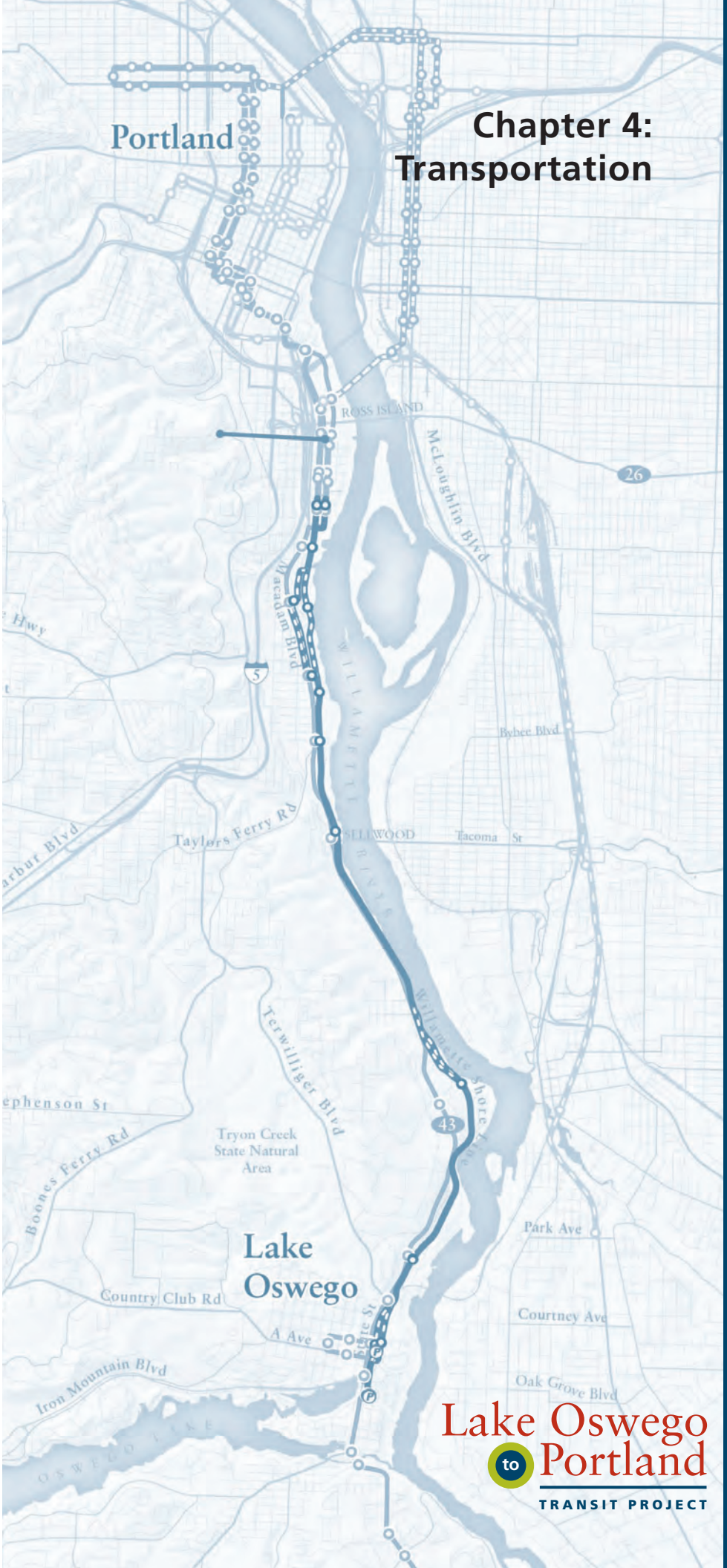
CHAPTER 4

Chapter 4: Transportation



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4. TRANSPORTATION

This chapter describes the effects that the No-Build, Enhanced Bus and Streetcar alternatives would have on transit operations and ridership, traffic operations and movement, freight movement, bicycle movement, pedestrian facilities and parking. Where there are differences between the effects of the Streetcar Alternative's design options, the sections describe those differences. Where appropriate, this chapter includes a summary of the relevant regulations and analysis methods. Short-term effects (effects related to construction activities) are addressed in section 4.3. More detailed information on the effects of the alternatives on the regional and local transportation system may be found in the *Lake Oswego to Portland Transit Project: Transportation Impacts Technical Report* (TriMet/Metro, November, 2010).

4.1 Affected Environment

This section summarizes characteristics of the existing transportation system and travel behavior within the region and corridor.

4.1.1 Public Transportation

Transit service in the corridor is primarily provided by TriMet's fixed-route, fixed-schedule buses operating in mixed traffic on Highway 43 and other arterial and collector roadways. The corridor includes one transit center, which is an on-street facility located in downtown Lake Oswego. The transit center is served by four bus routes, including: two that provide a feeder function with suburb-to-suburb connections (Line 37 and Line 78); one that provides peak-only service to downtown Portland and provides suburb-to-suburb connections in the midday (Line 36); and one that provides all day trunk route service from Oregon City to downtown Portland via the Lake Oswego Transit Center (Line 35).

In the northern portion of the corridor, public transit service also includes Line 43 Taylors Ferry which operates on Southwest Corbett Avenue and Macadam Avenue, streetcar service on Moody Avenue, connecting Northwest and downtown Portland to Lowell Street and aerial tram service between Gibbs Street at Moody Avenue and the Oregon Health and Sciences University (OHSU). The corridor also includes an excursion trolley operating on the existing Willamette Shore Line railroad.

4.1.1.1 Public Transportation Providers

There are three fixed-route transit providers in the Lake Oswego to Portland corridor. The Tri-County Metropolitan Transportation District of Oregon (TriMet) is the mass transit operating agency in the Portland metropolitan area. TriMet is the largest transit district in Oregon and the fifth largest on the West Coast. Under Oregon law (ORS 267), TriMet is a non-profit, municipal corporation operating in the urbanized portion of three Oregon counties: Multnomah, Clackamas and Washington. Its operating area covers 575 square miles and serves a population of approximately 1.3 million.

Portland Streetcar operates between South Waterfront and Northwest Portland through downtown Portland. Portland Streetcar is managed by the Portland Bureau of Transportation, under the direction of the Commissioner-in-Charge of Transportation. The City of Portland contracts with Portland Streetcar, Inc. (PSI) to construct and operate the Streetcar system. PSI is a private non-profit corporation. PSI contracts with TriMet to operate the streetcars. OHSU, through an

intergovernmental agreement with the City of Portland, operates the Portland Aerial Tram, while the City is responsible for maintenance.

The Oregon Electric Railway Historical Society (a non-profit Oregon Corporation) has operated weekend and special event excursion service on the Willamette Shore Trolley since 1987 through an agreement with the City of Lake Oswego and TriMet. TriMet, representing a consortium of seven local, regional and state agencies, is responsible for maintenance of the trackway.

4.1.1.2 Transit Lines, Operations and Facilities

TriMet's current fleet of 652 buses serves 81 bus lines and seasonal shuttles with 7,155 bus stops and 1,040 bus shelters. There are 164 miles of frequent service bus lines on 12 routes that provide 15-minute or better service throughout the day, 7 days a week. The 84-station Metropolitan Area Express (MAX) light rail system is 52 miles long and also operates at least every 15 minutes. The 14.7-mile Westside Express Service (WES) Commuter Rail service provides eight peak period trips in each direction during weekdays, serving five stations. In addition to fixed-route bus and MAX service, TriMet operates 254 LIFT vehicles and 15 sedans, providing door-to-door service for people with special needs.

Table 4.1-1 summarizes TriMet's existing fixed-route service. Overall, 90 percent of people in the TriMet district live within one-half mile of TriMet service.

Table 4.1-1 Number and Length of Existing TriMet Fixed Route Transit Lines

	Streetcar[1]	MAX LRT	Frequent Bus	Total Bus
Routes	1	4	12	81
Length (miles)	8	52	164	792

Source: TriMet and Portland Streetcar Inc.; February 2010.
[1] Includes 2010 operations between NW 23rd Avenue and SW Lowell Street. The Eastside Loop Streetcar Project is currently under construction and is scheduled to open in 2012.

The Portland Streetcar operates four miles between the intersection of Northwest 23rd Avenue and Northrup Street and Southwest Moody Avenue and Lowell Street. Streetcars operate approximately every 13 minutes during most of the day and less frequently in the evening and weekends. An extension of Portland Streetcar from Northwest Northrup Street to the OMSI district is currently under construction and scheduled to open in 2012 and will provide approximately 12-minute frequency between those two locations.

The Portland Aerial Tram generally operates daily between South Waterfront and the OHSU campus on SW Sam Jackson Park Road on Marquam Hill, with Sunday operations only in the summer. The Marquam Hill area also includes the Shriners Hospital for Children and the Veterans Affairs Medical Center.

4.1.1.3 Current Ridership, Operating Revenue, and Operating Expenses

For fiscal year (FY) 2009, TriMet weekday system boarding rides (bus and light rail) averaged approximately 322,900 boarding rides with 215,300 on bus and 107,600 on light rail. Total weekend ridership (bus and light rail) averaged 351,800 trips. In addition, weekday boarding rides on streetcar averaged 12,100 during the same period.

Between FY 1999 and FY 2009, TriMet's annual systemwide farebox revenues increased from $40.6 million to $88.7 million. Costs for operations and maintenance during this period increased from $141.5 million to $261.1 million. Fare revenue as a percentage of the cost of operation and maintenance improved from 28.7 percent to 34 percent and the average operations cost per boarding ride for the entire fixed-route system increased from $1.85 to $2.57, reflecting inflation and service expansion to lower ridership areas and times. Cost per boarding ride for light rail, at $1.92, is lower than that for buses, at $2.88 (FY 2009). Cost per boarding ride for the Portland Streetcar is $1.30 (FY 2009).

4.1.2 Travel Behavior

The basic unit of measurement used in describing travel behavior is the "person trip," which is a trip made by one person from a point of origin to a destination, via any travel mode. Several trip variables, including the origin, destination, mode and purpose of the trip, further describe travel behavior.

For 2005, the transportation facilities in the Lake Oswego-Portland corridor carried approximately 27,200 person trips from the corridor to the Portland Central Business District (CBD) on an average weekday. Of these, approximately 2,100 (8 percent) were on the transit system. Of the 3,700 daily work trips from the corridor to the CBD, 700 (18 percent) were on transit.

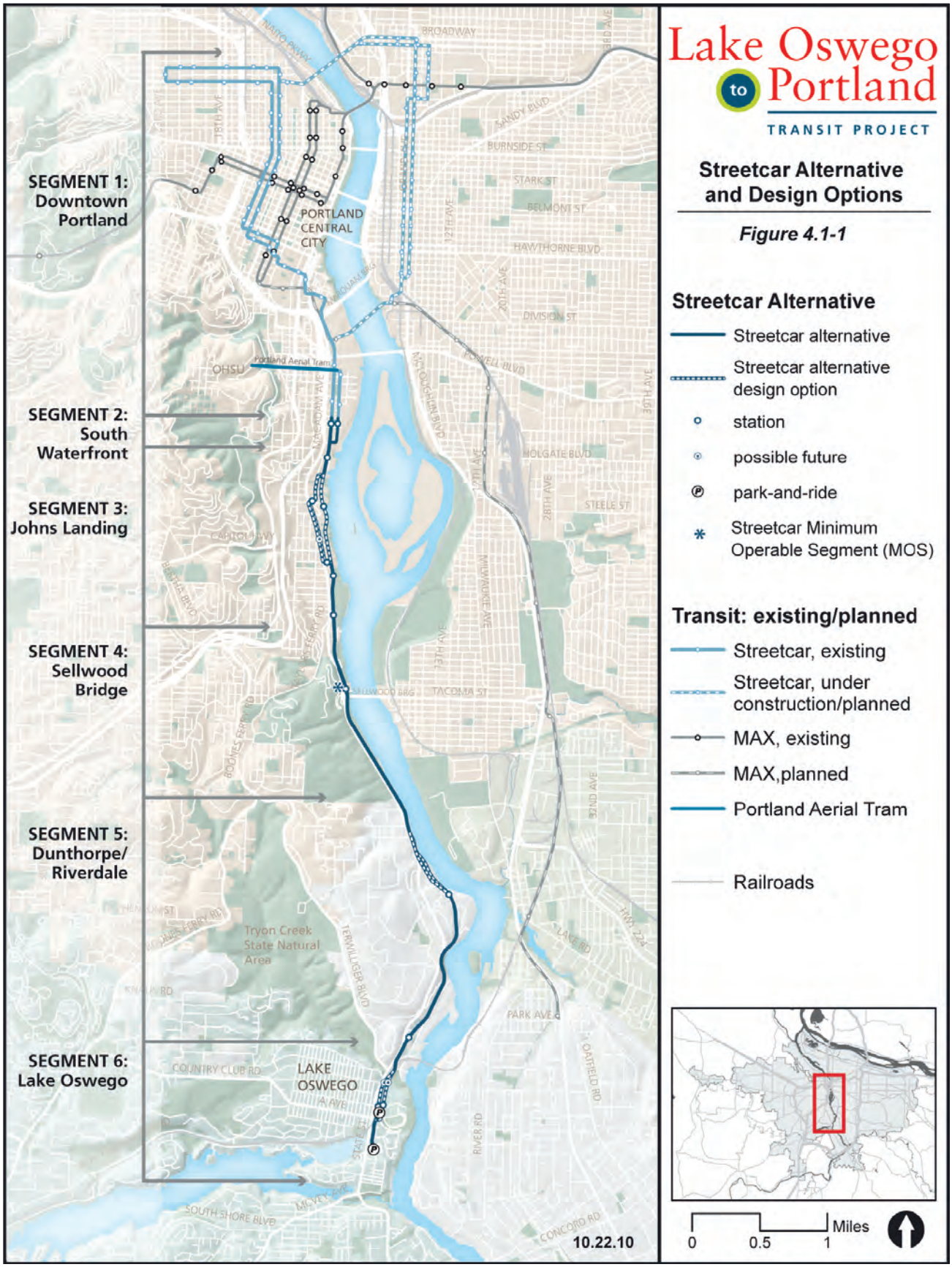
4.1.3 Roadways

The Lake Oswego to Portland corridor is served by a network of roads under the jurisdiction of the Oregon Department of Transportation (ODOT), Clackamas and Multnomah counties, the City of Lake Oswego, and the City of Portland. Congestion currently occurs on the corridor's highways, arterials and local streets.

4.1.3.1 Roadway Network

Although the transportation analysis focuses on system performance within the corridor, many of the region's freeways and highways are also affected by travel choices within the study corridor. The regional facilities related to the corridor include: Interstate 5 (I-5), Interstate 405 (I-405), Southeast McLoughlin Boulevard, Southwest Macadam Avenue/ Riverside Drive/ State Street (Highway 43), and Southwest Barbur Boulevard (OR 99W). When facilities such as I-5, Barbur Boulevard and McLoughlin Boulevard experience severe congestion, some overflow traffic is diverted to Highway 43 (Macadam Avenue/ Riverside Drive/State Street).

The roadway performance evaluation focuses on a study area that includes arterial and local streets within the corridor, principally, Highway 43 (Macadam Avenue/ Riverside Drive/State Street) and the streets that intersect this arterial route from Lake Oswego to Portland.


Lake Oswego to Portland
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Streetcar Alternative and Design Options
Figure 4.1-1
SEGMENT 1: Downtown Portland
SEGMENT 2: South Waterfront
SEGMENT 3: Johns Landing
SEGMENT 4: Sellwood Bridge
SEGMENT 5: Dunthorpe/ Riverdale
SEGMENT 6: Lake Oswego
PORTLAND CENTRAL CITY
OHSU
Portland Aerial Tram
Tryon Creek State Natural Area
LAKE OSWEGO
Streetcar Alternative
Streetcar alternative
Streetcar alternative design option
station
possible future
park-and-ride
Streetcar Minimum Operable Segment (MOS)
Transit: existing/planned
Streetcar, existing
Streetcar, under construction/planned
MAX, existing
MAX,planned
Portland Aerial Tram
Railroads
0
0.5
1
Miles
10.22.10

The study area is divided into six segments, as illustrated in Figure 4.1-1. The segments and a brief description of the roadway network to be analyzed are provided below.

Segment 1 – Downtown Portland: (Northwest Portland to Southwest Lowell Street) does not include any roadway network operations analysis. With the Streetcar Alternative the number of streetcars operating on the existing alignment through downtown would increase from 5 to 6 trains per hour during the peak hours. Because there are no changes to the street network, streetcar operates in mixed traffic and does not include any signal priority or preemption in downtown Portland, no intersection analysis was included in this segment.

Segment 2 – South Waterfront: (Southwest Lowell Street to Hamilton Court) includes nine intersections in the roadway network analysis, either on Macadam Avenue (Highway 43) or on other roadways which could be impacted by one of the alternatives.

Segment 3 – Johns Landing: (Southwest Hamilton Court to Miles Street) includes 22 intersections in the roadway network analysis, primarily along Macadam Avenue (Highway 43).

Segment 4 – Sellwood Bridge: (Southwest Miles Street to south end of Powers Marine Park) includes four intersections in the roadway network analysis, all on Macadam Avenue/ Riverside Drive (Highway 43) clustered around the Sellwood Bridge.

Segment 5 – Dunthorpe/Riverdale: (south end of Powers Marine Park to Southwest Briarwood Road) includes ten intersections in the roadway network analysis, primarily along Riverside Drive (Highway 43).

Segment 6 – Lake Oswego: (Southwest Briarwood Road to Lake Oswego Terminus) includes 14 intersections in the roadway network analysis, primarily along State Street (Highway 43).

4.1.3.2 Motor Vehicle Operations

Motor vehicle performance is assessed using a number of different operational measures including volume-to-capacity (V/C) ratio, level of service (LOS) and queuing. The V/C represents a comparison of vehicular demand to available throughput or capacity of an intersection and is the basic performance measure used by ODOT. Delay is used to define the LOS at intersection, which is a measure of operational conditions and how those conditions are perceived by motorists; the City of Portland and City of Lake Oswego use LOS in their performance standards. Queuing occurs as vehicles line up at either a traffic signal while waiting for the light to turn green or a stop or yield sign while waiting for a gap in the traffic flow on the major street. While none of the agencies use queuing as a performance standard, when queues build up between intersections or when they overflow out of a turn lane into the adjacent through lane, they can affect the performance of the surrounding roadway network. Table 4.3-5 displays the V/C ratio or LOS for intersections that would exceed standards in the forecast year. A more detailed explanation of these performance measures can be found in the *Lake Oswego to Portland Transit Project: Transportation Impacts Technical Report*.

The assessment of existing traffic conditions is based primarily on analysis of operations using traffic volumes collected in August 2009. The 2009 traffic volume counts were adjusted in some locations using 2006 traffic counts to account for seasonal fluctuations and a reduction in regional

traffic volumes due to the economic recession during 2009. Year 2009 traffic volumes were calculated at 59 study area intersections. Operational analysis was completed for all intersections in p.m. peak period. The a.m. peak period traffic operations analysis was completed for intersections in Segments 2 (South Waterfront) and 3 (Johns Landing). This DEIS provides a summary of the analysis, more detailed information is available in the *Lake Oswego to Portland Transit Project: Transportation Impacts Technical Report*.

The 59 study area intersections were evaluated to determine V/C and LOS for the p.m. peak hour and 31 intersections were evaluated for the a.m. peak hour[1]. Based on the 2009 data, all of the study area intersections analyzed currently meet ODOT and local jurisdictional standards, with the exception of the unsignalized intersection at the Highway 43 southbound approach to Sellwood Bridge in the p.m. peak hour.

Queuing at the study area intersections was evaluated in segments 2 through 6 to determine: where existing queues build up or spill back from one signalized intersection to another, or where queues overflow out of a turn lane into the adjacent through lane[2]. Locations where queue spillback or overflow would occur are listed in Table 4.1-2.

[1] Traffic operations were evaluated using Synchro, which is based on the *2000 Highway Capacity Manual* methodologies.

[2] Queuing was evaluated using VISSIM peak hour simulation for Segment 2, 3 and 6. Synchro was used for Segment 4 and 5.

Table 4.1-2 Summary of Existing Queue Spillback or Overflow Locations

Intersection Location (Traffic Control)	Queue Spillback or Overflow[1]	
	A.M. Peak Hour Direction[2]	P.M. Peak Hour Direction[2]
Segment 2		
SW Moody Ave/SW Bancroft St		SB Left Turn
SW Macadam Ave (Highway 43)/SW Bancroft St.	WB Left Turn	WB Left Turn
SW Macadam Ave (Highway 43)/SW Hamilton Ct.		WB Left Turn, WB Right Turn
Segment 3		
SW Macadam Ave (Highway 43)/SW Boundary St.		EB Left Turn, WB Left Turn
SW Macadam Ave (Highway 43)/SW Nevada St.	NA	EB Right Turn, WB Approach
SW Macadam Ave (Highway 43)/SW Taylors Ferry Rd.	NA	NB Left Turn
Segment 4		
SW Macadam Ave (Highway 43)/Sellwood Bridge	NA	SB back to Pendleton
Segment 5		
None	NA	NA
Segment 6		
N State St (Highway 43)/A Ave.	NA	EB Left Turn, NB Left Turn
N State St (Highway 43)/Foothills Rd.	NA	WB Approach
S State St (Highway 43)/McVey Ave.	NA	EB Left Turn

Notes:
[1] Queue spillback refers to traffic queues spilling back from one signalized intersection to another. Overflow refers to traffic queues exceeding the capacity of a turn lane and overflowing into the adjacent lane.
[2] Refers to the direction of travel approaching the intersection: NB = northbound, SB = southbound, EB = eastbound, WB = westbound. NA = not analyzed
Source: David Evans and Associates, Inc, 2010.

4.1.4 Freight Facilities and Activities

Highway 43 is not designated as a truck or freight route in the 1999 Oregon Highway Plan and is not approved as a continuous route for oversized freight by the ODOT Permit Unit. Despite its lack of official designation, Highway 43 carries truck traffic. Some carriers use Highway 43 as a route for oversized freight in order to bypass sections of I-5. Truck activity on Highway 43 is generally highest during the midday period, when total traffic levels are lower, but the analysis included in this DEIS is based on the p.m. peak hour which is the most congested period of the day. Truck traffic characteristics by segment are summarized below.

Segment 1 – Downtown Portland: does not include any freight analysis. With the Streetcar Alternative the number of streetcars operating on the existing alignment through downtown would increase from 5 to 6 trains per hour during the peak hours. This change is considered insignificant with regards to freight activities.

Segment 2 – South Waterfront: Truck traffic accounts for 2 to 3 percent of the total daily traffic and 1 to 1.5 percent of the p.m. peak hour traffic along Southwest Macadam Avenue (Highway 43) in this segment. Truck volumes on the other streets within the South Waterfront segment are

less than 2 percent of the total traffic volume. Over-dimensional loads typically use Bancroft Street to access the South Waterfront neighborhood.

Segment 3 – Johns Landing: Truck traffic accounts for 2 to 3 percent of the total daily traffic and 1 to 2 percent of the p.m. peak hour traffic along Macadam Avenue (Highway 43) in this segment. Truck volumes on the other streets within the Johns Landing segment are less than 2 percent of the total traffic volume.

Segment 4 – Sellwood Bridge: North of the Sellwood Bridge, truck traffic accounts for 2 to 3 percent of the total daily traffic and 1 to 2 percent of the p.m. peak hour traffic along Macadam Avenue (Highway 43). South of the Sellwood Bridge, truck percentages are similar to those found north of the bridge.

Segment 5 – Dunthorpe/Riverdale: Truck traffic accounts for 1 to 2 percent of the total daily traffic and 1 to 2 percent of the p.m. peak hour traffic along Riverside Drive (Highway 43) in this segment. Truck volumes on the other streets within this segment are less than 2 percent of the total traffic volume.

Segment 6 – Lake Oswego: Truck traffic accounts for 2 to 3.5 percent of the total daily traffic along State Street (Highway 43). During the p.m. peak hour, trucks account for 1 to 3 percent of total traffic. Cross streets with the highest truck volumes in this segment include A Avenue and Foothills Road.

4.1.5 Bicycle Facilities and Activities

Existing bicycle facilities in the Lake Oswego to Portland corridor include designated bike lanes, the Willamette Greenway Trail and the Tryon Creek State Park Trail. There is currently a gap in north-south bicycle facilities between the Sellwood Bridge and Southwest Terwilliger Boulevard in Lake Oswego. Macadam Avenue/ Riverside Drive (Highway 43) provides the only through north-south route serving the corridor. South of the Sellwood Bridge, Highway 43 includes sections with no shoulders, high traffic volumes and high speeds.

In the northern portion of the corridor Segment 1 – Downtown Portland has traffic signals set for 12 miles per hour which allows bicycles to travel relatively flat sections in the travel lanes with auto traffic. Certain uphill sections (e.g. SW Broadway and SW Jefferson Street) include bicycle facilities. Segment 2 - South Waterfront and Segment 3 - Johns Landing, include several existing bicycle facilities; however, gaps or deficiencies are associated with them. These existing facilities include on-street bike lanes along Moody and Bond avenues and an existing portion of the incomplete Willamette Greenway Trail that meanders near the Willamette River shore line.

Bicycle counts taken at several intersections found fewer than 5 peak hour bicycle trips being taken directly on Highway 43 in Segment 3 - Johns Landing, Segment 4 – Sellwood Bridge and Segment 5 – Dunthorpe/Riverdale. This relatively light usage could be due to safety concerns related to the narrow right of way and high traffic speeds on Highway 43. Bicycle planners have estimated latent demand for commuter and recreational bicycle travel exists in the corridor and suggested

improvements to address existing safety concerns[3]. Bicycle counts taken on the Willamette Greenway Trail south of Willamette Park found daily bicycle volumes of 275 in 2009[4].

4.1.6 Pedestrian Facilities

The existing pedestrian facilities in the Lake Oswego to Portland corridor vary considerably among the study segments. The segment pedestrian environments are summarized below.

Segment 1 - Downtown Portland: includes sidewalks and traffic signals with pedestrian crossings at most intersections. This segment does not include any pedestrian analysis. With the Streetcar Alternative the number of streetcars operating on the existing alignment through downtown would increase from 5 to 6 trains per hour during the peak hours. This change is considered insignificant with regards to pedestrian activities.

Segment 2 – South Waterfront: This segment includes areas that are currently converting from industrial uses to residential uses. North of Southwest Bancroft Street most block faces include existing or new sidewalks. Portions of the Willamette Greenway Trail are being implemented as development occurs, resulting in a discontinuous exclusive trail at this time.

Segment 3 – Johns Landing: West of Macadam Avenue the Johns Landing area is a traditional grid system with sidewalks on all block faces. East of Macadam Avenue, the development pattern is marked by office and condominium developments with private walkways and some public easements. Public pedestrian facilities are the sidewalk on the east side of Macadam Avenue and the Willamette Greenway Trail.

Segment 4 – Sellwood Bridge: Pedestrian facilities in this segment include the Willamette Greenway Trail and a 5-foot sidewalk adjacent to Highway 43 just north of the Sellwood Bridge. South of the bridge is an informal dirt path in Powers Marine Park.

Segment 5 – Dunthorpe/Riverdale: Neighborhood streets in this segment have occasional sidewalks, although many streets have low traffic volumes and low speeds.

Segment 6 – Lake Oswego: Central Lake Oswego west of State Street is a traditional grid pattern with sidewalks. East of State Street pedestrian facilities are limited but would be included in any planned Foothills area redevelopment. The Kincaid Curlicue Trail also provides pedestrian access east of State Street.

4.1.7 Parking

The number of on-street and off-street parking facilities and spaces were assessed for the Segments 2 through 6. Segment characteristics are summarized below.

Segment 1 - Downtown Portland: does not include parking analysis. With the Streetcar Alternative the number of streetcars operating on the existing alignment through downtown would increase from 5 to 6 trains per hour during the peak hours. This change is considered insignificant with regards to parking.

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[3] *Lake Oswego to Portland Transit and Trail Study, Evaluation Summary Public Review Draft, July 12, 2007.*

[4] City of Portland Bicycle Counts, 2009.

Segment 2 – South Waterfront: The majority of the parking in this segment is in private, off-street lots serving adjacent development. This segment has some on-street parking along the streetcar alignment and on the adjacent streets. Most on-street parking in this segment is metered with both short-term and long-term spaces.

Segment 3 – Johns Landing: Although there is no on-street parking directly on Southwest Macadam Avenue (Highway 43), many of the side streets in the Johns Landing neighborhood west of Macadam Avenue permit on-street parking. The area is also served by private, off-street parking lots serving adjacent development. There is one large pay public parking lot within Willamette Park used by boaters and other park users.

Segment 4 – Sellwood Bridge: In this segment there are public parking spaces at the Macadam Bay Club and a limited number of private lots associated with adjacent businesses. On the east side of Southwest Riverside Drive (Highway 43) adjacent to Powers Marine Park there are two wide gravel areas that are used as informal parking for park visitors.

Segment 5 – Dunthorpe/Riverdale: On-street parking is available in limited portions of Riverside Drive (Highway 43) where adequate shoulder is available. There are no public or private parking lots immediately adjacent to Riverside Drive (Highway 43) in this segment.

Segment 6 – Lake Oswego: There is no on-street parking along Riverside Drive or State Street (Highway 43) in this segment. On-street parking is permitted along most streets in downtown Lake Oswego with many areas signed with time restrictions. South of D Avenue, numerous private, off-street parking lots serve adjacent development and public parking is available in the development adjacent to Millennium Park, on the corner of North State Street and A Avenue. East of State Street, there is public parking associated with a public riverfront park and private parking associated with individual businesses and residential properties.

4.2 Transit Impacts

This section presents the effects that project alternatives and options would have on the transit system in the corridor. For more detailed information on transportation impacts see the *Lake Oswego to Portland: Transportation Technical Report*.

The No-Build Alternative represents the service characteristics of the 2035 financially constrained transit network associated with the 2035 Regional Transportation Plan (Metro) (see Figure 4.2-1) without the proposed transit investment in the corridor. The corridor's bus network would vary by alternative, but would not be affected by the Streetcar design options under consideration. See Figures 4.2-2 and 4.2-3 for the Enhanced Bus and Streetcar alternatives transit networks. The transit analysis includes a distinction in Segment 3 Johns Landing between the Willamette Shore Line design option and the two design options that would operate in Southwest Macadam Avenue (Macadam Additional Lane and Macadam In-Street design options). The Macadam In-Street design option would include the streetcar operating in mixed traffic in the existing outside lanes of Macadam Avenue between Carolina Street and Boundary Street. The Macadam Additional Lane design option would include a third northbound lane between Carolina Street and Boundary Street with streetcar operating in mixed traffic. See Chapter 2, Section 2.1 for a detailed description of the alternatives and design options.

4.2.1 Amount of Service

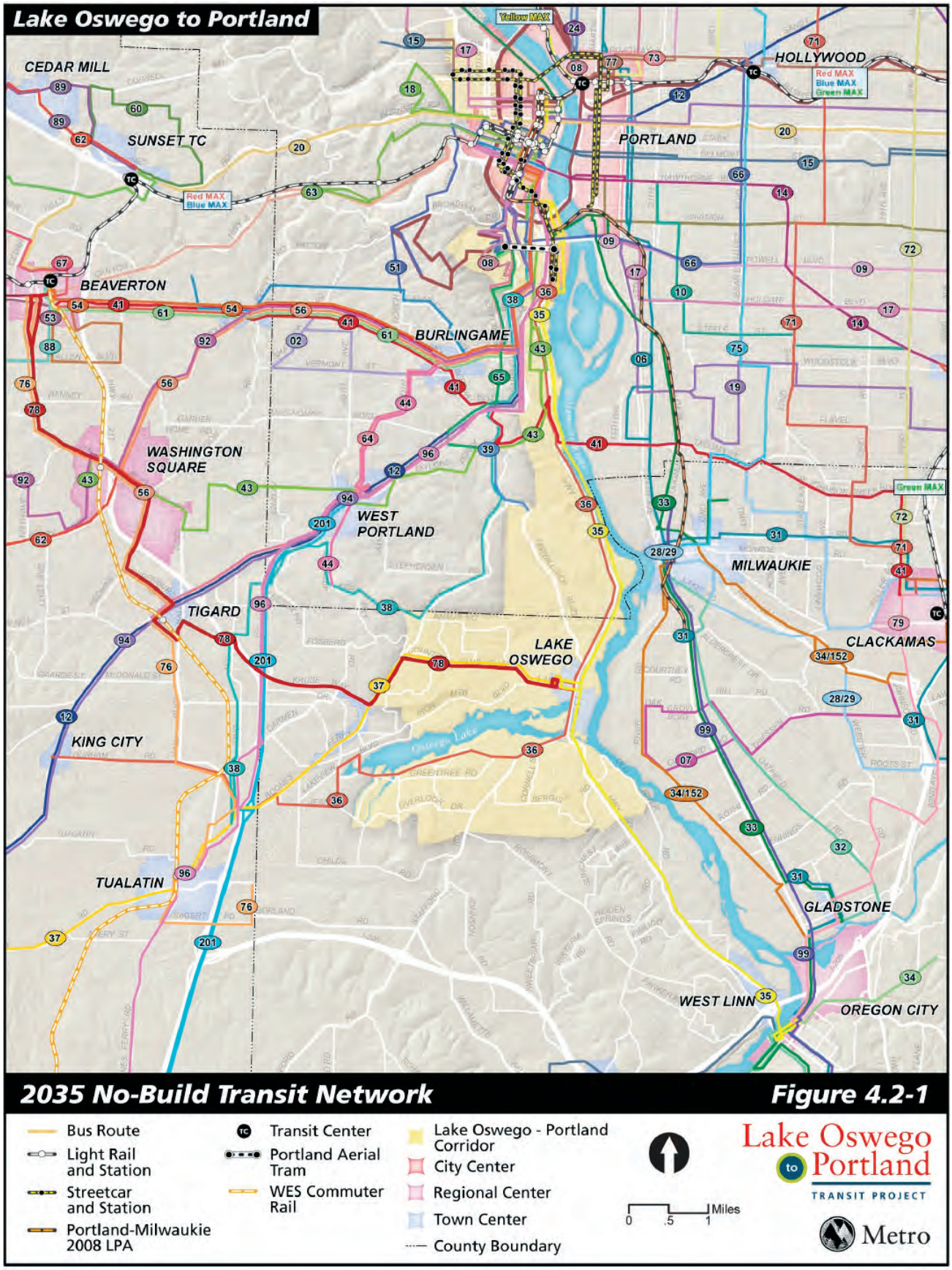
The amount of transit service provided is measured by daily transit vehicle hours traveled (VHT) in revenue service, daily transit vehicle miles traveled (VMT) in revenue service, and daily place-miles of service. Daily VHT are the cumulative time that transit vehicles are in service and daily VMT are the distance they travel, independent of the size of the vehicle. Daily is defined as an average weekday in the year 2035. Place-miles refers to the total carrying capacity (seated and standing) of each bus or train type and is calculated by multiplying the vehicle capacity of each bus or light rail vehicle type by the daily VMT for each vehicle type. Place-miles highlight differences between alternatives caused by a different mix of vehicle types and levels of service. Table 4.2-1 summarizes these transit service characteristics.

Table 4.2-1 Average Weekday Corridor[1] Transit Service Characteristics, Year 2035

			Streetcar[2]	
	No-Build	Enhanced Bus	Willamette Shore Line	Macadam Avenue design options
Transit VMT				
Bus	3,160	3,780	2,400	2,400
Streetcar[2]	320	320	1,300	1,330
Total	3,480	4,100	3,700	3,730
Percent Change	N/A	18%	6%	7%
Transit VHT				
Bus	200	240	140	140
Streetcar[2]	30	30	80	90
Total	230	270	220	230
Percent Change	N/A	17%	-4%	0%
Place Miles				
Bus	161,160	192,780	122,400	122,400
Streetcar[2]	29,440	29,440	119,600	122,360
Total	190,600	222,220	242,000	244,760
Percent Change	N/A	17%	27%	28%

Source: Metro, 2010.
Note: VMT = vehicle miles traveled; VHT = vehicle hours traveled; N/A = not applicable.
[1] Excludes downtown Portland and NW Portland.
[2] Streetcar data is from the RiverPlace Station south to Lake Oswego. In the 2005 base year the streetcar did not travel south of the RiverPlace Station. There would be differences in transit service characteristics for the Streetcar Alternative design options in Segment 3 Johns Landing. No other design options include differences in transit service characteristics.

The Enhanced Bus Alternative would increase the corridor transit VMT by 18 percent, the corridor transit VHT by 17 percent and the corridor place miles by 17 percent compared with the No-Build Alternative. The Streetcar Alternative would increase the corridor transit VMT by 37 percent (Macadam Avenue design options) and 46 percent (Willamette Shore Line design option). Although the Streetcar Alternative (with all design options) would provide more frequent service in the corridor than the No-Build Alternative bus (lines 35 and 36), it would result in less transit VHT than the No-Build Alternative because the new streetcar would connect to existing streetcar at Lowell Street, replacing the No-Build Alternative bus lines that extend through downtown to Union Station. Conversely, the transit VHT for the Enhanced Bus Alternative would increase over the No-Build Alternative because it would provide more frequent service but would also be routed to Union Station. The Streetcar Alternative would include the largest increase in place miles, with a 27 percent (Willamette Shore Line design option) to 28 percent (Macadam Avenue design options) increase over the No-Build Alternative.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CEDAR MILL
SUNSET TC
BEAVERTON
WASHINGTON SQUARE
TIGARD
KING CITY
TUALATIN
BURLINGAME
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LAKE OSWEGO
PORTLAND
HOLLYWOOD
MILWAUKIE
CLACKAMAS
GLADSTONE
WEST LINN
OREGON CITY
Red MAX
Blue MAX
Green MAX
Yellow MAX
2035 No-Build Transit Network
Figure 4.2-1
Bus Route
Light Rail and Station
Streetcar and Station
Portland-Milwaukie 2008 LPA
Transit Center
Portland Aerial Tram
WES Commuter Rail
Lake Oswego - Portland Corridor
City Center
Regional Center
Town Center
County Boundary
Miles
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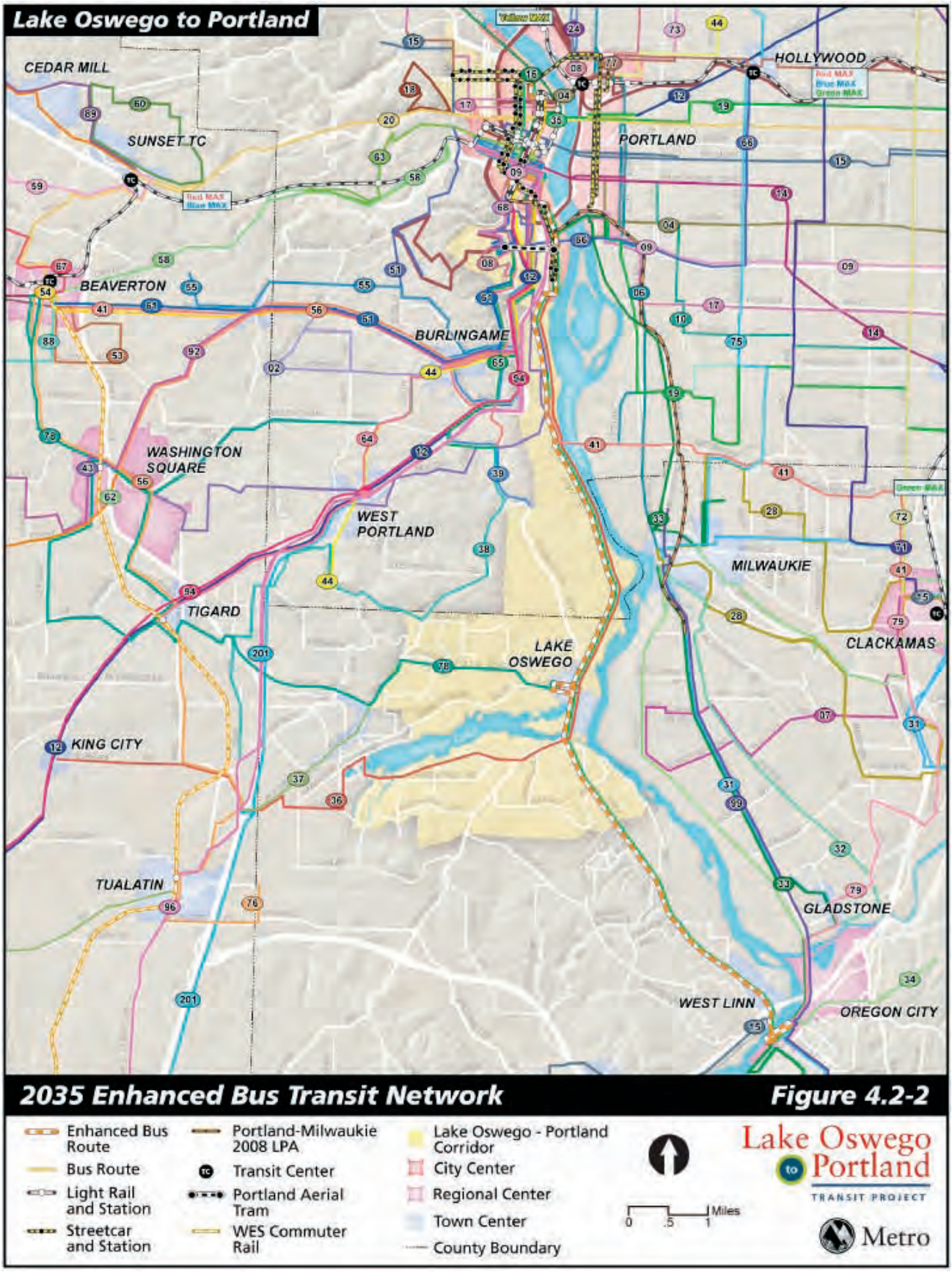
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MILWAUKIE
LAKE OSWEGO
CLACKAMAS
GLADSTONE
WEST LINN
OREGON CITY
2035 Enhanced Bus Transit Network
Figure 4.2-2
Enhanced Bus Route
Bus Route
Light Rail and Station
Streetcar and Station
Portland-Milwaukie 2008 LPA
Transit Center
Portland Aerial Tram
WES Commuter Rail
Lake Oswego - Portland Corridor
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Regional Center
Town Center
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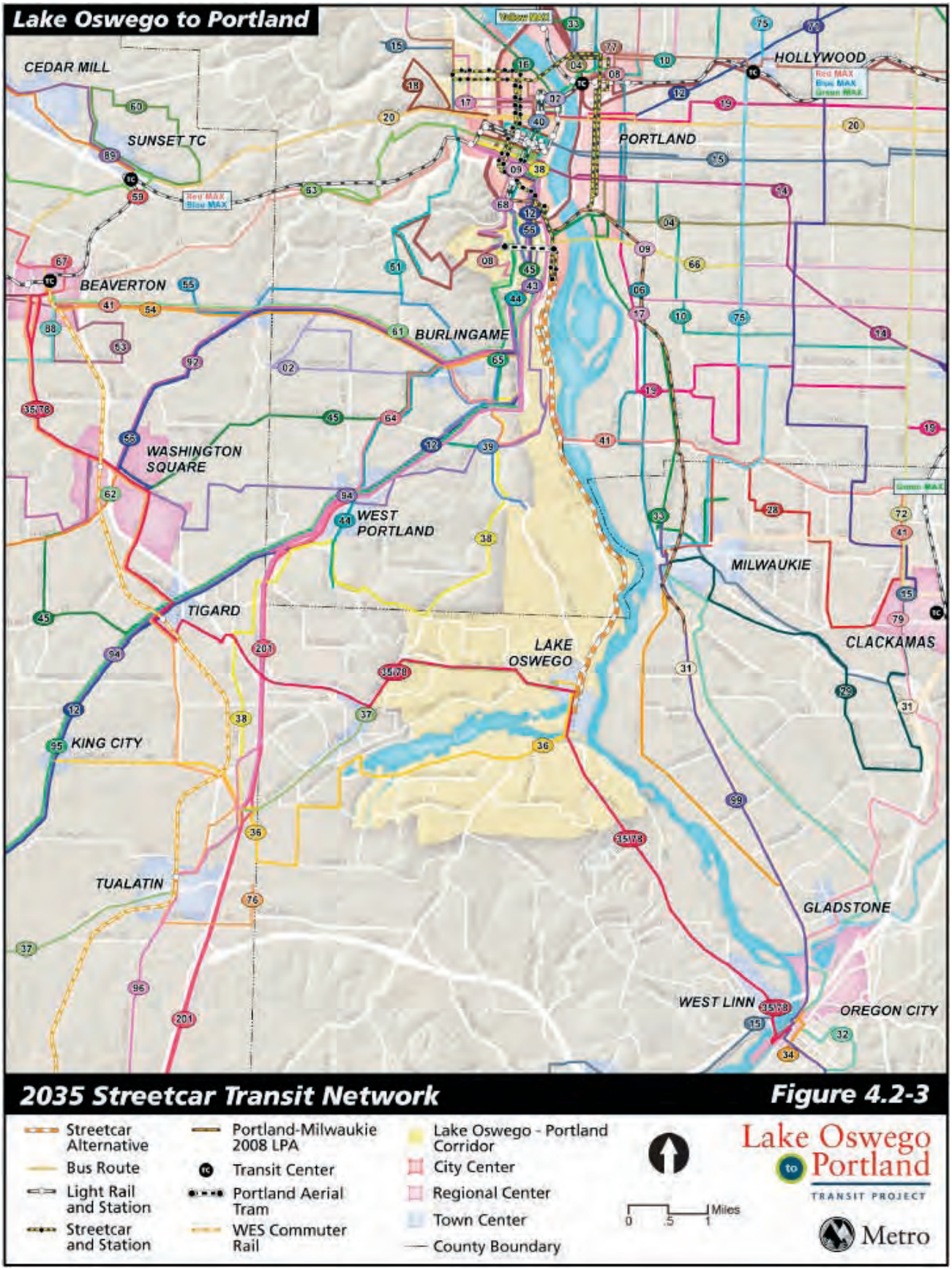
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OREGON CITY
2035 Streetcar Transit Network
Figure 4.2-3
Streetcar Alternative
Bus Route
Light Rail and Station
Streetcar and Station
Portland-Milwaukie 2008 LPA
Transit Center
Portland Aerial Tram
WES Commuter Rail
Lake Oswego - Portland Corridor
City Center
Regional Center
Town Center
County Boundary
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TRANSIT PROJECT
Metro

4.2.2 Service Growth

Service growth under the No-Build Alternative would be constrained by available revenue sources, consistent with the Financially Constrained transit network in the 2035 RTP. With the No-Build Alternative, weekday corridor transit VMT and VHT would increase compared to existing levels by 41 and 53 percent, respectively. The greater percentage increase in VHT compared to VMT indicates that transit speeds in the corridor would slow relative to existing conditions due to increasingly congested and slowing traffic on highways, arterials and local streets. The build alternatives would result in increased transit capacity in the corridor and a level of service similar to the No-Build Alternative outside of the corridor.

The Enhanced Bus Alternative would operate between the Oregon City Transit Center and downtown Portland. South of Lake Oswego, service would be similar to the existing Line 35 Macadam. Modifications to existing service would occur north of Lake Oswego, including limited stop service to improve travel times in the corridor. A new park-and-ride lot at the Lake Oswego Terminus would be constructed under the Streetcar Alternative and the Enhanced Bus Alternative. A second, smaller park and ride location would be constructed at the B Avenue station under the Streetcar Alternative only.

The Streetcar Alternative would result in an approximately 5.9 to 6.0 mile extension of the existing Portland Streetcar line from Southwest Lowell Street in South Waterfront to downtown Lake Oswego. Streetcars would operate every 7.5 minutes along the extension in the peak direction to meet projected demand during the peak period. The bus feeder network would be reconfigured to provide connectivity with streetcar stations and transit centers. Bus service that would be parallel to and duplicative of the proposed Streetcar alignment would be eliminated[5] (see Section 2.2.3.2 for details).

4.2.3 Travel Time

Transit travel times are assessed using in-vehicle time and total travel time, as shown in Table 4.2-2. This table summarizes the change in p.m. peak hour in-vehicle and total travel time between the No-Build, Enhanced Bus and Streetcar alternatives. Transit in-vehicle travel times would be reduced under the Enhanced Bus Alternative by three minutes between Southwest Lowell Street and downtown Lake Oswego, compared to the No-Build Alternative; and transit in-vehicle travel times would be reduced by 9 to 14 minutes under the Streetcar Alternative, compared to the No-Build Alternative. Under the Streetcar Alternative, the Willamette Shore Line design option in Segment 3 – Johns Landing would reduce transit travel times between corridor destinations by approximately four minutes, compared to the two Macadam Avenue design options.

4.2.4 Reliability

Table 4.2-3 summarizes three measures of transit reliability in the corridor: miles of separated right of way, the number of passenger miles that would occur on that separated right of way, and the percentage of corridor passenger miles that would occur in separated right of way. In the TriMet system, transit lines, which use reserved or separated right of way, exhibit a greater proportion of on-time arrivals than lines operating in mixed traffic. Transit service that would utilize little or no reserved right of way would be subject to traffic congestion and delay which would typically result

[5] During project implementation, TriMet would determine the final bus operations plan to support streetcar service in the corridor.

in worse on-time performance. Neither the No-Build Alternative nor the Enhanced Bus Alternative includes portions of exclusive guideway, queue jumps or signal priority. These strategies were considered during the Alternatives Analysis phase and were not included in the Enhanced Bus Alternative due to the length of queues and resulting right of way impacts in the most congested portions of Highway 43.

Table 4.2-2 Transit and Auto Average Weekday P.M. Peak Hour Travel Times to Lake Oswego from Selected Locations (in minutes, year 2035)

					Streetcar[1]			
	No-Build		Enhanced Bus		Willamette Shore Line		Macadam Avenue Design Options	
Origin/Destination	**Auto**	**Transit**	**Auto**	**Transit**	**Auto**	**Transit**	**Auto**	**Transit**
In-Vehicle Travel Time[2]								
To Lake Oswego from:								
Portland State University	28	42	28	39	27	29	27	33
SW Lowell Street	22	32	22	29	22	18	22	22
Total Travel Time[3]								
To Lake Oswego from:								
Portland State University	33	53	33	48	32	38	32	42
SW Lowell Street	27	43	27	37	27	27	27	31

Source: Metro, 2010.
[1] Except in Segment 3 – Johns Landing, there would be no difference in transit travel times for the Streetcar Alternative by design option. This table presents the differences in Segment 3 due to either of the two Macadam Avenue design options (i.e. Macadam Additional Lane and Macadam In-Street) and the Willamette Shore Line Design Option.
[2] In minutes; in-vehicle time is the time that a passenger would spend within a public transit vehicle or an automobile.
[3] In minutes; total travel time includes walk access times at the start and end of a trip, in-vehicle time and wait time, if any.

Table 4.2-3 Measures of Transit Reliability in the Corridor, Year 2035[1, 2]

			Streetcar[3]	
Rail Right of way Measure	**No-Build**	**Enhanced Bus**	**Willamette Shore Line**	**Macadam Avenue design options**
Miles of Separated or Exclusive ROW[4]	0	0	4.8	4.0
Average Weekday Passenger Miles in Exclusive ROW[5]	0	0	39,700	32,500
Percent of Total Corridor Passenger Miles	0%	0%	71%	60%

Source: Metro, 2010.
Note: ROW = right of way.
[1] Some streetcar sections would provide an exclusive grade and/or barrier-separated transit right of way.
[2] Excludes Portland CBD and NW Portland districts to isolate transit lines that primarily serve the corridor.
[3] Except in Segment 3 – Johns Landing, there would be no difference in transit reliability measures for the Streetcar Alternative by design option. This table presents the differences in Segment 3 due to either of the two Macadam Avenue design options (i.e. Macadam In-Street and Macadam Additional Lane) and the Willamette Shore Line Design Option.
[4] Miles of Separated or Exclusive ROW based on Streetcar Alternative as modeled. The model assumed either Macadam or Willamette Shore Line design options in Segment 3, Willamette Shore Line in Segments 4 and 5 and Foothills Design Option in Segment 6.
[5] Rail right of way in the corridor would also be provided by the Milwaukie Light Rail Project for all alternatives. This measure considers only additional rail in exclusive right of way provided by the Lake Oswego to Portland Transit Project.

The Enhanced Bus Alternative would result in no additional passenger miles in separated right of way in the corridor compared to the No-Build Alternative. The Streetcar Alternative includes 4 miles of separated right of way and 32,500 separated right of way passenger miles for the Macadam In-Street/Macadam Additional Lane design options and 4.8 miles of separated right of way or 39,700 separated right of way passenger miles for the Willamette Shore Line design option. Of the average weekday streetcar passenger miles in the corridor in 2035 (excluding passenger miles on the Milwaukie light rail), approximately 60 and 71 percent of transit passenger miles would be in

separated or exclusive right of way with the Streetcar Alternative for the Macadam In-Street and Macadam Additional Lane design options or the Willamette Shore Line design option, respectively.

4.2.5 Transit Ridership

This section summarizes transit ridership data including: line boardings and peak load points for specific lines, corridor and total transit system ridership, work and non-work transit trips, transit mode share and Lake Oswego to Portland Streetcar and Enhanced Bus station boardings.

The transit ridership forecasts for the No-Build, Enhanced Bus and Streetcar alternatives summarized in this section were prepared using Metro's regional travel demand model for average weekdays in 2035. In Segment 3 – Johns Landing, the streetcar travel times and station locations would be similar with the Macadam In-Street and Macadam Additional Lane design options. The streetcar travel times and station locations with the Willamette Shore Line design option would be substantially different than the Macadam design options and would result in differences in overall streetcar ridership. The design options in all other segments would have similar streetcar travel times and station locations and there would be no difference in overall streetcar ridership due to those design options. Differences in transit ridership due to the design options in Segment 3 for the Streetcar Alternative are presented within this section.

- **Lake Oswego to Portland Line Ridership.** Table 4.2-4 summarizes average weekday boardings for corridor streetcar and bus lines in each alternative (bus lines 35, 36, 43 and 78), including the corridor boardings between Lake Oswego and Southwest Bancroft Street. In summary, the Enhanced Bus Alternative would produce a total of 19,980 daily boardings among these transit lines. In comparison, the Streetcar Alternative would result in 23,600 streetcar and bus boardings with the Willamette Shore Line design option and 23,110 streetcar and bus boardings with the Macadam Avenue design option. With the No-Build Alternative, the frequency of service assumed for the Line 35 Macadam would not be adequate to accommodate the forecast boardings. The corridor transit service assumed in each of the three build alternatives, however, was sized to accommodate the forecast demand.
- **Corridor and Total System-wide Ridership.** Table 4.2-5 and Figure 4.2-4 show that the total average daily transit ridership in the corridor would increase over the No-Build Alternative by 1,800 with the Enhanced Bus Alternative and by 3,100to 3,400 with the Streetcar Alternative. Total transit ridership in the system would increase over the No-Build Alternative by 2,400 with the Enhanced Bus Alternative and by 3,600 to 3,900 with the Streetcar Alternative. The increase in ridership outside the corridor with the Streetcar Alternative is due to the ability to through-route the southern portion of Line 35 with Line 78, thus providing a through transit connection between Oregon City Transit Center and Beaverton Transit Center.
- **Transit Trip Productions.** Transit trip productions refers to the number of transit trips that would be generated or "produced" under the various alternatives, both within the corridor and in the region. Increases in the number of transit trips produced would primarily be due to reductions in transit travel time and improved transit accessibility with the proposed streetcar line and bus line modifications. Reductions in transit trip productions would occur in areas where bus line modifications would result in loss of access to transit or access to less frequent transit. In summary, the Enhanced Bus Alternative would result in an increase of approximately 2,020 transit trips produced in the corridor and an additional 360 transit trips produced outside of the corridor. The Streetcar Alternative (Willamette Shore Line design option) would result in an increase of approximately 3,130 transit trips produced in the corridor and an additional 750 transit

trips produced outside of the corridor, compared to the No-Build Alternative. The Streetcar Alternative with the Macadam In-Street and Macadam Additional Lane design options would result in increases of 2,970 trips generated within the corridor and 620 generated outside of the corridor.

Table 4.2-4 Average Weekday Boarding Rides and Peak Loads for Corridor Transit Routes[1,2], Year 2035

			Streetcar	
Segment	**No-Build**	**Enhanced Bus**	**Willamette Shore Line**	**Macadam Avenue design options**
Streetcar				
Lake Oswego to Portland Streetcar (SW Bancroft St to Lake Oswego)	N/A	N/A	**11,930**	**11,170**
Bus				
35 Macadam (SW Bancroft St to Lake Oswego)	**8,590**	N/A	N/A	N/A
35 Enhanced Bus (SW Bancroft St to Lake Oswego)	N/A	**9,810**	N/A	N/A
36 King City to Lake Oswego	600	1,070	1,230	1,200
36 King City to Portland	1,310	N/A	N/A	N/A
3578 Beaverton to Oregon City	N/A	N/A	8,110	8,060
43 Washington Square to Portland	2,590	2,550	2,330	2,680
78 Beaverton to Lake Oswego	6,500	6,550	N/A	N/A
Bus Total	**19,590**	**19,980**	**11,670**	**11,940**
Total Boardings	**19,590**	**19,980**	**23,600**	**23,110**
P.M. Peak Hour, Peak-Direction, Peak Load Point[2]				
Portland Streetcar	554	652	N/A	N/A
Lake Oswego to Portland Streetcar	N/A	N/A	974	932
35 Macadam (LO to Union Station)	460	N/A	N/A	N/A
35 Enhanced Bus (LO to Union Station)	N/A	724	N/A	N/A

Source: Metro, 2010

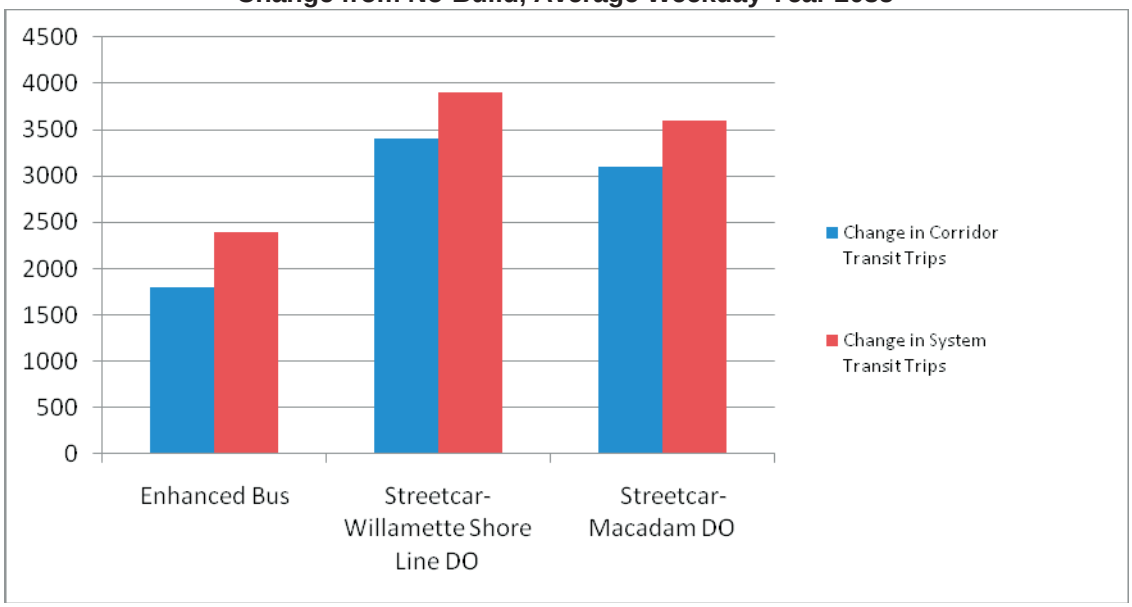
[1] Corridor boarding rides are per line. Linked trips include two boardings if the passenger transfers from one transit line to another line.
[2] Boardings for No-Build and Enhanced Bus 35, and LO to Portland Streetcar are restricted to the segment between Lake Oswego and SW Bancroft Street for comparative purposes.
[3] The peak-load points for each line would be in the following locations: Portland Streetcar -- north of W Burnside St.; Lake Oswego to Portland Streetcar -- north of Lowell St.; Streetcar Loop -- south of NE Holladay St.; 35 Macadam -- north of Lowell St.; 35 Enhanced Bus -- north of Lowell St.

Table 4.2-5 Average Weekday Total Systemwide and Corridor Transit Ridership[1], Year 2035

Ridership area	Existing (2005)	No-Build	Enhanced Bus	Streetcar[2]	
				Willamette Shore Line	Macadam Avenue design options
Total Corridor Transit Trips	103,600	231,900	233,700	235, 300	235,000
Change from Existing	N/A	128,300	130,100	131,700	131,400
Change from No-Build	N/A	N/A	1,800	3,400	3,200
Total Systemwide Transit Trips[2]	**267,300**	**583,800**	**586,200**	**587,700**	**587,400**

Source: Metro, 2010.
Note: N/A = not applicable
[1] Ridership is measured in person trips, which are also termed originating rides (i.e. one-way linked trips from an origin (e.g., home) to a destination (e.g., place of work or school), independent of whether the trip requires a transfer. A person traveling from home to work and back counts as two trips. Total corridor transit trips include all streetcar, bus, and light rail trips produced in or attracted to the Lake Oswego-Portland corridor. Excludes intra-Portland CBD and intra-NW Portland trips and trips between the Portland CBD and Northwest Portland (districts 1 and 2; see Figure 1.2-1).
[2] The design options in Segment 3 – Johns Landing would be the only design options that would result in a difference in Streetcar Alternative total corridor transit trips and total systemwide transit trips. This table presents the differences in Segment 3 due to either of the two Macadam design options (i.e. Macadam Additional Lane and Macadam In-Street) and the Willamette Shore Line design option.

Figure 4.2-4
Enhanced Bus and Streetcar Alternative Corridor and System Transit Trips[1]
Change from No-Build, Average Weekday Year 2035



[1] Transit trips are one-way linked trips from an origin (e.g., home) to a destination (e.g., place of work or school), independent of whether the trip requires a transfer. A person traveling from home to work and back counts as two trips. Total corridor transit trips include all light rail, bus and streetcar trips produced in or attracted to the corridor. Intra-CBD trips are not included.
[2] Except in Segment 3 – Johns Landing, there would be no difference in transit ridership for the Streetcar Alternative by design option. This table presents the differences in Segment 3 due to either of the two Macadam design options (i.e. Macadam Additional Lane and Macadam In-Street) and the Willamette Shore Line Design Option.
Source: Metro, 2010 – see Table 4.2-5 for the illustrated data.

- **Work and Non-Work Transit Trips and Mode Share.** Table 4.2-6 shows projected transit trips and transit mode share for trips produced in the corridor that would be destined to Portland's central business district (CBD) for work and non-work purposes. The CBD is projected to have 147,830 jobs in 2035, accounting for 63 percent of the jobs in the Corridor. The build alternatives

would induce higher transit mode shares for home-based work trips between the corridor and Portland CBD, compared to the No-Build Alternative.

- **Station Usage.** Table 4.2-7 summarizes individual station use for the Enhanced Bus and the Streetcar alternatives with the Macadam In-Street and Macadam Additional Lane and the Willamette Shore Line design options. With the Enhanced Bus alternative, the highest level of on/off activity would be at Albertsons, accounting for 16 percent of boardings and alightings between Lake Oswego and Southwest Lowell Street. With the Streetcar Alternative (under all design options), the most heavily used station along the streetcar extension would be the B Avenue station in downtown Lake Oswego. The B Avenue station would account for 29 percent of the streetcar boardings and alightings with all streetcar options.

Table 4.2-6 Average Weekday Work and Non-Work Transit Trips and Transit Mode Share Between the Corridor and Portland CBD, Year 2035

				Streetcar	
Trip Purpose	**Existing (2005)**	**No-Build**	**Enhanced Bus**	**Willamette Shore Line**	**Macadam Avenue design options**
Home-Based Work[1]					
Transit	940	5,860	6,380	6,920	6,860
Transit Mode Share	20%	43%	45%	49%	49%
Non-Work[2]					
Transit	1,760	9,500	9,890	9,880	9,880
Transit Mode Share	6%	14%	14%	14%	14%
Total					
Transit	2,700	15,360	16,270	16,740	16,800
Transit Mode Share	8%	19%	19%	20%	20%

Source: Metro, 2010.
Note: LRT = Light Rail Transit; N/A = not applicable.
[1] Home-based work trips are defined as trips taken directly from one's home to one's place of work.
[2] Non-work trips are defined as all trips that are not home-based work trips.

Table 4.2-7 Average Weekday Station Usage (Ons and Offs), Year 2035

			Streetcar			
	Enhanced Bus		Willamette Shore Line		Macadam Avenue design options	
Station	Station Ons/Offs	% of Total Ons/Offs	Station Ons/Offs	% of Total Ons/Offs	Station Ons/Offs	% of Total Ons/Offs
Hamilton Ct	275	3%	622	5%	583	5%
Boundary / Macadam	2,118	22%	0	0%	2,281	18%
Boundary (Shoreline)	0	0%	2,429	18%	0	0%
Carolina / Macadam	1,938	20%	0	0%	2,049	16%
Nebraska (Shoreline)	0	0%	2,178	16%	0	0%
Nevada	734	8%	755	6%	707	6%
Sellwood Bridge	116	1%	407	3%	365	3%
Riverwood Rd	136	1%	201	1%	197	2%
Briarwood Rd	62	1%	92	1%	86	1%
B Avenue	1,229	13%	3,868	29%	3,684	29%
Other Downtown LO stops (Enhanced Bus)	1,559	16%	0	0%	0	0%
Albertson's Station / P&R	1,578	16%	3,003	22%	2,832	22%
Total Station Ons/Offs	**9,745**		**13,555**		**12,784**	

Source: Metro, 2010.

4.3 Effects on the Regional, Corridor and Local Roadways

This section presents the impacts to the regional and corridor highway and street network that would result from the project's alternatives and design options.

4.3.1 System-Wide Effects

This section addresses how the project's alternatives would affect overall transportation system demand and performance using three measures: 1) vehicle miles traveled (VMT); 2) vehicle hours traveled (VHT); and 3) vehicle hours of delay (VHD) (see Table 4.3-1). In summary, the Streetcar Alternative would reduce average weekday VMT, VHT and VHD by 68,000 miles, 5,700 hours and 400 hours, respectively, compared to the No-Build Alternative, while the Enhance Bus Alternative would reduce average weekday VMT, VHT and VHD by 41,000 miles, 3,300 hours and 200 hours, respectively, compared to the No-Build Alternative.

Average weekday peak period, peak direction vehicle volumes across three corridor screen lines in 2035 are summarized in Table 4.3-2 for the No-Build, Enhanced Bus and Streetcar alternatives. In summary, the Streetcar Alternative would reduce screen line volumes by approximately 100 vehicles in the peak direction during the two-hour peak period, compared to the No-Build Alternative, while the Enhanced Bus Alternative would not decrease screen line volumes.

Table 4.3-1 Average Weekday Regional VMT, VHT and VHD, Year 2035

System-Wide Measure	No-Build	Enhanced Bus	Streetcar[1]
VMT[2]	63,076,000	63,035,000	63,008,000
VMT Change from No-Build	N/A	-41,000	-68,000
VHT[2]	2,371,800	2,368,500	2,366,100
VHT Change from No-Build	N/A	-3,300	-5,700
VHD[3]	49,400	49,200	49,000
VHD Change from No-Build	N/A	-200	-400

Source: Metro, 2010.
Note: VMT = vehicle miles traveled; VHT = vehicle hours traveled; VHD = vehicle hours of delay.
[1] Based on Willamette Shore Line Design Option. With the Macadam In-Street and Macadam Additional Lane design options VMT would be 63,010,600, VHT would be 2,366,400, VHD would be 49,000.
[2] Based on average weekday conditions in 2035 on freeways, arterials and collector streets.
[3] Based on average weekday p.m. peak hour conditions in 2035 on freeways, arterials, and collector streets.

Table 4.3-2 Average Weekday Two Hour PM Peak Period, Peak Direction Corridor Screen Line Volumes, Year 2035

Screen line Location	No-Build	Enhanced Bus	Streetcar
SW Macadam Ave (Highway 43) and Parallel Streets in Johns Landing[1]	5,600	5,600	5,500
Change from No-Build	N/A	0	-100
N State St (Highway 43) north of Lake Oswego	6,200	6,200	6,100
Change from No-Build	N/A	0	-100
S State St (Highway 43) south of Lake Oswego	7,100	7,100	7,100
Change from No-Build	N/A	0	0

Source: Metro, 2010.[1] Screen line includes SW Macadam Avenue and SW Corbett Avenue at SW Pendleton Street.

4.3.2 Corridor and Local Roadways

This section addresses the long-term direct effects that the project's alternatives would have in 2035 on corridor and local roadways. In addition to standard intersection operations (LOS and V/C ratio), this section also addresses queuing and signal warrants. This section is organized by the corridor segments; note that traffic in Segment 1 – Downtown Portland was not analyzed for this study because there would be no changes to roadway facilities or operation within that segment under any alternative. A more detailed analysis of motor vehicle operations can be found in the *Lake Oswego to Portland Transit Project: Transportation Technical Report.*

Standards for Considering Mitigation

Potential mitigation measures are identified in this section when specific criteria would be met. Mitigation criteria are based on level of service (LOS), volume to capacity (V/C) ratio, queuing, signal warrants and turn lane criteria. The need for turn lanes or traffic signals is based on turn lane criteria and traffic signal warrants in the ODOT Analysis Procedures Manual. Criteria for mitigation of intersection operations on Highway 43 that are below standards would follow the ODOT Transportation Planning Rule and Oregon Highway Plan guidelines, and are dependent on whether the No-Build Alternative would meet applicable V/C ratio standards. If the No-Build Alternative would meet operational standards, then the Enhanced Bus and Streetcar alternatives must meet the same operational standards or potential mitigation measures are identified. If the No-Build Alternative would not meet operational standards, then the Enhanced Bus and Streetcar alternatives must not cause the intersection to perform worse than the with the No-Build Alternative or potential mitigation measures are identified. For the cities of Portland and Lake Oswego, the compliance

standard is measured by overall intersection LOS. However, all but one intersection impact would occur at intersections with Highway 43 where the ODOT standards would apply.

Mitigation for queuing is identified for locations where traffic queues from one intersection would back up through another signalized intersection under the Enhanced Bus or Streetcar alternatives, while under the No-Build Alternative queues at that intersection would not backup to another intersection. Warrants for proposed signals and for left and right turn lanes were evaluated for all alternatives.

Impacts and Potential Mitigation

Table 4.3-3 identifies locations on an average weekday in 2035 along Highway 43 where queue spillback or overflow would occur under the No-Build Alternative. Queue spillback refers to traffic queues spilling back from one signalized intersection to another. Overflow refers to traffic queues exceeding the capacity of a turn lane and overflowing into the adjacent lane. Table 4.3-4 identifies locations where queues with the build alternatives would exceed those in the No-Build Alternative. In summary, queue spillback and overflow would occur from 31 corridor intersections under the No-Build Alternative, compared to 10 corridor intersections under existing conditions (see Table 4.1-2). Compared to the No-Build Alternative, the project's alternatives and design options would generally not result in an increase in queue spillback at corridor intersections, except potentially in Segment 6, which is discussed below.

Table 4.3-5 summarizes average weekday levels of congestion (i.e., V/C ratio or LOS with average delay) in 2035 at signalized intersections in the corridor under the No-Build, Enhanced Bus and Streetcar alternatives, in relationship to the applicable ODOT standard for the intersections (except for Southwest Landing Drive and Hamilton Court, which is under the jurisdiction of the City of Portland). The intersections included in the table are only those that would operate at congested levels under the No-Build Alternative, based on the jurisdictional standard. In summary, all of the intersections would see the same level or slightly reduced congestion under the Enhanced Bus and Streetcar alternatives (compared to the No-Build Alternative) in segments 2, 4 and 5. In no instances would the reduction in congestion result in an intersection meeting the jurisdictional standard. In segments 3 and 6, congestion levels at most of the intersections would also remain unchanged or become slightly reduced under the Enhanced Bus and Streetcar alternatives (compared to the No-Build Alternative) except for five intersections, which are discussed below. The primary cause of the slight reduction in congestion at most of the corridor intersections would be the reduction of vehicle volumes on Highway 43 as a result of some automobile users shifting to transit, responding to improved transit travel times and access under the Enhanced Bus and Streetcar alternatives, compared to the No-Build Alternative.

In Segment 3, the intersection at Southwest Macadam Avenue and Carolina Street would require the installation of a traffic signal with the Macadam In-Street and Macadam Additional Lane design options of the Streetcar Alternative (which would not be required under the Willamette Shore Line design option or the Enhanced Bus Alternative). With a new traffic signal, the intersection of Macadam Avenue and Carolina Street would have operations exceeding the jurisdictional standard in 2035 (1.26 V/C during the AM peak hour, compared to the standard of 0.99 V/C). However, this level of congestion would be similar to or better than at other intersections in the surrounding street network. The signal at the intersection at Macadam Avenue and Boundary Street would require modification to accommodate the In-Street and Additional Lane Alternatives. The modified signal

Table 4.3-3 Summary of Corridor No-Build Alternative Queue Spillback or Overflow Average Weekday, 2035

Segment/Intersection	Queue Spillback or Overflow[1] AM Peak Hour Direction[2]	PM Peak Hour Direction[2]
Segment 2		
Highway 43/SW Hamilton St	SB Left Turn	WB Left Turn
Highway 43/SW Hamilton Ct	NB, WB Left Turn	NB, SB, WB Left Turn
SW Moody Ave/SW Hamilton St		EB
SW Landing Drive/SW Hamilton Ct		NB
Segment 3		
Highway 43/SW Richardson Ct	EB	EB
Highway 43/SW Mitchell St		EB
Highway 43/SW Boundary St	NB, NB Left Turn, EB Left Turn	SB past Bancroft, NB, NB Left Turn, EB Left Turn, WB Left Turn
Highway 43/SW Sweeney St		EB
Highway 43/SW Flower St		EB
Highway 43/SW Pendleton St	NB	NB
Highway 43/SW Iowa St	EB, WB	EB, WB
Highway 43/SW Carolina St	EB, WB	
Highway 43/SW Nebraska St	NB, SB	SB
Highway 43/SW Idaho St		EB
Highway 43/SW Vermont St		EB, WB
Highway 43/SW California St		EB
Highway 43/SW Nevada St		SB
Highway 43/SW Taylors Ferry Rd		SB, NB Left turn, EB Right Turn
Segment 4		
Highway 43/Sellwood Bridge	NA	SB Left Turn past Pendleton
Highway 43/Riverview Cemetery	NA	SB on Highway 43 and from Sellwood Bridge
Segment 5		
Highway 43 and SW Radcliff Road	NA	EB
Highway 43 and SW Riverdale Road	NA	NB
Highway 43 and SW Riverwood Road	NA	WB
Highway 43 and SW Military Road	NA	NB
Highway 43 and SW Greenwood Road	NA	SB
Highway 43 and SW Midvale Road	NA	SB
Highway 43 and SW Brianwood Road	NA	SB
Segment 6		
B AveLeftHighway 43/A Ave	NA	SB, EB Left Turn
Highway 43/Foothills Rd	NA	SB, SB Left Turn, WB Left Turn
Highway 43/North Shore Rd	NA	NB Left Turn, NB, SB, EB, WB, WB Left Turn
Highway 43/McVey Ave	NA	SB, NB, EB Left Turn

Note: NB = northbound; SB = southbound; EB = eastbound; WB = westbound; NA = not analyzed.
[1] Queue spillback refers to traffic queues spilling back from one signalized intersection to another. Overflow refers to traffic queues exceeding the capacity of a turn lane and overflowing into the adjacent lane.
[2] Refers to the through movement direction of travel approaching the intersection, unless otherwise noted.
Source: David Evans and Associates, Inc, 2010. Queuing was evaluated using Synchro for all segments

Table 4.3-4 Queue Spillback or Overflow for the Enhanced Bus and Streetcar Alternatives, Average Weekday, 2035

		Project Queuing Impact[2]		
			Streetcar	
Segment/Time Period[1]/Intersection	No-Build	Enhanced Bus	Willamette Shore Line	Macadam Avenue Design Options[3]
Segment 3 - *PM Peak Hour*				
SW Macadam Ave/SW Boundary St	SB past Bancroft, NB, NB Left Turn, EB Left Turn, WB Left Turn	**EB Left Turn**	**NB Left Turn, EB Left Turn**	**EB Left Turn, WB, WB Left Turn**
SW Macadam Ave/SW Carolina St			No Impact	**NB, SB**
Segment 3 - *AM Peak Hour*				
SW Macadam Ave/SW Boundary St	NB, NB Left Turn, EB Left Turn	No Impact	**EB Left Turn**	**EB Left Turn**
SW Macadam Ave/SW Carolina St	EB, WB	No Impact	No Impact	**NB**
Segment 6 - *PM Peak Hour*				
N/S State St/North Shore Rd	NB Left Turn, NB, SB, EB, WB	**NB Left Turn, NB, EB**	**NB Left Turn, NB, WB**	**NB Left Turn, NB, WB**
S State St/Middlecrest Rd/Wilbur St	SB	**SB**	**SB**	**SB**
S State St/McVey Ave/Green St	SB, NB, EB Left Turn	**SB, NB**	**SB, NB**	**SB, NB**

Note: Bolded values indicate a project impact as defined by the mitigation criteria. NB = northbound; SB = southbound; EB = eastbound; WB = westbound; NA = not analyzed. The direction refers to the through movement direction of travel approaching the intersection, unless otherwise noted.

[1] Unless noted, all intersections were analyzed for PM peak period conditions.

[2] Queuing Impact indicates increased queue spillback and/or overflow compared to the No-Build Alternative. Queue spillback refers to traffic queues spilling back from one signalized intersection to another. Overflow refers to traffic queues exceeding the capacity of a turn lane and overflowing into the adjacent lane. Generally a through movement refers to queue spillback and turn movements refer overflow.

[3] Queuing findings apply to both the Macadam In-Street and Macadam Additional Lane design options.

As noted previously, there would be no increase in congestion levels in Segment 4 due to the Enhanced Bus or Streetcar alternatives, compared to the No-Build Alternative. In Segment 5 the Riverwood In-Street design option of the Streetcar Alternative would close the existing intersection of Riverside Drive (Highway 43) and Riverwood Road to all vehicular traffic, which would require all vehicles to access the neighborhood east of Riverside Drive via Military Road. This closure would redirect vehicles to Military Road, however the additional vehicles would not change the overall intersection V/C ratio or LOS. The additional left-turning vehicles would increase southbound queuing at Military Road. The traffic volume increase would not result in queue spillback to upstream intersections or queues spilling out of a turn lane because there is no southbound left-turn lane on Highway 43 at Military Road. The slight increased frequency of left-turning vehicles on Highway 43 at Military Road could result in an increased potential for rear-end accidents. Although it would not meet specific mitigation criteria, consideration should be given to adding an exclusive southbound left turn pocket at Military Road with this design option.

In Segment 6, the 300-space structured park-and-ride lot at the Lake Oswego Village Shopping would generate additional traffic during the average weekday p.m. peak period in 2035 under the Enhanced Bus and the Streetcar alternatives, which would result in a slight increase in V/C ratios and the potential for increased queuing spillback and overflow at three intersections along State Street. There would also be some increased queuing on Foothills Road due to streetcar operations.

Table 4.3-5 Corridor Intersection V/C and LOS for the No-Build, Enhanced Bus and Streetcar Alternatives, Average Weekday, 2035

Segment/Time Period[1]/Intersection	Standard[2]	Alternative			Project Impact
		No-Build	Enhanced Bus	Streetcar[3]	
Segment 2					
PM Peak Hour					
SW Macadam Ave/SW Hamilton Ct	0.99	1.10	1.08	1.07	
SW Landing Dr/SW Hamilton Ct[2]	LOS E	LOS F (103 sec)	LOS F (100 sec)	LOS F (95 sec)	
AM Peak Hour					
SW Macadam Ave/SW Hamilton Ct	0.99	1.21	1.21	1.20	
Segment 3					
PM Peak Hour					
SW Macadam Ave/SW Boundary St	0.99	1.45	1.45	1.45 / 1.32 / 1.32[4]	
SW Macadam Ave/SW Pendleton St	0.99	1.06	1.05	1.04 / 1.05 / 1.05[4]	
SW Macadam Ave/SW Carolina St	0.99	1.99[5]	1.81[5]	1.58[5] / **1.11** / **1.11**[4]	**Yes**
SW Macadam Ave/SW Nevada St	0.99	1.00	0.99	0.98 / 0.98 / 0.98[4]	
SW Macadam Ave/SW Taylors Ferry Rd/SW Miles St	0.99	1.29	1.28	1.27	
AM Peak Hour					
SW Macadam Ave/SW Boundary St	0.99	1.32	1.31	1.30 / 1.26 / 1.27[4]	
SW Macadam Ave/SW Pendleton St	0.99	1.09	1.08	1.06	
SW Macadam Ave/SW Carolina St	0.99	>2.00[5]	>2.00[5]	>2.00[5]/ **1.26** / **1.26**[4]	**Yes**
SW Macadam Ave/SW Nebraska St	0.99	1.35	1.32	1.32	
Segment 4					
Existing Intersection Configuration					
SW Riverside Dr/Sellwood Bridge[5]	0.99	1.59	1.59	1.59	
SW Riverside Dr/Riverview Cemetery	0.99	1.54	1.52	1.50	
Future Interchange Configuration					
SW Riverside Dr/Sellwood Bridge[5]	0.99	1.20	1.20	1.19	
Segment 5					
SW Riverside Dr/SW Military Rd	0.99	1.20	1.17	1.13	
SW Riverside Dr/SW Greenwood Rd/ SW Breyman Ave	0.99	1.35	1.34	1.31	
SW Riverside Dr/SW Midvale Rd/SW Elk Rock Rd	0.99	1.34	1.32	1.31	
SW Riverside Dr/Briarwood Rd	0.99	1.40	1.38	1.36	
Segment 6					
N State St/ B Ave	1.10	1.32	1.31	1.30	
N State St/A Ave	1.10	1.95	1.94	1.92	
N State St/Foothills Rd	1.10	1.30	1.29	1.27	
N/S State St/North Shore Rd	1.10	1.91	**1.96**	1.89	**Yes**
S State St/Middlecrest Rd/Wilbur St	1.10	1.30	**1.32**	**1.32**	**Yes**
S State St/McVey Ave/Green St	1.10	1.15	**1.17**	**1.17**	**Yes**

Note: **Bolded values indicate a project impact as defined by the mitigation criteria** (any worsening of V/C ratio when intersection performance does not meet operational standards of ODOT intersections). LOS = level of service; V/C = volume-to-capacity.
[1] Unless noted, all intersections were analyzed for p.m. peak period conditions.
[2] Except for the intersection at SW Landing Drive and SW Hamilton Court, the applicable standard for the intersection is based on V/C ratio because those intersections are under the jurisdiction of ODOT; for the intersection at SW Landing Drive and SW Hamilton Court, the City of Portland's LOS standard applies (including the length of time in seconds of delay, which is noted).
[3] Unless noted, the V/C or LOS/delay applies to all Streetcar Alternative design options in the segment for that intersection.
[4] V/Cs are for the Willamette Shore Line, Macadam In-Street and Macadam Additional Lane design options, respectively.
[5] Unsignalized intersection highest stop controlled approach V/C ratio (Westbound approach in a.m. Eastbound in p.m.)
Source: David Evans and Associates, Inc, 2010.

The three intersections with increased V/C ratios and potential for queuing on Highway 43 are at North Shore Road, Middlecrest Road/Wilbur Street and McVey Avenue/Green Street. At Highway 43 and North Shore Road, the V/C ratio would increase from 1.91 under the No-Build Alternative to 1.96 under the Enhanced Bus Alternative (and declining to 1.89 under both Streetcar design options). Potential mitigation at Highway 43 and North Shore Road would be the addition of an eastbound left-turn lane, which would reduce the intersection's V/C ratio to 1.83.

At Highway 43 and Middlecrest Road/Wilbur Street and at Highway 43 and McVey Avenue/Green Street, the No-Build Alternative V/C ratios of 1.30 and 1.15, respectively, would increase to 1.32 and 1.17 under the Enhanced Bus Alternative and both Streetcar design options, respectively. A potential mitigation measure at Highway 43 and Middlecrest Road/Wilbur Street is changing the signal phasing to provide permitted/protected northbound and southbound left-turn phases which reduces the intersection's V/C ratio to 1.25. At Highway 43 and McVey Avenue/Green Street, a potential mitigation measure of closing the intersection's westbound approach (with alternate access provided via Ladd and Wilbur streets) reduces the intersection's V/C ratio to 0.99.

4.4 Effects on Freight Movement

The Enhanced Bus and Streetcar alternatives would have little effect on freight operations, except at those locations within the study area where there would be effects to motor vehicle operations, as discussed in Section 4.2.3. No restrictions to truck movements would occur with the Enhanced Bus Alternative. No restrictions to truck movements would occur with the Streetcar Alternative. However, the Macadam design options could require raising the catenary wires to their maximum height of 20.5 feet where the wires cross Macadam Avenue at Boundary and Carolina streets in order to accommodate oversized loads that sometimes utilize Macadam Avenue to bypass I-5.

4.5 Effects on Bicycle and Pedestrian Facilities

This section provides a summary of the effects that the project's alternatives and options would have on bicycle and pedestrian facilities and behavior. More detailed information may be found in the *Lake Oswego to Portland Transit Project: Transportation Impacts Technical Report.*

Because the No-Build Alternative would not construct any transit capital improvement projects in the corridor, it would result in no direct impacts to bicycle or pedestrian infrastructure. Compared to the No-Build Alternative, there would be no changes to corridor's bicycle and pedestrian infrastructure under the Enhanced Bus Alternative, except for new bike facilities and sidewalks associated with the 300-space structured park-and-ride lot in the vicinity of Albertsons.

Table 4.5-1 summarizes the effects that the Streetcar Alternative would have on existing or funded bicycle facilities within the corridor. Along certain streets where existing or planned bike lanes would parallel the tracks, this alternative would intentionally avoid the bike facilities by running in the far left-hand lane (Southwest Bond Avenue south of Lowell Street). The majority of the remaining bicycle facilities would cross the tracks in a generally perpendicular and safe manner.

Following is a brief description, by segment, of the changes to bicycle and pedestrian facilities that would result from the Streetcar Alternative. In addition to the changes associated with existing or funded bicycle and pedestrian facilities, the Streetcar Alternative, with the Macadam In-Street and Macadam Additional Lane design options in Segment 3 – Johns Landing, could limit the ability to implement a future bike improvement on Macadam Avenue as identified in the Portland Bicycle

Table 4.5-1 Summary of Impacts of Streetcar Alternative on Existing or Funded Bicycle/Pedestrian Facilities, By Segment and Design Option

Location	Facility Type	Direction	Extent of Facility in Proximity to Project	Design Considerations
Segment 1 – Downtown Portland				
None				
Segment 2 – South Waterfront[1]				
SW Moody	On-Street Bike Lane	SB	SW Lowell - SW Bancroft	Parallel; separation at station; perpendicular crossing; box left turn
SW Bond	On-Street Bike Lane	NB	SW Bancroft - SW Lowell	Bike lane on right side of street opposite streetcar tracks
SW Bond (new street)	New connection to existing Greenway Trail	EB/WB	Willamette Shore Line - Willamette Greenway Trail	Interim connection; near perpendicular crossing
Willamette Greenway Trail	Existing bike path	NB/SB	SW Bancroft - SW Moody	Extend and formalize multi-use path
Segment 3 – Johns Landing: Willamette Shore Line Design Option				
Willamette Greenway Trail	Existing/funded bike/ pedestrian path	NB/SB	SW Hamilton Ct - SW Miles Ct	Crossing improvements
Segment 3 – Johns Landing: Macadam Additional Lane Design Option				
Willamette Greenway Trail	Existing/funded bike/ pedestrian path	NB/SB	SW Hamilton Ct - SW Miles Pl	Parallel facilities; WSL right of way could potentially be used for future bike path
Segment 3 – Johns Landing: Macadam In-Street Design Option				
Willamette Greenway Trail	Existing/funded bike/pedestrian path	NB/SB	SW Hamilton Ct - SW Miles Pl	Parallel facilities; WSL right of way could potentially be used for future bike path
Segment 4 – Sellwood Bridge[1]				
Sellwood Bridge Replacement Project	Funded bike/ pedestrian facilities	EB/WB	Highway 43 - SE Grand Av	Connection with new bridge bike/pedestrian facilities
Powers Marine Park	New overcrossing connection to Powers Marine Park	EB/WB	Highway 43 - Powers Marine Park	New connection; grade-separated
Segments 5 and 6				
Kincaid Curlicue Corridor	Local Trail/Pathway	EB/WB	Foothills Road – Roehr Park	New connection

Source: City of Portland, City of Lake Oswego URS: March 2010
Notes: EB = eastbound, WB = westbound, NB = northbound, SB = southbound. Additional details of the crossings of the Willamette Shore Line right of way are noted in the track crossings table on page CS-020 of the *LOPT Transit Project Streetcar Plan Set*, November 9, 2009. Sidewalks are provided on many streets and bicycle travel is allowed on all streets in the study area.
[1] The South Waterfront and Sellwood Bridge Segments contain potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

Plan for 2030 (adopted in February 2010). Bicycle parking facilities would be provided at the new streetcar stations.

Similarly, in the Lake Oswego to Portland corridor, Metro and the cities of Lake Oswego and Portland show a potential regional bike or trail facility along Macadam Avenue, Highway 43 and the Willamette Shore Line right of way. Though the Streetcar Alternative may operate along portions of Macadam Avenue and/or the Willamette Shore Line right of way, the Streetcar Alternative would not preclude the implementation of a future regional bike/trail facility in the corridor.

Segment 1 – Downtown Portland: There would be no changes to existing or planned bicycle or pedestrian facilities in Segment 1. While a new rail connection between the existing tracks would be installed along Southwest 10th Avenue and Market Street, the connection would not interfere with any existing or planned bike routes or facilities.

Segment 2 – South Waterfront: In Segment 2, the Streetcar Alternative would extend the existing streetcar/bike facility pattern and design strategies already established in the district by the streetcar and other transportation projects. For example, as shown in the Figure 4.5-1, the new southbound streetcar station at Bancroft would position the on-street bike lane between the station platform and the sidewalk and be graded-separated from the platform. Along Bond Avenue, the alternative would position the northbound streetcar tracks in the left-hand lane to avoid the right-hand side bicycle lane. The existing bicycle/pedestrian path along the Willamette Shore Line right of way would be maintained or improved in this segment and access to the existing portion of the Willamette Greenway Trail would be maintained.

Figure 4.5-1
Bike lane at the SW Moody – Gaines station.

Segment 3 – Johns Landing: In Segment 3, the Willamette Shore Line Design Option would change two existing bicycle and pedestrian crossings of the trackway. First, a bike/pedestrian "z-crossing" would be installed where an existing asphalt concrete pathway currently provides a direct crossing of the trackway near Richardson Street. Second, the current grade-separated bike/pedestrian crossing below the Jones Trestle between Sweeney and Flower streets would be replaced with an at-grade crossing in roughly the same location.

With the Macadam In-Street and the Macadam Additional Lane design options, no additional bicycle or pedestrian facilities are currently proposed. However, the Willamette Shore Line right of way between Boundary and Carolina could be improved by others and establish part of a regional bike facility that would parallel the existing, more meandering Willamette Greenway Trail to the east.

With either of the two Macadam design options, relocation of curbs associated with the reconstruction of Macadam Avenue would trigger the need to comply with the Oregon Highway Plan, the Oregon Bicycle and Pedestrian Plan (ODOT, June 1995) and the provisions of Oregon

Revised Statute (ORS) 366.514, also known as the "Bike Bill." [6] Where the project realigns the position of roadway curbs, the project would need to provide bike facilities, provide appropriate width for future bike facilities or provide a suitable, alternate parallel bike facility. In the Macadam In-Street design option, the curb realignment is limited to the intersection of Macadam Avenue and Carolina. With the Macadam Additional Lane design option, the curb realignment is limited to the intersection of Macadam Avenue and Carolina and the eastern curb of Macadam Avenue from SW Carolina to SW Boundary (associated with the new northbound streetcar lane). See the *Lake Oswego to Portland Transit Project Land Use and Planning Technical Report* for a discussion of these policies.

Segment 4 – Sellwood Bridge:Segment 4 would include the addition of a second track at several existing bike/pedestrian crossings and a new bicycle and pedestrian overcrossing of the Willamette Shore Line right of way, which would be located near the south end of the City of Portland's Powers Marine Park, connecting the now informal trails of the park to Highway 43. Other trail improvement projects could lead to new bicycle and pedestrian trails in this segment, which could be facilitated through coordination of design efforts for the streetcar and trail projects. For example, Multnomah County's Sellwood Bridge Replacement Project includes proposed changes to bicycle and pedestrian access to local streets and Metro's Lake Oswego to Portland Trail Project is examining options for trails within this segment.

Segment 5 – Dunthorpe/Riverdale: In Segment 5, the Streetcar Alternative would affect local bicycle and pedestrian access by changing the frequency of rail vehicle use of the existing rail right of way at street crossings and access ways to private residences and to a privately-owned boating facility. Figure 4.5-2 illustrates an example of an existing pedestrian crossing and the Streetcar Alternative Plan Set provides a list of the location of all existing private pedestrian crossings in this segment and how they would be changed under the Streetcar Alternatives' design options. In summary, the number of private accesses crossing the existing rail right of way would decrease if the Riverwood In-Street design option were selected in this segment. Additionally, new sidewalks and bicycle facilities would be included in the design of the new Riverwood Road. However, the new Riverwood Road would no longer have direct access to Riverside Drive (Highway 43); access to the highway would be provided via Military Road.

Figure 4.5-2
Existing Private Residence Pedestrian Crossing of Willamette Shore Line right of way in Segment 5

Segment 6 – Lake Oswego: In Segment 6, the Streetcar Alternative would provide a new bicycle and pedestrian connection under the existing Union Pacific Railroad (UPRR) freight tracks north and east of Terwilliger Boulevard. This new crossing, which would occur under both design options for

[6] http://www.oregon.gov/ODOT/HWY/BIKEPED/bike_bill.shtml

this segment, would connect Fielding Road and Stampher Road, which is not possible under existing conditions. In addition, both design options would create new sidewalks and bike facilities along the new or re-aligned roadways that are part of each option within the segment south from the crossing of the freight rail line to the Lake Oswego terminus. Other changes for pedestrians would include new or enlarged sidewalks near streetcar station platforms that would facilitate access to the stations.

In the Foothills design option, the Streetcar Alternative would intersect a local bicycle/ pedestrian pathway known as the Kincaid Curlicue Corridor along the realigned Foothills Road. This design option would provide a new connection between this pathway and new bike and pedestrian facilities along Foothills Road.

Additionally, both design options would create new sidewalks and bike facilities along the new or re-aligned roadways that are part of each option within the segment south from the crossing of the freight rail line to the Lake Oswego terminus. Other changes for pedestrians would include new or enlarged sidewalks near streetcar station platforms that would facilitate access to the stations.

4.6 Parking

This section discusses potential impacts that the project's alternatives and options would have on on-street and off-street parking. A more detailed description can be found in the *Lake Oswego to Portland Transit Project Transportation Technical Report.*

Neither the No-Build Alternative nor the Enhanced Bus Alternative would affect the supply of on or off-street parking in the corridor (except that the Enhanced Bus Alternative would result in the construction of the 300-space structured park-and-ride lot at the Lake Oswego Village Shopping Center).

Under the Streetcar Alternative, Segment 3 is the only segment that would have a loss of parking spaces (in Segment 6, the Streetcar Alternative would result in the construction of a 100-space surface park-and-ride lot and a 300-space structured park-and-ride lot). Table 4.6-1 shows the potential loss of off-street and gain in on-street parking spaces in Segment 3 that would result from the various Streetcar Alternative design options. In summary, several privately-owned parking lots along Southwest Landing Drive would lose parking spaces under the Macadam In-Street and Macadam Additional Lane design options, due to property acquisitions to provide additional project right of way. There would be a loss of 166 and 193 spaces under the Macadam In-Street and Macadam Additional Lane design options, respectively. Both of these design options would include the addition of 18 on-street parking spaces along Landing Drive. Potential mitigation to offset some of the off-street parking loss could include reconfiguring affected parking lots to maximize the use of the remaining parking spaces. The Willamette Shore Line design option would not result in any loss of off-street parking spaces or gain in on-street parking spaces in Segment 3.

Table 4.6-1 Potential Change in Parking Spaces for Segment 3 – Johns Landing By Alternative and Streetcar Design Option

			Streetcar		
Parking Type	**No-Build**	**Enhanced Bus**	**Macadam In-Street**	**Macadam Additional Lane**	**Willamette Shore Line**
Off-Street Parking	0	0	-166	-193	0
On-Street Parking	0	0	18	18	0
Net Parking Loss	**0**	**0**	**148**	**175**	**0**

Source: David Evans and Associates, Inc (2010).

Another potential affect that the Streetcar Alternative would have on parking in Segment 3 would occur at the Willamette Sailing Club. Although there will be no loss of parking at the club, sailboats are often rigged in the parking lots west of the existing Willamette Shore Line right of way and then brought across the tracks to be launched from the sailing club property. Under all three Streetcar Alternative design options, sailboats would need to be rigged on the Willamette Sailing Club property east of the rail line because the clearance under the catenary would be approximately 18 feet which is too low to move even the smallest rigged sailboats.

Unauthorized parking (parking within a neighborhood or a downtown area when not destined to that area) as a result of the introduction of streetcar stations would not be an issue along the majority of the alignment. However, in the Johns Landing area there could be increased potential for unauthorized parking for automobile users seeking to access the proposed streetcar station. If this type of activity is identified as a problem by the adjacent neighborhoods, TriMet would work with the local jurisdictions and neighborhood residents to assist in the evaluation of the problem and the development of potential feasible solutions.

4.7 Cumulative and Indirect Impacts

The cumulative impacts associated with the Enhanced Bus or Streetcar alternatives are taken into account through the use of regional travel forecasting models. The regional models use population and employment growth forecasts and include planned and funded transportation projects throughout the region. The models encompass the entire Portland metropolitan area, including Washington, Clackamas and Multnomah counties in Oregon and Clark County, Washington. The models account for the cumulative effect that the planned projects would have within the study corridor and the models found that there were only very minor changes in traffic volumes and transit ridership in areas outside of the study corridor.

In certain instances the potential population and employment growth and redevelopment in the corridor could be considered to be an indirect impact of the planned transit improvements. However, the regional growth forecast used in the travel models already includes aggressive assumptions regarding the potential for redevelopment in the corridor. The growth forecast includes an assumption of transit-supportive, mixed use development in the north portion of Segment 3 – Johns Landing and in the Foothills portion of Segment 6 – Lake Oswego. The traffic and transit ridership consequences of this growth is captured in the travel demand models and is included in this chapter under the discussion of direct effects of the project alternatives.

The transit networks developed for modeling the Enhanced Bus and Streetcar alternatives make assumptions regarding modifications to the supporting bus system. As with previous rail transit projects in the region, the final decisions on bus system modifications occur later in the project planning phase and are developed in conjunction with the local community and the TriMet Board. A possible indirect impact of the Enhanced Bus and Streetcar alternatives could be other bus route modifications that could include changes in routing and bus stop locations.

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