3.1 Transportation

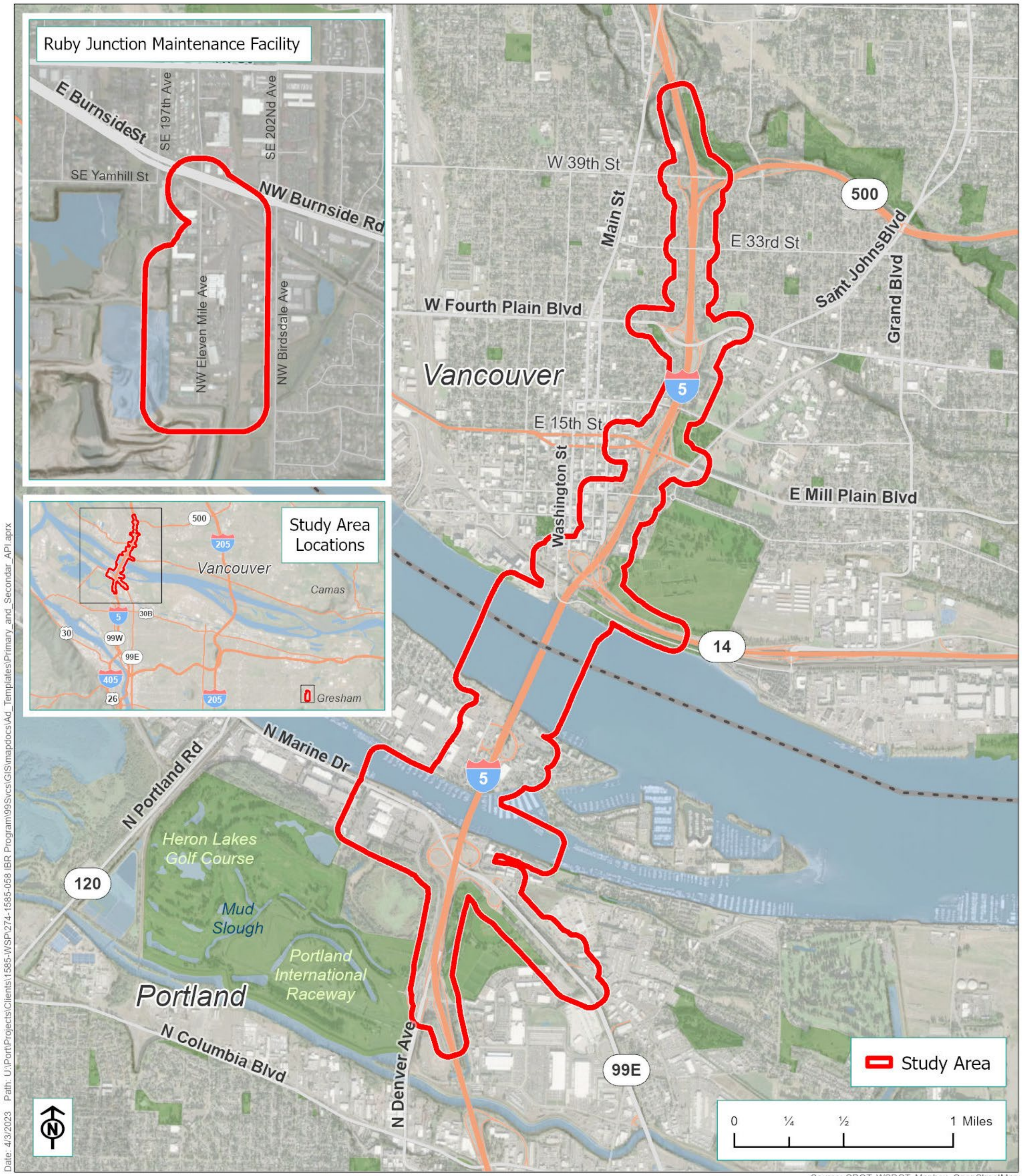
This section describes how the No-Build Alternative and the Modified LPA and options would affect travel patterns and mobility for cars, trucks/freight, transit vehicles, transit riders, pedestrians, and bicyclists. New information developed since 2013 is identified, and anticipated long-term, temporary, and indirect effects of the Modified LPA and options compared to the No-Build Alternative are summarized. Potential measures to avoid, minimize, and/or mitigate impacts, as well as to increase the mobility benefits of the IBR Program, are presented.

The IBR Program study area, shown in Figure 3.1-1 below, is centered on Interstate 5 and the bridge crossing of the Columbia River between Oregon and Washington. This study area also encompasses other interstate and state highways, transit, local roadways, bicycle and pedestrian facilities, and other facilities that serve the study area and influence travel behavior and conditions.

The information presented in this section is based on the Transportation Technical Report, which provides additional details on the following aspects of transportation:

- Regional transportation, including major freeway and highway facilities, vehicle miles of travel, vehicle hours of travel, vehicle hours of delay, and mode share.
- Freeway operations, including I-5 vehicle and person-trip volumes, bottlenecks, level of service (LOS), volume-to-capacity (V/C) ratios, travel times, and speeds.
- Freight mobility and access.
- Bridge lifts and gate closures, including yearly and hourly frequency as well as average event duration.
- Arterial and local streets, including corridor analysis, and intersection operations.
- Transit, including regional and local transit services, corridor and station ridership, and transit operations.
- Sufficiency and quality of active transportation (bicycle and pedestrian facilities) around stations as well as circulation/connections to existing networks.
- Safety.
- Transportation demand management (TDM) and transportation system management (TSM).

Figure 3.1-1. IBR Study Area



Source: ODOT, WSDOT, Mapbox, OpenStreetMap

3.1.1 Changes and New Information Since 2013

The Columbia River Crossing (CRC) Final Environmental Impact Statement (EIS) and Record of Decision were completed in 2011. Since then, there have been changes to the definition of the Modified LPA compared to the CRC project, including changes to the design of interchanges and access configurations and in the routing of light-rail transit through downtown Vancouver. In addition, several design options for the Modified LPA are being evaluated, including different bridge configurations, either one or two auxiliary lanes, potential elimination of the C Street ramps, a westward shift of I-5 near the SR 14 interchange, and options for park-and-ride locations in downtown Vancouver. See Chapter 2 for additional details on the design changes and the options being considered. After evaluation of the Modified LPA and design options, the IBR Program did not identify any impacts from the Modified LPA that would differ substantially from those of the CRC LPA.

3.1.2 Existing Conditions

The COVID-19 pandemic that began in 2020 altered travel patterns and trends, traffic volumes, and transit ridership in the region and in the transportation study area for the IBR Program. Traffic volumes and transit ridership dropped below historic levels, and then began to increase as health emergency restrictions gradually eased over the following 3 years. As of March 2023, according to traffic count data from both WSDOT and ODOT (WSDOT 2022; ODOT 2021), traffic volumes were close to pre-pandemic levels for auto and freight traffic within the study area. Transit has been slower to recover but, according to both C-TRAN and TriMet, transit service levels and ridership continue to see increases as more time goes by since the start of the pandemic (C-TRAN n.d.; TriMet n.d.).

Transportation analyses generally incorporates the most recently available data. Due to the influence of the COVID-19 pandemic on travel patterns between 2020 and 2023, the IBR Program is following industry standards and trends observed over a long period of time rather than basing the analysis on short-term phenomena. Therefore, the Program is using 2019 as the baseline year for most of the data presented in the existing conditions. The exception is for outputs that rely on the Metro/RTC[1] regional travel demand model, which has not yet updated its base year model from 2015 to 2020. As a result, all Metro/RTC regional travel demand model outputs summarize 2015 data based on 2015 land use, population, and employment data. Following standard practices for NEPA evaluation of transportation projects, the analysis methods for the IBR Program apply the Metro/RTC travel demand model to replicate some of the regional existing conditions. These regional data provide the basis for predicting future conditions and travel demand in the year 2045. Additional details on the transportation analysis methods are presented in the Transportation Technical Report.

Regional Roadways

Regional roadways within the study area include Interstate 5 (I-5), SR 500, SR 14, and Martin Luther King Jr. Boulevard (Highway 99E), all of which are limited-access corridors. Table 3.1-1 summarizes their characteristics in the study area.

[1] Metro = Oregon Metro; RTC = Southwest Washington Regional Transportation Council

Table 3.1-1. Existing Regional Roadways in Study Area

Regional Roadway	Roadway Classification	Number of Travel Lanes	Speed Limit (mph)	Average Weekday Daily Traffic [a]	Bicycle Facilities [b]	Pedestrian Facilities [b]
I-5	Interstate	4–9	50–60	60,000–146,500	Yes	Yes
SR 500	State Highway (Washington)	4–6	55	35,000–52,000	No	No
SR 14	State Highway (Washington)	4–6	60	58,000–73,000	No	No
MLK Jr. Boulevard (Hwy 99E)	State Highway (Oregon)	4	30–55	16,200-18,400	Yes	No

Source: WSDOT Online Map Center *Historic Traffic Counts*. ODOT Traffic Volume Tables for State Highways 2019.
a A range of average weekday daily traffic volumes is shown, as the volumes differ along freeway segments in the Portland metropolitan region.
b Shared-use paths exist on the Interstate Bridge over the Columbia River.
MLK = Martin Luther King

The study area covers a 5-mile section of I-5 between the Interstate Avenue/Victory Boulevard interchange in Portland and the SR 500/39th Street interchange in Vancouver. It includes seven interchange areas: Interstate Avenue/Victory Boulevard, Marine Drive, Hayden Island, City Center/SR 14, Mill Plain Boulevard, Fourth Plain Boulevard, and SR 500/39th Street.

Most of the traffic (between 77% and 86%) crossing the Interstate Bridge in peak directions during the AM and PM peak periods is entering and/or exiting I-5 at one of these seven interchanges. According to the Metro/RTC regional travel demand model, the average length of regional (metropolitan area) evening peak trips across the Interstate Bridge is 15.6 miles for passenger cars and 20.2 miles for trucks. The region’s typical average trip length for all trips within the region is approximately 5.7 miles.

Regional Travel Measures

The typical measures of travel performance on a regional level are vehicle miles traveled (VMT), vehicle hours traveled (VHT), and vehicle hours of delay (VHD). These measures are calculated using the Metro/RTC regional travel demand model. As noted above, 2015 is the current base year available from the Metro/RTC regional travel demand model.

Table 3.1-2 shows existing (2015) VMT, VHT, and VHD at two regional scales, both of which extend beyond the study area (see the Transportation Technical Report for figures of these study areas). The first includes the entire region covered by the Metro/RTC regional travel demand model. The second is a smaller traffic subarea within the most densely developed areas of Portland and Vancouver, covering a triangle around I-5 from I-205 to I-84 on the west, I-205 from I-5 to I-84 on the east, and I-84 from I-5 to I-205 on the south.

Table 3.1-2. Regional Travel Measures – Existing 2015 Daily Vehicle Miles Traveled, Vehicle Hours Traveled, and Vehicle Hours of Delay

Area	Vehicle Miles Traveled	Vehicle Hours Traveled	Vehicle Hours of Delay [a]
Portland Metropolitan Region	43,115,600	1,225,400	19,400
Traffic Subarea (I-5, I-205, and I-84)	11,277,600	326,900	10,100

Source: Metro/RTC regional travel demand model.

a Delay is measured as time spent in congestion on network links that exceed 0.9 volume/capacity ratio.

Traffic Volumes

The analysis of traffic volumes uses several measures to describe existing conditions and allow comparisons to future conditions.

Screenlines

Screenlines are imaginary lines drawn across major roadways (highways and arterials) within the study area to measure the total amount of traffic moving in each direction across multiple facilities. These north/south and east/west screenlines are a snapshot of typical existing AM and PM peak traffic conditions.

I-5 Mainline and Ramp Vehicle Volumes

The IBR team collected data from ODOT and WSDOT for 2019. ODOT and WSDOT maintain permanent traffic counters throughout their freeway/highway systems that collect hourly traffic counts 365 days a year, 24 hours a day. This information was used to estimate average weekday daily traffic volumes in 2019 for the I-5 mainline and ramps in the study area.

Daily Person Throughput

Person throughput measures the number of people that a transportation facility serves within a given time frame. The number of vehicles (passenger cars, freight trucks, and buses) crossing the Interstate Bridge was multiplied by average vehicle occupancy assumptions to calculate total person throughput. Southbound, daily person throughput across the Interstate Bridge is 93,400 people. Northbound, the daily person throughput is 92,400 people. Consistent with historical traffic counts, the northbound and southbound volumes are slightly different due to external through-trip patterns and different transit routing between the AM and PM peak periods.

I-5 Operations

As noted above, the IBR study area is the approximately 5-mile section of I-5 between the SR 500/39th Street interchange in Vancouver and the Interstate Avenue/Victory Boulevard interchange in Portland. Because traffic volumes and congestion within and outside of the study area influence each other, these interactions were captured by analyzing a longer section of I-5. This section (referred to as the freeway analysis area) consists of a 17-mile length of I-5 between the I-205 interchange north of Vancouver and the Marquam Bridge in Portland.

- Existing conditions for freeway operations for I-5 within the freeway analysis area were evaluated using VISSIM microsimulation models. The models were developed and calibrated for all travel modes to simulate the observed and regularly occurring traffic operations along northbound and southbound I-5 during the 6 to 10 a.m. and 3 to 7 p.m. peak periods. These models incorporate average traffic volumes and simulate the recurring congestion that occurs when vehicle volumes approach the capacity of the facility at a given location or bottleneck. They account for the effects of on- and off-ramps, merging and weaving areas, lane adds and drops, and design constraints such as curves, grades, underpasses, and narrow or nonexistent shoulders. However, the models do not account for non-recurring congestion caused by traffic incidents, work zones or lane closures, bad weather, special events, or bridge closures or lifts.

ODOT and WSDOT define congestion as speeds below a certain threshold. ODOT has historically defined congestion as when speeds drop below 75% of the posted speed limit due to constrained conditions (for example, speeds slower than 45 mph in an area with a posted speed 60 mph). ODOT has recently refined its measures of congestion into two levels, with congestion defined as speeds below 45 mph and severe congestion defined as speeds below 35 mph. ODOT is coordinating this updated congestion definition with WSDOT. Therefore, the IBR Program has defined congestion as speeds below 45 mph. Table 3.1-3 shows the critical bottleneck locations under existing conditions and summarizes the hours of congestion at bottlenecks according to this definition.

Table 3.1-3. Weekday AM and PM Peak Period Bottleneck Locations when Speeds are below 45 mph – 2019 Existing Conditions

	Location	Time of Day	Duration (hours)	Maximum Extent (miles)
Southbound	Interstate Bridge	6–9 a.m.	3 hours	3 miles
	I-5/I-405 Split in North Portland	6:30 a.m.–1 p.m.	6.5 hours	3 miles
	Rose Quarter	7:15 a.m.–7:45 p.m.	12.5 hours	3 miles
Northbound	Interstate Bridge	11:15 a.m.–8:00 p.m.	8.75 hours	10+ miles

Source: IBR Analysis.

During the 4-hour AM and PM peak periods, I-5 southbound is operating with speeds below 45 mph 26% of the time. During the 4-hour AM and PM peak periods, I-5 northbound is operating with speeds below 45 mph 30% of the time.

Southbound Congestion

In the southbound direction, the Interstate Bridge experiences 3 hours of congestion between 6 and 9 a.m. The congestion extends from the Interstate Bridge back to the SR 500/39th Street interchange, and vehicle speeds vary from zero to 10 to 20 mph for much of that time. The congestion is caused by approaching traffic that is above the bridge's limited capacity, limited sight distance, substandard shoulders, short merge and diverge locations north and south of the bridge, heavy on- and off-ramp flows north of the river, and heavy truck volumes.

Southbound travel in the study area is also affected by backups from regional bottlenecks such as the I-5/I-405 split in north Portland, which results in 6.5 hours of congestion between 6:30 a.m. and 1 p.m.

that can extend north and combine with the Interstate Bridge bottleneck. Another southbound regional bottleneck is at the Rose Quarter, where congestion occurs for 12.5 hours from 7:15 a.m. to 7:45 pm. where I-5 is reduced from three to two travel lanes.

Northbound Congestion

In the northbound direction, the main bottleneck originates at the Interstate Bridge and lasts for 8.75 hours between 11:15 a.m. and 8 p.m. The congestion extends south from the Interstate Bridge and influences traffic flows south of the study area, back to I-405 and I-84. The northbound congestion at the Interstate Bridge occurs for similar reasons as the southbound congestion, including limited bridge capacity; limited sight distance; substandard shoulders; short merge and diverge locations north and south of the bridge; heavy merging, diverging, and weaving flows of traffic; and heavy freight flows. As with southbound conditions, northbound speeds through the congested segments of the corridor vary between 0 and 20 mph.

Peak Period Travel Times

The VISSIM traffic operations model was used to determine AM and PM peak period travel times along the I-5 corridor, northbound and southbound. Table 3.1-4 shows travel times on I-5 between I-205 in Vancouver and I-405 in North Portland in the AM and PM peak periods for both northbound and southbound travel. Southbound AM peak period travel times are the most affected by congestion, while southbound PM peak period travel times are similar to free-flow conditions. Northbound peak period travel times are free flow during the AM peak period and affected by congestion during the PM peak period.

Table 3.1-4. I-5 Average Weekday Peak Period Travel Times between I-205 and I-405 in North Portland – 2019 Existing Conditions

Direction	Metric	AM Peak Travel Time (mins)				PM Peak Travel Time (mins)			
		6 AM	7 AM	8 AM	9 AM	3 PM	4 PM	5 PM	6 PM
Southbound	Hourly Average Travel Time	24	38	32	21	13	13	14	13
	Peak 2-hour Average Travel Time	35	35	35	35	14	14	14	14
Northbound	Hourly Average Travel Time	13	13	13	13	36	40	31	19
	Peak 2-hour Average Travel Time	13	13	13	13	35	35	35	35

Source: IBR Analysis.

Level of Service and Volume-to-Capacity Ratios

As described in the Transportation Technical Report, WSDOT uses LOS as its standard for highway performance, while ODOT uses volume-to-capacity (V/C) ratios to set mobility standards and performance targets. WSDOT's LOS standard for I-5 in Washington is LOS D. ODOT's performance standard for I-5 in Oregon is a V/C ratio of 1.1 for the highest peak hour and 0.99 for all other hours. The Transportation Methods Report provides more information on how these standards are defined and evaluated.

Table 3.1-5 and Table 3.1-6 list the I-5 study area highway segments with below-standard performance (shown in red-shaded cells) for southbound and northbound traffic during peak periods. Results for Washington segments are shown in terms of LOS, and results for Oregon segments are shown in terms of V/C.

Table 3.1-5. I-5 Highway Performance for Southbound AM and PM Peak – 2019 Existing Conditions

Location	Segment Type	AM LOS / V/C				PM LOS / V/C			
		6 AM	7 AM	8 AM	9 AM	3 PM	4 PM	5 PM	6 PM
Main St on-ramp to 39th St off-ramp	Weave	C	E	B	B	B	B	B	B
39th St off-ramp to SR 500/39th St on-ramp	Basic	F	F	D	C	B	C	C	B
SR 500/39th St on-ramp to Fourth Plain off-ramp	Weave	F	F	E	B	B	B	B	B
Fourth Plain off-ramp to Fourth Plain on-ramp	Basic	F	F	E	B	B	B	B	B
Fourth Plain on-ramp to Mill Plain off-ramp	Weave	F	F	E	B	B	B	B	B
Mill Plain off-ramp to Mill Plain on-ramp	Basic	F	F	F	C	B	C	C	B
Mill Plain on-ramp to SR 14 off-ramp	Weave	F	F	F	C	C	C	C	B
SR 14 off-ramp to SR 14/Washington St on-ramp	Basic	F	F	F	C	C	C	C	B
SR 14/Washington St on-ramp merge	Merge	F	F	F	C	B	C	C	B
Interstate Bridge	Basic	0.90-1.0 E	0.90-1.0 E	>1.1 F	0.50-0.75 D	0.50-0.75 C	0.50-0.75 C	0.50-0.75 D	0.50-0.75 C
Hayden Island off-ramp to Hayden Island on-ramp		0.75-0.80	0.75-0.80	0.90-1.0	0.50-0.75	0.25-0.50	0.50-0.75	0.50-0.75	0.25-0.50
Hayden Island on-ramp to Marine Dr off-ramp	Weave	0.50-0.75	0.50-0.75	>1.1	0.50-0.75	0.25-0.50	0.25-0.50	0.25-0.50	0.25-0.50
Marine Dr off-ramp to Marine Dr on-ramp	Basic	0.50-0.75	0.75-0.80	>1.1	0.50-0.75	0.25-0.50	0.25-0.50	0.25-0.50	0.25-0.50
Marine Dr on-ramp to Interstate Ave off-ramp	Weave	0.50-0.75	1.0-1.1	>1.1	0.75-0.80	0.25-0.50	0.25-0.50	0.25-0.50	0.25-0.50
Interstate Ave off-ramp to Victory on-ramp	Basic	.050-0.75	>1.1	>1.1	>1.1	0.25-0.50	0.25-0.50	0.25-0.50	0.25-0.50

Source: IBR Analysis. Red-highlighted cells do not meet performance standard. Ave = Avenue; Dr = Drive; St = Street.

1 Table 3.1-6. I-5 Highway Performance for Northbound AM and PM Peak – 2019 Existing Conditions

Location	Segment Type	AM LOS / V/C				PM LOS / V/C			
		6 AM	7 AM	8 AM	9 AM	3 PM	4 PM	5 PM	6 PM
Victory off-ramp to Marine Dr off-ramp	Diverge	<0.75	<0.75	<0.75	<0.75	>1.1	>1.1	>1.1	>1.1
Marine Dr off-ramp to Int./Victory on-ramp	Basic	<0.2.5	0.25-0.50	0.25-0.50	<0.25	>1.1	>1.1	>1.1	>1.1
Int./Victory on-ramp Merge	Merge	0.25-0.50	0.25-0.50	0.25-0.50	0.25-0.50	>1.1	>1.1	>1.1	>1.1
Int./Victory on-ramp to Marine Dr on-ramp	Merge	0.25-0.50	0.25-0.50	0.25-0.50	0.25-0.50	>1.1	>1.1	>1.1	>1.1
Marine Dr on-ramp to Hayden Island off-ramp	Weave	0.25-0.50	0.25-0.50	0.25-0.50	0.25-0.50	>1.1	>1.1	>1.1	>1.1
Hayden Island off-ramp to Hayden Island on-ramp	Basic	0.25-0.50	0.25-0.50	0.25-0.50	0.25-0.50	>1.1	>1.1	>1.1	>1.1
Hayden Island on-ramp merge	Merge	0.25-0.50	0.25-0.50	0.25-0.50	0.25-0.50	>1.1	>1.1	>1.1	>1.1
Interstate Bridge	Basic	0.25-0.50 B	.050-0.75 C	.050-0.75 C	0.25-0.50 C	1.0-1.1 F	1.0-1.1 F	1.0-1.1 F	0.90-1.0 E
SR 14 off-ramp to C St off-ramp	Diverge	B	B	B	B	C	C	C	C
C St off-ramp to SR 14 on-ramp	Basic	A	B	B	B	C	C	C	C
SR 14 on-ramp to Mill Plain/Fourth Plain off-ramp	Weave	B	B	B	B	C	C	C	C
Mill/Fourth Plain off-ramp to Mill Plain on-ramp	Basic	A	B	B	B	C	C	C	C
Mill Plain on-ramp merge	Merge	A	A	A	A	B	C	B	B
Mill Plain on-ramp to Fourth Plain on-ramp	Merge	A	B	B	B	C	C	C	B
Fourth Plain on-ramp merge	Weave	A	A	A	B	B	C	C	B
Fourth Plain on-ramp to SR 500/39th St off-ramp	Weave	A	B	B	B	C	D	C	B
SR 500/39th St off-ramp to 39th St on-ramp	Basic	A	B	A	B	C	C	C	B
39th St on-ramp to Main St off-ramp	Weave	A	A	A	B	B	C	B	B

2 Source: IBR Analysis. Red-highlighted cells do not meet performance standard. Ave = Avenue; Dr = Drive; St = Street.

Impacts to Local Roads

During the AM peak period, I-5 mainline congestion affects the ability of vehicles to enter the freeway on southbound on-ramps. This routinely affects the operations of local roads and intersections, including at Washington Street, SR 14, Mill Plain Boulevard, Fourth Plain Boulevard, and SR 500.

During the PM peak period, congestion on I-5 northbound and backups on northbound on-ramps impact the operations of local roads and intersections at Marine Drive, Martin Luther King Jr. Boulevard, and the Victory Boulevard/Interstate Avenue on-ramps.

Freight Mobility and Access

The I-5 crossing is critical to national and international freight flow. I-5 serves direct international land connections to Mexico and Canada. The Portland-Vancouver region is the fourth largest freight hub for domestic and international trade on the West Coast behind Los Angeles/Long Beach, Seattle/Tacoma, and San Francisco/Oakland. National, West Coast, and regional freight flows depend on the efficient functioning of I-5 within the study area.

I-5 is the primary truck route for local, regional, national, and international movement of goods through the Portland-Vancouver region. Trucks carry 55% of all freight in Clark County and 74% of all freight in Portland/Columbia County. Approximately $82 million in commodity value was transported daily across the Interstate Bridge in 2019.

Approximately 14,000 heavy and medium trucks crossed the Interstate Bridge on an average weekday in 2019, accounting for approximately 10% of all bridge traffic. About 70% of the truck trips using the Interstate Bridge either start or end in the Portland-Vancouver metropolitan area. Freight traffic does not peak during typical commute hours (6 to 9 a.m. and 3 to 6 p.m.). Instead, the highest freight volumes occur during the middle of the day as freight truck operators try to avoid the most congested periods.

The busiest interchanges for truck traffic are at Mill Plain Boulevard, City Center/SR 14, and Marine Drive, which all provide access to the Ports of Vancouver and Portland and surrounding industrial areas.

Bridge Lifts and Gate Closures

Bridge lifts occur when the movable spans are physically raised for the passage of commercial and non-commercial maritime vessels that exceed the available vertical clearance between the water level and the bridge in its closed position. When bridge lifts occur, all forms of both northbound and southbound traffic, freight, transit, and active transportation users on the Interstate Bridge are stopped.

The maximum vertical navigation clearance under the Interstate Bridge at any time depends on the water level in the Columbia River (higher river levels result in less clearance) and which of the three navigation channels a ship is using (the primary navigation channel, the barge channel, or the alternate barge channel). The alternate barge channel, which is aligned with the highest point of the bridge, has a vertical clearance of up to 72 feet above 0 feet Columbia River Datum (CRD). The primary navigation channel, which aligns with the Interstate Bridge lift spans, provides a maximum vertical navigation clearance of 39 feet CRD when the lift spans are in the closed position and 178 feet when the spans are fully raised.

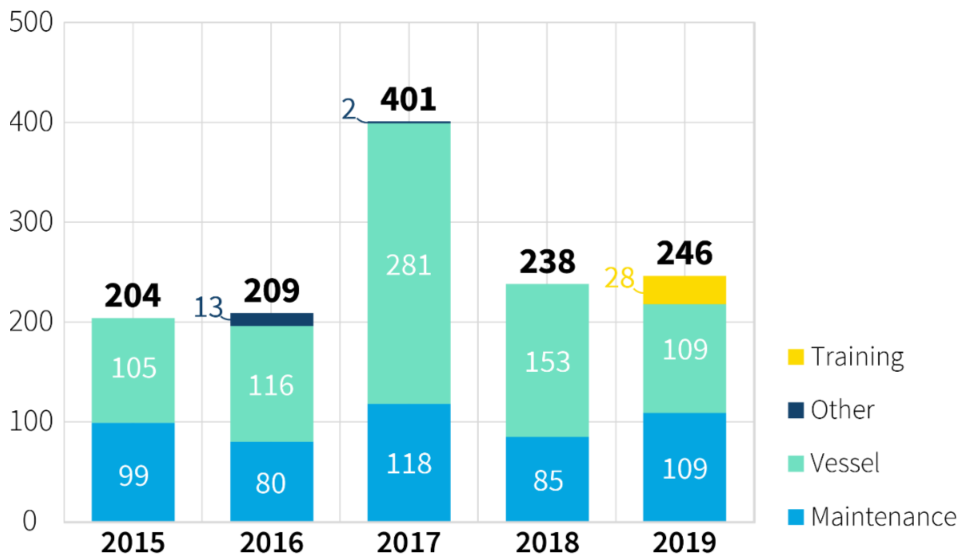
In addition to vertical clearance, vessels passing beneath the bridge must also consider horizontal clearance between the Interstate Bridge piers and the piers of the BNSF Railway Bridge located approximately 0.9 miles downstream. The existing horizontal clearances for the Interstate Bridge are approximately 263 feet for the primary channel, 511 feet for the barge channel, and 260 feet for the alternate barge channel. The alignments of the navigation channels factor into vessel passage of both the Interstate Bridge and the BNSF bridge; due to the proximity of the two, vessel operators typically plan their route based on navigation factors associated with both bridges. Vessels needing less than 33 feet of vertical navigation clearance to pass the BNSF Railway Bridge may take a route outside the primary navigation channel, while vessels needing additional vertical navigation clearance require the BNSF Railway Bridge swing span to be opened and must use the primary navigation channel. More information on clearances and navigation channels can be found in Section 3.2, Aviation and Navigation.

Frequent river traffic (tug and tows, river cruise ships, and recreational craft) typically does not require a bridge lift, as these vessels often opt to pass the bridge using either the alternate barge channel or the barge channel. However, bridge lifts are needed for some government vessels, tall ships and sailboats, floating construction equipment, larger ocean-going tugs or vessels, and specialty shipments from area fabricators that require more than 72 feet CRD of vertical navigation clearance. A bridge lift is also needed if river traffic requires use of the primary navigation channel to pass through the Interstate Bridge and the BNSF Railway Bridge for maneuverability and safety considerations. Additional detail on river traffic and existing navigation considerations is provided in Section 3.2, Aviation and Navigation.

In addition to bridge lifts, traffic on the bridge is affected by gate closure events, where traffic is stopped to allow for bridge-related activity without the bridge being raised. These gate closure events occur for several reasons, including bridge maintenance and on-site training of department of transportation personnel. Training and practice lifts are performed during the day and overnight periods. Depending on the reason for the event, traffic may be stopped in one or both directions.

For the 5-year period from January 1, 2015, to December 31, 2019, there were 1,298 bridge lift and gate closure events. On average, the bridge was lifted/gate closed 260 times per year, with the range over the 5-year period fluctuating between 204 and 401 bridge lifts and gate closures. Above average high water levels occurred in 2017, resulting in more bridge lifts. Figure 3.16-2 displays bridge lift and gate closure events for each year, by reason, from 2015 to 2019.

Figure 3.16-2. Interstate Bridge Lift and Gate Closure Events 2015–2019



Source: ODOT, WSDOT

The average bridge lift and gate closure duration during this period was 11.6 minutes. While bridge lifts are not allowed during peak periods (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 lift and gate closure. A closure just before the peak period can last even longer, affecting conditions throughout the peak.

Arterial and Local Street Network

In addition to the regional roadways that connect population and employment centers, the study area contains ODOT and WSDOT highways and City of Portland and City of Vancouver arterials and local streets that serve travel to and from the regional network, as well as providing for local access and circulation. Many of these roads and highways include bicycle and pedestrian facilities.

The study area includes 73 intersections: 55 in Vancouver and 18 in Portland. These include intersections originally evaluated in the CRC Final EIS and additional intersections that were identified for analysis in this Draft Supplemental EIS (SEIS) based on data reviews, consultations with partner agency staff, and the potential for intersection operations to be affected by I-5 operations or IBR Program improvements. More information on how study area intersections were identified can be found in the Transportation Technical Report. The study intersections were categorized into four subareas, based on their proximity to interchange areas and because different partner agencies have different performance standards. The four subareas are:

- SR 500/Main Street/39th Street/Fourth Plain Boulevard
- Mill Plain Boulevard
- SR 14/City Center Interchange/Columbia Way
- Hayden Island/Marine Drive/Victory Boulevard/Columbia Boulevard

Under existing conditions, four intersections in the study area do not meet the applicable agency performance standards. The three Vancouver area intersections that do not meet agency standards under existing conditions are listed in Table 3.1-7, and the Portland area intersection that does not meet agency standards is listed in Table 3.1-8. The detailed existing conditions information in the Transportation Technical Report includes information on peak hour intersection volumes as well as intersection operations.

Table 3.1-7. Vancouver Intersections Not Meeting Agency Standards (2019 Existing Conditions)

Peak	Intersection	Control Type	Standard	LOS	Delay (seconds)	ICU / V/C	Meets Standard
AM	I-5 SB Ramp and 39th Street (#4)	TWSC	LOS D WSDOT	F	> 300	1.25	No
PM	Main Street and 39th Street (#3)	Signal	LOS E COV	F	94	0.65	No
PM	I-5 SB Ramp and 39th Street (#4)	TWSC	LOS D WSDOT	F	> 300	0.90	No
PM	Columbia Shores Boulevard and Columbia Way (#55)	Signal	LOS E COV	F	179	0.54	No

Source: IBR Analysis.

Note. Study intersections were analyzed without considering the impacts of freeway congestion spilling back into local roadways and may operate worse than shown.

COV = City of Vancouver; LOS = level of service; ICU = intersection capacity utilization for signalized and all-way stop-controlled intersections; TWSC = two-way stop-control; V/C ratio = volume-to-capacity ratio for worse movement in two-way stop-controlled intersections

Table 3.1-8. Portland Intersections Not Meeting Agency Standards (2019 Existing Conditions)

Peak	Intersection	Control Type	Standard/ Target	LOS	Delay (seconds)	ICU / V/C	Meets Standard
PM	Marine Drive/Martin Luther King Jr. Boulevard and I-5 NB/SB on-/off-ramps (#63)	Signal	V/C = 0.85 ODOT	E	59	0.92	No

Source: IBR Analysis.

Note. Study intersections were analyzed without considering the impacts of freeway congestion spilling back into local roadways and may operate worse than shown.
ICU = intersection capacity utilization; LOS = level of service; NB = northbound; SB = southbound

Transit

Transit Providers and Systems

Transit service in the region and study area is provided by the Tri-County Metropolitan Transportation District of Oregon (TriMet) and the Clark County Public Transportation Benefit Area Authority (C-TRAN).

To serve its three-county service area in metropolitan Portland, TriMet has a bus fleet of approximately 700 vehicles and operates the 60-mile-long Metropolitan Area Express (MAX) light-rail transit (LRT) system. The MAX system has five lines that operate at 15-minute or better frequencies between approximately 5 a.m. and 1 a.m., 7 days a week. This includes the Yellow Line, also known as Interstate MAX, which runs northbound and southbound from downtown Portland (Portland State University) to the Expo Center. (South of downtown, the Yellow Line transitions to the Orange Line and continues south to Milwaukie.) The TriMet MAX system does not currently provide service across North Portland Harbor to Hayden Island or across the Columbia River into Clark County. TriMet has five operations and maintenance facilities: three for buses and two for rail.

C-TRAN is the transit provider in the Clark County service area, with a fixed-route fleet of approximately 122 buses that serve 28 bus lines and The Vine bus rapid transit (BRT) service. The Vine service began operations in 2017 between downtown Vancouver and the Vancouver Mall Transit Center, primarily along Fourth Plain Boulevard. New Vine BRT service along Mill Plain Boulevard will begin in late 2023 (note that this service is not reflected in existing conditions in the Draft SEIS, which are based on 2019). In addition to local bus and BRT service, C-TRAN operates three regional routes that provide transit service crossing the Columbia River to connect with the TriMet rail system and Portland International Airport, as well as seven express routes that provide connections between regional park-and-ride locations, downtown Vancouver, and the downtown Portland area. C-TRAN has a fleet of 64 demand-responsive vehicles and 40 vanpool vehicles. C-TRAN currently operates one bus operations and maintenance facility.

Several transit centers and park-and-ride facilities are used for travel between Clark County and Portland. These are served by various combinations of local, express, and regional bus routes as well as MAX.

Transit Service in the Study Area

There are 27 bus routes and one MAX light-rail line that serve the study area, including BRT, local, express, and regional service provided by C-TRAN and local bus and LRT service provided by TriMet. Both C-TRAN and TriMet provide special access and shared mobility services (i.e., paratransit, on-demand ridesharing, neighborhood shuttles, and vanpools) in the study area.

Table 3.1-9 shows the existing 2019 transit trips served by C-TRAN and TriMet in the study area. Approximately 4,800 people travel across the Columbia River via bus each weekday on routes using either I-5 or I-205. For transit trips between Vancouver and Portland on I-5, buses operate along with other vehicles in general-purpose travel lanes. On I-205, C-TRAN buses operate on the shoulder when peak period congestion warrants. As a result, congestion impacts bus travel times and the reliability of trips, which are key measures of service quality for transit systems.

Table 3.1-9. Existing 2019 Average Weekday Transit Ridership

Organization	Transit Service	Regional System	Study Area Routes [a]
TriMet	Local Bus	189,200	50,400
	Light-Rail	122,000	13,200
	Westside Express Service (Commuter Rail)	1,400	N/A
	Total	312,600	63,600

Organization	Transit Service	Regional System	Study Area Routes [a]
C-TRAN	Local Bus	10,400	7,100
	The Vine BRT	4,500	4,500
	Regional Bus	2,100	1,500
	Express Bus	2,900	2,400
	Total	19,900	15,500

Source: TriMet Spring 2019 Route Ridership Report, C-TRAN 2019 April Boarding Report.

a Includes boardings for entire route, not just the portion within the study area.

Transit travel time within the study area varies by time of day. For all trips between Vancouver and Portland, congestion on I-5 affects both transit travel time and the reliability of transit trips. Currently, only transit trips destined for downtown Portland have the possibility of a one-seat ride (i.e., a single ride with no transfers) on express buses that operate in mixed traffic on I-5. Total transit travel times (including in vehicle, walking, waiting, and transfer time) range between 38 and 65 minutes southbound during the AM peak period and between 46 and 71 minutes northbound during the PM peak period. Nearly all of the transit travel times currently require a transfer to complete the trip exclusively on transit. Transfer time often makes up a larger portion of the trip than time spent in the transit vehicle.

Active Transportation

Active transportation facilities in the study area include sidewalks, on-street bicycle facilities, and shared-use paths. The analysis of these facilities extended over 3 miles beyond the study area to account for local network conditions and the potential for active transportation modes to reach the Interstate Bridge from locations outside of the study area.

In Portland, the width and condition of active transportation facilities vary. Most existing sidewalks are between 4 and 6 feet wide, but there are areas with no sidewalks, as well as segments with missing connections. The Portland bicycle network in the study area comprises a mixture of bike lanes and off-street shared-use paths. Part of the 40-Mile Loop Trail, which is planned to create a route around the Portland region, runs through the study area on the south edge of the Columbia River but has a gap within the study area.

Land uses in the area south of North Portland Harbor (e.g., the Columbia Slough Watershed, Delta Park, the Expo Center, and industrial lands) have limited the overall roadway network development. As a result of large block spacing and historically lower standards, there are limited sidewalk connections. An incomplete network of shared-use paths connects to and through this portion of the study area, with some non-standard segments.

Bike lanes connect North and Northeast Portland with the North Portland Harbor bridge via N Denver Avenue, Martin Luther King Jr. Boulevard, and N Marine Drive. Access to the shared-use path on the North Portland Harbor bridge is circuitous and non-continuous on both ends of the structure (in North Portland and on Hayden Island). On Hayden Island, the path connecting the bridge with mainland Portland is narrow and does not meet applicable standards. The pedestrian network on the island is largely absent despite the grid-like nature of the street network.

The existing Interstate Bridge over the Columbia River between Vancouver and Hayden Island has substandard shared-use paths on the outside edges of the northbound and southbound bridge structures. While the design of each path is different, neither meets the American Association of State Highway and Transportation Officials (AASHTO) standards for shared-use paths. The "clear" (or unobstructed) widths of the paths on the existing bridges are less than 4 feet. The mixing of pedestrians and bicycles in this constrained space can result in safety conflicts and an uncomfortable traveling environment for many users. Still, an estimated 410 bicyclists and pedestrians, on average, make trips across the bridge daily.

In Vancouver, sidewalks are present on the west side of I-5 on most major corridors and in the downtown core, but gaps or non-standard facilities are present on several major routes. I-5 is a major barrier to pedestrian travel between Vancouver neighborhoods and destinations on the east and west sides of the freeway. Pedestrian facilities are provided at some I-5 crossing locations, but not consistently. The bicycle network in Vancouver comprises a mixture of shared roadways (designated bikeways in which people biking share the road space with cars and other vehicles), bike lanes, and off-street paved paths providing access to the Interstate Bridge.

Safety

For existing safety-related conditions in the study area, the IBR Program collected crash data records from WSDOT and ODOT from January 2015 to December 2019 (pre-pandemic). Within the study area, there were 2,270 total crashes on the I-5 mainline, ramps, and at study area intersections for the 5-year period evaluated, with rear-end crashes comprising about half of the total. Most crashes occurred between 6 and 9 a.m. and 12 to 7 p.m. About 38% of total crashes resulted in injury, with 2% fatal or serious. The Transportation Technical Report details existing crash data by type, severity, and location, including crashes occurring during bridge lifts and gate closures.

Transportation Demand Management and Transportation System Management

A variety of demand- and system-management programs and measures are currently in use in the study area. Demand-management programs can be categorized according to four basic strategies to alter transportation choices:

- Programs to improve public awareness of transportation choices.
- Programs to improve access to or availability of alternative transportation choices.
- Incentives and disincentives that cause changes in transportation choices by individuals.
- Institutional and organization approaches, including employer-based or area-based programs, as well as transit-oriented or land use-based programs.

System-management measures and actions are used to increase the operational efficiency of the transportation system, especially the street and highway network, including signals and signal systems. These systems are owned or operated by the local agencies and the states and include:

- System monitoring and traveler information systems (e.g., web-based information systems, variable message signs).
- Facility management systems (e.g., active traffic management system, bus-on-shoulder operations, optimized signal systems, ramp meters, signal priority for special users, such as transit).

- Incident management systems (e.g., incident response and recovery teams).

3.1.3 Long-Term Effects

The long-term effects described in this section are for the year 2045. Year 2045 conditions incorporate the 2040 Financially Constrained Regional Transportation Plan adopted by both Metro and RTC with updates to extend the forecasts to 2045.

The evaluation of alternatives is organized by element of the transportation system, and then by alternative. The Modified LPA is discussed in comparison to the No-Build Alternative. The base scenario modeled for the Modified LPA is a double-deck, fixed-span bridge, with one auxiliary lane and ramps at C Street. Three of the Modified LPA design options—those that would remove the C Street ramps, add a second auxiliary lane, and replace the Interstate Bridge with a new movable-span bridge—would operate differently than the Modified LPA base scenario in some categories and are discussed below where their impacts would differ. The other design options described in Chapter 2 of this Draft SEIS would not differ from the Modified LPA in terms of transportation and are not discussed further.

Regional Travel Impacts Based on Year 2045 Forecasts

Table 3.1-10 shows the daily measures of travel demand in year 2045 for the No-Build Alternative, the Modified LPA base scenario (one auxiliary lane), and the Modified LPA with two auxiliary lanes, based on the results from the regional travel demand model. The other design options under consideration have the same regional travel demand results as the Modified LPA base scenario and are not shown separately. Further detail on the key elements of the design options can be found in Chapter 2, Description of Alternatives. The Transportation Technical Report has additional information on the regional model's assumptions.

Compared to the No-Build Alternative, the Modified LPA with one auxiliary lane would decrease travel (measured by VMT) and travel times (measured by VHT) by 1% in the Portland metropolitan region and up to 3% in the subarea. This is due to the transit improvements and the tolls assumed with the Modified LPA, with transit accommodating a larger share of the daily trips compared to the No-Build Alternative (see the section Daily Person Throughput below). The Modified LPA with either one or two auxiliary lanes would result in an 11% decrease in delay (measured in VHD) in the Portland metropolitan region. The one and two auxiliary lane design options would result in a 30% and 32% decrease in delay in the traffic subarea, respectively, compared to the No-Build Alternative. The Transportation Technical Report includes more information on the modeling analysis and results.

Table 3.1-10. 2045 Weekday Daily Vehicle Miles Traveled, Vehicle Hours Traveled, and Vehicle Hours of Delay

Alternative	Study Area	Vehicle Miles Traveled	Vehicle Hours Traveled	Vehicle Hours of Delay
No-Build Alternative	Portland Metropolitan Region	58,835,800	1,793,400	64,000
	Traffic Subarea	14,291,000	436,400	24,300
Modified LPA (Base Scenario)	Portland Metropolitan Region	58,743,200	1,782,300	57,000
	Traffic Subarea	14,211,400	424,900	17,000
Modified LPA (Two Auxiliary Lane Design Option)	Portland Metropolitan Region	58,751,200	1,781,800	56,700
	Traffic Subarea	14,219,500	424,300	16,600
Change between No-Build and Modified LPA Base Scenario	Regional Difference	-92,700 (<-1%)	-11,100 (-1%)	-7,000 (-11%)
	Subarea Difference	-79,600 (-1%)	-11,500 (-3%)	-7,300 (-30%)
Change between No-Build and Modified LPA Two Auxiliary Lane Design Option	Regional Difference	-84,600 (<-1%)	-11,600 (-1%)	-7,300 (-11%)
	Subarea Difference	-71,400 (-1%)	-12,100 (-3%)	-7,700 (-32%)
Change between Modified LPA Base Scenario and Modified LPA Two Auxiliary Lane Design Option	Regional Difference	8,000 (<-1%)	-500 (<-1%)	-300 (<-1%)
	Subarea Difference	8,200 (<-1%)	-600 (<-1%)	-400 (-2%)

Source: Metro/RTC Regional Travel Demand Model.

Screenline Peak Hour Traffic Volume Forecasts in 2045

The AM and PM peak hour screenline volumes for 13 screenline locations within the study area were analyzed using the regional travel demand model to determine the relative differences in traffic volumes between the No-Build Alternative and the Modified LPA. Screenline volumes did not differ among the design options.

For the Vancouver screenlines, capturing northbound and southbound vehicle movements, the Modified LPA would result in increased volumes in the peak directions (southbound in the AM peak and northbound in the PM peak) for all screenlines compared to the No-Build Alternative. These forecast increases would be primarily on I-5 rather than on surrounding north-south arterial facilities, which for the most part would see decreases in volumes with the Modified LPA. However, eastbound and westbound traffic in Vancouver would experience increases in both the AM and PM peak hours with the Modified LPA. These changes reflect the ability for more vehicles to be accommodated on I-5 during the peak period with the Modified LPA compared to the No-Build Alternative.

For Portland screenlines, the Modified LPA would also increase vehicle volumes compared to the No-Build Alternative, but with total changes below 10% in the peak direction. The increases would occur on I-5 as well as arterials. Some of the changes would be related to Hayden Island area access and circulation changes that would occur with the Modified LPA. In a number of cases, the volumes would be lower than with the No-Build Alternative, particularly in the off-peak direction.

I-5/I-205 Travel Forecasts in 2045

Year 2045 volumes were developed using the four-step Metro/RTC regional travel demand model, with adjustments reflecting differences between observed existing traffic counts and the traffic volumes simulated by the Metro/RTC regional travel demand model. Year 2045 forecast volumes were developed for the No-Build Alternative and the Modified LPA. The forecast volumes do not differ among the design options. The Transportation Technical Report has additional information on the methods used.

Daily and Peak Period Cross-River Demand Volume Forecasts in 2045

The forecasts indicate that 45% of daily traffic would use the I-5 bridge and 55% would use the I-205 bridge in both the No-Build Alternative and the Modified LPA.

Both daily and during peak periods, the regional travel demand model predicts increased trips across the Columbia River by 2045. Table 3.1-11 shows year 2045 average weekday traffic demand volumes for I-5, I-205, and total Columbia River crossings. These are indications of the predicted demand for travel across the Columbia River; however, the Transportation Technical Report also evaluates more detailed operational measures to assess how well the facilities could handle future travel demand.

In the 2045 No-Build Alternative, average weekday daily traffic volumes are forecast to increase 26% over 2019 conditions for the Interstate Bridge. Similar but slower growth is predicted during the peak periods.

The Modified LPA would have 3% lower traffic volumes than the No-Build Alternative in 2045. This reduction is due to more investment in high-capacity transit (LRT, express bus on shoulder, and new park-and-ride lots) throughout the study area, variable-rate tolls that would be implemented on the new Columbia River bridges, and improved active transportation facilities. As noted above, average weekday daily traffic volumes are forecast to be similar across the Modified LPA design options.

Table 3.1-11. 2045 Forecast Average Weekday Daily Traffic Volumes on I-5 and I-205

Location	Existing AWDT	2045 No-Build AWDT [a]	2045 Modified LPA AWDT [b]
Total River Crossing	313,000	400,000 (+28%)	389,000 (-3%)
I-5 Bridge	143,400	180,000 (+26%)	175,000 (-3%)
I-205 Bridge	169,600	220,000 (+30%)	214,000 (-3%)

Source: ODOT/WSDOT, Metro/RTC Regional Travel Demand Model, IBR Analysis 2022
a Percentages reflect change from existing conditions.
b Percentages reflect change from 2045 No-Build Alternative.
AWDT = average weekday daily traffic

I-5 Peak Period Mainline and Ramp Volumes in 2045

The regional demand model was also used to predict peak period mainline and ramp volumes by location, with refinements based on with observed traffic volumes under current conditions. In general, ramps that have the highest proportion of demand relative to others in the existing condition would continue to have the highest proportion of demand relative to other ramps under the No-Build

Alternative and the Modified LPA. Further detail about the forecast volumes at individual mainline locations and ramps can be found in the Transportation Technical Report.

No-Build Alternative

For southbound travel during the AM peak period and northbound travel during the PM peak period, hourly demand volume crossing the Interstate Bridge would increase between 17% and 30% under the No-Build Alternative compared to existing conditions. Hourly demand volume crossing the Interstate Bridge in the reverse commute period and direction would increase between 34% and 58% compared to existing conditions. Overall, the southbound mainline and ramp travel demand volumes would continue to be highest during the AM peak, and northbound mainline and ramp travel demand volumes would continue to be highest during the PM peak. However, in some locations near downtown Vancouver, such as Mill Plain Boulevard and the SR 14 ramps, there would be more balanced AM/PM peak volumes, with some slightly higher volumes in the reverse direction of the traditional commute. This likely reflects a predicted increase in mixed-use development in Vancouver's downtown and central areas, resulting in more people commuting to jobs in Vancouver, as well as the influence of continued congestion.

Modified LPA

Similar to the 2045 No-Build Alternative, southbound mainline and ramp volumes under the Modified LPA would be highest during the AM peak period and northbound mainline and ramp volumes would be highest during the PM peak period, but some locations near downtown Vancouver would see higher mainline or ramp volumes in the reverse commute direction.

Hourly traffic volumes crossing the I-5 and I-205 Columbia River bridges in the peak period and peak direction (southbound during the AM peak period and northbound during the PM peak period) would be up to 10% higher in the Modified LPA base scenario compared to No-Build Alternative. Hourly traffic volumes crossing the bridges in the reverse commute direction (northbound during the AM peak period and southbound during the PM peak period) would be between 4% and 6% lower in the Modified LPA base scenario compared to the No-Build Alternative. The reason that the number of vehicles crossing the bridges would increase during the peak period in the peak direction and decrease in the off-peak direction is the cost of variable-rate tolls and the congestion levels on both river crossings. In the No-Build Alternative, congestion in the peak period and peak direction would continue to limit the traffic volumes on the Columbia River bridges.

Under the Modified LPA base scenario, the regional travel demand results reflect the additional person-moving capacity offered by transit and the improvements in traffic operations from the addition of an auxiliary lane in each direction. Tolling is predicted to reduce the *daily* demand volume crossing the river on the I-5 corridor, but the forecasts still assume growth in commute trips during peak periods in the peak direction, because these trips are less affected by tolls than periods with more discretionary trips. The result would be an increase in vehicle demand volume during the peak periods in the peak direction.

All other Modified LPA design options would have similar peak period traffic volumes as the base scenario, with the exception of the design option that would remove the C Street ramps. This option would eliminate an access and egress point for downtown Vancouver and would shift between 300 and 600 vehicles per hour to the C-D roadways and the Mill Plain Boulevard ramps during the peak periods, compared to the Modified LPA where these trips would be accommodated by the C Street ramps.

Daily Person Throughput

Person throughput measures the number of people (as opposed to the number of vehicles) that a transportation facility carries. The number of vehicles (passenger cars and freight trucks) crossing the Interstate Bridge was multiplied by average vehicle occupancy assumptions to calculate total person throughput in vehicles. For all vehicle modes, the same average vehicle occupancy used to calculate existing (2019) daily person throughput was applied to future year vehicle volumes. The number of people crossing the bridge in transit (buses and light-rail) and via active transportation was included in the total number of people crossing the bridge to calculate 2045 daily person throughput for the No-Build Alternative and the Modified LPA.

In the southbound direction, the Interstate Bridge is forecast to carry 118,900 people under the No-Build Alternative and 122,500 people under all design options of the Modified LPA. For the northbound direction, the daily person throughput is forecast to be 124,200 people under the No-Build Alternative and 129,900 people under the Modified LPA.

There would be 3% fewer vehicles crossing the Columbia River bridges on an average weekday in the Modified LPA compared to the No-Build Alternative. High-capacity transit, improved active transportation facilities, and variable-rate tolling under the Modified LPA would increase the number of people crossing the I-5 Columbia River bridges using transit or active transportation while reducing the daily number of vehicles. The increase in the number of transit and active transportation users compared to the No-Build Alternative would be greater than the decrease in the number of people crossing the Columbia River bridges in vehicles, resulting in a net increase in the number of people crossing the Columbia River bridges with the Modified LPA compared to the No-Build Alternative.

I-5 Operations Overview

The 2045 operations for I-5 were evaluated using VISSIM microsimulation models. Future year 2045 forecast operations were analyzed during the 4-hour AM and PM peak periods. Congestion would occur outside of the 4-hour peaks based on the 2045 VISSIM forecasts, as indicated by the congestion levels seen at the beginning and end of the modeled 4-hour peak periods and influence the demand volumes outside of the modeled 4-hour peak periods.

The I-5 operations analysis includes peak-period congestion estimates, peak-period speeds, peak-period travel times, LOS and V/C ratios, and impacts to local roads. These results are summarized below.

No-Build Alternative

- Under the No-Build Alternative, the Interstate Bridge would remain the main bottleneck in the study area. Northbound I-5 approaching the bridge would be congested for 14 hours from 7 a.m. to 9 p.m., and southbound I-5 approaching the bridge would be congested for 16 hours from 5 a.m. to 9 p.m. Backups would extend beyond the limits of the freeway analysis area, which is between the Marquam Bridge in downtown Portland and the I-5/I-205 interchange north of Vancouver.

Modified LPA

- Under the Modified LPA base scenario and the design option without C Street ramps, the northbound bottleneck at the Columbia River bridges would be reduced but not eliminated and would continue to be a bottleneck during the PM peak period, with congestion lasting for 9 hours from 12 to 9 p.m. and backing up south as far as 5 miles to the I-5/I-405 merge in North Portland.

- Under the Modified LPA Two Auxiliary Lane Design Option, the northbound bottleneck at the Columbia River bridge would be reduced, with congestion for 6 hours from 1:30 to 7:30 p.m. but only backing up for 0.75 miles to Hayden Island.
- Under all design options of the Modified LPA, the southbound bottleneck at the Columbia River bridges would be reduced, but the improved southbound flow at the Columbia River bridges would increase the extent and duration of the downstream bottleneck at the I-5/I-405 split in North Portland, with congestion spilling back into the study area for most of the AM peak period. Mitigation may be considered to address this impact.
- The southbound travel time on I-5 between I-205 north of Vancouver and I-405 in North Portland during the 2-hour AM and PM peak periods would be 7% faster than the No-Build Alternative under the Modified LPA base scenario and 52% faster under the design option without C Street ramps. Northbound travel times during the 2-hour AM and PM peak periods would be 28% faster than the No-Build Alternative under the Modified LPA base scenario and 38% faster under the design option without C Street ramps. With two auxiliary lanes, the southbound travel time between I-205 and I-405 would be 7% faster than the Modified LPA base scenario during the 2-hour AM peak period, and the northbound travel time would be 46% faster.
- During the AM peak period, I-5 southbound approaching the Columbia River bridges would not meet the WSDOT mobility standard under either the No-Build or any of the Modified LPA design options due to congestion spilling back from the downstream bottleneck at the I-5/I-405 split in North Portland. During the PM peak period, the No-Build Alternative would not meet the WSDOT mobility standard, while the Modified LPA under all design options would improve conditions to meet the standard.
- During the AM peak period, I-5 northbound approaching the Interstate Bridge would not meet the ODOT mobility standard under the No-Build Alternative due to over-capacity conditions at the Columbia River bridges; the Modified LPA under all design options would improve conditions to meet the standard. During the PM peak period, neither the No-Build Alternative, the Modified LPA baseline scenario, nor the Modified LPA without C Street ramps would meet the ODOT mobility standard. The Modified LPA with two auxiliary lanes would improve most segments of highway to meet ODOT's mobility standard, but some segments near the Columbia River bridges would continue to not meet standards.
- With all Modified LPA design options, the C-D system between Mill Plain Boulevard and SR 14 in Vancouver would not meet performance standards in the southbound direction during both the AM and PM peak periods, but the C-D between SR 14 and Mill Plain Boulevard in the northbound direction would meet performance standards.

Bottlenecks and Speeds

I-5 traffic performance within the freeway analysis area was evaluated using VISSIM during the 4-hour peak periods and estimated speeds during midday. Key information about forecast bottlenecks, including the location, time of day, duration, and extent of the congestion when speeds are below 45 mph, is summarized in Table 3.1-12 for the No-Build Alternative, Modified LPA base scenario, Modified LPA without C Street ramps, and the Modified LPA with two auxiliary lanes. This analysis shows the maximum levels of congestion at the peaks, but congestion levels would build over time and then dissipate as traffic demand volumes begin decreasing after peak periods.

To show the results in more detail, the Transportation Technical Report has maps of average vehicle speeds by segment and location, and it also shows the hours of congestion.

No-Build Alternative

In the southbound direction, the Interstate Bridge would be congested throughout the 4-hour AM and PM peak periods. Congestion at the bridge would continue to be caused by overall high traffic volumes, the structure's limited capacity, limited sight distance, substandard shoulders, short merge and diverge locations north and south of the bridge, high-volume on- and off-ramp flows north of the river, and high truck volumes.

Southbound congestion would span both peaks, from 5 a.m. until 9 p.m. (16 hours). This is an increase of 13 hours, compared to the 3 hours of southbound congestion under 2019 existing conditions. At times, congestion from the Interstate Bridge would extend north from the bridge beyond the I-5/I-205 interchange north of Vancouver, a distance of over 8 miles.

Beyond the study area, a regional southbound bottleneck at the I-5/I-405 split in North Portland would continue to affect I-5 operations back toward the Interstate Bridge and into the Interstate Bridge congestion throughout the AM peak period and into midday lasting over 8 hours from 5 a.m. to 1 p.m.

In the northbound direction under the No-Build Alternative, the Interstate Bridge bottleneck would remain the primary bottleneck and would be congested for most of the 4-hour AM peak period and all of the 4-hour PM peak period. The northbound congestion on the bridge is caused by similar factors as the southbound congestion and would last from 6 a.m. until 9 p.m. (15 hours). This is an increase of 6.25 hours over the 8.75 hours of congestion that exist in 2019. Congestion from the Interstate Bridge would extend south of the study area beyond the Marquam Bridge (over 10 miles) and combine with other northbound I-5 bottlenecks near downtown Portland.

Table 3.1-12. Future Year 2045 Average Weekday Bottleneck Summary when Speeds are below 45 mph

Travel Direction	Location	No-Build Alternative			Modified LPA Base Scenario			Modified LPA Without C Street Ramps			Modified LPA with Two Auxiliary Lanes		
		Time of Day	Duration (hours)	Extent (miles)	Time of Day	Duration (hours)	Extent (miles)	Time of Day	Duration (hours)	Extent (miles)	Time of Day	Duration (hours)	Extent (miles)
Southbound	Mill Plain/ SR 14 C-D	N/A	N/A	N/A	6 a.m.–12 p.m.	6	4	6 a.m.–12 p.m.	6	4.5	7–11 a.m.	4	1.5
	Existing Interstate Bridge/New Columbia River Bridges	5 a.m. – 9 p.m.	16	8+	6 a.m. – 10:45 a.m.	4.75	4.5	6 a.m. – 10:45 a.m.	4.75	4.5	6:15 a.m. –10:45 a.m.	4.5	1
	I-5/I-405 Split in North Portland	5 a.m.–1 p.m.	8	5	5 a.m.–1:30 p.m.	8.5	6	Same as Modified LPA base scenario.	Same as Modified LPA base scenario.	Same as Modified LPA base scenario.	Same as Modified LPA base scenario.	Same as Modified LPA base scenario.	Same as Modified LPA base scenario.
	Rose Quarter	1:30–9 p.m.	7.5	1	Same as No-Build.	Same as No-Build.	Same as No-Build.	Same as Modified LPA base scenario.	Same as Modified LPA base scenario.	Same as Modified LPA base scenario.	Same as Modified LPA base scenario.	Same as Modified LPA base scenario.	Same as Modified LPA base scenario.
Northbound	Existing Interstate Bridge/New Columbia River Bridges	7 a.m.–9 p.m.	14	10+	12–9 p.m.	9	5	Same as Modified LPA base scenario.	Same as Modified LPA base scenario.	Same as Modified LPA base scenario.	1:30–7:30 p.m.	6	0.75

Source: IBR Analysis.
C-D = collector-distributor; N/A = not applicable.

Modified LPA Base Scenario

During the AM peak period, overall congestion southbound would be reduced compared to the No-Build Alternative, but congested conditions would still occur. For the AM peak period, most segments of I-5 would operate with less congestion than No-Build, but congestion in North Portland would worsen approaching the downstream I-5/I-405 bottleneck in North Portland because traffic would no longer be as constrained by a bridge bottleneck. The combined congestion from the I-5/I-405 bottleneck in North Portland plus the bridge volumes would extend back into the study area as far north as the collector-distributor (C-D)[2] system in Vancouver between Mill Plain Boulevard and SR 14. While traffic congestion on southbound I-5 through North Portland would be worse with the Modified LPA compared to the No-Build Alternative, the traffic volume demand forecasts are similar between the Modified LPA and the No-Build Alternative south of the IBR study area, and the Modified LPA would provide multimodal choices for users to avoid the downstream bottleneck near the I-5/I-405 split in North Portland via enhanced high-capacity transit, express bus options, and active transportation improvements connecting to the current active transportation system through North Portland.

During the PM peak period, there would be no southbound congestion at the bridge or to the north.

In the northbound direction, the bottleneck at the Columbia River bridges would be reduced with the Modified LPA compared to the No-Build Alternative, improving northbound traffic flow at the bridges. However, the Columbia River bridges would still be a bottleneck for northbound traffic for 9 hours, with congestion forecast to occur between the Columbia River bridges and the I-5/I-405 split in North Portland with the Modified LPA. No northbound congestion is forecast during the AM peak period with the Modified LPA.

Modified LPA Without C Street Ramps

Under the Modified LPA without C Street ramps, congestion would be the same as the Modified LPA base scenario except for the southbound congestion at the C-D system in Vancouver. The congestion would still exist, but the removal of the C Street ramps would result in higher volumes at the Mill Plain Boulevard on-ramp to southbound I-5, and thus in higher demand volumes through the southbound C-D system. The higher demand through the southbound C-D would cause the congestion at the C-D off-ramp to extend further north (4.5 miles compared to 4 miles) than under the Modified LPA.

Modified LPA With Two Auxiliary Lanes

Under the Modified LPA with two auxiliary lanes, congestion during the AM peak would be similar to the Modified LPA base scenario for the southbound direction, largely due to the regional system-level bottleneck near the I-5/I-405 split in North Portland. However, within the areas where auxiliary lanes would be added approaching and across the new Columbia River bridges, operations would improve at the on- and off-ramps and there would be fewer hours of congestion and shortened backups. Peak period AM congestion would last for 4 hours (compared to 6 hours with the Modified LPA base scenario) and would extend 1.5 miles (compared to 4 miles with the base scenario). No southbound congestion is forecast during the PM peak period.

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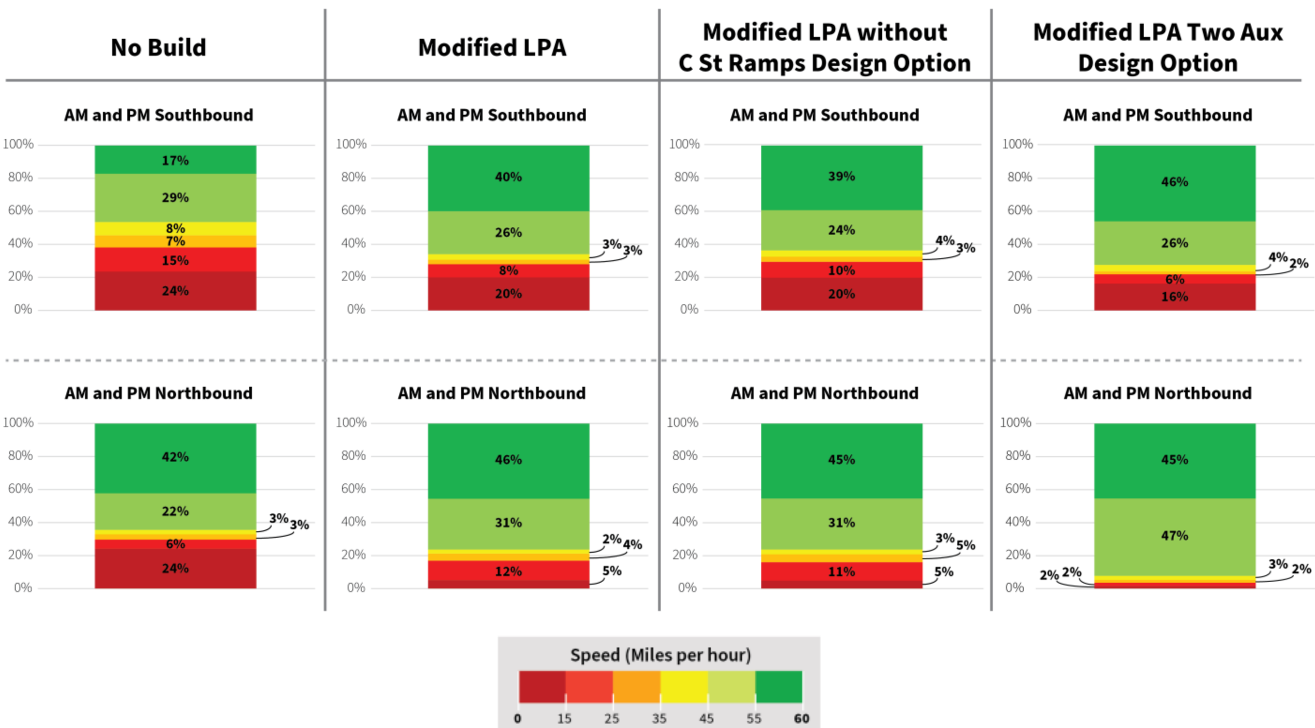
[2] A collector-distributer roadway parallels and connects the main travel lanes of a highway and frontage roads or entrance ramps.

PM peak period northbound congestion would be substantially reduced compared to the Modified LPA base scenario and No-Build. PM peak northbound congestion would be reduced from 9 to 6 hours and would extend back less than 0.75 miles to Hayden Island, rather than to the I-5/I-405 merge in North Portland under the No-Build Alternative. No northbound congestion is forecast during the AM peak period.

Congestion Index

Figure 3.1-3 provides a congestion index for No-Build, the Modified LPA base scenario, and the design options without C Street ramps and with two auxiliary lanes. The index aggregates the levels of congestion on I-5 during the 8 peak hours, including the 4-hour AM peak (6 to 10 a.m.) and the 4-hour PM peak period (3 to 7 p.m.). These indices are a summary of northbound and southbound congestion and how long any given section of I-5 in the analysis area is operating at a particular speed. Overall, all Modified LPA design options would improve conditions compared to the No-Build Alternative, and the addition of a second auxiliary lane would offer the highest level of improvement in reducing congestion, particularly for northbound travel.

Figure 3.1-3. Forecast I-5 2045 Congestion Index



Peak Period Travel Times

I-5 travel time comparisons from I-405 to I-205 generally mirror the congestion results described above, but they also provide an additional measure of how different the travel experience would be by alternative and design option, based on the time of day. Southbound travel differences are less varied than northbound travel differences, largely due to the constraints posed by backups at the I-5/I-405 split in North Portland. Table 3.1-13 to Table 3.1-16 show the 2045 forecast southbound and northbound I-5 average travel times between I-205 and I-405 in the AM and PM peak periods. The Transportation Technical Report has hour-by-hour details, which provide more comparisons, including for periods when travel is closer to free-flow conditions.

Table 3.1-13. 2045 Forecast I-5 Weekday Southbound AM Peak Period Average Travel Times

Alternative/Design Option	Peak 2-hour Average Travel Time (mins)
No-Build Alternative	58
Modified LPA Base Scenario	54 (7% reduction)
Modified LPA without C Street Ramps	54 (7% reduction)
Modified LPA with Two Auxiliary Lanes	50 (14% reduction)

Source: IBR Analysis.

Table 3.1-14. 2045 Forecast I-5 Weekday Southbound PM Peak Period Average Travel Times

Alternative/Design Option	Peak 2-hour Average Travel Time (mins)
No-Build Alternative	29
Modified LPA Base Scenario	14 (52% reduction)
Modified LPA without C Street Ramps	14 (52% reduction)
Modified LPA with Two Auxiliary Lanes	14 (52% reduction)

Source: IBR Analysis.

Table 3.1-15. 2045 Forecast I-5 Weekday Northbound AM Peak Period Average Travel Times

Alternative/Design Option	Peak 2-hour Average Travel Time (mins)
No-Build Alternative	18
Modified LPA Base Scenario	13 (28% reduction)
Modified LPA without C Street Ramps	13 (28% reduction)
Modified LPA with Two Auxiliary Lanes	13 (28% reduction)

Source: IBR Analysis.

Table 3.1-16. 2045 Forecast I-5 Weekday Northbound PM Peak Period Average Travel Times

Alternative/Design Option	Peak 2-hour Average Travel Time
No-Build Alternative	42
Modified LPA Base Scenario	26 (38% reduction)
Modified LPA without C Street Ramps	25 (40% reduction)
Modified LPA with Two Auxiliary Lanes	14 (67% reduction)

Source: IBR Analysis.

Level of Service and Volume-to-Capacity Ratios

As described previously, WSDOT uses LOS for its highway performance standard, and ODOT uses V/C ratios for mobility standards and performance targets. The ODOT performance standard depends on the implementation of project improvements. Segments of I-5 in Oregon that are reconstructed as part of an infrastructure improvement project have a V/C standard of 0.75. This means that in the study area, the V/C standard for the No-Build Alternative is 1.1 for the peak hour and 0.99 for all other hours, and the V/C standard for the Modified LPA is 0.75. At the Interstate Bridge freeway segment, both LOS and V/C ratios are reported.

In general, the LOS and V/C ratios show results similar to other measures (see the previous sections Bottlenecks and Speeds, Congestion Index, and Peak-Period Travel Times). Where bottlenecks are predicted and speeds and travel times are slow, the LOS and V/C ratios would be below standards. More detail on measures and locations is available in the Transportation Technical Report.

- During the AM peak period, I-5 southbound approaching the Interstate Bridge would not meet WSDOT's mobility standard under the No-Build Alternative due to over-capacity conditions at the bridge, and the Modified LPA (including all design options) would not meet the ODOT standards due to congestion spilling back from the downstream bottleneck at the I-5/I-405 split in North Portland. During the PM peak period, the No-Build Alternative would not meet WSDOT's mobility standard, but the Modified LPA and the design options would improve conditions to meet the standard.
- During the AM peak period, I-5 northbound approaching the Interstate Bridge would not meet ODOT's mobility standard under the No-Build Alternative due to over-capacity conditions at the Interstate Bridge; the Modified LPA and the design options would improve conditions to meet the standard. During the PM peak period, the No-Build Alternative, the Modified LPA base scenario, and the Modified LPA without C Street ramps would not meet ODOT's mobility standard. The Modified LPA with two auxiliary lanes would improve most segments of I-5 to meet ODOT's mobility standard, but some segments near the Columbia River bridges would continue to not meet standards.
- With all design options of the Modified LPA, the C-D system between Mill Plain Boulevard and SR 14 in Vancouver would not meet performance standards in the southbound direction during both the AM and PM peak periods, but the C-D between SR 14 and Mill Plain Boulevard in the northbound direction would meet performance standards.

Freight Mobility and Access

Freight transportation in the Portland-Vancouver metropolitan region is estimated to increase by 45% to 65% in the next 25 to 30 years, based on forecasts by Washington and Oregon. Increasing truck volumes are expected to exacerbate many challenges the state freight system currently faces, including those associated with traffic congestion and safety. Data from the Metro/RTC regional travel demand model forecasts that by 2045, trucks will comprise almost 15% of total trips across the new Columbia River bridges, which is an increase of 50% in truck traffic compared to 2019. This means that freight truck traffic would grow more quickly than general traffic under all alternatives and design options.

With the No-Build Alternative, trucks would be subject to the same delays as general-purpose traffic on I-5, as described above under I-5 Operations Overview, as well as in the following discussion of Arterials and Local Streets.

Under the Modified LPA and the design options, I-5 in the study area would be improved to meet current design standards. While the elevation of the freeway lanes above the river would be higher than on the existing Interstate Bridge, the grades would still meet design standards for freight vehicles. Lane and shoulder widths would be increased, and highway ramps and interchanges would be rebuilt to meet current design standards. The one to two added auxiliary lanes would also better accommodate freight movements to and from the mainline lanes, especially at the interchanges serving the ports and industrial areas near the bridge. All of these factors were accounted for in the traffic operations models, which assumed a mix of freight and other vehicles. Overall, the Modified LPA would improve access, mobility, and safety for freight.

Bridge Lifts

No-Build Alternative

Under the No-Build Alternative, bridge lifts and gate closures would occur at a frequency and for durations similar to existing conditions, assuming no major changes to the U.S. Coast Guard bridge permit. Bridge lifts would avoid high traffic volume periods, and training and bridge maintenance activities would occur predominantly during the overnight period. However, as the durations of future congestion events increase compared to existing conditions, the recovery periods associated with gate closures would be similarly extended, exacerbating overall congestion within the study area.

Modified LPA

The Modified LPA and all design options, except the single-level movable-span configuration, would eliminate the lift spans on the Columbia River bridges. Gate closures required for bridge lifts and traffic stoppage events would no longer occur. Recovery times associated with bridge lifts and gate closures would no longer contribute to the number and duration of congestion events.

The single-level movable-span configuration would require periodic bridge lifts and gate closures that would interrupt traffic operations. The lifts would be up to 50% less frequent than under the No-Build Alternative because the vertical clearance for the alternative barge channel would be higher under this option than under the No-Build, allowing more vessels to pass without a bridge lift. There would also be additional timing restrictions on when the bridge would be lifted. The analysis assumes the number of lifts would be reduced to approximately 60 per year for marine vessels, 12 per year for maintenance, and some number of lifts per year for training purposes. The total number of resulting lifts would be less than with the No-Build Alternative, assuming that the U.S. Coast Guard would approve further restrictions on when bridge lifts would be allowed.

Similar to the No-Build Alternative, daytime bridge lifts under the Modified LPA with a movable span could impact traffic congestion for an hour or more; nighttime bridge lifts would have less impact to traffic congestion. Transit and active transportation trips would also be affected. For transit, the lifts would cause a system-level disruption in service, affecting operations for the Yellow Line to downtown and the interconnected Orange Line service, as well as other lines that converge at the Rose Quarter and through downtown Portland. Bus and rail connections would also be disrupted, increasing overall travel times for riders. Depending on when the disruptions occur, it could take hours for the system to recover.

Arterials and Local Streets

This section covers impacts to roadway network traffic patterns, study intersections, peak-hour volumes, and intersection operations under all alternatives and design options. The Transportation Technical Report provides more detail on the analysis, while this section focuses on areas where impacts or benefits differ between the Modified LPA and the No-Build Alternative.

Changes to Local Traffic Patterns

No-Build Alternative

Under the No-Build Alternative, other projects would be implemented that would modify interchange and arterial geometries in the study area, but no major changes affecting traffic patterns and circulation would occur. The No-Build Alternative would continue to require all Hayden Island traffic to access I-5, because no other local access route would be available.

Modified LPA

Within Oregon, all design options of the Modified LPA would affect local traffic patterns within the Hayden Island, Bridgeton, and north and northeast Portland neighborhoods in the study area. The changes to local traffic patterns would primarily result from the revised Hayden Island and Marine Drive interchanges and the proposed arterial bridge over North Portland Harbor. These improvements would alter access and circulation routes and patterns for the Hayden Island and Bridgeton neighborhoods but would also allow local access to be accommodated without requiring trips on I-5.

Within Washington, the Modified LPA would change local traffic patterns compared to the No-Build Alternative, primarily in the Esther Short and Arnada neighborhoods in downtown Vancouver. These changes would be the result of modifications to the interchanges in this area. Effects would be similar across design options except for the option without the C Street ramps, which would cause additional changes to traffic patterns by eliminating an access point to the downtown area.

Intersection Impacts

The local traffic analysis evaluated 73 intersections for the No-Build Alternative and 79 intersections for the Modified LPA. Due to interchange and access changes under the Modified LPA, some of the No-Build intersections would no longer exist, and other intersections would be added. The Transportation Technical Report provides details on these intersections, including the changes to traffic volumes, while discussion in this section focuses on locations where intersections would not meet agency standards in 2045.

No-Build Alternative

All study intersections would operate at or better than the intersection performance standards except for the following six intersections:

1. Intersection #3 – 39th Street and Main Street (PM)
2. Intersection #4 – 39th Street and I-5 southbound on-/off-ramps (AM and PM)
3. Intersection #10 – Fourth Plain Boulevard and Main Street (AM)
4. Intersection #54 – Columbia Shores Boulevard and SR 14 eastbound off-ramp (AM and PM)
5. Intersection #55 – Columbia Shores Boulevard and Columbia Way (PM)
6. Intersection #63 – Marine Drive/Martin Luther King Jr. Boulevard and I-5 northbound/southbound on-/off-ramps (AM and PM)

Modified LPA Base Scenario and Modified LPA with Two Auxiliary Lanes

Under the Modified LPA with either one or two auxiliary lanes, 10 intersections would operate below agency standards:

1. Intersection #3 – 39th Street and Main Street (PM)
2. Intersection #4 – 39th Street and I-5 southbound on-/off-ramps (AM and PM)
3. Intersection #10 – Fourth Plain Boulevard and Main Street (AM)
4. Intersection #25 – 15th Street and C Street (PM)
5. Intersection #31 – Mill Plain Boulevard and I-5 southbound on-/off-ramps (PM)
6. Intersection #32 – Mill Plain Boulevard and I-5 northbound on-/off-ramps (PM)
7. Intersection #54 – Columbia Shores Boulevard and SR 14 eastbound off-ramp (AM and PM)
8. Intersection #55 – Columbia Shores Boulevard and Columbia Way (PM)
9. Intersection #63 – Marine Drive/ Martin Luther King Jr. Boulevard and I-5 northbound/southbound on-/off-ramps (AM and PM)
10. Intersection #64 – Marine Drive and Vancouver Way (PM)

The park-and-ride options in downtown Vancouver would not notably alter the operating conditions for the Modified LPA under any of the design options.

Modified LPA Without C Street Ramps

An additional nine study area intersections would operate below agency standards during the AM and/or PM peak hours under the Modified LPA without the C Street ramps. The removal of the ramps would redirect all trips between downtown Vancouver and I-5 to the Mill Plain Boulevard interchange. All of these intersections would operate acceptably under the No-Build Alternative, and eight of the nine would operate acceptably with the Modified LPA baseline scenario. The additional affected intersections would be:

1. Intersection #20 – Mill Plain Boulevard and Franklin Street (AM and PM)
2. Intersection #22 – 15th Street and Washington Street (PM)
3. Intersection #23 – 15th Street and Main Street (AM and PM)
4. Intersection #24 – 15th Street and Broadway Street (PM)
5. Intersection #26 – Mill Plain Boulevard and Columbia Street (AM and PM)
6. Intersection #27 – Mill Plain Boulevard and Washington Street (AM and PM)
7. Intersection #28 – Mill Plain Boulevard and Main Street (PM only)
8. Intersection #29 – Mill Plain Boulevard and Broadway Street (AM and PM)
9. Intersection #30 – Mill Plain Boulevard and C Street (PM)

Transit

The following section summarizes transit service effects in 2045 for the No-Build Alternative and the Modified LPA, describing transit routing, ridership, station area mode of access, and transit transfer rates. Details on the transit networks, service and routing changes and facilities are in the

Transportation Technical Report. The report also has information on maintenance facilities, annual operating costs, and related factors.

The No-Build Alternative assumes C-TRAN's and TriMet's anticipated regional transit networks for 2045, as informed by the Regional Transportation Plans for both Metro (Metro 2018) and RTC (RTC 2019). This includes several BRT lines that would be developed even if the Modified LPA was not advanced, as well as other facility and service adjustments.

Regionally, the Modified LPA would have much the same future network as the No-Build Alternative, but with other service modifications and improvements in the study area to match the new light-rail and express bus service and facilities. A detailed description of the Modified LPA transit elements is in Chapter 2 of this Draft SEIS. Both C-TRAN and TriMet have identified conceptual transit bus service plans that could be integrated in the Modified LPA.

The effects of the Modified LPA on transit service would not differ substantially between design options, with two exceptions. The design option without C Street ramps would result in small transit routing changes to access downtown Vancouver, and the two auxiliary lane design option would result in transit travel time improvements. The other design options are not discussed in this subsection because they would not affect transit service differently than the Modified LPA base scenario.

Amount of Service

The amount of service provided in the transit system can be measured by VHT in revenue service, daily VMT in revenue service, and daily place-miles of service. Table 3.1-17 shows average weekday totals for all three of these measures for the model base year (2015) as well as for the 2045 No-Build Alternative and Modified LPA. The service provided under the Modified LPA would not vary by design option. The base year is included to provide information on system growth, which reflects background transit changes that are part of the Regional Transportation Plan. Daily VHT and VMT are measured as time and distance, respectively, for transit vehicles in service on an average weekday. VMT would increase in 2045 with the Modified LPA, primarily due to the extension of LRT and to more frequent express buses operating in bus-on-shoulder mode in the study area. VHT would decrease on local bus and increase on LRT and express bus by a similar number of hours, resulting in approximately the same total VHT compared to the No-Build Alternative.

Place-miles reflect the carrying capacity of the vehicles in service (seated and standing) for each bus or train and are calculated by multiplying the vehicle capacity by the VMT. Place-miles can highlight differences in total available capacity between alternatives as shown in Table 3.1-17 below. The Modified LPA would have more place-miles than the No-Build Alternative, in part because of the extension of LRT across the Columbia River and in part because additional express bus service between Vancouver and Portland would be provided under the Modified LPA.

Table 3.1-17. 2045 Average Weekday Corridor [a] Transit Service Characteristics

Measure	Mode	Existing (2015)	2045 No-Build Alternative	2045 Modified LPA
Transit VMT (miles)	Local Bus	9,250	13,500	11,900
	Express Bus	5,450	3,900	7,650
	LRT [b]	800	850	1,300
	BRT	0	5,300	5,250
	Total	**15,500**	**23,550**	**26,050**
	% Change [c]	**N/A**	**51.0%**	**9.5%**
Transit VHT (hours)	Local Bus	650	850	750
	Express Bus	200	150	250
	LRT	50	50	75
	BRT	0	300	300
	Total	**850**	**1,400**	**1,400**
	% Change [c]	**N/A**	**58.8%**	**0%**
Place-miles [d] (miles)	Local Bus	602,100	879,100	773,200
	Express Bus	545,300	388,900	763,300
	LRT[2]	208,200	228,400	351,300
	BRT	0	530,200	524,500
	Total	**1,355,500**	**2,026,600**	**2,408,700**
	% Change [c]	**N/A**	**48.7%**	**19.7%**

Source: Metro/RTC Regional Travel Demand Model, IBR Analysis 2022.

a Excludes Portland central business district.

b For LRT, transit VMT is measured in train miles rather than in car miles.

c For the No-Build Alternative, the percentage change is the change compared to existing conditions; for the Modified LPA the percentage change is compared to the No-Build Alternative.

d Place-miles = transit vehicle capacity (seated and standing) multiplied by VMT. Bus capacity = 55, BRT and express bus capacity = 100, LRT capacity = 266 (LRT consists of two-car trains; each car can carry 133 people).

VMT = vehicle miles traveled; VHT = vehicle hours traveled; BRT = bus rapid transit; LRT = light-rail transit; N/A = not applicable.

Regional Transit Ridership

The Metro/RTC regional travel demand model was used to produce estimates of ridership for both the No-Build Alternative and the Modified LPA. The Transportation Technical Report has more details on a variety of ridership performance measures, including station boardings; the comparison here in the SEIS focuses on the primary differences between the alternatives.

Travel Demand and Mode Choice

Table 3.1-18 shows the 2045 daily person trips and transit trips for the No-Build Alternative and the Modified LPA, including project, corridor and systemwide totals. The daily systemwide and corridor transit trips would be the same for all the design options. The Transportation Technical Report has further details on ridership levels and the service used, including total trips across the river on both I-5 and I-205.

Table 3.1-18. 2045 Weekday Daily Systemwide and Corridor Transit Trips

Measure	No-Build Alternative	Modified LPA
Total Regional Transit Trips [a]	684,850	696,900
Regional Transit Mode Share	5.75%	5.85%
Total Regional Daily Transit Boardings [b]	1,106,400	1,136,200
Percentage Change from No-Build	N/A	2.7%
Total Daily Regional Light-Rail Boardings [b]	391,300	417,500
Percentage Change from No-Build	N/A	6.7%
Total Corridor Person Trips (all modes)	2,522,000	2,521,100
Total corridor transit trips [a]	447,850	459,400
Percentage Change from No-Build	N/A	2.6%
Total Modified LPA Project Riders [c]	**N/A**	**32,950**
LRT Extension Project Riders	**N/A**	**21,000**
North Portland LRT Project Riders	**N/A**	**1,600**
Express Bus Project Riders	**N/A**	**10,550**

Source: Metro/RTC Regional Travel Demand Model, IBR Analysis 2022.

a Transit trips count each passenger only once between the origin and destination of their trip. Transit trips include all trips on any transit mode.

b Boardings count each time a passenger boards a transit vehicle; passengers who transfer between transit lines in a single trip count as multiple transit boardings.

c "Project riders" is a term FTA uses to indicate transit ridership that accounts for daily linked trips using any part of the proposed capital investment.

LRT Station Use Levels and Mode of Access/Egress

Light-rail stations are accessed by transit (local, regional, and express bus, BRT, LRT) and by active transportation modes including walking, biking, and rolling. Trips by automobile are also reflected, primarily based on park-and-ride trips, but can also include drop-off or pick-up activities. The primary mode of access by station reflects key differences in the location of the station and the surrounding land uses served. Table 3.1-19 summarizes the predicted station use and mode of access and egress to the new LRT stations with the Modified LPA. The LRT station usage by mode of access for the design options would be the same for all Modified LPA design options. The Evergreen Station is expected to be the most-used station and the one with the highest level of access by transit. This reflects the station's connections to the C-TRAN system serving downtown, including BRT lines.

Table 3.1-19. 2045 Modified LPA LRT Station Usage (Boardings and Alightings) by Mode of Access and Egress, Year 2045

Station Location	Station Boardings/Alightings	Percentage of Total Boardings/Alightings	% Walking [a]	% Transfer	Percentage Park and Ride [b]
Hayden Island	3,500	16%	100%	N/A	N/A
Waterfront	5,000	23%	26%	61%	13%
Evergreen/I-5	12,850	60%	16%	76%	9%

Source: Metro/RTC Regional Travel Demand Model, IBR Analysis 2022 a Bike access is assumed to be approximately 3% of walk access trips based on TriMet 2018 On-Board Survey data.

b Park-and-ride numbers do not explicitly assume numbers for drop-off (private vehicle, taxi, rideshare) and are not included in this number. Drop-off is estimated to be approximately 22% of total drive access trips to MAX stations based on TriMet 2018 On-Board Survey data.

Transit Travel Time

Transit travel times for both the AM and PM peak periods were calculated for the No-Build Alternative, the Modified LPA base scenario, and the Modified LPA with two auxiliary lanes. The other design options would have similar travel times to the Modified LPA base scenario.

The travel time summary in Table 3.1-20 shows the total transit travel time (including in-vehicle, walking, waiting, and transfer time) for trips between downtown Vancouver and four locations in Portland, including Hayden Island, Lombard Transit Center, Rose Quarter, and downtown Portland. The latter three locations in Portland provide access to connections for travel to other regional locations via transfer to and from the TriMet system. The Modified LPA base scenario and Modified LPA with two auxiliary lanes travel times are provided for both express bus and LRT where they both would provide service.

Express bus travel times include delays identified through the I-5 operational analysis. This is especially notable for southbound trips in the AM peak hour through the area approaching the I-5/I-405 split in North Portland. Improved traffic flow under both the Modified LPA base scenario and the two auxiliary lane design option would allow more southbound vehicles to cross the new Columbia River bridges. This would result in more vehicles reaching the bottleneck at the I-5/I-405 interchange during the peak period, meaning that southbound buses running in traffic would experience higher levels of congestion approaching the bottleneck. This congestion would lengthen southbound express bus travel times compared to the No-Build Alternative, which would continue to constrain vehicle trips at the Interstate Bridge. Differences in travel time between the Modified LPA base scenario and the two auxiliary lane design option would be primarily in the PM peak period in the northbound direction, where the Modified LPA with two auxiliary lanes would result in faster travel times (12 minutes) than the base scenario. LRT travel times would be similar for all Modified LPA design options.

Table 3.1-20. 2045 Average Weekday AM and PM Peak Total Transit Travel Time for Selected Corridor Locations (minutes)

Origin/Destination	2045 No-Build Alternative		Modified LPA Base Scenario [a]		Modified LPA With Two Auxiliary Lanes	
	AM Peak SB	PM Peak NB	AM Peak SB	PM Peak NB	AM Peak SB	PM Peak NB
Between downtown Vancouver and Hayden Island	36[b]	21	17[c]	17[c]	17[c]	17[c]
Between downtown Vancouver and Lombard Transit Center	43[d]	41[d]	25[c]	25[c]	25[c]	25[c]
Between downtown Vancouver and Rose Quarter: • Express Bus[e] (no stops between downtown Vancouver and Rose Quarter)	43	62	52	38	52	26
Between downtown Vancouver and Rose Quarter: • LRT (includes 13 stations between downtown Vancouver and Rose Quarter)	N/A	N/A	37	37	37	37
Between downtown Vancouver and Pioneer Square (Portland central business district): • Express Bus[e] (includes two stops between downtown Vancouver and Pioneer Square)	48	67	59	45	59	33
Between downtown Vancouver and Pioneer Square (Portland central business district): • LRT (includes 16 stops between downtown Vancouver and Pioneer Square)	N/A	N/A	47	47	47	47

Sources: Metro/RTC Regional Travel Demand Model, IBR VISSIM Microsimulation.

Note: Total transit travel times include 10 minutes of walk access (1/4 mile walk on either end of the trip at 3 mph average walk speed) in addition to initial and transfer (if applicable) wait time. Wait times are based on half the headway.

a Removal of the C Street ramps would require express bus transit to be rerouted to access downtown Vancouver via Mill Plain Boulevard. This would add more travel time for express bus transit trips in and out of downtown Vancouver on express bus because of added distance and congestion on the mainline.

b Route 60 does not stop at Hayden Island southbound, so a trip from Vancouver to Hayden Island travels south to Delta Park and then back north to stop on Hayden Island.

c Travel time is on Yellow Line LRT.

d Route includes 60 Vancouver – Delta Park with transfer to Yellow Line LRT.

e Route includes Route 101 from downtown Vancouver – Rose Quarter or Pioneer Square.

LRT = light-rail transit; N/A = not applicable; NB = northbound; SB = southbound

Transit Reliability

Table 3.1-21 summarizes three measures of transit reliability in the corridor: miles of exclusive or reserved right of way, the number of passenger miles that would occur in the right of way, and the percentage of passenger miles that would occur in the right of way. Under the Modified LPA, the extension of the Yellow Line from the Expo Center north to the new terminus at the Evergreen/I-5 station would be completely in its own guideway, and new shoulders proposed as part of the Modified LPA would provide bus-on-shoulder operations that are reserved for express buses.

Table 3.1-21. 2045 Measures of Transit Reliability in the I-5 Corridor

Right-of-Way Measure	2045 No-Build Alternative	2045 Modified LPA
Miles of Exclusive/Reserved ROW	10.07	26.88
Average Weekday Passenger Miles	69,200	213,400
Percentage of Total Corridor Passenger Miles	11%	28%

Active Transportation

No-Build Alternative

Conditions for active transportation on the Interstate Bridge and in the connecting areas would continue to worsen under the No-Build Alternative. As the region experiences increased population growth and development intensifies, more pressure would be placed on deficient existing active transportation facilities, including the shared-use path for walking, rolling, and riding between the two cities. For the bridge crossing itself, an increase in the volume of people traveling on the narrow and constrained paths would result in increased conflict between users sharing space along the paths, which are not wide enough for two-way travel or for people to pass each other. This deterioration in user experience would limit the potential for active transportation trips over the bridge and further reinforce the bridge as a barrier to active travel. Therefore, to be conservative, the No-Build evaluation assumes average daily bridge trips would be the same as the existing 2019 conditions (410 daily trips).

Modified LPA

With the Modified LPA, future active transportation trips across the new Columbia River bridges are estimated to range between 740 and 1,600 trips per day. The Modified LPA would offer improved conditions for active transportation, improving capacity, access, safety, and user experience for trips across the bridge . These improvements would combine with the transit improvements offered by the Modified LPA to further improve mobility. Trains and buses would accommodate bicycle trips and allow active transportation travelers to use the new stations to reach a wider array of destinations on both sides of the river, compared to the No-Build Alternative. Measures for evaluating the perceived stress active transportation travelers experience would also improve.

The Modified LPA would include bicycle and pedestrian improvements for all ages and abilities on the new Columbia River bridges, as well as facilities to access these bridge connections. All Modified LPA design options would include a two-way shared-use path, approximately 25 feet wide in total, which would be designed to meet Americans with Disabilities Act (ADA) standards and would include other features to optimize user experience, safety, comfort, and directness. To prevent conflicts between path users traveling at varying speeds, the shared-use path would provide separate spaces for people walking and biking. The design elements of the path would buffer it from vehicle traffic, noise, and exposure to street debris and stormwater to provide a well-lit, attractive, and comfortable environment for all users. On each end of the bridge, the shared-use path would include improvements to existing and proposed network facilities and would also provide new connections that do not exist today.

In the Modified LPA base scenario, the shared-use path would be on the lower deck of the I-5 northbound bridge. The path would be at an elevation of 163 feet above the Columbia River due to waterway clearance requirements, compared to 90 feet for the existing Interstate Bridge. The path transition from the I-5 northbound bridge down to Columbia Way in Vancouver would require extensive ramp lengths to span the vertical distance at a grade that meets or exceeds ADA requirements. The design incorporates a helix ramp to make this transition, but this introduces considerable additional path length. Co-locating the shared-use path with the proposed Waterfront Station to provide additional elevator access down to Columbia Street/Columbia Way is a potential design solution that is being considered.

With single-level fixed-span bridges, the shared-use path would be at an elevation of 135 feet above the river, while with single-level movable-span bridges it would be 120 feet above the river. While lower than the Modified LPA with the double-deck bridge, the paths in these options would still be higher than under the No-Build Alternative; thus, all users must climb over a longer distance to get over the peak. The maximum grade for the fixed-span bridges would be 1.5% on the Washington side and 3% on the Oregon side; for movable-span bridges, these grades would be 4% and 1%, respectively. In both options, users would experience a similar level of security as with the No-Build Alternative and would continue to be exposed to the elements.

All Modified LPA design options would include substantial bicycle and pedestrian improvements at reconstructed I-5 interchanges and crossings throughout the study area, as well as in areas around new transit stations. Where roadways are replaced or modified or where new roadways are developed (such as the new arterial bridge proposed over North Portland Harbor), active transportation facilities including sidewalks and bike facilities would meet applicable standards, at a minimum. These changes would reduce many of the perceived barriers to bicycle and pedestrian travel and would improve the connectivity of the active transportation network in North Portland and Vancouver within the study area.

The Transportation Technical Report has detailed listings and maps of the individual locations and facilities that would improve active transportation conditions with the Modified LPA.

Safety

Note: This section will be updated to respond to multiple comments for additional safety analysis and details. The findings will be developed and reviewed in coordination with ODOT, WSDOT, FTA and FHWA and incorporated into the Draft SEIS prior to publication.

Transportation Demand Management and Transportation System Management

TDM and TSM systems would continue to be available to reduce travel demand and maximize system efficiency, and are generally already incorporated in the analysis of impacts and performance for all alternatives and design options discussed in the preceding section.

Under the No-Build Alternative, existing TDM and TSM programs would continue to support trip reduction and shifts from single-occupancy vehicle use. Existing established TSM programs including system monitoring and traveler information systems, facility management systems, and incident management systems would be maintained and updated using advancing technologies and infrastructure as implemented by 2045.

The Modified LPA, under all design options, would develop physical infrastructure and provide operations that support non-single-occupancy vehicle modes for travel needs in the study area. These would include:

- Expanded and improved transit service via the extension of the MAX Yellow Line with three new stations in the study area, park-and-ride facilities at two of the new light-rail stations, express bus and feeder routes, and I-5 median shoulders that accommodate bus-on-shoulder operations.
- New and improved bicycle and pedestrian facilities that accommodate more bicyclists and pedestrians and improve connectivity, safety, and travel time.
- Variable-rate tolling on the Columbia River bridges.

The Modified LPA would also include facilities and equipment that could support or expand TSM programs, including:

- Replacement or expansion of traveler information systems.
- Active traffic management system expansion.
- Expanded use of ramp meters.
- Queue jumps or bypass lanes for transit vehicles at freeway ramp meters or bus-on-shoulder operations.
- Preferential traffic signal priority.
- Incident management.

3.1.4 Temporary Effects

This section summarizes potential construction impacts for transportation modes and facilities affected by the construction of the Modified LPA. Impacts would be similar across all Modified LPA design options.

Regional Travel

Construction of the Modified LPA is anticipated to last 9 to 15 years, impacting all modes of transportation within the study area as well as adjacent corridors. In addition to I-5, several regional roadway facilities including I-205, SR 500, SR 14, I-405, and I-84 would be affected by construction as drivers may temporarily reroute I-5 trips to these other highways. The Modified LPA could require nighttime closure of regional roadways, interchanges, and local roads during construction. Construction-related truck traffic for delivery of materials, equipment and for removal of materials/debris from demolition could also increase congestion and delays, particularly during periods of major construction. Table 2-3 in Chapter 2 lists the expected durations of Modified LPA construction components.

All modes of travel on the I-5 mainline and interchanges within the study area would be affected by changes associated with construction (e.g., temporary detours, lane closures, reduced shoulder and lane widths, reduced speeds).

Freight Mobility and Access

Impacts of the Modified LPA to freight truck movements on mainline I-5 would be similar to impacts to general traffic. Temporary closures, detours, or restrictions on primary truck traffic access corridors between I-5 and the Ports of Portland and Vancouver container terminals and to other industrial/commercial locations could result in delays to freight traffic. Affected designated freight corridors include Marine Drive, Mill Plain Boulevard and Fourth Plain Boulevard.

Temporary access closures or access modifications for businesses could also occur, affecting freight (such as deliveries). If driveway closures are required, access to these properties would be maintained to the extent possible. With driveway closures, detours for freight would cause similar impacts compared to what is described for general-purpose traffic impacts.

During construction across active rail lines, there could be temporary closures that result in delays to freight train traffic. Coordination plans with the rail operators would be required.

Bridge Lifts

All highway and active transportation users would be affected during construction by ongoing bridge lifts and gate closures of the existing Interstate Bridge, similar to existing conditions. This would include bridge lifts for maintenance activities until traffic is shifted onto the new Columbia River bridges, but it could also include additional lifts to accommodate construction equipment.

Arterials and Local Streets

Construction of the Modified LPA would require local road closures, lane closures, traffic detours, and property access modifications and closures. Construction staging plans would include coordination with local jurisdictions to minimize the effect of closures, including detour routes. If driveway closures are required, access to these properties would be maintained to the extent practical. If access to a business could not be maintained during construction, the specific construction activity would be conducted during non-business hours where feasible.

Construction truck traffic would use approved truck routes, and where necessary, local roadways to access the construction areas. This could result in increased congestion, queues, and delays for local traffic and access. Delivery of large items would occur via truck routes. There would be limited direct access via the I-5 mainline, although trucks may use I-5 to access construction areas. During construction there may be some short-term closures (night/weekend) to on- and off-ramps to accommodate construction activities. As the design and construction plans are advanced, there could be a need for direct access between I-5 and construction areas. If direct access is required, the IBR Program would coordinate with WSDOT, ODOT, and FHWA.

Transit Operations

Construction of the Modified LPA could involve lane closures, bus stop relocations, light-rail station closures, partial or full temporary closures of park-and-ride facilities, and sidewalk and bicycle lane impacts that could affect transit operations and/or access to transit within the study area.

Buses on existing routes could experience delays from increased congestion due to potential roadway or interchange closures. Buses that travel through downtown Vancouver may encounter temporary closures and reroutes as LRT guideway is installed and I-5 is reconstructed.

The existing TriMet MAX Yellow Line could be adversely affected during construction. The current Yellow Line travels along Denver/Expo Road and has two stations in the south end of the IBR study area. Construction along Expo Road and as part of the Marine Drive interchange may require temporary relocation or closure of the Yellow Line's station near Delta Park and its terminus station near the Expo Center. These temporary relocations, closures, or schedule adjustments could take place intermittently for up to 4 years.

Active Transportation

Construction of the Modified LPA could temporarily close sidewalks, bicycle facilities, and/or shared-use paths or reduce facility widths within construction areas. Active transportation travel could be affected within the study area, including in the Expo Center and Delta Park light-rail station area, during station and guideway construction. Limited opportunities are available for active transportation crossings of I-5, but existing crossings would be maintained to the extent practical. Active transportation facilities would be temporarily rerouted during intermittent and temporary closures.

Safety

Many of the construction modifications to facilities, routes and services would involve temporary conditions where safety would be an increased concern. Maintaining safety for travelers as well as construction workers is one of the primary elements of construction plans, including for traffic control. Traffic diversion caused by construction would lead to higher traffic volumes on detour streets. The higher traffic volumes could lead to a potential increase in collision frequency. In locations where there is no physical change to the roadway, the types of crashes would remain similar to existing conditions.

Transportation Demand Management and Transportation System Management

During construction of the Modified LPA, the impacts to facilities, traffic, transit and other modes would affect TDM and TSM programs and operations, and modifications would be needed.

3.1.5 Indirect Impacts

The completion of the Modified LPA, including improved highway facilities and safety on I-5, enhanced transit solutions (light-rail service and increase express bus service), and improved active transportation facilities, would improve regional transportation between Vancouver and Portland. Because adopted regional and local planning efforts and documents anticipate implementation of the Modified LPA, indirect effects would be limited and are expected to be consistent with adopted plans and policies.

Predicted improvements in congestion and travel times under the Modified LPA would help to reduce current impediments to freight mobility and provide greater travel time reliability for trucks crossing the bridge. Because of the importance of I-5 in West Coast freight transport, improved freight mobility across the Columbia River bridges could contribute to more efficient, reliable, and predictable operations at local, regional, and national ports as well as more reliable freight deliveries to local businesses and residences. These operational improvements could result in positive economic effects such as increased employment and tax revenues within the Portland-Vancouver metropolitan area.

Areas in proximity to new LRT stations could experience increased development densities, especially if plans are in place that support redevelopment in station areas, as is the case on Hayden Island and in downtown Vancouver. These higher densities could increase automobile and bus transit trips to and from the station areas. This increase in traffic could cause increased congestion on arterials and increased delays in local street operations, including streets near transit stations. Increases in traffic and congestion could also affect freight mobility and access on local roadways. However, increased densities in areas surrounding the proposed stations are already incorporated in local planning assumptions regarding urban growth and the growth of travel demand.

Over time, C-TRAN and TriMet could redeploy or reinvest in bus service that would be replaced by the extension of Yellow Line light-rail service into the IBR study area. Increased development in areas near the IBR Program stations are anticipated in the regional travel demand model, which includes changes to overall transit ridership beyond the study area. However, the mode of access to and from stations may shift to a greater percentage of active transportation or transit transfers and a lower percentage of automobile access as population and employment densities increase within station area walksheds and bikesheds. Increased active transportation trips to stations, particularly if higher-density residential and commercial development develops in surrounding areas, may involve need travel along streets that lack ADA accessibility or facilities to accommodate active transportation. However, increased development and transportation activity along these streets could encourage improvements by local jurisdictions.

Safety conditions and effects on TDM and TSM would be similar to those described under direct effects because they already incorporate projected urban growth and increased transportation activity as part of the analysis.

3.1.6 Potential Avoidance, Minimization, and Mitigation Measures

Long-Term Effects

Regulatory Mitigation

When traffic operations on new highway facilities and at local intersections do not meet the applicable agency standards, mitigation may be required. Mitigation measures are typically negotiated between the project sponsor (in this case, the IBR Program) and the transportation agencies with jurisdiction over the affected facilities. Because mitigation is developed on a project-specific level, potential mitigation for each category of transportation effects is discussed below.

Project-Specific Mitigation

I-5 Operations

Traffic impacts were determined for I-5 mainline and ramp segments in the freeway analysis area by comparing freeway and ramp operations for the No-Build Alternative and the Modified LPA against agency performance standards for the 2045 design year.

WSDOT maintains a performance standard of LOS D. Mitigation could be required for the study area freeway and ramp segments in Washington if (1) the Modified LPA caused I-5 operations to degrade below this standard, or (2) this standard was not met under the No-Build Alternative, but the Modified LPA caused I-5 operations to degrade by more than 10% compared to the No-Build Alternative.

ODOT's performance standard for new or rebuilt highway facilities is a 0.75 V/C ratio, compared to a 1.1 and 0.99 V/C ratio (highest hour and second highest hour respectively) for existing facilities. Therefore, freeway and ramp mitigation could be required if the Modified LPA did not meet ODOT's 0.75 V/C ratio performance standard in Oregon. Areas where I-5 operations would not meet ODOT's and/or WSDOT's standards include:

- With the Modified LPA base scenario and all design options except the two auxiliary lane design option, I-5 northbound approaching the Columbia River bridges would not meet ODOT's mobility standard during the PM peak period due to over-capacity conditions at the Columbia River bridges. Congestion from the bottleneck at the bridges would back up to the I-5/I-405 interchange and would last for approximately 9 hours.
- With the two auxiliary lane design option, I-5 northbound approaching the Columbia River bridges would improve compared to the other design options but would not meet ODOT's mobility standard during the PM peak period due to over-capacity conditions at the Columbia River bridges. Congestion from the bottleneck at the bridges would back up 0.75 mile and last for approximately 6 hours.
- With all Modified LPA design options, I-5 southbound through the study area would not meet WSDOT's or ODOT's mobility standards during the AM peak period due to congestion spilling back from the I-5/405 bottleneck in North Portland.
- With all Modified LPA design options, the southbound C-D roadway between the Mill Plain and SR 14 interchanges would not meet WSDOT's mobility standard during the AM or PM peak periods.

Potential mitigation measures for these impacts include:

- A potential solution to mitigate northbound I-5 congestion could be providing an additional auxiliary lane between the Hayden Island on-ramp and the SR 14 off-ramp. This would be a smaller addition than defined in the Modified LPA with two auxiliary lanes and would have similar or fewer environmental effects than that option.
- Another option for northbound congestion would be more intensive demand reduction strategies beyond what the IBR Program already includes (variable-rate tolling, improved transit and active transportation systems, and enhanced TDM and TSM systems).
- A potential solution to mitigate southbound I-5 congestion could be adding an auxiliary lane to provide additional capacity between Columbia Boulevard and Going Street to alleviate the bottleneck approaching the I-5/I-405 split in North Portland. ODOT will continue to analyze solutions and work with partners to study the bottleneck at the I-5/I-4054 split in North Portland to identify other potential mitigation measures in addition to the multimodal demand-management strategies included in the IBR Program. Even with the I-5/I.405 bottleneck in North Portland reduced or eliminated, I-5 through the study area may still potentially need mitigation to meet WSDOT's standards because the Columbia River bridges would continue to be a bottleneck, causing congestion on I-5 through Vancouver.
- The southbound C-D roadway would be impacted by congestion spilling back from I-5 during the AM peak period, but even during the PM peak period when no downstream congestion is present, the C-D roadway would not meet WSDOT's mobility standards. Potential mitigation measures

could include braiding the Mill Plain on-ramp and SR 14 off-ramp and possibly providing a slip lane to continue providing access for trips traveling from the Mill Plain interchange to SR 14.

Final mitigation measures would be determined and agreed upon with the appropriate agencies and partners as needed.

Arterials and Local Streets

Traffic impacts were determined for arterials and local streets by comparing the overall intersection operations (LOS or V/C ratios) for the No-Build Alternative and the Modified LPA against the agency operational standards. Mitigation could be required for study intersections that would meet agency performance standards under the No-Build Alternative but would operate below agency performance standards under the Modified LPA. Mitigation could also be required if intersection operations that did not meet agency standards under the No-Build Alternative were degraded by more than 10% under the Modified LPA. Any potential mitigation measures would be determined and agreed upon with the appropriate agency; ODOT and WSDOT could contribute a proportionate share toward identified mitigation to improve intersection performance as agreed to with the local jurisdiction.

Local traffic impacts and mitigation would be similar among the Modified LPA design options except for the Modified LPA design option without C Street ramps, as described below.

Modified LPA Base Scenario

Five intersections in the Modified LPA could require mitigation improvements, as summarized below. As part of final design, additional traffic analysis would be conducted to confirm the SEIS analysis and refine mitigation measures as needed. Final mitigation would be determined and agreed upon by the IBR Program and the affected agency.

- E 15th Street and C Street (Intersection #25). Forecast traffic operations at this intersection are constrained by high delays on the southbound, northbound, and westbound approaches. During the PM peak hour, queues would develop along southbound C Street approaching the nearby Mill Plain Boulevard and C Street intersection and would exceed the allotted storage space, thus blocking incoming traffic at this intersection. Potential mitigation could include optimizing signal phasing at both the E 15th Street and C Street intersection and the Mill Plain Boulevard and C Street intersections, as well as alleviating nearby interchange traffic through other mitigation.
- Mill Plain Boulevard and I-5 southbound on-/off-ramps (Intersection #31). Forecast traffic operations at this intersection are constrained by high delays from the southbound I-5 off-ramp and the eastbound approach. During the PM peak hour, westbound queues along 15th Street would spill back into the interchange, affecting southbound movements at this intersection. Potential mitigation could include an alternative interchange configuration, such as a diverging diamond interchange, to mitigate the larger-scale impacts.
- Mill Plain Boulevard and I-5 northbound on-/off-ramps (Intersection #32). Future traffic operations at this intersection are constrained by high delays along the northbound and eastbound approaches. During the PM peak hour, the eastbound left movement spills back along Mill Plain Boulevard, affecting the Mill Plain Boulevard and I-5 southbound on-/off-ramps and other downtown intersections. High delays along the northbound left-turn movement are also related to the downstream bottleneck at the E 15th Street and C Street intersection, as well as the intersection of Mill Plain Boulevard and the I-5 southbound on-/off-ramps. Potential mitigation could likely be similar to the Mill Plain Boulevard and I-5 southbound on-/off-ramps (Intersection

#31) and could include an alternative interchange configuration, such as a diverging diamond interchange.

- Marine Drive/Martin Luther King Jr. Boulevard and I-5 northbound/southbound on-/off-ramps (Intersection #63). Future traffic operations at this intersection are constrained by the eastbound left and southbound left movements through the interchange. During both the AM and PM peak hours, volumes at each movement would exceed the mobility standard for the intersection given the current lane configuration. Potential mitigation could include modifying interchange design such as adding turn lanes, modifying geometric elements to enhance capacity, or changing the interchange type.
- Marine Drive and Vancouver Way (Intersection #64). Future traffic operations at this intersection are constrained by the V/C ratios on the northbound left-turn lane. During the PM peak hour, the volume accessing the proposed lower roadways from N Union Court would cause the lane group to exceed the relevant mobility standards. Potential mitigation could include upgrading the intersection control type to a signal or roundabout.

Modified LPA Without C Street Ramps

Twelve intersections in the Modified LPA design option without C Street ramps could require mitigation improvements and are summarized below. As part of final design, additional traffic analysis would be conducted to confirm the SEIS analysis and refine mitigation measures, as needed. Final mitigation would be determined and agreed upon by the IBR Program and the affected agency.

1. Intersection #20 – Mill Plain Boulevard and Franklin Street (AM and PM peaks)
2. Intersection #22 – 15th Street and Washington Street (PM peak)
3. Intersection #23 – 15th Street and Main Street (AM and PM peaks)
4. Intersection #24 – 15th Street and Broadway Street (PM peak)
5. Intersection #25 – 15th Street and C Street (AM and PM peaks)
6. Intersection #26 – Mill Plain Boulevard and Columbia Street (AM and PM peaks)
7. Intersection #27 – Mill Plain Boulevard and Washington Street (AM and PM peaks)
8. Intersection #28 – Mill Plain Boulevard and Main Street (PM peak)
9. Intersection #29 – Mill Plain Boulevard and Broadway Street (AM and PM peaks)
10. Intersection #30 – Mill Plain Boulevard and C Street (PM peak)
11. Intersection #31 – Mill Plain Boulevard and I-5 southbound on-/off-ramps (AM and PM peaks)
12. Intersection #32 – Mill Plain Boulevard and I-5 northbound on-/off-ramps (AM and PM peaks)

The majority of the impacts would be caused by the additional traffic volumes accessing eastbound Mill Plain Boulevard due to the elimination of I-5 access via the C Street ramps. Mitigation of this congestion could include retaining the C Street ramps. Additional mitigation would be consistent with the mitigation proposed above for the Modified LPA base scenario.

Temporary Effects

Regulatory Mitigation

Construction activities would comply with ODOT and WSDOT requirements for maintenance of traffic. More specific measures related to maintenance of traffic are discussed in the Project-Specific mitigation section below. The Transportation Technical Report identifies additional potential mitigation measures and best practices such as for signage, traffic plans and control, access, communications, and safety.

Project-Specific Mitigation

Regional Travel

- Detailed construction plans and maintenance of traffic plans would be developed to address all affected facilities and their modes of transportation. Such plans would be prepared during subsequent design and construction phases for agency approvals. The plans would describe staging, access, facility, lane or shoulder closures and transitions, hauling, traffic management (including general-purpose traffic, transit, bicycle, and pedestrian traffic), detours, lane modifications, incident management, traffic control, closure details, and coordination and communications plans and would cover other construction zones or activities. Plans would be developed to meet applicable agency standards. The Program would coordinate with agencies with jurisdiction for review and applicable approvals.

Freight Mobility and Access

- Freight mobility and access would be an element of the Program construction plans identified above. To minimize potential freight impacts, the IBR Program would coordinate with all facility owners, including railroads, as well as freight operators and affected businesses, throughout the construction period to notify them of facility or access closures. Construction information would be provided to the Port of Vancouver, Port of Portland, and local jurisdictions. Similar information would be provided to WSDOT and ODOT for use in the states' freight notification systems. The IBR Program would provide information in formats required by WSDOT and ODOT.
- To minimize impacts to freight rail operations, the Program would coordinate with the railroad owners and rail operators and would obtain all applicable required permits. Critical work that would result in rail line shutdowns would be performed only at night and on weekends. Construction would be limited to the times approved and coordinated with freight rail operators.

Bridge Lifts

- During IBR construction, the IBR Program would work with WSDOT, ODOT, the U.S. Coast Guard, the ports, and other jurisdictions to minimize bridge lifts and gate closures to overnight periods to lessen the impact to all transportation modes. The construction plan would cover coordination and communication with agencies and the public for bridge lifts and gate closures.

Arterials and Local Streets

- All avoidance and minimization measures associated with constructing the Modified LPA would comply with local regulations governing construction traffic control and construction truck routing. The IBR Program would finalize detailed construction plans in close coordination with local jurisdictions, WSDOT, and ODOT during the final design and permitting phases of the Program.

Transit Operations

- Transit service and facility modifications would be coordinated with TriMet and C-TRAN to minimize temporary impacts and disruptions to bus and light-rail facilities and service during construction. Detailed construction plans and coordination/communication plans would be developed. This would include support for public information and communication throughout the construction period, including for periods where alternative routes, facilities or services would be needed to maintain service.

Active Transportation

- Construction plans would include specific mitigation for impacts to active transportation facilities and users, in coordination with local jurisdictions. The Transportation Technical Report has additional detail on potential measures including protected facilities through construction areas, signage, lighting, communications, safety and maintenance.

Safety

- In addition to the commitments to develop construction plans as identified above, the IBR Program would work with WSDOT and ODOT on implementing the latest safety technology during construction.

Transportation Demand Management and Transportation System Management

- The IBR Program would work with WSDOT and ODOT and partner agencies on adapting and implementing TDM and TSM treatments during construction. Potential strategies could include:
  - Expanded transit service.
  - Vanpool/carpool program.
  - Telecommuting options.
  - Compressed work week/flexible work schedules.
  - Active transportation improvements and enhancements.