Fatal	0.00	0.00	0.00	$9,600,000	$0.00
Injury A	0.14	0.13	0.19	$459,100	$0.09
Injury B &C	1.25	1.14	2.08	$94,450	$0.20
PDO	1.66	1.53	2.66	$4,300	$0.01
Bike and Pedestrians					
Fatal	0.48	0.18	5.84	$9,600,000	$56.10
Injury A	0.48	0.17	6.03	$459,100	$2.77
Injury B &C	0.73	0.26	9.14	$94,450	$0.86
				Total Accident Cost Reduced	**$60.03**

Note: Monetary Values are in 2017 dollars. Source: Analysis conducted by HDR. Unit accident costs are based on recommendations from US Department of Transportation for benefit-cost analysis (U.S. Department of Transportation. "Benefit-Cost Analysis Guidance for Discretionary Grant Programs", December 2018.) Injury A and Injury B&C accidents are defined as in Table 19.

Right-of-Way and Business Displacements Impacts

The Couch Extension Alternative would require additional ROW acquisitions. In particular, this alternative would permanently displace PCFC (as opposed to a 12-month, temporary displacement under other alternatives).

Other Right-of-Way Impacts

In addition, the Couch Extension Alternative will require closures of several pedestrian access points to properties on the east side of the Burnside Bridge along the Couch Street alignment (nine additional access points). The affected properties are apartment complexes with ground-level retail or small business establishments (Bridgehead Development LLC and Block 75 LLC). These closures will cause some inconvenience by

requiring longer walk times to alternative access points. The anticipated location of the elevated Couch Street structure only two to five feet from three buildings (including The Yard, the Eastside Exchange, and Block 75 Slate Apartments) may obstruct views as well as increase noise along the street and inside the buildings.

The Couch Extension Alternative will also require closures of on-street parking for bike lanes or roadway in the block where the alignment merges with the city streets. Locations affected include 3rd Avenue (west side between Davis Street and E Burnside Street), Davis Street (south side between 3rd Avenue and Martin Luther King Jr. Boulevard), Martin Luther King Jr. Boulevard (east side between Davis Street and Couch Street), and a small section on the north side of E Burnside Street. Parking closures will reduce opportunities for short-term parking in the area and reduce parking revenues. Businesses located here may also face a risk of a reduction in number of visits from pass-through car traffic. At the same time, bike lane installations may increase bicycle traffic and bring new customers. Studies indicate that retailers tend to over-estimate the number of customers who are arriving by car and underestimate those customers who are walking or using a bicycle to get to the store.[16] Overall, the impacts of closures of on-street parking on individual businesses are likely to be small to moderate.

Indirect

The same indirect impacts are expected under this alternative as under the Retrofit Alternative.

7.3 Post-Earthquake Impacts

7.3.1 No-Build

Portland's aging downtown bridges, including the Burnside Bridge, are not expected to withstand a major earthquake.[17] The existing Burnside Bridge would be seriously damaged. Traffic would not be able to cross it resulting in economic disruptions in the local and regional economies. In particular, broken local bridge connections would cause disruptions in the movement of people and goods, disruptions in the operations of businesses that rely on input deliveries or employees coming from/to the other side of the Willamette River, and disruptions in getting relief efforts and emergency supplies. Some businesses may be forced to suspend operations suffering losses in revenues and income. Some people may be stranded, separated from their family members and homes, or unable to get to work. They could suffer inconvenience and costs of alternative accommodation and possibly a loss of employment income.

Because the bridge structure debris is expected to fall on roadways, rail tracks, and into the river below the bridge, road traffic, rail traffic, and navigation on the Willamette River will also be disrupted. This will cause further disruptions and delays in the movement of people and goods, even if these movements do not cross the Burnside Bridge. As the infrastructure below the bridge includes interstate highways, major arterials, and UPRR

[16] As an example, see discussion in "Good for Business. The benefits of making streets more walking and cycling friendly. Discussion paper, The Heart Foundation, November 22, 2011.

[17] https://multco.us/earthquake-ready-burnside-bridge/about-project (accessed November 2019).

rail tracks, these disruptions could affect not only Portland but also a broader regional economy.

These disruptions could last for days and possibly for several months until the debris is cleared and replacement links established. The cleaning operations can be expected to involve a substantial monetary cost, possibly diverting funds and resources from other ongoing or planned projects.

The collapse of the bridge itself and debris falling on roadways below can also be expected to cause multiple fatalities and serious injuries to people who are on and around the bridge during the earthquake event.

7.3.2 Enhanced Retrofit

Direct

Bridge Seismic Resiliency

An earthquake resilient Burnside Bridge will improve the resiliency of Portland's transportation network by providing a crossing over the Willamette River that is expected to stand and be usable after a major earthquake. This will help avoid or reduce bridge damage and restoration costs, avoid or reduce fatalities and injuries to people who were on or around the bridge during the earthquake event, reduce transportation disruptions and their costs, and speed up the recovery process for the entire region.

The overall monetary value of these effects could be substantial. Benefit-cost studies of seismic retrofitting of urban bridges show that these projects can be highly cost-effective with benefits exceeding costs when both infrastructure restoration costs and socioeconomic disruption costs avoided are considered.[18]

Indirect

The API may experience increased traffic and congestion over a period of time until other bridges and road infrastructure are repaired. Travel times for local residents and businesses would increase, leading to increased delays and travel costs compared to the situation before an earthquake.

7.3.3 Replacement, Short-span

Direct

The same post-earthquake impacts are expected as under the Retrofit Alternative.

[18] As an example see: Caltrans, Division of Research and Innovation "Socio-Economic Effect of Seismic Retrofit Implemented on Bridges in the Los Angeles Highway Network", Report CA06-0145, December 2008. Assuming low to moderate residual link capacity, the benefit-cost ratio was estimated to be greater than one (showing benefits greater than $1 for each $1 of costs) when both restoration costs avoided and disruption costs avoided were taken into account. The benefit-cost analysis of seismic resilience of the Burnside Bridge is not included in the scope of this environmental assessment.

Indirect

The same post-earthquake impacts are expected as under the Retrofit Alternative.

7.3.4 Replacement, Long-span

Direct

The same post-earthquake impacts are expected as under the Retrofit Alternative.

Indirect

The same post-earthquake impacts are expected as under the Retrofit Alternative.

7.3.5 Replacement with Couch Extension

Direct

The same post-earthquake impacts are expected as under the Retrofit Alternative.

Indirect

The same post-earthquake impacts are expected as under the Retrofit Alternative.

7.4 Construction Impacts

7.4.1 Without Temporary Bridge

Enhanced Retrofit

Traffic Disruptions and Delays to Bridge Traffic

As stated in Section 6.2, traffic disruption impacts were calculated for all modes currently using the Burnside Bridge – autos and trucks, bus transit, bicyclists, and pedestrians – as well as auto and truck traffic on detour routes where the bridge traffic can be expected to divert (the latter element only for AM Peak westbound and PM Peak eastbound traffic flows). As outlined in the *EQRB Description of Alternatives Report* (Multnomah County 2021d), under the Enhanced Seismic Retrofit scenario without the Temporary Bridge, the Burnside Bridge crossing would be closed for a period of 3.5 years during which all modes would have to use a detour route.

The analysis of outputs from the transportation modeling revealed that incremental travel times to bridge traffic diverting to alternate routes will amount to an average of about 9.1 minutes per trip for westbound AM Peak hour and 7.8 minutes per trip for eastbound PM Peak hour, compared to No-Build. For existing traffic on alternate routes, incremental travel times were calculated at 5.8 minutes per trip for westbound AM Peak hour and 6.6 minutes for eastbound PM Peak hour. It should be noted that the traffic analysis estimated travel times for specific origins and destinations rather than for all traffic, and only for peak period travel. The total delay was not estimated with the traffic model but was instead approximated with a variety of assumptions (Appendix A) and should, therefore, be considered to be a general approximation of delay rather than an actual

estimate. For non-directional peak traffic (i.e., traffic taking place during peak hours, but not in the same directions as the main traffic flows) and off-peak traffic the average delay was calculated at 2.4 minutes per trip. Transit buses are estimated to incur additional travel time of about 4.8 minutes per trip during peak hours and 2.8 minutes during off-peak hours. Pedestrians would incur an additional time of 16 minutes and bicycle users 7.5 minutes per trip. Appendix A provides more details regarding calculations of the above delays per trip. Table 22 provides a summary of the results reported above.

Table 22. Travel Delays due to Closure of Burnside Bridge and Traffic Detours, by Mode

Mode	Travel Delay Compared to No-Build (Minutes per Trip)
Autos and Trucks	
WB AM Peak Hour	9.1
EB PM Peak Hour	7.8
Off-Peak and Non-Directional Peak over Burnside Bridge or Displaced	2.4
Traffic on Alternate Paths	
WB AM Peak Hour	5.8
EB PM Peak Hour	6.6
Transit over Bridge	
Peak	4.8
Off-Peak	2.8
Active Transportation	
Bike	7.5
Pedestrians	16

Source: HDR analysis.

Disruptions and Delays to Other Transportation in the API

In addition to detours of traffic normally crossing the Burnside Bridge, there will be disruptions to the traffic around the bridge resulting from the need to accommodate the construction process (activities such as demolition of the old and construction of the new bridge deck), or storage and operation of construction equipment. Based on the *EQRB Description of Alternatives Report* (Multnomah County 2021d), the key anticipated impacts are outlined below.

- Temporary closures of I-5 and I-84. Lane closures are anticipated for limited weekend evening hours, up to 10 times over the construction period. Motorists using these facilities during these times will have to find alternate routes during these times and experience an increase in travel times and travel costs. Given that closures are planned for weekend evening hours when traffic volumes are much smaller than during weekday day time hours, these impacts can be expected to be relatively small.

- Impacts on the UPRR tracks. Temporary access over and adjacent to the railroad tracks will be required over the construction period. This may cause delays/ increase in travel times in the passenger and freight rail traffic.
- Restrictions on TriMet's MAX operations on 1st Avenue around the Skidmore Fountain. The station in this location will have to be closed for a period of up to about 16 weeks. A "bus bridge" to shuttle the passengers around the station will have to be put in place to mitigate the situation. Passengers will likely experience longer travel times during these periods, and the transit operator will incur additional operating costs during the closures.
- Vera Katz Eastside Esplanade closure. The section crossing under the fixed trusses of the bridge will have to be closed for a period of about 26 months. Users of the facility will experience a loss of enjoyment and recreational benefits during the closure time, as well as a loss of a transportation option. The Vera Katz Eastside Esplanade completes a loop route for bikers and walkers (recreational users and commuters) between the Steel Bridge and the Hawthorne Bridge.
- Restriction on city streets around the bridge. City streets will routinely be occupied by large equipment, and will have to be closed for certain activities. This may require additional traffic detours and impede access for pedestrians, increasing their travel/walk time.
- Closures and restrictions on the navigation channel. The number of closures is estimated between two and ten, depending on the type of movable span structure (with bascule options requiring more closures and restrictions than the lift bridge options). Each closure could be up to three weeks in duration. As outlined in the *EQRB Preliminary Navigational Study* (Multnomah County 2021h), there may be thousands of river users transiting under the Burnside Bridge and thus potentially affected by closures to navigation. Nearly two-thirds of the users are commercial users and include tug and barge (at 35 percent of total traffic), cruise lines (at 26 percent), and other commercial operators. The second-largest group at 28 percent is recreational users, and the remainder is government users (infrastructure, regulatory, and emergency response users). Commercial cargo shipments reached a flat level of about 1 million tons annually between 2011 and 2016. Out of this tonnage, 99 percent is classified as sand and gravel, and the remaining 1 percent is accounted for by fabricated metal products and forestry products. Each of the user groups may be impacted by closures to navigation in different ways. Freight shipments may have to be diverted to trucks which are likely to be more expensive, in particular for heavy commodities such as sand and gravel. This may substantially increase operating costs to shippers. Impacts on the cruise lines will depend on their ability to redesign the itinerary to other docks/ports of call or adjust schedules with Portland destinations to avoid the closure times. Overall, such adjustments seem possible and within a range of route modifications that operators can be expected to implement from time to time. Therefore, the economic impact on cruise lines is likely to be rather small. Impacts on recreational users will depend on the season of closures (summer, early spring, or fall), their frequency of travel, and the ability to reschedule the trips. Some loss of recreational benefits to those users may occur.

Right-of-Way Impacts, Displacements, and Disruptions in Access to Businesses, Services, and Social Amenities

In order to construct the Project, the constructor's crews will need access alongside the bridge footprint. As stated in the *EQRB Construction Approach Technical Report* (Multnomah County 2021b), a 30-40 feet work area on each side of the bridge may be needed to set up the equipment or receive and store the materials. This may cause a range of disruptions during the construction period, as discussed below.

IMPACTS ON BUSINESSES

Temporary construction-related business impacts include relocations or closures of PSM, PRM, and parking (parking lots under the bridge and on-street parking).

PSM will have to be relocated from its current location for a period corresponding to the length of construction. It may be challenging to find a suitable alternate location. The current location has the advantages of being in a downtown tourist area, providing some protection against weather (part located under the bridge), and having access to electricity and plumbing. PSM has over 300 fee-paying members, and generates gross sales of over $8 million annually.[19] Closure of PSM would mean a loss of income for the participating vendors, loss of revenue to Portland Parks and Recreation, and temporary loss of a city "landmark" and a tourist attraction.

The PRM entrances will be blocked for two to three months and may require a temporary closure of the mission during this period. This would affect sensitive populations who rely on PRM as a resource. See the *EQRB Acquisitions and Displacements Technical Report* (Multnomah County 2021a) for further details.

Parking lots under the bridge on both sides of the river will have to be closed during construction. In addition, on the east side, closures will be required for on-street parking along 2nd Avenue and 3rd Avenue north and south of Burnside Street. Loss of parking will cause inconvenience to motorists (as they would have to find an alternative parking location) as well as a loss of revenue to parking operators.

IMPACTS ON ACCESS TO SERVICES, RESIDENCES

Construction is expected to obstruct access/entry points to several buildings in the vicinity of the bridge footprint for a period ranging from a few weeks to a few years. Affected properties include Portland Rescue Mission (PRM) building from 1st Street, Mercy Corps building, and the White Stag building. *EQRB Acquisitions and Displacements Technical Report* (Multnomah County 2021a) and *EQRB Right-of-Way Technical Report* (Multnomah County 2021j) provide a detailed list of properties that would be affected. The closures are expected to cause inconvenience and confusion to people residing in the affected buildings or visiting the area. Access to PRM is of particular concern; PRM indicated that an accessible pedestrian connectivity is vital for their clients.

[19] Portland Saturday Market website, https://www.portlandsaturdaymarket.com/about/history/ (accessed December 2019).

Some parks, attractions, or events located/taking place near or under the bridge will have to be closed for the duration of the construction. Key impacts are discussed below.

- On the east side of the bridge, the Vera Katz Eastside Esplanade would have to be closed for about 26 months. As stated earlier, users of this facility would experience a loss of enjoyment, recreational benefits, and a transportation option during the closure. In addition, this closure would reduce opportunities for organization of public events. Currently, the Vera Katz Eastside Esplanade is used by over 20 organized running and walking events, including fundraising events. While the Vera Katz Eastside Esplanade is closed, the groups organizing the events would have to use the designated detour route, find another location, or not hold their events, which would result in a loss of revenue for the groups. In addition, this would also result in a loss of fee revenue to the Portland Parks and Recreation department which relies on fee revenue to support operations.
- On the west side of the bridge, the areas of Tom McCall Waterfront Park under the bridge, to the south of the bridge, and to the north of the bridge to the Japanese American Historical Plaza would be closed to the general public for 3.5 years and used as construction staging areas. The greenspace would be cleared and covered with gravel to accommodate construction vehicle access and storage of materials. This closure will create an obstacle in the continuous flow of the Tom McCall Waterfront Park and trails on the west bank of the Willamette River, although a slight trail detour would still allow access around the construction area within Tom McCall Waterfront Park. Users who access Tom McCall Waterfront Park from areas around the Burnside Bridge will have to use alternate access points and recreation areas. Construction noise extending from the construction site may also make use of these areas less enjoyable than usual. This is likely to cause some reduction in the number of users and visitors and thus a loss of recreational benefits, or reduction in recreational and enjoyment benefits to remaining users and visitors. The areas may also become less useful for organization of events, which would result in a reduction in fee revenues to Portland Parks as well as revenues to retail and other businesses that benefit from various events organized in downtown Portland. Some events may be cancelled, and there is a risk that it may be difficult to attract organizers and visitors back to these events after construction is completed. A reduction in the event-related expenditures and business activity may have further multiplier effects throughout the region.
- Construction will likely disrupt the Portland Rose Festival, an annual civic festival taking place in May and June involving a number of mainly outdoor events and activities such as parades and pageants, boat races, fairs and shows. The Grand Floral Parade, one of the key events and attractions of the Festival, has been using a route over the Burnside Bridge since the 1960s. The organizers of the Parade would have to assess the available options such as a route over the Broadway Bridge that was used until the 1960s. Another major event that could be affected is Fleet Week when U.S. Navy, U.S. Coast Guard, and Canadian Coast Guard ships moor on the west bank between the Steel Bridge and Tilikum Crossing. During Fleet Week, the general public gets the rare opportunity to visit and tour U.S. Navy ships and meet

the sailors.[20] Construction activities could make docking and access to vessels difficult or impossible. Each year over 400,000 people attend the Grand Floral Parade, and the Festival is estimated to generate $65 million in business revenues across the Portland-Metro region.[21] If the Festival appears to be less attractive, attendance would decrease. At the same time, visitor expenditures during the Festival and thus its economic impact on the regional economy would all decrease as well.

Increased Noise Impacts

Studies show that noise pollution has a downward impact on real estate prices as people in general prefer living in neighborhoods free of loud or intrusive noises. The literature reports a price discount of about 0.2 percent to 0.6 percent for each 1 dBA increase in noise above 55 dBA.[22] It is uncertain, however, to what extent the effect would apply to the study area and the case of EQRB construction as the noise source – the construction activity – is expected to disappear after a few years. The impacts may be stronger during times of a "buyer's market" and perhaps not as pronounced during times of a "seller's market."

In addition, increased noise may have an impact on health and wellbeing of the populations exposed to it. These impacts are addressed in more detail in a separate Health Impact Assessment.

Business and Employment Opportunities

Construction costs under the Retrofit Alternative without Temporary Bridge net of ROW were estimated at $585.2 million in 2017 dollars. As stated in Section 6.2, for the purpose of this analysis it was assumed that 75 percent of project expenditures would be spent in Multnomah County and 90 percent within the state of Oregon. This implies an expenditure of about $439 million in Multnomah County and $527 million across Oregon (including Multnomah County).

Table 23 presents the results for the impacts in Multnomah County while Table 24 presents the results for the impacts across all of Oregon over the construction period of the bridge (estimated at about 3.5 years).

[20] http://www.rosefestival.org/event/fleet-week

[21] Portland Rose Festival 2018 Annual Report.

[22] A recent example of studies on the impact of noise includes: Esra Ozdenerol, Ying Huang, Farid Javadnejad, and Anzhelika Antipova, "The Impact .of Traffic Noise on Housing Values", *Journal of Real Estate Practice and Education*, July 2015, pp. 35-53. The study examined empirically the impact of traffic noise on property prices in Shelby County, Tennessee, and found that properties located in areas with a noise level in excess of 55 dB(A) had an average price discount of 4.3 percent. This was in addition to a price discount experienced by neighborhoods known to have a high level of traffic congestion and noise.

Table 23. Economic Impact of Construction, Enhanced Retrofit without Temporary Bridge, Multnomah County, Total Over Construction Period

Type of Effect	Business Revenue ($M)	Employment Income ($M)	Employment (Job-Years)	Value Added ($M)
Direct	$439	$48	782	$230
Indirect	$165	$25	448	$86
Induced	$72	$13	349	$44
Total	**$676**	**$86**	**1,580**	**$359**

Note: Monetary values are in 2017 dollars Source: HDR Analysis

Table 24. Economic Impact of Construction, Enhanced Retrofit without Temporary Bridge, Oregon, Total Over Construction Period

Type of Effect	Business Revenue ($M)	Employment Income ($M)	Employment (Job-Years)	Value Added ($M)
Direct	$527	$72	1,170	$276
Indirect	$260	$66	1,219	$129
Induced	$225	$67	1,742	$133
Total	**$1,012**	**$206**	**4,130**	**$538**

Note: Monetary values are in 2017 dollars Source: HDR Analysis

Table 23 shows that over the construction period the Project is expected to generate in Multnomah County a total of 1,580 job-years (equivalent to 1,580 jobs for one year), $86 million in employment income, $676 million in business revenue, and $359 million in value added. This translates to an annual average of 451 jobs (including 223 jobs directly related to the construction of the new bridge), $25 million in employment income, $193 million in business revenue, and $103 million in value added.

Economic impacts extend beyond Multnomah County to the entire state as some supplies and services would be produced outside of Multnomah County. As Table 24 shows, the Project is expected to generate in all of Oregon a total of 4,130 job-years (equivalent to 4,130 jobs for one year), $206 million in employment income, $1,012 million in business revenue, and $538 million in value added. This translates to an annual average of 1,180 jobs, $59 million in employment income, $289 million in business revenue, and $154 million in value added.

Impacts specific to the economy and residents of Census Tracts 21, 51, and 106 are more difficult to determine at this time before a detailed procurement plan is developed and supplies of goods and services are contracted out. Local residents who are construction workers may get jobs related to the Project construction itself, or see overall improvement in employment prospects in the industry as the level of business activity increases. Workers from other industries that provide construction support goods and

services may be hired by a business that obtains a supply contract related to the EQRB Project contractor.

Businesses from service industries such as food services and personal services located in the Project vicinity may benefit from increased traffic related to the construction itself, such as traffic from construction workers and personnel coming for lunches and other services.

Replacement, Short-span

Traffic Disruptions and Delays to Bridge Traffic

Under this Build Alternative, travel delays per trip to all traveler groups affected by the closure of the Burnside Bridge crossing would be the same as under the Retrofit Alternative (Table 22). However, the construction under this option and the closure of the Burnside Bridge crossing are estimated to take longer: about 4.5 years as opposed to 3.5 years under the Retrofit Alternative. Therefore all traffic delays and disruptions due to bridge detours would last two years longer than under the Retrofit Alternative.

Right-of-Way, Displacements, and Other Disruptions and Delays

Most other construction-related disruptions to transportation and services are anticipated to be similar as for the Retrofit Alternative. Differences include longer closures of the Vera Katz Eastside Esplanade (30 months), Tom McCall Waterfront Park (4.5 years), and PSM (4.5 years). However, disruptions to PRM would largely be avoided.

Business and Employment Opportunities

Construction costs for the Short-span Alternative are higher than for the Retrofit Alternative. This will result in higher economic impacts. Specifically, the adjusted cost of the Short-span Alternative with Bascule Option and No Temporary Bridge is estimated at $645.6 million (in 2017 dollars net of ROW costs). As for the Retrofit Alternative, it was assumed that 75 percent of project expenditures would be spent in Multnomah County and 90 percent in all of Oregon. Table 25 and Table 26 show the results of the analysis.

Table 25. Economic Impact of Construction, Short-span Alternative without Temporary Bridge (Bascule Option), Multnomah County, Total Over Construction Period

Type of Effect	Business Revenue ($M)	Employment Income ($M)	Employment (Job-Years)	Value Added ($M)
Direct	$484	$53	863	$253
Indirect	$182	$27	494	$94
Induced	$79	$14	386	$48
Total	**$746**	**$95**	**1,743**	**$396**

Note: Monetary values are in 2017 dollars Source: HDR Analysis

Table 26. Economic Impact of Construction, Short-span Alternative without Temporary Bridge, Oregon, Total Over Construction Period

Type of Effect	Business Revenue ($M)	Employment Income ($M)	Employment (Job-Years)	Value Added ($M)
Direct	$581	$79	1,290	$304
Indirect	$287	$73	1,344	$142
Induced	$248	$74	1,921	$147
Total	**$1,116**	**$227**	**4,556**	**$593**

Note: Monetary values are in 2017 dollars Source: HDR Analysis

Table 25 shows that over the construction period the Project is expected to generate in Multnomah County a total of 1,743 job-years, $95 million in employment income, $746 million in business revenue, and $396 million in value added. This translates to an annual average of 498 jobs, $27 million in employment income, $213 million in business revenue, and $113 million in value added.

For all of Oregon, Table 26 shows that over the construction period the Project is expected to generate in the State a total of 4,556 job-years, $227 million in employment income, $1,116 million in business revenue, and $593 million in value added. This translates to an annual average of 1,012 jobs, $50 million in employment income, $248 million in business revenue, and $132 million in value added.

Replacement, Long-span

Most impacts and disruptions are expected to be the same or similar as for the Short-span Alternative. The key difference is that it may be possible to mitigate some of the impacts due to a slightly different construction approach, smaller number of piers, avoidance of certain types of ground improvement works, and possibility to perform work with traffic flowing. As a result, the Vera Katz Eastbank Esplanade would be closed for a period of up to 18 months (as opposed up to 30 months under the Short-span Alternative).

Business and employment opportunities impacts would also be almost the same as for the Short-span Alternative given that the two alternatives have similar construction cost.

Replacement with Couch Extension

Right-of-Way Impacts

The Replacement with Couch Extension Alternative would have the same construction-related disruptions as the Short-span Alternative. In addition, Replacement with Couch Extension will also affect access points to buildings located on 3rd Avenue between Burnside Street and Davis Street, and on Martin Luther King Jr. Boulevard between Couch Street and Davis Street, causing additional inconvenience and longer walk times to pedestrians.

Business and Employment Opportunities

Construction costs for the Replacement with Couch Extension Alternative are higher than the other alternatives. This will result in higher economic impacts. Specifically, the adjusted cost of the Replacement with Couch Extension without Temporary Bridge is estimated at $667.6 million (moveable bridge with bascules, in 2017 dollars). 75 percent of project expenditures are assumed to be spent in Multnomah County and 90 percent in all of Oregon. Table 27 and Table 28 show the results of the analysis.

Table 27. Economic Impact of Construction, Replacement with Couch Extension without Temporary Bridge, Multnomah County, Total Over Construction Period

Type of Effect	Business Revenue ($M)	Employment Income ($M)	Employment (Job-Years)	Value Added ($M)
Direct	$501	$55	892	$262
Indirect	$188	$28	511	$98
Induced	$82	$15	399	$50
Total	**$771**	**$98**	**1,802**	**$409**

Note: Monetary values are in 2017 dollars Source: HDR Analysis

Table 28. Economic Impact of Construction, Replacement with Couch Extension without Temporary Bridge, Oregon, Total Over Construction Period

Type of Effect	Output ($M)	Earnings ($M)	Employment (Job-Years)	Value Added ($M)
Direct	$601	$82	1,334	$315
Indirect	$297	$76	1,390	$147
Induced	$256	$77	1,987	$152
Total	**$1,154**	**$234**	**4,711**	**$614**

Note: Monetary values are in 2017 dollars Source: HDR Analysis

Table 27 shows that over the construction period the Project is expected to generate in Multnomah County a total of 1,802 job-years, $98 million in employment income, $771 million in business revenue, and $409 million in value added. This translates to an annual average of 400 jobs, $21.8 million in employment income, $171.4 million in business revenue, and $91 million in value added.

For all of Oregon, Table 28 shows that over the construction period the Project is expected to generate in the State a total of 4,711 job-years, $234 million in employment income, $1,154 million in business revenue, and $614 million in value added. This translates to an annual average of 1,047 jobs, $52 million in employment income, $256 million in business revenue, and $136 million in value added.

7.4.2 With Temporary Bridge

The key differences between options with and without a temporary bridge are:

1. Less delay for traffic that will be able to use the Temporary Bridge during construction of the permanent bridge (and after the Temporary Bridge is completed). There would still be vehicle detours and delays because the Temporary Bridge would have only two traffic lanes compared to the existing bridge, which has five lanes including a transit only lane
2. Additional disruptions related to the construction and then demolition of the Temporary Bridge
3. Additional ROW impacts on certain properties and additional relocations due to an increased bridge footprint
4. Longer overall construction period and thus a longer period of certain construction-related disruptions such as detours and delays to traffic unable to use the Temporary Bridge, or construction noise
5. Higher total project construction costs and corresponding larger business and employment opportunities impacts
6. Higher impacts to parks, natural resources, endangered species, recreation facilities and historic resources from Temporary Bridge construction

The details for items 1-5 above are outlined below. Impacts listed in item 6 are described in other reports, including *EQRB Parks and Recreation Technical Report* (Multnomah County 2021g); *EQRB Cultural Resources Technical Report* (Multnomah County 2021c); *EQRB Vegetation, Wildlife, and Aquatic Species Technical Report* (Multnomah County 2021m); and *EQRB Social / Neighborhood Technical Report* (Multnomah County 2021k).

Enhanced Retrofit with Temporary Bridge

Traffic Disruptions and Delays to Bridge Traffic

With the Temporary Bridge option, river crossing in the Burnside Street corridor would be closed for only one week. However, after opening of the Temporary Bridge motorized modes using it would still incur delays, although smaller than under No Temporary Bridge options. In particular, autos traveling on the bridge in the westbound AM Peak direction would incur a delay of about 5.5 minutes per trip, and auto traveling in the eastbound direction in the PM peak would incur a delay of 2.5 minutes per trip. Some auto trips would still be displaced to alternate routes where they still would be delayed (by about 5 to 6.5 minutes per trip) and cause travel delays to the existing traffic (of about 3 to 4 minutes per trip). Variants of the Temporary Bridge Option could allow only transit and active modes, or only active modes, to use the bridge. For modes which would not be allowed on the bridge, the length of the disruptions and delays would be the same as under the options without the Temporary Bridge. The delays, compared to No-Build, for each mode assumed based on the transportation modeling are shown in Table 29. (The negative sign for transit bus under one of the Temporary Bridge Options indicates that there will be travel time savings to bus riders under this option due to less traffic on the bridge). For comparison, the table also shows delays expected under options with No Temporary Bridge.

Table 29. Travel Delays by Mode and Temporary Bridge Option, Minutes per Trip Compared to No-Build

Mode	Temporary Bridge Options			No Temporary Bridge
	All Modes on Temporary Bridge	Transit and Active Transportation	Active Transportation Only	
Autos and Trucks				
On the Bridge				
WB AM Peak Hour	5.5	NA	NA	NA
EB PM Peak Hour	2.5	NA	NA	NA
Diverted				
WB AM Peak Hour	6.5	9.1	9.1	9.1
EB PM Peak Hour	5.0	7.8	7.8	7.8
Off-Peak and Non-Directional Peak over Burnside Bridge or Displaced	2.4	2.4	2.4	2.4
Traffic on Alt Paths				
WB AM Peak Hour	3.1	5.8	5.8	5.8
EB PM Peak Hour	3.9	6.6	6.6	6.6
Transit over Bridge				
Peak	1.1	-0.7	4.8	4.8
Off-Peak	0.0	-0.7	2.8	2.8
Active Transportation				
Bike	0	0	0	7.5
Pedestrians	0	0	0	16

Source: HDR transportation modeling.
Note: eastbound (EB), westbound (WB)

Disruptions and Delays to other Transportation in the API

The Temporary Bridge Options will increase some of the other construction-related disruptions due to additional work elements needed to construct the Temporary Bridge. These are outlined below.

- Additional closures to traffic on I-5, I-84, and UPRR rail tracks.
- Restrictions on TriMet's MAX operations on 1st Avenue around the Skidmore Fountain: there would be up to two, 8-week closures for a total of up to 16 weeks (compared to about 8 weeks without the Temporary Bridge).
- Vera Katz Eastside Esplanade closure: there would be a closure for a period of 2.5 years compared to 2 years, 2 months for the option without the Temporary Bridge. Closure time would increase by about 4 months.

- Restrictions on city streets around the bridge: impacts on city streets would be approximately double of those without the Temporary Bridge.
- Closures on the Willamette River navigation channel: Temporary Bridge will require up to two additional closures of 2 weeks each.
- PSM: longer closure will likely be required for the options with Temporary Bridge.

Right-of-Way Impacts, Displacements, and Disruptions in Access to Businesses, Services, and Social Amenities

The Temporary Bridge will partially mitigate disruptions in access to services and amenities located on either side of the Burnside Bridge, especially services/amenities in locations users typically access by foot, or by transit. In particular, this includes the PRM, Salvation Army, or the Mercy Corps.

The Temporary Bridge could also mitigate the impact on the annual Portland Rose Festival parade. The key feature of the Festival, the Grand Floral Parade with its traditional route over the Burnside Bridge, could potentially be re-routed to the Temporary Bridge with only small impacts to the character of that parade (subject to review of feasibility).

However, the alternatives with a temporary bridge would increase the length of closures to PSM and Tom McCall Waterfront Park, increasing the length and extent of disturbances to these amenities as previously discussed.

Increased Noise

Noise and vibration impacts would last longer due to a longer construction period (5 years as opposed to 3.5 years for the option without the Temporary Bridge). Also, as stated in Section 7.4.1, installation of the Temporary Bridge itself is expected to cause a substantial amount of noise rated as the highest level of all phases.

Business and Employment Opportunities

Construction costs for all alternatives with a temporary bridge are higher than the same alternative without a temporary bridge. Specifically, the adjusted cost of the Retrofit Alternative with Temporary Bridge (allowing all modes) is estimated at $663.5 million (in 2017 dollars net of ROW costs). As for the other alternatives, 75 percent of project expenditures were assumed to be spent in Multnomah County and 90 percent in all of Oregon. Table 30 and Table 31 show the results of the analysis.[23]

[23] The results presented here are for the Temporary Bridge Option that allows all modes. Temporary Bridge Options that allow only active transportation or only transit with active transportation have somewhat lower costs. The resulting business and employment impacts will be smaller but of similar magnitude.

Table 30. Economic Impact of Construction, Enhanced Retrofit with Temporary Bridge, Multnomah County, Total Over Construction Period

Type of Effect	Business Revenue ($M)	Employment Income ($M)	Employment (Job-Years)	Value Added ($M)
Direct	$498	$55	887	$260
Indirect	$187	$28	508	$97
Induced	$82	$15	396	$49
Total	**$766**	**$97**	**1,791**	**$407**

Note: Monetary values are in 2017 dollars Source: HDR Analysis

Table 31. Economic Impact of Construction, Enhanced Retrofit with Temporary Bridge, Oregon, Total Over Construction Period

Type of Effect	Business Revenue ($M)	Employment Income ($M)	Employment (Job-Years)	Value Added ($M)
Direct	$597	$82	1,326	$313
Indirect	$295	$75	1,382	$146
Induced	$255	$76	1,974	$151
Total	**$1,147**	**$233**	**4,682**	**$610**

Note: Monetary values are in 2017 dollars Source: HDR Analysis

Table 30 shows that over the construction period the Project is expected to generate in Multnomah County a total of 1,791 job-years, $97 million in employment income, $766 million in business revenue, and $407 million in value added. This translates to an annual average of 358 jobs, $19.5 million in employment income, $153.3 million in business revenue, and $81.4 million in value added.

For all of Oregon, Table 31 shows that over the construction period the Project is expected to generate in the State a total of 4,682 job-years, $233 million in employment income, $1,147 million in business revenue, and $610 million in value added. This translates to an annual average of 936 jobs, $47 million in employment income, $229 million in business revenue, and $122 million in value added.

Replacement, Short-span with Temporary Bridge

Most of the impacts are expected to be the same as for the Retrofit Alternative with Temporary Bridge. The main differences are with regards to temporary traffic disruptions, Project costs and resulting business and employment opportunities. These are outlined below. In addition, temporary closures of the MAX station on 1st Avenue would be 2 weeks shorter than with the Retrofit Alternative (although still 2 weeks longer than without a Temporary Bridge).

Traffic Disruptions and Delays to Bridge Traffic

Under the Short-span Alternative with Temporary Bridge, travel delays per trip to all traveler groups displaced by the closure of the Burnside Bridge crossing will be the same as under the Retrofit Alternative with a Temporary Bridge. However, the construction period for this option takes longer and traffic that is not able to use the bridge will be affected for a longer period of time (4 years as opposed to 2 years under the Retrofit Alternative).

Business and Employment Opportunities

Construction costs for all alternatives with a temporary bridge are higher than the same alternative without the Temporary Bridge. Specifically, the adjusted cost of the Retrofit Alternative (bascule option) with Temporary Bridge (allowing all modes) is estimated at $714.4 million (in 2017 dollars). As for the other alternatives, it was assumed that 75 percent of project expenditures would be spent in Multnomah County and 90 percent in Oregon. Table 32 and Table 33 show the results of the analysis.

Table 32. Economic Impact of Construction, Short-span Alternative with Temporary Bridge, Multnomah County, Total Over Construction Period

Type of Effect	Business Revenue ($M)	Employment Income ($M)	Employment (Job-Years)	Value Added ($M)
Direct	$536	$59	955	$280
Indirect	$202	$30	547	$104
Induced	$88	$16	427	$53
Total	**$825**	**$105**	**1,928**	**$438**

Note: Monetary values are in 2017 dollars Source: HDR Analysis

Table 33. Economic Impact of Construction, Short-span Alternative with Temporary Bridge, Oregon, Total Over Construction Period

Type of Effect	Business Revenue ($M)	Employment Income ($M)	Employment (Job-Years)	Value Added ($M)
Direct	$643	$88	1,428	$337
Indirect	$318	$81	1,488	$158
Induced	$274	$82	2,126	$163
Total	**$1,235**	**$251**	**5,041**	**$657**

Note: Monetary values are in 2017 dollars Source: HDR Analysis

Table 32 shows that over the construction period the Project is expected to generate in Multnomah County a total of 1,928 job-years, $105 million in employment income, $825 million in business revenue, and $438 million in value added. This translates to an annual average of 297 jobs, $16 million in employment income, $127 million in business revenue, and $67 million in value added.

For all of Oregon, Table 33 shows that over the construction period the Project is expected to generate a total of 5,041 job-years, $251 million in employment income, $1,235 million in business revenue, and $657 million in value added. This translates to an annual average of 776 jobs, $39 million in employment income, $190 million in business revenue, and $101 million in value added.

Replacement, Long-span with Temporary Bridge

The temporary construction impacts for the Long-span Alternative with Temporary Bridge would be similar to the impacts for the Short-span Alternative with Temporary Bridge. As for the alternatives without a temporary bridge, the duration of closures to the Vera Katz Eastside Esplanade will be shorter than under the other alternatives (including Short-span Alternative with Temporary Bridge and the Retrofit Alternative with Temporary Bridge).

Construction costs for the Long-span Alternative are of a similar magnitude which is expected to result in a similar magnitude of business and employment impacts.

Replacement with Couch Extension with Temporary Bridge

Most impacts are expected to be the same or similar to the Short-span Alternative with Temporary Bridge.

Because construction costs of the Replacement with Couch Extension and Temporary Bridge are somewhat higher than for the Short-span Alternative – estimated at $735 million – the corresponding business and employment opportunity costs are somewhat higher as well. These documented in Table 34 and Table 35.

Table 34. Economic Impact of Construction, Replacement with Couch Extension and Temporary Bridge, Multnomah County, Total Over Construction Period

Type of Effect	Business Revenue ($M)	Employment Income ($M)	Employment (Job-Years)	Value Added ($M)
Direct	$551	$60	982	$289
Indirect	$207	$31	563	$108
Induced	$90	$16	439	$55
Total	**$849**	**$108**	**1,984**	**$451**

Note: Monetary values are in 2017 dollars Source: HDR Analysis

Table 35. Economic Impact of Construction, Replacement with Couch Extension and Temporary Bridge, Oregon, Total Over Construction Period

Type of Effect	Business Revenue ($M)	Employment Income ($M)	Employment (Job-Years)	Value Added, $M
Direct	$662	$90	1,469	$346
Indirect	$327	$83	1,531	$162
Induced	$282	$84	2,187	$168
Total	**$1,271**	**$258**	**5,187**	**$676**

Note: Monetary values are in 2017 dollars Source: HDR Analysis

7.4.3 Potential Off-site Staging Areas

The construction contractor may use one or more off-site staging areas, outside the bridge study area to store and and/or assemble materials that would then be transported by barge to the construction site. Off-site staging could occur with any of the alternatives. Whether, where and how to use such sites would be the choice of the contractor and therefore the actual site or sites cannot be known at this time. Given this uncertainty, detailed analysis of impacts is not possible at this time. To address this uncertainty, four possible sites have been identified that represent a much broader range of potential sites where off-site staging might occur. While the contractor could choose to use one of these or any other site, it is assumed that because of regulatory and time constraints on the contractor, any site they choose would need to be already developed with road and river access. It is also assumed that the contractor would be responsible for relevant permitting and/or mitigation that could be required for use of a chosen site. The Draft EIS identifies the types of impacts that could occur from off-site staging, based on the above assumptions. This analysis is not intended to "clear" any specific site, but rather to ensure disclosure of the general types of impacts based on the possible sites.

The four representative sites include:

A Willamette Staging Option off Front Avenue
B USACE Portland Terminal 2
C Willamette Staging Option off Interstate Avenue
D Ross Island Sand and Gravel Site

If a contractor chooses to use an off-site staging area, certain local, state, and federal regulations could apply. Regulations specific to this resource were not identified. Based on the four sample sites identified, the types of impacts that could occur from off-site staging include:

- Increased truck traffic on roads directly leading to the sites resulting in increased congestion on those roads; and
- Increased traffic on the navigation channel with possible closures and restrictions when moving large volumes of materials and equipment.

Both of the above effects could result in delays to other traffic using the respective facility.

7.5 Cumulative Effects

From an economic impacts point of view, past and present projects and actions in the vicinity of the Burnside Bridge to which the EQRB Project could contribute cumulative effects include the following:

- Recent construction of new buildings at the Burnside Bridgehead at the eastside intersection of Burnside and the Willamette River (2014-2018). These include The Yard (formerly Block 67), a 21-story mixed use tower constructed at 123 NE 3rd Avenue; The Fair-Headed Dumbbell, two 6-story office buildings at 11 NE Martin Luther King Jr. Boulevard; Aura Burnside, an apartment building at 77 NE Grand Avenue; and Slate (formerly Block 75), a 10-story mixed use building at 111 NE Martin Luther King Jr. Boulevard.
- The Burnside Bridge Maintenance Project performed over the years 2015 to 2019, included improvements and repairs to the main bridge span, approaches, and other elements.
- Ongoing construction in Block 76 West, a 5-story mixed use building at 218 NE Couch Street and 5 MLK, a 200-ft, mixed-use building at 5 SE Martin Luther King Jr. Boulevard.
- Construction of Vera Katz Eastbank Esplanade and bicycle deck on Steel Bridge expanding area-wide pedestrian and bicycle network (2001).

Reasonably foreseeable future projects and actions in the vicinity of the Burnside Bridge to which the EQRB Project could contribute cumulative effects include:

- I-5 Rose Quarter Improvements
- TriMet and Portland Streetcar service expansions
- Portland Superfund Harbor Site Remediation project
- Other City of Portland transportation projects (involving primarily lane reductions for expanding bike lane network and transit service capacity)

7.5.1 No-Build Alternative

As stated in Section 7.2.1, actions implemented under the No-Build Alternative would involve primarily construction maintenance and repairs for the bridge to be fully operational. These are unlikely to contribute to cumulative impacts with other projects.

7.5.2 Build Alternatives

Long-Term Cumulative Impacts

The project with its upgraded bicycle and pedestrian paths on the bridge (in particular the Replacement Alternatives) and conversion of some parking lanes into bicycle lanes will connect to the existing bike-pedestrian infrastructure and thus contribute to the

expansion of Portland's network of modern bike and pedestrian infrastructure that is more comfortable and safer to users. In the long-term, this may contribute to further growth in use and increased mode shares for bicycle and pedestrian trips.

In general, all Build Alternatives except for the Replacement with Couch Extension have essentially the same footprint as the existing Burnside Bridge and are not forecasted to have a long-term impact on traffic relative to No-Build. As a result, the Project is not expected under these alternatives to contribute cumulative economic effects to other past, current, or future actions.

As discussed in Section 7.4, the Replacement with Couch Extension will require additional ROW, displace an additional established business on the east side of the Burnside Bridge, and change access points to some buildings which could combine with impacts from other unrelated projects in the future.

Short-Term Cumulative Impacts

As the introduction to Section 7.5 suggests, the east side of the Burnside Bridge is undergoing extensive redevelopment with the construction of new residential, office, and mixed-use multi-story buildings. In addition, the area has recently been or may still be subject to impacts of various road improvements and re-construction projects.

To the extent that construction occurs on a concurrent schedule with other projects, traffic disruptions due to detours, street closures, or lane reductions can cascade delays for auto and truck travel across the study area, and the length of time over which disruptions are experienced may increase. This also applies to other construction-related disruptions such as construction noise, disruptions in access to businesses and residences, and ROW impacts.

Combined impacts could come from the I-5 Rose Quarter Improvement Project and short-term closures of one direction of I-5 during the same period as closures of the Burnside Bridge. Vehicles normally using I-5 would divert to some of the same routes as traffic from the Burnside Bridge further increasing traffic congestion and travel times on those routes. To test the implications of this possibility, transportation analysis of travel time disruptions to peak traffic due to closures of the Burnside Bridge crossing also included scenarios with simultaneous closures of I-5. Traffic simulations of those scenarios show that travel times on various alternate paths would increase by another 2 to 7 minutes per trip compared to scenarios with traffic diversion from the Burnside Bridge only (see *EQRB Transportation Technical Report* [Multnomah County 2021l] for detailed results). This would be a substantial, short-term increase in travel delay costs.

7.6 Compliance with Laws, Regulations, and Standards

No compliance issues were identified for economics.

7.7 Conclusions

The concluding observations arising from the analysis of the economic impacts are outlined below.

- Under No-Build, the Burnside Bridge is not expected to survive a major earthquake. The Burnside Bridge would be seriously damaged or collapse altogether, and the bridge debris would fall into the Willamette River, roads, rail tracks, and MAX tracks below. This will likely result in severe disruptions to transportation of people and goods. The next major CSZ earthquake is expected to cause widespread damage to the region's infrastructure and services, as well as extensive casualties. With no usable crossing of the Willamette River in downtown Portland, emergency response, evacuation, and long-term recovery will all be impaired. This scenario is described in the *EQRB Purpose and Need Statement* (Multnomah County 2021i).
- Under the Build scenarios, the Burnside Bridge would serve as a vital post-earthquake connection in the transportation of emergency personnel and supplies, facilitate evacuation, facilitate and speed up the recovery and reconstruction efforts in the entire region, and help minimize long term loss of population, employment, and commerce.
- The long-term, pre-earthquake impacts of the Build Alternatives are relatively moderate. In particular, no residential displacements are anticipated. However, five businesses would be displaced, including the AMR, an ambulance service for the Multnomah, Clackamas, and Clark counties. This can be expected to have moderate business relocation and adjustment costs.
- The Replacement Alternatives would improve safety for automobiles, bike and pedestrian traffic on the bridge and bridge approaches leading to a reduction in crashes (including accidents with fatalities and serious injuries), which reduces the costs associated with crashes. The Retrofit Alternative would improve safety only on the west approach.
- The short-term negative impacts of the Build Alternatives include various construction-related disruptions:
    - Detours, travel delays and travel costs to traffic that normally uses the Burnside Bridge (automobiles, trucks, bikes, and pedestrians) as well as increased congestion on alternate roads where auto traffic would divert if the Burnside crossing is not available
    - Short-term disruptions on other transportation infrastructure in the API including I-5, I-84, UPRR rail tracks, TriMet MAX light rail transit under the Bridge, and navigational channel on the Willamette River
    - Impediments in access to certain buildings, businesses and services in Project vicinity, including the PRM
    - Displacements to three business operations, including the PSM (which would be temporarily relocated)
    - Disruptions in access to social amenities, parks, and events in the vicinity of the Burnside Bridge, including the Portland Rose Festival
    - Noise from construction activities
- Temporary disruptions to other transportation infrastructure in the API (i.e. interstate highways, transit, rail, river navigation) would be short in duration (1 to 3 weeks) a few times over the construction period, which is estimated at 3.5 to 5 years for the

Retrofit Alternative and 4.5 to 6.5 years for the Replacement Alternatives (with longer construction periods for the alternatives with a Temporary Bridge). Other disruptions listed above can be expected to last for most of the construction period.

- A multi-modal Temporary Bridge option can partially mitigate travel delays and travel costs to traffic that normally uses the Burnside Bridge, although it cannot eliminate the delays completely. Traffic which is not allowed on the Temporary Bridge would incur the same delays as under options without the Temporary Bridge.
- The Project would provide a boost to the local, regional, and state economies. Industries that would benefit include the construction industry and various other industries that provide supplies and services to this industry as well as consumer goods to their workers. The location and number of jobs and business revenues will depend on the Build Alternative selected, location of builders and suppliers awarded the contracts. As an approximation, over the construction period the impacts in Multnomah County can be expected to exceed as much as 400 jobs and $170 million in business revenues annually. During the construction period, the Project is expected to cause some disruptions in access and potential economic losses to local businesses. However, overall the former effect will likely be much higher than the latter.

8 Mitigation Measures

8.1 Enhanced Retrofit

Mitigation measures that could reduce the negative economic impacts would aim to (1) reduce the burden, in particular the financial burden, to the affected parties, (2) increase public awareness about the project, construction schedule, and various impacts that may affect various members of the public, and (3) provide information to the general public about alternate ways to access destinations temporarily affected by construction activities. This could include the following:

- Coordination with TriMet on potential to provide “bus bridging” or other supplemental transit services to transport passengers around the Skidmore MAX station when closed for project construction
- Scheduling of work requiring temporary closures of various transportation facilities for periods of low traffic levels (such as at night and during weekends)
- Signage and advanced information about detours and closures to allow travelers to plan their trips in advance and avoid any confusion and additional delays
- Relocation assistance to displaced businesses (*EQRB Right-of-Way Technical Report* [Multnomah County 2021j])
- Assistance in establishing alternate access points to buildings where access will be made more difficult (if feasible)
- Signage and other communications directing customers of affected businesses to alternate access points, informing customers that businesses remain open

- Provision of parking in alternate locations (if feasible)
- Compensation for loss of parking
- Consider construction approach/measures that could reduce the overall extent and duration of construction noise, street closures, park closures, and crossing closure
- As design and construction assumptions advance, identify potential opportunities to reduce property impacts

Also, mitigation measures specific to other resources may benefit economic resources as well. Reduction in the overall extent and duration of construction noise is one such example.

8.2 Replacement, Short-span

Mitigation measures are the same as for the Enhanced Retrofit Alternative.

8.3 Replacement, Long-span

Mitigation measures are the same as for the Enhanced Retrofit Alternative.

8.4 Replacement with Couch Extension

Mitigation measures are the same as for the Enhanced Retrofit Alternative.

8.5 Temporary Bridge Option

Mitigation measures are the same as for the Enhanced Retrofit Alternative.

9 Contacts and Coordination

The work for this resource relied extensively on the modeling outputs and analytical results from the transportation analysis and project cost analysis. In addition, interviews and outreach with project stakeholders conducted in summer 2019 by the study team were used in impact assessment to provide additional context and detail as relevant. No other additional contacts were made.

10 Preparers

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Ewa Tomaszewska	HDR, Inc.	Ph.D. Economics	20
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Appendix A. Methodology of Calculation of Travel Delays per Trip

This appendix provides additional details regarding calculations of travel delay per trip as reported in Table 22 and Table 29.

Autos and Trucks

As stated in Section 6.2, transportation modeling was conducted for a sample of origin-destination pairs that would use the Burnside Bridge on the usual travel route. For each of these pairs, a few alternative travel paths were determined that could be taken instead. Simulations were then conducted for AM Peak hour westbound and PM Peak hour eastbound to estimate travel times for each alternative route and the route with the Burnside Bridge. These simulations were conducted for the existing conditions, Build scenario without the Temporary Bridge, and Build scenarios with the Temporary Bridge. The latter scenario included variations with all traffic allowed on the Temporary Bridge, transit and active transportation only, and active transportation only. It is noted that even with the Temporary Bridge option allowing all modes of transportation, some auto traffic will not be accommodated and will still be diverting to alternate routes. In addition, traffic which will use the Temporary Bridge will still incur some travel delays. The simulation results do not differ with respect to the type of Build construction alternative (i.e. they are the same for the Retrofit Alternative and all Replacement Alternatives).

The transportation simulations provided travel times and traffic volumes for existing conditions and each Build scenario for both the Burnside Bridge traffic as well as traffic on alternate routes. An average of travel times across all travel routes (separately for AM Peak and PM Peak) was calculated for each origin-destination pair and then used to calculate the incremental travel time under Build for each travel group (i.e. for both the Burnside Bridge traffic and traffic on alternate routes). As an example, for the Build scenario without the Temporary Bridge, incremental travel times to bridge traffic were calculated at 9.1 minutes per trip for westbound AM Peak hour and 7.8 minutes per trip for eastbound PM Peak hour. For existing traffic on alternate routes, incremental travel times were calculated at 5.8 minutes per trip for westbound AM Peak hour and 6.6 minutes for eastbound PM Peak hour.

Since the transportation modeling was conducted only for the directional peak flow, an additional step was needed to account for impacts to the non-directional peak travel and off-peak travel across the Burnside Bridge. Although congestion during those times is much smaller, alternate travel routes are longer and will still cause travel time delays. To capture this effect, an average off-peak travel speed of 15 mph was used to calculate the travel time on the average incremental route length (determined to be approximately 0.6 miles). This gave an incremental travel time of 2.4 minutes per trip.

Transit Bus

Under the construction scenario involving No Temporary Bridge or Temporary Bridge for active transportation only, transit buses would be re-routed over the Steel Bridge. Transportation simulations estimated that during the PM peak hour this would result in an additional travel time of about 4.8 minutes per trip (approximately the same in both directions) over a distance of 0.7 miles.

For the purpose of this analysis, it was assumed that additional travel times for the AM peak hours would be the same. The off-peak incremental travel time was calculated

assuming the incremental distance of 0.7 miles and the average bus speed of 15 mph. This resulted in an estimated travel delay of about 2.8 minutes per trip.

Active Transportation

Under construction scenario involving No Temporary Bridge, bicyclists and pedestrians would have to use an alternate route over the Steel Bridge or over the Morrison Bridge. Transportation analysis concluded that this would result in an additional walk or cycling distance of about 0.6 to 1 mile and additional time of 14 to 18 minutes for pedestrians and 7 to 8 minutes for bike users. For the purpose of this analysis, an average of 16 minutes for pedestrians and 7.5 minutes for bike users was used.