For some impacts identified in this FEIS, there is no meaningful difference between the design options (LPA Option A and LPA Option B) or the construction phasing option. In these cases, the terms "LPA" or "the project" are used when impacts or mitigation would the same for any of the design options or the construction phasing option. When impacts differ among options, it has been noted.

Exhibit 2.2-1 illustrates which elements of the LPA are evaluated for potential phased construction. The phasing scenario evaluated in this FEIS is a reasonable expectation of what could be constructed in the first phase if full funding is not available. Reasonable phasing options are not likely to result in any new significant adverse impacts beyond those described in this FEIS. The primary result of construction phasing would be to delay some of the benefits that the full LPA would provide.

2.2.1 Multimodal River Crossing and Highway Improvements

River Crossing Structures

The LPA includes construction of new bridges across the main channel of the Columbia River and new structures across North Portland Harbor, along with improvements to the existing I-5 bridges across North Portland Harbor. These improvements are described in detail below.

COLUMBIA RIVER BRIDGES

The parallel bridges that form the existing I-5 crossing over the Columbia River would be replaced by two new parallel bridges. The eastern structure would accommodate northbound highway traffic on the bridge deck, with a bicycle and pedestrian path underneath; the western structure would carry southbound traffic on the bridge deck, with a two-way light rail guideway below. Whereas the existing bridges have only three lanes each, with virtually no shoulders, each of the new bridges would be wide enough to accommodate three through lanes and two add/drop lanes (Exhibit 2.2-2). Lanes and shoulders would be built to full Washington State Department of Transportation (WSDOT) and Oregon Department of Transportation (ODOT) design standards (i.e., no reduced width lanes or shoulders will be constructed). See the discussion of Highway and Interchange Improvements for additional description of the add/drop lanes.

TERMS & DEFINITIONS

Auxiliary (add/drop) lanes

Auxiliary (or add/drop) lanes connect two or more highway interchanges. These lanes improve safety and reduce congestion by providing space for cars and trucks entering the highway to speed up before merging into traffic and to slow down after diverging out of traffic. This is especially important at the river crossing, where three large interchanges (Marine Drive, Hayden Island, and SR 14) all have traffic entering and exiting I-5 within a 1.5-mile segment.

The southbound (western) bridge would accommodate a two-way guideway for light rail vehicles (LRVs) beneath the highway deck. Similarly, the northbound (eastern) bridge would accommodate a bicycle and pedestrian path approximately 16 to 20 feet wide below the highway deck, located within the support structure under the highway deck. The width of the path will depend on the width of the support structure itself. The proposed bridge type of the two new main river crossing bridges is a composite deck truss design in which the "walls" are constructed of diagonal steel members (Exhibit 2.2-3). This allows for a partially open-sided, covered passage for bicyclists and pedestrians beneath the eastern bridge deck and for light rail transit beneath the western bridge deck. This bridge type would allow for natural light and ventilation as well as views to the east from the bicycle and pedestrian path and views to the west from the light rail trains.

The height of the new bridges was established to give adequate clearance for river traffic below and for air traffic above. The top of deck of the new bridge would range in elevation from approximately 100 to 140 feet over the Columbia River. The new bridges would be high enough to provide approximately 95 feet of vertical clearance for river traffic beneath, but not so

Exhibit 2.2-2
LPA Columbia River Crossing Cross-section

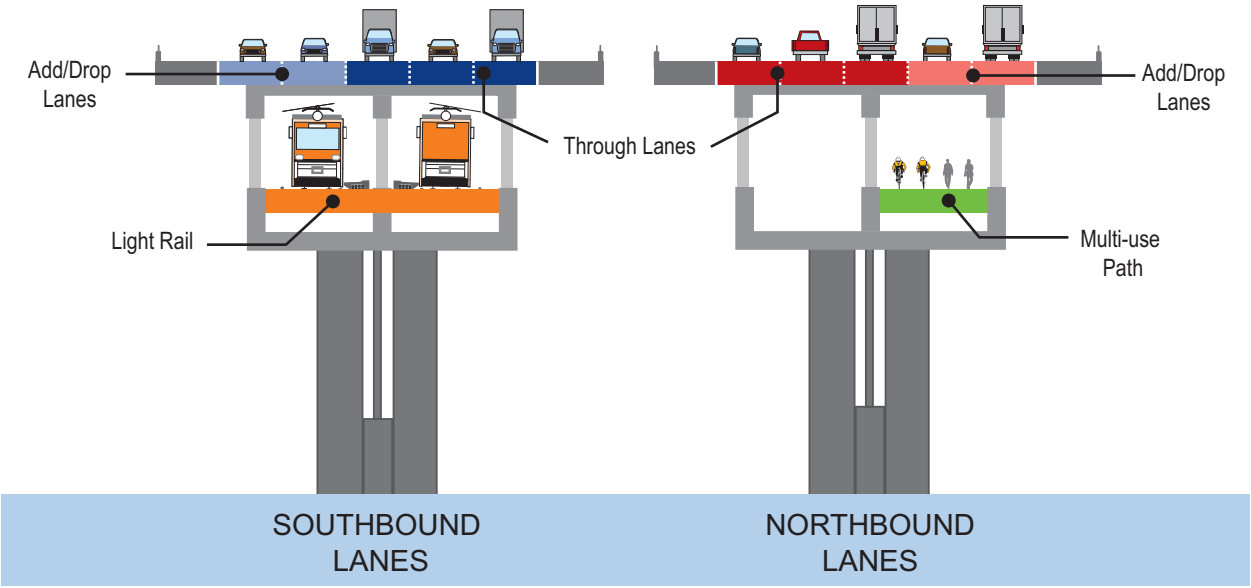
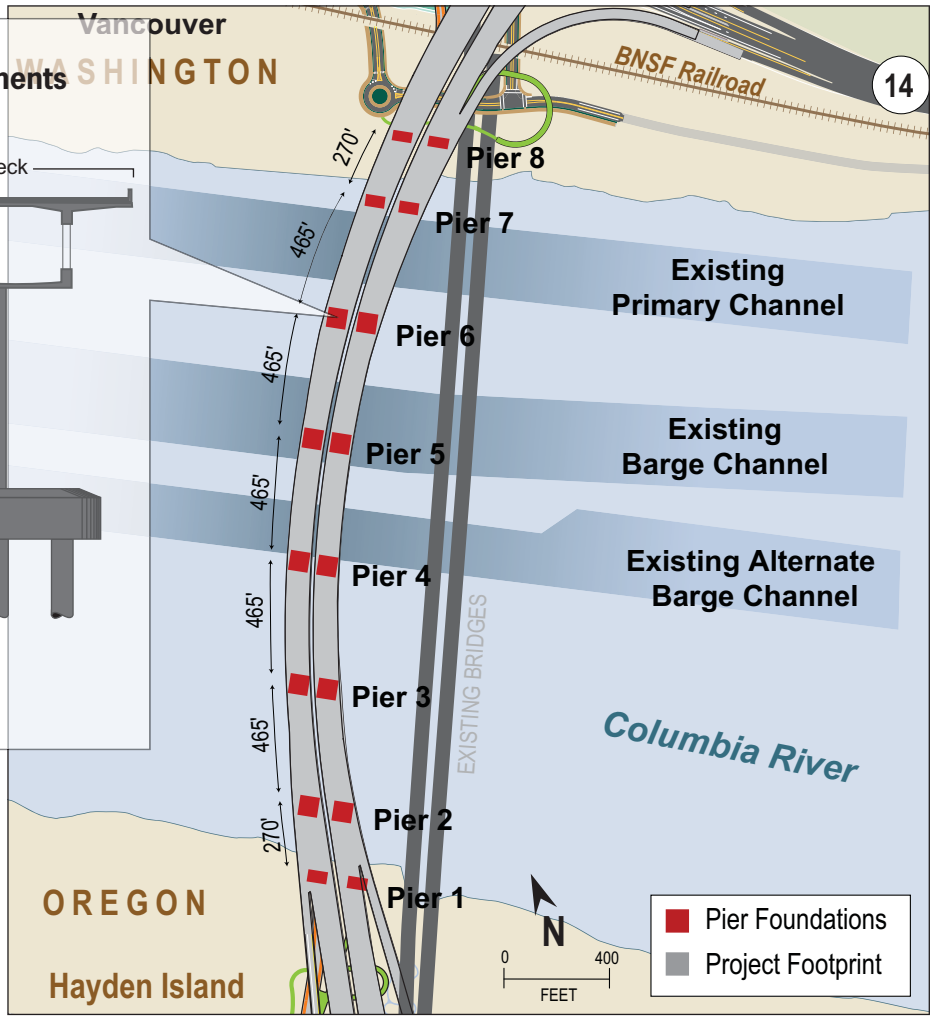


Exhibit 2.2-3
Composite Deck Truss Bridge Type

high as to impede take-offs and landings by aircraft using Pearson Field and Portland International Airport (PDX) to the east. Unlike the existing bridge over the Columbia River, the new structures would not include lift spans.

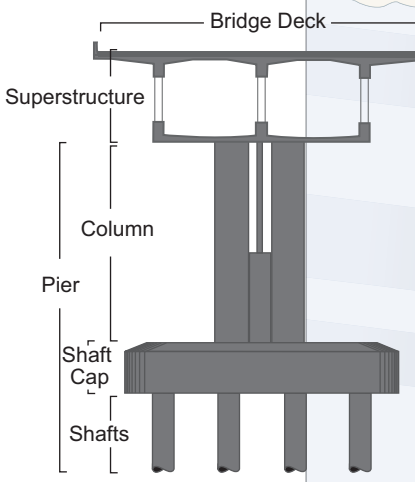
The existing bridges over the Columbia River have nine pier sets. Each of the new bridges would be built on six pairs of in-water piers plus two pairs of piers on land (Exhibit 2.2-4). Each of these pier sets would be supported by a foundation of approximately sixteen 10-foot-diameter drilled shafts. Each group of shafts would be tied together with a concrete cap measuring approximately 75 feet by 75 feet at the water line. Slender columns would rise from the shaft caps and connect to the superstructure of the bridges. See Exhibit 2.2-5 for an illustration of these bridge structure elements. During final design, project staff will further explore the potential for reducing the diameter of the Columbia River bridges' in-water piers.

Exhibit 2.2-4
Pier Locations, Sizes, and Spacing



Dimensions are approximate.

Exhibit 2.2-5
Bridge Structure Elements



Not to scale.

NOTE: The bridge type shown is for display purposes only.

TERMS & DEFINITIONS

Drilled shafts

Drilled shafts are a type of deep foundation used to support structures such as bridges. Drilled shafts are installed by boring deep holes that are then filled with a reinforcing cage made of rebar and concrete. Drilled shafts differ from driven piles, which are forced into the substrate using a large hammer called a pile driver.

The improvements to the Columbia River bridges would not differ between LPA Option A and Option B.

NORTH PORTLAND HARBOR BRIDGES

The existing highway structures over North Portland Harbor would not be replaced; instead, they would be retained and would accommodate all mainline I-5 traffic (Exhibit 2.2-6). As discussed at the beginning of this chapter, the Hayden Island and Marine Drive interchanges have been further evaluated based on public involvement and input. From this process two design options have emerged. The preferred option, which is described in this chapter as LPA Option A, includes local vehicular access between Marine Drive and Hayden Island on a local multimodal bridge. LPA Option B does not have traffic lanes on the light rail bridge, but instead provides direct auto access between Marine Drive and the island with collector-distributor lanes on the two new bridges that would be built adjacent to I-5.

LPA Option A: Four new, narrower parallel structures would be built across the waterway, three on the west side and one on the east side of the existing North Portland Harbor bridge (see inset in Exhibit 2.2-6). Option A would not widen or seismically upgrade the existing North Portland Harbor bridge.

Three of the new structures would carry on- and off-ramps to mainline I-5. Two structures west of the existing bridge would carry traffic merging onto I-5 southbound from Hayden Island or exiting off of I-5 southbound to Marine Drive. The new structure on the east side of I-5 would serve as an on-ramp for traffic merging onto I-5 northbound from Marine Drive and Martin Luther King Jr. Boulevard and would carry the multi-use path underneath the bridge deck.

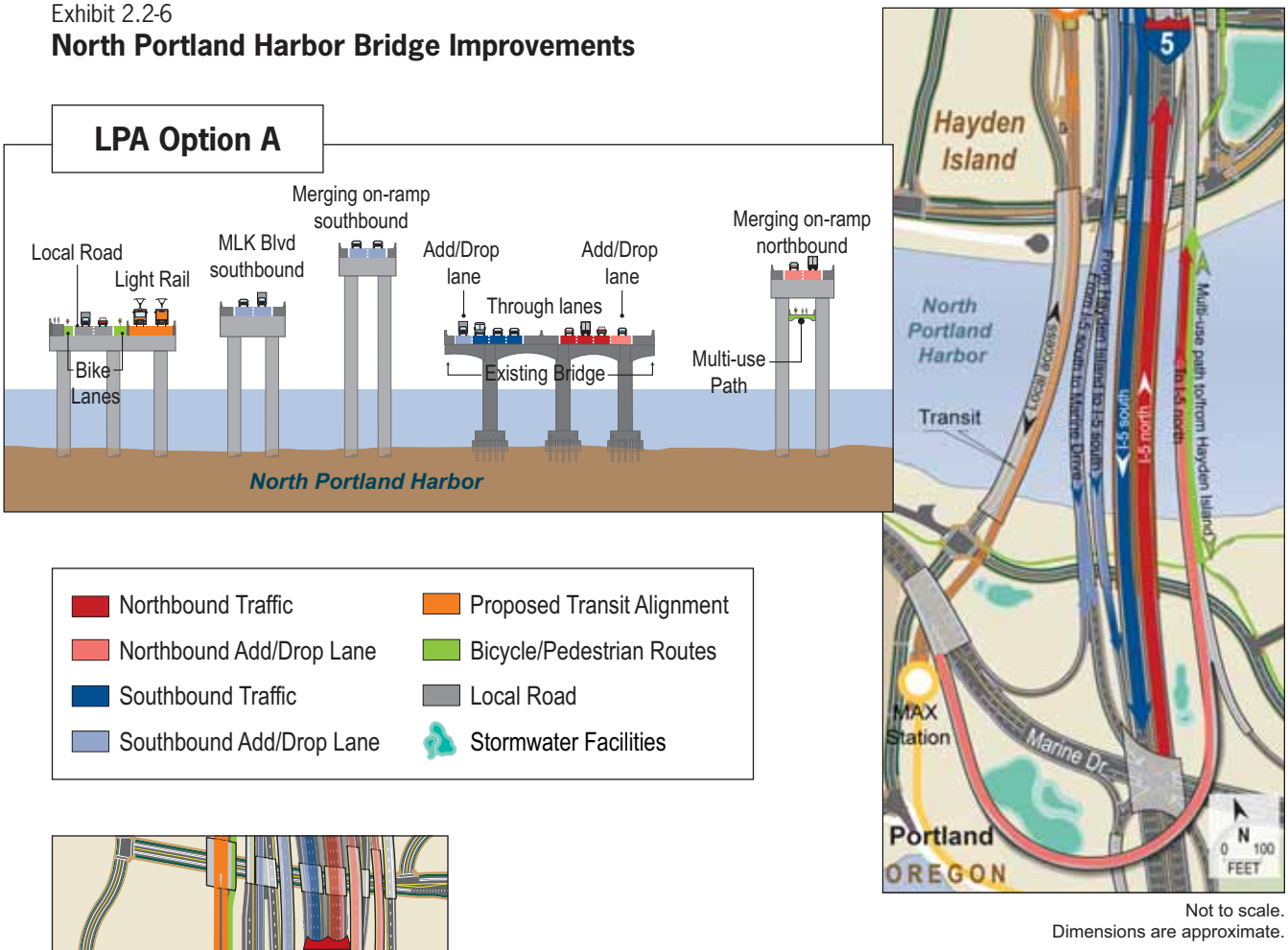
The fourth new structure would be built slightly farther west and would include a two-lane local multimodal bridge for local traffic to and from Hayden Island, light rail transit, and would include bicycle lanes and sidewalks. The length of each new structure would be between 800 and 1,000 feet, depending on its location and the angle relative to the channel. Spans would vary by bridge, and the existing navigation channel would be preserved. All of the new structures would have at least as much vertical clearance over the river as the existing North Portland Harbor bridges.

LPA Option B: This option would build the same number of structures over North Portland Harbor as Option A, although the locations of certain functions on those bridges would differ. With Option B, the existing bridge over North Portland Harbor would be widened and would receive seismic upgrades.

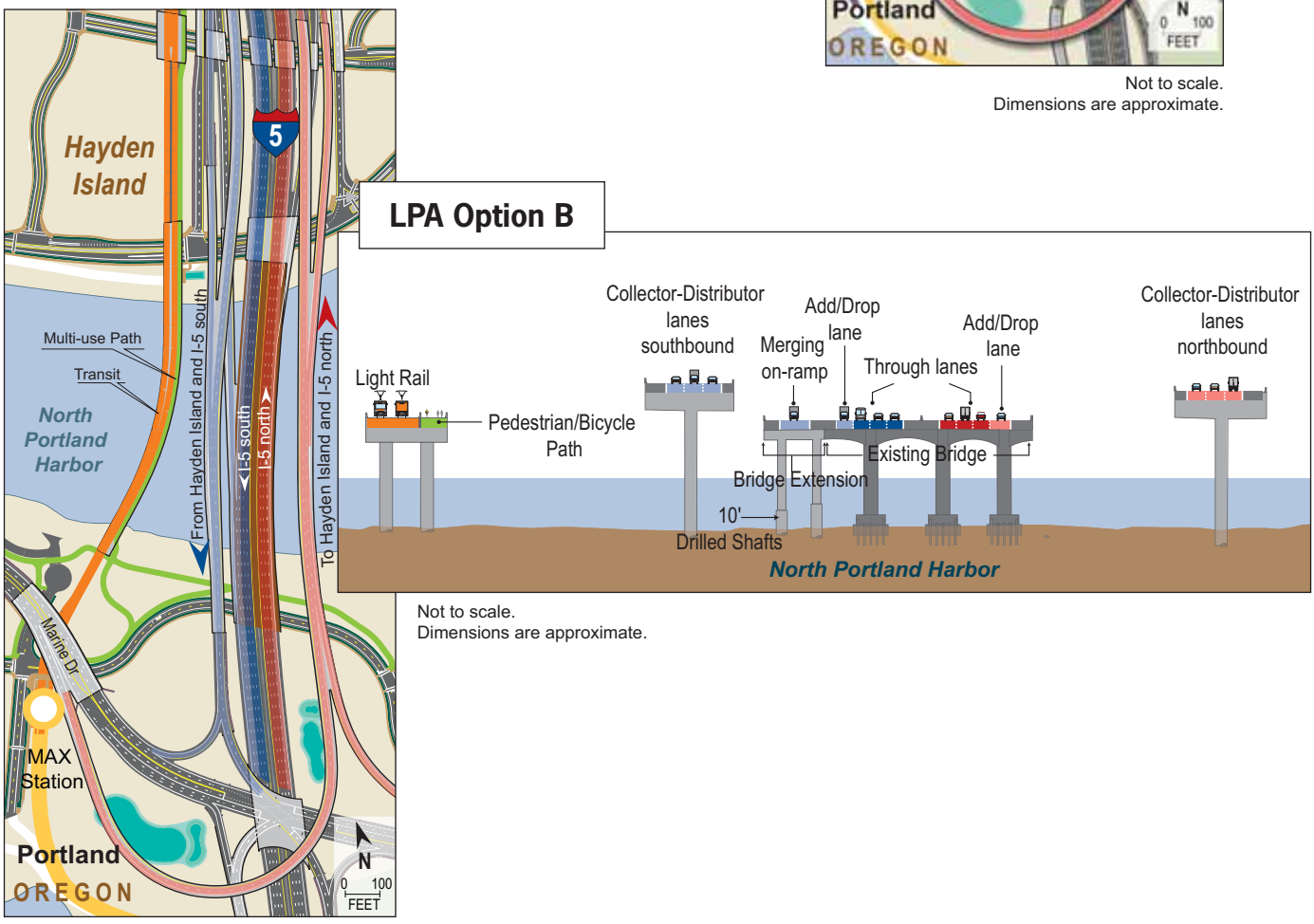
LPA Option B would not have traffic lanes on the light rail/multi-use path bridge. Direct access between Marine Drive and the island would be provided with collector-distributor lanes. The two structures adjacent to the highway bridge would carry traffic merging onto or exiting off of mainline I-5 between the Marine Drive and Hayden Island interchanges. The new structure on the west side of I-5 would serve as a collector-distributor road for southbound traffic. Similarly, the new structure on the east side of I-5 would serve as a CD road for northbound traffic. The multi-use path would be located on the westernmost bridge structure that carries the light rail guideway.

Exhibit 2.2-6

North Portland Harbor Bridge Improvements



Not to scale.
Dimensions are approximate.

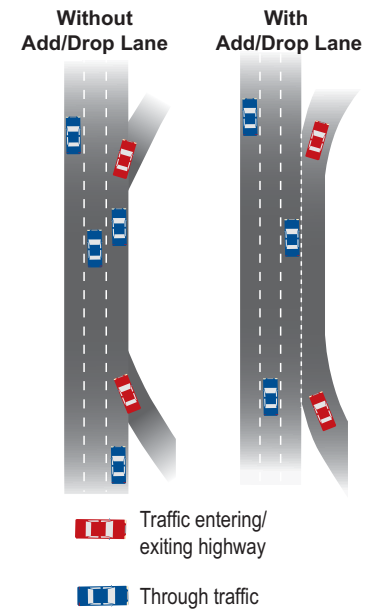


Not to scale.
Dimensions are approximate.

Highway, Interchange, and Local Street Improvements

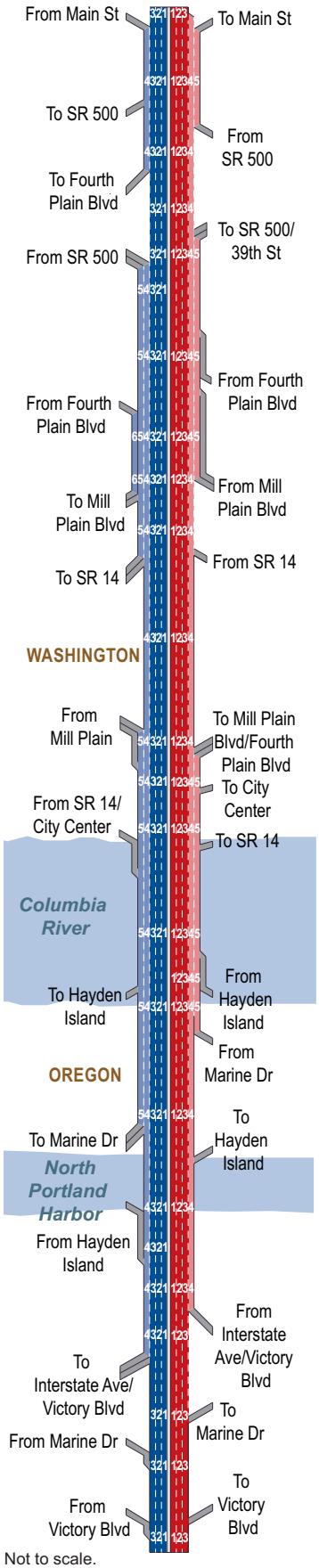
The LPA includes improvements to seven interchanges along a 5-mile segment of I-5 between Victory Boulevard in Portland and SR 500 in Vancouver. These improvements result in some reconfiguration of adjacent local streets to complement the new interchange designs, and include new street extensions, added travel lanes, and new and extended turn pockets at key intersections. The new facilities increase accessibility and mobility for vehicular, bicyclist and pedestrian travel. The bicycle and pedestrian improvements are described in Section 2.2.3.

Exhibit 2.2-7
Auxiliary Lanes



In addition to interchange improvements, a series of auxiliary (add/drop) lanes would be sequentially added and then dropped at strategic locations through the corridor (see Exhibit 2.2-7). The add/drop lanes would allow vehicles to travel between given points without merging into mainline interstate traffic, and would allow vehicles exiting or entering to minimize conflicts with through traffic. From the south end of the project area, I-5 northbound would have one added auxiliary lane starting where the Victory Boulevard/Denver Avenue on-ramp enters I-5. Another auxiliary lane would be added where the Marine Drive on-ramp enters I-5. One of these lanes would be dropped at the Mill Plain Boulevard/Fourth Plain Boulevard off-ramp. An auxiliary lane would be added where the Mill Plain on-ramp enters I-5. One auxiliary lane would be dropped at the SR 500 interchange and the second would be dropped north of the Main Street off-ramp. Lanes would be added or dropped as the various on-ramps and off-ramps enter or exit I-5 with each subsequent interchange. Southbound I-5 and the associated interchanges and ramps would have a similar series of add/drop lanes. Exhibit 2.2-8 illustrates these through and auxiliary lanes for the LPA. If highway construction is phased, construction of some auxiliary lanes would be deferred, as characterized within the corresponding description of interchange improvements. The location of auxiliary lanes would not differ between LPA Option A and Option B.

Exhibit 2.2-8
LPA Through/Auxiliary Lanes



VICTORY BOULEVARD INTERCHANGE

The southern extent of the CRC highway improvements is the Victory Boulevard interchange in Portland. Improvements at this interchange would be limited to two of the ramps. The Marine Drive to I-5 southbound on-ramp would be braided over the I-5 southbound to Victory Boulevard/Denver Avenue off-ramp (Exhibit 2.2-9). Braiding these two movements would eliminate the existing short (substandard) weave distance and improve traffic safety. Braiding the two movements would also eliminate direct access from the Marine Drive interchange to the Victory Boulevard interchange. Motorists would instead use local roads to travel from Marine Drive to Victory Boulevard. Local roads would also connect the Bridgeton Neighborhood to the Kenton Neighborhood.

TERMS & DEFINITIONS

Braiding

When two ramps cross each other at different grades (one going over the other) this is referred to as braiding. This approach is used to safely accommodate different traffic movements in the same section of roadway.

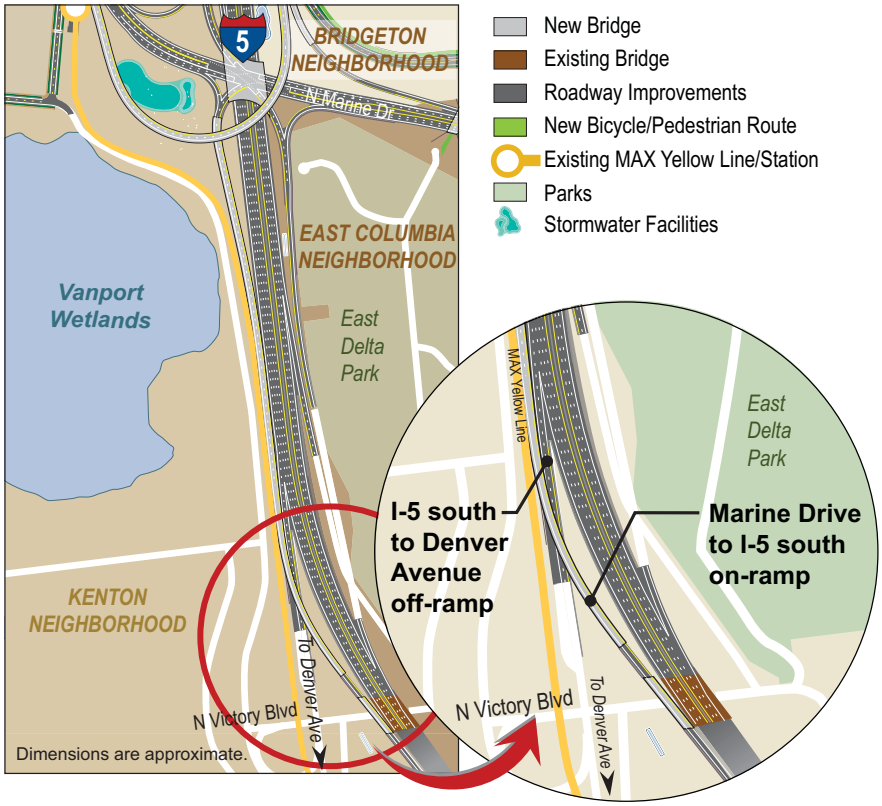
Currently, the existing Victory Boulevard/Denver Avenue on-ramp merges with I-5 mainline northbound traffic; this improvement would bring this ramp on as an add lane, acting as an auxiliary lane within the project limits to provide additional capacity and a safer roadway.

The improvements to the Victory Boulevard interchange would not differ between LPA Option A and Option B.

Phased highway construction option: To reduce project construction costs, construction of the aforementioned southbound braided ramp improvements to the Victory Boulevard interchange could be deferred. If these improvements are not included in initial project construction, then this would leave a weave section on the main highway between Marine Drive and Victory Boulevard. The braided ramp connection could be constructed separately in the future as funding becomes available. The braided ramp improvement is included in the LPA, but is assumed to be deferred if the project has to be phased.

Exhibit 2.2-9

Victory Boulevard Interchange Improvements



MARINE DRIVE INTERCHANGE

All movements within this interchange would be reconfigured to reduce congestion and improve safety for trucks and other motorists entering and exiting I-5. The proposed configuration is a single-point urban interchange (SPUI) with a flyover ramp serving the eastbound to northbound movement (Exhibit 2.2-10). With this configuration, three legs of the interchange would converge at a point on Marine Drive over the I-5 mainline. This configuration would allow the movements with the highest volumes in the interchange to move freely without being impeded by stop signs or traffic signals.

Specific changes to traffic movements at this interchange include:

- The northbound flyover ramp would allow trucks and motorists to travel from Marine Drive eastbound to I-5 northbound without stopping. Currently this movement is served by a double left turn at a signalized intersection.
- The Marine Drive eastbound to I-5 southbound ramp would also provide trucks and motorists with access to I-5 southbound without stopping. This ramp would touch down south of Victory Boulevard and is also described as part of the Victory Boulevard southbound braided ramp.
- Motorists traveling on Martin Luther King Jr. Boulevard westbound to I-5 northbound would access I-5 without stopping at the intersection. Currently this movement is served by a loop that goes under the freeway. The new configuration would have less out of direction travel for this movement.
- Travel safety and mobility between the Marine Drive interchange and Hayden Island would be improved by eliminating the local movement between interchanges from the I-5 mainline and accommodating the connection with a local multimodal bridge (Option A) or collector-distributor lanes (Option B). Additional safety and mobility improvements would occur by braiding the on- and off-ramps between Marine Drive and Hayden Island.
- The new interchange configuration changes the westbound Marine Drive (east of I-5) and westbound Vancouver Way connections to Martin Luther King Jr. Boulevard and to northbound I-5. Rather than merging onto Martin Luther King Jr. Boulevard, which then loops on the west side and back to the east side of I-5 before entering northbound I-5, these two streets would instead access westbound Martin Luther King Jr. Boulevard farther east. Martin Luther King Jr. Boulevard would have a new direct connection to I-5 northbound.
- In the new configuration, the connections from Vancouver Way and Marine Drive would be served, improving the existing connection to Martin Luther King Jr. Boulevard east of the interchange. The improvements to this connection would allow traffic to turn from Vancouver Way and accelerate onto Martin Luther King Jr. Boulevard. On the south side of Martin Luther King Jr. Boulevard, the existing loop connection would be replaced with a new connection farther east, connecting to Union Court at Hayden Meadows Drive. A new undercrossing of Martin Luther King Jr. Boulevard would replace the existing one at Marine Way.

TERMS & DEFINITIONS

Diamond Interchange

A **diamond interchange** is a common type of interchange used where a highway crosses a minor road. The highway is grade separated from the minor road, and the off-ramps diverge gently from the main highway, intersect directly with the minor road, and continue as gently merging on-ramps. The term "diamond" is used because, seen from the air, the interchange has a diamond shape.

TERMS & DEFINITIONS

Single-Point Urban Interchange (SPUI)

A **SPUI** is an interchange that allows left turns to proceed simultaneously by compressing two diamond intersections into a single intersection over or the under the free-flowing road. The term "single-point" refers to the fact that all through traffic on the minor road and left-turning traffic is controlled by a single set of traffic signals.

- Improvements to the local street system around the interchange, including an extension of Vancouver Way under I-5 to connect to the new north-south street adjacent to the Expo Center.
- Improvements and a realignment of Expo Road (with Option A only). The proposed realignment of the west end of this road may be adjusted in final design, in coordination with the Expo Center. Expo Road is located largely on Expo Center property in an area where Metro is currently refining parking and access plans as part of their Master Plan process.

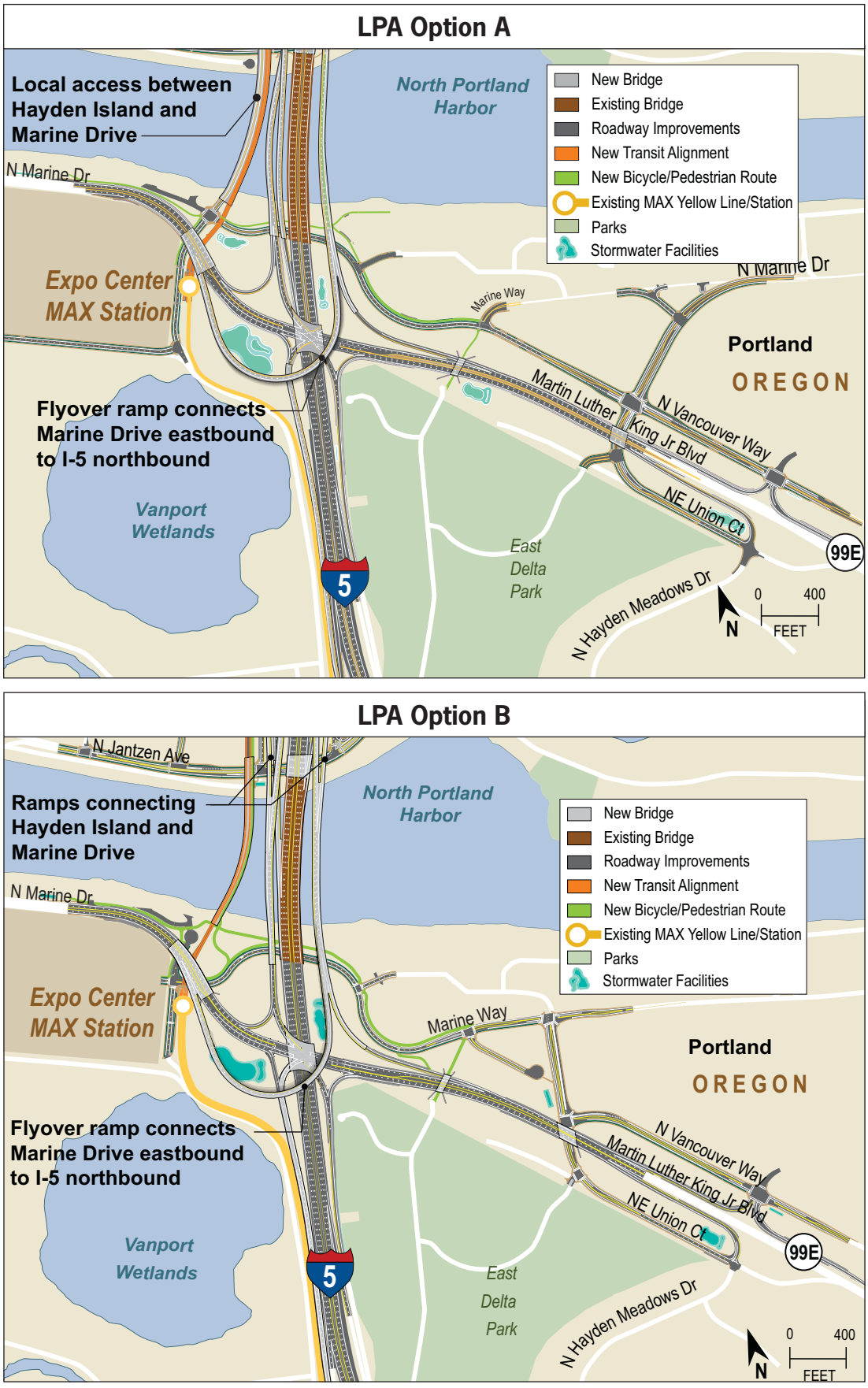
LPA Option A: Local traffic between Martin Luther King Jr. Boulevard/Marine Drive and Hayden Island would travel via a local multimodal bridge over North Portland Harbor. There would be some variation in the alignment of local streets in the area of the interchange between Option A and Option B. The most prominent differences are the alignments of Vancouver Way and Union Court (Exhibit 2.2-10).

LPA Option B: With this design option, there would be no vehicle traffic lanes on the light rail transit/multi-use path bridge over North Portland Harbor. Instead, vehicles traveling between Martin Luther King Jr. Boulevard/Marine Drive and Hayden Island would travel on the collector-distributor bridges that would parallel each side of I-5 over North Portland Harbor. Traffic would not need to merge onto mainline I-5 to travel between the island and Martin Luther King Jr. Boulevard/Marine Drive.

Phased highway construction option: To reduce initial project construction costs, construction of the aforementioned eastbound to northbound flyover ramp could be deferred. If the flyover is not included in the first phase of project construction, then the eastbound Marine Drive to northbound I-5 movement would be accommodated through the signal-controlled SPUI. The flyover could be constructed separately in the future as funding becomes available. The construction of this flyover would require the reconstruction of the Martin Luther King Jr. Boulevard westbound to I-5 northbound ramp farther to the east in order for it to merge into the ramp north of where the flyover connects. In this FEIS, the flyover and related ramp improvements are included in the LPA, but are assumed to be deferred if highway construction needs to be phased.

Exhibit 2.2-10

Marine Drive Interchange Improvements



Dimensions are approximate.

HAYDEN ISLAND INTERCHANGE

The Hayden Island interchange would be reconfigured to lengthen the ramps and improve merging speeds by building longer ramps parallel to the highway. The current Hayden Island interchange off of I-5 contains substandard features, including short on- and off- ramps. The existing short ramps do not provide ample distance for some vehicles, especially trucks, to reach mainline speed before merging onto the mainline lanes, which results in a safety hazard. The combination of short ramps and lack of add/drop lanes to the north of the interchange requires traffic entering and exiting the highway to accelerate quickly when entering and decelerate quickly when exiting, or to back up along the ramps and mainline. These conditions result in congestion and higher crash rates on the highway and local streets.

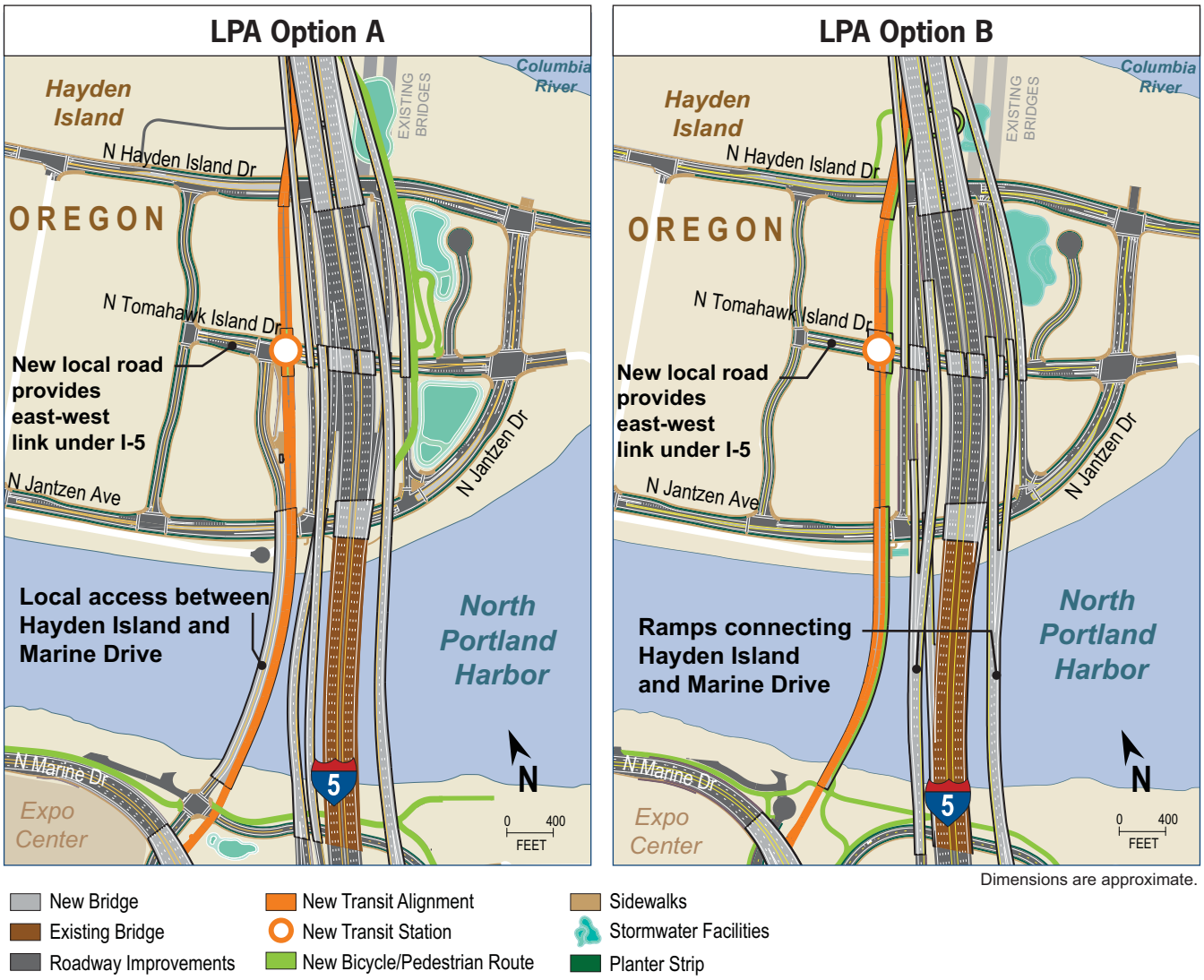
All movements for this interchange would be reconfigured, as illustrated in Exhibit 2.2-11. The new configuration would be a split tight diamond interchange. Specific changes to traffic movements at this interchange would include:

- Improvements to Jantzen Drive would include additional through, left-turn, and right-turn lanes. Currently, Jantzen Drive does not connect to highway ramps. Ramp connections are made to Hayden Island Drive and Center Avenue. Ramps to/from southbound I-5 would connect to Jantzen Drive. Jantzen Drive would also connect to northbound I-5. Jantzen Drive would be improved from the existing two- to three-lane roadway to a three- to five-lane roadway, depending on the location. Double left-turn lanes and a right-turn lane would be provided at the northbound entrance.
- Hayden Island Drive would be improved from a three-lane roadway to a three- to five-lane roadway, depending on the location. Ramps from I-5 northbound would connect to Hayden Island Drive. On-ramps from Hayden Island Drive would connect to I-5 southbound. Right-turn lanes would be provided at the southbound ramp entrance and at Jantzen Drive, and double left-turn lanes would be provided at the southbound entrance.
- A new local road, Tomahawk Island Drive, located through the middle of the island, would provide an east-west link under the I-5 mainline for travelers to access both sides and would improve connectivity for local traffic, pedestrians, and bicyclists.

LPA Option A: A proposed local multimodal bridge with two lanes of traffic, one in each direction, would allow vehicles to travel between Martin Luther King Jr. Boulevard/ Marine Drive and Hayden Island without accessing I-5. Tomahawk Island Drive would connect to the local multimodal bridge and the local street system. There would be a slight variation in the alignment of local streets in the area of the interchange between Option A and Option B (Exhibit 2.2-11).

LPA Option B: With this design option there would be no vehicle traffic lanes on the light rail bridge over North Portland Harbor. Instead, vehicles traveling between Martin Luther King Jr. Boulevard/Marine Drive and Hayden Island would travel on the collector-distributor bridges that parallel each side of I-5 over North Portland Harbor. Traffic would not need to merge onto mainline I-5 to travel between the island and Martin Luther King Jr. Boulevard/Marine Drive.

Exhibit 2.2-11
Hayden Island Interchange Improvements



SR 14 INTERCHANGE

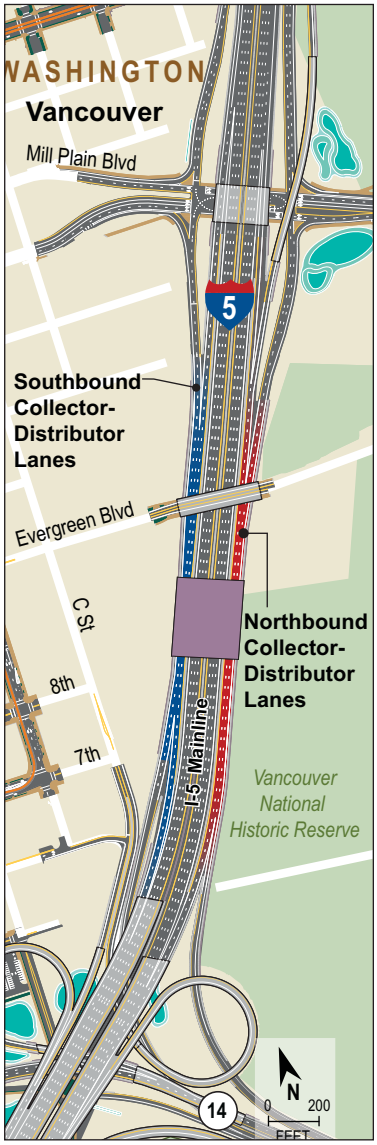
The basic functions of this interchange would remain largely the same as the existing interchange, but safety would be improved and congestion reduced, as described in the list below. Direct connections between I-5 and SR 14 would be rebuilt, as illustrated in Exhibit 2.2-12. Access to and from downtown would be provided as it is today, but the connection points would be relocated.

Specific changes to traffic movements at this interchange include:

- Downtown Vancouver I-5 access to and from the south would be at C Street rather than Washington Street.
- Downtown connections to SR 14 would be via Columbia Street at 4th Street and Main Street. Connections from SR 14 would be made to Washington Street and Columbia Street at 4th Street.
- The distance between the northbound I-5 exit to SR 14 and the exit to City Center would be increased to improve safety.

Exhibit 2.2-12

SR 14 Interchange Improvements



Dimensions are approximate.

Dimensions are approximate.

New Bridge
Roadway Improvements
New Transit Alignment
New Transit Station
Community Connector
New Park and Ride
New Bicycle/Pedestrian Route
Sidewalks
Parks
Stormwater Facilities
Planter Strip
Northbound Traffic
Southbound Traffic
New Surface Parking Lot

- The southbound I-5 connection to SR 14 would be made with a structure under I-5 and SR 14.
- The northbound I-5 connection to SR 14 would be a flatter curve, allowing traffic to travel at a higher speed than on the existing ramp.
- Both north and southbound movements between the Mill Plain interchange and the SR 14 interchange would be separate from the highway on CD roads, eliminating the substandard weave distances on the I-5 mainline (See inset of Exhibit 2.2-12).
- For all connections, acceleration and deceleration distances would meet highway design standards to improve safety.
- Raising I-5 at this interchange would allow for an extension of Main Street beneath the BNSF railroad crossing, from 5th Street south to Columbia Way, which supports the City of Vancouver's vision of providing greater connectivity to the waterfront.

A surface parking lot would be built within the western SR 14 loop ramp (for more information see Chapter 3.1 Transportation). The improvements to the SR 14 interchange would not differ between LPA Option A and Option B.

TERMS & DEFINITIONS

Collector-distributor

A collector-distributor (CD) is a one-way roadway adjacent to and separated from the freeway mainline that allows entering and exiting traffic to weave without disrupting the mainline freeway traffic. Collector-distributors are often used with cloverleaf type interchanges or between closely spaced interchanges.

MILL PLAIN BOULEVARD INTERCHANGE

This interchange would be reconfigured into a tight diamond, as illustrated in Exhibit 2.2-13. The existing "diamond" configuration requires two traffic signals to move vehicles through the interchange. The tight diamond has two closely spaced ramp terminals run by a single controller or two coordinated controllers improving the efficiency of the interchange. This will minimize queuing between the intersections and keeps traffic flowing through the interchange. All highway exits would be very similar to the existing interchange.

Exhibit 2.2-13

Mill Plain Boulevard Interchange Improvements

Dimensions are approximate.

Specific changes to traffic movements at this interchange include:

- Northbound I-5 traffic exiting at Mill Plain would travel on a CD ramp to Mill Plain. The CD would also accommodate the movements from I-5 northbound to Fourth Plain Boulevard and SR 14 to I-5 northbound.
- Mill Plain traffic would enter southbound I-5 from a CD ramp that would also accommodate the movement from southbound I-5 to SR 14.
- Acceleration and deceleration distances would be lengthened.

The improvements to the Mill Plain Boulevard interchange would not differ between LPA Option A and Option B.

FOURTH PLAIN BOULEVARD INTERCHANGE

The improvements to this interchange would better accommodate freight mobility and access to the Clark Park and Ride. Northbound I-5 traffic exiting to Fourth Plain Road would continue to use the off-ramp just north of the SR 14 interchange (Exhibit 2.2-14).

Exhibit 2.2-14

Fourth Plain Boulevard Interchange Improvements

Dimensions are approximate.

Dimensions are approximate.

Specific changes to traffic movements at this interchange include:

- The southbound I-5 exit to Fourth Plain would be braided under the 39th Street connection to I-5, eliminating the substandard weave between the SR 500 connection and the off-ramp to Fourth Plain. The 39th Street on-connection would be carried by a bridge over the Fourth Plain off-ramp in the vicinity of 37th Street.
- This braided exit ramp eliminates the direct connection between westbound SR 500 and Fourth Plain. Traffic currently using this connection would instead access the area by exiting SR 500 at St. Johns Road or 15th/P Streets or by traveling south on I-5 and exiting at Mill Plain.
- A southbound road would be added to provide access to the Clark Park and Ride from Fourth Plain at the northbound ramp terminal. This is for traffic exiting I-5 at Fourth Plain or already on Fourth Plain.
- The ramp terminal intersections at the entrance to I-5 north and south would be designed to accommodate large trucks turning from Fourth Plain.

- The intersection at the exit from I-5 south would provide double left turns for south to east movements. Double left turns would be provided at the intersection at the entrance to I-5 north for the movements going east to north and west to south into the park and ride access road. Two through lanes would be added for the northbound on-ramp to facilitate traffic coming from the park and ride.

Vehicular traffic could access Clark Park and Ride from I-5 southbound via the Fourth Plain off-ramp, crossing over I-5 on Fourth Plain Boulevard and turning onto the local road leading to the park and ride. Clark Park and Ride would be accessed from I-5 northbound by an off-ramp onto Mill Plain Boulevard, then via Fort Vancouver Way and McLoughlin Boulevard. Local access to the park and ride would be via McLoughlin Boulevard or Fourth Plain Boulevard.

The improvements to the Fourth Plain Boulevard interchange would not differ between LPA Option A and Option B.

SR 500 INTERCHANGE

Improvements to the SR 500 interchange would add direct connections to and from I-5 (Exhibit 2.2-15). Currently, the connections between SR 500 and I-5 to and from the north require exiting the highway, traveling on a local street (39th Street), and then re-entering the highway. As illustrated in Exhibit 2.2-15, on- and off-ramps would be built to directly connect SR 500 and I-5 for both of these connections. I-5 southbound traffic is proposed to connect to SR 500 via a new structure underneath I-5. SR 500 westbound traffic would connect to I-5 northbound on a new ramp.

Exhibit 2.2-15

SR 500 Interchange Improvements

Dimensions are approximate.

These improvements would eliminate the direct connections between 39th Street and I-5 to and from the north. These connections would instead be made through the I-5/Main Street interchange to the north.

The improvements to the SR 500 interchange would not differ between LPA Option A and Option B.

Phased highway construction option: To reduce project construction costs, reconstruction of the northern half of the interchange could be deferred. If these improvements are not included in the first phase of project construction, then the northern half of this interchange could be retained in its existing configuration. The improvements could be constructed separately in the future as funding becomes available. In this FEIS, the north half of the interchange improvements are included in the LPA, but are assumed to be deferred if the project needs to be constructed and funded in phases.

2.2.2 Transit

The transit element of the LPA is primarily an extension of light rail to Clark College in Vancouver from the Expo Center in north Portland, where the MAX Yellow Line currently terminates. To accommodate and complement this major addition to the region's transit system, a variety of additional improvements are also included in the project. These include park and ride facilities in Vancouver, expansion of the current TriMet light rail maintenance base in Gresham, changes to C-TRAN local bus routes, and upgrades to the existing Steel Bridge light rail crossing over the Willamette River in Portland.

Light Rail Alignment and Stations

OPERATING CHARACTERISTICS

The project would include a 2.9-mile extension of the existing MAX Yellow Line from the Expo Center station across the North Portland Harbor, over Hayden Island, across the Columbia River, and through downtown Vancouver, ending near Clark College (Exhibit 2.2-17). Nineteen new light rail transit vehicles (LRVs) would be purchased as part of the CRC project to operate this extension of the MAX Yellow Line. These vehicles would be similar to those currently used on the MAX light rail transit system. Trains would operate in a two-car configuration. Exhibit 2.2-16 compares the size and capacity of LRVs to typical buses.

Exhibit 2.2-16
Transit Vehicle Characteristics

Vehicle Type		Length	Seats	Average Vehicle Passenger Capacity[a]
Standard Local Bus		40 feet	43	61
Articulated Bus		62 feet	60	100
Light Rail Transit	Single Train	90 feet	64	133
	Two-Car Train	180 feet	128	266

a Average vehicle capacity is the total number of seats, plus the floor area of the transit vehicle divided by 3 persons per square meter.

With the LPA, LRVs in the new guideway and in the existing Yellow Line alignment would be planned to operate with 7.5-minute headways during the "peak of the peak" (the 2-hour period within the 4-hour morning and afternoon/evening peak periods when demand for transit is the highest) and with 15-minute headways at all other times. This compares to 12-minute headways in "peak of the peak" and 15-minute headways at all other times for the existing Yellow Line (and No-Build Alternative).

OREGON LIGHT RAIL ALIGNMENT AND STATION

A double-track light rail guideway for north and southbound trains would be constructed to extend northward from the existing Expo Center MAX station. The alignment would curve eastward toward I-5 as it passes beneath a newly reconstructed Marine Drive. North of Marine Drive the profile would rise as the guideway transitions onto a bridge structure to cross North Portland Harbor. The two-way guideway over Hayden Island would be elevated at approximately the height of the rebuilt mainline of I-5. A station would be constructed on Hayden Island immediately west of the reconstructed I-5/Hayden Island interchange. The alignment would extend northward on Hayden Island, along the western edge of I-5, until it transitions into the new bridge over the Columbia River. It would be located on the lower deck of the western bridge, which would service southbound highway traffic on the top deck.

DOWNTOWN VANCOUVER LIGHT RAIL ALIGNMENT AND STATIONS

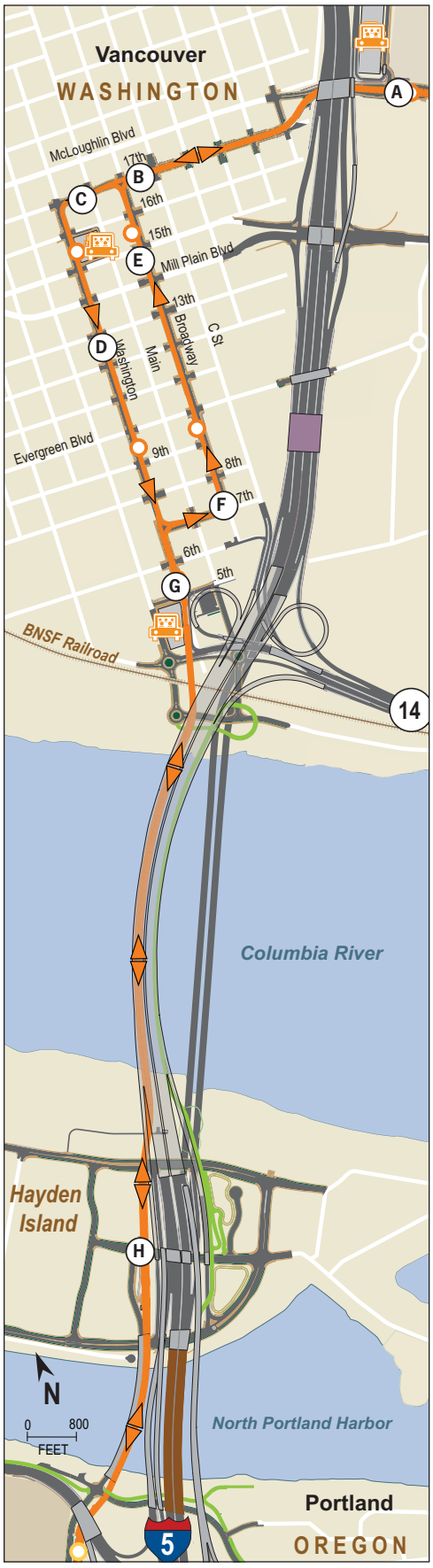
After crossing the Columbia River, the light rail alignment would curve slightly west, off of the highway bridge and onto its own smaller structure over the Burlington Northern Santa Fe (BNSF) rail line. The double-track guideway would descend on structure and touch down on Washington Street south of 5th Street, continuing north on Washington Street to 7th Street. The elevation of 5th Street would be raised to allow for an at-grade crossing of the tracks on Washington Street. Between 5th and 7th Streets, the two-way guideway would run down the center of the street. Traffic would not be allowed on Washington between 5th and 6th Streets and would be two-way between 6th and 7th Streets. There would be a station on each side of the street on Washington between 5th and 6th Streets.

At 7th Street, the light rail alignment would divide into a couplet. The single-track northbound guideway would turn east for two blocks, then turn north onto Broadway Street, while the single-track southbound guideway would continue on Washington Street. Seventh Street would be converted to one-way traffic eastbound between Washington and Broadway, with light rail operating on the north side of 7th Street. This couplet would extend north to 17th Street, where the two guideways would join and turn east.

The light rail guideway would run on the east side of Washington Street and the west side of Broadway Street, with one-way traffic southbound on Washington Street and one-way traffic northbound on Broadway Street. On station blocks, the station platform would be on the side of the street at the sidewalk. There would be two stations on the Washington-Broadway couplet, one pair of platforms near Evergreen Boulevard, and one pair near 15th Street.

Exhibit 2.2-17

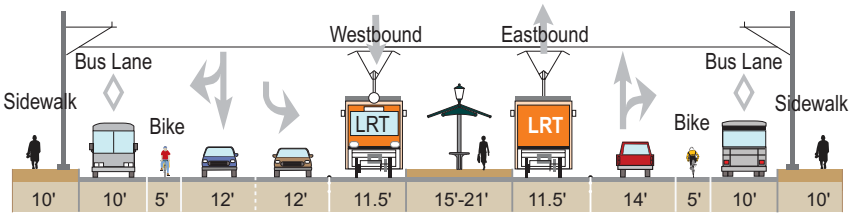
Proposed LPA Transit Alignment and Street Cross Sections (1 of 2)



Dimensions are approximate.

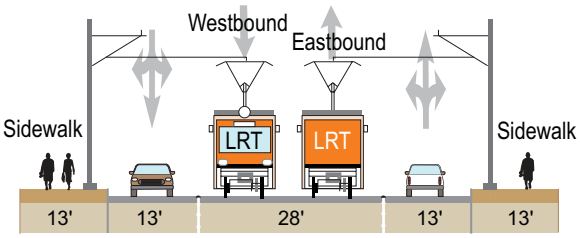
A. Terminus

Station block with center platform
Double track in median and center platform



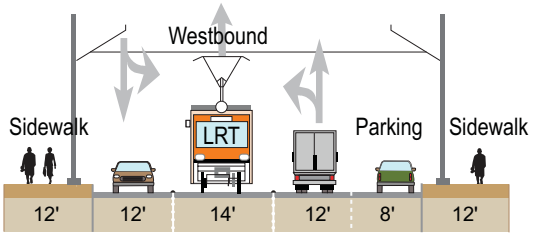
B. 17th Street

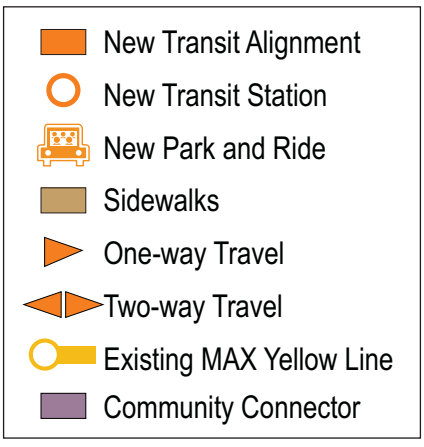
Non-station block
from Broadway to G Streets
Double track in median



C. 17th Street

Non-station block
from Washington to Main
Single track in median with parking lane





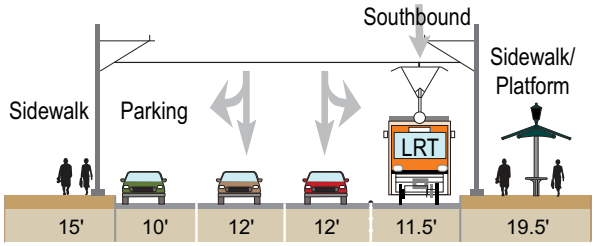
Not to scale. Conceptual designs.

Exhibit 2.2-17

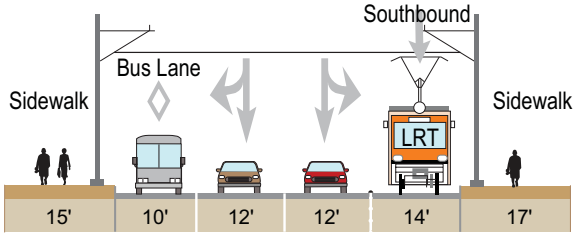
Proposed LPA Transit Alignment and Street Cross Sections (2 of 2)

D. Washington Street

Station block with side platform
Inside single track with one-way traffic
and bus or parking lane (depending on block)

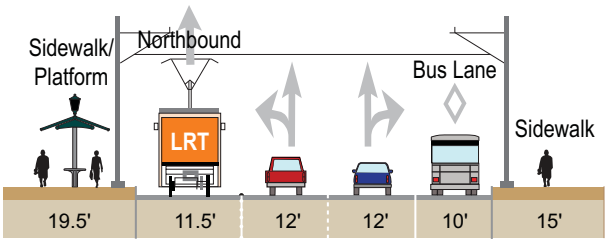


Non-station block
Inside single track with one-way traffic
and bus or parking lane (depending on block)

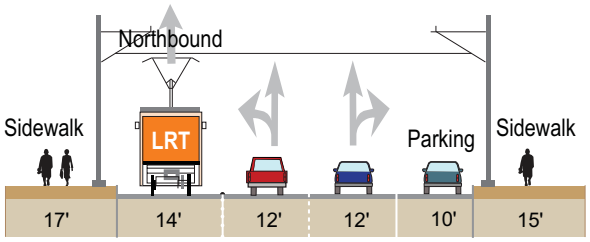


E. Broadway Street

Station block with side platform
Inside single track with one-way traffic
with bus or parking lane (depending on block)

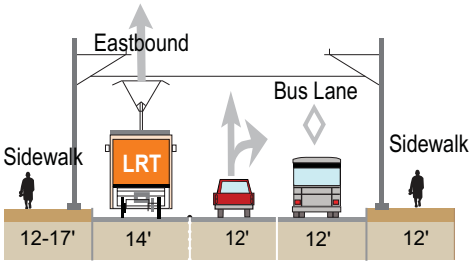


Non-station block
Inside single track with one-way traffic
and bus or parking lane (depending on block)



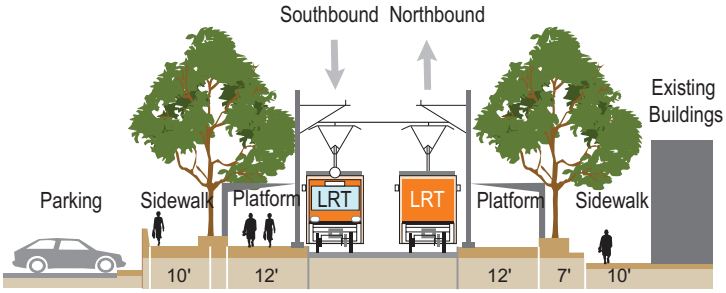
F. 7th Street

Between Washington and Main Streets
Single track with one-way traffic
and bus lane



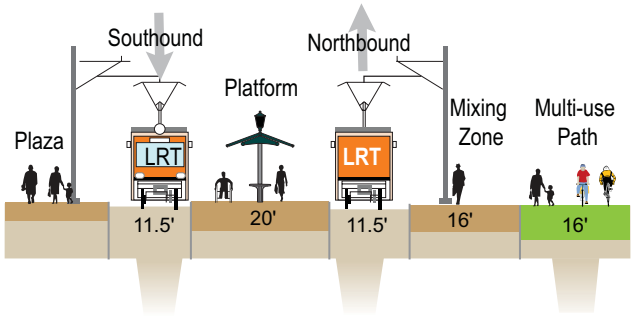
G. Washington Street

Station block between 5th and 6th
Double track with no traffic



H. Hayden Island

At Tomahawk Island Drive
Elevated station at plaza



EAST-WEST LIGHT RAIL ALIGNMENT AND TERMINUS STATION

Both north and southbound alignments of the couplet would become a two-way guideway traveling east-west on 17th Street. The double-track, center-running guideway on 17th Street would run until G Street, then curve north to McLoughlin Boulevard, and then continue east through the existing underpass beneath I-5. The underpass would be widened and the road bed lowered to accommodate the light rail trains and overhead catenary system. The guideway would end at a station and park and ride structure east of I-5, on the western boundary of Clark College and across from the Marshall Community Center, Luepke Senior Center, and Marshall Park.

Park and Rides

Three park and rides would be built in Vancouver along the light rail transit alignment (Exhibit 2.2-18).

Exhibit 2.2-18

Proposed Park and Rides Included in the LPA

Site Location	Columbia Park and Ride West side of Washington Street between 4th and 5th Streets	Mill Park and Ride East side of Washington Street from 15th to 16th Streets	Clark Park and Ride Northeast of McLoughlin Boulevard and I-5
Size (parking spaces)	570	420	1910
Number of Levels	5	4	5
Footprint (SF)	50,000	42,000	128,000
Retail Space Included Inside Structure	Yes	Yes	No

COLUMBIA PARK AND RIDE

A park and ride would be bounded by Washington, Columbia, and 5th Streets, and half the block between 3rd and 4th Streets. This facility would have five floors above ground and would contain approximately 570 parking spaces (Exhibit 2.2-19). Active uses would be included on the ground floor.

MILL PARK AND RIDE

A smaller park and ride would be built in the block surrounded by Washington and Main Streets and 15th and 16th Streets (Exhibit 2.2-20). This facility would have four floors, with active use space (which could include retail) on the ground floor. The current design includes 420 parking spaces.

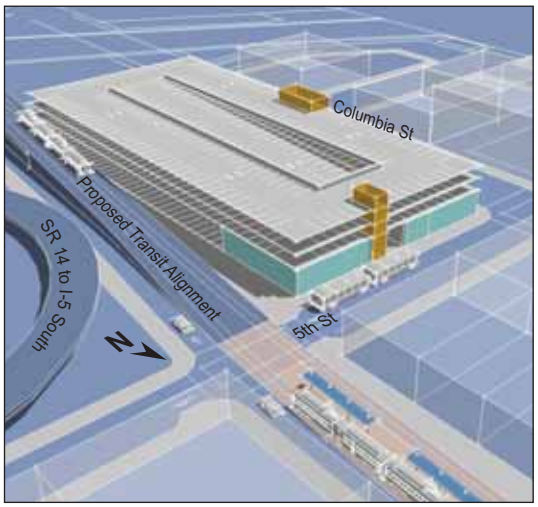
CLARK PARK AND RIDE

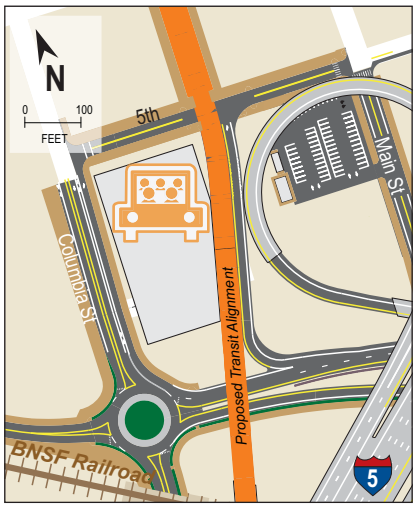
The largest park and ride would be built at the Clark College terminus. This facility would have five floors, and contain approximately 1,910 parking spaces (Exhibit 2.2-21).

Ruby Junction Maintenance Facility Expansion

The CRC project would expand the existing Ruby Junction Maintenance Facility in Gresham, Oregon to accommodate the additional LRVs associated

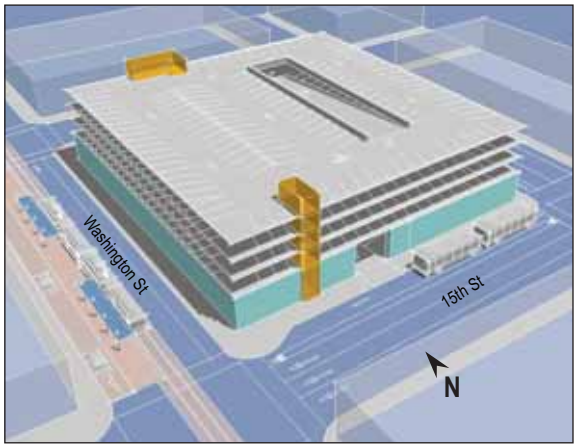
Exhibit 2.2-19
Columbia Park and Ride

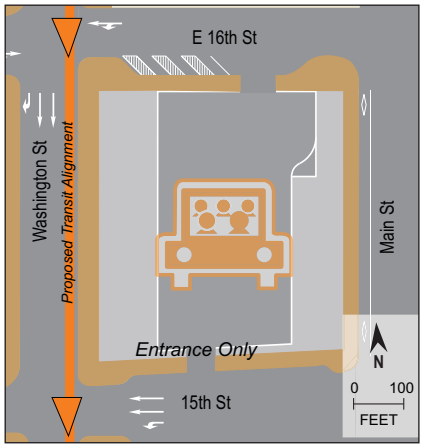




Conceptual designs. Dimensions are approximate.

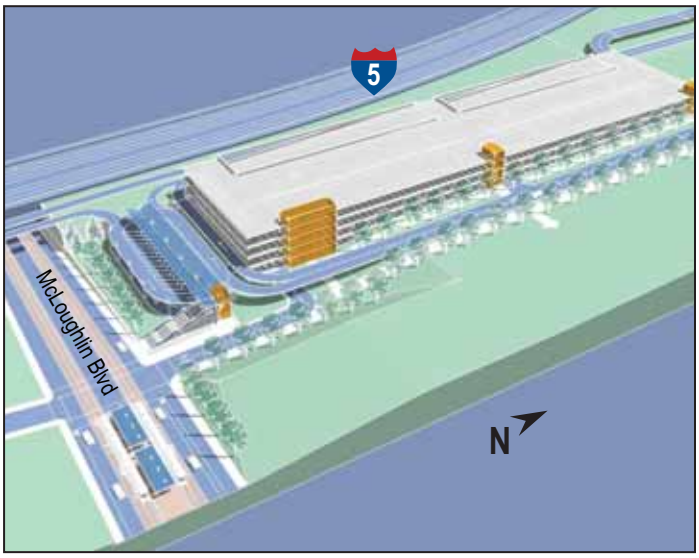
Exhibit 2.2-20
Mill Park and Ride

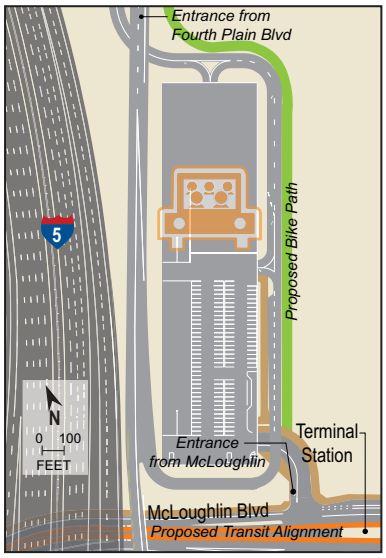




Conceptual designs. Dimensions are approximate.

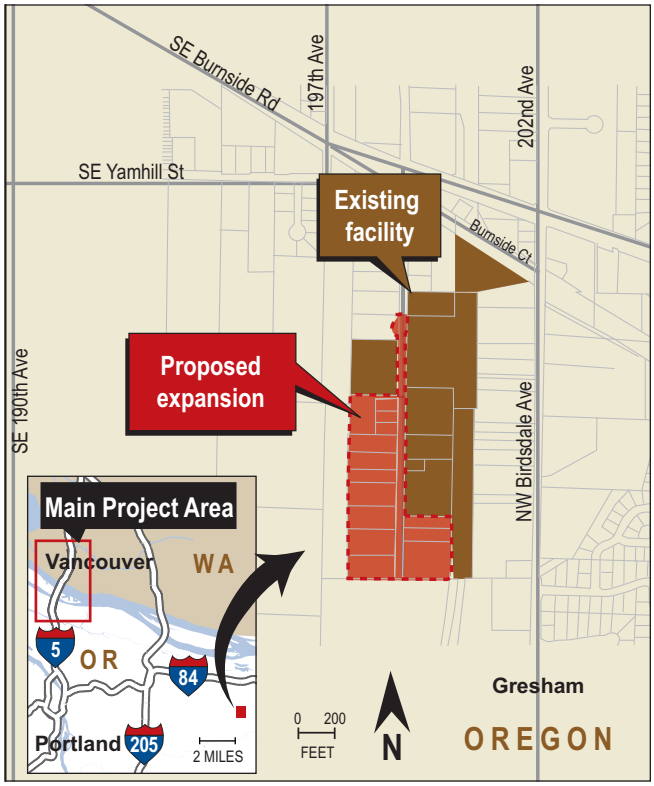
Exhibit 2.2-21
Clark Park and Ride





Conceptual designs. Dimensions are approximate.

Exhibit 2.2-22
Ruby Junction Maintenance Base Facility Expansion



Dimensions are approximate.

with the operations of the CRC project (Exhibit 2.2-22). The proposed expansion of the Ruby Junction facility would also accommodate the additional LRVs associated with the separately proposed Portland-Milwaukie Light Rail Project. Improvements would include additional storage for LRVs, maintenance equipment and materials, an expansion of LRV maintenance bays, and expanded parking for additional personnel. The Portland-Milwaukie Light Rail Project is considering phasing the maintenance facility expansion to first build only the capacity required for their initial operations, as described in the Portland-Milwaukie Final EIS (FTA 2010). Their initial phase would expand the facility to the west but defer the development of some track, internal roadway, parking facilities, and other structures. If the Portland-Milwaukie project implements phased construction, that would not change the total impacts at the site, but it would change the timing of some of the impacts. Phasing will be determined by the Portland-Milwaukie Light Rail Project and its timing relative to the CRC project construction. A new operations command center would be located at the existing TriMet Center Street location. This would not require any new building construction or expansion of the existing Center Street facility.

Local Bus Route Changes

As part of the CRC project, several C-TRAN local bus routes would be changed in order to better complement the new light rail transit system and reduce redundancies. Most of these changes truncate bus lines in downtown Vancouver where riders could transfer to light rail transit. Express routes, other than those listed below, are expected to continue service between Clark County and downtown Portland. The following exhibit shows the anticipated changes to future bus routes compared to the No-Build Alternative (Exhibit 2.2-23).

Exhibit 2.2-23
Proposed C-TRAN Bus Routes Comparison

C-TRAN Bus Route	Route Changes
#4 - Fourth Plain	Route truncated in downtown Vancouver
#41 - Camas / Washougal Limited	Route truncated in downtown Vancouver
#44 - Fourth Plain Limited	Route truncated in downtown Vancouver
#47 - Battle Ground Limited	Route truncated in downtown Vancouver
#105 - I-5 Express	Route truncated in downtown Vancouver
#105S - I-5 Express Shortline	Route eliminated with LPA (No-Build runs articulated buses between downtown Portland and downtown Vancouver on this route)

Steel Bridge Improvements

In addition to extending the MAX Yellow line, the CRC project would include minor modifications to a critical element of the existing MAX light rail transit system located outside the main project area. These modifications would improve the existing light rail transit track and electrical system on the Steel Bridge, which is located approximately 4 miles south of the crossing of the Columbia River. These improvements would allow the Yellow Line trains, as well as all other MAX line trains that would use these tracks, to increase their travel speed over the Steel Bridge.

Since the publication of the DEIS, a Documented Categorical Exclusion (DCE) from the NEPA process was requested for the work on Steel Bridge. The DCE evaluation determined that there would be minimal environmental impacts from improvements to the bridge trackway and controls. A determination that the work would be excluded from the NEPA process was made by FTA in February 2011. The Steel Bridge improvements were included in the CRC 2008 Federal New Starts application.

Currently, all light rail transit lines within the regional MAX system cross the Willamette River in downtown Portland via the Steel Bridge. The Steel Bridge was built in 1912 and was retrofitted in 1984 to receive LRVs. When the first light rail line opened in 1986, 40 LRVs crossed the bridge during the 4-hour PM peak period; in 2007, with the Red and Yellow Lines opened, 116 LRVs crossed the bridge during the 4-hour PM peak period. In 2009, TriMet opened the I-205 South Corridor Project, increasing the number of vehicles that cross the Steel Bridge to 152 during the 4-hour PM peak period. With a "peak of the peak" headway of 7.5 minutes, the CRC project would increase the number of LRVs that cross the Steel Bridge in 2030 during the 4-hour PM peak period to 176 trains. To accommodate these additional trains, the CRC project would retrofit the existing rails on the Steel Bridge to increase the allowed light rail transit speed over the bridge, increasing the LRV throughput of the bridge.

The Steel Bridge has a lift span that requires lift joints in the MAX rails within the track bed. These lift joints limit the crossing speed of LRVs to no more than 10 miles per hour (mph). This limitation is because the vibrations at these joints disrupt the signaling and electrification system. Modifications to reduce the wheel rise from the lift joint would decrease the bridge vibration, allowing MAX trains a maximum speed of 15 mph on the Steel Bridge, thus improving the speed of all MAX lines crossing the bridge. There is also an existing signal case on the lift span that cannot withstand high levels of vibration. The overhead catenary system (OCS) that supplies electrical power to the trains is also not designed to withstand the high levels of vibration that are generated with speeds above 10 mph. The work needed to increase the speed limits from 10 mph to 15 mph over the Steel Bridge lift spans would include the following:

1. Grind the transit rails within the track bed to remove the lift joint bumps, rail corrugation, and any rough field welds.
2. Install a vibration pad under the signal case to dissipate vibration.
3. Stiffen the OCS brackets to allow for greater impact as the catenary transfers from the fixed to movable span.