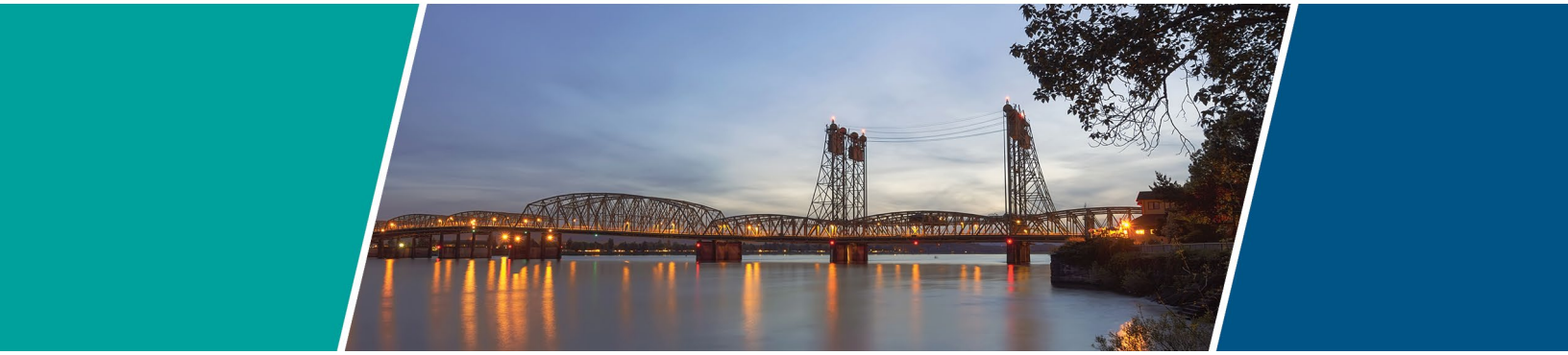
Interstate BRIDGE Replacement Program

Considering the importance of our natural environment



Economics Technical Report

September 2024

Oregon

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Economics Technical Report

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CONTENTS

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

Acronyms/Abbreviations	Definition
AAGR	average annual growth rate
ADA	Americans with Disabilities Act
BIPOC	Black, Indigenous, and People of Color
BRT	bus rapid transit
C-TRAN	Clark County Public Transit Benefit Area Authority
CRC	Columbia River Crossing
CTR	C-TRAN
EIS	environmental impact statement
FHWA	Federal Highway Association
FSCR	Flood Safe Columbia River
FTA	Federal Transit Administration
IBR	Interstate Bridge Replacement
I-5	Interstate 5
LPA	locally preferred alternative
LRT	light-rail transit
LRV	light-rail vehcile
MAX	Metropolitan Area Express (Portland)
Metro	Oregon Metropolitan Regional Government
MSA	Metropolitan Statistical Area
NAVD 88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
ODOT	Oregon Department of Transportation
OTC	Oregon Transportation Commission
PMLS	Portland Metro Levee System

Acronyms/Abbreviations	Definition
PMSA	Primary Metropolitan Statistical Area
PNCD	Preliminary Navigation Clearance Determination
ROD	Record of Decision
RTC	Regional Transportation Commission (Clark County)
RTP	regional transportation plan
SEIS	supplemental environmental impact statement
SMSA	Standard Metropolitan Statistical Area
SOV	single-occupancy vehicle
SR	state route
TAZ	traffic analysis zone
TriMet	Tri-County Metropolitan Transportation District
TSP	transportation system plan
UFSWQD	Urban Flood Safety and Water Quality District
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDOT	U.S. Department of Transportation
WSDOT	Washington State Department of Transportation
WSTC	Washington State Transportation Commission

1. PROGRAM OVERVIEW

This technical report identifies, describes, and evaluates short-term and long-term effects on economics resulting from the Interstate Bridge Replacement (IBR) Program. The construction and operation of transportation infrastructure has the potential to result in permanent and temporary impacts within the project study area. The Modified Locally Preferred Alternative (LPA) would be designed to avoid and/or minimize these effects to the greatest extent possible. This report provides mitigation measures for potential effects when avoidance is not feasible.

The purpose of this report is to satisfy applicable portions of the National Environmental Policy Act (NEPA) 42 United State Code (USC) 4321 "to promote efforts which will prevent or eliminate damage to the environment." Information and potential environmental consequences described in this technical report will be used to support the Draft Supplemental Environmental Impact Statement (SEIS) for the IBR project pursuant to 42 USC 4332.

The objectives of this report are to:

- Define the project study area and the methods of data collection and evaluation used for the analysis (Chapter 2).
- Describe existing economic conditions within the study area (Chapter 3).
- Discuss potential long-term, temporary, and indirect effects resulting from construction and operation of the Modified LPA in comparison to the No-Build Alternative (Chapters 4 through 6).
- Provide proposed avoidance and mitigation measures to help prevent, eliminate or minimize environmental consequences from the Modified LPA (Chapter 7).

The IBR Program is a continuation of the previously suspended Columbia River Crossing (CRC) project with the same purpose to replace the aging Interstate 5 (I-5) Bridge across the Columbia River with a modern, seismically resilient multimodal structure. The proposed infrastructure improvements are located along a 5-mile stretch of the I-5 corridor that extends from approximately Victory Boulevard in Portland to State Route (SR) 500 in Vancouver as shown in Figure 1-1.

The Modified LPA is a modification of the CRC LPA, which completed the NEPA process with a signed Record of Decision (ROD) in 2011 and two re-evaluations that were completed in 2012 and 2013. The CRC project was discontinued in 2014. This Technical Report is evaluating the effects of changes in project design since the CRC ROD and re-evaluations, as well as changes in regulations, policy, and physical conditions.

Figure 1-1. IBR Program Location Overview

1.1 Components of the Modified LPA

The basic components of the Modified LPA include:

- A new pair of Columbia River bridges—one for northbound and one for southbound travel—built west of the existing bridge. The new bridges would each include three through lanes, safety shoulders, and one auxiliary lane (a ramp-to-ramp connection on the highway that improves interchange safety by providing drivers with more space and time to merge, diverge, and weave) in each direction. When all highway, transit, and active transportation would be moved to the new Columbia River bridges, the existing Interstate Bridge (both spans) would be removed.

a. Three bridge configurations are under consideration: (1) double-deck truss bridges with fixed spans, (2) single-level bridges with fixed spans, and (3) single-level bridges with movable spans over the primary navigation channel. The fixed-span configurations would provide up to 116 feet of vertical navigation clearance, and the movable-span configuration would provide 178 feet of vertical navigation clearance in the open position. The primary navigation channel would be relocated approximately 500 feet south (measured by channel centerline) of its existing location near the Vancouver shoreline.

b. A two auxiliary lane design option (two ramp-to-ramp lanes connecting interchanges) across the Columbia River is also being evaluated. The second auxiliary lane in each direction of I-5 would be added from approximately Interstate Avenue/Victory Boulevard to SR 500/39th Street.

- A 1.9-mile light-rail transit (LRT) extension of the current Metropolitan Area Express (MAX) Yellow Line from the Expo Center MAX Station in North Portland, where it currently ends, to a terminus near Evergreen Boulevard in Vancouver. Improvements would include new stations at Hayden Island, downtown Vancouver (Waterfront Station), and near Evergreen Boulevard (Evergreen Station), as well as revisions to the existing Expo Center MAX Station. Park and rides to serve LRT riders in Vancouver could be included near the Waterfront Station and Evergreen Station. The Tri-County Metropolitan Transportation District of Oregon (TriMet), which operates the MAX system, would also operate the Yellow Line extension.
    a. Potential site options for park and rides include three sites near the Waterfront Station and two near the Evergreen Station (up to one park and ride could be built for each station location in Vancouver).
- Associated LRT improvements such as traction power substations, overhead catenary system, signal and communications support facilities, an overnight light-rail vehicle (LRV) facility at the Expo Center, 19 new LRVs, and an expanded maintenance facility at TriMet's Ruby Junction.
- Integration of local bus transit service, including bus rapid transit (BRT) and express bus routes, in addition to the proposed new LRT service.
- Wider shoulders on I-5 from Interstate Avenue/Victory Boulevard to SR 500/39th Street to accommodate express bus-on-shoulder service in each direction.
- Associated bus transit service improvements would include three additional bus bays for eight new electric double-decker buses at the Clark County Public Transit Benefit Area Authority (C-TRAN) operations and maintenance facility (see Section 1.1.7, Transit Operating Characteristics, for more information about this service).
- Improvements to seven I-5 interchanges and I-5 mainline improvements between Interstate Avenue/ Victory Boulevard in Portland and SR 500/39th Street in Vancouver. Some adjacent local streets would be reconfigured to complement the new interchange designs, and improve local east-west connections.
    a. An option that shifts the I-5 mainline up to 40 feet westward in downtown Vancouver between the SR 14 interchange and Mill Plain Boulevard interchange is being evaluated.
    b. An option that eliminates the existing C Street ramps in downtown Vancouver is being evaluated.

- Six new adjacent bridges across North Portland Harbor: one on the east side of the existing I-5 North Portland Harbor bridge and five on the west side or overlapping with the existing bridge (which would be removed). The bridges would carry (from west to east) LRT tracks, southbound I-5 off-ramp to Marine Drive, southbound I-5 mainline, northbound I-5 mainline, northbound I-5 on-ramp from Marine Drive, and an arterial bridge for local traffic with a shared-use path for pedestrians and bicyclists.
- A variety of improvements for people who walk, bike, and roll throughout the study area, including a system of shared-use paths, bicycle lanes, sidewalks, enhanced wayfinding, and facility improvements to comply with the Americans with Disabilities Act. These are referred to in this document as active transportation improvements.
- Variable-rate tolling for motorists using the river crossing as a demand-management and financing tool.

The transportation improvements proposed for the Modified LPA and the design options are shown in Figure 1-2. The Modified LPA includes all of the components listed above. If there are differences in environmental effects or benefits between the design options, those are identified in the sections below.

Section 1.1.1, Interstate 5 Mainline, describes the overall configuration of the I-5 mainline through the study area, and Sections 1.1.2, Portland Mainland and Hayden Island (Subarea A), through Section1-44, Upper Vancouver (Subarea D), provide additional detail on four geographic subareas (A through D), which are shown on Figure 1-3. In each subarea, improvements to I-5, its interchanges, and the local roadways are described first, followed by transit and active transportation improvements. Design options are described under separate headings in the subareas in which they would be located.

Table 1-1 shows the different combinations of design options analyzed in this Technical Report. However, **any combination of design options is compatible**. In other words, any of the bridge configurations could be combined with one or two auxiliary lanes, with or without the C Street ramps, a centered or westward shift of I-5 in downtown Vancouver, and any of the park-and-ride location options. Figures in each section show both the anticipated limit of ground disturbance, which includes disturbance from temporary construction activities, and the location of permanent infrastructure elements.

Figure 1-2. Modified LPA Components

Figure 1-3. Modified LPA – Geographic Subareas

Table 1-1. Modified LPA and Design Options

Design Options	Modified LPA	Modified LPA with Two Auxiliary Lanes	Modified LPA Without C Street Ramps	Modified LPA with I-5 Shifted West	Modified LPA with a Single-Level Fixed-Span Configuration	Modified LPA with a Single-Level Movable-Span Configuration
Bridge Configuration	**Double-deck fixed-span***	Double-deck fixed-span	Double-deck fixed-span	Double-deck fixed-span	**Single-level fixed-span***	**Single-level movable-span***
Auxiliary Lanes	**One***	**Two***	One	One	One	One
C Street Ramps	**With C Street ramps***	With C Street ramps	**Without C Street Ramps***	With C Street ramps	With C Street ramps	With C Street ramps
I-5 Alignment	**Centered***	Centered	Centered	**Shifted West***	Centered	Centered
Park-and-Ride Options	**Waterfront:*** 1. Columbia Way (below I-5); 2. Columbia Street/SR 14; 3. Columbia Street/Phil Arnold Way **Evergreen:*** 1. Library Square; 2. Columbia Credit Union					

Bold text with an asterisk (*) indicates which design option is different in each configuration.

1.1.1 Interstate 5 Mainline

Today, within the 5-mile corridor, I-5 has three 12-foot-wide through lanes in each direction, an approximately 6- to 11-foot-wide inside shoulder, and an approximately 10- to 12-foot-wide outside shoulder with the exception of the Interstate Bridge, which has approximately 2- to 3-foot-wide inside and outside shoulders. There are currently intermittent auxiliary lanes between the Victory Boulevard and Hayden Island interchanges in Oregon and between SR 14 and SR 500 in Washington.

The Modified LPA would include three 12-foot through lanes from Interstate Avenue/Victory Boulevard to SR 500/39th Street and a 12-foot auxiliary lane from the Marine Drive interchange to the Mill Plain Boulevard interchange in each direction. Many of the existing auxiliary lanes on I-5 between the SR 14 and Main Street interchanges in Vancouver would remain, although they would be reconfigured. The existing auxiliary lanes between the Victory Boulevard and Hayden Island interchanges would be replaced with changes to on- and off-ramps and interchange reconfigurations. The Modified LPA would also include wider shoulders (12-foot inside shoulders and 10- to 12-foot outside shoulders) to be consistent with ODOT and WSDOT design standards. The wider inside shoulder would be used by express bus service to bypass mainline congestion, known as “bus on shoulder” (refer to Section 1.1.7, Transit Operating Characteristics). The shoulder would be available for express bus service when general-purpose speeds are below 35 miles per hour (mph).

Figure 1-4 shows a cross section of the collector-distributor (C-D)[1] roadways, Figure 1-5 shows the location of the C-D roadways, and Figure 1-6 shows the proposed auxiliary lane layout. The existing Interstate Bridge over the Columbia River does not have an auxiliary lane; the Modified LPA would add one auxiliary lane in each direction across the new Columbia River bridges.

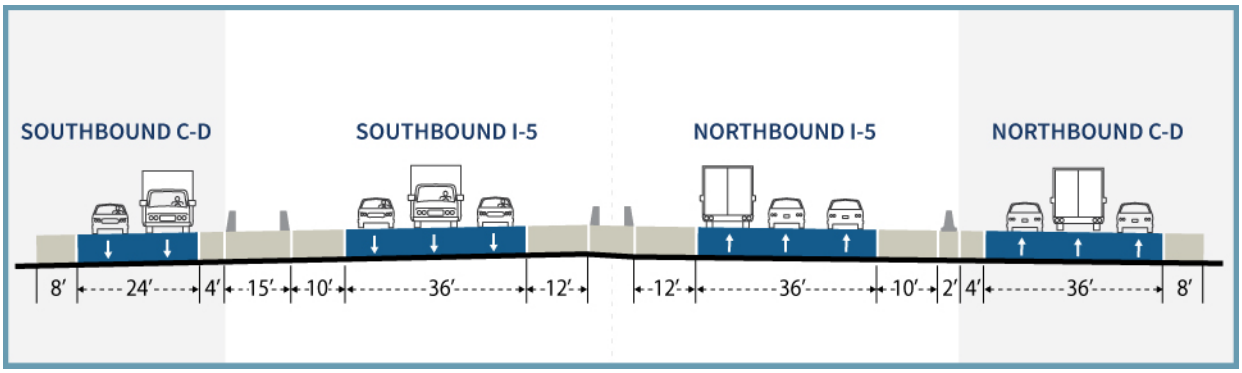
On I-5 northbound, the auxiliary lane that would begin at the on-ramp from Marine Drive would continue across the Columbia River bridge and end at the off-ramp to the C-D roadway, north of SR 14 (see Figure 1-5). The on-ramp from SR 14 westbound would join the off-ramp to the C-D roadway, forming the northbound C-D roadway between SR 14 and Fourth Plain Boulevard. The C-D roadway would provide access from I-5 northbound to the off-ramps at Mill Plain Boulevard and Fourth Plain Boulevard. The C-D roadway would also provide access from SR 14 westbound to the off-ramps at Mill Plain Boulevard and Fourth Plain Boulevard, and to the on-ramp to I-5 northbound.

On I-5 northbound, the Modified LPA would also add one auxiliary lane beginning at the on-ramp from the C-D roadway and ending at the on-ramp from 39th Street, connecting to an existing auxiliary lane from 39th Street to the off-ramp at Main Street. Another existing auxiliary lane would remain between the on-ramp from Mill Plain Boulevard to the off-ramp to SR 500.

On I-5 southbound, the off-ramp to the C-D roadway would join the on-ramp from Mill Plain Boulevard to form a C-D roadway. The C-D roadway would provide access from I-5 southbound to the off-ramp to SR 14 eastbound and from Mill Plain Boulevard to the off-ramp to SR 14 eastbound and the on-ramp to I-5 southbound.

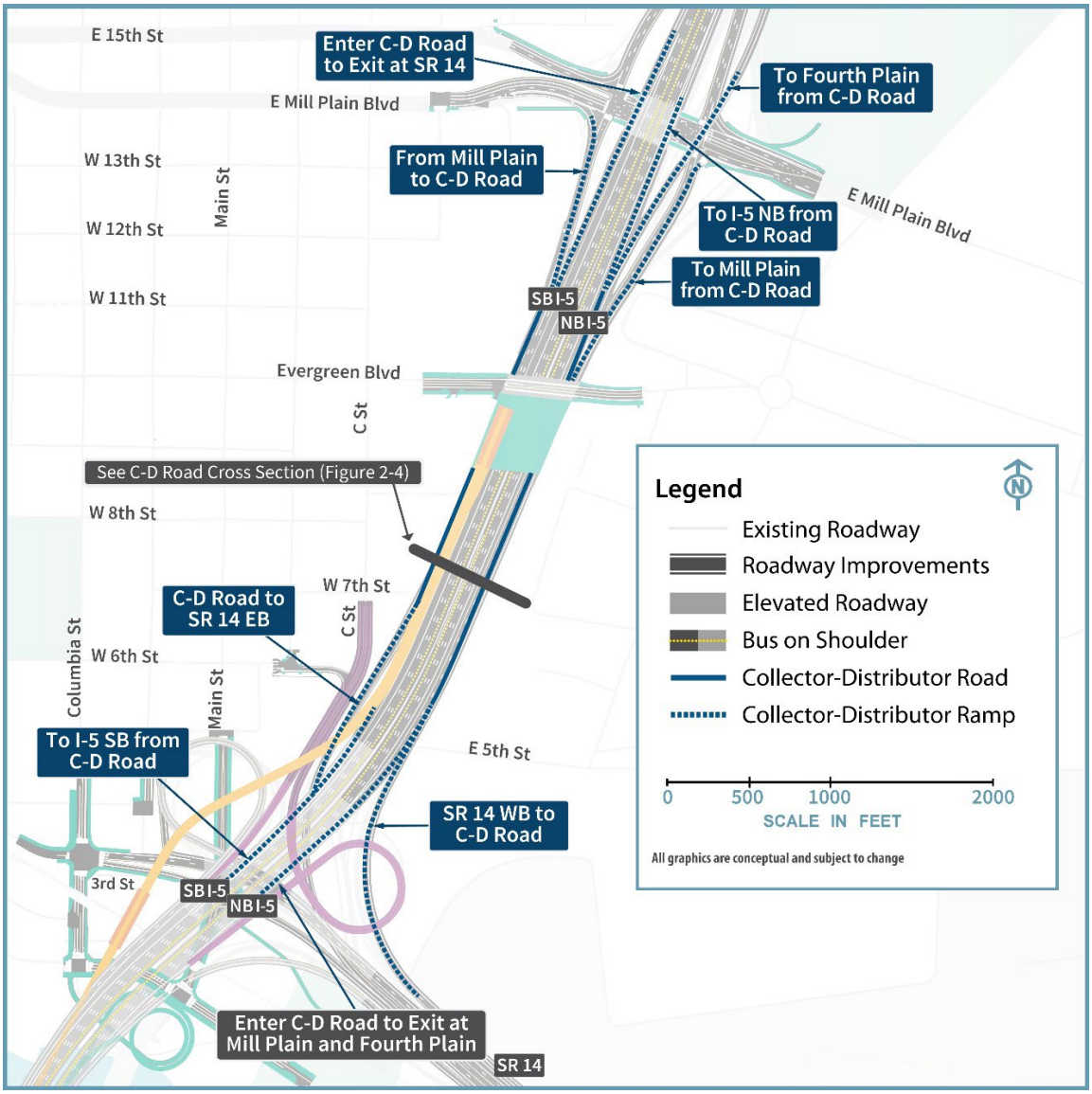
On I-5 southbound, an auxiliary lane would begin at the on-ramp from the C-D roadway and would continue across the southbound Columbia River bridge and end at the off-ramp to Marine Drive. The combined on-ramp from SR 14 westbound and C Street would merge into this auxiliary lane.

Figure 1-4. Cross Section of the Collector-Distributor Roadways



[1] A collector-distributer roadway parallels and connects the main travel lanes of a highway and frontage roads or entrance ramps.

Figure 1-5. Collector-Distributor Roadways



C-D = collector-distributor; EB = eastbound; NB = northbound; SB = southbound; WB = westbound

1.1.1.1 Two Auxiliary Lane Design Option

This design option would add a second 12-foot-wide auxiliary lane in each direction of I-5 with the intent to further optimize travel flow in the corridor. This second auxiliary lane is proposed from the Interstate Avenue/Victory Boulevard interchange to the SR 500/39th Street interchange.

On I-5 northbound, one auxiliary lane would begin at the combined on-ramp from Interstate Avenue and Victory Boulevard, and a second auxiliary lane would begin at the on-ramp from Marine Drive. Both auxiliary lanes would continue across the northbound Columbia River bridge, and the on-ramp from Hayden Island would merge into the second auxiliary lane on the northbound Columbia River bridge. At the off-ramp to the C-D roadway, the second auxiliary lane would end but the first auxiliary

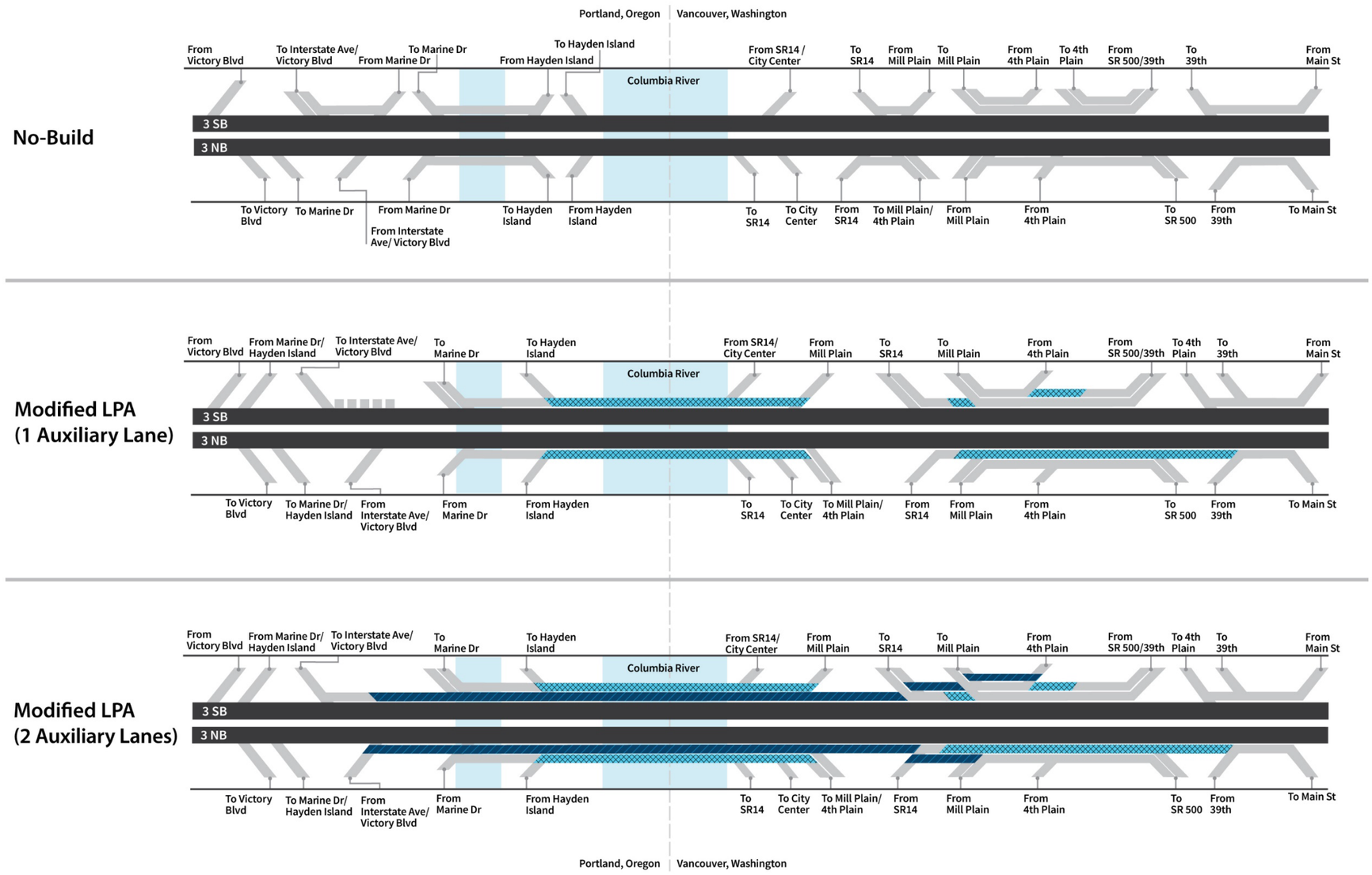
lane would continue. A second auxiliary lane would begin again at the on-ramp from Mill Plain Boulevard. The second auxiliary lane would end at the off-ramp to SR 500, and the first auxiliary lane would connect to an existing auxiliary lane at 39th Street to the off-ramp at Main Street.

On I-5 southbound, two auxiliary lanes would begin at the on-ramp from SR 500. Between the on-ramp from Fourth Plain Boulevard and the off-ramp to Mill Plain Boulevard, one auxiliary lane would be added to the existing two auxiliary lanes. The second auxiliary lane would end at the off-ramp to the C-D roadway, but the first auxiliary lane would continue. A second auxiliary lane would begin again at the southbound I-5 on-ramp from the C-D roadway. Both auxiliary lanes would continue across the southbound Columbia River bridge, and the combined on-ramp from SR 14 westbound and C Street would merge into the second auxiliary lane on the southbound Columbia River bridge. The second auxiliary lane would end at the off-ramp to Marine Drive, and the first auxiliary lane would end at the combined off-ramp to Interstate Avenue and Victory Boulevard.

Figure 1-6 shows a comparison of the one auxiliary lane configuration and the two auxiliary lane configuration design option. Figure 1-7 shows a comparison of the footprints (i.e., the limit of permanent improvements) of the one auxiliary lane and two auxiliary lane configurations on a double-deck fixed-span bridge. For all Modified LPA bridge configurations (described in Section 1.1.3, Columbia River Bridges (Subarea B)), the footprints of the two auxiliary lane configurations differ only over the Columbia River and in downtown Vancouver. The rest of the corridor would have the same footprint. For all bridge configurations analyzed in this document, the two auxiliary lane option would add 16 feet (8 feet in each direction) in total roadway width compared to the one auxiliary lane option due to the increased shoulder widths for the one auxiliary lane option.[2] The traffic operations analysis incorporating both the one and two auxiliary lane design options applies equally to all bridge configurations in this Technical Report.

[2] Under the one auxiliary lane option, the width of each shoulder would be approximately 14 feet to accommodate maintenance of traffic during construction. Under the two auxiliary lane option, maintenance of traffic could be accommodated with 12-foot shoulders because the additional 12-foot auxiliary lane provides adequate roadway width. The total difference in roadway width in each direction between the one auxiliary lane option and the two auxiliary lane option would be 8 feet (12-foot auxiliary lane – 2 feet from the inside shoulder – 2 feet from the outside shoulder = 8 feet).

Figure 1-6. Comparison of Auxiliary Lane Configurations



Each scenario has three through lanes in each direction

- Existing Through Lanes
- Interchange Ramps and Existing Auxiliary Lanes
- Existing Auxiliary Lanes Removed
- One Auxiliary Lane added in Modified LPA
- Second Auxiliary Lane added in Modified LPA

Notes:

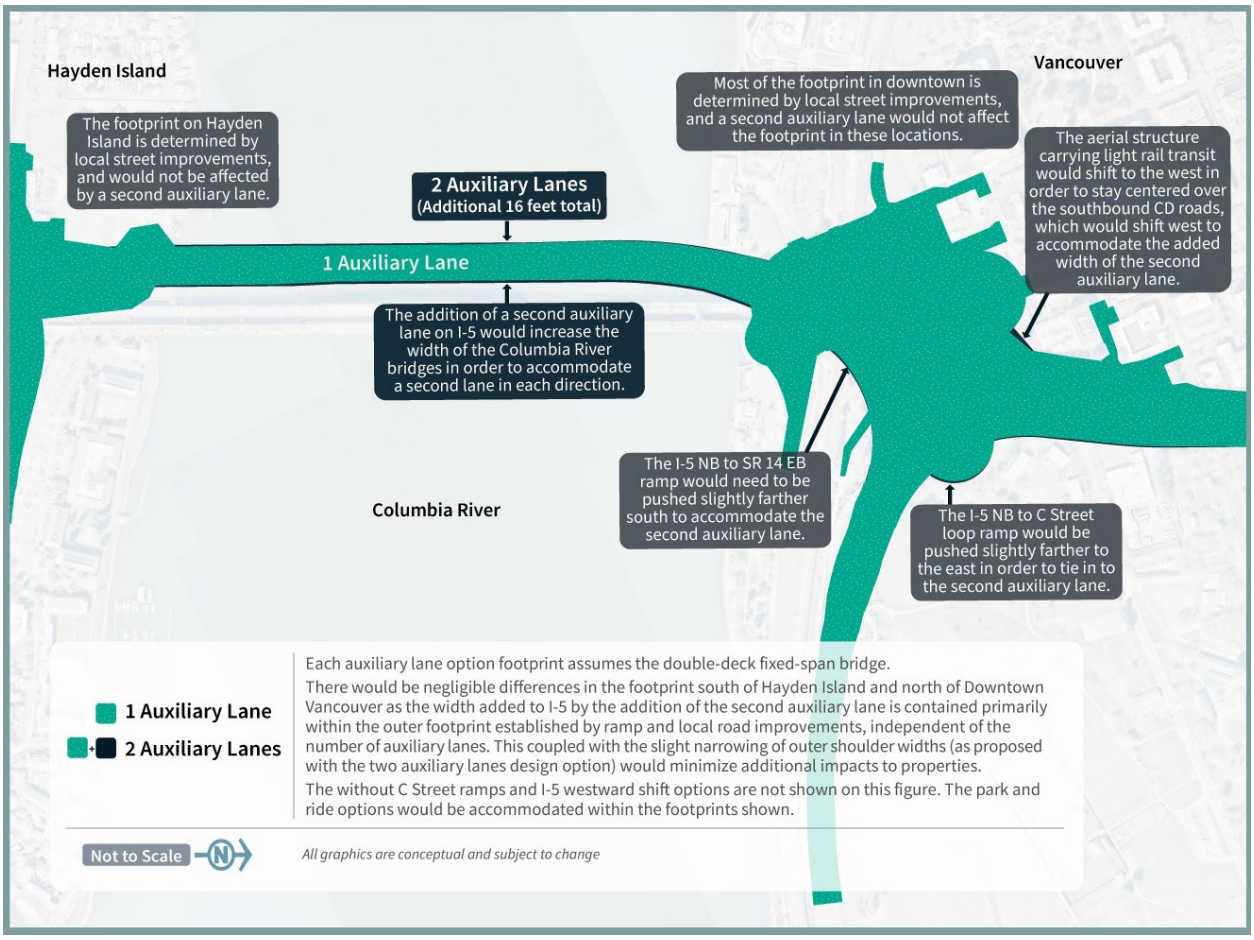
Collector Distributor Lanes not shown.

The traffic operations analysis incorporating both the one and two auxiliary lane design option applies equally to all bridge configuration options in this Draft SEIS.

The C Street ramp (NB to City Center) is an option.

Figure is not to scale.

Figure 1-7. Auxiliary Lane Configuration Footprint Differences



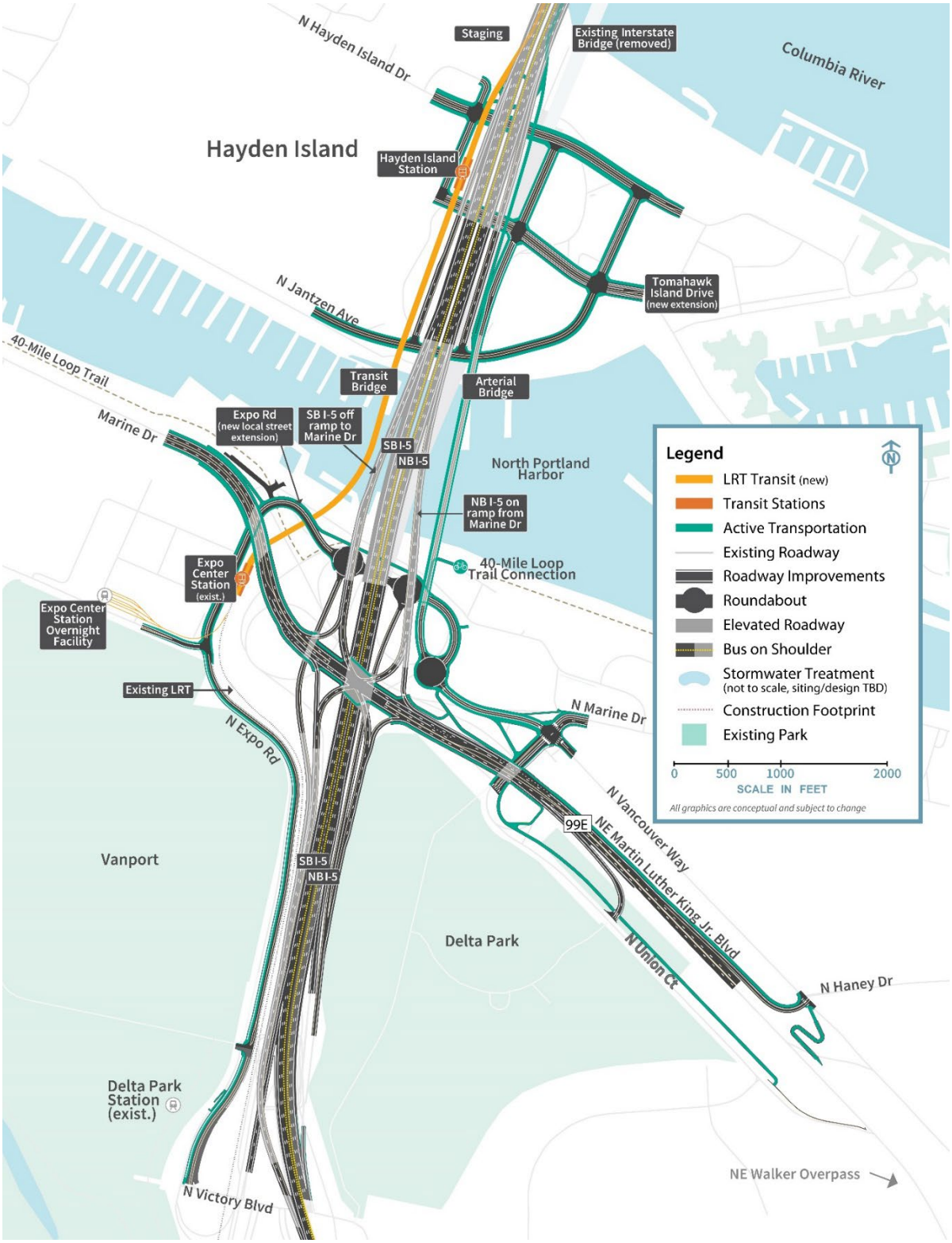
1.1.2 Portland Mainland and Hayden Island (Subarea A)

This section discusses the geographic Subarea A shown in Figure 1-3. See Figure 1-8 for highway and interchange improvements in Subarea A, including the North Portland Harbor bridge. Figure 1-8 illustrates the one auxiliary lane design option; please refer to Figure 1-6 and the accompanying description for how two auxiliary lanes would alter the Modified LPA's proposed design. Refer to Figure 1-3 for an overview of the geographic subareas.

Within Subarea A, the IBR Program has the potential to alter three federally authorized levee systems:

- The Oregon Slough segment of the Peninsula Drainage District Number 1 levee (PEN 1).
- The Oregon Slough segment of the Peninsula Drainage District Number 2 levee (PEN 2).
- The PEN1/PEN2 cross levee segment of the PEN 1 levee (Cross Levee).

Figure 1-8. Portland Mainland and Hayden Island (Subarea A)



LRT = light-rail transit; NB = northbound; SB = southbound; TBD = to be determined

The levee systems are shown on Figure 1-9, and intersections with Modified LPA components are described throughout Section 1.1.2, Portland Mainland and Hayden Island (Subarea A), where appropriate. Within Subarea A, the IBR Program study area intersects with PEN 1 to the west of I-5 and with PEN 2 to the east of I-5. PEN 1 and PEN 2 include a main levee along the south side of North Portland Harbor and are part of a combination of levees and floodwalls. PEN 1 and PEN 2 are separated by the Cross Levee that is intended to isolate the two districts if one of them fails. The Cross Levee is located along the I-5 mainline embankment, except in the Marine Drive interchange area where it is located on the west edge of the existing ramp from Marine Drive to southbound I-5.[3]

There are two concurrent efforts underway that are planning improvements to PEN1, PEN2, and the Cross Levee to reduce flood risk:

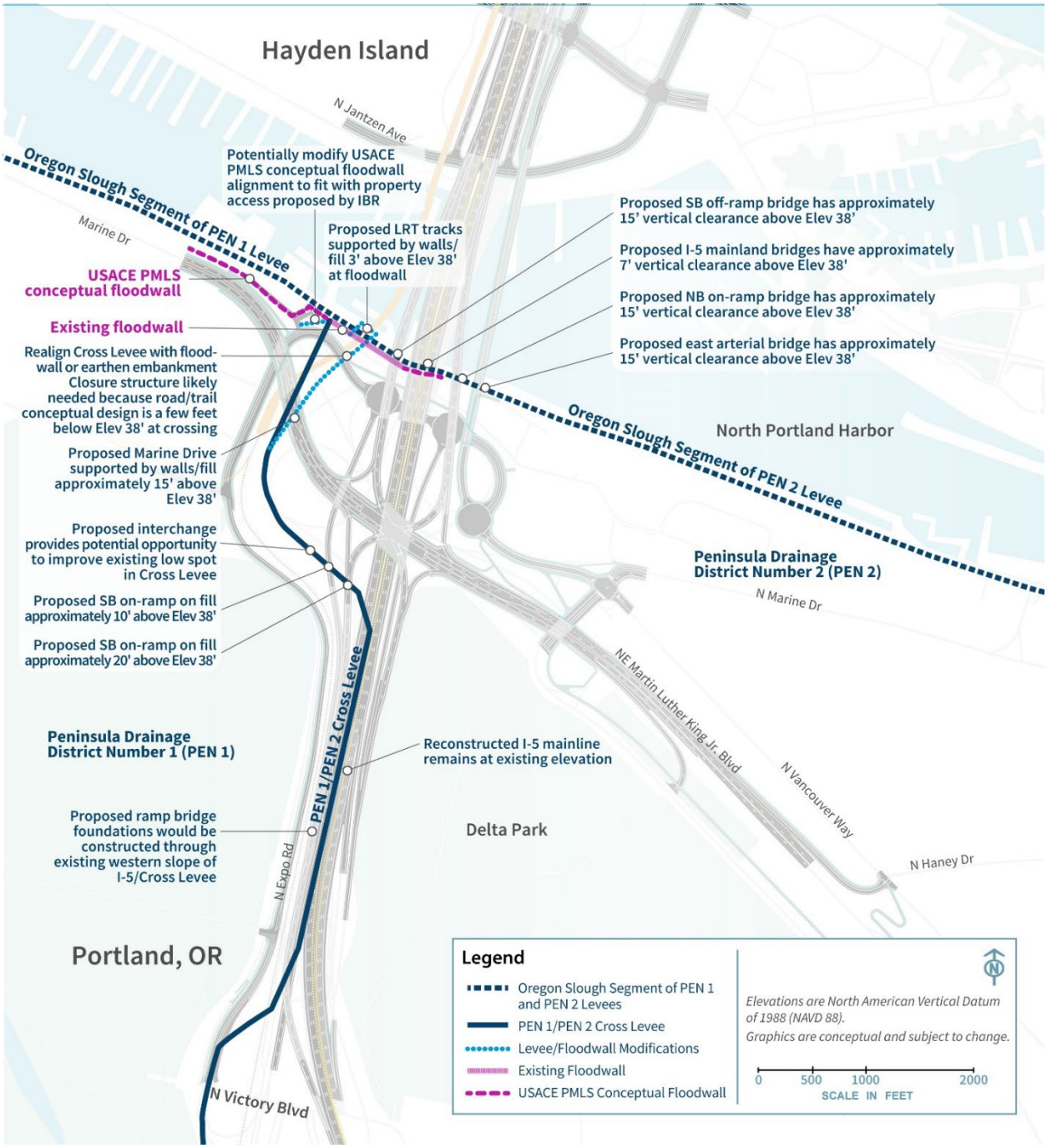
- The U.S. Army Corps of Engineers (USACE) Portland Metro Levee System (PMLS) project.
- The Flood Safe Columbia River (FSCR) program (also known as "Levee Ready Columbia").

The Urban Flood Safety and Water Quality District (UFSWQD)[4] is working with the USACE through the PMLS project, which includes improvements at PEN 1 and PEN 2 (e.g., raising these levees to elevation 38 feet North American Vertical Datum of 1988 [NAVD 88]).[5] Additionally, as part of the FSCR program, UFSWQD is studying raising a low spot in the Cross Levee on the southwest side of the Marine Drive interchange.

The IBR Program is in close coordination with these concurrent efforts to ensure that the IBR Program's design efforts consider the timing and scope of the PMLS and the FSCR proposed modifications. The intersection of the IBR Program proposed actions to both the existing levee configuration and the anticipated future condition based on the proposed PMLS and FSCR projects are described below, where appropriate.

[3] The portion of the original Denver Avenue levee alignment within the Marine Drive interchange area is no longer considered part of the levee system by UFSWQD.
[4] UFSWQD includes PEN 1 and PEN 2, Urban Flood Safety and Water Quality District No. 1, and the Sandy Drainage Improvement Company.
[5] NAVD 88 is a vertical control datum (reference point) used by federal agencies for surveying.

Figure 1-9. Levee Systems in Subarea A



1.1.2.1 Highways, Interchanges, and Local Roadways

VICTORY BOULEVARD/INTERSTATE AVENUE INTERCHANGE AREA

The southern extent of the Modified LPA would improve two ramps at the Victory Boulevard/Interstate Avenue interchange (see Figure 1-8). The first ramp improvement would be the southbound I-5 off-ramp to Victory Boulevard/ Interstate Avenue; this off-ramp would be braided below (i.e., grade separated or pass below) the Marine Drive to the I-5 southbound on-ramp (see the Marine Drive Interchange Area section below). The other ramp improvement would lengthen the merge distance for northbound traffic entering I-5 from Victory Boulevard and from Interstate Avenue.

The existing I-5 mainline between Victory Boulevard/Interstate Avenue and Marine Drive is part of the Cross Levee (see Figure 1-9). The Modified LPA would require some pavement reconstruction of the mainline in this area; however, the improvements would mostly consist of pavement overlay and the profile and footprint would be similar to existing conditions.

MARINE DRIVE INTERCHANGE AREA

The next interchange north of the Victory Boulevard/Interstate Avenue interchange is at Marine Drive. All movements within this interchange would be reconfigured to reduce congestion for motorists entering and exiting I-5. The new configuration would be a single-point urban interchange. The new interchange would be centered over I-5 versus on the west side under existing conditions. See Figure 1-8 for the Marine Drive interchange's layout and construction footprint.

The Marine Drive to I-5 southbound on-ramp would be braided over I-5 southbound to the Victory Boulevard/Interstate Avenue off-ramp. Martin Luther King Jr. Boulevard would have a new more direct connection to I-5 northbound.

The new interchange configuration would change the westbound Marine Drive and westbound Vancouver Way connections to Martin Luther King Jr. Boulevard. An improved connection farther east of the interchange (near Haney Street) would provide access to westbound Martin Luther King Jr. Boulevard for these two streets. For eastbound travelers on Martin Luther King Jr. Boulevard exiting to Union Court, the existing loop connection would be replaced with a new connection farther east (near the access to the East Delta Park Owens Sports Complex).

Expo Road from Victory Boulevard to the Expo Center would be reconstructed with improved active transportation facilities. North of the Expo Center, Expo Road would be extended under Marine Drive and continue under I-5 to the east, connecting with Marine Drive and Vancouver Way through three new connected roundabouts. The westernmost roundabout would connect the new local street extension to I-5 southbound. The middle roundabout would connect the I-5 northbound off-ramp to the local street extension. The easternmost roundabout would connect the new local street extension to an arterial bridge crossing North Portland Harbor to Hayden Island. This roundabout would also connect the local street extension to Marine Dr and Vancouver Way.

To access Hayden Island using the arterial bridge from the east on Martin Luther King Jr. Boulevard, motorists would exit Martin Luther King Jr. Boulevard at the existing off-ramp to Vancouver Way just west of the Walker Street overpass. Then motorists would travel west on Vancouver Way, through the intersection with Marine Drive and straight through the roundabout to the arterial bridge.

From Hayden Island, motorists traveling south to Portland via Martin Luther King Jr. Boulevard would turn onto the arterial bridge southbound and travel straight through the roundabout onto Vancouver Way. At the intersection of Vancouver Way and Marine Drive, motorists would turn right onto Union Court and follow the existing road southeast to the existing on-ramp onto Martin Luther King Jr. Boulevard.

The conceptual floodwall alignment from the proposed USACE PMLS project is located on the north side of Marine Drive, near two industrial properties, with three proposed closure structures[6] for property access. The Modified LPA would realign Marine Drive to the south and provide access to the two industrial properties via the new local road extension from Expo Road. Therefore, the change in access for the two industrial properties could require small modifications to the floodwall alignment (a potential shift of 5 to 10 feet to the south) and closure structure locations.

Marine Drive and the two southbound on-ramps would travel over the Cross Levee approximately 10 to 20 feet above the proposed elevation of the improved levee, and they would be supported by fill and retaining walls near an existing low spot in the Cross Levee.

The I-5 southbound on-ramp from Marine Drive would continue on a new bridge structure. Although the bridge's foundation locations have not been determined yet, they would be constructed through the western slope of the Cross Levee (between the existing I-5 mainline and the existing light-rail).

NORTH PORTLAND HARBOR BRIDGES

To the north of the Marine Drive interchange is the Hayden Island interchange area, which is shown in Figure 1-8. I-5 crosses over the North Portland Harbor when traveling between these two interchanges. The Modified LPA proposes to replace the existing I-5 bridge spanning North Portland Harbor to improve seismic resiliency.

Six new parallel bridges would be built across the waterway under the Modified LPA: one on the east side of the existing I-5 North Portland Harbor bridge and five on the west side or overlapping the location of the existing bridge (which would be removed). From west to east, these bridges would carry:

- The LRT tracks.
- The southbound I-5 off-ramp to Marine Drive.
- The southbound I-5 mainline.
- The northbound I-5 mainline.
- The northbound I-5 on-ramp from Marine Drive.
- An arterial bridge between the Portland mainland and Hayden Island for local traffic; this bridge would also include a shared-use path for pedestrians and bicyclists.

Each of the six replacement North Portland Harbor bridges would be supported on foundations constructed of 10-foot-diameter drilled shafts. Concrete columns would rise from the drilled shafts

[6] Levee closure structures are put in place at openings along the embankment/floodwall to provide flood protection during high water conditions.

and connect to the superstructures of the bridges. All new structures would have at least as much vertical navigation clearance over North Portland Harbor as the existing North Portland Harbor bridge.

Compared to the existing bridge, the two new I-5 mainline bridges would have a similar vertical clearance of approximately 7 feet above the proposed height of the improved levees (elevation 38 feet NAVD 88). The two ramp bridges and the arterial bridge would have approximately 15 feet of vertical clearance above the proposed height of the levees. The foundation locations for the five roadway bridges have not been determined at this stage of design, but some foundations could be constructed through landward or riverward levee slopes.

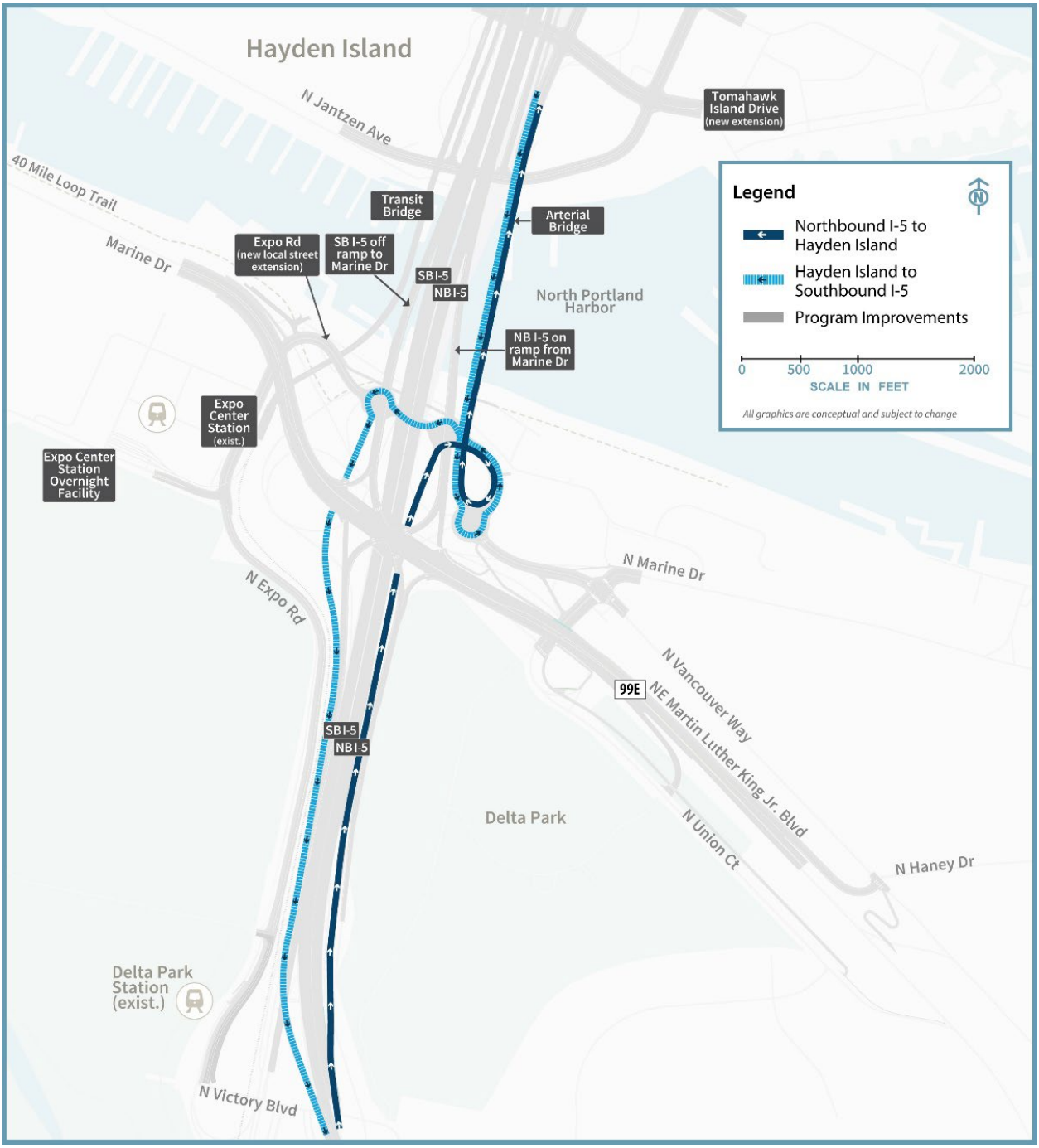
HAYDEN ISLAND INTERCHANGE AREA

All traffic movements for the Hayden Island interchange would be reconfigured. See Figure 1-8 for a layout and construction footprint of the Hayden Island interchange. A half-diamond interchange would be built on Hayden Island with a northbound I-5 on-ramp from Jantzen Drive and a southbound I-5 off-ramp to Jantzen Drive. This would lengthen the ramps and improve merging/diverging speeds compared to the existing substandard ramps that require acceleration and deceleration in a short distance. The I-5 mainline would be partially elevated and partially located on fill across the island.

There would not be a southbound I-5 on-ramp or northbound I-5 off-ramp on Hayden Island. Connections to Hayden Island for those movements would be via the local access (i.e., arterial) bridge connecting North Portland to Hayden Island (Figure 1-10). Vehicles traveling northbound on I-5 wanting to access Hayden Island would exit with traffic going to the Marine Drive interchange, cross under Martin Luther King Jr. Boulevard to the new roundabout at the Expo Road local street extension, travel east through this roundabout to the easternmost roundabout, and use the arterial bridge to cross North Portland Harbor. Vehicles on Hayden Island looking to enter I-5 southbound would use the arterial bridge to cross North Portland Harbor, cross under I-5 using the new Expo Road local street extension to the westernmost roundabout, cross under Marine Drive, merge with the Marine Drive southbound on-ramp, and merge with I-5 southbound south of Victory Boulevard.

Improvements to Jantzen Avenue may include additional left-turn and right-turn lanes at the interchange ramp terminals and active transportation facilities. Improvements to Hayden Island Drive would include new connections to the new arterial bridge over North Portland Harbor. The existing I-5 northbound and southbound access points from Hayden Island Drive would also be removed. A new extension of Tomahawk Island Drive would travel east-west through the middle of Hayden Island and under the I-5 interchange, thus improving connectivity across I-5 on the island.

Figure 1-10. Vehicle Circulation between Hayden Island and the Portland Mainland



NB = northbound; SB = southbound

1.1.2.2 Transit

A new light-rail alignment for northbound and southbound trains would be constructed within Subarea A (see Figure 1-8) to extend from the existing Expo Center MAX Station over North Portland Harbor to a new station at Hayden Island. An overnight LRV facility would be constructed on the southeast corner of the Expo Center property (see Figure 1-8) to provide storage for trains during hours when MAX is not in service. This facility is described in Section 1.1.6, Transit Support Facilities. The existing Expo Center MAX Station would be modified to remove the westernmost track and platform. Other platform modifications, including track realignment and regrading the station, are anticipated to transition to the extension alignment. This may require reconstruction of the operator break facility, signal/communication buildings, and traction power substations. Immediately north of the Expo Center MAX Station, the alignment would curve east toward I-5, pass beneath Marine Drive, cross the proposed Expo Road local street extension and the 40-Mile Loop Trail at grade, then rise over the existing levee onto a light-rail bridge to cross North Portland Harbor. On Hayden Island, proposed transit components include northbound and southbound LRT tracks over Hayden Island; the tracks would be elevated at approximately the height of the new I-5 mainline. An elevated LRT station would also be built on the island immediately west of I-5. The light-rail alignment would extend north on Hayden Island along the western edge of I-5 before transitioning onto the lower level of the new double-deck western bridge over the Columbia River (see Figure 1-8). For the single-level configurations, the light-rail alignment would extend to the outer edge of the western bridge over the Columbia River.

After crossing the new local road extension from Expo Road, the new light-rail track would cross over the main levee (see Figure 1-9). The light-rail profile is anticipated to be approximately 3 feet above the improved levees at the existing floodwall (and improved floodwall), and the tracks would be constructed on fill supported by retaining walls above the floodwall. North of the floodwall, the light-rail tracks would continue onto the new light-rail bridge over North Portland Harbor (as described above).

The Modified LPA's light-rail extension would be close to or would cross the north end of the Cross Levee. The IBR Program would realign the Cross Levee to the east of the light-rail alignment to avoid the need for a closure structure on the light-rail alignment. This realigned Cross Levee would cross the new local road extension. A closure structure may be required because the current proposed roadway is a few feet lower than the proposed elevation of the improved levee.

1.1.2.3 Active Transportation

In the Victory Boulevard interchange area (see Figure 1-8), active transportation facilities would be provided along Expo Road between Victory Boulevard and the Expo Center; this would provide a direct connection between the Victory Boulevard and Marine Drive interchange areas, as well as links to the Delta Park and Expo Center MAX Stations.

New shared-use path connections throughout the Marine Drive interchange area would provide access between the Bridgeton neighborhood (on the east side of I-5), Hayden Island, and the Expo Center MAX Station. There would also be connections to the existing portions of the 40-Mile Loop Trail, which runs north of Marine Drive under I-5 through the interchange area. The path would

continue along the extension of Expo Road under the interchange to the intersection of Marine Drive and Vancouver Way, where it would connect under Martin Luther King Jr. Boulevard to Delta Park.

East of the Marine Drive interchange, new shared-use paths on Martin Luther King Jr. Boulevard and on the parallel street, Union Court, would connect travelers to Marine Drive and across the arterial bridge to Hayden Island. The shared-use facilities on Martin Luther King Jr. Boulevard would provide westbound and eastbound cyclists and pedestrians with off-street crossings of the interchange and would also provide connections to both the Expo Center MAX Station and the 40-Mile Loop Trail to the west.

The new arterial bridge over North Portland Harbor would include a shared-use path for pedestrians and bicyclists (see Figure 1-8). On Hayden Island, pedestrian and bicycle facilities would be provided on Jantzen Avenue, Hayden Island Drive, and Tomahawk Island Drive. The shared-use path on the arterial bridge would continue along the arterial bridge to the south side of Tomahawk Island Drive. A parallel, elevated path from the arterial bridge would continue adjacent to I-5 across Hayden Island and cross above Tomahawk Island Drive and Hayden Island Drive to connect to the lower level of the new double-deck eastern bridge or the outer edge of the new single-level eastern bridge over the Columbia River. A ramp down to the north side of Hayden Island Drive would be provided from the elevated path.

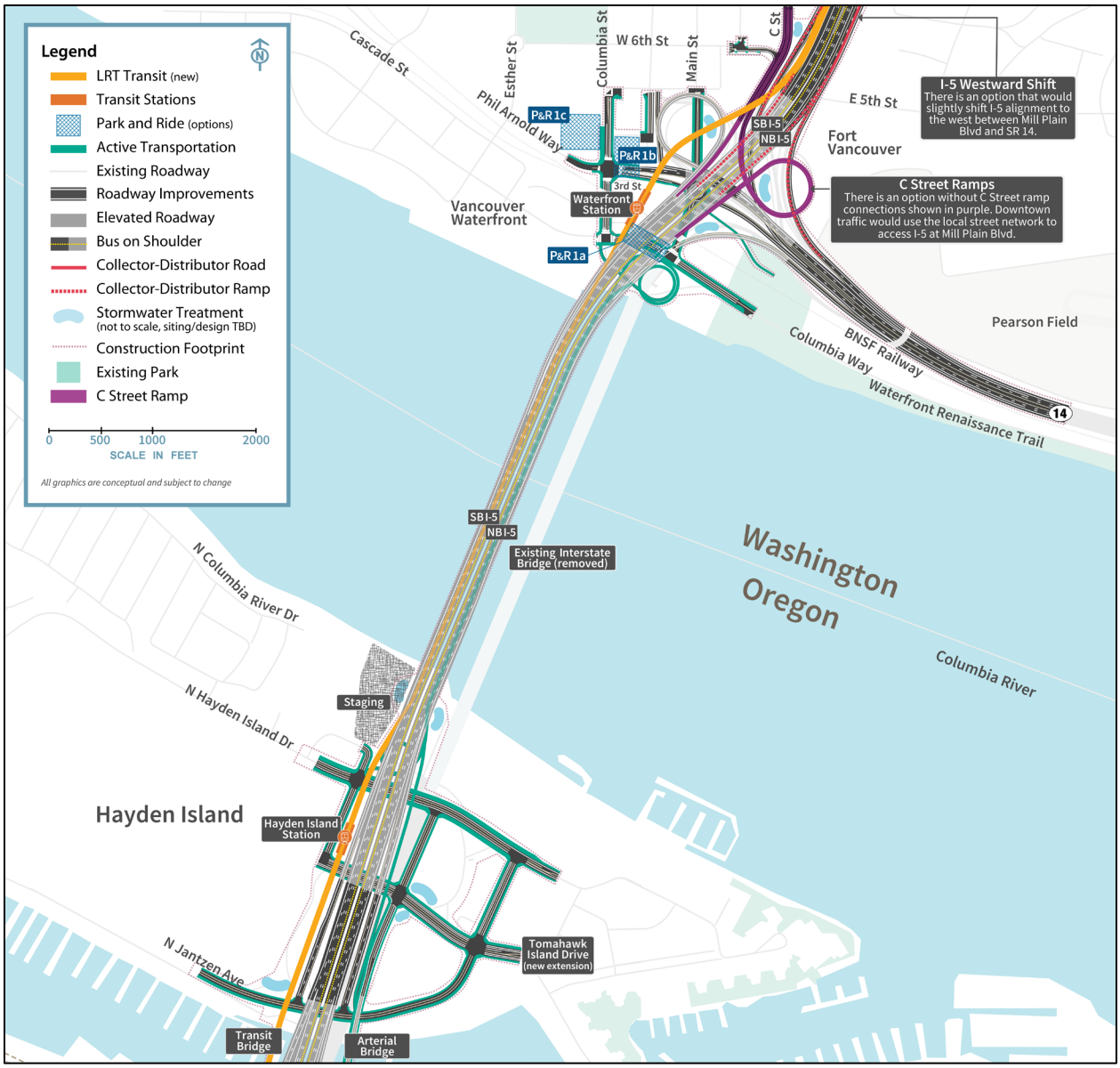
1.1.3 Columbia River Bridges (Subarea B)

This section discusses the geographic Subarea B shown in Figure 1-3. See Figure 1-11 for highway and interchange improvements in Subarea B. Refer to Figure 1-3 for an overview of the geographic subareas.

1.1.3.1 Highways, Interchanges, and Local Roadways

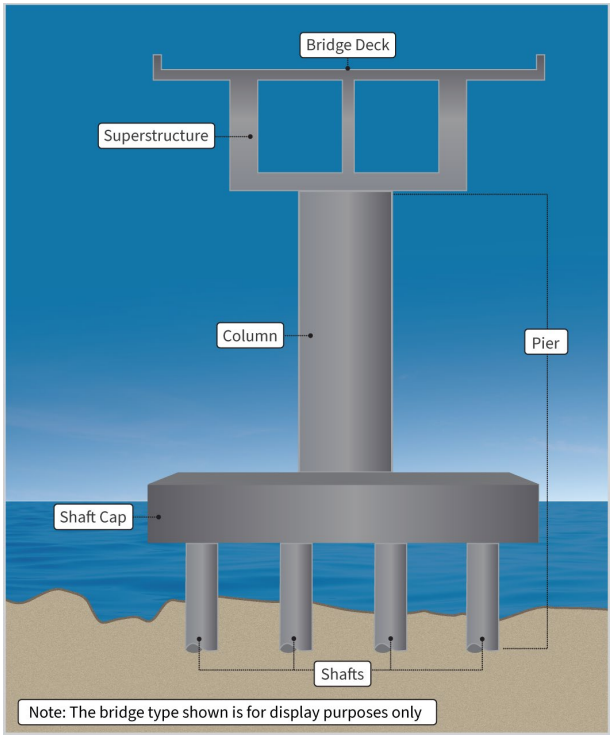
The two existing parallel I-5 bridges that cross the Columbia River would be replaced by two new parallel bridges, located west of the existing bridges (see Figure 1-11). The new eastern bridge would accommodate northbound highway traffic and a shared-use path. The new western bridge would carry southbound traffic and two-way light-rail tracks. Whereas the existing bridges each have three lanes with no shoulders, each of the two new bridges would be wide enough to accommodate three through lanes, one or two auxiliary lanes, and shoulders on both sides of the highway. Lanes and shoulders would be built to full design standards.

Figure 1-11. Columbia River Bridges (Subarea B)



As with the existing bridge (Figure 1-13), the new Columbia River bridges would provide three navigation channels: a primary navigation channel and two barge channels (see Figure 1-14). The current location of the primary navigation channel is near the Vancouver shoreline where the existing lift spans are located. Under the Modified LPA, the primary navigation channel would be shifted south approximately 500 feet (measured by channel centerlines), and the existing center barge channel would shift north and become the north barge channel. The new primary navigation channel would be 400 feet wide (this width includes a 300-foot congressionally or USACE-authorized channel plus a 50-foot channel maintenance buffer on each side of the authorized channel) and the two barge channels would also each be 400 feet wide.

Figure 1-12. Bridge Foundation Concept



The existing Interstate Bridge has nine in-water pier sets,[7] whereas the new Columbia River bridges (any bridge configuration) would be built on six in-water pier sets, plus multiple piers on land (pier locations are shown on Figure 1-14). Each in-water pier set would be supported by a foundation of drilled shafts; each group of shafts would be tied together with a concrete shaft cap. Columns or pier walls would rise from the shaft caps and connect to the superstructures of the bridges (see Figure 1-12).

BRIDGE CONFIGURATIONS

Three bridge configurations are being considered: (1) double-deck fixed-span (with one bridge type), (2) a single-level fixed-span (with three potential bridge types), and (3) a single-level movable-span (with one bridge type). Both the double-deck and single-level fixed-span configurations would provide 116 feet of vertical navigation clearance at their respective highest spans; the same as the CRC LPA. The CRC LPA included a double-deck fixed-span bridge configuration. The single-level fixed-span configuration was developed and is being considered as part of the IBR Program in response to physical and contextual changes (i.e., design and operational considerations) since 2013 that necessitated examination of a refinement in the double-deck bridge configuration (e.g., ingress and egress of transit from the lower level of the double-deck fixed-span configuration on the north end of the southbound bridge).

[7] A pier set consists of the pier supporting the northbound bridge and the pier supporting the southbound bridge at a given location.

Consideration of the single-level movable-span configuration as part the IBR Program was necessitated by the U.S. Coast Guard's (USCG) review of the Program's navigation impacts on the Columbia River and issuance of a Preliminary Navigation Clearance Determination (PNCD) (USCG 2022). The USCG PNCD set the preliminary vertical navigation clearance recommended for the issuance of a bridge permit at 178 feet; this is the current vertical navigation clearance of the Interstate Bridge.

The IBR Program is carrying forward the three bridge configurations to address changed conditions, including changes in the USCG bridge permitting process, in order to ensure a permittable bridge configuration is within the range of options considered. The IBR Program continues to refine the details supporting navigation impacts and is coordinating closely with the USCG to determine how a fixed-span bridge may be permittable. Although the fixed-span configurations do not comply with the current USCG PNCD, they do meet the Purpose and Need and provide potential improvements to traffic (passenger vehicle and freight), transit, and active transportation operations.

Each of the bridge configurations assumes one auxiliary lane; two auxiliary lanes could be applied to any of the bridge configurations. All typical sections for the one auxiliary lane option would provide 14-foot shoulders to maintain traffic during construction of the Modified LPA and future maintenance.

Figure 1-13. Existing Navigation Clearances of the Interstate Bridge

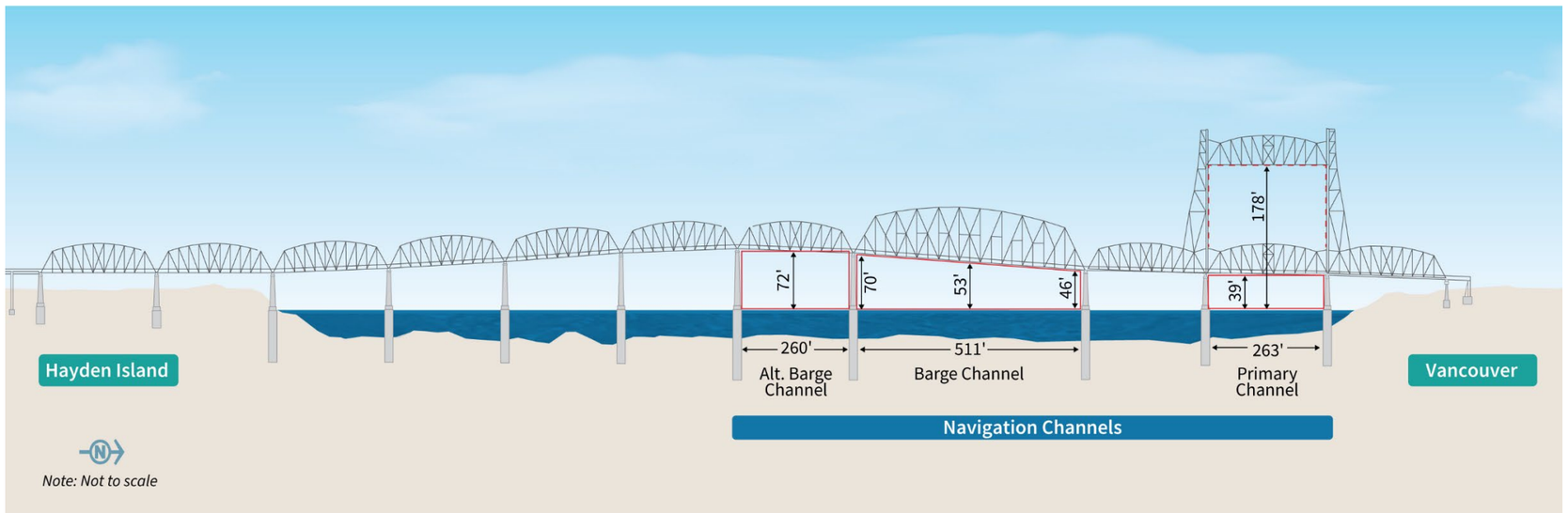
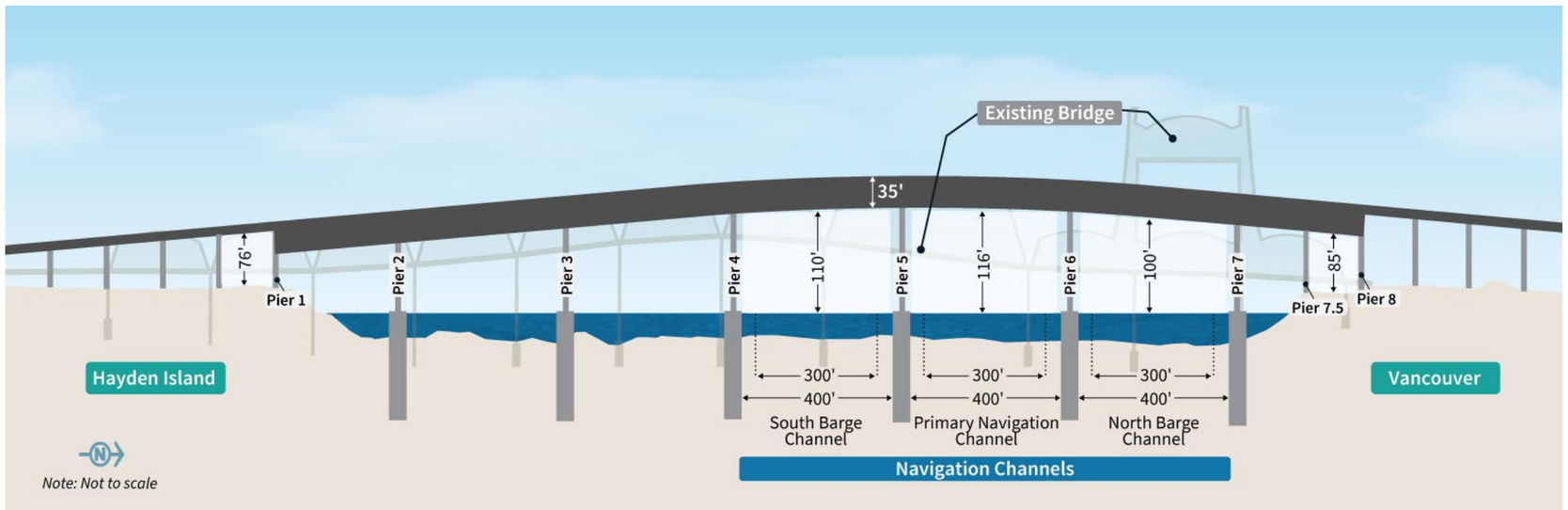


Figure 1-14. Profile and Navigation Clearances of the Proposed Modified LPA Columbia River Bridges with a Double-Deck Fixed-Span Configuration



Note: The location and widths of the proposed navigation channels would be same for all bridge configuration and bridge type options. The three navigation channels would each be 400 feet wide (this width includes a 300-foot congressionally or USACE-authorized channel (shown in dotted lines) plus a 50-foot channel maintenance buffer on each side of the authorized channel). The vertical navigation clearance would vary

Double-Deck Fixed-Span Configuration

The double-deck fixed-span configuration would be two side-by-side, double-deck, fixed-span steel truss bridges. Figure 1-15 is an example of this configuration (this image is subject to change and is shown as a representative concept; it does not depict the final design). The double-deck fixed-span configuration would provide 116 feet of vertical navigation clearance for river traffic using the primary navigation channel and 400 feet of horizontal navigation clearance at the primary navigation channel, as well as barge channels. This bridge height would not impede takeoffs and landings by aircraft using Pearson Field or Portland International Airport.

The eastern bridge would accommodate northbound highway traffic on the upper level and the shared-use path and utilities on the lower level. The western bridge would carry southbound traffic on the upper level and two-way light-rail tracks on the lower level. Each bridge deck would be 79 feet wide, with a total out-to-out width of 173 feet.[8]

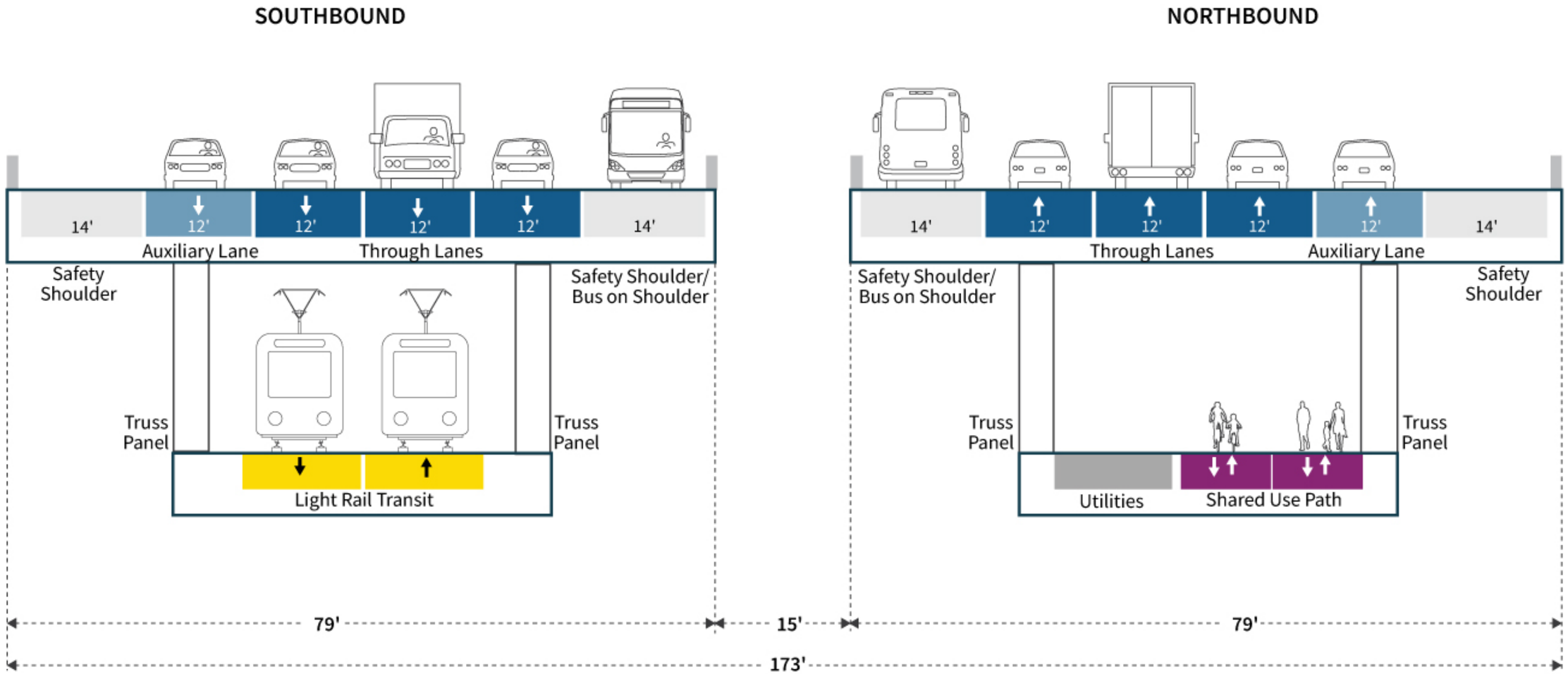
Figure 1-15. Conceptual Drawing of a Double-Deck Fixed-Span Configuration

Note: Visualization is looking southwest from Vancouver.

Figure 1-16 is a cross section of the two parallel double-deck bridges. Like all bridge configurations, the double-deck fixed-span configuration would have six in-water pier sets. Each pier set would require 12 in-water drilled shafts, for a total of 72 in-water drilled shafts. Each individual shaft cap would be approximately 50 feet by 85 feet. This bridge configuration would have a 3.8% maximum grade on the Oregon side of the bridge and a 4% maximum grade on the Washington side.

[8] "Out-to-out width" is the measurement between the outside edges of the bridge across its width at the widest point.

Figure 1-16. Cross Section of the Double-Deck Fixed-Span Configuration



Single-Level Fixed-Span Configuration

The single-level fixed-span configuration would have two side-by-side, single-level, fixed-span steel or concrete bridges. This report considers three single-level fixed-span bridge type options: a girder bridge, an extradosed bridge, and a finback bridge. The description in this section applies to all three bridge types (unless otherwise indicated). Conceptual examples of each of these options are shown on Figure 1-17. These images are subject to change and do not represent final design.

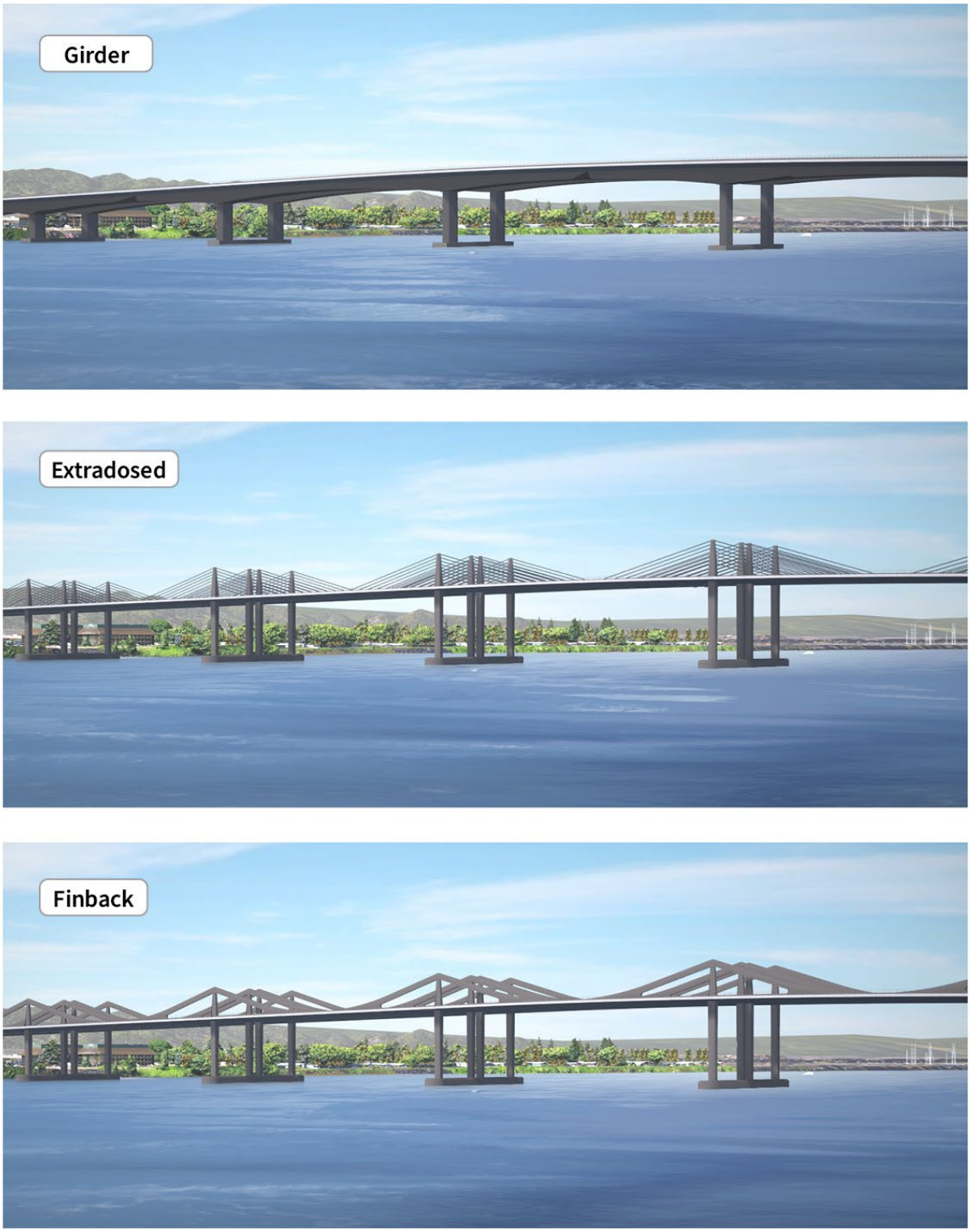
This configuration would provide 116 feet of vertical navigation clearance for river traffic using the primary navigation channel and 400 feet of horizontal navigation clearance at the primary navigation channel, as well as barge channels. This bridge height would not impede takeoffs and landings by aircraft using Pearson Field or Portland International Airport.

The eastern bridge would accommodate northbound highway traffic and the shared-use path; the bridge deck would be 104 feet wide. The western bridge would carry southbound traffic and two-way light-rail tracks; the bridge deck would be 113 feet wide. The I-5 highway, light-rail tracks, and the shared-use path would be on the same level across the two bridges, instead of being divided between two levels with the double-deck configuration. The total out-to-out width of the single-level fixed-span configuration (extradosed or finback options) would be 272 feet at its widest point, approximately 99 feet wider than the double-deck configuration. The total out-to-out width of the single-level fixed-span configuration (girder option) would be 232 feet at its widest point. Figure 1-18 shows a typical cross section of the single-level configuration. This cross section is a representative example of an extradosed or finback bridge as shown by the 10-foot-wide superstructure above the bridge deck; the girder bridge would not have the 10-foot-wide bridge columns shown on Figure 1-18.

There would be six in-water pier sets with 16 in-water drilled shafts on each combined shaft cap, for a total of 96 in-water drilled shafts. The combined shaft caps for each pier set would be 50 feet by 230 feet.

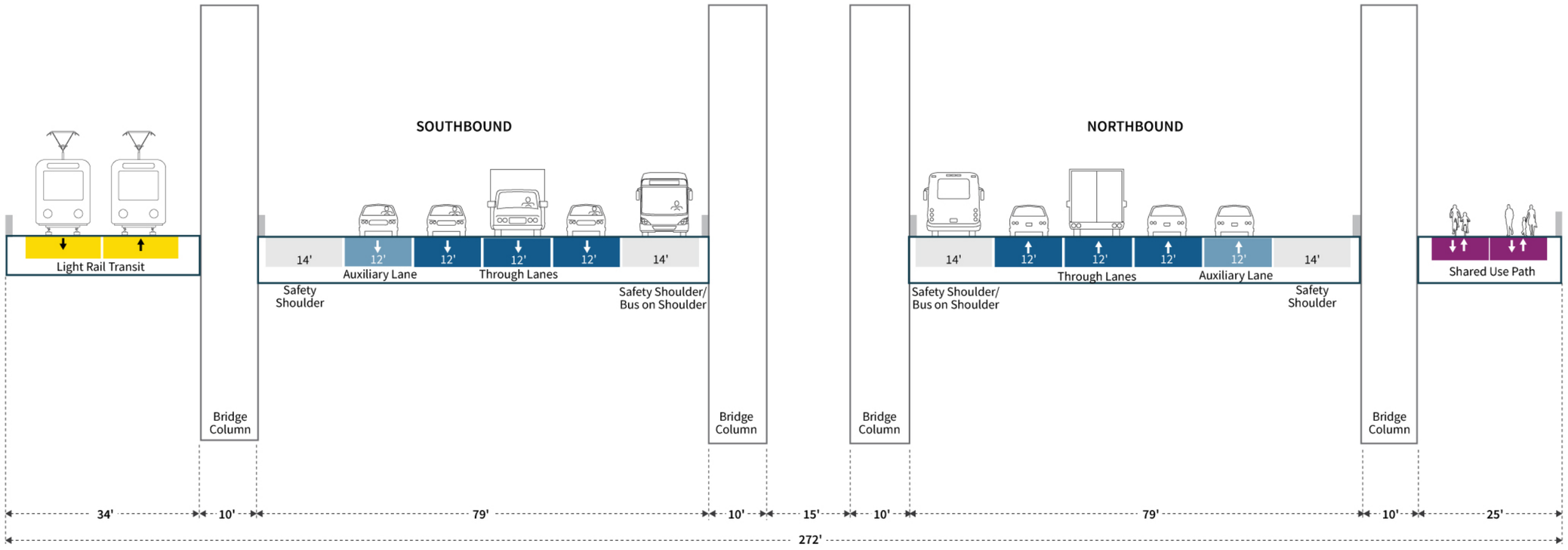
This bridge configuration would have a 3% maximum grade on both the Oregon and Washington sides of the bridge.

Figure 1-17. Conceptual Drawings of Single-Level Fixed-Span Bridge Types



Note: Visualizations are for illustrative purposes only. They do not reflect property impacts or represent final design. Visualization is looking southwest from Vancouver.

Figure 1-18. Cross Section of the Single-Level Fixed-Span Configuration (Extradosed or Finback Bridge Types)



Note: The cross section for a girder type bridge would be the same except that it would not have the four 10-foot bridge columns making the total out-to-out width 232 feet.

Single-Level Movable-Span Configuration

The single-level movable-span configuration would have two side-by-side, single-level steel girder bridges with movable spans between Piers 5 and 6. For the purpose of this report, the IBR Program assessed a vertical lift span movable-span configuration with counterweights based on the analysis in the *River Crossing Bridge Clearance Assessment Report – Movable-Span Options,* included as part of Attachment C in Appendix D, Design Options Development, Screening, and Evaluation Technical Report. A conceptual example of a vertical lift-span bridge is shown in Figure 1-19. These images are subject to change and do not represent final design.

A movable span must be located on a straight and flat bridge section (i.e., without curvature and with minimal slope). To comply with these requirements, and for the bridge to maintain the highway, transit, and active transportation connections on Hayden Island and in Vancouver while minimizing property acquisitions and displacements, the movable span is proposed to be located 500 feet south of the existing lift span, between Piers 5 and 6. To accommodate this location of the movable span, the IBR Program is coordinating with USACE to obtain authorization to change the location of the primary navigation channel, which currently aligns with the Interstate Bridge lift spans near the Washington shoreline.

The single-level movable-span configuration would provide 92 feet of vertical navigation clearance over the proposed relocated primary navigation channel when the movable spans are in the closed position, with 99 feet of vertical navigation clearance available over the north barge channel. The 92-foot vertical clearance is based on achieving a straight, movable span and maintaining an acceptable grade for transit operations. In addition, it satisfies the requirement of a minimum of 72 feet of vertical navigation clearance (the existing Interstate Bridge's maximum clearance over the alternate (southernmost) barge channel when the existing lift span is in the closed position).

In the open position, the movable span would provide 178 feet of vertical navigation clearance over the proposed relocated primary navigation channel.

Similar to the fixed-span configurations, the movable span would provide 400 feet of horizontal navigation clearance for the primary navigation channel and for each of the two barge channels.

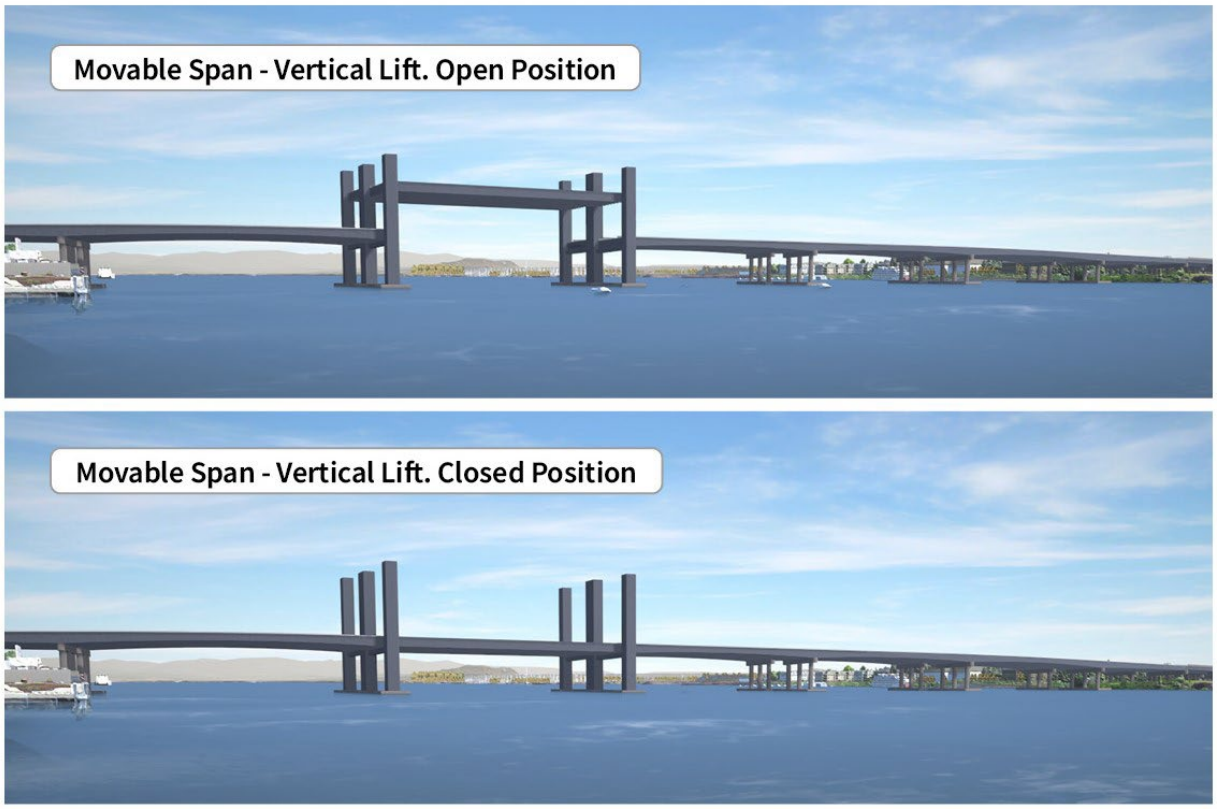
The vertical lift-span towers would be approximately 243 feet high; this is shorter than the existing lift-span towers, which are 247 feet high. This height of the vertical lift-span towers would not impede takeoffs and landings by aircraft using Portland International Airport. At Pearson Field, the Federal Aviation Administration issues obstacle departure procedures to avoid the existing Interstate Bridge lift towers; the single-level movable-span configuration would retain the same procedures.

Similar to the single-level fixed-span configuration, the eastern bridge would accommodate northbound highway traffic and the shared-use path, and the western bridge would carry southbound traffic and two-way light-rail tracks. The I-5 highway, light-rail tracks, and shared-use path would be on the same level across the bridges instead of on two levels as with the double-deck configuration. Cross sections of the single-level movable-span configuration are shown in Figure 1-20; the top cross section depicts the vertical lift spans (Piers 5 and 6), and the bottom cross section depicts the fixed spans (Piers 2, 3, 4, and 7). The movable and fixed cross sections are slightly different because the movable span requires lift towers, which are not required for the other fixed spans of the bridges.

There would be six in-water pier sets and two piers on land per bridge. The vertical lift span would have 22 in-water drilled shafts each for Piers 5 and 6; the shaft caps for these piers would be 50 feet by 312 feet to accommodate the vertical lift spans. Piers 2, 3, 4, and 7 would have 16 in-water drilled shafts each; the shaft caps for these piers would be the same as for the fixed-span options (50 feet by 230 feet). The vertical lift-span configuration would have a total of 108 in-water drilled shafts.

This single-level movable-span configuration would have a 3% maximum grade on the Oregon side of the bridge and a 1.5% maximum grade on the Washington side.

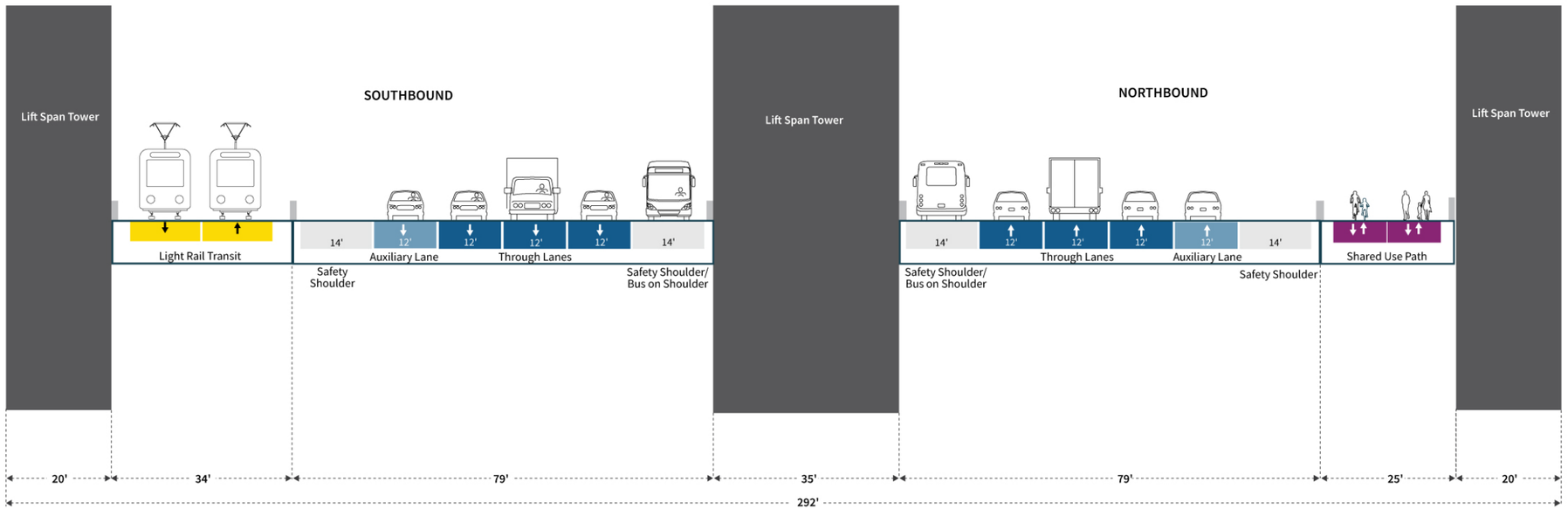
Figure 1-19. Conceptual Drawings of Single-Level Movable-Span Configurations in the Closed and Open Positions



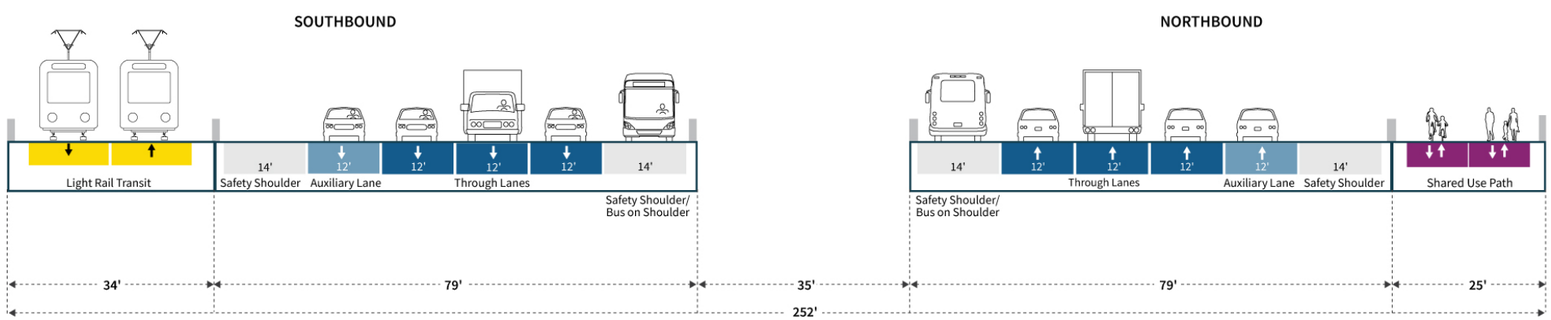
Note: Visualizations are for illustrative purposes only. They do not reflect property impacts or represent final design. Visualization is looking southeast (upstream) from Vancouver.

Figure 1-20. Cross Section of the Single-Level Movable-Span Bridge Type

Single-level Bridge with Movable Span - Vertical Lift Span Cross-section (Piers 5 and 6)



Single-level Bridge with Movable Span - Fixed Spans Cross-section (Piers 2, 3, 4, and 7)



Summary of Bridge Configurations

This section summarizes and compares each of the bridge configurations. Table 1-2 lists the key considerations for each configuration. Figure 1-21 compares each configuration's footprint. The footprints of each configuration would differ in only three locations: over the Columbia River and at the bridge landings on Hayden Island and Vancouver. The rest of the I-5 corridor would have the same footprint. Over the Columbia River, the footprint of the double-deck fixed-span configuration would be 173 feet wide. Comparatively, the finback or extradosed bridge types of the single-level fixed-span configuration would be 272 feet wide (approximately 99 feet wider), and the single-level fixed-span configuration with a girder bridge type would be 232 feet wide (approximately 59 feet wider). The single-level movable-span configuration would be 252 feet wide (approximately 79 feet wider than the double-deck fixed-span configuration), except at Piers 5 and 6, where larger bridge foundations would require an additional 40 feet of width to support the movable span. The single-level configurations would have a wider footprint at the bridge landings on Hayden Island and Vancouver because transit and active transportation would be located adjacent to the highway, rather than below the highway in the double-deck option.

Figure 1-22 compares the basic profile of each configuration. The lower deck of the double-deck fixed-span and the single-level fixed-span configuration would have similar profiles. The single-level movable-span configuration would have a lower profile than the fixed-span configurations when the span is in the closed position.

This section summarizes and compares each of the bridge configurations. Table 1-2 lists the key considerations for each configuration. Figure 1-21 compares each configuration's footprint. The footprints of each configuration would differ in only three locations: over the Columbia River and at the bridge landings on Hayden Island and Vancouver. The rest of the I-5 corridor would have the same footprint. Over the Columbia River, the footprint of the double-deck fixed-span configuration would be 173 feet wide. Comparatively, the finback or extradosed bridge types of the single-level fixed-span configuration would be 272 feet wide (approximately 99 feet wider), and the single-level fixed-span configuration with a girder bridge type would be 232 feet wide (approximately 59 feet wider). The single-level movable-span configuration would be 252 feet wide (approximately 79 feet wider than the double-deck fixed-span configuration), except at Piers 5 and 6, where larger bridge foundations would require an additional 40 feet of width to support the movable span. The single-level configurations would have a wider footprint at the bridge landings on Hayden Island and Vancouver because transit and active transportation would be located adjacent to the highway, rather than below the highway in the double-deck option.

Figure 1-22 compares the basic profile of each configuration. The lower deck of the double-deck fixed-span and the single-level fixed-span configuration would have similar profiles. The single-level movable-span configuration would have a lower profile than the fixed-span configurations when the span is in the closed position.

Figure 1-21. Bridge Configuration Footprint Comparison

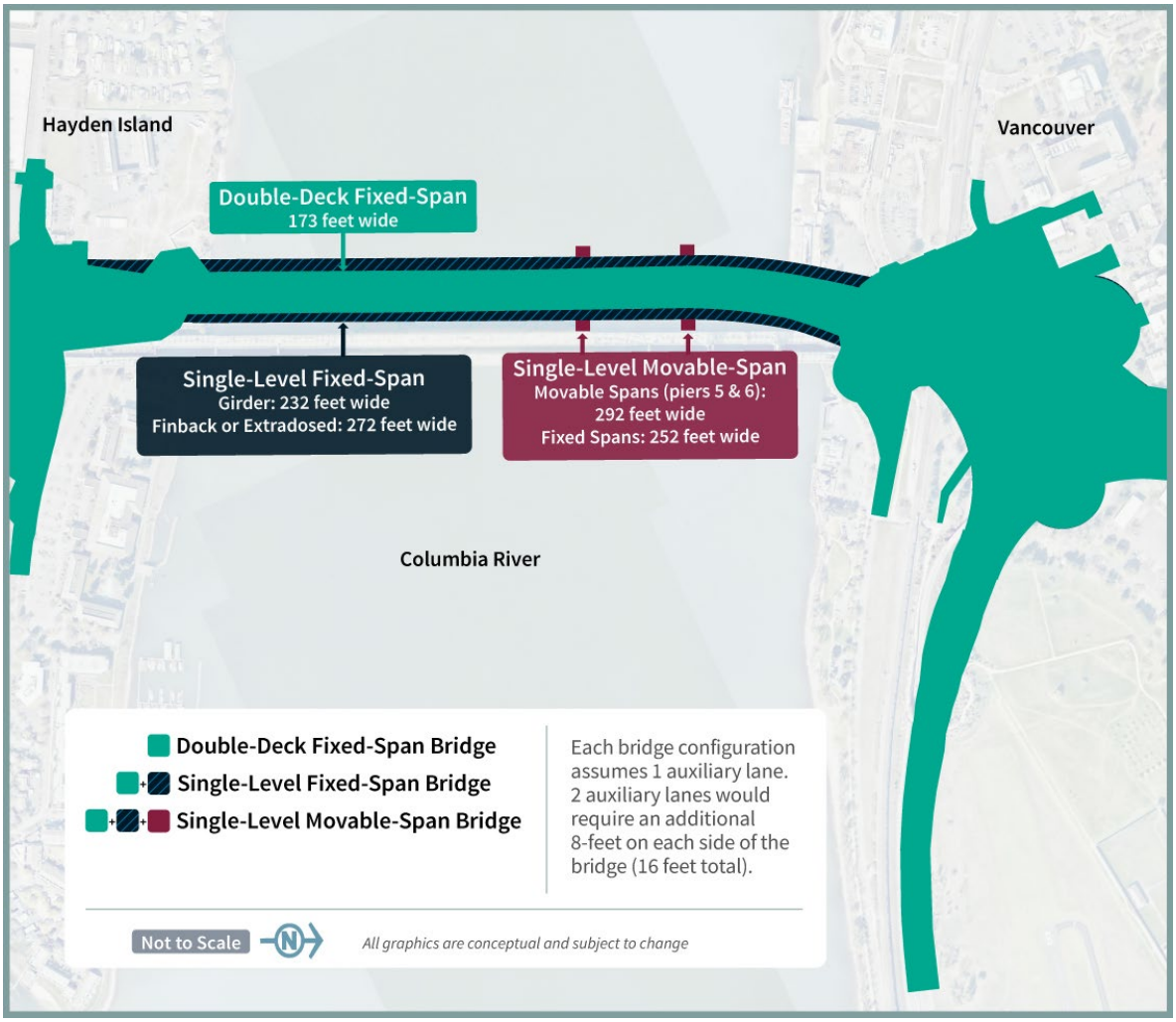


Figure 1-22. Bridge Configuration Profile Comparison

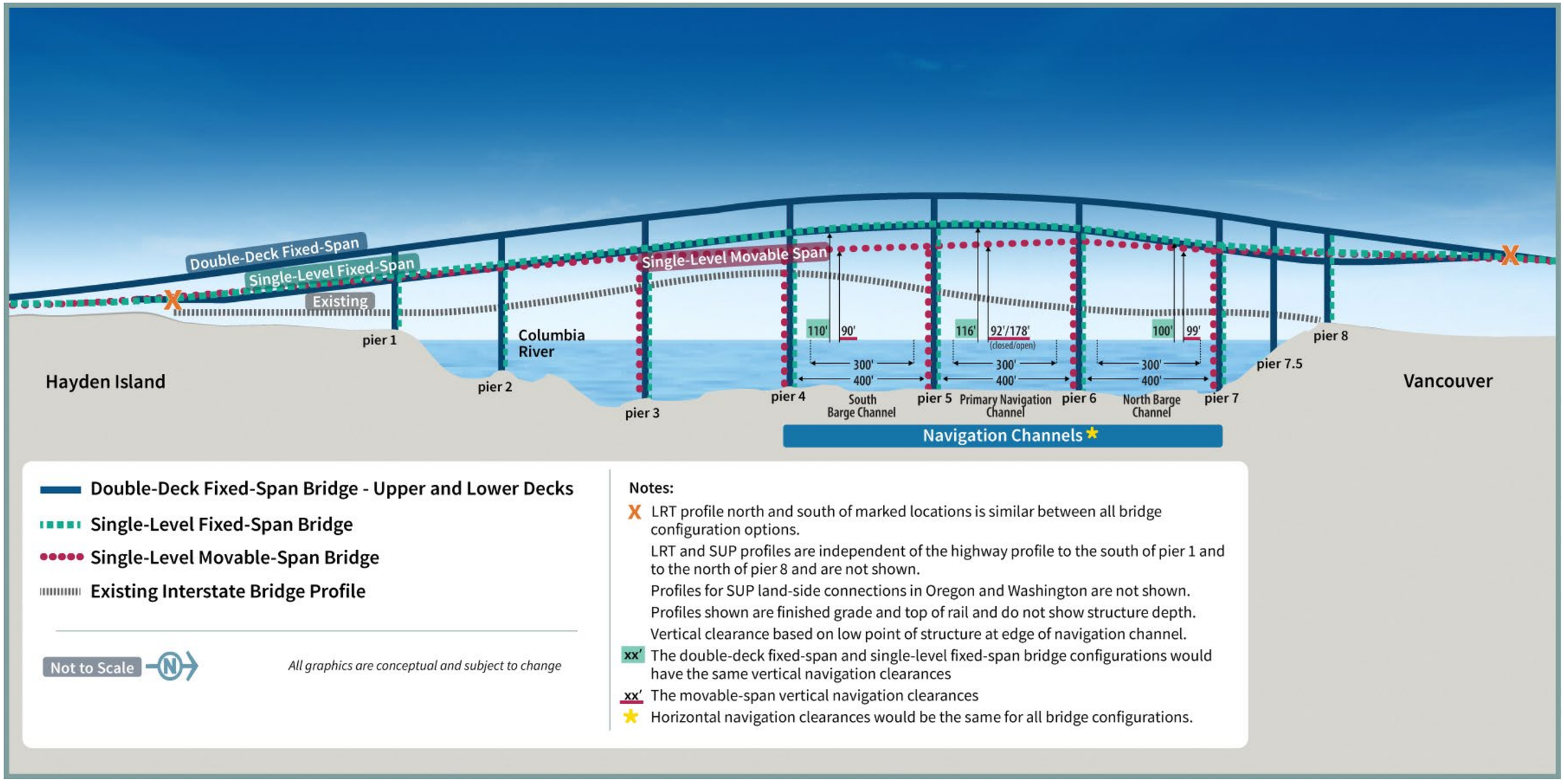


Table 1-2. Summary of Bridge Configurations

	No-Build Alternative	Modified LPA with Double-Deck Fixed-Span Configuration	Modified LPA with Single-Level Fixed-Span Configuration [a]	Modified LPA with Single-Level Movable-Span Configuration
Bridge type	Steel through-truss spans.	Double-deck steel truss.	Single-level, concrete or steel girders, extradosed or finback.	Single-level, steel girders with vertical lift span.
Number of bridges	Two	Two	Two	Two
Movable-span type	Vertical lift span with counterweights.	N/A	N/A	Vertical lift span with counterweights.
Movable-span location	Adjacent to Vancouver shoreline.	N/A	N/A	Between Piers 5 and 6 (approximately 500 feet south of the existing lift span).
Lift opening restrictions	Weekday peak AM and PM highway travel periods. [b]	N/A	N/A	Additional restrictions to daytime bridge openings; requires future federal rulemaking process and authorization by USCG (beyond the assumed No-Build Alternative bridge restrictions for peak AM and PM highway travel periods).[b] Typical opening durations are assumed to be 9 to 18 minutes [c] for the purposes of impact analysis but would ultimately depend on various operational considerations related to vessel traffic and river and weather conditions. Additional time would also be required to stop traffic prior to opening and restart traffic after the bridge closes.

	No-Build Alternative	Modified LPA with Double-Deck Fixed-Span Configuration	Modified LPA with Single-Level Fixed-Span Configuration [a]	Modified LPA with Single-Level Movable-Span Configuration
Out-to-out width [d]	138 feet total width.	173 feet total width.	Girder: 232 feet total width. Extradosed/Finback: 272 feet total width.	• 292 feet at the movable span. • 252 feet at the fixed spans.
Deck widths	52 feet (SB) 52 feet (NB)	79 feet (SB) 79 feet (NB)	Girder: • 113 feet (SB) • 104 feet (NB) Extradosed/Finback: • 133 feet (SB) • 124 feet (NB)	113 feet SB fixed span. 104 feet NB fixed span.
Vertical navigation clearance	Primary navigation channel: • 39 feet when closed. • 178 feet when open. Barge channel: • 46 feet to 70 feet. Alternate barge channel: • 72 feet (maximum clearance without opening).	Primary navigation channel: • 116 feet maximum. North barge channel: • 100 feet maximum. South barge channel: • 110 feet maximum.	Primary navigation channel: • 116 feet maximum. North barge channel: • 100 feet maximum. South barge channel: • 110 feet maximum.	Primary navigation channel: • Closed position: 92 feet. • Open position: 178 feet. North barge channel: • 99 feet maximum. South barge channel: • 90 feet maximum.
Horizontal navigation clearance	263 feet for primary navigation channel. 511 feet for barge channel. 260 feet for alternate barge channel.	400 feet for all navigation channels (300-foot congressionally or USACE-authorized channel plus a 50-foot channel maintenance buffer on each side).	400 feet for all navigation channels (300-foot congressionally or USACE-authorized channel plus a 50-foot channel maintenance buffer on each side).	400 feet for all navigation channels (300-foot congressionally or USACE-authorized channel plus a 50-foot channel maintenance buffer on each side).

	No-Build Alternative	Modified LPA with Double-Deck Fixed-Span Configuration	Modified LPA with Single-Level Fixed-Span Configuration [a]	Modified LPA with Single-Level Movable-Span Configuration
Maximum elevation of bridge component (NAVD 88)[e]	247 feet at top of lift tower.	166 feet.	Girder: 137 feet. Extradosed/Finback: 179 feet at top of pylons.	243 feet at top of lift tower.
Movable span length (from center of pier to center of pier)	278 feet.	N/A	N/A	450 feet.
Number of in-water pier sets	Nine	Six	Six	Six
Number of in-water drilled shafts	N/A	72	96	108
Shaft cap sizes	N/A	50 feet by 85 feet.	50 feet by 230 feet.	Piers 2, 3, 4, and 7: 50 feet by 230 feet. Piers 5 and 6: 50 feet by 312 feet (one combined footing at each location to house tower/equipment for the lift span).
Maximum grade	5%	4% on the Washington side. 3.8% on the Oregon side.	3% on the Washington side. 3% on the Oregon side.	1.5% on the Washington side. 3% on the Oregon side.
Light-rail transit location	N/A	Below highway on SB bridge.	West of highway on SB bridge.	West of highway on SB bridge.
Express bus	Shared roadway lanes.	Inside shoulder of NB and SB (upper) bridges.	Inside shoulder of NB and SB bridges.	Inside shoulder of NB and SB bridges.

	No-Build Alternative	Modified LPA with Double-Deck Fixed-Span Configuration	Modified LPA with Single-Level Fixed-Span Configuration [a]	Modified LPA with Single-Level Movable-Span Configuration
Shared-use path location	Sidewalk adjacent to roadway in both directions.	Below highway on NB bridge.	East of highway on NB bridge.	East of highway on NB bridge.

a When different bridge types are not mentioned, data applies to all bridge types under the specified bridge configuration.

b The No-Build Alternative assumes existing conditions that restrict bridge openings during weekday peak periods (Monday through Friday 6:30 a.m. to 9 a.m.; 2:30 p.m. to 6 p.m., excluding federal holidays). This analysis estimates the potential frequency for bridge openings for vessels requiring more than 99 feet of clearance.

c For the purposes of the transportation analysis (see the Transportation Technical Report), the movable-span opening time is assumed to be an average of 12 minutes.

d "Out-to-out width" is the measurement between the outside edges of the bridge across its width at the widest point.

e NAVD 88 (North American Vertical Datum of 1988) is a vertical control datum (reference point) used by federal agencies for surveying.

NB = northbound; SB = southbound; USCG = U.S. Coast Guard

1.1.4 Downtown Vancouver (Subarea C)

This section discusses the geographic Subarea C shown in Figure 1-3. See Figure 1-23 for all highway and interchange improvements in Subarea C. Refer to Figure 1-3 for an overview of the geographic subareas.

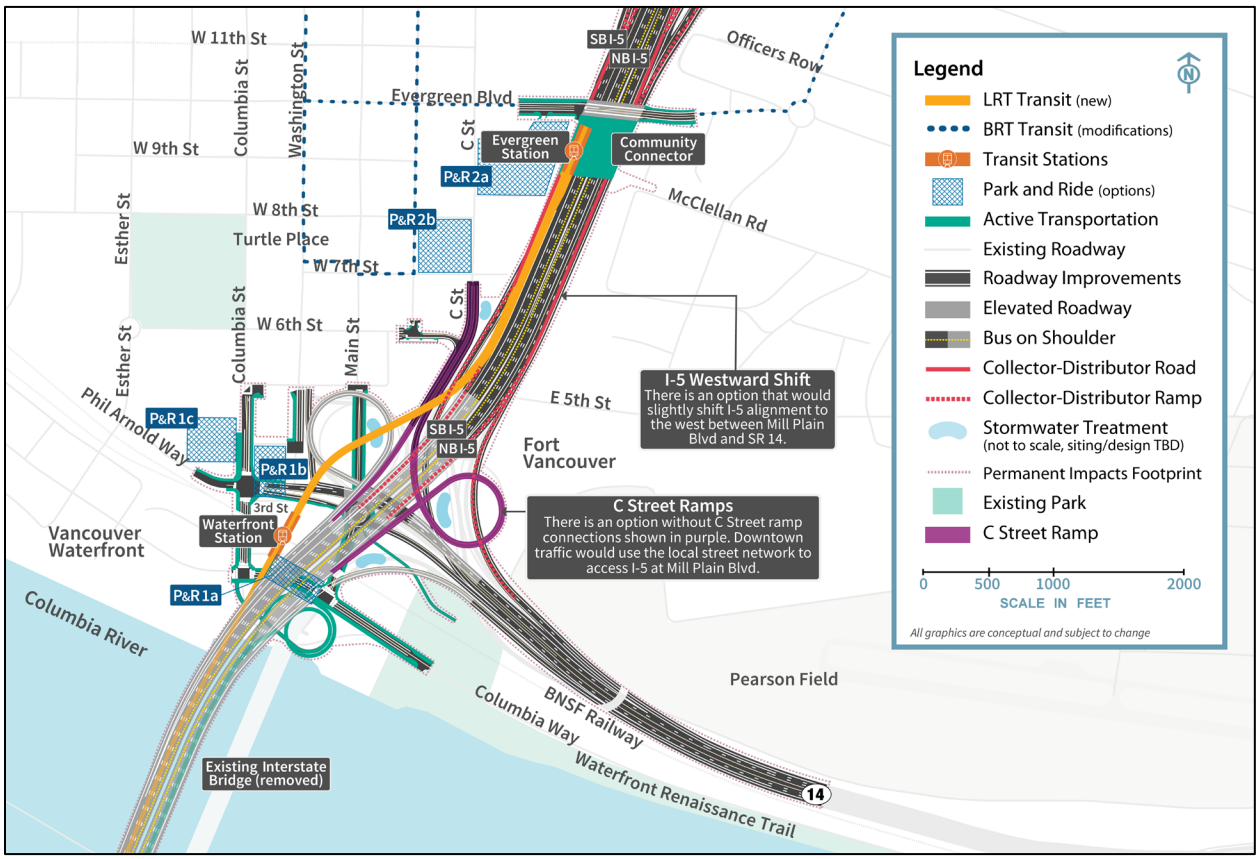
1.1.4.1 Highways, Interchanges, and Local Roadways

North of the Columbia River bridges in downtown Vancouver, improvements are proposed to the SR 14 interchange (Figure 1-23).

SR 14 INTERCHANGE

The new Columbia River bridges would touch down just north of the SR 14 interchange (Figure 1-23). The function of the SR 14 interchange would remain essentially the same as it is now, although the interchange would be elevated. Direct connections between I-5 and SR 14 would be rebuilt. Access to and from downtown Vancouver would be provided as it is today, but the connection points would be relocated. Downtown Vancouver I-5 access to and from the south would be at C Street as it is today, while downtown connections to and from SR 14 would be from Columbia Street at 3rd Street.

Figure 1-23. Downtown Vancouver (Subarea C)



BRT = bus rapid transit; LRT = light-rail transit; NB = northbound; P&R = park and ride; SB = southbound

Main Street would be extended between 5th Street and Columbia Way. Vehicles traveling from downtown Vancouver to access SR 14 eastbound would use the new extension of Main Street to the roundabout underneath I-5. If coming from the west or south (waterfront) in downtown Vancouver, vehicles would use the Phil Arnold Way/3rd Street extension to the roundabout, then continue to SR 14 eastbound. The existing Columbia Way roadway under I-5 would be realigned to the north of its existing location and would intersect both the new Main Street extension and Columbia Street with T intersections.

In addition, the existing overcrossing of I-5 at Evergreen Boulevard would be reconstructed.

Design Option Without C Street Ramps

Under this design option, downtown Vancouver I-5 access to and from the south would be through the Mill Plain interchange rather than C Street. There would be no eastside loop ramp from I-5 northbound to C Street and no directional ramp on the west side of I-5 from C Street to I-5 southbound. The existing eastside loop ramp would be removed. This design option has been included because of changes in local planning that necessitate consideration of design options that reduce the footprint and associated direct and temporary environmental impacts in Vancouver.

Design Option to Shift I-5 Westward

This design option would shift the I-5 mainline and ramps approximately 40 feet to the west between SR 14 and Mill Plain Boulevard. The westward I-5 alignment shift could also be paired with the design option without C Street ramps. The inclusion of this design option is due to changes in local planning, which necessitate consideration of design options that that shifts the footprint and associated direct and temporary environmental impacts in Vancouver.

1.1.4.2 Transit

LIGHT-RAIL ALIGNMENT AND STATIONS

Under the Modified LPA, the light-rail tracks would exit the highway bridge and be on their own bridge along the west side of the I-5 mainline after crossing the Columbia River (see Figure 1-23). The light-rail bridge would cross approximately 35 feet over the BNSF Railway tracks. An elevated light-rail station near the Vancouver waterfront (Waterfront Station) would be situated near the overcrossing of the BNSF tracks between Columbia Way and 3rd Street. Access to the elevated station would be primarily by elevator as the station is situated approximately 75 feet above existing ground level. A stairwell(s) would be provided for emergency egress. The number of elevators and stairwells provided would be based on the ultimate platform configuration, station location relative to the BNSF trackway, projected ridership, and fire and life safety requirements. Passenger drop-off facilities would be located at ground level and would be coordinated with the C-TRAN bus service at this location. The elevated light-rail tracks would continue north, cross over the westbound SR 14 on-ramp and the C Street/6th Street on-ramp to southbound I-5, and then straddle the southbound I-5 C-D roadway. Transit components in the downtown Vancouver area are similar between the two SR 14 interchange area design options discussed above.

North of the Waterfront Station, the light-rail tracks would continue to the Evergreen Station, which would be the terminus of the light-rail extension (see Figure 1-23). The light-rail tracks from

downtown Vancouver to the terminus would be entirely on an elevated structure supported by single columns, where feasible, or by columns on either side of the roadway where needed. The light-rail tracks would be a minimum of 27 feet above the I-5 roadway surface. The Evergreen Station would be located at the same elevation as Evergreen Boulevard, on the proposed Community Connector, and it would provide connections to C-TRAN's existing BRT system. Passenger drop-off facilities would be near the station and would be coordinated with the C-TRAN bus service at this location.

PARK AND RIDES

Up to two park and rides could be built in Vancouver along the light-rail alignment: one near the Waterfront Station and one near the Evergreen Station. Additional information regarding the park and rides can be found in the Transportation Technical Report.

> Park and rides can expand the catchment area of public transit systems, making transit more accessible to people who live farther away from fixed-route transit service, and attracting new riders who might not have considered using public transit otherwise.

Waterfront Station Park-and-Ride Options

There are three site options for the park and ride near the Waterfront Station (see Figure 1-23). Each would accommodate up to 570 parking spaces.

1. Columbia Way (below I-5). This park-and-ride site would be a multilevel aboveground structure located below the new Columbia River bridges, immediately north of a realigned Columbia Way.
2. Columbia Street/SR 14. This park-and-ride site would be a multilevel aboveground structure located along the east side of Columbia Street. It could span across (or over) the SR 14 westbound off-ramp to provide parking on the north and south sides of the off-ramp.
3. Columbia Street/Phil Arnold Way (Waterfront Gateway Site). This park-and-ride site would be located along the west side of Columbia Street immediately north of Phil Arnold Way. This park and ride would be developed in coordination with the City of Vancouver's Waterfront Gateway program and could be a joint-use parking facility not constructed exclusively for park-and-ride users.

Evergreen Station Park-and-Ride Options

There are two site options for the park and ride near the Evergreen Station (see Figure 1-23).

1. Library Square. This park-and-ride site would be located along the east side of C Street and south of Evergreen Boulevard. It would accommodate up to 700 parking spaces in a multilevel belowground structure according to a future agreement on City-owned property associated with Library Square. Current design concepts suggest the park and ride most likely would be a joint-use parking facility for park-and-ride users and patrons of other uses on the ground or upper levels as negotiated as part of future decisions.
2. Columbia Credit Union. This park-and-ride site is an existing multistory garage that is located below the Columbia Credit Union office tower along the west side of C Street between 7th Street and 8th Street. The existing parking structure currently serves the office tower above it and the Regal City Center across the street. This would be a joint-use parking facility, not for the exclusive

use of park-and-ride users, that could serve as additional or overflow parking if the 700 required parking spaces cannot be accommodated elsewhere.

1.1.4.3 Active Transportation

Within the downtown Vancouver area, the shared-use path on the northbound (or eastern) bridge would exit the bridge at the SR 14 interchange, loop down on the east side of I-5 via a vertical spiral path, and then cross back below I-5 to the west side of I-5 to connect to the Waterfront Renaissance Trail on Columbia Street and into Columbia Way (see Figure 1-23). Access would be provided across state right of way beneath the new bridges to provide a connection between the recreational areas along the City's Columbia River waterfront east of the bridges and existing and future waterfront uses west of the bridges.

Active transportation components in the downtown Vancouver area would be similar without the C Street ramps and with the I-5 westward shift.

At Evergreen Boulevard, a community connector is proposed to be built over I-5 just south of Evergreen Boulevard and east of the Evergreen Station (see Figure 1-23). The structure is proposed to include off-street pathways for active transportation modes including pedestrians, bicyclists, and other micro-mobility modes, and public space and amenities to support the active transportation facilities. The primary intent of the Community Connector is to improve connections between downtown Vancouver on the west side of I-5 and the Vancouver National Historic Reserve on the east side.

1.1.5 Upper Vancouver (Subarea D)

This section discusses the geographic Subarea D shown in Figure 1-3. See Figure 1-24 for all highway and interchange improvements in Subarea D. Refer to Figure 1-3 for an overview of the geographic subareas.

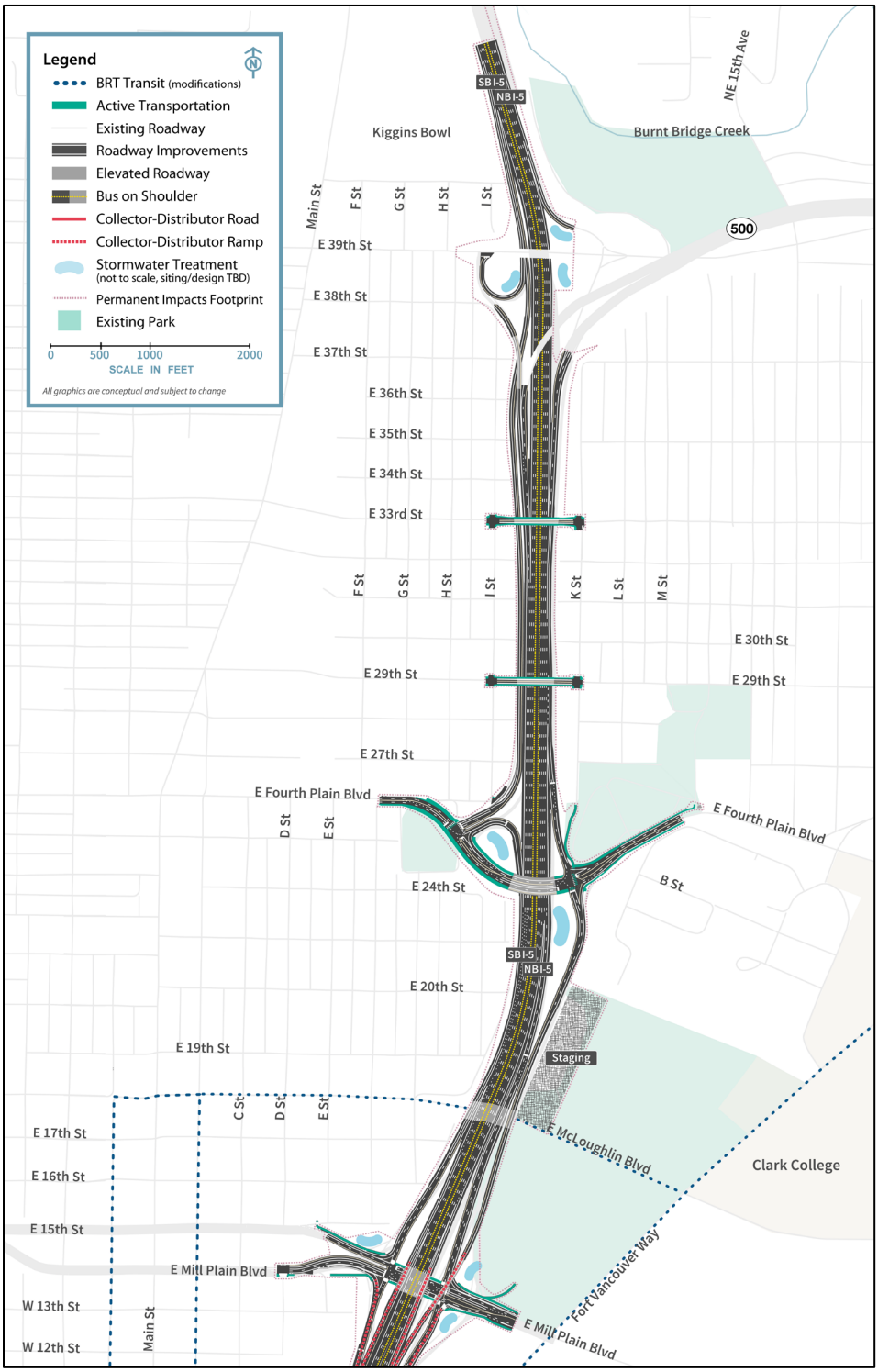
1.1.5.1 Highways, Interchanges, and Local Roadways

Within the upper Vancouver area, the IBR Program proposes improvements to three interchanges—Mill Plain, Fourth Plain, and SR 500—as described below.

MILL PLAIN BOULEVARD INTERCHANGE

The Mill Plain Boulevard interchange is north of the SR 14 interchange (see Figure 1-24). This interchange would be reconstructed as a tight-diamond configuration but would otherwise remain similar in function to the existing interchange. The ramp terminal intersections would be sized to accommodate high, wide heavy freight vehicles that travel between the Port of Vancouver and I-5. The off-ramp from I-5 northbound to Mill Plain Boulevard would diverge from the C-D road that would continue north, crossing over Mill Plain Boulevard, to provide access to Fourth Plain Boulevard via a C-D roadway. The off-ramp to Fourth Plain Boulevard would be reconstructed and would cross over Mill Plain Boulevard east of I-5, similar to the way it functions today.

Figure 1-24. Upper Vancouver (Subarea D)



BRT = bus rapid transit; TBD = to be determined

FOURTH PLAIN BOULEVARD INTERCHANGE

At the Fourth Plain Boulevard interchange (Figure 1-24), improvements would include reconstruction of the overpass of I-5 and the ramp terminal intersections. Northbound I-5 traffic exiting to Fourth Plain Boulevard would first exit to the northbound C-D roadway which provides off-ramp access to Fourth Plain Boulevard and Mill Plain Boulevard. The westbound SR 14 to northbound I-5 on-ramp also joins the northbound C-D roadway before continuing north past the Fourth Plain Boulevard and Mill Plain Boulevard off-ramps as an auxiliary lane. The southbound I-5 off-ramp to Fourth Plain Boulevard would be braided below the 39th Street on-ramp to southbound I-5. This change would eliminate the existing nonstandard weave between the SR 500 interchange and the off-ramp to Fourth Plain Boulevard. It would also eliminate the existing westbound SR 500 to Fourth Plain Boulevard off-ramp connection. The existing overcrossing of I-5 at 29th Street would be reconstructed to accommodate a widened I-5, provide adequate vertical clearance over I-5, and provide pedestrian and bicycle facilities.

SR 500 INTERCHANGE

The northern terminus of the I-5 improvements would be in the SR 500 interchange area (Figure 1-24). The improvements would primarily be to connect the Modified LPA to existing ramps. The off-ramp from I-5 southbound to 39th Street would be reconstructed to establish the beginning of the braided ramp to Fourth Plain Boulevard and restore the loop ramp to 39th Street. Ramps from existing I-5 northbound to SR 500 eastbound and from 39th Street to I-5 northbound would be partially reconstructed. The existing bridges for 39th Street over I-5 and SR 500 westbound to I-5 southbound would be retained. The 39th Street to I-5 southbound on-ramp would be reconstructed and braided over (i.e., grade separated or pass over) the new I-5 southbound off-ramp to Fourth Plain Boulevard.

The existing overcrossing of I-5 at 33rd Street would also be reconstructed to accommodate a widened I-5, provide adequate vertical clearance over I-5, and provide pedestrian and bicycle facilities.

1.1.5.2 Transit

There would be no LRT facilities in upper Vancouver. Proposed operational changes to bus service, including I-5 bus-on-shoulder service, are described in Section 1.1.7, Transit Operating Characteristics.

1.1.5.3 Active Transportation

Several active transportation improvements would be made in Subarea D consistent with City of Vancouver plans and policies. At the Fourth Plain Boulevard interchange, there would be improvements to provide better bicycle and pedestrian mobility and accessibility; these include bicycle lanes, neighborhood connections, and a connection to the City of Vancouver's planned two-way cycle track on Fourth Plain Boulevard. The reconstructed overcrossings of I-5 at 29th Street and 33rd Street would provide pedestrian and bicycle facilities on those cross streets. No new active transportation facilities are proposed in the SR 500 interchange area. Active transportation improvements at the Mill Plain Boulevard interchange include buffered bicycle lanes and sidewalks, pavement markings, lighting, and signing.

1.1.6 Transit Support Facilities

1.1.6.1 Ruby Junction Maintenance Facility Expansion

The TriMet Ruby Junction Maintenance Facility in Gresham, Oregon, would be expanded to accommodate the additional LRVs associated with the Modified LPA's LRT service (the Ruby Junction location relative to the study area is shown in Figure 1-25). Improvements would include additional storage for LRVs and maintenance materials and supplies, expanded LRV maintenance bays, expanded parking and employee support areas for additional personnel, and a third track at the northern entrance to Ruby Junction. Figure 1-25 shows the proposed footprint of the expansion.

The existing main building would be expanded west to provide additional maintenance bays. To make space for the building expansion, Eleven Mile Avenue would be vacated and would terminate in a new cul-de-sac west of the main building. New access roads would be constructed to maintain access to TriMet buildings south of the cul-de-sac.

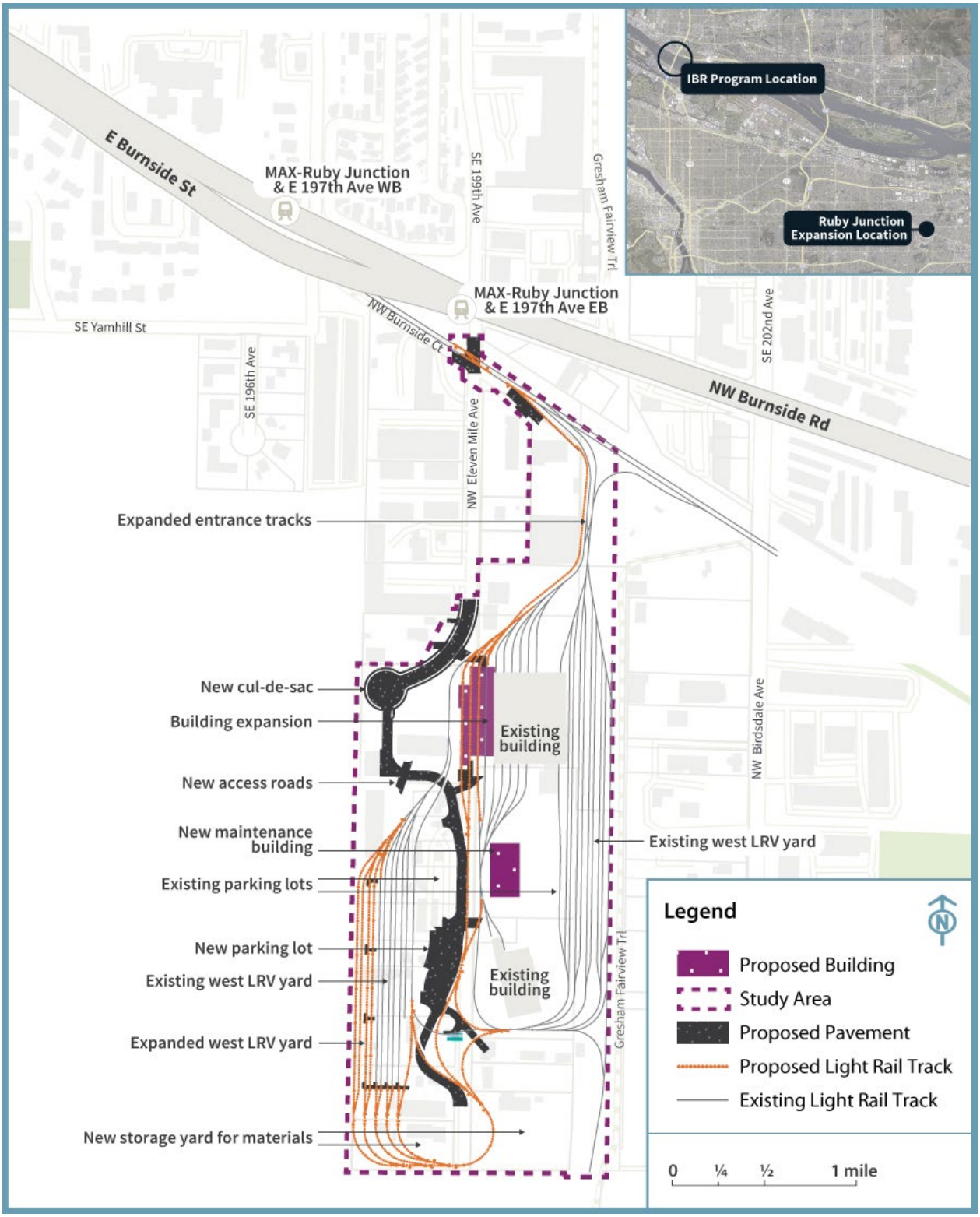
The existing LRV storage yard, west of Eleven Mile Avenue, would be expanded to the west to accommodate additional storage tracks and a runaround track (a track constructed to bypass congestion in the maintenance yard). This expansion would require partial demolition of an existing TriMet building (just north of the LRV storage) and would require relocating the material storage yard to the properties just south of the south building.

All tracks in the west LRV storage yard would also be extended southward to connect to the proposed runaround track. The runaround track would connect to existing tracks near the existing south building. The connections to the runaround track would require partial demolition of an existing TriMet building plus full demolition of one existing building and partial demolition of another existing building on the private property west of the south end of Eleven Mile Avenue. The function of the existing TriMet building would either be transferred to existing modified buildings or to new replacement buildings on site.

The existing parking lot west of Eleven Mile Avenue would be expanded toward the south to provide more parking for TriMet personnel.

A third track would be needed at the north entrance to Ruby Junction to accommodate increased train volumes without decreasing service. The additional track would also reduce operational impacts during construction and maintenance outages for the yard. Constructing the third track would require reconstruction of Burnside Court east of Eleven Mile Avenue. An additional crossover would also be needed on the mainline track where it crosses Eleven Mile Avenue; it would require reconstruction of the existing track crossings for vehicles, bicycles, and pedestrians.

Figure 1-25. Ruby Junction Maintenance Facility Study Area



EB = eastbound; LRV = light-rail vehicle; WB = westbound

1.1.6.2 Expo Center Overnight LRV Facility

An overnight facility for LRVs would be constructed on the southeast corner of the Expo Center property (as shown on Figure 1-8) to reduce deadheading between Ruby Junction and the northern terminus of the MAX Yellow Line extension. Deadheading occurs when LRVs travel without passengers to make the vehicles ready for service. The facility would provide a yard access track, storage tracks for approximately 10 LRVs, one building for light LRV maintenance, an operator break building, a parking lot for operators, and space for security personnel. This facility would necessitate relocation and reconstruction of the Expo Road entrance to the Expo Center (including the parking lot gates and booths). However, it would not affect existing Expo Center buildings.

The overnight facility would connect to the mainline tracks by crossing Expo Road just south of the existing Expo Center MAX Station. The connection tracks would require relocation of one or two existing LRT facilities, including a traction power substation building and potentially the existing communication building, which are both just south of the Expo Center MAX Station. Existing artwork at the station may require relocation.

1.1.6.3 Additional Bus Bays at the C-TRAN Operations and Maintenance Facility

Three bus bays would be added to the C-TRAN operations and maintenance facility. These new bus bays would provide maintenance capacity for the additional express bus service on I-5 (see Section 1.1.7, Transit Operating Characteristics). Modifications to the facility would accommodate new vehicles as well as maintenance equipment.

1.1.7 Transit Operating Characteristics

1.1.7.1 LRT Operations

Nineteen new LRVs would be purchased to operate the extension of the MAX Yellow Line. These vehicles would be similar to those currently used for the TriMet MAX system. With the Modified LPA, LRT service in the new and existing portions of the Yellow Line in 2045 would operate with 6.7-minute average headways (defined as gaps between arriving transit vehicles) during the 2-hour morning peak period. Mid-day and evening headways would be 15 minutes, and late-night headways would be 30 minutes. Service would operate between the hours of approximately 5 a.m. (first southbound train leaving Evergreen Station) and 1 a.m. (last northbound train arriving at the station), which is consistent with current service on the Yellow Line. LRVs would be deadheaded at Evergreen Station before beginning service each day. A third track at this northern terminus would accommodate layovers.

1.1.7.2 Express Bus Service and Bus on Shoulder

C-TRAN provides bus service that connects to LRT and augments travel between Washington and Oregon with express bus service to key employment centers in Oregon. Beginning in 2022, the main express route providing service in the IBR corridor, Route 105, had two service variations. One pattern provides service between Salmon Creek and downtown Portland with a single intermediate stop at the 99th Street Transit Center, and one provides service between Salmon Creek and downtown Portland with two intermediate stops: 99th Street Transit Center and downtown Vancouver. This route currently provides weekday service with 20-minute peak and 60-minute off-peak headways.

Once the Modified LPA is constructed, C-TRAN Route 105 would be revised to provide direct service from the Salmon Creek Park and Ride and 99th Street Transit Center to downtown Portland, operating at 5-minute peak headways with no service in the off-peak. The C-TRAN Route 105 intermediate stop service through downtown Vancouver would be replaced with C-TRAN Route 101, which would provide direct service from downtown Vancouver to downtown Portland at 10-minute peak and 30-minute off-peak headways.

Two other existing C-TRAN express bus service routes would remain unchanged after completion of the Modified LPA. C-TRAN Route 190 would continue to provide service from the Andresen Park and Ride in Vancouver to Marquam Hill in Portland. This route would continue to operate on SR 500 and I-5 within the study area. Route headways would be 10 minutes in the peak periods with no off-peak service. C-TRAN Route 164 would continue to provide service from the Fisher's Landing Transit Center to downtown Portland. This route would continue to operate within the study area only in the northbound direction during PM service to use the I-5 northbound high-occupancy vehicle lane in Oregon before exiting to eastbound SR 14 in Washington. Route headways would be 10 minutes in the peak and 30 minutes in the off-peak.

C-TRAN express bus Routes 105 and 190 are currently permitted to use the existing southbound inside shoulder of I-5 from 99th Street to the Interstate Bridge in Vancouver. However, the existing shoulders are too narrow for bus-on-shoulder use in the rest of the I-5 corridor in the study area. The Modified LPA would include inside shoulders on I-5 that would be wide enough (14 feet on the Columbia River bridges and 11.5 to 12 feet elsewhere on I-5) to allow northbound and southbound buses to operate on the shoulder, except where I-5 would have to taper to match existing inside shoulder widths at the north and south ends of the corridor. Figure 1-8, Figure 1-16, Figure 1-23, and Figure 1-24 show the potential bus-on-shoulder use over the Columbia River bridges. Bus on shoulder could operate on any of the Modified LPA bridge configurations and bridge types. Additional approvals (including a continuing control agreement), in coordination with ODOT, may be needed for buses to operate on the shoulder on the Oregon portion of I-5.

After completion of the Modified LPA, two C-TRAN express bus routes operating on I-5 through the study area would be able to use bus-on-shoulder operations to bypass congestion in the general-purpose lanes. C-TRAN Route 105 would operate on the shoulder for the full length of the study area. C-TRAN Route 190 would operate on the shoulder for the full length of the corridor except for the distance required to merge into and out of the shoulder as the route exits from and to SR 500. These two express bus routes (105 and 190) would have a combined frequency of every 3 minutes during the 2045 AM and PM peak periods. To support the increased frequency of express bus service, eight electric double-decker or articulated buses would be purchased.

If the C Street ramps were removed from the SR 14 interchange, C-TRAN Route 101 could also use bus-on-shoulder operations south of Mill Plain Boulevard; however, if the C Street ramps remained in place, Route 101 could still use bus-on-shoulder operations south of the SR 14 interchange but would need to begin merging over to the C Street exit earlier than if the C Street ramps were removed. Route 101 would operate at 10-minute peak and 30-minute off-peak headways. C-TRAN Route 164 would not be anticipated to use bus-on-shoulder operations because of the need to exit to SR 14 from northbound I-5.

1.1.7.3 Local Bus Route Changes

The TriMet Line 6 bus route would be changed to terminate at the Expo Center MAX Station, requiring passengers to transfer to the new LRT connection to access Hayden Island. TriMet Line 6 is anticipated to travel from Martin Luther King Jr. Boulevard through the newly configured area providing local connections to Marine Drive. It would continue west to the Expo Center MAX Station. Table 1-3 shows existing service and anticipated future changes to TriMet Line 6.

As part of the Modified LPA, several local C-TRAN bus routes would be changed to better complement the new light-rail extension. Most of these changes would reroute existing bus lines to provide a transfer opportunity near the new Evergreen Station. Table 1-3 shows existing service and anticipated future changes to C-TRAN bus routes. In addition to the changes noted in Table 1-3, other local bus route modifications would move service from Broadway to C Street. The changes shown may be somewhat different if the C Street ramps are removed.

Table 1-3. Proposed TriMet and C-TRAN Bus Route Changes

Bus Route	Existing Route	Changes with Modified LPA
TriMet Line 6	Connects Goose Hollow, Portland City Center, N/NE Portland, Jantzen Beach and Hayden Island. Within the study area, service currently runs between Delta Park MAX Station and Hayden Island via I-5.	Route would be revised to terminate at the Expo Center MAX Station. Route is anticipated to travel from Martin Luther King Jr. Boulevard through the newly configured Marine Drive area, then continue west to connect via facilities on the west side of I-5 with the Expo Center MAX Station.
C-TRAN Fourth Plain and Mill Plain bus rapid transit (The Vine)	Runs between downtown Vancouver and the Vancouver Mall Transit Center via Fourth Plain Boulevard, with a second line along Mill Plain Boulevard. In the study area, service currently runs along Washington and Broadway Streets through downtown Vancouver.	Route would be revised to begin/end near the Evergreen Station in downtown Vancouver and provide service along Evergreen Boulevard to Fort Vancouver Way, where it would travel to or from Mill Plain Boulevard or Fourth Plain Boulevard depending on clockwise/counterclockwise operations. The Fourth Plain Boulevard route would continue to serve existing Vine stations beyond Evergreen Boulevard.
C-TRAN #2 Lincoln	Connects the 99th Street Transit Center to downtown Vancouver via Lincoln and Kaufman Avenues. Within the study area, service currently runs along Washington and Broadway Streets between 7th and 15th Streets in downtown Vancouver.	Route would be modified to begin/end near C Street and 9th Street in downtown Vancouver.

Bus Route	Existing Route	Changes with Modified LPA
C-TRAN #25 St. Johns	Connects the 99th Street Transit Center to downtown Vancouver via St. Johns Boulevard and Fort Vancouver Way. Within the study area, service currently runs along Evergreen Boulevard, Jefferson Street/Kaufman Avenue, 15th Street, and Franklin Street in downtown Vancouver.	Route would be modified to begin/end near C Street and 9th Street in downtown Vancouver.
C-TRAN #30 Burton	Connects the Fisher's Landing Transit Center with downtown Vancouver via 164th/162nd Avenues and 18th, 25th, 28th, and 39th Streets. Within the study area, service currently runs along McLoughlin Boulevard and on Washington and Broadway Streets between 8th and 15th Streets.	Route would be modified to begin/end near C Street and 9th Street in downtown Vancouver.
C-TRAN #60 Delta Park Regional	Connects the Delta Park MAX station in Portland with downtown Vancouver via I-5. Within the study area, service currently runs along I-5, Mill Plain Boulevard, and Broadway Street.	Route would be discontinued.

1.1.8 Tolling

Tolling cars and trucks that would use the new Columbia River bridges is proposed as a method to help fund the bridge construction and future maintenance, as well as to encourage alternative mode choices for trips across the Columbia River. Federal and state laws set the authority to toll the I-5 crossing. The IBR Program plans to toll the I-5 river bridge under the federal tolling authorization program codified in 23 U.S. Code Section 129 (Section 129). Section 129 allows public agencies to impose new tolls on federal-aid interstate highways for the reconstruction or replacement of toll-free bridges or tunnels. In 2023, the Washington State Legislature authorized tolling on the Interstate Bridge, with toll rates and policies to be set by the Washington State Transportation Commission (WSTC). In Oregon, the legislature authorized tolling giving the Oregon Transportation Commission the authority to toll I-5, including the ability to set the toll rates and policies. Subsequently, the Oregon Transportation Commission (OTC) is anticipated to review and approve the I-5 tollway project application that would designate the Interstate Bridge as a "tollway project" in 2024. At the beginning of 2024, the OTC and the WSTC entered into a bi-state tolling agreement to establish a cooperative process for setting toll rates and policies. This included the formation of the I-5 Bi-State Tolling Subcommittee consisting of two commissioners each from the OTC and WSTC and tasked with developing toll rate and policy recommendations for joint consideration and adoption by each state's commission. Additionally, the two states plan to enter into a separate agreement guiding the sharing and uses of toll revenues, including the order of uses (flow of funds) for bridge construction, debt service, and other required expenditures. WSDOT and ODOT also plan to enter into one or more agreements addressing implementation logistics, toll collection, and operations and maintenance for tolling the bi-state facility.

The Modified LPA includes a proposal to apply variable tolls on vehicles using the Columbia River bridges with the toll collected electronically in both directions. Tolls would vary by time of day with higher rates during peak travel periods and lower rates during off-peak periods. The IBR Program has evaluated multiple toll scenarios generally following two different variable toll schedules for the tolling assessment. For purposes of this NEPA analysis, the lower toll schedule was analyzed with tolls assumed to range between $1.50 and $3.15 (in 2026 dollars as representative of when tolling would begin) for passenger vehicles with a registered toll payment account. Medium and heavy trucks would be charged a higher toll than passenger vehicles and light trucks. Passenger vehicles and light trucks without a registered toll payment account would pay an additional $2.00 per trip to cover the cost of identifying the vehicle owner from the license plate and invoicing the toll by mail.

The analysis assumes that tolling would commence on the existing Interstate Bridge—referred to as pre-completion tolling—starting April 1, 2026. The actual date pre-completion tolling begins would depend on when construction would begin. The traffic and tolling operations on the new Columbia River bridges were assumed to commence by July 1, 2033. The actual date that traffic and tolling operations on the new bridges begin would depend on the actual construction completion date. During the construction period, the two commissions may consider toll-free travel overnight on the existing Interstate Bridge, as was analyzed in the Level 2 Toll Traffic and Revenue Study, for the hours between 11 p.m. and 5 a.m. This toll-free period could help avoid situations where users would be charged during lane or partial bridge closures where construction delays may apply. Once the new I-5 Columbia River bridges open, twenty-four-hour tolling would begin.

Tolls would be collected using an all-electronic toll collection system using transponder tag readers and license plate cameras mounted to structures over the roadway. Toll collection booths would not be required. Instead, motorists could obtain a transponder tag and set up a payment account that would automatically bill the account holder associated with the transponder each time the vehicle crossed the bridge. Customers without transponders, including out-of-area vehicles, would be tolled by a license plate recognition system that would bill the address of the owner registered to that vehicle's license plate. The toll system would be designed to be nationally interoperable. Transponders for tolling systems elsewhere in the country could be used to collect tolls on I-5, and drivers with an account and transponder tag associated with the Interstate Bridge could use them to pay tolls in other states for which reciprocity agreements had been developed. There would be new signage, including gantries, to inform drivers of the bridge toll. These signs would be on local roads, I-5 on-ramps, and on I-5, including locations north and south of the bridges where drivers make route decisions (e.g., I-5/I-205 junction and I-5/I-84 junction).

1.1.9 Transportation System- and Demand-Management Measures

Many well-coordinated transportation demand-management and system-management programs are already in place in the Portland-Vancouver metropolitan region. In most cases, the impetus for the programs comes from state regulations: Oregon's Employee Commute Options rule and Washington's Commute Trip Reduction law (described in the sidebar).

The physical and operational elements of the Modified LPA provide the greatest transportation demand-management opportunities by promoting other modes to fulfill more of the travel needs in the corridor. These include:

- Major new light-rail line in exclusive right of way, as well as express bus routes and bus routes that connect to new light-rail stations.
- I-5 inside shoulders that accommodate express buses.
- Modern bicycle and pedestrian facilities that accommodate more bicyclists and pedestrians and improve connectivity, safety, and travel time.
- Park-and-ride facilities.
- A variable toll on the new Columbia River bridges.

In addition to these fundamental elements of the Modified LPA, facilities and equipment would be implemented that could help existing or expanded transportation system management measures maximize the capacity and efficiency of the system. These include:

- Replacement or expanded variable message signs in the study area. These signs alert drivers to incidents and events, allowing them to seek alternate routes or plan to limit travel during periods of congestion.
- Replacement or expanded traveler information systems with additional traffic monitoring equipment and cameras.
- Expanded incident response capabilities, which help traffic congestion to clear more quickly following accidents, spills, or other incidents.
- Queue jumps or bypass lanes for transit vehicles where multilane approaches are provided at ramp signals for on-ramps. Locations for these features will be determined during the detailed design phase.
- Active traffic management including strategies such as ramp metering, dynamic speed limits, and transit signal priority. These strategies are intended to manage congestion by controlling traffic flow or allowing transit vehicles to enter traffic before single-occupant vehicles.

State Laws to Reduce Commute Trips

Oregon and Washington have both adopted regulations intended to reduce the number of people commuting in single-occupancy vehicles (SOVs). Oregon's Employee Commute Options Program, created under Oregon Administrative Rule 340-242-0010, requires employers with over 100 employees in the greater Portland area to provide commute options that encourage employees to reduce auto trips to the work site. Washington's 1991 Commute Trip Reduction (CTR) Law, updated as the 2006 CTR Efficiency Act (Revised Code of Washington §70.94.521) addresses traffic congestion, air pollution, and petroleum fuel consumption. The law requires counties and cities with the greatest traffic congestion and air pollution to implement plans to reduce SOV demand. An additional provision mandates "major employers" and "employers at major worksites" to implement programs to reduce SOV use.

1.2 Modified LPA Construction

The following information on the construction activities and sequence follows the information prepared for the CRC LPA. Construction durations have been updated for the Modified LPA. Because the main elements of the IBR Modified LPA are similar to those in the CRC LPA (i.e., multimodal river crossings and interchange improvements), this information provides a reasonable assumption of the construction activities that would be required.

The construction of bridges over the Columbia River sets the sequencing for other Program components. Accordingly, construction of the Columbia River bridges and immediately adjacent highway connections and improvement elements would be timed early to aid the construction of other components. Demolition of the existing Interstate Bridge would take place after the new Columbia River bridges were opened to traffic.

Electronic tolling infrastructure would be constructed and operational on the existing Interstate Bridge by the start of construction on the new Columbia River bridges. The toll rates and policies for tolling (including pre-completion tolling) would be determined after a more robust analysis and public process by the OTC and WSTC (refer to Section 1.1.8, Tolling).

1.2.1 Construction Components and Duration

Table 1-4 provides the estimated construction durations and additional information of Modified LPA components. The estimated durations are shown as ranges to reflect the potential for Program funding to be phased over time. In addition to funding, contractor schedules, regulatory restrictions on in-water work and river navigation considerations, permits and approvals, weather, materials, and equipment could all influence construction duration and overlap of construction of certain components. Certain work below the ordinary high-water mark of the Columbia River and North Portland Harbor would be restricted to minimize impacts to species listed under the Endangered Species Act and their designated critical habitat.

Throughout construction, active transportation facilities and three lanes in each direction on I-5 (accommodating personal vehicles, freight, and buses) would remain open during peak hours, except for short intermittent restrictions and/or closures. Advanced coordination and public notice would be given for restrictions, intermittent closures, and detours for highway, local roadway, transit, and active transportation users (refer to the Transportation Technical Report, for additional information). At least one navigation channel would remain open throughout construction. Advanced coordination and notice would be given for restrictions or intermittent closures to navigation channels as required.

Table 1-4. Construction Activities and Estimated Duration

Component	Estimated Duration	Notes
Columbia River bridges	4 to 7 years	• Construction is likely to begin with the main river bridges. • General sequence would include initial preparation and installation of foundation piles, shaft caps, pier columns, superstructure, and deck.
North Portland Harbor bridges	4 to 10 years	• Construction duration for North Portland Harbor bridges is estimated to be similar to the duration for Hayden Island interchange construction. The existing North Portland Harbor bridge would be demolished in phases to accommodate traffic during construction of the new bridges.
Hayden Island interchange	4 to 10 years	• Interchange construction duration would not necessarily entail continuous active construction. Hayden Island work could be broken into several contracts, which could spread work over a longer duration.
Marine Drive interchange	4 to 6 years	• Construction would need to be coordinated with construction of the North Portland Harbor bridges.
SR 14 interchange	4 to 6 years	• Interchange would be partially constructed before any traffic could be transferred to the new Columbia River bridges.
Demolition of the existing Interstate Bridge	1.5 to 2 years	• Demolition of the existing Interstate Bridge could begin only after traffic is rerouted to the new Columbia River bridges.
Three interchanges north of SR 14	3 to 4 years for all three	• Construction of these interchanges could be independent from each other and from construction of the Program components to the south. • More aggressive and costly staging could shorten this timeframe.
Light-rail	4 to 6 years	• The light-rail crossing would be built with the Columbia River bridges. Light-rail construction includes all of the infrastructure associated with light-rail transit (e.g., overhead catenary system, tracks, stations, park and rides).

Component	Estimated Duration	Notes
Total construction timeline	9 to 15 years	• Funding, as well as contractor schedules, regulatory restrictions on in-water work and river navigation considerations, permits and approvals, weather, materials, and equipment, could all influence construction duration.

1.2.2 Potential Staging Sites and Casting Yards

Equipment and materials would be staged in the study area throughout construction generally within existing or newly purchased right of way, on land vacated by existing transportation facilities (e.g., I-5 on Hayden Island), or on nearby vacant parcels. However, at least one large site would be required for construction offices, to stage the larger equipment such as cranes, and to store materials such as rebar and aggregate. Criteria for suitable sites include large, open areas for heavy machinery and material storage, waterfront access for barges (either a slip or a dock capable of handling heavy equipment and material) to convey material to the construction zone, and roadway or rail access for landside transportation of materials by truck or train.

Two potential major staging sites have been identified (see Figure 1-8 and Figure 1-23). One site is located on Hayden Island on the west side of I-5. A large portion of this parcel would be required for new right of way for the Modified LPA. The second site is in Vancouver between I-5 and Clark College. Other staging sites may be identified during the design process or by the contractor. Following construction of the Modified LPA, the staging sites could be converted for other uses.

In addition to on-land sites, some staging activities for construction of the new Columbia River and North Portland Harbor bridges would take place on the river itself. Temporary work structures, barges, barge-mounted cranes, derricks, and other construction vessels and equipment would be present on the river during most or all of the bridges' construction period. The IBR Program is working with USACE and USCG to obtain necessary clearances for these activities.

A casting or staging yard could also be required for construction of the overwater bridges if a precast concrete segmental bridge design is used. A casting yard would require access to the river for barges, a slip or a dock capable of handling heavy equipment and material, a large area suitable for a concrete batch plant and associated heavy machinery and equipment, and access to a highway or railway for delivery of materials. As with the staging sites, casting or staging yard sites may be identified as the design progresses or by the contractor and would be evaluated via a NEPA re-evaluation or supplemental NEPA document for potential environmental impacts at that time.

1.3 No-Build Alternative

The No-Build Alternative illustrates how transportation and environmental conditions would likely change by the year 2045 if the Modified LPA is not built. This alternative makes the same assumptions as the Modified LPA regarding population and employment growth through 2045, and it assumes that the same transportation and land use projects in the region would occur as planned.

Regional transportation projects included in the No-Build Alternative are those in the financially constrained 2018 *Regional Transportation Plan* (2018 RTP) adopted in December 2018 by the Metro Council (Metro 2018) and in March 2019 (RTC 2019) by the Southwest Washington Regional Transportation Council (RTC) Board of Directors is referred to as the 2018 RTP in this report. The 2018 RTP has a planning horizon year of 2040 and includes projects from state and local plans necessary to meet transportation needs over this time period; financially constrained means these projects have identified funding sources. The Transportation Technical Report lists the projects included in the financially constrained 2018 RTP.

The implementation of regional and local land use plans is also assumed as part of the No-Build Alternative. For the IBR Program analysis, population and employment assumptions used in the 2018 RTP were updated to 2045 in a manner consistent with regional comprehensive and land use planning. In addition to accounting for added growth, adjustments were made within Portland to reallocate the households and employment based on the most current update to Portland's comprehensive plan, which was not complete in time for inclusion in the 2018 RTP.

Other projects assumed as part of the No-Build Alternative include major development and infrastructure projects that are in the permitting stage or partway through phased development. These projects are discussed as reasonably foreseeable future actions in the IBR Cumulative Effects Technical Report. They include the Vancouver Waterfront project, Terminal 1 development, the Renaissance Boardwalk, the Waterfront Gateway Project, improvements to the levee system, several restoration and habitat projects, and the Portland Expo Center.

In addition to population and employment growth and the implementation of local and regional plans and projects, the No-Build Alternative assumes that the existing Interstate Bridge would continue to operate as it does today. As the bridge ages, needs for repair and maintenance would potentially increase, and the bridge would continue to be at risk of mechanical failure or damage from a seismic event.

2. METHODS

2.1 Introduction

This economics methods report describes the methods that were used to support the IBR Program environmental evaluation. This report outlines the proposed approach to evaluate the beneficial and adverse impacts of a Modified LPA.

This report includes a description of the study area, relevant laws and regulations, and methods for collecting data, assessing impacts, and evaluating possible mitigation measures. The analysis is designed to comply with the NEPA and relevant federal, state and local laws. These methods are based on those developed for the CRC project, which completed the NEPA process with a signed ROD in 2011,[9] followed by NEPA re-evaluations in 2012 (to evaluate an increase in bridge clearance) and 2013 (to evaluate phased construction). The CRC project was discontinued in 2014; the IBR Program is evaluating what changes in regulations, policy, and physical conditions have occurred since the completion of the ROD.

The economics evaluation identifies potential significant adverse impacts and beneficial effects on the local and regional economy. The local economy is defined as businesses located within the primary study area (see Section 2.2, below), while the regional economy is the Portland-Vancouver Primary Metropolitan Statistical Area (PMSA), which includes the counties of Clackamas, Columbia, Multnomah, Washington, and Yamhill in Oregon, and Clark and Skamania counties in Washington.

Potential cumulative effects from the IBR Program are evaluated in the Program's Cumulative Effects Technical Report. Potential indirect effects resulting from changes in land use are discussed in Chapter 6 of this report.

The methods used in this report have been updated for the IBR Program in the following ways:

- Updated guidance from the 2022 Washington State Department of Transportation (WSDOT) Environmental Manual for social and community effects, Chapter 458.04(1): Economic Effects.
- Updated local, regional, and state plans and policies to review for consistency.

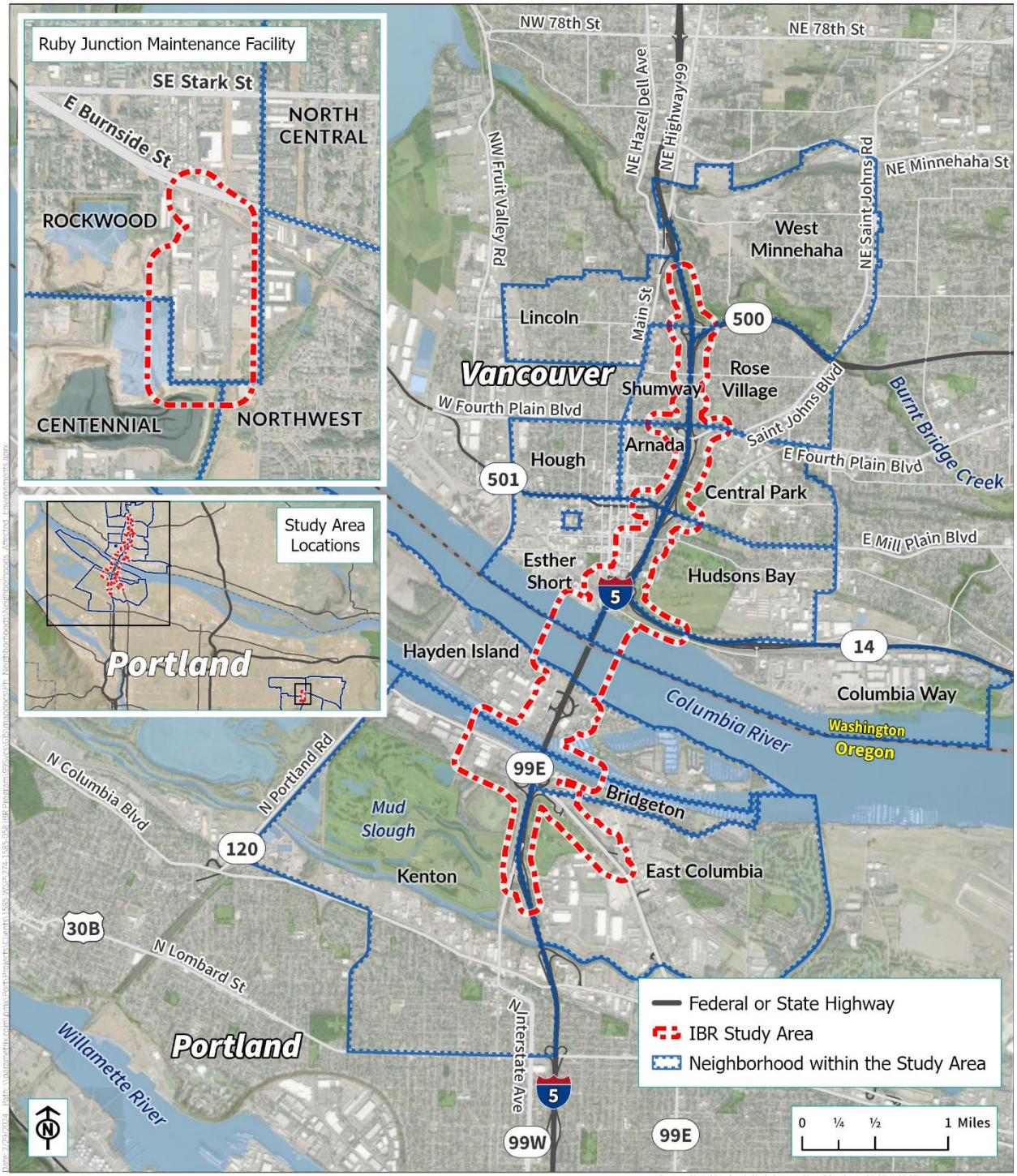
2.2 Study Area

The economic impacts evaluation will use two study areas for environmental effects: the primary and secondary study areas. The primary study area (Figure 2-1) runs along a 5-mile segment of I-5, approximately between the State Route 500 interchange in Washington and the Columbia Boulevard interchange in Oregon. Most physical changes associated with the Program would occur in this area, though mitigation could still occur outside of it. Temporary construction easements would be established directly adjacent to the proposed construction areas, while larger staging areas and

[9] The ROD and supporting environmental documents can be found on the Washington Department of Transportation's website: https://www.wsdot.wa.gov/accountability/ssb5806/environmental-process-and-permitting.htm.

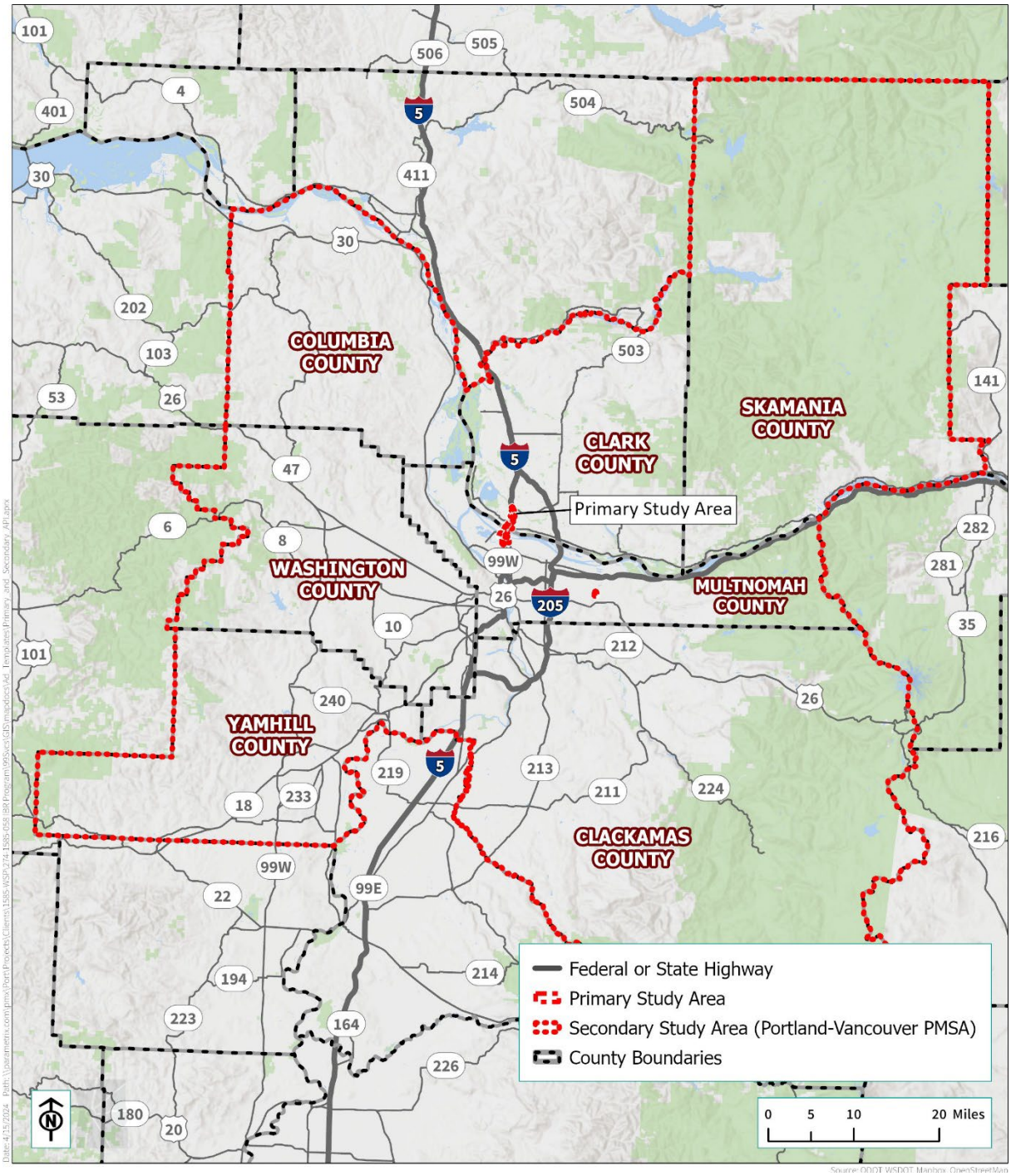
casting yards could be located upstream or downstream of the Interstate Bridge. The IBR Modified LPA also includes expansion of the Ruby Junction Maintenance Facility in Gresham, Oregon.

Figure 2-1. Primary Study Area



The secondary study area represents the area where indirect economic impacts, including traffic delay and construction staging, may occur as a result of the Modified LPA (Figure 2-2). The secondary study area is composed of the seven-county Portland-Vancouver PMSA. This larger region was analyzed because the Program is anticipated to have economic effects outside the primary IBR study area shown in Figure 2-1.

Figure 2-2. Secondary Study Area



2.3 Relevant Policies, Plans, and Regulations

This Economics Technical Report was prepared according to the U.S. Department of Transportation (USDOT) Federal Highway Administration's (FHWA's) 1987 Guidance for Preparing and Processing Environmental and Section 4(f) Documents, Technical Advisory T6640.8A, and is consistent with guidance from the Federal Transit Administration's (FTA's) Environmental Resources Information and WSDOT Environmental Manual Chapter 458 (458.04[1], Economic Effects).

Relevant regulations, policies, and guidance include federal, state, and local plans and laws governing economic development, land use, and transportation planning adopted by jurisdictions within the Portland-Vancouver PMSA. Local policies and goals related to economic development depend on the implementation of certain transportation policies. For this reason, the major transportation and land use plans of the region were reviewed.

2.3.1 Federal Guidelines

- USDOT, FHWA, 1987.

  The FHWA Guidance for Preparing and Processing Environmental and Section 4(f) Documents was used to guide the economic analysis for the IBR Program. According to the FHWA, the analysis should discuss the following for each alternative commensurate with the level of impacts:

  - The economic impacts to the regional and local economy such as the effects of the project on development, tax revenues and public expenditures, employment opportunities, accessibility, and retail sales.
  - The impacts to the economic vitality of existing highway-related businesses (e.g., gasoline stations, motels, etc.) and the resultant impact, if any, on the local economy.
  - Impacts of the proposed action on established business districts, and any opportunities for public or private sectors to minimize or reduce such impacts.

- USDOT, FTA, 2007.

  The FTA Environmental Resources Information web page discusses social and economic externalities that should be addressed in environmental documents. For economic impacts, it states:

  > *Proposed transit projects may have economic impacts that should be included in environmental impact documents. In particular, projects may create direct and indirect taxation changes, cause substantial displacement of businesses and individuals, disrupt business activities, and influence regional construction costs. If a proposed project is small, contained on a single site, does not involve displacements, and is compatible with surrounding land uses, there will probably be few economic impacts and extensive analysis is not needed. If a project is costly, covers a wide area, and will cause extensive displacement of businesses and individuals, there is a greater chance that it will cause economic impacts. In such cases, a detailed economic impact analysis should be included in environmental documentation.*

2.3.2 State Guidelines

- NEPA Manual (Socioeconomics). ODOT, 2021.

  ODOT has developed guidelines for conducting environmental analysis for highway projects. The guidelines for socioeconomics are consistent with the recommendations made by the FHWA, as discussed above.

- Oregon Statewide Planning Goals (OAR 660). Oregon Department of Land Conservation and Development, 1974, amendments through July 2019. Goal 9 (To provide adequate opportunities throughout the state for a variety of economic activities vital to the health, welfare, and prosperity of Oregon's citizens) includes guidance for economic development. Goal 12 (To provide and encourage a safe, convenient, and economic transportation system) includes guidance for transportation.

- Washington State Environmental Manual (Social and Community Effects [Economics]), 2022.

  WSDOT has developed guidelines for conducting environmental analysis for highway projects. Like the ODOT manual, the guidelines for economics follow closely the recommendations made by the FHWA.

- ODOT Regional Mobility Pricing Project, ongoing.

  The Regional Mobility Pricing Project is currently underway. This project will evaluate congestion pricing (using variable-rate tolls) to manage congestion and raise revenue to help fund construction of approved congestion-relief transportation projects.

2.3.3 Local Plans

Local policies and goals related to economic development depend on the implementation of certain transportation policies. For this reason, major regional transportation and land use plans were reviewed, as described below.

2.3.3.1 Oregon

- Oregon Metropolitan Regional Government (Metro) Regional Transportation Plan (RTP) (Metro 2018).

  The Metro RTP is a 20-year blueprint for the Metro three-county regional transportation system. The Metro RTP establishes policies and priorities for all forms of transportation and anticipates the region's current and future transportation needs. These policies focus on ensuring that the region's transportation system works in the most effective way and recognizes the importance of the movement of goods and services for the regional economy. The 2018 update includes Climate Smart Strategy plans.

- Tri-County Public Transportation Improvement Plan (fiscal year [FY] 2021–2023) (TriMet 2020).

  The Tri-County Public Transportation Improvement Plan establishes a five-year roadmap for the rollout of future services and programs to improve service in low-income communities. It also provides for planned revenue and service improvements and programs within the next two years (FY 2021–2023). The plan covers Multnomah, Washington, and Clackamas counties.

- City of Portland Central City 2035 Plan (City of Portland 2020a).

  The Central City 2035 Plan replaces the 1988 Central City Plan as the primary guiding policy document for the Central City with goals, policies, and tools designed to make Portland's urban core more vibrant, innovative, sustainable, and resilient.

- Portland Transportation System Plan (Portland Department of Transportation 2016).

  The City of Portland Transportation System Plan (TSP) is the long-range plan to guide transportation investments in Portland. The TSP meets state and regional planning requirements and addresses local transportation needs for cost-effective street, transit, freight, bicycle, and pedestrian improvements. The objective of the TSP is to provide a balanced transportation system to support neighborhood livability and economic development.

- Metro High Capacity Transit Plan

  The Metro High Capacity Transit Plan describes Metro's vision for future bus rapid transit, light rail transit, and commuter rail within the area's Urban Growth Boundary. The timeframe for this vision is 20 years (2030). The extension of light rail transit to Vancouver was considered as "under development" in the High Capacity Transit Plan.

- Costs of Congestion Study (EDR 2005).

  This study analyzed the impacts of congestion on economic development in the Portland metropolitan area. The study's findings conclude that:

  - Congestion currently threatens economic growth in the Portland region.
  - Congestion problems are already reducing profits for local businesses.
  - Failure to invest in the region's transportation system could create an $844 million annual value loss.

  According to this study, increasing regional transportation investment would create a $2.00 benefit for every dollar spent. Interviews conducted for the Cost of Congestion Study found that local businesses have shifted work shifts and deliveries to the early morning to avoid congestion, but as the time periods of congestion increase, businesses have fewer options to avoid traffic congestion and delays. Some businesses have increased their internal inventories to reduce disruption from missed deliveries, and others pass transportation cost increases to the consumer. Some have relocated outside the region.

- Other Portland-area plans.

  Several plans were reviewed for consistency with the IBR Program; the following were pertinent to this technical report:

  - City of Portland Enhanced Transit Corridors Plan, 2018.
  - 2019 ODOT Transportation Survey.
  - Portland Development Commission (now Prosper Portland) Interstate Corridor Urban Renewal Plan – Amended and Restated through July 27, 2011.
  - Albina Community Plan (City of Portland Bureau of Planning 2000).
  - Freight Master Plan (City of Portland 2006).

2.3.3.2 Washington

- C-TRAN 2030 Transit Development Plan (C-TRAN 2016).

  This plan will preserve existing service levels with improvements in the following areas: two new bus routes in east Vancouver; increased frequencies on many of C-TRAN's existing bus routes; meeting the growing demand of C-TRAN's paratransit service for people with disabilities; constructing two new park and rides with increased commuter service to downtown Vancouver and Portland; and constructing C-TRAN's first bus rapid transit line with service along Fourth Plain Boulevard. The most recent updated version acknowledges cancellation of the CRC project.

- RTP for Clark County (Clark County RTC 2019).

  The Clark County RTP is based on the Comprehensive Growth Management Plan for Clark County and is the collective regional strategy for developing a transportation system to provide mobility and accessibility for people as well as freight and goods movement.

- Vancouver Transportation Plan. City of Vancouver, 2004 (Vancouver TSP update is anticipated in 2023).

  The Vancouver Transportation Plan describes the vision of Vancouver's future transportation system, consistent with the overall community vision developed in the Comprehensive Plan.

- City Center Vision Plan (City of Vancouver 2006).

  The Vancouver City Center Vision Plan for Vancouver was developed in 2006 to foster and guide development of a city center area. It provides a vision and guiding principles for six areas in downtown Vancouver. The revitalization and development plan relied on improved infrastructure; it attempted to ensure that I-5 improvements and the CRC project improved access to the downtown area and minimized potentially adverse impacts to the city.

- Columbia Gateway Master Plan (Port of Vancouver 2006).

  The Columbia Gateway, a piece of undeveloped property at the Port of Vancouver, includes nearly 1,100 acres of industrial-zoned land. The purpose of the proposed Columbia Gateway project is to develop a strategic master plan that meets the long-term economic, infrastructure, marine, and industrial land needs of the Port of Vancouver, City of Vancouver, Clark County, and the region.

- Columbia Connects Shared Investment Strategy (RTC and Metro 2021).

  Columbia Connects provides a Shared Investment Strategy that identifies recommended actions to enhance the regional economy within the bi-state area. Related investments include transportation improvements, activities to manage and support land use change and site development readiness, workforce training, and business retention and expansion.

- The Columbia River Economic Development Council Clark County Comprehensive Economic Development Plan 2018-2023 (Columbia River Economic Development Council 2018).

  The Clark County Comprehensive Economic Development Plan 2018-2023 documents the countywide goals and objectives of all economic development partners. The plan lays out goals and objectives, specific action items and implementation timelines over the next 5 years.

- Other Vancouver-area plans:

  Several plans were reviewed for consistency with the IBR Program; the following were pertinent to this technical report:

  - The Waterfront Development Master Plan. Columbia Waterfront LLC, 2022 updates.
  - Terminal 1 Waterfront Development Project Narrative. Port of Vancouver, 2016.
  - The Historic Reserve Plan. Vancouver National Historic Reserve, 2006.

2.4 Data Collection Methods

This section explains the general methodology and data sources used to describe the current economic conditions in the study area and discusses the potential economic impacts associated with the construction and operation of the Modified LPA.

Data sources that were used to analyze economic impacts potentially resulting from the Modified LPA include a combination of previous studies, field surveys, and purchased information.

2.4.1 Previous Studies

Published studies evaluating the relationship between transportation investment and economic growth were reviewed and summarized. A literature search was conducted, and the results summarized, to gain insight into the effect that high-capacity transit stations may have on economic development trends around station areas. Published reports on the impact of congestion in the study area and reports on the economy of the study area were reviewed, and relevant conclusions summarized. Research into the effects of tolling and transportation investment on retail sales, property values, and public revenue sources was summarized, and a qualitative discussion of the potential for such impacts from the Modified LPA is presented.

2.4.2 Business Owner Outreach

Following publication of the SEIS and after project design has been developed to a higher level of detail, the IBR Program economics team will provide outreach to business owners along the alignment as part of the overall IBR Program. Summaries from working group meetings will also be reviewed.

2.4.3 Other Technical Reports

Economic impacts affect a variety of resources, and economic-related topics are addressed in several other IBR Program technical reports. The economics team has coordinated with other technical report teams as needed to ensure that economic impacts are thoroughly considered.

The indirect effects chapter of this technical report focuses on changes to economic development that could occur as a result of the Modified LPA. The potential for long-term residential displacement and neighborhood changes is addressed in the Neighborhoods and Populations Technical Report. Business displacement and commercial property acquisitions are addressed in the Acquisitions Technical Report. The Acquisitions Technical Report also addresses the potential for housing

displacements and the availability of affordable housing. Potential economic impacts to environmental justice populations and equity priority communities, including the potential for the Modified LPA to affect housing affordability for minority and low-income populations, are addressed in the Environmental Justice Technical Report and the Equity Technical Report, respectively. Land use changes and the potential for induced development, which could affect regional affordability, are described in the Land Use Technical Report, which concluded that the Modified LPA is unlikely to result in induced development.

Right-of-way acquisition data was obtained and used along with Multnomah and Clark County tax assessor data to determine the tax implications of the Modified LPA (e.g., potential reduction in property tax revenues). Right-of-way acquisition data was reviewed in conjunction with employment land demand analysis data developed by Metro to determine the numbers of businesses and employees that may be impacted by the Modified LPA. The economics team coordinated with other IBR resource area teams to ensure consistency across impacts reported in the Economics Technical Report and those reported in the Acquisitions Technical Report. Data from the transportation analysis will inform the identification of impacts related to traffic flows, travel times, and shifts in travel patterns for the Modified LPA.

2.5 Analysis Methods

Economic impacts were analyzed in accordance with WSDOT Environmental Manual Chapter 458 (458.04(1), Economic Effects), which provides guidance on determining types and scale of impacts. To determine the scale of potential impacts, the magnitude of the impacts was examined in terms of the type, quality, and sensitivity of the resource involved; location of the proposed project; duration of the effect (short- or long-term), and other considerations of context.

The economics analysis considered the context and intensity (who or what is affected and to what degree) when determining the type and importance of economic impacts. The Program action was considered at the scale of the primary and secondary study areas for both short-term and long-term effects.

The economics team considered the following questions when assessing impacts:

1. Would the proposed action directly result in a short-term loss of tax revenues for local jurisdictions?
2. Would the proposed action change access in a manner that would adversely affect the profitability of a substantial number of businesses in a local business district, or the marketability of a substantial number of non-residential properties?
3. What are the economic development implications of the proposed action?
4. What indirect impacts might be associated with the proposed action?

2.5.1 Construction Impacts

Short-term construction impacts that affect the economy can result from changes in access to local businesses, parking changes, and short-term construction activities that contribute to noise, vibration, and visibility changes.

Project construction could temporarily increase jobs and income in the region as a result of construction spending. Expenditures during construction would result in demand for construction materials and jobs. These expenditures are considered direct effects. These direct effects lead to indirect effects as firms in other industries provide goods and services to the construction industry. Wages paid to workers in construction trades or supporting industries are spent on other goods and services; these are referred to as indirect effects.

Construction-related traffic delays, increased noise and dust, restricted access, and reduced parking may impact the revenues of firms located in the primary study area. For this report, analysis of these effects was based on review of construction techniques, review of aerial photos, site visits, and information about transportation effects and construction impacts and duration taken from the IBR Program's Transportation Technical Report to determine which properties have the potential to be impacted by construction activity.

Temporary economic impacts that may result from restrictions placed on marine traffic during construction were assessed qualitatively by obtaining and analyzing data on:

- Marine freight traffic patterns.
- Expected duration of closures of the primary navigation channel and barge channels.
- Any necessary assistance through channel required during construction.
- Likely restrictions on river traffic.

2.5.2 Long-Term Operational Impacts

Long-term economic impacts include property acquisitions that cause relocation of a business as well as changes in property taxes or economic impacts that result from a change in access or mobility patterns.

Estimates of the net loss of taxable property due to the IBR Program's right-of-way acquisitions were prepared. Assessed property values for 2022 reported by Multnomah County and Clark County tax assessors were used to estimate the assessed value of the property to be acquired. The portion of each property affected by the Program and the average property tax levies for Multnomah and Clark Counties were used to estimate the amount of property tax revenue that would be removed as a result of the Program. Total parcel area and the estimated acquired area were obtained from the IBR Program's right-of-way acquisition database.

Localized effects on businesses were estimated by reviewing the design drawings for the Modified LPA and information about potential transportation effects included in the Transportation Technical Report. The potential risk of lost employment from businesses displaced by the Modified LPA and business districts affected by the Modified LPA were estimated using a variety of sources, discussed earlier in this section.

The impacts analysis provides estimates of employment of businesses displaced by the Modified LPA, as well as estimates of the potential for employment impacts to business districts that may be

affected by the Program. These estimates were prepared using the best available information from the following sources:

- Updated employee-per-square-foot ratios for business types, using data from the results of the latest reported ratios from Metro modeling (Metro 2015, p.8).
- Updated tax assessment information on the square footage of properties.
- Updated windshield surveys to verify business names, types and addresses.

The results of the IBR Program's Land Use and Transportation Technical Reports and published economic and demographic data were used to estimate the economic effects of the Modified LPA on the trucking industry, the two states, and the ports.

For broader regional effects, research into the links among transportation infrastructure improvements, mobility, congestion, and economic growth helped to evaluate how the Modified LPA may affect the regional economy. Vehicle miles traveled and average speeds for different travel modes presented in the Transportation Technical Report were used to estimate the direct user benefits to the trucking industry and the traveling public.

3. AFFECTED ENVIRONMENT

3.1 Introduction

This section describes the current economic conditions of the primary (local) and secondary (regional) study areas.

3.2 Regional Conditions

The Portland-Vancouver region is located at the confluence of two navigable rivers, the Columbia and the Willamette, and is served by BNSF and Union Pacific Railroad transcontinental rail lines, Portland International Airport, and marine terminals at the Ports of Portland and Vancouver. The region's economic competitiveness is largely dependent on its role as a gateway and distribution center for domestic and international markets. Because many of the region's industries depend on the movement of freight, reliable freight access must be maintained in order for the region to stay competitive locally and internationally. This section describes the historical and forecast conditions of the Portland-Vancouver regional economy.

3.2.1 Unemployment

Table 3-1 presents unemployment rates for the Portland-Vancouver PMSA, the states of Oregon and Washington, and the U.S. over the most recent 15-year period for which data are available (2005 to 2020). From 2015 to 2020, the unemployment rate for the Portland-Vancouver PMSA, which includes Clark, Clackamas, Multnomah, Yamhill, Columbia and Skamania Counties, trended lower than rates overall in Washington, Oregon, and the nation. Unemployment spikes in 2009 to 2011 and in 2020 were caused by the economic recession and the pandemic, respectively. These trends are consistent for the region, states and nation.

The most recent unemployment information (2021) shows a positive trend for economic recovery from the COVID-19 pandemic. The data show a 3.9% unemployment rate for the region, a 4.7% unemployment rate for the state of Oregon, and a 4.9% unemployment rate for the state of Washington. The nation's unemployment rate for this same period was 4.8%.

Table 3-1. Unemployment Rate 2005 through 2020

Year	Portland-Vancouver MSA	Washington	Oregon	U.S.
2005	5.9	5.6	6.2	5.1
2006	5.1	5.0	5.4	4.6
2007	4.9	4.6	5.2	4.6
2008	5.8	5.3	6.3	5.8
2009	10.4	8.3	10.8	9.3
2010	10.1	9.1	10.7	9.6
2011	8.8	8.5	9.6	8.9
2012	7.8	7.6	8.8	8.1
2013	7	6.6	7.8	7.4
2014	6	5.9	6.6	6.2
2015	5.1	5.4	5.5	5.3
2016	4.5	5.2	4.8	4.9
2017	3.8	4.6	4.1	4.4
2018	3.8	4.4	4	3.9
2019	3.5	4.2	3.7	3.7
2020	7.8	8.4	7.6	8.1
2021	5.1	5.2	5.2	5.3

Source: BLS 2021

MSA = metropolitan statistical area

3.2.2 Employment

Table 3-2 below shows employment by industry for the Portland-Vancouver Metropolitan Statistical Area (MSA) for the years 2002, 2010, and 2019, the most recent data available. Between 2002 and 2019, there was an overall increase of 301,160 (or 33.5%) jobs in the Portland-Vancouver MSA; the largest increases in employment share during this period were in Health Care and Social Assistance (3.2% increase) and Professional, Scientific, and Technical Services (1.5% increase). Both Health Care and Social Assistance employment and Professional, Scientific, and Technical Services employment nearly doubled in terms of the total number of regional jobs, increasing to 13.7% and 6.7% of total regional employment, respectively. In the same time period, the largest decreases in employment share were in Manufacturing (2.9% decrease) and Retail Trade (1.3% decrease).

Table 3-2. Jobs by Industry Sector in the Portland-Vancouver MSA

Industry	2002 Count	2002 Share	2010 Count	2010 Share	2019 Count	2019 Share
Agriculture, Forestry, Fishing and Hunting	12,531	1.4%	13,730	1.4%	15,238	1.3%
Mining, Quarrying, and Oil and Gas Extraction	858	0.1%	697	0.1%	854	0.1%
Utilities	3,902	0.4%	6,050	0.6%	5,913	0.5%
Construction	48,511	5.4%	42,142	4.4%	72,978	6.1%
Manufacturing	118,675	13.2%	103,633	10.8%	123,052	10.3%
Wholesale Trade	53,315	5.9%	53,089	5.6%	55,779	4.7%
Retail Trade	98,537	11.0%	100,318	10.5%	115,948	9.7%
Transportation and Warehousing	33,463	3.7%	32,375	3.4%	45,269	3.8%
Information	25,109	2.8%	24,130	2.5%	29,362	2.4%
Finance and Insurance	41,573	4.6%	38,390	4.0%	43,550	3.6%
Real Estate and Rental and Leasing	18,254	2.0%	17,042	1.8%	20,697	1.7%
Professional, Scientific, and Technical Services	46,341	5.2%	53,726	5.6%	80,560	6.7%
Management of Companies and Enterprises	19,321	2.2%	20,908	2.2%	41,866	3.5%
Administration & Support, Waste Management and Remediation	52,881	5.9%	51,422	5.4%	69,915	5.8%
Educational Services	74,537	8.3%	96,696	10.1%	101,751	8.5%
Health Care and Social Assistance	94,474	10.5%	126,128	13.2%	164,142	13.7%
Arts, Entertainment, and Recreation	13,731	1.5%	15,803	1.7%	20,693	1.7%
Accommodation and Food Services	69,627	7.8%	79,042	8.3%	103,346	8.6%
Other Services (excluding Public Administration)	35,856	4.0%	38,952	4.1%	50,263	4.2%
Public Administration	36,245	4.0%	40,949	4.3%	37,725	3.1%
Total All Jobs	897,741	100%	955,222	100%	1,198,901	100%

Source: U.S. Census Bureau 2019a

Table 3-3 presents the Portland-Vancouver MSA cross-border commute patterns of residents working in Clark County or the Oregon PMSA counties. Of the I-5 bridge commuters, 79% are residents of Clark County who work in the Oregon PMSA counties. Conversely, 21% of I-5 bridge commuters are Oregon PMSA residents working in Clark County.

Table 3-3. Portland-Vancouver MSA Cross-Border Commute Patterns

Area	Total	Percent
Oregon PMSA County [a] Residents Working in Clark County	17,595	21%
Clark County Residents Working in Oregon PMSA Counties	66,086	79%

Source: U.S. Census Bureau 2018

a Clackamas, Columbia, Multnomah, Washington, and Yamhill Counties.

3.2.3 Major Employers

Table 3-4 lists the largest 25 employers in the Portland-Vancouver MSA (as of September 2023). The diversity of the companies on this list is representative of the region's diverse economy. Each of these businesses depends on the region's transportation system to provide reliable movement of goods and services, customers, and employees to and from their business locations. The I-5 corridor is one of the most critical components of the region's transportation network, as it provides the only uninterrupted north-south freeway corridor connecting Oregon and Washington with Mexico, California, and British Columbia, Canada.

Table 3-4. Largest Employers in the Portland MSA (Clackamas, Multnomah, Washington, and Clark County)

Rank	Employer	No. of Employees
1	Providence Health System	23,100
2	Intel Corp.	22,328
3	Oregon Health & Science University	19,603
4	Nike, Inc.	15,522
5	Legacy Health System	13,087
6	Kaiser Permanente	12,51412,000
7	Fred Meyer Stores	9,0008,163
8	Portland Public Schools	7,111
9	City of Portland	6,753
10	Multnomah County	6,317
11	U.S. Department of Veterans Affairs	4,845
12	Beaverton School District	4,600
13	Portland State University	3,731
14	U.S. Postal Service	3,590

Rank	Employer	No. of Employees
15	Vancouver Public Schools	3,264
16	TriMet	3,152
17	U.S. Bank	3,144
18	Portland Community College	3,049
19	Daimler Truck North America	3,000
20	Precision Castparts Corp.	2,500
21	Hillsboro School District	2,463
22	Oregon Department of Human Services	2,439
23	Portland General Electric	2,423
24	Clackamas County	2,363
25	North Clackamas Schools	2,223

Source: Portland Business Journal 2023

3.2.4 Median Household Income

Table 3-5 presents median household incomes for the Portland-Vancouver MSA, the states of Oregon and Washington, and the U.S. In 2010, the median household income of the Portland-Vancouver MSA was approximately $56,000 and was below the Washington median of $78,687 but above the Oregon and national median, $67,058 and $65,712, respectively. By 2015, the regional median household income was just above $60,000, which was closer to the Washington state median but still above the national and the Oregon state median. By 2019, the regional median household was nearly $75,000, which was higher than the Oregon, Washington, and national median.

Table 3-5. Median Household Income 2010 through 2019

Year	Portland-Vancouver MSA	Washington	Oregon	U.S.
2010	56,275	57,244	49,260	51,914
2011	57,307	58,890	49,850	52,762
2012	57,896	59,374	50,036	53,046
2013	58,110	59,478	50,229	53,046
2014	58.832	60,294	50,521	53,482
2015	60,286	61,062	51,243	53,889
2016	62,772	62,848	53,270	55,322
2017	66,657	66,174	56,119	57,652
2018	70,724	70,116	59,393	60,293
2019	74,792	73,775	62,818	62,843

Source: U.S. Census Bureau 2019b

3.2.5 Retail Sales

Table 3-6 presents historical annual retail sales growth within the Portland-Vancouver MSA. In 2012, the most recent year for which data was available, retail sales totaled $40.4 billion per year. Portland and Vancouver represented 39% of all regional retail sales in 2012, indicating the outsize share of regional retail activity represented by these two communities.

Table 3-6. Portland-Vancouver MSA Retail Sales (thousands)

County/City	2012 Retail Sales
Multnomah County, OR	$9,982,933
Washington County, OR	$8,389,744
Clackamas County, OR	$5,125,309
Clark County, WA	$4,276,454
Yamhill County, OR	$886,639
Columbia County, OR	$318,072
Total	**$28,979,151**

County/City	2012 Retail Sales
City of Portland	$8,508,267
City of Vancouver	$2,863,863
Cities of Portland-Vancouver as Percent of Total	**39%**

Source: U.S. Census Bureau 2012

3.2.6 Transportation and Freight Mobility

The I-5 corridor is the backbone of a series of roads that provides access to the greater Vancouver and Portland regional area for freight, employees, and personal trips. The Regional Commodity Movement Forecast (Cambridge Systematics 2015) forecasts an increase in commodities transported by truck in the Portland-Vancouver region from 300 million tons in 2007 to nearly 600 million tons by 2040, nearly doubling in 30 years. The study further concludes that failure to replace the Interstate Bridge is a threat to the economic competitiveness of the Portland metropolitan region.

As noted in a study about the cost of congestion to the local economy (EDR Group 2005), the Portland-Vancouver region is more susceptible to long-term economic losses from congestion than other areas of the country because its economy is relatively highly dependent on manufacturing, transportation/port distribution, and services that serve broader regional, national, and global markets. These firms bring new money into the region by selling their products and services nationally and internationally. They could locate elsewhere, but choose the Portland-Vancouver region for its attractiveness and competitiveness for their operations. These industries are particularly vulnerable to costs imposed by increased congestion and have the option of moving their operations elsewhere if transportation conditions compromise the viability of the region as a base for their operations. A conclusion of this study was that an inadequate transportation system would negatively impact regional competitiveness if not addressed.

Tight local and regional industrial land supply can constrain the traded sector and economic equity benefits of industrial job growth (City of Portland 2022b). Portland's 2035 Comprehensive Plan added over 400 acres of industrial land development capacity to meet forecast shortfalls to 2035 (City of Portland 2022b). The largest source of additional capacity was 190 acres through "industrial land intensification," which was anticipated to be met primarily by strategic freight infrastructure investments, such as IBR, that encourage private reinvestment in existing industrial facilities.

The Ports of Portland and Vancouver are critical to the economic growth and prosperity of the region. The ports rely on efficient and cost-effective intermodal connections to remain competitive with other West Coast ports. Reducing freight travel times helps maintain the efficiency of the area's freight movement. This growth has implications for the transportation network as products are moved to and from the regional marketplace.

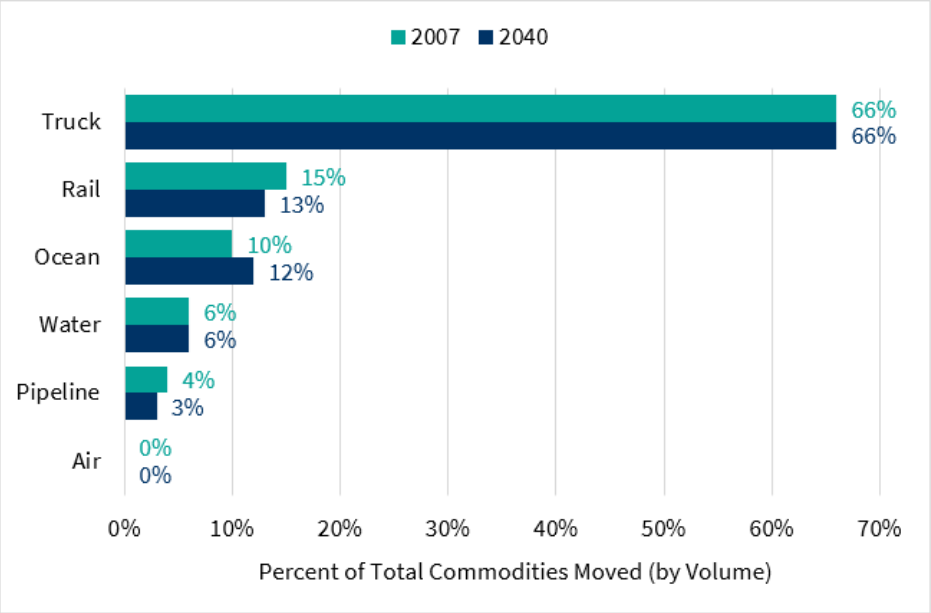
Congestion at the Interstate Bridge, which is a major West Coast congestion point, impacts the region's hub of multimodal freight infrastructure, terminals, and warehousing. The majority of the region's warehouse facilities and jobs are concentrated in the contiguous Columbia Corridor and harbor industrial districts that intersect I-5 near the bridge. Congestion at the Interstate Bridge

reduces the hours of practical truck travel, trip scheduling reliability, and location competitiveness of these terminal, warehousing, and manufacturing districts.

Figure 3-1 presents the percentage of commodities moved through the Port of Portland by transportation mode and shows both actual 2007 percentages and forecast 2040 percentages. Currently, the largest volume of goods moved in and out of the Portland-Vancouver MSA is via commercial truck. This is not expected to change over the next 25 years. All modes of freight are expected to see substantial growth from 2007 to 2040. Commodities moved by trucks are expected to grow from about 200 million tons to about 400 million tons from 2007 to 2040, though the percentage of total freight transported by truck is expected to remain roughly the same, at 67% of total freight. Approximately $133 million in commodity value was transported by trucks daily across the Interstate Bridge in 2019.

Ocean freight is expected to increase in percentage by mode, while the rest of the modes will stay at roughly the same percentage or decrease slightly. The projected growth in trucking has implications for the roadway network and capacity needs, as efficient and safe movement of products to and from the ports will be needed to maintain their competitiveness. The increased truck traffic will have to compete for highway capacity with the expected increase in passenger travel.

Figure 3-1. Port of Portland Commodity Flows by Mode, 2007 and 2040



Source: Cambridge Systematics 2015

3.2.7 Marine Commerce

The Columbia River has been a commerce route from time immemorial for Native Americans. European and European American contact with the Columbia River occurred around 1800 and prompted further exploration, trade, and settlement activities. The Interstate Bridge (existing northbound span) was built and opened in 1917, replacing a ferry system to transport people and

goods across the river. The original bridge included a lift span to accommodate navigation for vessels and cargo with heights up to 178 feet. In 1958, a second bridge (existing southbound span) was completed and opened for traffic; this bridge was designed as a twin to the original bridge, including a lift span to accommodate navigation. For over 100 years, the Interstate Bridge has supported navigation on the Columbia River for commerce, recreation, and government agency missions.

Commercial vessels on the Columbia River include cruise vessels, tugs, tows, barges, and marine contractors' vessels. Several passenger cruise lines host tours up and down the Columbia and Snake Rivers and require frequent passage under the Interstate Bridge during the cruise season. Commercial tugs and barges have the highest share of river usage and transit year round and accounted for approximately 54% of the bridge opening events across a 35-year study period. Tugs and barges are usually able to use the barge channel or alternate barge channel unless river and weather conditions are a factor or cargo requires additional vertical clearance. Tugs and barges will request an opening of the Interstate Bridge to provide sufficient vertical clearance or minimize safety hazards between the Interstate Bridge and the BNSF bridge downstream.

Marine contractors use vessels such as crane barges, dredges, and other construction equipment transported on the Columbia River. Transits of the Interstate Bridge are not limited to a particular time of year or frequency, as construction work is typically performed on an as-needed or contract basis. Whether the transport of construction equipment requires a bridge opening event depends upon the contractor's location and the location of the construction project. Construction equipment used by marine contractors accounted for an average of 17% of bridge opening events, ranging from no lifts (2013) to a high of 32% (1989 and 2000).

Commodity transport by ship and tug/tow on the Columbia River is important to the regional economy. Inland navigation along the 360-mile Columbia Snake River System, Portland/Vancouver to Lewiston, Idaho, carried over 8.3 million tons of commercial cargo in 2020 (PNWA 2024). Recreational vessels, such as sailboats, powerboats, personal watercraft, and yachts modestly contribute to the regional economy. In 2021 there were 8,499,857 tons of various commodities transported between Vancouver, WA and The Dalles, OR on the Columbia River. Table 3-7 provides a detailed breakdown of cargo types and quantities transported.

Table 3-7. 2017–2021 Cargo Report between Vancouver, Washington, and The Dalles, Oregon (in tons)

	2021	2020	2019	2018	2017
All Commodities	8,499,857	8,304,485	8,488,840	8,675,632	8,363,316
Gasoline, Jet Fuel, Kerosene	580,748	427,111	528,133	632,369	431,977
Distillate, Residual & Other Fuel Oils; Lube Oil & Greases	676,007	359,574	460,295	527,512	484,263
Fertilizers	65,038	61,566	85,925	82,122	82,603

	2021	2020	2019	2018	2017
Other Chemicals and Related Products	299,953	270,707	275,014	267,842	133,234
Forest Products, Lumber, Logs, Woodchips	531,118	621,482	609,496	693,740	719,590
Sand, Gravel, Stone, Rock, Limestone, Soil, Dredged Material	1,027,450	1,082,078	1,567,823	1,442,827	1,568,278
Iron Ore and Iron & Steel Waste & Scrap	107,677	98,703	82,517	83,850	63,850
Wheat	4,831,578	5,054,619	4,568,282	4,630,976	4,577,167
Corn	0	0	0	0	8,419
Barley, Rye, Oats, Rice and Sorghum Grains	0	0	0	0	6,888
Oilseeds (Soybean, Flaxseed and Others)	22,134	0	0	0	0
All Manufactured Equipment, Machinery and Products	29	0	0	0	0
Waste Material; Garbage, Landfill, Sewage Sludge, Waste Water	358,125	328,645	311,355	314,394	287,047

Source: U.S. Army Corps of Engineers WCSC 2021

Existing horizontal and vertical obstructions limit the size of vessels on the Columbia River upriver of the Interstate Bridge. The BNSF Railway bridge at Celilo Falls, located 95 miles upstream of the Interstate Bridge, has a vertical clearance of 79 feet in the raised position. Upstream from Celilo, several bridges and other obstructions such as power cables further limit the vertical clearance on the river to less than 79 feet. In addition, the Bonneville Locks and all other locks on the Columbia/Snake River system constrain navigation uses to a maximum width of 86 feet, which prohibits passage by ocean-going barges.

3.3 Local Conditions

Local population, household, and employment data were calculated based on traffic analysis zone (TAZ) data provided by Metro, the Metropolitan Planning Organization for the Portland region.

Specific TAZs were selected if the proposed Modified LPA alignment crossed through that TAZ. TAZs that would not be impacted directly by the Modified LPA were not used for this analysis.

3.3.1 Population and Households

Table 3-8 presents recent and forecast population data for the primary study area, broken down by state, along with total population forecasts for the four-county Portland-Vancouver Standard Metropolitan Statistical Area (SMSA).[10] Between 2015 and 2045, Metro forecasts that the four-county region (including Clark, Clackamas, Multnomah and Washington Counties) will grow by an annual 1.4%, lower than the projected growth for the Oregon portion of the study area of 2.7% per year, but slightly higher than the 1.1% forecast for the Washington portion.

Table 3-8. Population Forecast in the Primary Study Area

Area	2015	2045	Average Annual Growth Rate
Oregon (area within study area only)	61,362	110,128	2.7%
Washington (area within study area only)	60,228	80,323	1.1%
Portland-Vancouver SMSA [a]	2,006,417	2,850,534	1.4%

Source: Metro distributed forecast 2021a.

a Data provided by Metro includes the four-county standard metropolitan statistical area (SMSA), which includes Clark, Clackamas, Multnomah, and Washington Counties.

Table 3-9 presents recent and forecast household data for the study area in Oregon, the study area in Washington, and the four-county Portland-Vancouver SMSA. Between 2015 and 2045, the number of households in the SMSA is forecast to grow approximately 1.5% per year. This is lower than the Oregon-area projected growth rate of 2.7% per year, but higher than the Washington state area projected growth rate of 1.2% per year. Household growth in the metropolitan region is forecast to be similar to population growth. However, the Metro forecast does predict a slight decrease in persons per household, declining from 2.36 in 2015 to 2.32 in 2045 (assuming no change in housing vacancy rates). This is relevant because travel demand usually correlates more closely with household growth than population growth.

[10] Forecast data provided by Metro includes the four-county SMSA, which includes Clark, Clackamas, Multnomah and Washington counties. The PMSA includes these four counties and also includes Yamhill and Columbia counties in Oregon and Skamania County in Washington.

Table 3-9. Household Forecast in the Primary Study Area

Area	2015	2045	Average Annual Growth Rate
Oregon (within study area only)	26,023	47,469	2.7%
Washington (within study area only)	25,542	34,622	1.2%
Portland-Vancouver SMSA	850,898	1,228,679	1.5%

Source: Metro 2021

Note: Demographic information for the project area is described in the Neighborhoods and Populations and Environmental Justice Technical Reports.

SMSA = standard metropolitan statistical area

3.3.2 Employment

Table 3-10 presents forecasted employment data for the Oregon and Washington portions of the study area and the four-county Portland-Vancouver SMSA.[11] Between 2015 and 2045, Metro forecasts that total employment in the four-county SMSA is forecast to grow by approximately 1.6% per year. This is slightly higher than the Oregon-area forecast growth rate of 1.1% per year and the Washington state area forecast growth rate of 1.0% per year.

Table 3-10. Employment Forecast in the Primary Study Area

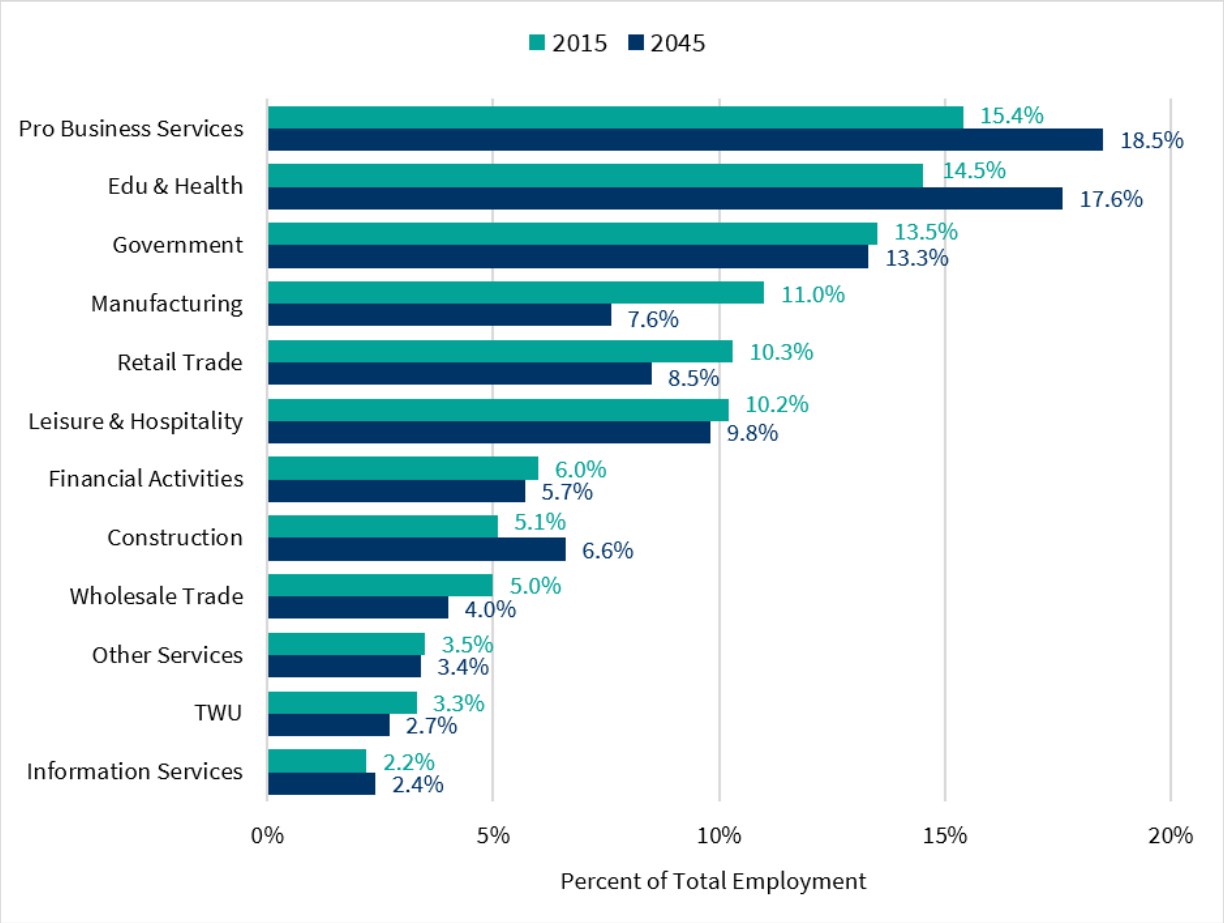
Area	2015	2045	Average Annual Growth Rate
Oregon (within study area only)	55,251	73,186	1.1%
Washington (within study area only)	36,647	47,914	1.0%
Portland-Vancouver SMSA	1,072,925	1,592,290	1.6%

Source: Metro 2021.

Figure 3-2 presents recent (2015) and forecast (2045) employment by sector, in total and on a percentage basis, for the Portland MSA. Metro forecasts that the percentage of total jobs in the Professional Business Services, Education and Health, Construction, and Information Services will increase, while other sectors will either decrease or stay roughly the same. Retail Trade and Manufacturing in the Portland MSA are both predicted to decrease the most as a share of total employment, with the actual number of Manufacturing jobs decreasing by 5,500. Note that Metro's industry categories do not correspond directly with the Census Bureau's categories.

[11] Forecast data provided by Metro includes the four-county SMSA, which includes Clark, Clackamas, Multnomah and Washington Counties. The PMSA would also include Yamhill and Columbia Counties in Oregon and Skamania County in Washington.

Figure 3-2. Percent of Total Employment by Industry for Portland MSA, 2015 and 2045



Source: Metro 2018c

Pro = professional; Edu = education; TWU = transportation, warehousing, and utilities

More recent data and forecasts show accelerating traded sector job growth—including transportation and warehousing growth—even through the COVID-19 recession. The Oregon Employment Department's 2019–2029 industry projections (reflecting a peak-to-peak long-term horizon) for the Portland Tri-County Area (82% of MSA jobs in 2019) identify transportation and warehousing among the fastest growing sectors at 1.7% average annual growth rate (AAGR) and manufacturing growth at 0.5% AAGR, both substantially exceeding the earlier forecasts (State of Oregon Employment Department 2020; City of Portland 2022a).

Industrial job growth facilitated by IBR can be a driver of inclusive prosperity. The region could see economic equity benefits of major freight investments like IBR that support middle-wage job growth. High-wage jobs typically require bachelor's degree credentials. In contrast, middle-wage occupations extend prosperity more broadly to workers without bachelor's degrees. Freight-dependent industrial jobs in goods production and distribution are the region's largest source of middle-wage jobs and jobs that raise the incomes of Black, Indigenous, and People of Color (BIPOC) communities, while most regional job growth since 2000 has been in high- and low-wage occupations that increase income inequality and comparatively reduce BIPOC incomes (City of Portland 2022c).

3.3.3 Revenue Sources

Both the City of Portland and the City of Vancouver rely on tax revenues to fund general services to their respective jurisdictions. Portland and Vancouver General Fund revenue sources are presented in Table 3-11 and Table 3-12, respectively. Portland's largest source of revenue is property taxes, which accounts for 49% of the city's total revenues. The second largest revenue source for Portland was Licenses and Fees. In Vancouver, the largest source of revenue is Business & Occupation Taxes (32%), followed by property tax and then sales tax (Oregon does not have a sales tax). Revenues collected by each City, other than taxes, consist of funding from state and local sources, internal transfers, and various types of fees collected from government operated facilities and issuing licenses and permits. Revenue sources for 2019 are included, despite the availability of more recent data (2020), because the effects of the pandemic are likely to have affected revenues in a way that is not expected to continue post pandemic.

Table 3-11. City of Portland General Fund Revenue Sources

Source	2019 (Thousands)	2020 (Thousands)
Property Tax [a]	$413,960	$419,630
Lodging Tax	$39,187	$30,778
Licenses & Fees	$242,390	$262,252
Charges for Services	$16,328	$9,735
Miscellaneous Service Charges	$5,120	$4,371
Intergovernmental	$36,338	$35,031
Interagency	$65,582	$72,083
Rents and Reimbursements	$4,906	$4,047
Investment Earnings	$5,068	$4,567
Payments in Lieu of Taxes	$856	$1,140
Miscellaneous	$3,042	$4,950
Total	**$833,270**	**$848,827**

Sources: City of Portland 2019, 2020b

a Property tax excludes payment in lieu of taxes.

Table 3-12. City of Vancouver General Revenue Sources

Source	2019 (Thousands)	2020 (Thousands)
Property Tax	$49,898	$51,125
Sales Tax	$46,853	$48,420
Business & Occupation Taxes	$51,358	$55,613
Excise Taxes	$664	$661
License and Permits	$2,703	$793
Intergovernmental	$5,570	$9,142
Charges for Services	$8,756	$5,257
Fines & Penalties	$1,583	$1,149
Investment Earnings	$2,088	$855
Rents and Royalties	$3,858	$3,017
Prior Period Cost Allocation Adjustment	$4,539	N/A
Miscellaneous	$259	$206
Total	**$178,250**	**$176,347**

Source: City of Vancouver 2018, 2020

4. LONG-TERM EFFECTS

4.1 Introduction

This chapter describes the long-term economic effects that are anticipated from the No-Build Alternative and from the Modified LPA and its design options. Except where specifically noted otherwise, the effects of all Modified LPA design options would be similar. Impacts and benefits have been analyzed separately for the Oregon and Washington portions of the study area.

Each of the subsections below contains an analysis of business displacements, property tax impacts to Multnomah and Clark Counties, and estimated parking impacts associated with the Modified LPA. This section also includes an assessment of the economic effects of changes in the availability of parking, changes in traffic volumes and travel patterns, and access. Regional economic impacts, tolling impacts, and impacts on marine commerce are also discussed at the end of this section.

This section addresses direct long-term effects. Temporary (construction) impacts are discussed in Chapter 5. Indirect effects in each portion of the study area are described in Chapter 6.

4.2 No-Build Alternative

The No-Build Alternative would retain the existing Interstate Bridge and would make only minor preservation improvements to I-5 within the study area. Projects included in the No-Build Alternative are consistent with the Financially Constrained RTP adopted in 2018 by the Metro Council and by the RTC Board of Directors in March 2019. The Transportation Technical Report contains a list of all projects considered as part of the No-Build Alternative. Several projects are planned to improve freight mobility, access, and safety in the IBR Program vicinity. In Washington, an extension of the separated bike-pedestrian path is planned on Columbia Way to connect the City Waterfront Park with the Renaissance Trail through the Port of Vancouver Terminal 1 property. Additionally, a rail overpass at Gateway Avenue and the rail loop at the Port of Vancouver Terminal 5 would improve industrial access. Near the Port of Portland, improvements include separated crossings to eliminate conflicts between rail and trucks, and roadway modifications to meet freight district street standards and reduce congestion. More detail on freight mobility, access and safety improvements included in the No-Build Alternative is provided in the Transportation Technical Report.

If no improvements were made to I-5, the severity of the existing bottlenecks would increase. Under the No-Build Alternative in 2045, the Interstate Bridge would increasingly serve as a bottleneck for southbound traffic, including freight traffic. Forecast operations indicate that congestion on the bridge on weekdays would last from 5 a.m. to 9 p.m., a total of 16 hours. In the northbound direction, congestion on the bridge would last 14 hours, from 7 a.m. until 9 p.m. Given the progressive nature of congestion to build and recede over time, it is reasonable to assume congestion would be present before and/or after the peak periods when congestion is present at the beginning and/or end of a peak period.

During the AM peak period, southbound congestion would begin at the Interstate Bridge and extend north to the I-205 interchange by 7:30 a.m. This congestion would continue through the remainder of

the AM peak period (through 10 a.m.). In the PM peak period, southbound congestion would start at the Hayden Island off-ramp beginning at 3 p.m. and would reach its northernmost extent at the 99th Street off-ramp at 6 p.m.

In the northbound direction, congestion in the AM peak period would be concentrated at the SR 14 off-ramp from 6 to 7 a.m. and then would reach south of the Victory Boulevard on-ramp for the remainder of the AM peak period. Congestion would also be present from the Morrison Bridge on-ramp to the Marquam Bridge for most of the AM peak period. In the PM peak period, congestion would start at the SR 14 off-ramp and extend across the Interstate Bridge to Exit 302A. Congestion would also be present near the Morrison Bridge on-ramp and south of Exit 300. Congestion would be continuous between the SR 14 off-ramp and the Marquam Bridge by 3:45 p.m. and throughout the remainder of the PM peak period (through 7 p.m.). Although trucks traveling along I-5 in the project vicinity tend to travel outside the peak periods, it is likely that congestion would extend beyond the peak periods, impacting freight mobility.

Total southbound travel times across all segments under the No-Build Alternative would range between 38 and 95.9 minutes, with forecast travel times increasing throughout the AM peak period. These southbound travel times exceed the free-flow travel time by as much as 81 minutes. In the northbound direction, total travel times across all segments under the No-Build Alternative would range between 54.6 and 86.6 minutes. These travel times exceed the free-flow travel time by as much as 72 minutes.

Under the No-Build Alternative, no businesses in Oregon or Washington would be displaced by right-of-way acquisition, and there would be no resulting decrease in property or sales tax revenues or jobs lost. However, increasing congestion on I-5 could result in potentially significant economic effects. Economic development planned for this area may occur more slowly because business owners may be more reluctant to locate in an area with poor access and mobility for employees and customers. Freight reliability would decrease as congestion would continue to spread throughout the day, into times when trucks tend to travel. Customers could elect to shop in other areas with easier access and improved mobility.

4.3 Modified LPA Long-Term Effects in Oregon

The IBR Program would acquire additional rights-of-way from taxable property within the City of Portland to construct the project. This taxable property would be removed from the City's tax base with the potential for decreasing property tax revenues. The additional right of way acquired would include both full parcels, which would be removed from the tax rolls completely, and partial acquisitions. The tax effect of the partial acquisitions was calculated by multiplying the actual 2022 property tax collected for the parcel by an estimate of the percentage of the parcel taken for the project. The effects of the Modified LPA in Oregon would not differ by design option.

4.3.1 Oregon Mainland

The Oregon Mainland portion of the study area encompasses north Portland from the south end of the study area to the North Portland Harbor. The Modified LPA would have impacts to two interchanges in this segment: Marine Drive and Victory Boulevard.

The Modified LPA at the Marine Drive interchange would be designed to optimize truck mobility. The Marine Drive interchange configuration is a single-point interchange. With this configuration, all four legs of the interchange would converge at a point on Marine Drive over the I-5 mainline.

4.3.1.1 Business Displacements

Table 4-1 provides an estimate of the number of businesses and employees located on properties that would be displaced by the Modified LPA in the Oregon Mainland area.

Table 4-1. Business Effects on the Oregon Mainland

Area	No. Businesses Displaced	No. Employees Impacted
Oregon Mainland Modified LPA	7	41

Sources: IBR 2022b; Metro 2015

The seven businesses that would be displaced by the Modified LPA in the Marine Drive area are a combination of marine-related light-industrial and commercial-retail uses, including a boat repair business with an auxiliary boat dock, a billboard operated as a business, and other marine-related businesses with a total of approximately 41 staff. Some of these marine-related businesses may be dependent upon a location close to the river. Finding suitable locations for relocation may be difficult because much of the Columbia River area in the vicinity of freeway access is built up for either residential or industrial/commercial use. ODOT would provide relocation assistance to displaced businesses. Displaced employees may be impacted by longer commutes or may need to find other employment opportunities.

4.3.1.2 Property Tax Impacts

Table 4-2 presents the estimated property tax impacts associated with the Modified LPA on the Oregon Mainland. As shown in the table, the reduction in tax revenue of approximately $72,000 would reduce overall budgeted property tax revenues in Multnomah County by only about 0.02%.

Table 4-2. Tax Impacts from the Modified LPA (Mainland Oregon)

Area	Estimated Assessed Value of Right-of-Way (Millions)	Property Tax Impact (Thousands)	Multnomah County Budgeted 2022 Property Tax Revenues
Oregon Mainland Modified LPA	$19.0	$72	0.02%

Sources: IBR 2022b; Multnomah County Tax Assessor 2022

There would be no impacts to sales tax revenue in this area as Oregon does not have sales tax.

4.3.1.3 Parking

There would be no impacts to on-street parking in this area. The Expo Center Park and Ride would be reduced by 386 parking spaces, or a reduction of 18% of the total parking. This area would be used for landscaping and the realignment of both Marine Drive and the new Expo Center Drive. The Expo

Center seldom requires the use of all 2,160 parking stalls, and any impacts that could be observed during peak events would likely be offset by the new light rail transit service provided connecting the Expo Center with Vancouver. The parking loss on Hayden Island is a small fraction of available parking in the area; for businesses affected by parking loss, coordination with property owners would occur as the design progresses to minimize impacts to parking and site use. No significant economic impacts from the impacts due to the elimination of parking are anticipated.

4.3.1.4 Changes in Travel Patterns

Under the Modified LPA, intersection operations at the I-5 interchange with Marine Drive would be worse compared to the No-Build Alternative for both the AM and PM peak periods. This would indicate a reduction in mobility and access to this freight and employment corridor. For detailed information on traffic impacts, see the Transportation Technical Report.

4.3.1.5 Access and Circulation Impacts

There would be some minor access and circulation changes associated with the Modified LPA. The roadway realignments and extensions in the vicinity of the Marine Drive interchange associated with the Modified LPA would improve access and circulation overall. The realignment of Marine Drive would still provide circulation to I-5, Vancouver Way, and Martin Luther King Jr. Boulevard. Some vehicles traveling on Marine Drive to the east of I-5 would be required to complete a minimal level of out-of-direction travel to access Marine Drive west of I-5. Access would remain with a connection from Marine Drive to Vancouver Way and then to Martin Luther King Jr. Boulevard, which would connect with Marine Drive to the west of I-5 through the new interchange.

The project would include some partial acquisitions of properties that could have minor impacts to existing driveways. Driveways to these properties could be modified or relocated to a different location on the property. However, all parcels would retain access under the Modified LPA, and coordination with property owners would occur as the design progresses. Access changes would not be anticipated to impact business operations on the properties; therefore, no significant economic impacts are anticipated.

The local arterial bridge connection between North Portland and Hayden Island would provide one lane in each direction over the North Portland Harbor; this bridge would provide access to Hayden Island from the Oregon mainland, as the Hayden Island interchange would no longer include a southbound on-ramp or northbound off-ramp from I-5.

The impacts to access and circulation on the Oregon mainland are not anticipated to negatively impact economic conditions.

4.3.2 Hayden Island

This section describes positive and negative economic impacts associated with the Modified LPA on Hayden Island. The Hayden Island portion of the study area traverses the entire island, from North Portland Harbor to the Columbia River. There is one affected interchange in this area, referred to as the Hayden Island interchange.

4.3.2.1 Business Displacements

As shown in Table 4-3, an estimated 15 businesses on Hayden Island would be displaced to construct the Modified LPA. Approximately 130 employees would be affected. Business displacements would comprise a variety of commercial, service and retail establishments. One cellular phone tower would also be displaced. Additionally, the Modified LPA would require the acquisition of a parcel that contains a public service facility, the Portland Water Bureau's Newport Bay water tank. This site has been identified by the Portland Water Bureau as surplus property, which is no longer needed for ongoing operations and will be sold by the agency.

Table 4-3. Business Effects on Hayden Island

Area	No. Businesses Impacted	No. Employees Impacted
Hayden Island Modified LPA	15	159

Source: IBR Acquisitions Technical Report and Metro 2014

The business displacements caused by the Modified LPA would include a group of fast-food, restaurant, and bar establishments and a cellular services store located between the existing freeway and N Center Drive; a restaurant and retail store west of N Center Drive along N Jantzen Street; a retail store on the west side of N Center Drive south of its intersection with N Hayden Island Drive; and a restaurant along N Jantzen Beach Drive. Hayden Island is a regional draw because of the numerous big box retail establishments located west of the freeway and the Jantzen Beach Center. The displacements caused by the Modified LPA would not impact these regional attractors.

The City of Portland has documented a vision for this area in the Hayden Island Plan (City of Portland 2009). This plan anticipates the extension of light rail across Hayden Island and assumes redevelopment of the Jantzen Beach Center property into a Regional Retail Center (called a "Lifestyle Center") with mixed-use and transit-oriented developments (residential) to the south. The Jantzen Beach Center property was acquired by Kimco Realty Corporation in 2017, and currently there are no immediate plans to redevelop the property. Even without redevelopment of the property, the retail uses west of the freeway could be assumed to continue to draw regional traffic unless other regional centers locate nearby. Long term, the Modified LPA is not expected to result in any adverse impact to the Hayden Island Plan implementation.

Also important from an economic standpoint is the effect of the Modified LPA on island residents as customers and/or employees of displaced businesses. The majority of businesses that would be displaced by the Modified LPA serve mainly local clientele. There could be minimal parcels on Hayden Island that would be available to relocate displaced businesses due to the level of development on the island. ODOT would work with affected business owners to provide relocation assistance. Displaced employees may be impacted by longer commutes or may need to find other employment opportunities. Because Hayden Island is expected to be redeveloped (based on the City of Portland's Hayden Island Plan) with a variety of new uses, there could be many opportunities to relocate businesses and jobs within the island. The extension of light rail transit service to Hayden Island would also support redevelopment goals.

4.3.2.2 Property Tax Impacts

Table 4-4 presents the estimated property tax impacts associated with the Modified LPA on Hayden Island. The loss of approximately $531,000 in tax revenue for land acquired for right of way in this area represents less than two-tenths of 1% of the total 2022 tax revenues for Multnomah County.

Table 4-4. Tax Impacts from the Modified LPA (Hayden Island)

Area	Estimated Assessed Value of Right-of-Way (Millions)	Property Tax Impact (Thousands)	Multnomah County Budgeted 2022 Property Tax Revenues
Hayden Island Modified LPA	$49.8	$542	0.16%

Sources: IBR 2022b; Multnomah County Tax Assessor 2022

Note: There would be no impacts to sales tax revenue in this area as Oregon does not have sales tax.

4.3.2.3 Parking Impacts

There is currently no on-street parking in this area. However, the Modified LPA would impact a portion of the parking spaces at commercial properties as summarized in Table 4-5.

Table 4-5. Parking Impacts for Businesses on Hayden Island

Number of Parking Stalls Impacted	Current Number of Parking Stalls	Reduction in Parking
180	4,354	4%

The potential parking impacts are not likely to constitute a substantial impact to most parcels on Hayden Island because businesses on parcels with minor parking reductions could continue to operate with minimal disruptions. There are two parcels where reductions in parking could impact operations of the business. Coordination with these property owners would occur as the design progresses to minimize impacts to parking.

4.3.2.4 Changes in Travel Patterns

Intersection operations at the Hayden Island interchange under the Modified LPA would be similar to operations under the No-Build Alternative for both the AM and PM peak periods. These intersections would operate at acceptable levels with minimal delay, meaning that the interchange would provide adequate mobility to Hayden Island. The Hayden Island arterial bridge intersections would also operate at acceptable levels under the Modified LPA. For detailed information on traffic impacts, see the Transportation Technical Report.

4.3.2.5 Access and Circulation Impacts

There would be some minor access and circulation impacts associated with the Modified LPA. The extension of the MAX Line would provide direct transit service for residents, employees, and

customers between the island and downtown Portland and Vancouver. The two-lane arterial bridge between Hayden Island and North Portland would provide access for travelers between the island and mainland Oregon. Direct access to Hayden Island from I-5 would be provided to and from the north (Vancouver). The Modified LPA includes widening three east-west local streets and extending N Tomahawk Drive under I-5.

The Modified LPA would include some partial acquisitions of properties that could have minor impacts to existing driveways. Driveways to these properties could be modified or relocated to a different location on the property. However, all parcels would retain access under the Modified LPA and coordination with property owners would occur as the design progresses. Access changes would not be anticipated to impact business operations on the properties. The transit alignment and station on Hayden Island would be elevated and would create minimal to no disruptions to circulation within Hayden Island.

The impacts to access and circulation on Hayden Island are not anticipated to negatively impact economic conditions.

4.3.3 Ruby Junction Maintenance Facility

This section describes impacts associated with the maintenance base expansion at the TriMet[12] Ruby Junction Maintenance Facility located in Gresham, Oregon. TriMet currently owns and operates this rail storage and maintenance facility, which would be expanded to accommodate the additional rail vehicles needed to support light rail transit extension under the Modified LPA. All impacts are related to the light rail transit portion of the project.

4.3.3.1 Business Displacements

Table 4-6 summarizes the business effects of the TriMet maintenance facility in Ruby Junction. The facility expansion would displace three businesses employing an estimated 16 people. The affected area primarily includes industrial businesses, with one service business. There are other industrial and commercial lands in the area that could accommodate these businesses. The displaced businesses do not have overly large land needs, and ODOT would provide relocation assistance to each affected property owner. Displaced employees may be impacted by longer commutes, depending on the availability of nearby space for the businesses to be relocated.

Table 4-6. Business Effects on Ruby Junction from the Modified LPA

Area	No. Businesses Impacted	No. Employees Impacted
Ruby Junction	3	16

Sources: IBR 2022b; Metro 2014

[12] Tri-County Metropolitan Transportation District

4.3.3.2 Property Tax Impacts

Table 4-7 presents the estimated property tax impacts associated with the Modified LPA at Ruby Junction. As shown in Table 4-7, the reduction in property tax revenues from land acquired for right of way in this area represents less than 0.01% of the total annual 2022 property tax revenues for Multnomah County.

Table 4-7. Tax Impacts from the Modified LPA (Ruby Junction)

Area	Estimated Assessed Value of Right-of-Way (Millions)	Property Tax Impact (Thousands)	Multnomah County Budgeted 2022 Property Tax Revenues
Ruby Junction	$4.3	$43.2	<0.01%

Source: IBR 2022b; Multnomah County Tax Assessor 2022

Note: There would be no impacts to sales tax revenue in this area as Oregon does not have sales tax.

4.4 Modified LPA Long-Term Effects in Washington

4.4.1 Downtown Vancouver

For purposes of this analysis, the downtown Vancouver area starts at the northern bank of the Columbia River and extends north to McLoughlin Boulevard. The City of Vancouver defines downtown as the Central Downtown subdistrict, the Mill Plain couplet subdistrict, and the Esther Short neighborhood. Impacts and benefits associated with both light trail transit and roadway improvements are described in this section.

Employment and property tax impacts of acquisitions for the project in downtown Vancouver are described in the sections that follow. Some of these impacts would differ based on the Modified LPA design option chosen; these differences are noted as applicable.

4.4.1.1 Business Displacements

Table 4-8 provides an estimate of the number of businesses that would be displaced by the Modified LPA in downtown Vancouver, as well as the estimated number of employees that would be affected by the Modified LPA. The Modified LPA with a centered I-5 mainline configuration would impact 10 businesses. Compared to the centered I-5 mainline configuration, shifting the I-5 mainline west would displace an additional three businesses and 142 employees (in total, 13 businesses and 542 employees). Displaced employees may be impacted by longer commutes, depending on the availability of nearby space for the businesses to be relocated.

According to the U.S. Census Bureau, in 2020 there were approximately 94,130 individuals in the workforce within the City of Vancouver (U.S. Census Bureau 2020). The estimated displacement of 400 employees for the Modified LPA is equal to approximately 0.4% of the total workforce in the city. Displaced businesses primarily include commercial office businesses and one commercial-retail business. WSDOT would provide relocation assistance to each affected property owner. Displaced

employees may be impacted by longer commutes, depending on the availability of nearby space for the businesses to be relocated.

Table 4-8. Business Displacements in Downtown Vancouver for Modified LPA Design Options

Area	No. Businesses Impacted from Modified LPA Design Options with Centered I-5 Mainline	No. Employees Impacted from Modified LPA Design Options with Centered I-5 Mainline	Businesses Displaced with I-5 Mainline Westward Shift Design Option	Total Employees of Displaced Businesses with I-5 Mainline Westward Shift Design Option
Downtown Vancouver	10	400	13	542

Sources: IBR 2022b; Metro 2015

4.4.1.2 Property Tax Impacts

Table 4-9 presents the estimated property tax impacts associated with the Modified LPA within Downtown Vancouver. The reduction in property tax revenues from land acquired in this area represents approximately 0.33 to 0.43% of total 2022 tax revenues in Clark County.

Table 4-9. Property Tax Reduction from the Modified LPA (Downtown Vancouver)

Area	Estimated Assessed Value of Right-of-Way (Millions) with Modified LPA with Centered I-5 Mainline Design Options	Property Tax Impact (Thousands) with Modified LPA with Centered I-5 Mainline Design Options	Clark County Budgeted 2022 Property Tax Revenues with Modified LPA with Centered I-5 Mainline Design Options	Estimated Assessed Value of Right of Way (millions) with I-5 Mainline Westward Shift Design Option	Property Tax Reductions (thousands) with I-5 Mainline Westward Shift Design Option	Percent of 2022 County Budgeted Property Tax Revenues with I-5 Mainline Westward Shift Design Option
Downtown Vancouver Modified LPA	$21.6	-$195.8	0.3	$32.1	-$259.3	0.4%

Sources: IBR 2022b; Clark County Tax Assessor 2022

4.4.1.3 Sales Tax Impacts

The displacement of businesses in Downtown Vancouver would result in a reduction of sales tax revenue from displaced businesses where sales tax is collected. Detailed information on the amount of sales tax collected by these businesses was not available; however, it is not anticipated that the reduction in sales tax would have a substantial economic impact given that most of the affected businesses would be commercial offices.

4.4.1.4 Parking Impacts

Parking impacts would be experienced at commercial properties, as summarized in Table 4-10. Impacts to parking from the Modified LPA would not be anticipated to adversely impact the ability of businesses to operate, given that the businesses are operating on multiple parcels under the same ownership that provide ample supply of parking.

Table 4-10. Parking Impacts to Businesses in Downtown Vancouver

Number of Parking Stalls Impacted	Current Number of Parking Stalls	Reduction in Parking
1	2	50%

4.4.1.5 Changes in Travel Patterns

Under the Modified LPA, operations at most intersections in Downtown Vancouver would be similar to or better than under the No-Build Alternative for both the AM and PM peak periods. For detailed information on traffic impacts, see the Transportation Technical Report.

4.4.1.6 Access and Circulation Impacts

The Modified LPA would include some partial acquisitions of properties, but it is not anticipated that these acquisitions would result in impacts to driveways and property access. Coordination with property owners would occur as the design progresses. Access changes would not be anticipated to impact business operations on the properties.

The impacts to access and circulation in Downtown Vancouver are not anticipated to negatively impact economic conditions.

PARK AND RIDES

Access to and from the two proposed park-and-ride locations in downtown Vancouver would add traffic to the local street system. If a park-and-ride location is selected for Waterfront Station, additional traffic would occur along Columbia Street in the vicinity of W 5th Street to W Columbia Way, depending on which of the three proposed sites is selected. If a park-and-ride location is selected for Evergreen Station, additional traffic would occur in the vicinity of E Evergreen Boulevard and C Street, depending on which of the two sites is selected. Intersections within the vicinity of the proposed park-and-ride sites would operate acceptably during both the AM and PM peak periods. For more information on intersection operations, see the Transportation Technical Report. Because intersections would operate acceptably, the additional traffic near the park-and-ride sites would not be anticipated to negatively impact economic conditions.

Site 3 for the Waterfront Park and Ride would result in one business displacement as summarized in Table 4-11; all other park-and-ride sites for both Waterfront Park and Ride and Evergreen Park and Ride would not result in any business displacements. The Webber Building, which is currently an office building, would be displaced if Site 3 is chosen for the Waterfront Park and Ride. This would displace approximately 53 employees.

Table 4-12 presents the estimated property tax impacts associated with the park and rides. The State of Washington owns Waterfront Site 3, so there would be no loss of property tax associated with that potential impact. As shown in Table 4-12, the reduction in property tax revenues from land acquired in this area represents approximately 0.08% of the total annual 2022 property tax revenues for Clark County.

The park and rides would include parking impacts to commercial properties, as summarized in Table 4-13. Site 1 for the Evergreen Park and Ride would reduce parking by 25%. These parking impacts would not be expected to prevent the businesses from operating; therefore, no economic impact is anticipated. None of the other sites identified for park and rides would have parking impacts.

Table 4-11. Park and Ride Business Displacements in Downtown Vancouver

Park and Ride	Site	Displacements	No. Employees Impacted
Waterfront	1	0	0
	2	0	0
	3	1 business	53
Evergreen	1	0	0
	2	0	0

Sources: IBR 2022b; Metro 2015

Table 4-12. Park and Ride Tax Impacts (Downtown Vancouver)

Park and Ride	Site	Estimated Assessed Value of Right-of-Way (Millions)	Property Tax Impact (Thousands)	Clark County Budgeted 2022 Property Tax Revenues
Waterfront	1	0	0	0
	2	0	0	0
	3	4.5	$0	0
Evergreen	1	$6.0	-$58.2	0.08
	2	0	0	0

Table 4-13. Park and Ride Parking Impacts to Businesses in Downtown Vancouver

Park and Ride	Site	Number of Parking Stalls Impacted	Current Number of Parking Stalls	Reduction in Parking
Waterfront	1	0	0	0
	2	0	0	0
	3	0	0	0
Evergreen	1	9	36	25%
	2	0	0	0

4.4.2 Upper Vancouver

Upper Vancouver encompasses the area from McLoughlin Boulevard north to SR 500, and includes the Uptown Village District and the Arnada, Shumway, Central Park, and Rose Village neighborhoods. Employment and property tax impacts of acquisitions associated with the Modified LPA in Upper Vancouver are described in the following sections. These effects would not differ among Modified LPA design options.

4.4.2.1 Business Displacements

No businesses would be displaced in Upper Vancouver as a result of the Modified LPA.

4.4.2.2 Property Tax Impacts

Table 4-14 presents the estimated property tax impacts associated with the Modified LPA in Upper Vancouver. Acquisitions in this area would primarily consist of narrow sections of properties adjacent to I-5 where new or revised ramps, retaining walls, and other facilities are proposed, as well as some full acquisitions. See the Acquisitions Technical Report for more information.

Table 4-14. Tax Impacts from the Modified LPA (Upper Vancouver)

Area	Estimated Assessed Value of Right-of-Way (Millions)	Property Tax Impact (Thousands)	Clark County Budgeted 2022 Property Tax Revenues
Upper Vancouver	$2.6	$21.3	0.03%

Sources: IBR 2022b; Clark County Tax Assessor 2022

4.4.2.3 Sales Tax Impacts

There would be no displaced businesses in Upper Vancouver. The Modified LPA would not result in a reduction of sales tax revenue.

4.4.2.4 Parking Impacts

There would be no impacts to parking in Upper Vancouver from the Modified LPA.

4.4.2.5 Changes in Travel Patterns

Under the Modified LPA, operations at most intersections in Upper Vancouver would be similar to or better than under the No-Build Alternative for both the AM and PM peak periods. For detailed information on traffic impacts, see the Transportation Technical Report.

4.4.2.6 Access and Circulation Impacts

The Modified LPA would include some partial acquisitions of properties, but it is not anticipated that there would be impacts to driveways and property access. Coordination with property owners would occur as the design progresses. Access changes would not be anticipated to impact business operations on the properties.

The impacts to access and circulation in Upper Vancouver are not anticipated to negatively impact economic conditions.

4.5 Impacts to Regional Economic Sectors

According to a study of the regional economic effects of transportation choke points (Cambridge Systematics 2003), five industries are particularly sensitive to road and rail congestion in the Portland-Vancouver region (mainly in the I-5 and I-205 corridors): lumber/wood/paper, distribution/wholesale trade, transportation equipment/steel, farm and food products, and high tech (electronics and scientific instruments). These industries are particularly vulnerable to delay and decreased travel time reliability resulting from roadway congestion in the I-5 corridor. According to the study, congestion at the Interstate Bridge will increase the cost of congestion delay to trucks. The Modified LPA would result in user benefits to the trucking industry by reducing labor costs, improving safety, potentially improving vehicle operating costs, and reducing scheduling uncertainty. Travel time improvements would benefit all business and worker trips that travel through the I-5 corridor in the primary study area.

The main sources of regional truck traffic are the Port of Portland, the Columbia Corridor, the Port of Vancouver, and the Columbia Industrial Park in Washington. The highest truck demands occur in the vicinity of Columbia Boulevard and Marine Drive. In Washington, the important regional truck movements occur east-west from SR 14 to Mill Plain Boulevard via I-5. On I-5, the truck volume peak hour is between noon and 1 p.m. in both the northbound and southbound direction. Improved access resulting from the project would reinforce economic growth and development that is already occurring in both regions, based on the many factors that drive growth. The project would support this growth by reducing the roadway congestion experienced by freight and other vehicles going to and from the two cities. Additionally, the new transit connections in Downtown Vancouver would improve travel time accessibility and broaden the pool of labor available to downtown firms within a given commute time. Improved travel times and reduced congestion would also likely broaden the labor pool available to businesses along the corridor.

The Modified LPA would benefit the trucking industry by reducing travel times and increasing reliability, which in turn would reduce costs and improve efficiency for truck freight operators. As described in the Transportation Technical Report, traffic operations on I-5 are expected to improve with the addition of one auxiliary lane and would improve even more with the addition of a second auxiliary lane. These improvements would enhance regional mobility and access, which would increase the competitiveness of the regional economy, reduce transportation costs for local businesses, and increase operational flexibility for businesses (e.g., deliveries, shipping, and business operations). However, if the C Street ramps at the SR 14 interchange were eliminated, additional traffic delay and longer travel times near the Mill Plain Boulevard interchange and in downtown Vancouver would have an adverse economic impact to local businesses in that area.

The single-level fixed-span configuration would have a lower maximum height and a reduced highway grade compared to the double-deck fixed-span configuration. The reduced grade would allow for improvements in freight vehicle speed. With the single-level movable-span configuration, the average number of bridge openings for vessels is anticipated to be less than 146 per year, which is the average number of openings for vessels over the past 12-year period (2012-2023). If future maritime use increases or decreases, the number of bridge openings may also deviate from recent historical patterns over the course of the 100+ year service life of the new Columbia River bridges. Future bridge openings would continue to cause delays and congestion for freight truck transport, with associated economic impacts that would offset the benefit provided by the reduced grade.

As described in the Transportation Technical Report, under existing conditions, the average bridge opening and gate closure duration during the 5-year period (January 1, 2015, to December 31, 2019) was 11.6 minutes. While bridge openings are not allowed during peak highway traffic periods[13] except in emergency situations, they are allowed before and after the peaks. Depending on the closure time and duration as well as traffic levels, it can take between 5 and 110 minutes for traffic to recover from a bridge opening and gate closure. An opening or closure just before the peak period can last even longer, affecting conditions throughout the peak traffic period. The single-level movable-span configuration would likely have increased restrictions on bridge openings to minimize impacts to vehicle traffic and transit compared to today's restrictions.

Commercial marine navigation includes similar products to those conveyed by road, which are transported under the Columbia River bridges both up and downriver. As with vehicle transportation, marine vessel transport products can be vulnerable to delays if vessels dependent upon bridge openings are delayed. Delays to some marine transport would occur with the movable-span configuration for vessels dependent upon bridge openings, as vessels may not be able to accurately time their arrival to outside the bridge opening time restrictions. No delays to marine transport would occur with either of the fixed-span configurations. However, vessels with vertical navigation clearance requirements of greater than 116 feet would permanently be unable to transit under the bridge for its 100+ year service life.

Earthquakes could cause economic impacts by delaying or completely stopping the flow of freight, disrupting travel routes for employees traveling to and from work and destroying billions of dollars in

[13] Interstate Bridge lift openings are currently restricted to avoid weekday peak highway traffic operations between 6:30 a.m. and 9:00 a.m. and between 2:30 p.m. and 6:00 p.m., excluding emergency bridge lifts.

infrastructure. The Modified LPA would withstand a major seismic earthquake, minimizing these impacts to the greatest extent possible.

New transit connections in downtown Vancouver would improve travel time accessibility and broaden the pool of labor available along the corridor and in the region.

4.6 Tolling

The Modified LPA assumes a variable-price toll using the scenarios outlined in Table 4-15. These tolling scenarios are used to study the impacts of various toll rates related to Program funding and other traffic-related impacts. It is anticipated that larger and commercial vehicles will be charged a higher rate than passenger vehicles. The IBR Program will not be setting toll rates and does not have the authority to do so. The Washington Transportation Commission and Oregon Transportation Commission will jointly set toll rates.

Two tolling scenarios are currently being analyzed. Other scenarios may be analyzed, including a potential low-income toll program with reduced toll rates for eligible users. Scenario A is used to estimate toll revenues, while Scenario B is used to develop forecasts of the impacts of tolling on traffic volumes for use in the NEPA analysis.

Table 4-15. Tolling Scenarios for the Modified LPA

North and Southbound Toll	Variable Toll Rate Range [a]
Scenario A Base Toll Schedule	$2.15 to $3.55
Scenario B Base Toll Schedule	$1.50 to $3.15

a Tolls are in Fiscal Year 2026 dollars and are assumed to escalate by 2.15% per year.

The application of a variable toll pricing scheme to the new Columbia River bridges would add an out-of-pocket cost to auto trips over the bridges and is anticipated to result in an overall reduction in auto bridge crossings for the Modified LPA with tolling, compared to the Modified LPA with no toll and the No-Build Alternative. Although traffic analyses of bridge crossings for tolling scenarios under the Modified LPA are not yet available, the Traffic Technical Report prepared for the CRC Draft EIS provides a comparison of tolling effects on total bridge crossings. Compared to the No-Build Alternative conditions, provision of a toll on Alternative 3 of the Draft EIS (closest to the Modified LPA) would decrease overall river crossings by 19,000 vehicles per day in 2030, with I-5 traffic volumes decreasing by 32,000 vehicles but I-205 volumes increasing by 13,000 vehicles (CRC 2011).

With the proposed tolling scenarios, the highest annual cost of tolls for a typical driver making an outbound and inbound trip five days a week, 50 weeks per year, would be approximately $1,625 (this assumes the driver pays $3.25 per trip under Scenario A in Fiscal Year 2022 dollars). The median household income for Portland households was $78,476 and $67,462 for Vancouver households in 2021 (U.S. Census Bureau n.d. a, b respectively). The cost of tolls for traveling across the Columbia River bridges would constitute approximately 2% and 2.4% of the median household's income in Portland and Vancouver, respectively. According to the Consumer Expenditure Survey, administered by the Bureau of Labor Statistics (2021), the average household spent approximately $10,961 on transportation expenditures in 2021, which is between approximately 14% and 16% of household

income for Portland and Vancouver households, respectively. The addition of toll fees would increase these percentages to approximately 16% of household income for Portland households and 19% for Vancouver households. The Environmental Justice Technical Report includes additional information on the impact of toll expenditures to environmental justice populations and potential mitigation.

Travel times for these tolling scenarios have not yet been forecasted, but a toll on I-5 is anticipated to reduce travel times and improve travel time reliability (Metro 2000) because some drivers would avoid making a river crossing or switch to transit or another mode instead, such as biking or walking. These modes would not be subject to tolls. For many, the value of time saved from reduced congestion would be greater than the out-of-pocket cost of the toll, creating a user benefit that would translate into greater efficiency and increased business productivity. The freight travel cost index is measured as the ratio of driver wages for a given trip segment (using $1.40 per mile for daytime urban costs) to travel time required to complete the segment. People employed in freight trucking are typically paid per mile traveled, and direct costs (fuel costs, maintenance) increase when freight vehicles are stuck in traffic. The higher this ratio, the more efficient the freight movement is. Increased business productivity can make a location more attractive for business and residential development, and improve opportunities for trade (Clower and Weinstein 2005).

The proposed toll options would have a variable toll structure, charging different toll amounts for the peak and the non-peak periods. Variable priced tolling schemes have the potential to reduce overall congestion and regulate traffic flows. This is because, in part, drivers with greater schedule flexibility and more sensitivity to out-of-pocket costs will choose to travel during the non-peak period to pay a lower toll, while drivers with less flexible schedules, carrying valuable or time-sensitive goods, would be less sensitive to the out-of-pocket cost of the toll and would travel during whatever period was dictated by their schedules. Depending on specific tolling schemes and transit fare structures, some people most sensitive to out-of-pocket costs may shift to transit.

Variable tolls are likely to be beneficial for freight-dependent businesses and businesses that rely on just-in-time deliveries because the predictability of travel would also increase. This benefit is somewhat offset by the fact that truck movements during peak periods would incur higher toll charges; however, peak freight travel times tend to fall outside the current peak periods for general-purpose traffic. Truck volumes are typically highest during the midday because truck drivers prefer to travel during uncongested conditions.

4.7 Marine Commerce on the Columbia River

Commodity transport by ship is important to the regional economy. As described in Chapter 1, the existing Interstate Bridge provides a maximum vertical clearance of 72 feet when closed and a maximum vertical clearance of 178 feet when the lift span is opened. Apart from a small number of specialized vessels that use the river infrequently, the majority of vessels require vertical clearances of less than 90 feet from the surface of the water to the bottom of the bridge deck. Required openings of the Interstate Bridge have declined from an average of 289 per year between 1997 and 2011 to 157 per year between 2012 and 2020. Approximately 58% of the bridge openings were for tugs, 17% were for sailboats, and the remainder were for other vessel types. These openings represent 5 to 7% of the total river traffic, based on openings of the BNSF railroad bridge just downstream of the Interstate

Bridge and use of the locks at the Bonneville Dam. Currently, bridge openings are restricted to non-peak commute hours to minimize impacts to vehicle traffic on the bridges.

Under the Modified LPA, each of the new Columbia River bridges would be built on six pairs of in-water piers, plus several pairs of piers on land. The new bridges under consideration in the Modified LPA include both fixed-span and movable-span configurations. As with the existing Interstate Bridge, the new bridges would provide three shipping channels: a primary navigation channel and two alternate channels. Each of the three navigation channels would be 400 feet wide, which includes 50-foot maintenance buffers on each side of the navigation channels for all the bridge configurations and bridge types currently under consideration. All bridge types of the fixed-span configurations would provide approximately 116 feet of vertical navigation clearance over the primary navigation channel. The movable-span configuration would provide approximately 92 feet of vertical clearance in the closed position over the primary navigation channel (or 99 feet over the north barge channel) and 178 feet in the open position, compared to 72 feet (over the alternate barge channel) in the closed position for the existing Interstate Bridge. In the open position, the vertical lift span would provide 178 feet for the existing Interstate Bridge.

The Navigation Impact Report (WSP 2022) evaluated impacts to navigation from the proposed new Columbia River bridges, based on analysis of river use, bridge lift records, water level data, and other information. If the Interstate Bridge were replaced with a movable-span configuration, all current vessel traffic could pass beneath the new bridges; however, as noted above, the movable-span might be restricted to nighttime openings to minimize impacts to vehicle traffic and transit service. Construction of a fixed-span configuration with 116 feet of vertical navigation clearance would result in two vessels that currently transit under the Interstate Bridge and large cargo manufactured upstream by three industrial operations (fabricators) not being able to pass beneath the new bridges. The two vessels that would require a vertical navigation clearance greater than 116 feet include the Derrick Barge [DB] *Taylor*, which passes under the Interstate Bridge approximately 10 times per month, or 120 times per year; and, the DB *Freedom,* which makes approximately 10 trips under the bridge per year (based on 2012-2020 operations). On average during the 2012-2020 timeframe, about 2,600 commercial vessel trips occurred each year; therefore, the DB *Taylor* represents approximately 4.6% of total commercial vessel trips each year, while the DB *Freedom* represents approximately 0.3% of commercial vessel trips each year. Three additional vessels (DB *4100*, DB *General* and dredge *Yaquina*) would be restricted when the river level is at the ordinary high water level of 16 feet above Columbia River Datum, which is about 1% of days in a typical year. Each of these three vessels make approximately 12-28 trips per year. In summary, a total of five vessels and three fabricators would be adversely affected by all bridge types of the fixed-span configurations, whereas the movable-span configuration would allow passage for all current vessels and cargo. The IBR Program is committed to working with the owners and operators of these vessels to identify mutually acceptable measures to avoid economic impacts.

Vessels or cargo shipments unable to pass beneath a fixed-span configuration could result in economic effects including increased production costs, reduced potential for future work, and reduced employment opportunities in the region. Affected fabricators could continue to seek contracts for products that exceed the bridge vertical clearance, but would require securing a downriver satellite site to complete final assembly and would incur higher costs.

Under the Modified LPA with all bridge types of the fixed-span configurations, other commercial vessels on the Columbia River such as cruise vessels and tugs/tows for the barges would continue operations. Under the Modified LPA with the movable-span configuration, all vessels currently using the Columbia River would be able to pass under the bridge, but the movable-span configuration would provide greater vertical clearance (92 feet over the primary navigation channel or 99 feet over the north barge channel) compared to the No-Build Alternative (72 feet over the alternate barge channel) when in the closed position potentially allowing more vessels to pass without requesting a bridge opening. If a bridge opening were required, these vessels would either need to revise their schedules to avoid restricted times for bridge openings or experience delay. See the Navigation Impact Report for detailed discussion on the benefits and effects of the Modified LPA on vessel navigation.

Resulting economic benefits with the fixed-span configurations would be eliminating delays associated with the movable-span configuration and improving travel times for vehicles and transit service crossing over the river, which would no longer have interruptions from bridge openings.

The marine cargo transportation impacts listed above are a snapshot in time and represent current waterway usage. Over the 107 years of service life of the Interstate Bridge (northbound span opened in 1917 and southbound span opened in 1958), numerous bridge lifts have been conducted for mariners with large vertical navigation clearance requirements, including those requiring openings for clearances over 116 feet and up to 178 feet. It is difficult to predict maritime transportation system demands and associated needs for bridge openings for the 100+ year service life of the bridge, since vessel traffic and river-level conditions vary from year to year and economic trends for maritime commerce may change over time. Nevertheless, a fixed span configuration with 116 feet of vertical clearance would permanently deny access under the bridge for its 100+ year service life span to mariners who require vertical clearances of greater than 116 feet.

4.8 Rail Transport

The BNSF Railway mainline operates on an east-west alignment north of the Columbia River in Vancouver, between the river and downtown Vancouver. No long-term impacts to rail traffic operations are anticipated as a result of the Modified LPA. No long-term interface would exist between the Modified LPA and the railroad. Short-term impacts are discussed in Chapter 5.

5. TEMPORARY EFFECTS

5.1 Introduction

This section evaluates the positive and negative economic impacts that may occur during construction of the Modified LPA. Construction has the potential to cause negative economic effects by blocking visibility and access to businesses, causing traffic delays, and rerouting traffic on detours that increase travel times and make access to some locations difficult. The timeline for construction of the Modified LPA is expected to be 7 to 13 years. Traffic congestion is already a common occurrence within the study area during peak hours; adjacent construction activities and temporary detours could extend the peak duration, negatively impacting businesses whose employees commute using the I-5 corridor. Likewise, the movement of freight, goods, and services could be negatively affected if construction activities make travel times longer and/or less predictable.

Construction of the Modified LPA could also result in positive economic effects through increased employment and spending in the project area during construction. The extent of these effects depends on the source of project funding and the makeup of work crews used during project construction. Funds from local or regional sources are transfers of money that could be spent by residents and businesses on other economic activities in the region, and therefore do not add to the overall supply of funding in the regional economy. Conversely, federal or state funds that are new to a region can have a measurable economic effect, with employment and income gains resulting from project construction. The federal government and the states of Oregon and Washington would provide the funds for the IBR project, thus resulting in some income and job benefits in the region that would otherwise not occur.

The general time frame for project construction, as well as the estimated sequence and duration for specific construction activities, can be found in the project description. As staging plans are developed during subsequent phases of project design, they will include the following impact minimization measures to the greatest extent practicable:

- Minimizing traffic delays and disruptions by scheduling lane and road closures during the evening and weekend periods.
- Providing continued access to properties during construction.
- Constructing new elements outside of the existing road system to minimize closures and disruptions.
- Evaluating the potential to provide additional travel options for moving people between Portland and Vancouver.
- Minimizing construction-related impacts such as traffic, noise, and decreased air quality.

Because the Modified LPA would not be constructed in the No-Build Alternative, there would be no temporary impacts.

5.2 Regional Temporary Effects

The current IBR Program schedule estimates that the construction of the Modified LPA would occur over approximately 7 to 15 years. Capital expenditures on construction projects could support regional economic activity through the purchase of goods, services, and labor in the region. The economic contributions from construction projects are often temporary in nature and occur as construction spending unfolds. However, large-scale infrastructure projects that strengthen the capacity of a region to increase economic output more efficiently may have broader long-run benefits than what is typically measured in short-run economic impact analysis. The amount that construction increases employment and spending depends on the source of project funding and the types of workers used during project construction.

It is anticipated that project construction would result in both spending and jobs. Construction of a project of this magnitude would boost employment across the region. Employment related to construction of the Modified LPA would include both direct and secondary (supply chain and consumption) effects. For every $1 million invested, the region could expect 5.5 direct jobs and an additional 10.9 indirect jobs as a result (Economic Policy Institute 2019). These secondary effects are typically spread across other industries, such as fabrication, transportation of materials, etc. Industries that would benefit include those that provide supplies and services to the construction industry, as well as consumer goods to their workers. Indirect jobs include those that are supported by the demand that relies on the wage and salary income of both direct jobs and supplier jobs. For example, a job at a construction site also supports jobs in local restaurants, grocery stores, retail stores, and other commercial places where construction workers may spend their wages.

5.3 Temporary Effects on Marine Commerce

According to the U.S. Army Corps of Engineers, 62 million short tons of freight in over 30,000 movements passed through the lower Willamette River and the Columbia River below Vancouver in 2020 (USACE 2020). Construction of the proposed Columbia River bridges is anticipated to take place over a period of approximately four to seven years, with a general sequence of activities including initial preparation, installation of foundation piles, shaft caps, pier columns, superstructure, and deck. Construction barges would be anchored in the river, and support barges traveling to and from supply points could create conflicts with freight. Some likely effects on marine commerce include:

- There would be temporary closures or changes to the three navigation channels during construction of the proposed Columbia River bridges, but it is assumed that at least one navigable channel would remain open at all times for marine traffic.
- Commercial vessels may be provided with towing assistance during times where navigation is made difficult by construction activities.
- Vertical and horizontal clearance restrictions would be in place for portions of the construction period. Such restrictions would require U.S. Coast Guard concurrence. A temporary construction navigation envelope (height and width of unobstructed clearance for navigation) would be maintained during construction with a minimum clearance of 72 feet (vertical) by 150 to 200 feet (horizontal). During times when these minimum clearances are in effect, vessels requiring more than 72 feet of vertical navigation clearance would be unable to

pass under the bridge; however, potential passage with reduced width or scheduled interim short-term openings could be coordinated with the bridge construction contractor.

- Temporary river travel restrictions are anticipated as barges are used to ferry materials to and from work sites.

5.4 Temporary Effects on Oregon Study Area

5.4.1 Oregon Mainland

5.4.1.1 Staging

A variety of parcels could be used for construction staging, but impacts to businesses are anticipated to be minimal. Efforts would be made to avoid impacts to business operations during construction, and coordination with property owners would occur as design and construction planning progresses.

5.4.1.2 Roadway Closures

No closures are currently anticipated on the Oregon mainland; however, detour alignments would occur during Marine Drive interchange construction, making access to area businesses more difficult for employees and deliveries. Most of the affected businesses do not rely on pass-by traffic, and sales impacts are anticipated to be small.

5.4.1.3 Other Impacts

The construction of the Marine Drive interchange is projected to take approximately four to six years. The visibility of businesses could be impacted during this time, but businesses in the vicinity of the Marine Drive interchange are generally not dependent upon drive-by traffic. Widening I-5 and rebuilding interchanges in this location would entail many different activities, some of which could disrupt traffic.

Marine Drive and Martin Luther King Jr. Boulevard would serve as the major corridors in and out of the construction areas. North Portland is home to a large number of manufacturers on both sides of I-5, particularly in the Rivergate and Airport industrial districts. Marine Drive is a key commercial and industrial route. Routing construction traffic on the major corridors and having construction-related detours on Marine Drive would make access to these businesses more circuitous, which could result in impacts to public-facing businesses.

5.4.2 Hayden Island

5.4.2.1 Staging

A variety of parcels could be used for construction staging on Hayden Island, but impacts to businesses are anticipated to be minimal. Efforts would be made to avoid impacts to business operations during construction, and coordination with property owners would occur as design and construction planning progresses.

5.4.2.2 Roadway Closures

The Hayden Island interchange would be built at the same time as the SR 14 interchange to move traffic to the new southbound lanes and allow construction of the remaining northbound lanes and ramps. Construction of the Hayden Island interchange could be completed in several packages, so would not necessarily take place continuously; the overall duration could be from four to 10 years, depending on construction sequencing.

There is one temporary road closure associated with the Modified LPA; a portion of Jantzen Drive east and west of I-5 would be closed for approximately 8 months to allow for road and utility work. This section of roadway does not include any direct access points for businesses not permanently displaced by the Modified LPA. Access would remain open along N Hayden Island Drive and Center Avenue, but some out-of-direction travel could be required to continue to access businesses in the immediate vicinity of the closure.

5.4.2.3 Other Impacts

The marina and floating homes east and west of I-5 would be impacted by over-water work. Access would be retained, but some floating homes' boat slips would be impacted. This is an impact to the moorage, though slips may be reoccupied after project completion.

Some commercial businesses on Hayden Island may depend on drive-by traffic, and construction could negatively impact sales. Hayden Island is often a stop for visitors from out of state taking advantage of the lack of sales tax in Oregon. If businesses lose visibility and construction makes it difficult to reach the stores, customers could continue to mainland Oregon and bypass Hayden Island. Business impacts to Hayden Island could therefore be substantial during construction unless carefully mitigated.

The majority of businesses on Hayden Island are commercial and could be affected by construction noise and dust, but are sufficiently distant from construction activities that such impacts are unlikely to be substantial.

5.5 Temporary Effects in the Washington Study Area

5.5.1 Downtown Vancouver

5.5.1.1 Staging Areas

A variety of parcels could be used for construction staging, which could have impacts to businesses. Efforts would be made to avoid impacts to business operations during construction, and coordination with property owners would occur as design and construction planning progresses.

5.5.1.2 Roadway Closures

The SR 14 interchange would need to be completed before the existing Interstate Bridge is decommissioned, and the northbound bridge and northbound off-ramp to SR 14 must be completed and opened before traffic can be routed to the Columbia River bridges. The Mill Plain interchange

could be completed independently of the Marine Drive, Hayden Island, and SR 14 interchanges. It would be most efficient to complete Mill Plain along with the two interchanges farther north—Fourth Plain and the SR 500/39th Street interchanges.

The ramp closures would primarily affect traffic from downtown Vancouver to points east (SR 14), and the connection between Portland and downtown Vancouver on I-5. Alternate routes would be available to travel to these areas, but they would be more difficult and less direct. This could affect businesses in downtown Vancouver by increasing delivery times for goods and making it more difficult for employees and customers to reach businesses in downtown.

Roadway closures and rerouting could affect drive-by visibility for businesses in downtown Vancouver. Drive-by visibility is important to certain classifications of businesses, such as gas stations, fast-food restaurants, and convenience stores. However, most of the businesses in downtown Vancouver do not rely on pass-by traffic to attract customers. Many of the service and retail establishments in downtown attract customers because they provide specialized services and goods, and customers are anticipated to continue to patronize these businesses during construction. Careful staging and sequencing can minimize the impacts to adjacent businesses; additional mitigation measures are included in Section 7.3.

Most current traffic movements would be accommodated during construction. However, some movements may need to be closed on occasion for durations of a week to a month in order to complete a phase of construction. SR 14 into and out of downtown Vancouver would need to be closed, and traffic would be rerouted (most likely to Columbia Way) for much of the interchange construction period. SR 14 eastbound and Columbia Way would serve as the major corridors into and out of construction areas. Columbia Way could become a heavily used haul route, more so than other local roadways; since it may also be used as a detour route, the combination would contribute to congestion on this route and may make access to adjacent parcels more difficult. Businesses located on Columbia Way would be negatively affected by the congestion and difficulty in access.

5.5.1.3 Other Impacts

During the railroad's busiest time of the year, construction over the rail line north of the riverbank and south of SR 14 could be limited to periods when the rail line is not heavily used. Construction schedules would be designed to minimize impacts to BNSF lines and service frequency.

5.5.2 Upper Vancouver

5.5.2.1 Staging Areas

A variety of parcels in Upper Vancouver could be used for construction staging, but impacts to businesses are anticipated to be minimal because these parcels would likely be located adjacent to I-5. Efforts would be made to avoid impacts to business operations during construction, and coordination with property owners would occur as design and construction planning progresses.

5.5.2.2 Roadway Closures

The two interchanges in Upper Vancouver, along with the Mill Plain interchange, could be built independently of the Columbia River bridges and southern interchanges and independently of each other, though it would be most efficient to construct all three at the same time. Detours of I-5 near the SR 500/39th Street interchange would facilitate efficient construction and would be limited to nights and weekends. The three interchanges north of SR 14 (Mill Plain, Fourth Plain and SR 500/39th Street) could be constructed in approximately 3 to 4 years. Businesses in the vicinity of the roadway closures or those accessed by these roadways may be impacted during construction. Impacts could be lessened by staggering the timing of roadway closures.

6. INDIRECT EFFECTS

Analysis of indirect economic impacts considers the effects the project might have on decisions regarding business location and on travel patterns for goods and people. The underlying hypothesis of this analysis is that transportation investment has the potential to affect the locational decisions of businesses and households.

6.1 Indirect Impacts of Added Capacity

Indirect effects from added transit and highway projects could occur throughout the region. In particular, where new or greatly improved interchanges are constructed, there may be pressure to allow commercialization where it was not previously planned. If access is enhanced due to additional highway capacity, businesses may choose to locate farther from the urban core than otherwise assumed. The IBR Program addresses the growing travel demand and congestion in the I-5 corridor. Existing travel demand exceeds capacity in the Interstate Bridge area and interchanges upstream and downstream. This corridor experiences heavy congestion and long delays during afternoon peak travel periods and when crashes, vehicle breakdowns, or bridge openings occur. To avoid congestion in the I-5 corridor, some users take the sometimes longer, out-of-direction alternative I-205 route to cross the Columbia River. Traffic also spills over onto arterials parallel to I-5 north and south of the crossing, such as NE Martin Luther King Jr. Boulevard and N Interstate Avenue in Oregon, and Main Street and Columbia Street in Washington. This behavior increases local congestion. As such, there is potential for induced growth as a result of increased highway capacity and transit capacity that could result from relieving congestion within these areas.

6.2 Indirect Impacts to Local Businesses

Other economic impacts may also result from the displacement of local businesses if neighboring businesses that remain find it difficult to attract or retain customers because part of a complementary group of businesses (agglomeration economies) no longer exists. The long-term magnitude of this impact would depend on the potential to relocate displaced businesses in the same neighborhood and the extent and types of infill and redevelopment that take place in those areas. This in turn depends on a number of factors such as regional economic trends and market conditions, the willingness of businesses to relocate, available building space for lease during the relocation process, and community and city support for redevelopment. Improved travel times for vehicles and improved transit options would have a positive impact on workers and business trips in the project area, reducing delay and the time cost of travel.

6.2.1 Indirect Impacts on Marine Commerce

The types of economic activity dependent on marine navigation upriver of the bridge is not anticipated to change considerably in the near future. Most of the commercial river traffic in the shallow-draft upriver section of the Columbia/Snake river system would continue to be dominated by barged shipments of grain, petroleum products, wood products, and other bulk products for domestic consumption and export. It would be highly unlikely the nature or composition of upriver navigation

would change as a result of the Modified LPA. River depth and other existing, permanent height and width constraints limit the size and draft of vessels capable of upriver navigation, and the availability of suitable waterfront properties for industrial development is, and is expected to remain, extremely limited for the next 20 of more years. As a result, the Modified LPA is expected to have limited, at most, impact on future upriver economic activity.

7. PROPOSED MITIGATION

7.1 Introduction

The Modified LPA would provide positive economic impacts in the study area by reducing congestion on I-5 and facilitating the movement of traffic, particularly freight truck traffic between the Marine Drive corridor and I-5. The bulk of potential negative economic impacts identified in this report would result from business displacements, losses in parking, or changes in access to businesses. This section identifies measures that could be considered to avoid or mitigate the potential impacts.

7.2 Proposed Mitigation for Long-Term Adverse Effects

7.2.1 Regulatory Requirements

As described in the Acquisitions Technical Report, property acquisition and residential or business displacements would be mitigated under the provisions of the Uniform Relocation and Real Property Acquisitions Policies Act of 1970, as amended. Those affected would receive compensation and relocation assistance from ODOT or WSDOT, depending on location. Property would be purchased at fair market value, and residential occupants displaced by the Modified LPA would be provided decent, safe, and sanitary replacement housing. The Acquisitions Technical Report includes more information on the provisions of the Uniform Act and the processes used to value properties and provide relocation assistance.

The IBR Program would continue to work with the U.S. Coast Guard and the U.S. Army Corps of Engineers to help ensure that the potential for effects on river users is addressed through the agencies' permitting processes.

7.2.2 Program-Specific Mitigation

No Program-specific mitigation measures are proposed.

7.3 Proposed Mitigation for Adverse Effects during Construction

REGULATORY REQUIREMENTS

Construction best management practices would be used to avoid or minimize indirect construction effects on economics, such as dust, noise, and aesthetic impacts. These measures are discussed in the Air Quality Technical Report, Noise and Vibration Technical Report, and Visual Quality Technical Report.

PROGRAM-SPECIFIC MITIGATION

- Reduce impacts to local businesses by implementing a phased construction schedule that avoids complete closures of roads and access points to local businesses. A construction

communication plan could be developed to inform travelers about detours and road closures and would direct them to businesses.

- Design construction schedules to minimize temporary impacts to BNSF Railway lines and service frequency.
- Provide outreach to businesses affected by construction and use assistance programs to help mitigate potential negative construction-related effects.
- Coordinate with the Ports of Portland and Vancouver and associated businesses to identify ways to minimize delays for commercial freight vehicles during construction.
- To keep freight moving during construction, the IBR Program would conduct outreach to businesses in areas with high volumes of freight traffic to determine access and site circulation needs and maintain access as needed.

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