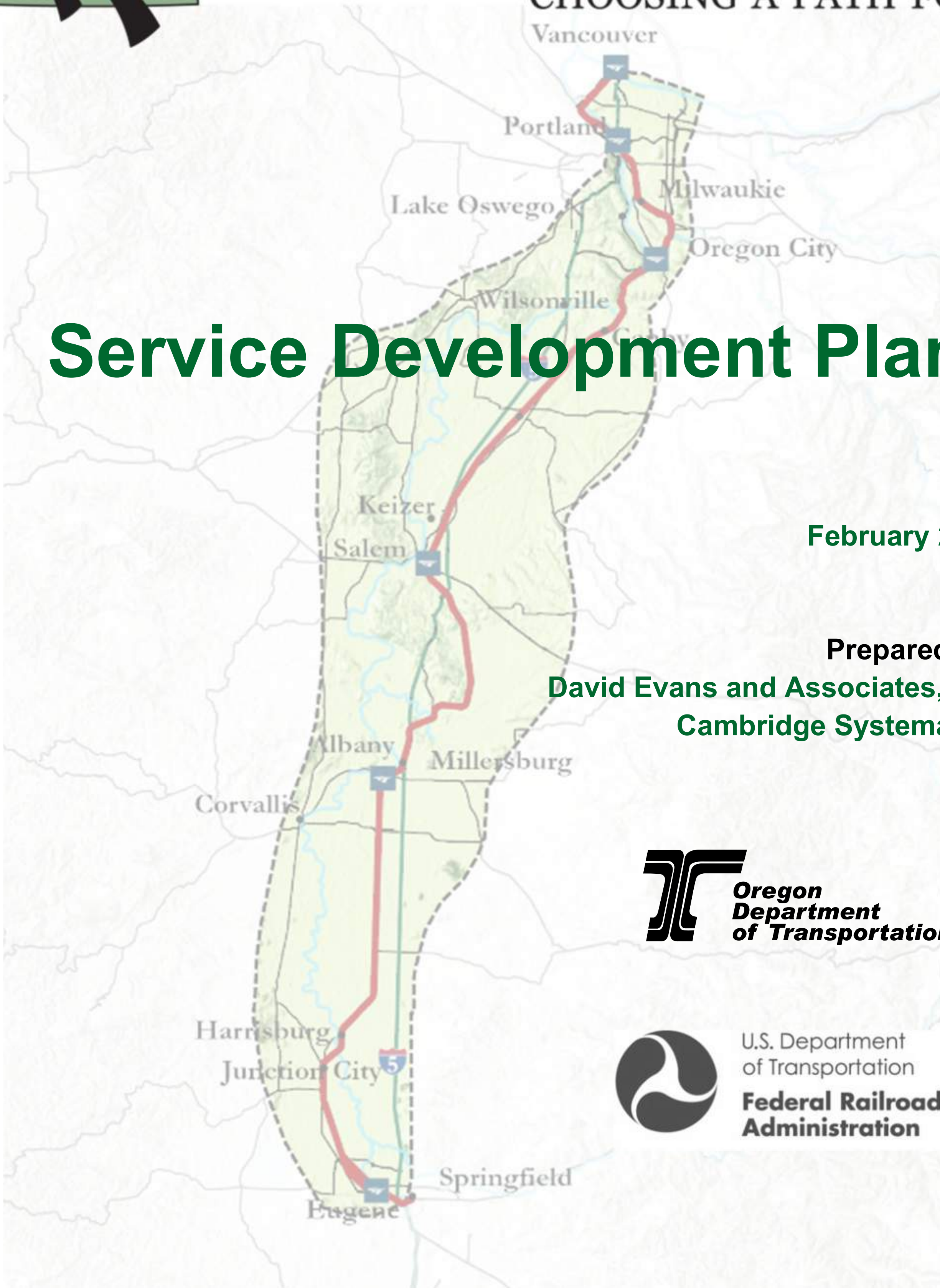
Oregon Passenger Rail

Eugene - Portland

CHOOSING A PATH FORWARD

Service Development Plan



February 2021

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INTRODUCTION

The Oregon Passenger Rail Service Development Plan (SDP) lays out the overall scope and approach for expansion of intercity passenger rail service between Eugene and Portland, Oregon, over the next 20 years. This SDP builds off the Oregon Department of Transportation (ODOT) State Rail Plan (2020) and *Oregon Passenger Rail Tier 1 Draft Environmental Impact Statement* (Tier 1 DEIS) to significantly increase passenger rail service in the region, with up to six daily round-trip trains connecting communities within the Willamette Valley and to cities in Washington state and Vancouver, British Columbia (BC).

Highlights from each of the ten chapters in the SDP follow.

<u>Background</u>

The Pacific Northwest Rail Corridor (PNWRC) has been the subject of intercity passenger rail planning, development and operation for more than 30 years. The PNWRC is one of 11 federally designated high-speed rail corridors in the U.S. The Federal Railroad Administration (FRA) designated this passenger rail corridor on October 20, 1992, as one of five original corridors called for in the Intermodal Surface Transportation Efficiency Act of 1991. The FRA classifies the PNWRC as a *Regional Express Corridor*.

Figure ES-1 Pacific Northwest Rail Corridor

As illustrated in **Figure ES-1**, the PNWRC serves the most densely populated regions of British Columbia, Washington and Oregon. It links Vancouver, BC, Seattle, Washington, and Portland and Eugene, Oregon, with growing intermediate communities (including the capital cities of Salem, Oregon, and Olympia, Washington). BNSF Railway (BNSF) owns the existing PNWRC railroad infrastructure in Washington, in British Columbia, and in Oregon north of Portland's Union Station. Union Pacific Railroad (UPRR) owns the existing PNWRC railroad infrastructure in Oregon south of Portland's Union Station. A mix of freight and passenger trains (operated by BNSF, UPRR, Portland Terminal Railroad, Central Oregon & Pacific Railroad (CORP), Portland & Western Railroad (PNWR), and Amtrak) currently utilize BNSF and UPRR trackage that also serves as the PNWRC.

Intercity Passenger Rail Service in Oregon

> **Chapter 1** of the **Service Development Plan** includes the introduction of the Oregon Passenger Rail Project, and a summary of the OPR Project's Purpose and Need. Chapter 1 also includes a summary of the OPR Project's Goals and Objectives, which were used to evaluate alternatives and select the Preferred Alternative in the Tier 1 DEIS.

In September 2011, ODOT received $4.2 million in federal grants from the High-Speed Intercity Passenger Rail (HSIPR) Program to continue planning efforts aimed at improving passenger rail service on the Oregon segment of the PNWRC. This funding, along with $5.8 million from ODOT, was used to prepare the *Oregon Passenger Rail Tier 1 Draft Environmental Impact Statement* (Tier 1 DEIS).

Current intercity passenger rail service in Oregon includes two Amtrak Cascades train round trips per day. In Oregon, the Amtrak Cascades station stops include Eugene, Albany, Salem, Oregon City and Portland, and the Amtrak Cascades route continues north through Washington to Vancouver, BC. In addition to the Amtrak Cascades service, Amtrak operates one daily round-trip of the Coast Starlight between Los Angeles and Seattle, and one daily round trip of the Empire Builder between Portland and Chicago. In Oregon, the Coast Starlight stops in Klamath Falls, Chemult, Eugene, Albany, Salem and Portland. Portland is the only stop for the Empire Builder in Oregon.

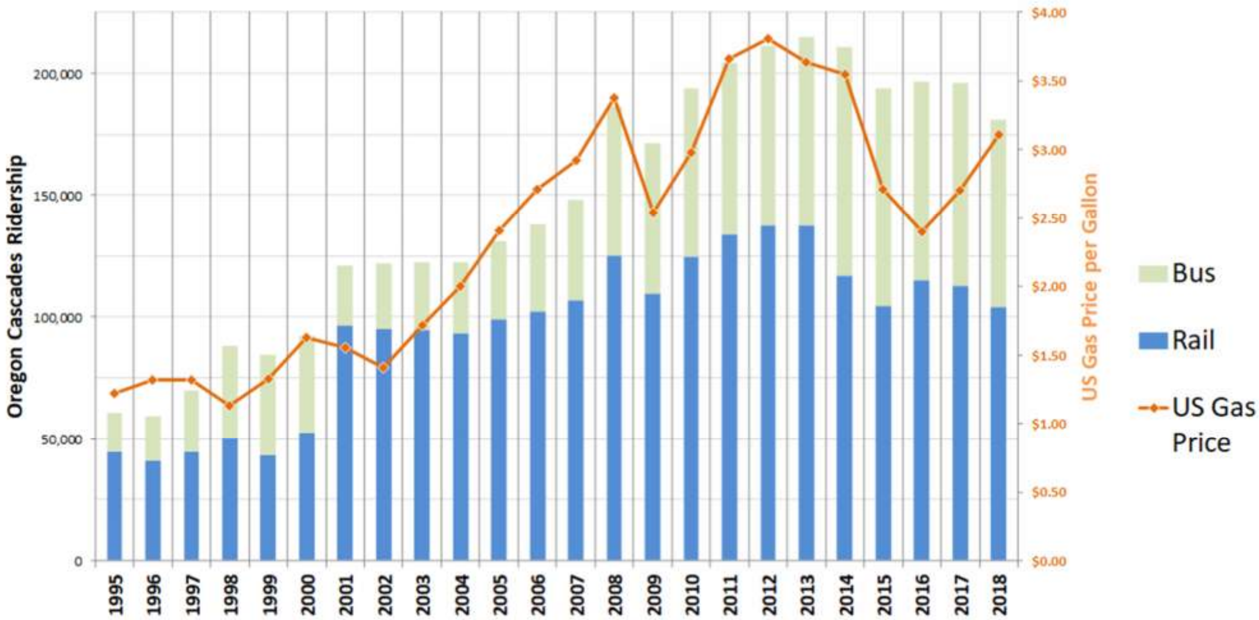
Amtrak Cascades ridership for the full PNWCR has grown from about 287,000 riders in 1995 to nearly 780,000 in 2014, and reached about 802,000 riders in 2018. Since 1995, rail ridership along the PNWRC has grown at an average annual growth rate of 4.8 percent.

An onboard "revealed preference survey" of current passengers of the Oregon Cascades train service and Thruway (operated as Cascades POINT) bus service boarding from Oregon stations was conducted in August 2013. Key findings from the survey are:

- There was a mix of travel purposes among intercity riders, with 82 percent of the trips made for personal or social purposes and 18 percent made for business or commute purposes.
- Approximately 50 percent of the daily transit trips were concentrated in the Portland–Eugene intercity market. Portland–Albany and Portland–Salem were other city pairs with notable travel activity.

Between 1995 and 2018, ridership on the Amtrak Cascades trains between Eugene and Portland increased by 134 percent. As illustrated in **Figure ES-2**, the highest year-over-year increases in the previous decade were observed in 2008 (17 percent) and 2010 (14 percent). However, ridership has dropped 10 percent since January 2014. Falling gasoline prices from 2012 to 2016 and reduced service schedules following a train derailment in late 2017 near Dupont, Washington are key contributing factors affecting recent ridership losses. This recent pattern of ridership losses follows a sustained period of substantial and steady growth underscores the need for new investments to add trains and increase reliability to improve the existing passenger rail service through the Willamette Valley.

Figure ES-2 Amtrak Cascades Ridership – Oregon Section of the Pacific Northwest Rail Corridor – between 1995 and 2018



Oregon Passenger Rail Project Service Development Plan
Source: ODOT Rail Division: 1995-2018 Ridership Data (ODOT 2019), U.S. Energy Information Administration

Purpose and Need for the Oregon Passenger Rail Project

The purpose of the OPR Project is to improve the frequency, convenience, speed and reliability of passenger rail service along the Oregon segment of the federally designated PNWRC in a manner that will:

- Provide riders with an efficient, safe, equitable and affordable alternative to highway, bus and air travel
- Be a cost-effective investment
- Protect freight-rail carrying capability[1]
- Support the ongoing implementation of regional high-speed intercity passenger rail in the PNWRC between the Eugene-Springfield metropolitan area and Vancouver, BC
- Be compatible with the Washington state portion of the PNWRC
- Promote economic development
- Avoid or minimize community and environmental impacts
- Integrate with existing and planned multimodal transportation networks

The need for the OPR Project arises from multiple transportation, land use, socio-economic and environmental considerations, including the following:

- Increasing intercity and regional travel demands
- Existing limited rail-system capacity and competing service needs
- Declining state and local roadway funding
- Increasing economic vitality of the corridor

[1] Cargo volume that can be transported by freight rail.

- Promoting transportation system safety and security
- Changing transportation demand resulting from demographic changes

OPR Project Goals and Objectives

The OPR Project's Goals and Objectives described in **Table 1-4** identify the primary issues the OPR Project intends to address. These goals and objectives served as the basis of the alternative's evaluation ODOT conducted in 2014 that led to the identification of the build alternatives evaluated in the Tier 1 DEIS. The initial set of goals came out of the public and agency scoping process in 2012.

Table ES-1 OPR Project Goals and Objectives

Goal		Objective
1	**Improve passenger rail mobility and accessibility to communities in the Willamette Valley**	1A Provide a viable alternative to auto, air, and bus travel between Eugene and Vancouver, Washington 1B Provide reliable and frequent passenger rail service 1C Support multimodal integration at each passenger rail station 1D Allow for future passenger rail improvements, including higher speeds
2	**Protect freight-rail capacity and investments in the corridor, and maintain safety**	2A Do not increase conflicts between passenger rail or freight rail and vehicles 2B Protect freight-rail carrying capability
3	**Plan, design, implement, maintain, and operate a cost-effective project**	3A Develop a strategy that can be reasonably funded and leveraged with a range of investment tools for construction and operation 3B Serve the maximum number of people with every dollar invested
4	**Provide an affordable and equitable travel alternative**	4A Provide a viable and affordable alternative for travelers 4B Provide equitable investments and service, with consideration to race/ethnicity and income
5	**Be compatible with passenger rail investments planned in Washington state**	5A Provide passenger rail service to meet the existing and future passenger rail demand for an interconnected system in the Pacific Northwest High-Speed Rail corridor
6	**Promote community health and quality of life for communities along the corridor**	6A Benefit communities within the corridor 6B Minimize negative impacts to communities along the corridor
7	**Protect and preserve the natural and built environments**	7A Support Oregon's commitment to the preservation of resource lands and to local land use and transportation planning 7B Reduce greenhouse gas emissions in support of national and state policies to slow climate change 7C Avoid and minimize impacts to the natural environment and cultural resources

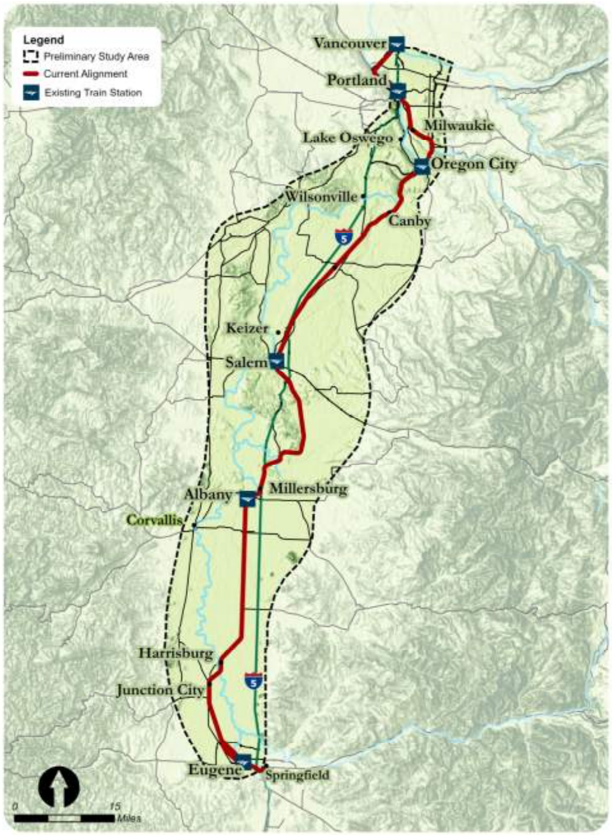
RATIONALE FOR THE OPR PROJECT

Chapter 2 summarizes the rationale for the OPR Project.

The OPR Project route is entirely within the state of Oregon and is 123 miles in length through the Willamette Valley (see **Figure ES-3**).

The Oregon Cascades service area includes the major urban population areas of Portland, Salem, Albany and Eugene. The rail line passes through a diverse variety of Willamette Valley agricultural areas between the major population centers. Generally, the topography between Portland and Eugene is relatively flat, but there are a few areas of hills that confine the route between Salem and Albany. The Willamette Valley is approximately 75 miles wide, bounded on the west by the Coast Range and to the east by the Cascades Range.

Figure ES-3 Oregon Amtrak Cascades Service Area



Currently Interstate 5 is the primary commerce corridor and connection for the movement of people and goods linking Eugene, Albany, Salem, Portland and cities north in Washington state and even British Columbia. However, traffic congestion on I-5 is particularly severe within the Salem, Portland-Vancouver, Olympia, and greater Puget Sound areas. There are limited plans to improve I-5 and reduce traffic congestion through the 20-year planning period. Congestion on I-5 will likely increase as the region grows, especially during peak periods so, to maintain mobility in Oregon and the region, cost-effective investments in Amtrak Cascades intercity passenger rail service are important.

Passenger rail service ridership thrives in an environment with frequent departures conveniently scheduled throughout the day, reliable service that passengers can depend on, and service with competitive travel times, at a reasonable cost. The plans for expanding Amtrak Cascades service into the future focus on these key elements to make the service more attractive to travelers. Both Oregon and Washington and local communities have also invested significant funds in multimodal facilities over the past 25 years. These facilities provide rail travelers last mile connections to begin or complete their journeys. This reduces dependence on the use of personal vehicles; limits the growth of highway congestion, greenhouse gases and toxic air emissions; and provides mobility options for the increasing number of people who do not drive or do not own a personal vehicle.

The Pacific Northwest is focused on sustainability and Amtrak Cascades service is an important element to ensure regional connectivity beyond personal vehicles in the future. Specifically, state of Oregon policy directs state agencies to reduce greenhouse gas emissions to 45 percent below 1990 emission levels by 2035.[1] The state of Oregon will be prioritizing and invest in projects that will attain these goals. Existing airline services are limited to Eugene and Portland, provide limited capacity, and have higher impacts on the environment and contribute to climate change. Communities such as Albany and Salem have no air service at all, and Amtrak Cascades provides travel options. Furthermore, air travel costs are high, which limits accessibility to people with lower incomes.

Amtrak's service in both Oregon and Washington is limited now due to the COVID-19 pandemic. However, the pre-pandemic schedules between Seattle and Portland provided four round trips per day, two of which extended down to Eugene.[2] ODOT and WSDOT will work together to determine when conditions allow to begin adding service back. These services provide additional connections to long-distance train services, thus expanding travel options to more locations.

Qualitative and quantitative assessments of the OPR Project costs, benefits and economic impacts are presented in Chapter 10 of this SDP. Benefit-cost ratios in excess of 1.0 indicate economic justification, where the value of benefits from a proposed infrastructure project outweigh their costs. With a project benefit-cost ratio of 1.2 to 1, the OPR Project will yield significant economic benefits to the state of Oregon. In addition, the OPR Project will have substantial environmental, livability, sustainability, and accessibility benefits to the state.

SELECTING THE PREFERED ALTERNATIVE

This section summarizes the two build alternatives (Alternative 1 and Alternative 2) that were advanced for further study in the Tier 1 DEIS.

Chapter 3 of the SDP summarizes the alternatives developed and evaluated in the Tier 1 DEIS. The chapter defines each of the two build alternatives evaluated, and describes the selection of Alternative 1 as the Preferred Alternative. The Preferred Alternative is subject to more detailed examination of the operational and capital improvement needs, costs, phasing plans and economic impacts, as detailed in later chapters of the SDP.

ODOT identified the infrastructure improvements for the build alternatives described below by developing conceptual designs based on Rail Traffic Controller (RTC) analysis conducted for the OPR Project (see Chapter 6). ODOT used the RTC results to identify areas that have existing and future infrastructure deficiencies and developed conceptual improvements for addressing rail capacity and operations in those areas. ODOT then used these proposed improvements to forecast future ridership, identify potential impacts and develop cost estimates.

Figure ES-4 maps the build alternatives and highlights the location of existing and potential new stations.

<u>Alternative 1</u>

Alternative 1 would improve the existing passenger rail route between Eugene and Portland, with the addition of parallel track in multiple sections within or immediately adjacent to the existing railroad alignment. The current Amtrak Cascades passenger rail service operates on existing UPRR track between Eugene and Portland's Union Station. North of Union Station, the Amtrak Cascades service operates on existing BNSF track.

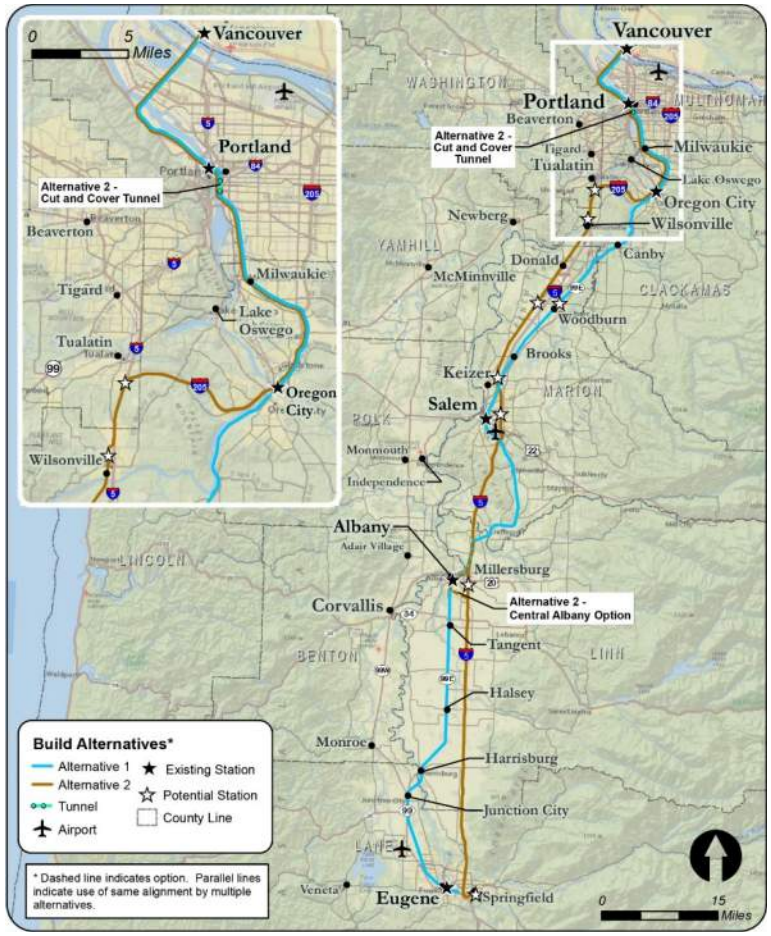
Under Alternative 1, passenger trains would continue to share track with freight trains, and the route would serve seven passenger rail round trips per day—six Amtrak Cascades and one Coast Starlight (a "6+1" schedule). Between Eugene and Portland, train frequency under Alternative 1 would reflect an increase of four round trips per day over the No Action Alternative. North of Portland Union Station, Alternative 1 would be the same as the 2035 No Action Alternative (eight round trips per day, a 6+2 schedule).

Alternative 1 would add new railroad track or modify existing track at select sections on the UPRR alignment in order to facilitate four more passenger rail round trips per day while maintaining freight rail carrying capability between Eugene and Portland. Track modifications or additions would consist of mainline track, sidings, crossovers and industry connections built or modified as needed to maximize the efficiency of freight and passenger rail operations throughout the full route. In most places, the new track for Alternative 1 would be offset 20 feet east of the existing UPRR mainline track and could require acquisition of linear strips of new right-of-way (ROW) to the east of the existing UPRR ROW.

Alternative 1 would use the existing stations along the current Amtrak Cascades route; no improvements to the existing stations are proposed in the Tier 1 DEIS.

Figure ES-4 Build Alternatives

Oregon Passenger Rail Project Draft Service Development Plan



Alternative 2

Between Springfield and Oregon City, Alternative 2 would consist of a mostly new rail route that would follow I-5, an existing freight rail route and I-205, as shown in **Figure ES-4**. It would also parallel the current passenger rail route north of Oregon City. The Alternative 2 track improvements would be constructed primarily adjacent to the existing I-5 and I-205 freeways, the existing PNWR line between Keizer and Wilsonville, and adjacent to the existing UPRR alignment north of Oregon City. Alternative 2 would add new mainline railroad track throughout the full route between Springfield and Portland. Between Keizer and Wilsonville, and north of Oregon City, Alternative 2 track would be shared with freight traffic on the PNWR and UPRR lines. Along the passenger rail-only sections of the route, siding tracks would be placed every 10 to 12 miles to facilitate passing operations. The new rail line between Springfield and Keizer, and between Wilsonville and Oregon City, and the cut-and-cover tunnel section in inner southeast Portland, would be for the exclusive use of passenger rail service. Alternative 2 would serve seven round trips per day—six Amtrak Cascades and one Coast Starlight (a "6+1" schedule). Between Portland's Union Station and Vancouver, Washington, Alternative 2 would be the same as the 2035 No Action Alternative and Alternative 1 (eight round trips per day, a 6+2 schedule).

Alternative 2 would require new passenger rail stations south of Portland's Union Station. Each of the potential new stations would be located adjacent to the proposed new alignment, generally near I-5. **Figure ES-4** shows the general station locations. The Tier 1 DEIS assesses a 20-acre study area around each potential new station location.

Selecting the Preferred Alternative

Based on the comparison of performance attributes, ODOT and FRA proposed that Alternative 1 be identified in the Tier 1 DEIS as the recommended Preferred Alternative. Outreach activities were conducted during fall of 2015 in order to share this recommendation with stakeholders and interested parties. Feedback received during the outreach period was largely in support of the recommendation. The Tier 1 DEIS, published in October 2018, identified Alternative 1 as the recommended Preferred Alternative, which was again largely supported by public and agency input. The OPR Project Final Environmental Impact Statement and Record of Decision identify Alternative 1 as the selected alternative and provide the rationale for its selection.

PLANNING METHODS USED IN THE SDP

Planning Horizon

ODOT adopted a 20-year planning horizon for the Tier 1 DEIS and the SDP. The 20-year planning horizon, which is from 2015 to 2035, is consistent with FRA guidelines and allows for a reasonable estimate of the needs of the traveling public, expected population growth, and expected freight rail service in the corridor. The 20-year planning horizon provides a reasonable framework to guide development of the OPR Project with successive phasing for a total of six Amtrak Cascades round trips per day between Portland and Eugene.

Chapter 4 of the SDP summarizes the 20-year planning horizon for the Tier 1 DEIS and SDP, major cross-cutting assumptions of the SDP, and the public involvement process undertaken in the Tier 1 DEIS to help select the Preferred Alternative.

Major Cross-cutting Assumptions

The SDP is based on a number of assumptions as discussed in the various chapters that follow:

- ODOT will need to coordinate and reach formal agreement with the rail owner—UPRR—to make operational and infrastructure improvements within the Oregon section of the PNWRC to support increased intercity passenger rail service frequency and maintain acceptable levels of freight operations. Chapter 6 (Operations Plan) and Chapter 8 (Conceptual Engineering and Capital Programming) identify the operational and infrastructure improvement needs and phasing plan that may become part of a formal agreement with UPRR.
- The capital cost of implementing expanded passenger rail service within the PNWRC will require further federal, state and local investment. Oregon will need to compete for the federal funds in an era of increasingly tight public resources. Furthermore, Oregon lacks sufficient and dedicated passenger rail funding to provide the required state match for federal passenger rail funding. Expansion of passenger rail service would compete with a wide variety of needs for limited state funds.
- The design of the expansion of passenger rail service in the corridor is based on various projections and forecasts. These include population projections, freight rail forecasts, cost estimates, ridership projections and revenue forecasts. ODOT has used generally accepted methodologies for estimating future passenger rail ridership within the PNWRC. These estimates are consistently integrated in the analysis and findings of future passenger rail service operations, revenue forecasts, operational and capital improvement needs and costs, and the estimate of public benefits.

Public Outreach and Agency Coordination

The public involvement process for the OPR Project was designed to solicit early and frequent coordination with interested parties, stakeholders, government agencies and Tribes to facilitate their input on the purpose and scope, key issues and concerns, and the development and narrowing of alternatives. Input received during the public involvement process helped to shape the OPR Project Purpose and Need, Goals and Objectives, methods of analysis and decision-making.

ODOT implemented several communication tools and materials to make information about the OPR Project widely available, and to attain high levels of public participation and input during the development of the Tier 1 DEIS. The OPR Project public involvement process has included the following activities and tools:

- Regulatory Agency Coordination
- Community and Jurisdictional Briefings
- Individual Stakeholder Briefings
- Community Events
- Website/Social Media
- Informational Videos

- Fact Sheets/Newsletters
- News Media
- Open Houses/Online Open Houses
- Outreach to Disadvantaged Populations
- Tribal Outreach and Coordination

Of special note, the OPR Project also formed and convened the Oregon Passenger Rail Leadership Council as the core advisory group and conducted more than a dozen meetings with railroad stakeholders.

Oregon Passenger Rail Leadership Council

In 2012, former Governor John Kitzhaber established the Oregon Passenger Rail Leadership Council, which is a core advisory group composed mostly of elected officials from the Willamette Valley. The Oregon Passenger Rail Leadership Council provides guidance to ODOT and works with ODOT to finalize OPR Project recommendations submitted to FRA for final approval. Eleven Leadership Council meetings have been held to date.

Railroad Coordination

ODOT met with railroad stakeholders in the OPR Project study area during the scoping period to inform them of the process, key elements, schedule and data input needed for the OPR Project. These meetings also provided an opportunity for the railroad stakeholders to comment on the OPR Project to assist in the development of the scope of the OPR Project. To date, 16 meetings have been held with railroad stakeholders.

ESTABLISHING THE OPR PROJECT RIDERSHIP AND REVENUE FORECASTS

Ridership and ticket revenue forecasts for proposed Amtrak Cascades service options were prepared for the Tier 1 DEIS using an incremental model that utilizes observed Amtrak ridership and ticket revenue data as well as socio-economic data and forecasts, Amtrak timetables and pricing. Those forecasts were originally prepared in 2015 and documented in the 2018 Tier 1 DEIS. For this SDP, the Tier 1 DEIS ridership forecasts have been updated to consider recent ridership trends and other factors.

> **Chapter 5** documents the year 2035 passenger ridership and revenue forecasts of the OPR Project's Preferred Alternative.

The Preferred Alternative would have more than twice the Amtrak Cascades ridership than the No Action Alternative. **Table ES-2** shows the existing ridership (2015) and the 2035 forecast ridership for Amtrak Cascades (including Cascades POINT/Thruway bus) between Eugene and Portland. Bus ridership would decline dramatically, because it is assumed that Cascades POINT/Thruway buses would be replaced by additional trains.

Table ES-2 Annual Amtrak Cascades Train and Cascades POINT Bus Ridership – Existing (2015) and 2035 Conditions for Tier 1 DEIS No Action Alternative and Preferred Alternative

	Actual 2015	No Action Alternative (2035)	Preferred Alternative (2035)
Train	105,000	153,600	519,500
Bus	89,000	106,000	20,300
Total	**194,000**	**259,600**	**539,800**

In 2035, total ridership (both Amtrak Cascades train and Cascades POINT/Thruway bus) for the Preferred Alternative is projected to be 539,800 annual passengers (including 519,500 rail passengers) compared to 259,600 annual passengers under the No Action Alternative.

Chapter 5 also summarizes the estimated revenue from increased ridership under the Preferred Alternative.

THE OPR PROJECT OPERATING PLAN

The Operating Plan translates the OPR Project's Purpose and Need for the service into the technical parameters of increased passenger rail service in the corridor, which will fulfill the service requirements in a cost-effective manner. Requirements include what is necessary to design, build, operate and maintain the service as it expands incrementally through phased implementation.

Chapter 6, the Operating Plan, summarizes the technical basis for establishing increased Oregon Amtrak Cascades passenger rail service between Eugene and Portland.

Combined passenger and freight rail operating scenarios were modeled and analyzed in support of the Tier 1 DEIS and the SDP, including the following:

- The **Base Case** scenario is current year (2015), with existing freight traffic and passenger rail service and schedules. Passenger rail service includes two Oregon Amtrak Cascades round trips plus Amtrak's Coast Starlight (2+1).
- **No Action** – The No Action Alternative is modeled for year 2035 and assumes an increase in freight traffic and no change in passenger rail service.
- **No Action Minimum Alternative** – Minor infrastructure improvements added to the No Action Alternative simulation network to yield year 2035 delay statistics within 10 percent of the Base Case Alternative, and no change in passenger rail service levels. This alternative was developed to identify the rail infrastructure needed to maintain the status quo of freight rail operations through year 2035, assuming no increase in passenger rail service.
- **Tier 1 DEIS Preferred Alternative** – Phase 1 **4+1 Service on No Action Minimum** - Minor infrastructure improvements added to the No Action Minimum Alternative simulation network to yield year 2035 delay statistics within 10 percent of the Base Case Alternative, with two additional Amtrak Cascades round trips (4+1) added to the Service.
- **Tier 1 DEIS Preferred Alternative** – Phase 2 **6+1 Service on the 4+1 Network** - Infrastructure improvements added to the DEIS Preferred Alternative 4+1 Service No Action Minimum simulation network. The infrastructure improvements yield year 2035 delay statistics within 10 percent of the Base Case scenario, with four additional Amtrak Cascades round trips (6+1).

<u>Rail Operation Modeling Results</u>

Key findings of the operation modeling include:

- **2015 Base Case scenario** – the existing infrastructure along the Amtrak Cascades corridor is adequate for the current volume of traffic, mode of operation and train schedules.
- **Future No Action Alternative** – existing rail infrastructure is insufficient to efficiently support anticipated future freight traffic, with delays increasing.
- **2035 No Action Minimum Alternative** – the added (minor) infrastructure improvements in the corridor enable future freight operations with traffic delays within 10 percent of the 2015 Base Case scenario metrics.
- **2035 Preferred Alternative** – with increased passenger rail service (6+1) and assumed infrastructure investments, the added corridor infrastructure will enable the proposed passenger trains to operate at higher travel speeds and lower train delay than both the 2015 Base Case and Future No Action scenarios. The simulated infrastructure investments will also support future

freight rail growth more effectively, and allow UPRR and BNSF to meet their through-transportation, shipper and interchange obligations more efficiently than in the Future No Action Alternative.

Rail Infrastructure Needs

The physical characteristics of the Amtrak Cascades route were included in the modeling parameters for their influence on train schedules, costs and suitability for expanded passenger rail operations along the UPRR and BNSF host railroads. The Operating Plan assumes that corridor investments will support expanded passenger train service while mitigating impacts on the host railroad freight capacity, speed, reliability, costs of operation or operational flexibility. **Figure ES-5** maps the rail infrastructure improvements needed under the future (2035) No Action Minimum Alternative and Preferred Alternative (by phase), and their costs (a range, from Low to High). The No Action Minimum Alternative infrastructure costs are estimated to be as high as $609 million (2015 dollars), and the Preferred Alternative Phase 1 (4+1) is estimated to be $200 million, and Phase 2 is estimated to be $558 million. A total of $1,367 million in infrastructure costs are estimated for the corridor.

Construction costs for the Preferred Alternative also include a total of $31.5 million for improvements to the Willbridge Crossover Tracks ($8.1 million) and Eugene Stub Tracks ($23.4 million), both projects subject to preliminary engineering and NEPA assessment in 2015.

Chapter 6 describes each of the individual rail infrastructure projects.

Trainset Needs

ODOT estimates that two additional passenger rail trainsets and locomotives will be needed to accommodate increased service between Eugene and Portland, and any new trainsets also will operate between Seattle and Eugene.

Figure ES-5 Amtrak Cascades Rail Infrastructure Improvements

Project	Cost Estimate Low	Cost Estimate High	No Action Minimum (NAM)	Preferred Alternative Phasing ❶ 4+1 on NAM	Preferred Alternative Phasing ❷ 6+1 on 4+1
Clackamas/Brooklyn Yard New Passing Track	$170M	$199M			✓
Clackamas/Brooklyn Yard Extension	$59M	$118M	✓	✓	✓
Coalca Siding Extension	$118M	$143M		✓	✓
Gervais Siding Extension	$49M	$59M			✓
Labish Siding Extension	$124M	$147M	✓	✓	✓
Renard Siding Extension	$41M	$48M	✓	✓	✓
Marion Siding Extension	$75M	$89M			✓
Millersburg	$26M	$31M			
Hallawell to Albany Extension	$57M	$69M			✓
Hallawell Extension	$26M	$35M			✓
Halsey New Passing Track	$47M	$56M		✓	✓
Alford Siding Extension	$65M	$78M			✓
Judkins Siding Extension	$248M	$297M	✓	✓	✓

Phasing	Cost Estimate Low	Cost Estimate High
No Action Minimum	$472M	$609M
❶ 4+1 on NAM	$165M	$200M
❷ 6+1 on 4+1	$467M	$558M
Total	**$1,104M**	**$1,367M**

The capital costs and operating and maintenance costs required to support operations of the additional two trainsets and Preferred Alternative operations (six additional daily round trips) are summarized in **Table ES-3** in 2015 dollars.

Table ES-3 Preferred Alternative Cost Estimate

Capital Costs	In Millions (2015 $s)
Rail Infrastructure Improvements	$1,104 - $1,367
Two Trainsets and Two Locomotives	$66
Willbridge Crossover Tracks and Eugene Stub Tracks	$31.5
Maintenance Yard/Layover Facility (Eugene)	$38.3
Operating and Maintenance Costs (annual)	**In Millions (2015 $s)**
Third Party Costs (Maintenance of Way (MOW), Fuel)	$3.3
Route Costs (T&E Labor, MoE)	$10.1
Amtrak Train & Engine (T&E) and Maintenance of Equipment (MoE) Additives	$3.4
Fixed Route Costs (Amtrak categories)	$17.4
Other Amtrak Additives	$1.1
Talgo Equipment Maintenance Estimate	$3.1

STATION AND ACCESS ANALYSIS

Chapter 7 summarizes the station and access analysis of the Preferred Alternative

For each Amtrak Cascades station, Chapter 7 summarizes the following:

- Station Location Analysis – including a broad summary of the site suitability as well as prevailing land use and major attractions in proximity to each station
- Station Operations – a summary evaluation of station capacity to meet future passenger demand, including building characteristics and platform area
- Intermodal Connectivity – a description of intercity transportation services integrated through each station
- Station Access and Circulation – a summary assessment of station access by mode, including a detailed summary of vehicle and bicycle parking, local transit interconnectivity, and walk and bicycle networks serving each station
- Summary Assessment – a broad summary statement indicating how each station will accommodate the expected increase in Amtrak Cascades service

Portland's Union Station (buildings, platforms and track infrastructure) is subject to a separate National Environmental Policy Act (NEPA) analysis and application of funding assistance for renovations and upgrades to accommodate future passenger rail traffic. Though private vehicle parking is limited in the area, Union Station is well served by public transit, taxi, walk and bicycle system features connecting the station to the greater Portland urban area.

The Oregon City Station was constructed in 2004 and provides ample capacity for existing and future passenger rail traffic, including passenger drop-off and on-site short-term and long-term parking facilities.

Similarly, the Salem, Albany and Eugene stations were renovated in 2000, 2006 and 2004, respectively. Each station includes adequate on-site short-term and long-term parking and passenger drop-off facilities, as well as taxi, transit, walk and bicycle systems and features for city-wide connectivity.

All five Amtrak stations currently include Americans with Disabilities Act (ADA) accessibility features and all, except for Oregon City, have restrooms. With the exception of Oregon City, each of the Amtrak stations features Quik-Trak ticketing kiosks to assist passengers

CONCEPTUAL ENGINEERING AND CAPITAL PROGRAMMING

Chapter 8 describes the conceptual engineering efforts used to identify improvements to the existing infrastructure required to expand passenger rail service through the Oregon Amtrak Cascades corridor. The conceptual engineering was completed in a manner to allow for phased implementation of the service including increases in service frequency.

Infrastructure capacity improvements will be necessary to support the various phases and frequencies of passenger rail service as well as to mitigate passenger-train caused delays or capacity loss to existing and future freight rail traffic on the lines of the host railroads. See **Figure ES-5**.

Rail infrastructure needs are summarized above and in Chapter 6.

<u>Layover Track and Maintenance Facility</u>

Two new facilities will probably be needed in Eugene to accommodate additional passenger train frequencies.

In support of the Tier 1 DEIS, ODOT is preparing conceptual plans and designs for two facilities: a new layover track at the Eugene station and a maintenance facility near the Eugene rail yard. The proposed Eugene layover track includes an added stub track diverging off the existing rail siding just west of the Eugene station with capacity to serve arriving Amtrak Cascades trains (southbound), where alighting passengers will be free from conflict with other train operations. Amtrak Cascades trains will remain on the layover track at the station, where they will receive passengers boarding the next northbound departures. Stand-by power (480 volts) will be available at the layover facility for rudimentary servicing and equipment turning activities.

Second, a new Eugene maintenance facility will possibly be located within the footprint of the downsized Eugene Yard. If funded, it, will provide day-to-day maintenance service functionality (periodic cleaning and inspections, light repairs, drive-through washing and restocking). Major maintenance functions will continue to be performed at the Seattle maintenance facility.

OPERATING AND MAINTENANCE COSTS

Chapter 9 summarizes the required operating and maintenance costs associated with the Preferred Alternative.

Operating and maintenance (O&M) costs have been approximated for Preferred Alternative of the Oregon portion of the Amtrak Cascades. Oregon currently shares the O&M costs of the Amtrak Cascades with Washington State. O&M cost estimates in the SDP are derived from high-level costs summarized by Amtrak for both the Amtrak Cascades service and national totals.

The O&M cost estimates for the Preferred Alternative (by phase) were derived for expanded Amtrak Cascades service in Oregon and Washington by utilizing combined forecasted train miles and passenger miles for the year 2015. Cost split percentages for Washington and Oregon were calculated as a percentage of train miles (see **Table 9-2**). The financial analysis results for each phase are summarized in this section.

Table ES-3 summarizes the projected O&M costs of the Preferred Alternative.

Passenger rail equipment capital replacement costs are also anticipated in future years, as outlined in the Amtrak Cascades 2017 Fleet Management Plan. See also **Table ES-3**. These replacement costs cover depreciation as well as lifecycle limitations of the infrastructure and rolling stock. Very different from the yearly regular maintenance costs outlined above, capital equipment acquisition will be necessary to replace assets at the end of their useful lives and to maintain the safety of passengers, employees and the general public.

DESCRIBING AND QUANTIFYING THE PUBLIC BENEFITS OF THE OPR PROJECT

> **Chapter 10** describes the public benefits that the OPR Project (service) is expected to deliver. The public benefits stemming from the OPR Project are summarized separately for those benefits that can be monetized from those that cannot.

Non-monetized benefits of intercity passenger rail improvements are often defined in broad terms describing improvements related to environmental sustainability and community livability. Improvements in environmental sustainability can be illustrated through reductions in motor fuel consumption, air emissions including greenhouse gases, and reductions in infrastructure capacity increases that would otherwise be required for airports and highways. Improvements in community livability can be described through measures that help illustrate reductions in transportation congestion and improved access to transportation, particularly for the elderly, disabled and people who cannot afford personal autos or airline transportation, or who are not able to drive or fly.

Given the unique economic, geographic and demographic profile of the PNWRC, non-monetized benefits of the OPR Project summarized in Chapter 10 (Section 10.2) are more specifically categorized as follows:

- Supporting livable communities
- Improving public transportation access
- Providing an equitable investment
- Improving transportation network resiliency
- Meeting the needs of a changing marketplace

Benefits of the OPR Project that create economic value are monetized.

Non-user benefits are those benefits that create economic value from changes in externalized cost of transportation such as reduced highway congestion, improved highway safety, reduced highway maintenance and reduction in air emissions. *User benefits* are those benefits that create economic value from services provided to the traveling public in the form of time spent in travel.

The OPR Project Benefit-Cost Analysis (BCA) focuses exclusively on monetized benefits (user and non-user) of the OPR Project. The BCA analysis addresses whether society is better off by performing a certain action (such as investing in improved rail service) versus doing nothing. BCA describes the viability of a project in terms of the ratio of benefits to costs and the net value (benefits, less costs).

Further, an Economic Impact Analysis (EIA) was performed to identify the economic impacts of construction projects necessary to build, operate and maintain the OPR Project service. The EIA specifically analyzes the impact on job creation, spending of employee wages and salaries, and related economic-development benefits stemming from the OPR Project investment. The EIA addresses how an economy is likely to change in response to an action. Specifically, the EIA describes the impacts of a project in terms of its impacts on a region’s employment, wages, Gross Regional or State Product, and taxes.

The BCA and EIA detailed in Chapter 10 build upon the information presented in passenger demand and revenue forecasts found in Chapter 5, and the operating plan in Chapter 6. These two chapters and the analyses used to develop them provide the basis for operating costs, ridership and passenger miles for the alternative deployment scenarios.

OPR Project Return on Investment

The OPR Project creates broad-based public benefits such as reductions in vehicle emissions and greenhouse gases, highway congestion and highway maintenance costs; improvements in highway safety; and user benefits such as improved access to transportation, improved reliability of transportation and lower transportation costs.

The OPR Project will contribute to passenger diversions from personal vehicles and highway miles, reduction in greenhouse gases, and improvement in cross-modal transportation within the PNWRC corridor. For a 30-year time horizon following implementation of the service (2029–2058), the projected cross-modal impacts of the OPR Project include:

- 102 million vehicle miles traveled removed from the Oregon and Washington highway systems;
- 4 million gallons less of auto and truck fuel consumed; and
- 708,200 short tons reduction in carbon dioxide

The OPR Project would divert travelers who would otherwise use a personal vehicle (545,300 annual auto person-trips), scheduled airline service (20,800 annual air person-trips), or scheduled intercity bus service (91,000 annual bus person-trips), as well as provide transportation growth capacity and capability for passengers who otherwise would have no viable transportation choice. See Chapter 5 for a more detailed discussion of travel diversion. The projected diversion rates for the OPR Project are 83 percent from personal vehicle, 3 percent from air, and 14 percent from bus.

Benefit-Cost Analysis and Economic Impact Analysis

The BCA focused on quantifiable benefits related to modeled passenger travel by mode. These include the costs/avoided costs of travel of rail versus automobile, bus/motor coach and air travel. These travel-related factors include transportation costs paid by users of the different modes, travel time costs, accident occurrence and its human and cost consequences, mobile-source emissions costs, and impacts on roadway infrastructure.

The study showed significant benefits over a 30-year period (2029–2058) following completion of initial construction to improve service from 2+1 to 4+1 in 2029. Benefits also increased significantly following additional investment to bring service to 6+1 starting in 2035.

Over the study period, the OPR Project is expected to generate a benefit-cost ratio of 1.2 to 1 and a Net Present Value (NPV) of $51 million in 2015 dollars at a 7 percent discount rate.

Sensitivity analysis, in terms of 2015 discounted dollars (7 percent discount rate), showed:

- 10 percent increase/decrease in capital expenditures equates to $27 million decrease/increase in NPV.
- 10 percent increase/decrease in ridership equates to $44 million increase/decrease in NPV.
- The discount rate chosen for the BCA has the greatest impact on NPV of the factors examined. At the discount rate of 7 percent (which is the discount rate recommended by the U.S. Department of Transportation), the OPR Project breaks even within the study period (in year 2055). The OPR Project would see significantly shorter financial breakeven periods with lower discount rates. For example, at 3 percent, 4 percent and 5 percent discount rates, financial breakeven would occur in the years 2047, 2048 and 2050, respectively.

The regional economic impacts of construction, operation and maintenance of the improved rail service, along with the value of travel time are substantial:

- For every $1 billion in OPR Project expenditures on the OPR Project, 15,500 job-years, worth $1 billion in wages, are created.
- For each $1 billion in OPR Project spending, Gross State Product (GSP) and tax revenues are estimated to increase by nearly $1.1 billion and $300 million, respectively.

As demonstrated by ODOT's 26-year history of supporting Amtrak intercity passenger rail service, and its substantial investments in rail line and station improvements along the corridor, Oregon is committed to realizing and sustaining the environmental benefits of the expanded service. The expanded passenger rail service will provide environmental, economic and transportation benefits for generations to come.

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Acronyms and Abbreviations

ADA	Americans with Disabilities Act
BCA	Benefit-Cost Analysis
BNSF	BNSF Railway
BRT	Bus Rapid Transit
CBD	Central Business District
CFR	Code of Federal Regulations
CIP	Corridor Investment Plan
D	Destination
DMU	Diesel Multiple Unit
EIA	Economic Impact Analysis
EIS	Environmental Impact Statement
EJ	Environmental Justice
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GHG	Greenhouse Gas
GIS	Geographic Information Systems
GSP	Gross State Product
HSIPR	High-Speed Intercity Passenger Rail
HSR	High-Speed Rail
I-205	Interstate 205
I-5	Interstate 5
MP	Milepost
mph	Miles Per Hour
MSA	Metropolitan Statistical Area
NPV	Net Present Value
O	Origin
O&M	Operations and Maintenance
OAR	Oregon Administrative Rule
OBS	Onboard Services
ODOT	Oregon Department of Transportation
OPR Project	Oregon Passenger Rail Project

OPR	Oregon Passenger Rail
OR	Oregon
ORS	Oregon Revised Statute
OSU	Oregon State University
OTP	On-time Performance
PNWR	Portland & Western Railroad
PNWRC	Pacific Northwest Rail Corridor
PRIIA	Passenger Rail Investment and Improvement Act
Project	Oregon Passenger Rail Project
PTC	Positive Train Control
ROW	Right-of-Way
RTP	Regional Transportation Plan
SDP	Service Development Plan
SIP	State Implementation Plan
STIP	2015-2018 Statewide Transportation Improvement Program
Title VI	Title VI of the Civil Rights Act of 1964
TSP	Transportation System Plan
U.S. Census	U.S. Census Bureau
UGB	Urban Growth Boundary
UPRR	Union Pacific Railroad
USC	United States Code
USDOT	U.S. Department of Transportation
WA	Washington
WSDOT	Washington State Department of Transportation

1 Introduction and Purpose and Need

1.1 Introduction

The Federal Railroad Administration (FRA) and Oregon Department of Transportation (ODOT) are preparing the Oregon Passenger Rail (OPR) Corridor Investment Plan (CIP) that will identify a recommended level of investment over the next 20 years for improved intercity passenger rail service between Eugene-Springfield, Oregon (OR), and Vancouver, Washington (WA). The OPR CIP is funded in part by the FRA's High Speed Intercity Passenger Rail (HSIPR) Program and consists of a Tier 1 Environment Impact Statement (EIS) in accordance with the National Environmental Policy Act (NEPA) and a Service Development Plan (SDP).

1.1.1 Federal High-Speed Intercity Passenger Rail Program

The HSIPR Program was created to help address the nation's transportation challenges by making strategic investments in an efficient network of passenger rail corridors. The objectives of the HSIPR Program are to:

- Build new high-speed rail corridors that expand and fundamentally improve passenger transportation in the geographic regions they serve
- Upgrade existing intercity passenger rail corridors to improve the reliability, speed, and frequency of existing services
- Lay the groundwork for future high-speed rail services through corridor and state planning efforts

In September 2011, ODOT received $4.2 million in federal grants from the HSIPR Program to continue planning efforts aimed at improving passenger rail service on the Oregon segment of the Pacific Northwest Rail Corridor (PNWRC). This funding, along with $5.8 million from ODOT, was used to prepare the *Oregon Passenger Rail Tier 1 Draft EIS* (Tier 1 DEIS).

1.1.2 Pacific Northwest Rail Corridor

The PNWRC has been the subject of intercity passenger rail planning, development and operation for more than 30 years. The PNWRC is one of 11 federally designated high-speed rail corridors in the U.S. The FRA designated this passenger rail corridor on October 20, 1992, as one of five original corridors called for in the Intermodal Surface Transportation Efficiency Act of 1991. The FRA classifies the PNWRC as a *Regional Express Corridor*.

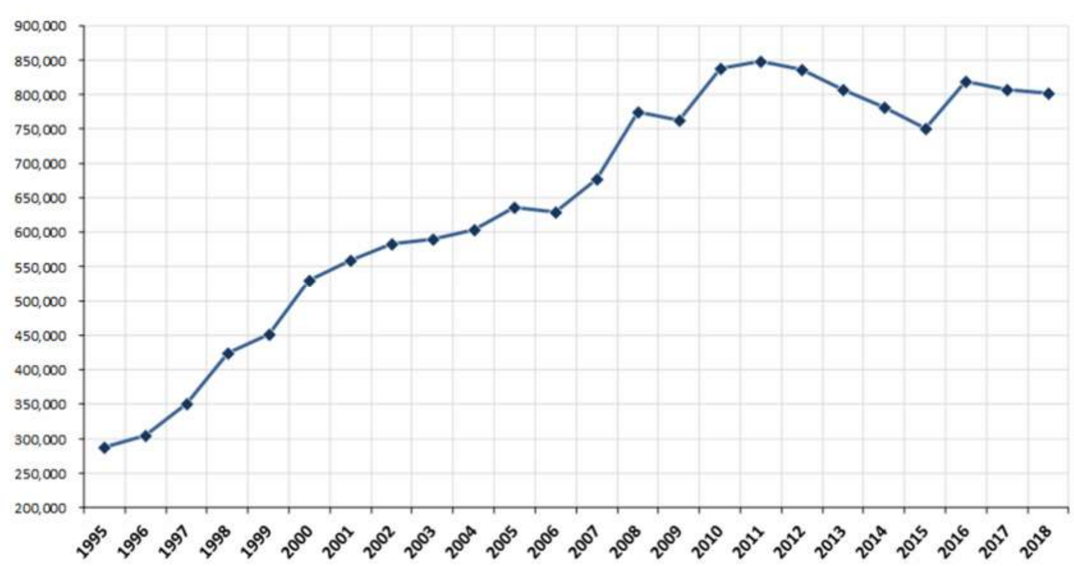
Figure 1-1 Pacific Northwest Rail Corridor

Oregon Passenger Rail Project Service Development Plan
Source: Washington State Department of Transportation (WSDOT, 2017).

As illustrated in **Figure 1-1**, the PNWRC serves the most densely populated regions of British Columbia (BC), Washington and Oregon. It links Vancouver, BC, Seattle, and Portland and Eugene with growing intermediate communities (including the capital cities of Salem and Olympia). BNSF Railway owns the existing PNWRC railroad infrastructure in Washington, in British Columbia, and in Oregon north of Portland's Union Station. Union Pacific Railroad (UPRR) owns the existing PNWRC railroad infrastructure in Oregon south of Portland's Union Station. A mix of freight and passenger trains (operated by BNSF, UPRR Central & Oregon Pacific (CORP), Portland Terminal Railroad (PTRC), Portland & Western Railroad (PNWR), and Amtrak) currently utilize BNSF Railway and UPRR trackage that also serves as the PNWRC.

As shown in **Figure 1-2**, Amtrak Cascades ridership for full PNWRC has grown from about 287,000 riders in 1995 to nearly 802,000 in 2018, having reached about 850,000 riders in 2011.[3] Since 1995, rail ridership along the PNWRC has grown at an average annual growth rate of 4.8 percent.

Figure 1-2 Amtrak Cascades Ridership – Pacific Northwest Rail Corridor – between 1995 and 2018



Oregon Passenger Rail Project Service Development Plan
Source: Amtrak Cascades-Pacific Northwest Corridor, 2018 Performance Data Report (WSDOT Rail Division, 2019)

The Tier 1 DEIS (Chapter 1) provides a comprehensive summary of FRA's High-Speed Intercity Passenger Rail Program, investment planning and a description of the tiered approach to the National Environmental Policy Act (NEPA) as they pertain to the PNWRC.

1.1.3 Oregon Passenger Rail Program

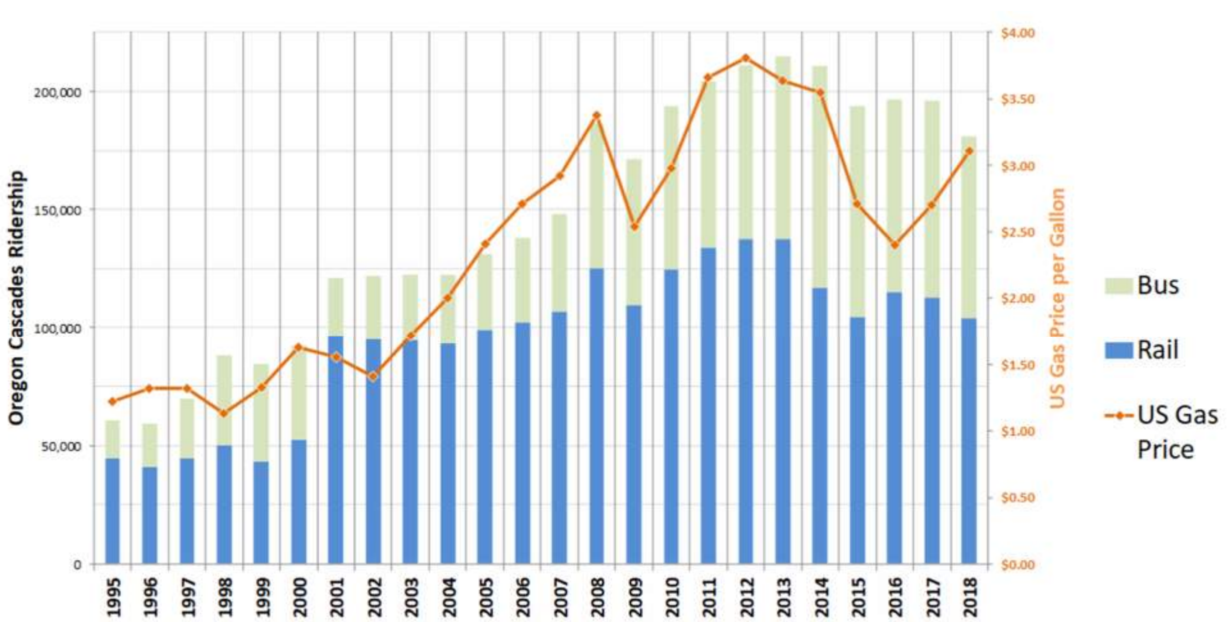
1.1.3.1 OPR Service History

ODOT initiated a daily Amtrak passenger rail round trip between Eugene and Portland in 1994. Since that time, Oregon has invested more than $77 million in capital improvements for passenger rail service, including railroad infrastructure, stations and rolling stock. A second state-sponsored daily round trip was added in 2000, resulting in Oregon ridership growth of over 64,700 rail passengers between 2000 and 2014 (**Figure 1-3**).[4] In 2010, ODOT purchased two new trainsets using Federal Highway Administration (FHWA) funds, repurposed by the Oregon Transportation Commission. The trains are now in service on the Amtrak Cascades corridor.

Current intercity passenger rail service in Oregon includes two Amtrak Cascades train round trips per day. In Oregon, the Amtrak Cascades station stops include Eugene, Albany, Salem, Oregon City and Portland, and the Amtrak Cascades route continues north through Washington to Vancouver, BC. In addition to the Amtrak Cascades service, Amtrak operates one daily round trip of the Coast Starlight between Los Angeles and Seattle, and one daily round trip of the Empire Builder between Portland and Chicago. In Oregon, the Coast Starlight stops in Klamath Falls, Chemult, Eugene, Albany, Salem and Portland. Portland is the only stop for the Empire Builder in Oregon.

ODOT also contracts with a private operator servicing eight dedicated state Cascades POINT (Public Oregon Intercity Transit)/Amtrak Thruway bus round trips between Eugene and Portland to supplement passenger rail service. Since 1995, the combined bus and rail ridership in Oregon has grown by over 120,400 passengers, at an average annual growth rate of 5.4 percent, an important contribution to the overall PNWRC growth.

Figure 1-3 Amtrak Cascades Ridership – Oregon Section – between 1995 and 2018



Oregon Passenger Rail Service Development Plan
Source: ODOT Rail Division: 1995-2018 Ridership Data (ODOT 2019), U.S. Energy Information Administration

1.1.3.2 Oregon Transportation Options Plan and Policy

The Oregon Transportation Commission recently adopted the Transportation Options Plan.[5] This modal plan creates policies, actions and strategies that provide a range of transportation options for Oregonians, and improve the efficiency with which people and goods move through the transportation system. Although the Transportation Options Plan does not directly address intercity passenger rail, it does provide a range of policies that promote equity, accessibility and health, making it compatible with the goals of the OPR Project.

ODOT is required to comply with all elements of the multi-modal Oregon Transportation Plan.[6] The Oregon Transportation Options Plan is an element of the Oregon Transportation Plan. The Transportation Options Plan goal is to reduce reliance on the single-occupancy vehicle by facilitating greater use of transit, biking, walking and rideshare. ODOT's continued investment in Amtrak Cascades intercity rail and bus service directly implements the policy intent of the Oregon Transportation Options Plan[5] and the Oregon Transportation Plan by providing more travel options to Oregon residents, businesses and visitors, through investment to expand the use of existing transportation infrastructure.

1.1.4 OPR Project Study Area

FRA and ODOT established a preliminary OPR Project study area during the NEPA scoping period in fall 2012 (**Figure 1-4**). The preliminary OPR Project study area was generally bounded by the Eugene-Springfield area to the south and the Washington state line (Columbia River) to the north. The Cascade foothills bounded the study area to the east and the Coast Range bounded it to the west. The study area was broad enough to encompass a variety of corridor alignments and potential station locations suggested by stakeholders and the public during the scoping period. As corridor concepts and potential station locations were considered and eliminated, FRA and ODOT narrowed the study area boundaries to assess a more localized range of potential impacts associated with each of the corridor concepts. (See Chapter 3 for the concepts that the OPR Project team considered and eliminated, and the reasons for eliminating these concepts).

1.1.4.1 Study Area Demographics

The PNWRC has 7.6 million residents within 25 miles of the existing rail line, with 2.2 million jobs located within 10 miles of the existing rail corridor.[7] The total air market within the PNWRC corridor is 2 million annual passengers, as measured by the number of passengers that originated and landed in airports between Eugene and Vancouver, BC.[8]

The Seattle metropolitan region is larger than Portland in terms of population and employment. However, with respect to Amtrak station proximity the differences are not great. Seattle has a population of 2.6 million within 25 miles of its downtown rail station (King Street Station), compared to a population of 2.1 million within 25 miles of Portland's downtown rail station (Union Station). The employment numbers are even more similar—700,000 people work within 10 miles of Seattle's King Street Station compared to 650,000 jobs within 10 miles of Portland's Union Station.

Figure 1-4 Preliminary OPR Project Study Area

Oregon Passenger Rail Service Development Plan

Major population centers (identified as Eugene Salem Portland, Vancouver, Washington; Seattle, and Vancouver, BC) will potentially experience a 39 to 48 percent growth in population and a 36 to 44 percent growth in employment by the year 2040, according to forecasts cited by the High Speed Rail in America report.[7]

1.1.4.2 Study Area Travel Characteristics

1.1.4.2.1 Passenger Rail Service

The Amtrak Cascades rail service focuses on trips within the PNWRC and shorter than 200 miles, meaning that, although the total distance between the southern and northern ends of the PNWRC is more than 450 miles, most trips are to serve markets within more specific segments of the PNWRC, as listed in **Table 1-1.**

Table 1-1 Daily Connections between City Pairs (less than 200 miles) along the Pacific Northwest Rail Corridor

Connection	Amtrak Cascades	Coast Starlight	Thruway Buses	Total # Trips/Day
Eugene to Portland (120 miles)	2	1	7	10
Portland to Seattle (180 miles)	4	1	0	5
Seattle to Vancouver, BC (150 miles)	2	N/A	4	6

[a] An equal number of connections between these city pairs are available in both the northbound and southbound directions.

[b] Thruway buses operated by Amtrak.

N/A = not applicable NOTE: Mileage is approximate.

Source: Based on Amtrak Cascades timetable, accessed June 2015 (Amtrak, 2015)
Oregon Passenger Rail Project Service Development Plan

Connections also exist for longer distance trips (between 250 and 350 miles) along the PNWRC, allowing relatively convenient connections (with a layover of under an hour), in both the northbound and southbound directions.

It is possible to travel the entire length of the PNWRC (between Vancouver, BC, and Eugene) in one day, through either a combination of rail and bus or all rail with substantial layovers in Portland or Seattle.

Though modestly priced, passenger rail travel times are not competitive with driving or flying between the same city pairs. **Table 1-2** illustrates this travel-time and cost comparison for travel between Eugene and Seattle.

Table 1-2 Travel-Time Comparisons by Mode between Eugene, OR, and Seattle, WA

Mode	Best Possible Travel Time	One-way Fare / Travel Cost
Amtrak Cascades Rail	6 hours 20 minutes	$58 [train fare only, excludes cost of travel to station and parking]
Drive	4 hours 25 minutes	$164 [based on 2020 Internal Revenue Service business travel rate of $0.58 per mile]
Air (In-Flight Only)	1 hour 40 minutes	$149 (saver) [air fare only, excludes cost of travel to airport and parking]

Sources: www.amtrak.com, www.maps.google.com, and www.alaskaair.com (last accessed September 2020)
Oregon Passenger Rail Service Development Plan

1.1.4.2.1.1 Amtrak Cascades Ridership Characteristics in Oregon

In Oregon, intercity passenger rail users are typically business or leisure travelers rather than day-to-day commuters. The composition of the labor market within a metropolitan region can have a positive impact on intercity rail travel. For example, people who work in knowledge industries are cited as being more mobile and traveling more often for business than those employed in manufacturing and industrial sectors.[5]

An onboard “revealed preference survey” of current passengers of the Oregon Cascades train service and Cascades POINT/Thruway bus service boarding from Oregon stations was conducted in August 2013.[9] The survey did not include Coast Starlight passengers. Some of the key findings from the survey are:

- There was a mix of travel purposes among intercity riders, with 82 percent of the trips made for personal or social purposes and 18 percent made for business or commute purposes.
- Approximately 50 percent of the daily transit trips were concentrated in the Portland–Eugene intercity market. Portland–Albany and Portland–Salem were other city pairs with notable travel activity.

Additional analysis of the potential Oregon intercity passenger travel market was conducted in 2014[10] and offers further insight and context:

- The transit rider market, specifically with Amtrak Cascades and Cascades POINT/Thruway bus riders, exhibited a high degree of transit dependency, with 18 percent of the riders not having a vehicle in their household, compared to 8 percent in the population of the general study area.
- Students made up about 19 percent of Amtrak Cascades riders in Oregon.

Between 1995 and 2018, ridership on the Amtrak Cascades trains between Eugene and Portland increased by 134 percent. As illustrated above on **Figure 1-3**, the highest year-over-year increases in the previous decade were observed in 2008 (17 percent) and 2010 (14 percent). However, ridership has dropped 10 percent since January 2014. Falling gasoline prices from 2012 to 2016 and reduced service schedules following a train derailment in late 2017 near Dupont, Washington are key contributing factors affecting recent ridership losses. This recent pattern of ridership losses follows a sustained period of substantial and steady growth underscores the need for new investments to add trains and increase reliability to improve the existing passenger rail service through the Willamette Valley.

1.1.4.2.2 Intercity Highways

The most direct travel route by car between Portland and Eugene is Interstate 5 (I-5). Built in the mid-1960s, this interstate in Oregon stretches 308 miles between the Washington and California borders. Between the cities of Portland and Eugene (112), the speed limit varies from 50 mph (in downtown Portland) to 65 mph (in rural areas). The highest traffic counts are observed at mile marker 291 in the Portland metropolitan area, just south of the Upper Boones Ferry Road interchange (157,900 cars daily).[11] I-5 is subject to frequent congestion, especially during peak commute hours on weekdays and summer weekends. Congestion can be most acute in the Portland metropolitan area (specifically, near the Rose Quarter, Terwilliger Curves, and between Wilsonville and Highway 217), the Salem Hills area, and between Albany and Highway 34. When I-5 is congested, relief routes provide limited connectivity—Oregon Highway 99W (OR 99W) parallels I-5 between Tigard and Portland, and OR 99E is a longer and slower alternative between Portland and Salem and again between Albany and Eugene.

ODOT is considering selective plans to widen I-5 in the future, including the Columbia River Crossing (Interstate Bridge) and Rose Quarter area near the junction of I-84. Otherwise, there are no major capacity improvements on I-5 in ODOT's short- or long-term plans.

1.1.4.2.3 Intercity Air Passenger Service

The Portland and Eugene airports combined have approximately 1.5 million annual passengers originating in and destined to commercial airports elsewhere in the Pacific Northwest. This is approximately 75 percent of the total air market between the airports in Eugene, Portland, Seattle, and Vancouver, BC. **Table 1-3** shows the air markets between major airport pairs along the PNWRC. The highest number of annual round-trip passengers is between the Portland and Seattle airports (1 million).

Table 1-3 Annual Air Traffic between Airports along PNWRC (2014)

Airport	Round-trip City Pair	Annual Round-trip Passengers	Total Airport Passengers
Eugene, OR	Seattle, WA	120,000	875,000
	Portland, OR	165,000	
Portland, OR	Vancouver, BC	200,000	16 million
	Seattle, WA	1 million	
	Eugene, OR	165,000	
Seattle, WA	Vancouver, BC	500,000	36 million
	Portland, OR	1 million	
	Eugene, OR	120,000	

Source: Bureau of Transportation Statistics data, 2014

Oregon Passenger Rail Project - Service Development Plan

As noted in **Table 1-3**, annual air traffic between these cities is a relatively small percentage of the total number of passengers that travel through the airports, particularly in Seattle, as the majority of trips are connecting flights with origins or destinations outside PNWRC. In addition, no market or economic forecasts indicate increased intra-state (Portland–Eugene) air passenger service. In 2014, United Airlines eliminated all Portland–Eugene air service (three round trips), leaving only four round trips per day operated on Alaska Airlines.[12]

The Seattle–Portland air market has always been robust. Alaska Airlines runs frequent service between Portland and Seattle, with 28 daily nonstop flights. In 2013, Delta Airlines initiated daily service between Portland and Seattle (four round trips per day), which increased competition with Alaska Airlines at SeaTac Airport.[13] There are also four daily round trip flights between Eugene and Seattle.

It is not expected that improved passenger rail between Portland and Eugene would substantially affect the existing air travel market because of various circumstances (such as travel time, convenience, and the need to connect at major airports to reach destinations farther afield).

1.1.4.3 Oregon State Rail Plan and Policy

The 2014 Oregon State Rail Plan was updated and adopted by the Oregon Transportation Commission in 2020.[14] The plan highlights the importance of both freight and passenger rail service as a significant conduit for economic and job activity throughout Oregon. Specific to passenger rail service, the Oregon State Rail Plan notes that intercity passenger rail connects job markets, recreation and tourism centers throughout the state (supporting local economies), provides mode choice and relieves congestion, contributes positively to the environment and enhances community quality of life. The plan also identifies three key elements for improving Amtrak Cascades passenger rail service:

- Improve travel times and reliability–Increased traffic congestion on the I-5 corridor and/or improved train travel times that are at least as fast as travel by private automobile will make passenger rail more competitive; reliability is equally important: if the trains operate on-schedule, travelers are more likely to use them.
- Frequency–The present passenger rail round trips (two in 2020) between Eugene and Portland do not provide sufficient schedule flexibility for many travelers.
- Connectivity–Improving access to stations and public transportation system connectivity can lower the overall time and effort required to use the Amtrak Cascades service and expand transportation options for travelers.

The Oregon State Rail Plan defers decisions on specific improvements to the Amtrak Cascades Service to the OPR Project.

As detailed in the *High-Speed Rail Concept Vision Report,*[15] the OPR Project represents a *Level 1* or *Level 2* investment, using conventional diesel technology and partially or fully shared track with freight.

1.2 Project Purpose

The purpose of the OPR Project is to improve the frequency, convenience, speed and reliability of passenger rail service along the Oregon segment of the federally designated PNWRC in a manner that will:

- Provide riders with an efficient, safe, equitable and affordable alternative to highway, bus and air travel
- Be a cost-effective investment

- Protect freight-rail carrying capability[2]
- Support the ongoing implementation of regional high-speed intercity passenger rail in the PNWRC between the Eugene-Springfield metropolitan area and Vancouver, BC
- Be compatible with the Washington state portion of the PNWRC
- Promote economic development
- Avoid or minimize community and environmental impacts
- Integrate with existing and planned multimodal transportation networks

1.3 Project Need

The need for the OPR Project arises from multiple transportation, land use, socio-economic and environmental considerations, including the following:

- Increasing intercity and regional travel demands
- Existing limited rail-system capacity and competing service needs
- Declining state and local roadway funding
- Increasing economic vitality of the corridor
- Promoting transportation system safety and security
- Changing transportation demand resulting from demographic changes

The Tier 1 EIS (Chapter 1) provides a comprehensive summary of each consideration.

1.4 Project Goals and Objectives

The OPR Project's goals and objectives described in **Table 1-4** identify the primary issues the OPR Project intends to address. These goals and objectives served as the basis of the alternatives evaluation conducted by ODOT in 2014 that led to the identification of the build alternatives evaluated in the Tier 1 DEIS. The initial set of goals came out of the public and agency scoping process in 2012. The OPR Project team refined the goals based on comments from the public, resource agencies, the Corridor Forum and the Leadership Council. (For more information on the Corridor Forum and the Leadership Council, see Chapter 6 of the Tier 1 DEIS.)

[2] Cargo volume that can be transported by freight rail.

Table 1-4 OPR Project Goals and Objectives

Goal		Objective
1	**Improve passenger rail mobility and accessibility to communities in the Willamette Valley**	1A Provide a viable alternative to auto, air, and bus travel between Eugene and Vancouver, WA 1B Provide reliable and frequent passenger rail service 1C Support multimodal integration at each passenger rail station 1D Allow for future passenger rail improvements, including higher speeds
2	**Protect freight-rail capacity and investments in the corridor, and maintain safety**	2A Do not increase conflicts between passenger rail or freight rail and vehicles 2B Protect freight-rail carrying capability
3	**Plan, design, implement, maintain, and operate a cost-effective project**	3A Develop a strategy that can be reasonably funded and leveraged with a range of investment tools for construction and operation 3B Serve the maximum number of people with every dollar invested
4	**Provide an affordable and equitable travel alternative**	4A Provide a viable and affordable alternative for travelers 4B Provide equitable investments and service, with consideration to race/ethnicity and income
5	**Be compatible with passenger rail investments planned in Washington state**	5A Provide passenger rail service to meet the existing and future passenger rail demand for an interconnected system in the Pacific Northwest High-Speed Rail corridor
6	**Promote community health and quality of life for communities along the corridor**	6A Benefit communities within the corridor 6B Minimize negative impacts to communities along the corridor
7	**Protect and preserve the natural and built environments**	7A Support Oregon’s commitment to the preservation of resource lands and to local land use and transportation planning 7B Reduce greenhouse gas emissions in support of national and state policies to slow climate change 7C Avoid and minimize impacts to the natural environment and cultural resources

2 Rationale

Chapter 2 addresses the service rationale for improving intercity passenger rail service on the Oregon segment of the PNWRC. The primary topics of this chapter include:

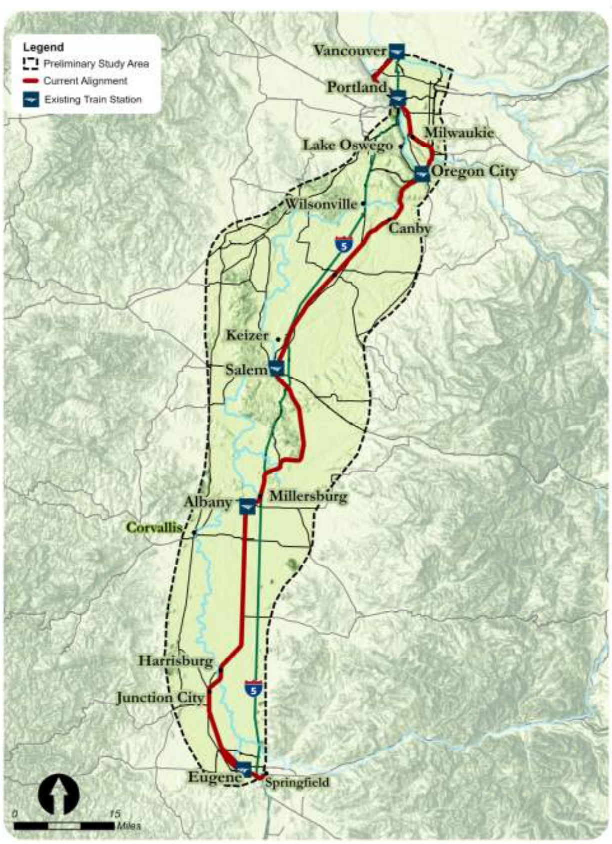
- Geographic Characteristics of the Service Area
- Connectivity to Other Modes of Transportation

2.1 Service Area Geographic Characteristics

The service area for the Oregon Amtrak Cascades service extends from the historic Portland Union Station in downtown Portland in the north, south to the Amtrak depot in Eugene. The route is entirely within the state of Oregon and is 123 miles in length through the Willamette Valley. See **Figure 2-1.**

The Oregon Amtrak Cascades service area includes the major urban population areas of Portland, Salem, Albany and Eugene. **Table 2-1** shows the population trends of the major urban population areas in the Oregon Amtrak Cascades corridor. The rail line passes through a diverse variety of Willamette Valley agricultural areas between the major population centers. Generally, the topography between Portland and Eugene is relatively flat, but there are a few areas of hills that confine the route between Salem and Albany. The Willamette Valley is approximately 75 miles wide and is bounded to the west by the Coast Range and to the east by the Cascades Range.

Figure 2-1 Oregon Amtrak Cascades Service Area



Portland is the largest city in the state of Oregon and was the 23rd largest metropolitan statistical area (MSA) in the United States in the 2010 census, with a population of 2,226,009. According to Metro Region Government, the population of the Portland-Vancouver-Hillsboro MSA has increased more than 46 percent from 1990 to 2010.[16] Portland is the second largest urban area in the Pacific Northwest and is a key regional commercial center. The Portland MSA is a major transportation hub, with significant port, highway and rail facilities intersecting at this location adjacent to the confluence of the Willamette and Columbia Rivers. The Portland area is home to several universities and major sports apparel brands. Manufacturing, high-tech and medical firms located in the Portland area are also significant employers. Portland is also a major visitor destination that offers many attractions, museums, entertainment venues, convention centers and musical events. Portland is also home to two professional sports teams, the NBA's Portland Trailblazers and MLS's Portland Timbers.

The existing Amtrak Cascades service has two stops in the Portland MSA. The busiest train station in

Oregon is Portland's Union Station, located in downtown. It serves as a major transportation hub for the city. The second station stop in the Portland MSA is located in Oregon City, approximately 20 miles south of downtown in the suburban area.

Table 2-1 Population Trends in the Oregon Amtrak Cascades Corridor

City/MSA	1990	2000	2010
Portland, OR	1,523,741	1,927,881	2,226,009
Salem, OR	278,024	347,214	390,738
Albany, OR	91,227	103,069	116,672
Eugene-Springfield, OR	282,912	323,011	351,705

Source: US Census

The Salem area is the second-largest community in the corridor with almost 400,000 residents, surpassing Eugene in population in 2000. Salem is the capital of Oregon, and the state government is the major employer in the area. Other major employers are food processors, educational institutions and medical facilities. Willamette University is in Salem and has an enrollment of approximately 2,100 students. The recently refurbished historic train station is located in downtown Salem.

Albany is the smallest community served by Amtrak Cascades in Oregon, with a population of almost 120,000. Surrounded by substantial agricultural and forest areas, food processing and forest products comprise a significant portion of the local manufacturing base. Oregon State University (OSU) is located approximately 12 miles southwest of Albany, in Corvallis. OSU has an enrollment of over 32,000 and is the largest university in Oregon. As a member of the PAC-12 athletic conference, OSU hosts a number of visitors for sporting events throughout the year.

The Eugene-Springfield MSA is the southern end of the Oregon Amtrak Cascades corridor. Eugene is home to the University of Oregon, with an enrollment of approximately 22,000 students. It is also the major employer in the community. Eugene is also a major site for a variety of PAC-12 college sporting events and a major visitor destination.

2.2 Transportation Modes and Connectivity

There are a variety of well-developed travel modes available along the Oregon Amtrak Cascades corridor. These include private vehicles, airlines, intercity bus and long-distance passenger rail services. In addition, there are a wide range of mobility options available for local connections.

2.2.1 Airline Service

There is limited airline service between communities in the service areas, with only Portland and Eugene having scheduled commercial airline services. Portland International Airport is a major regional airport, with extensive commercial airline operations providing connections to a number of locations in the region and the rest of the United States, and to foreign countries.

Eugene municipal airport is served by Alaska, Delta, United, American, and Allegiant airlines. Before the COVID-19 pandemic, airline schedules for Eugene did include four direct daily flights to/from Portland on Alaska Airlines. Currently, there are no direct scheduled flights between Eugene and Portland, but there are connecting flights via Seattle on Alaska Airlines. In 2015, Eugene had 23 arrivals and 23 airline departures scheduled daily.[17]

2.2.2 Transit

Oregon has an extensive public transit system. There are four main transit systems that operate in the Oregon Amtrak Cascades service area that provide connections to the service. These systems are described below.

TriMet is the service provider for transit in the Oregon portion of the Portland MSA. Portland Union Station is served by light rail transit, multiple local bus routes and the Portland Streetcar, which is located only two blocks away. The light rail line provides access to Portland International Airport. In Oregon City, TriMet provides no fixed-route services directly to the Oregon City train station. However, TriMet's Oregon City Transit Center is located approximately 0.7 miles southwest of the train station.

Cherriots is the public transit provider in the Salem area. The Salem train station is served directly by the Cherriots Route 18 bus. The downtown transit center is located approximately 1 mile from the train station, and connections can be made to other Cherriots routes there.

The Albany train station has been developed into a multimodal station, served by the Albany Transit system.[18] The train station serves as the main transit hub for the city, with all bus routes serving this multimodal station. The Linn-Benton Loop service provides additional transit connections from the Albany station to Corvallis and OSU.

Eugene-Springfield's transit provider is Lane Transit. The Lane Transit hub is located seven blocks south of the existing Amtrak station in Eugene. Lane Transit Routes 1 and 40 operate approximately one block south of the station, providing a closer alternative than the hub.

2.2.3 Intercity Passenger Rail Services

Amtrak's long-distance passenger rail service in the corridor includes the Empire Builder and the Coast Starlight. The Empire Builder service operates daily between Portland and Chicago via the Columbia River Gorge. The Coast Starlight service operates daily between Seattle and Los Angeles. It travels the entire route of the Amtrak Cascades service between Portland and Eugene, and provides additional rail travel options for passengers beyond the Oregon service area.

Before the COVID-19 pandemic, Amtrak operated two daily round trips between Portland and Eugene in the corridor, which has been reduced to one daily Seattle-Eugene round trip during the pandemic. Oregon's Amtrak Cascades service provides connections to and from additional Amtrak Cascades services to Washington state and Vancouver, BC.

2.2.4 Intercity Bus

Intercity bus service operates in the Amtrak Cascades service area, using I-5. Services are provided by BoltBus, Greyhound and Cascades POINT service.

BoltBus has currently suspended all bus service in the service areas due to COVID-19. Before the pandemic, BoltBus had been operating in the Pacific Northwest since 2012 between Seattle and Portland. Service was expanded south from Portland in late 2013[19] with four round trips between Eugene, Albany and Portland. It is unknown whether and when BoltBus will resume operations in the service area.

Greyhound currently provides one round trip between Portland, Salem, Corvallis and Eugene. Before COVID-19, Greyhound had intercity bus operations all along the West Coast I-5 corridor, from Canada to Mexico, including 8 round trips between Eugene and Portland.

Cascades POINT/Thruway service is an intercity bus service sponsored by ODOT and partially operated in coordination with the Amtrak Cascades service. The last pre-COVID-19 schedule[20] showed 6 daily Cascades POINT bus round trips between Eugene and Portland, and 1 round trip between Salem and

Portland. Cascades POINT buses provide connections to/from Amtrak trains in Portland, including the Empire Builder and Amtrak Cascades trains operating between Portland and Seattle. Cascades POINT buses are co-branded as Amtrak Thruway buses.

2.2.5 Private Vehicles

I-5 is the primary north-south interstate highway on the West Coast, and it closely parallels the rail corridor in the Willamette Valley between a point about 30 miles south of Portland and Salem, Albany and Eugene. In the Portland metropolitan area, Interstate 205 (I-205) provides additional Interstate highway capacity, as an alternative to I-5. Other major north/south highways along the route include Oregon Highway 99E and Highway 99W. These highways are part of a well-established roadway network in the Willamette Valley and provide a high degree of connectivity in the region for private vehicles. I-5 and I-205 experience significant traffic congestion in the Portland Metro area, especially during peak-periods.

Rental vehicles and car sharing services are also available throughout the service area. At Portland's Union Station Zipcar, a car sharing service, has vehicles available. Several car rental agencies have offices within 1 mile of the station as well. There are no car rental facilities near the Oregon City station. Rental cars are not available at the Salem Amtrak station, and the nearest location is approximately 1.5 miles distant. Albany has no rental car facilities at the station, but there is a rental car facility just 0.3 miles north of the station. In addition, Zipcar has vehicles in nearby Corvallis, specifically at OSU. The Eugene Amtrak station has Zipcar service available at the Eugene rail depot. The nearest rental car facilities are located just under 1 mile west of the station.

2.2.6 Other Mobility Options

In recent years, there has been a substantial rise in the use of bicycles and electric scooters in providing last mile/first mile connectivity for travelers. These options are generally located in urban locations or near major universities and utilize smartphone technology to manage the rental of the units. The following discussion describes the available mobility options in the area.

2.2.6.1 Bicycle Sharing/Rentals

Portland:

Launched in 2016, Biketown is Portland's bike share program. A Biketown bike hub is located at Portland's Union Station for easy access to rail passengers. Currently the Biketown program serves only the downtown and east-central neighborhoods of the city. Currently there are 1,000 bikes and 100 bike hubs in the program.

Oregon City, Salem and Albany:

There is a self-service bike rental stand at the north end of the station parking lot in Salem, but no bike rental or bike sharing facilities exist at Oregon City and Albany.

Eugene:

Peacehealth rides provides a bike-share service in the Eugene area. A bike-share station is located at the Eugene Amtrak station.

2.2.6.2 Electric Scooters Sharing/Rentals

Portland:

Both Bird and Lime provide electric scooters for rent in downtown Portland near Union Station.

Oregon City, Salem, Albany and Eugene:

There are no electric scooters available for rent in these locations.

2.3 Rationale for the OPR Project

Currently, I-5 is the primary commerce corridor and connection for the movement of people and goods linking Eugene, Albany, Salem, Portland and cities north in Washington state and even British Columbia. However, traffic congestion on I-5 is particularly severe within the Salem, Portland-Vancouver (Washington), Olympia and greater Puget Sound areas. There are limited plans to improve I-5 and reduce traffic congestion through the 20-year planning period. Congestion on I-5 will likely increase as the region grows, especially during peak periods; so, to maintain mobility in the state and region, cost-effective investments in Amtrak Cascades intercity passenger rail service are important.

Passenger rail service ridership thrives in an environment with frequent departures conveniently scheduled throughout the day, reliable service that passengers can depend on, and service with competitive travel times at a reasonable cost. The plans for expanding Amtrak Cascades service into the future focus on these key elements to make the service more attractive to travelers. Both Oregon and Washington, as well as local communities, have also invested significant funds in multimodal facilities over the past 25 years. These facilities provide rail travelers last mile connections to begin or complete their journeys. This reduces dependence on the use of personal vehicles; limits the growth of highway congestion, greenhouse gases and toxic air emissions; and provides mobility options for the increasing number of people who do not drive or do not own a personal vehicle.

The Pacific Northwest is focused on sustainability, and Amtrak Cascades service is an important element to ensure regional connectivity beyond personal vehicles in the future. Specifically, State of Oregon policy directs state agencies to reduce greenhouse gas emissions to 45 percent below 1990 emission levels by 2035.[21] The state will be prioritizing and investing in projects that will attain these goals. Existing airline services are limited to Eugene and Portland, and have higher impacts on the environment and contribute to climate change. Communities such as Albany and Salem have no air service at all, and Amtrak Cascades provides travel options. Furthermore, air travel costs are high, which limits accessibility to people with lower incomes.

Amtrak's service in both Oregon and Washington is limited now due to the COVID-19 pandemic. However, the pre-pandemic schedules between Seattle and Portland provided four round trips per day, with one of those round trips extended down to Eugene[22] and one round trip provided by a connecting Amtrak Cascades train. WSDOT has plans to add two more round trips between Seattle and Portland in the near term, after the pandemic emergency is over. As mentioned above in section 2.2.3, these services provide additional connections to long-distance train services, expanding travel options to more locations.

In the future, both Oregon and Washington will need to continue to work together to coordinate Amtrak Cascades service expansion. Washington state's recently published Rail Plan[23] includes several growth scenarios for the future and is consistent with the plans in this SDP. Continued close cooperation between ODOT and WSDOT will be critical to the future success of Amtrak Cascades service and any future, ultra high-speed rail service in the region.

Today's Amtrak Cascades service levels cannot fully meet the future needs of Oregon's intercity travelers. Passenger rail users in Oregon frequently travel to and from the Puget Sound region.[24] This service provides important intrastate and interstate connections, just as I-5 does. Expanded service would also provide a cost-effective and more eco-friendly alternative to air travel for a variety of business, school, leisure and other trips within the corridor.

Qualitative and quantitative assessments of the OPR Project costs, benefits and economic impacts are presented in Chapter 10 of this SDP. With a project benefit-cost ratio of 1.2 to 1, the OPR Project will yield significant economic benefits to the state of Oregon. In addition, the OPR Project will provide substantial environmental, livability, sustainability and accessibility benefits to the state.

3 Identification of Alternatives

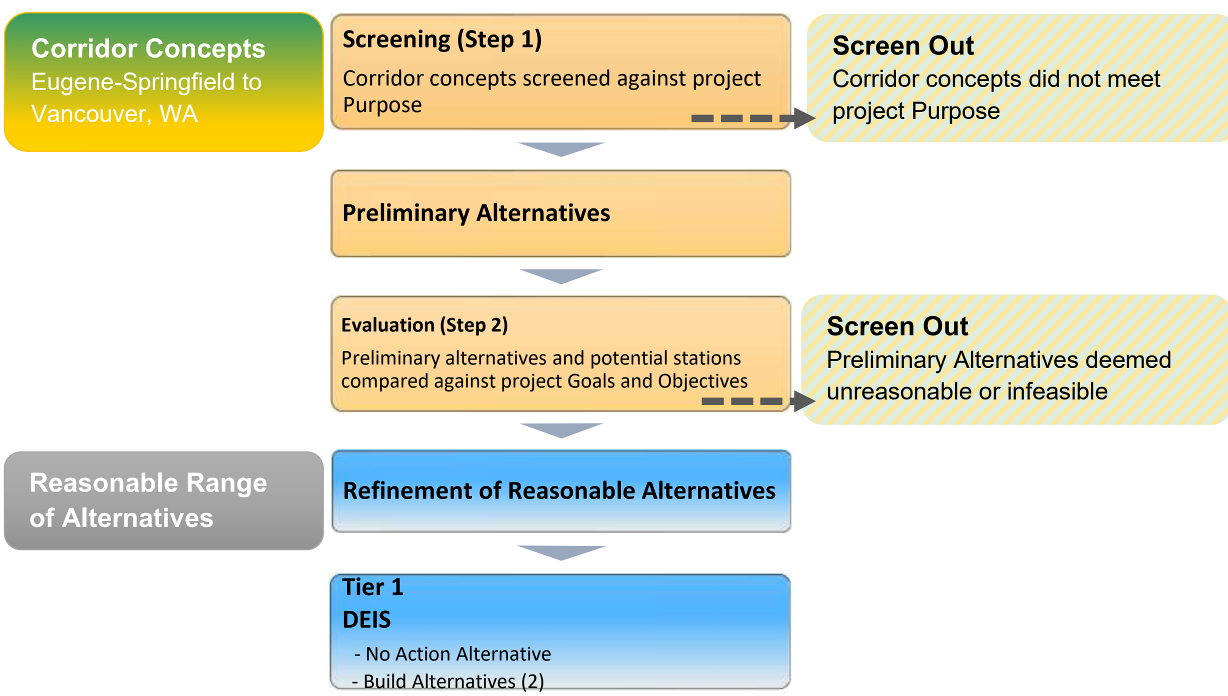
Chapter 3 addresses the foundation, assessment, and narrowing of options for improving intercity passenger rail service on the Oregon segment of the PNWRC. The primary topics of this chapter include:

- Corridor alignment concepts, existing and potential new stations, train technologies, and travel modes considered;
- Framework used for the screening and evaluation processes;
- Outcomes from the screening of corridor alignments, stations, technologies, and travel modes; and
- Outcomes from the preliminary alternative evaluation process.

3.1 Corridor Alignment and Station Concepts Considered and Eliminated

Figure 3-1, below, illustrates the process used to identify the build alternatives studied for the Oregon Passenger Rail (OPR) Project Tier 1 Draft Environmental Impact Statement (DEIS).

Figure 3-1 Tier 1 NEPA Process



3.1.1 Development of Corridor Concepts

In the fall of 2012, ODOT and FRA conducted public and agency scoping to solicit input on the initial “corridor concepts” for improved intercity passenger rail service on the Oregon segment of the PNWRC. Based on input received during the scoping period and information from previous regional and local planning studies, ODOT and FRA established a wide range of corridor concepts for initial study.[3] Corridor concepts were broadly defined as potential passenger rail alignments and approximate station locations between Eugene/Springfield and Vancouver, Washington.

3.1.2 Concept Rail Alignments and Stations

The corridor concept rail alignments and stations identified from the scoping process are shown on **Figure 3-2** and summarized in **Table 3-1**.

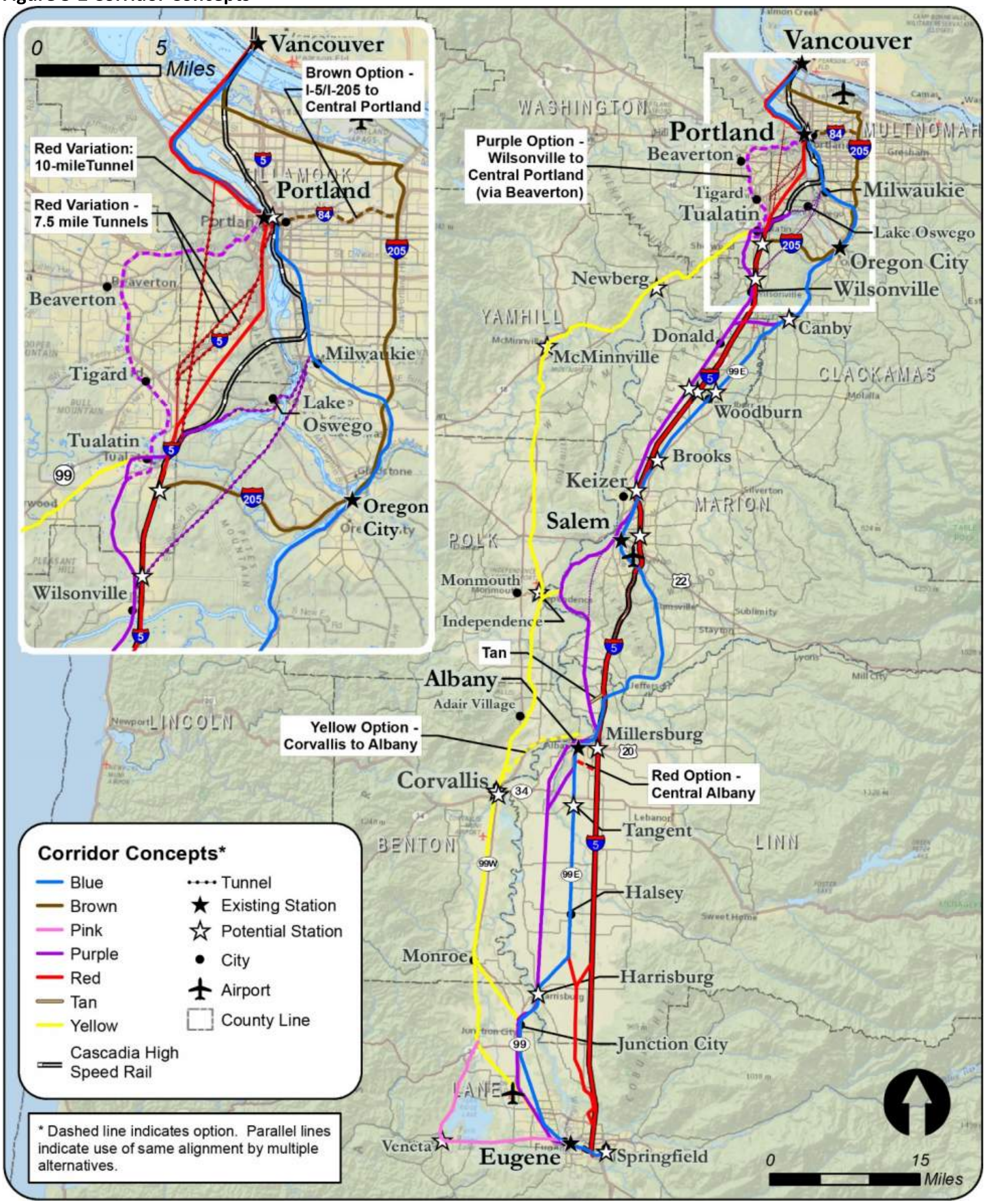
Table 3-1 Corridor Rail Alignment Concepts

Concept Alignment	Description	Passenger Rail Service	
		Mixed with Freight	Passenger Only
Blue	New mainline track parallel to the existing Amtrak Cascades route within or near the Union Pacific Railroad (UPRR) right-of-way. Shared track with freight trains and designed for a maximum speed of 79 mph.	x	
Red	Parallel I-5, either within or near the current highway right-of-way. Consist of largely new track devoted to intercity passenger rail service and have a maximum design speed of 110 mph.		x
Purple	New mainline track parallel to the existing freight rail line historically known as the Oregon Electric Railway, which is currently operated by Portland and Western Railroad (PNWR), with a maximum design speed of 110 mph.	x	
Yellow	Same as Purple concept between Tualatin and Portland. South of Tualatin route is sited along the existing PNWR line through Newberg, McMinnville, Independence and Corvallis. Maximum design speed of 79 mph.	x	
Cascade High-Speed Rail	A fully electric high-speed rail alignment from Eugene, OR, to Vancouver, WA. The alignment would be separate from existing rail right-of-way and have a maximum design speed of 180 mph or greater. North of Tualatin located along new ROW on a combination of new tunnels and elevated track.		x
Brown	Same as the Purple or Red options south of Wilsonville. North of Wilsonville travels within or adjacent to the I-5 and I205 rights-of-way, with a maximum design speed of 79 mph.	x	x
Pink	Same as Yellow option, new rail alignment from Eugene to Veneta, with a maximum design speed of 79 mph.	x	
Tan	Short new route linking Purple and Red alignments north of Millersburg.	x	x

3 Relevant planning studies included the Oregon Rail Plan (2001), the Oregon Transportation Plan (2006), and the ODOT Intercity Passenger Rail Study (2009); these and other applicable studies and reports are included in the reference list, Chapter 8 of the DEIS.

For a more detailed description of the corridor concept alignments and stations, see the Tier 1 DEIS (Sections 2.2.1 and 2.2.2).

Figure 3-2 Corridor Concepts



Oregon Passenger Rail Project Draft Service Development Plan

3.1.3 Transportation Modes and Train Technologies

Multiple transportation modes and train propulsion technologies were suggested through the public and agency scoping process. Descriptions of the suggested modes and technologies are found below.

Transportation Modes

- Intercity passenger rail
- Commuter rail
- Enhanced bus service
- Highway capacity improvements

Locomotive Technologies

- Locomotive hauled (existing technology)
- Diesel multiple units
- Dual mode/power
- Electric
- Magnetic levitation (Maglev)

See the Tier 1 DEIS (Section 2.2.3) for a more detailed description of the modes and train technologies considered.

3.2 Screening of Corridor Concepts

In early 2013, ODOT and FRA developed a screening and evaluation framework and initiated a two-step screening and evaluation process. ODOT used the screening and evaluation to develop a reasonable and feasible range of potential build alternatives to study in more detail in the Tier 1 DEIS. The overall screening and evaluation process consisted of the following two steps:

Step 1, Screening. ODOT conducted the first step of the framework in winter 2012 through spring 2013. For this initial screening step, ODOT assessed the range of corridor concepts identified during the scoping period against elements of the OPR Project's Purpose and Need statement. ODOT further developed and refined corridor concepts, including alignments and station locations, that passed the screening into preliminary alternatives. ODOT and FRA eliminated from further consideration those corridor concepts that failed the screening process.

Step 2, Evaluation. ODOT defined preliminary alternatives in terms of the general location of the mainline track, location of sidings and stations, whether crossings would be at-grade or grade-separated, and whether structures (e.g., bridges, culverts) would require replacement. Cost estimates were developed for each preliminary alternative. The preliminary alternatives were then evaluated according to how effectively they met the OPR Project evaluation criteria, which are based on the Purpose and Need statement as well as Goals and Objectives derived from stakeholder input.

For additional information on the goals and objectives, and the screening and evaluation processes, see the Tier 1 DEIS (Section 2.3).

3.2.1 Step One: Screening

3.2.1.1 Corridor Concept Alignments and Stations

ODOT assessed the corridor concepts against a series of screening questions using readily available environmental resource and land use GIS data provided by cities, counties, and regulatory agencies; engineering inventory information provided by state and local jurisdictions; and spatial data available via the Internet (such as U.S. Census Bureau data). **Table 3-2** lists the screening questions and notes their association with the OPR Project's Purpose and Need statement (see Tier 1 DEIS, Chapter 1).

Table 3-2 Screening Questions

Project Purpose (from Purpose and Need Statement)	Screening Questions (Yes or No)
Improve the frequency, convenience, speed, and reliability of passenger rail service to provide riders with an efficient, safe, equitable, and affordable alternative to highway, bus, and air travel.	**1.** Would the concept improve travel time for rail passengers between Eugene/Springfield, OR, and Vancouver, WA? **2.** Would the concept serve communities with the highest populations within or near the corridor?
Be a cost-effective investment.	**3.** Could the concept provide cost-effective intercity passenger rail?
Protect freight-rail carrying capability.	**4.** Could the concept preserve or expand existing freight-rail carrying capability?
Support the implementation of regional high-speed rail in the PNWRC between the Eugene-Springfield, OR, metropolitan area and Vancouver, BC.	**5.** Would the concept support service consistent with the FRA regional high-speed rail designation for the PNWRC?
Be compatible with the Washington State portion of the PNWRC.	**6.** Would the concept be compatible with the Washington State portion of the PNWRC?
Promote economic development.	**7.** Could the concept enhance the potential for increased economic development?
Avoid or minimize community and environmental impacts.	**8.** Could the concept be constructed in a manner that would avoid substantial regulatory hurdles and/or avoid or minimize substantial impacts to the community or the natural environment?
Integrate with existing and planned multimodal transportation networks	**9.** Would the concept support multimodal connections (such as commuter rail, other rail transit, bus, bicycle, and pedestrian services)?

[a] Sufficient data on cost-effectiveness were not available during screening, so this screening question was not used to screen corridor concepts.

Corridor concepts (which included rail alignments as well as existing and potential new stations) were required to pass all screening questions in order to move on to Step 2, Evaluation. As shown in **Figure 3-3**, combinations of the Red and Blue corridor concept segments passed the screening questions and were advanced to the Evaluation of Preliminary Alternatives. Shorter segments of the Purple and Yellow concepts also passed the screening questions, although those concepts rely on combinations with either the Red or Blue concepts to complete full corridor alignments.

3.2.1.2 Transportation Modes and Train Technologies

ODOT compared each of the transportation modes and train technologies against the screening questions (**Table 3-2**). Three locomotive technologies passed all of the screening questions: locomotive hauled (existing technology), diesel multiple units, and dual mode/power.

See the Tier 1 DEIS (Section 2.3) for a more detailed description of the corridor concept screening process and results.

3.3 Evaluation of Preliminary Alternatives

After completing screening, ODOT and FRA developed preliminary alternatives from those concepts that passed the screening step. ODOT defined preliminary alternatives in terms of the general location of the mainline track, location of sidings and stations, whether crossings would be at-grade or grade-separated, potential speeds for different sections of the alignment, and whether structures (e.g., bridges, culverts) would need replacement. ODOT developed cost estimates for each preliminary alternative. ODOT then evaluated the preliminary alternatives according to how effectively they met the OPR Project evaluation criteria, which are based on the Purpose and Need statement as well as Goals and Objectives derived from stakeholder input. The Goals and Objectives for the OPR Project are listed in Chapter 1, Section 1.3 of the Tier 1 DEIS. The evaluation process and results are presented below.

3.3.1 Step 2: Evaluation

3.3.1.1 Preliminary Alternative Alignments and Stations

Following the screening of corridor concepts, ODOT refined and developed concepts not eliminated in Step 1 into preliminary alternatives for subsequent analysis in the Step 2 evaluation process. ODOT refined the corridor concepts considering the project Purpose and Need, Goals and Objectives, and known community and environmental constraints. Engineering detail was developed to the level needed to allow ODOT to evaluate each preliminary alternative. The preliminary alternative alignments are shown in **Figure 3-3.**

For the Step 2 Evaluation, measures of effectiveness were developed for each evaluation criterion in order to facilitate criteria assessment and the relative comparison of preliminary alternatives. The measures of effectiveness were based on the Purpose and Need and Goals and Objectives. **Table 3-3** lists the evaluation criteria. For additional information on the Step 2 Evaluation process, including more information on the evaluation criteria and corresponding measures of effectiveness, and how the analysis was conducted, see the Tier 1 DEIS (Section 2.4).

3.3.1.2 Evaluation of Transportation Modes and Train Technologies

The only transportation mode to pass all Step 1 screening questions was intercity passenger rail. No further assessment of the intercity passenger rail mode was conducted in the Step 2 Evaluation.

During the assessment of locomotive technologies in the Step 2 evaluation process, ODOT conducted research on the dual mode technology. The dual mode/power technology was found to require electrification of the rail line at an added cost, whereas the technology would not achieve the benefit of higher speeds than the existing technology. Further, the electrification of the line would require increased overhead clearance on existing and proposed rail alignments due to the overhead catenary lines. Because of the added cost and impacts associated with electrification without any travel time or ridership benefits, the dual mode/power technology was eliminated from further consideration. Maglev technology was rejected, because it is incompatible with passenger rail plans for the Washington state portion of the PNWRC. The locomotive hauled and diesel multiple units technologies moved forward into the Tier 1 DEIS for further consideration.

Figure 3-3 Preliminary Alternatives

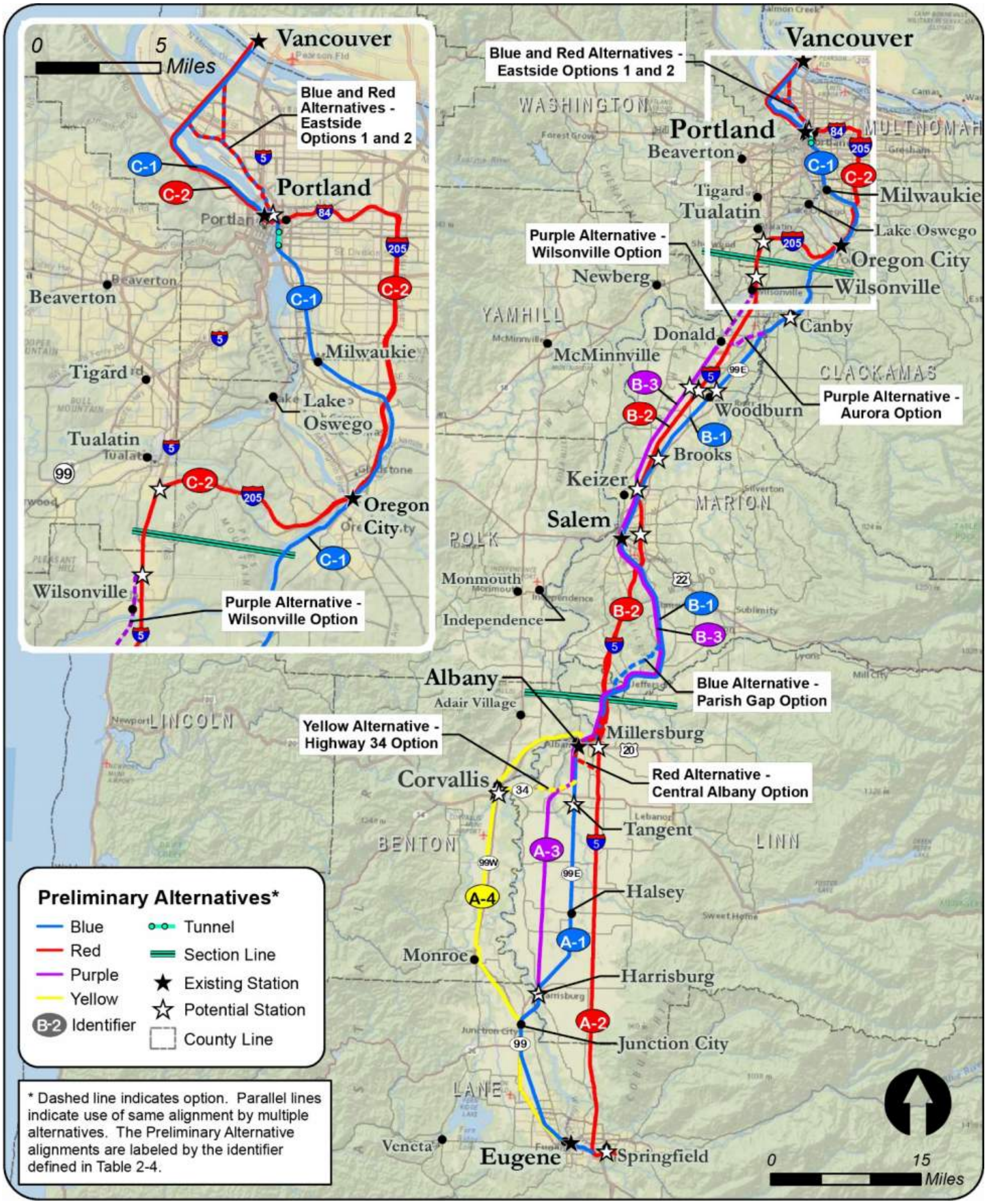


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Table 3-3 Evaluation Criteria and Measures of Effectiveness

	Evaluation Criteria		Evaluation Criteria
1A	Provide a viable alternative to auto, air, and bus travel between Eugene, OR and Vancouver, WA	5A	Provide passenger rail service to meet the existing and future passenger rail demand for an interconnected system in the PNWRC
1B	Provide reliable and frequent passenger rail service	6A	Benefit communities within the corridor
1C	Support multimodal integration at each potential passenger rail station	6B.1	Community cohesion impacts
1D	Allow for future passenger rail improvements, including higher speeds	6B.2	Impacts to sensitive noise receptors along the corridor
2A	Does not increase conflicts between passenger rail and/or freight rail and vehicles	7A.1	Farmland impacts
2B	Protect freight rail carrying capacity	7A.2	Land use and transportation plan consistency
3A.1	Phasing of improvements	7B	Reduce greenhouse gas emissions in support of national and state policies to slow climate change
3A.2	Construction cost	7C.1	Threatened and Endangered species impacts
3B	Serve the maximum number of people with every dollar invested	7C.2	Wetland impacts
4A	Provide a viable and affordable alternative for all travelers	7C.3	Geology impacts
4B.1	Equitable investments and service	7C.4	Section 4(f) impacts
4B.2	Environmental Justice impacts	7C.4	Cultural resources impacts

3.3.1.3 Conclusions

The alternatives which advanced to the Tier 1 DEIS analysis included a No-Action Alternative and two build alternatives. Each alternative is described in more detail in Sections 3.4 and 3.5.

3.4 No Action Alternative

The Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) implementing regulations require federal agencies to include an alternative of "no action" to serve as baseline in the DEIS for comparison with the proposed action and other reasonable alternatives carried forward. Analysis of a no action alternative provides a benchmark for comparison with the potential impacts of the build alternatives, and helps decision-makers and the public understand the consequences of taking no action.

The OPR Project No Action Alternative consists of the continuation of the existing Amtrak Cascades passenger train route, stations, and service in the rail corridor between Eugene and Portland. A mix of freight and passenger trains currently uses the UPRR and BNSF trackage that serves as the corridor. BNSF owns the existing Amtrak route in Oregon north of Portland's Union Station, and UPRR owns the route south of Portland's Union Station. In addition to the Amtrak Cascades passenger rail service, ODOT operates Cascades POINT/Thruway intercity motor coach bus service that provides six round trips per day between Eugene and Portland, and one round trip per day between Salem and Portland.

3.5 Build Alternatives

This section presents a summary of the two build alternatives (Alternative 1 and Alternative 2) that were advanced for further study in the DEIS. For a more detailed description of the build alternatives, see the Tier 1 DEIS (Section 3.2).

ODOT identified the infrastructure improvements for the build alternatives described below by developing conceptual designs based on Rail Traffic Controller (RTC) analysis conducted for the OPR Project (see Chapter 6). ODOT used the RTC results to identify areas that have existing and future infrastructure deficiencies and developed conceptual improvements for addressing rail capacity and operations in those areas. ODOT then used these proposed improvements to forecast future ridership, identify potential impacts, and develop cost estimates.

Figure 3-4 shows the build alternatives and highlights the location of existing and potential new stations.

3.5.1 Alternative 1

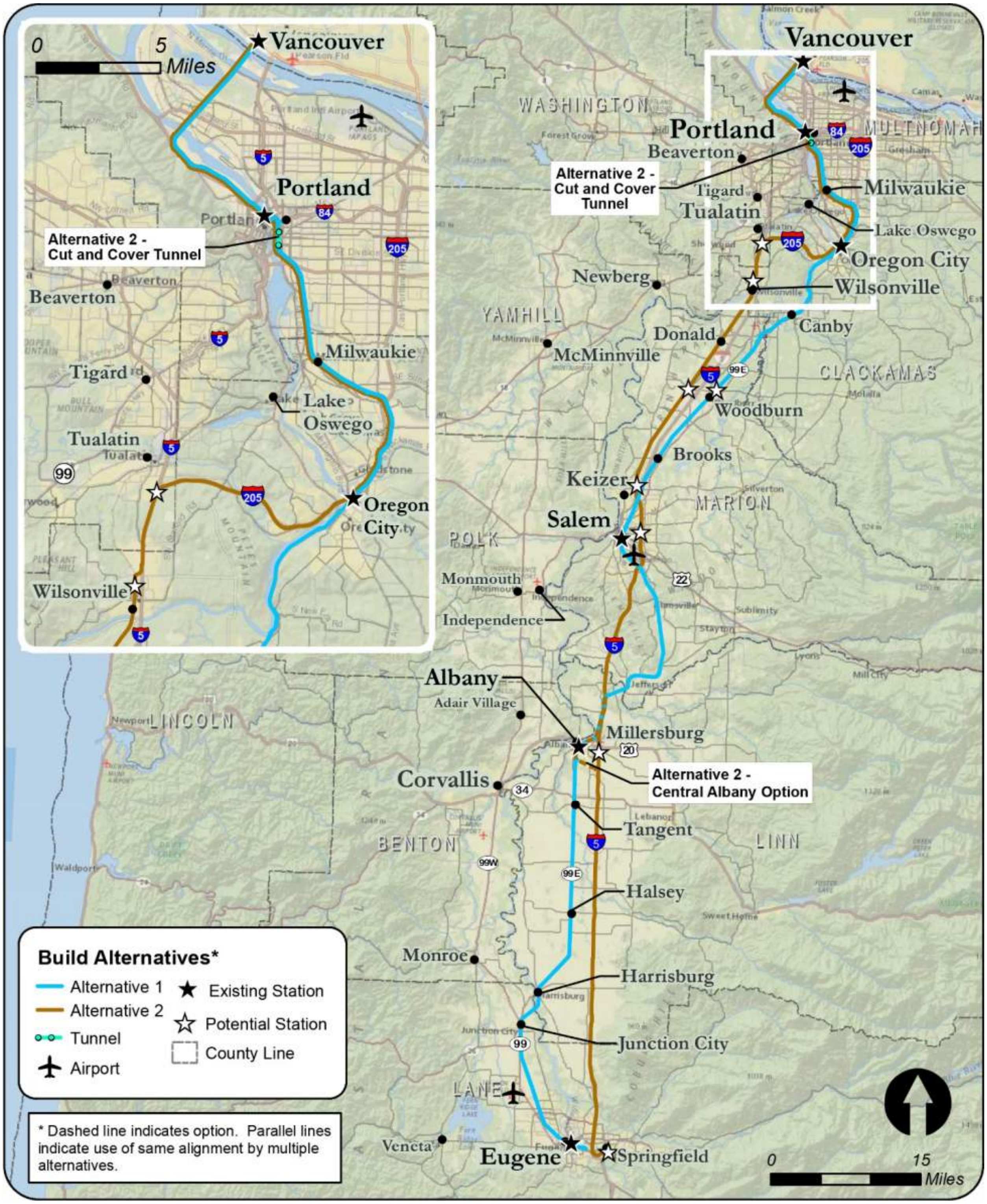
Alternative 1 would improve the existing passenger rail route between Eugene and Portland, with the addition of parallel track in multiple sections within or immediately adjacent to the existing railroad alignment. The current Amtrak Cascades passenger rail service operates on existing UPRR track between Eugene and Portland Union Station. North of Union Station, the Amtrak Cascades service operates on existing BNSF track.

Under Alternative 1, passenger trains would continue to share track with freight trains, and the route would serve seven passenger rail round trips per day—six Amtrak Cascades and one Coast Starlight (a "6+1" schedule). Between Eugene and Portland, train frequency under Alternative 1 would reflect an increase of four round trips per day over the No Action Alternative. North of Portland Union Station, Alternative 1 would be the same as the 2035 No Action Alternative (eight round trips per day, a 6+2 schedule).

Alternative 1 would add new railroad track or modify existing track at select sections on the UPRR alignment in order to facilitate four more passenger rail round trips per day while maintaining freight-rail carrying capability between Eugene and Portland. Track modifications or additions would consist of mainline track, sidings, crossovers, and industry connections built or modified as needed to maximize the efficiency of freight and passenger rail operations throughout the full route. In most places, the new track for Alternative 1 would be offset 20 feet east of the existing UPRR mainline track, and could require acquisition of linear strips of new ROW to the east of the existing UPRR ROW.

Alternative 1 would use the existing stations along the current Amtrak Cascades route; no improvements to the existing stations are proposed in the Tier 1 DEIS.

Figure 3-4 Build Alternatives



Oregon Passenger Rail Project Draft Service Development Plan

3.5.2 Alternative 2

Between Springfield and Oregon City, Alternative 2 would consist of a mostly new rail route that would follow I-5, an existing freight rail route and I-205, as shown in **Figure 3-4**. It would also parallel the current passenger rail route north of Oregon City. The Alternative 2 track improvements would be constructed primarily adjacent to the existing I-5 and I-205 freeways, the existing PNWR line between Keizer and Wilsonville, and adjacent to the existing UPRR alignment north of Oregon City. Alternative 2 would add new mainline railroad track throughout the full route between Springfield and Portland. Between Keizer and Wilsonville, and north of Oregon City, Alternative 2 track would be shared with freight traffic on the PNWR and UPRR lines. Along the passenger rail-only sections of the route, siding tracks would be placed every 10 to 12 miles to facilitate passing operations. The new rail line between Springfield and Keizer, and between Wilsonville and Oregon City, and the cut-and-cover tunnel section in inner southeast Portland, would be for the exclusive use of passenger rail service. Alternative 2 would serve seven round trips per day—six Amtrak Cascades and one Coast Starlight (a "6+1" schedule). Between Portland's Union Station and Vancouver, WA, Alternative 2 would be the same as the 2035 No Action Alternative and Alternative 1 (eight round trips per day, a 6+2 schedule).

Alternative 2 would require new passenger rail stations south of Portland's Union Station. Each of the potential new stations would be located adjacent to the proposed new alignment, generally near I-5. **Figure 3-4** shows the general station locations. The Tier 1 DEIS assesses a 20-acre study area around each potential new station location. Assessment of potential impacts associated with the construction of potential new stations under Alternative 2 considered the station building or buildings, parking, access and egress routes, and other needed infrastructure. Decisions on new station locations would need to follow the *Station Stop Policy for Amtrak Cascades Service.*[25]

3.5.3 Passenger Train Engine Technology

Train engine technologies considered for the OPR Project build alternatives include the existing technology (diesel locomotive-hauled) as well as the diesel multiple unit (DMU) technology. The Tier 1 DEIS assumes that either train engine technology would be suitable for the PNWRC. However, it is unlikely that capital investments would be made in DMU technology within the planning horizon (2035) of the Tier 1 DEIS. For a more detailed description of the passenger train technology associated with the build alternatives, see the Tier 1 DEIS (Section 3.2.5).

3.6 Recommended Preferred Alternative

3.6.1 Evaluation Findings – Comparing the Build Alternatives

In association with the technical analyses conducted for the Tier 1 DEIS, the performance attributes from the evaluation framework based on the OPR Project goals and objectives were also used as the basis for comparing Alternative 1 and Alternative 2. Performance attributes for the No Action Alternative were also assessed, where relevant, to provide a baseline context. Of the 29 total performance attributes, 15 were found to differentiate the two build alternatives.

Alternative 2 was found to out-perform Alternative 1 in only three of the performance attributes:

- Fewer at-grade rail crossings (52 compared to 148 for Alternative 1)
- Supports maximum speeds of 120 mph on portions of new alignment
- Faster passenger rail trip times between Portland and Eugene (2:02 compared to 2:20 for Alternative 1)

Alternative 1 out-performs Alternative 2 in 12 of the differentiating performance attributes:

- Greater potential for multimodal connections at existing Amtrak stations
- Could be constructed incrementally in smaller phased projects as funding allows
- Capitals costs are considerably lower ($695 million-$801 million, compared to $3.65 billion-$4.47 billion for Alternative 2)
- Larger residential population near existing or potential new station areas
- Greater number of jobs near existing or potential new station areas
- Existing Amtrak stations are located closer to higher growth industries
- Fewer community resources, commercial properties and residential properties adversely affected
- Significantly lower number of acres of farmland adversely affected (399 acres of EFU-zoned land compared to 1,312 acres for Alternative 2)
- No impacts to Willamette River Greenway (Alternative 2 requires 3 new Willamette River crossings, state planning Goal 15 Exceptions are likely required)
- Smaller construction footprint and shorter construction duration than Alternative 2 (less impacts to sensitive species and habitats),
- Shorter length of new rail track required through areas with unstable slopes, and
- Fewer impacts to parks/recreational areas and historical properties

See the Tier 1 DEIS (Section 3.3) for a comprehensive summary of the evaluation of the No Action and build alternatives.

3.6.2 Recommendation

Based on the comparison of performance attributes, ODOT and FRA proposed that Alternative 1 be identified in the Tier 1 DEIS as the recommended Preferred Alternative. Outreach activities were conducted during fall of 2015 in order to share this recommendation with stakeholders and interested parties. Feedback received during the outreach period was largely in support of the recommendation. The Tier 1 DEIS, published in October 2018, identified Alternative 1 as the recommended Preferred Alternative, which was again largely supported by public and agency input. The OPR Project Final Environmental Impact Statement and Record of Decision identify Alternative 1 as the selected alternative, as well as the rationale for its selection.

3.6.2.1 Phasing

Phasing for the Preferred Alternative would be flexible and coordinated closely with the railroad owners and operators. Because the Preferred Alternative follows the existing route, infrastructure investments could be developed in relatively small, lower-cost elements, so that ODOT could implement the Preferred Alternative incrementally as funding becomes available. ODOT could also implement the elements deemed most valuable to support expanded service, and expand service incrementally from two round trips to the six round trips that are considered full buildout for this alternative. This approach would allow ODOT to add round trips over time as the demand for additional passenger service grows.

In later chapters, this SDP outlines the initial phases for the OPR Project and quantifies the overall benefits of the entire OPR Project.

4 Planning Methodology

4.1 Planning Horizon

ODOT adopted a 20-year planning horizon for the Oregon Passenger Rail Project Draft Environmental Impact Statement (Tier 1 DEIS) and SDP. The 20-year planning horizon, which is 2015-2035, is consistent with FRA guidelines and allows for a reasonable estimate of the needs of the traveling public, expected population growth, and expected freight rail service in the corridor. The 20-year planning horizon provides a reasonable framework to guide development of the Oregon Passenger Rail Project with successive phasing for a total of six Amtrak Cascades round trips per day between Portland and Eugene.

4.2 Major Cross-cutting Assumptions

The OPR Project SDP is based on a number of assumptions as discussed in the various chapters that follow in this SDP.

ODOT will need to coordinate and reach formal agreement with the rail owner—UPRR—to make operational and infrastructure improvements within the Oregon section of the PNWRC to support increased intercity passenger rail service frequency and maintain acceptable levels of freight operations. Chapter 6 (Operations Plan) and Chapter 8 (Conceptual Engineering and Capital Programming) identify the operational and infrastructure improvement needs and phasing plan that may become part of a formal agreement with UPRR.

The capital cost of implementing expanded passenger rail service within the PNWRC will require further federal, state and local investment. Oregon will need to compete for the federal funds in an era of increasingly tight public resources. Furthermore, Oregon lacks sufficient dedicated passenger rail funding to provide the required state match for federal passenger rail funding.

The design of the expansion of passenger rail service in the corridor is based on various projections and forecasts. These include population projections, freight rail forecasts, cost estimates, ridership projections, and revenue forecasts. ODOT has used generally accepted methodologies for estimating future passenger rail ridership within the PNWRC. These estimates are consistently integrated in the analysis and findings of future passenger rail service operations, revenue forecasts, operational and capital improvement needs and costs, and the estimate of public benefits.

4.3 Public Outreach and Agency Coordination

The public involvement process for the OPR Project was designed to solicit early and frequent coordination with interested parties, host railroads, stakeholders, government agencies and Tribes to facilitate their input on the purpose and scope, key issues and concerns, and the development and narrowing of alternatives. Input received during the public involvement process helped to shape the OPR Project Purpose and Need, Goals and Objectives, methods of analysis and decision-making process. The OPR Project public involvement process includes the following goals:

- Communicate complete, accurate, understandable and timely information to the public throughout the development of the EIS and the SDP

- Actively seek public input throughout the OPR Project
- Provide meaningful public involvement opportunities and demonstrate how input has influenced the OPR Project EIS and SDP
- Seek participation of all potentially affected and/or interested individuals, communities and organizations
- Ensure that the public involvement process is sensitive to local policies, plans and perspectives

ODOT implemented a number of communication tools and materials to make OPR Project information widely available, and to attain high levels of public participation and input during the development of the Draft Tier 1 DEIS. The OPR Project public involvement process has included the following activities and tools:

- **Stakeholder Database.** The stakeholder database includes potentially impacted parties, interested parties and past meeting attendees. The database is regularly updated and serves as the main contact list for all OPR Project mailings and outreach materials.
- **Regulatory Agency Coordination.** ODOT coordinated with and solicited input from federal and state regulatory agencies during the development of this OPR Project Tier 1 DEIS, including the natural resource, cultural resource and land use planning agencies identified in Section 5.3.1 of the DEIS. ODOT has logged and analyzed all of the public and agency comments received to date and has provided responses to comments as appropriate.
- **Community and Jurisdictional Briefings.** ODOT met with local jurisdictions and community groups to discuss the OPR Project and collect input. These briefings provided an opportunity to meet with stakeholders and discuss issues specific to a region or community. These included 20 face to face briefings and three online briefings.
- **Individual Communications.** ODOT held briefings with stakeholders and officials upon request to share information and collect input. Examples of these individual communications included briefings with state representatives, communication with staff from local jurisdictions and contact with individual stakeholders.
- **Fact Sheets/Newsletters**. ODOT prepared fact sheets to support open houses, committee meetings and community briefings. ODOT also produced and distributed a newsletter before each round of open houses to share information and invite participation. To date, ODOT has developed and distributed four newsletters.
- **News Media**. ODOT sent out news releases before open houses and committee meetings, and at other key milestones. ODOT purchased print and radio advertisements with English and Spanish language media outlets to promote open houses. ODOT also participated in interviews with radio, television and print media.
- **Open Houses/Online Open Houses**. ODOT used open houses to share information with stakeholders and interested parties, as well as to gather their feedback and opinions. ODOT posted materials and displays from the open houses on the OPR Project website. Additionally, during each public open house, ODOT conducted an online open house to engage individuals who might not attend in-person open houses. The online open houses included OPR Project information and videos and provided the same opportunities for comment as the in-person open houses. Nineteen open houses and four online open houses have been held to date.

- **Community Events**. ODOT hosted information booths at 37 community events (such as farmers' markets, universities, athletic events and seasonal festivals) to provide opportunities to talk about the OPR Project one-on-one and to get feedback from the public.
- **Website/Social Media**. The OPR Project website, www.OregonPassengerRail.org, has been the primary portal for public information. The site includes a description of the OPR Project purpose and context, EIS-related materials and documents, and contact information for OPR Project staff. ODOT announces upcoming meetings on the OPR Project website and posts materials in advance of each meeting. The OPR Project website contains an online comment form that the public can use to share thoughts and ideas at any time. ODOT also employs its Facebook page and Twitter feed to convey information about OPR Project events and milestones. Furthermore, ODOT works with local jurisdictions and community organizations within the OPR Project study area to post information about the OPR Project on their own social media pages at key outreach points.
- **Informational Videos**. ODOT produced an overview video in the early stages of the OPR Project to help raise awareness regarding the purpose and context of the OPR Project. This video was featured on the OPR Project website and was integrated into online open houses. Subsequent informational videos were posted on the website in association with public outreach conducted during the development and narrowing of OPR Project alternatives. In addition, some key OPR Project committee meetings have been video-recorded and posted on the website.
- **Outreach to Disadvantaged Populations**. ODOT targeted outreach efforts to minority, low-income and limited English proficiency (LEP) populations by providing key project information in Spanish, reaching out to community-based organizations, using ethnic news media sources and having interpreters at meetings.
- **Tribal Outreach and Coordination**. In August 2012, ODOT and FRA identified Tribes with potential interest in the OPR Project because of historic presence and/or treaty interest in the OPR Project EIS study area. At the beginning of the scoping process, FRA and ODOT sent letters to those Tribes to initiate government-to-government consultation and to invite Tribal participation in the development of the OPR Project EIS. The correspondence requested input on the Purpose and Need as well as identification of Tribal issues and concerns related to the OPR Project. In addition, two meetings were held. ODOT and FRA will continue to coordinate with the Tribes through the remainder of the decision-making process for the OPR Project.
- **Leadership Council**. Then Governor John Kitzhaber established the Oregon Passenger Rail Leadership Council, which is a core advisory group composed mostly of elected officials from the Willamette Valley. The Leadership Council provides guidance to ODOT and works with ODOT to finalize OPR Project recommendations submitted to FRA for final approval. Eleven Leadership Council meetings have been held to date.
- **Railroad Coordination**. ODOT met with railroad stakeholders in the OPR Project study area during the scoping period to inform them of the process, key elements, schedule and data input needed for the OPR Project. These meetings also provided an opportunity for the railroad stakeholders to comment on the OPR Project to assist in the development of the scope of the OPR Project and preferred alternative decision. To date, 16 meetings have been held with railroad stakeholders.

ODOT and FRA released the Tier 1 DEIS for the Project in October 2018 for public review and comment. The U.S. Environmental Protection Agency (EPA) published a Notice of Availability in the Federal Register on October 19, 2018.[26] Stakeholders were invited to provide comments on the Tier 1 DEIS through various opportunities and communication methods, from October 18 through December 19, 2018.

During the public comment period for the Tier 1 DEIS, ODOT and FRA received a total of 212 comments from members of the public and agency/organization representatives at five public events, through the Project website, and by email and letter. Of the 212 comments, 60 were received via the website comment form, 59 through the online open house, 58 at the open house/public hearing events (51 via comment form and 9 via public testimony), 30 by email, and three by mail.

FRA and ODOT reviewed all of the public and agency comments and have taken the comments into consideration in the decision-making process for the Tier 1 FEIS/Record of Decision. All individuals and agencies that provided comments during the public and agency review period were informed of the Tier 1 FEIS/Record of Decision and responses to comments.

4.3.1.1 Summary

The public review and comment period on the Tier 1 DEIS provided interested parties, stakeholders, government agencies, Tribes and members of the public the opportunity to review the document, attend public hearings and provide comments to inform decision-making. ODOT and FRA prepared the Tier 1 FEIS/Record of Decision that confirms the selection of Alternative 1 as the Preferred Alternative, and identifies changes to the Tier 1 DEIS that occurred as a result of agency, stakeholder and public input or due to correction of errors, and responds to substantive comments received.

5 Passenger Demand and Revenue Forecast

5.1 Introduction

ODOT published a Tier 1 DEIS in 2018 for its OPR Project to evaluate service alternatives on the Amtrak Cascades route between Eugene and Portland. The Tier 1 DEIS forecasts, which were performed in 2015, included three project alternatives: No Action Alternative, Alternative 1 and Alternative 2.

Subsequently, ODOT intends to complete the FEIS with two project alternatives: the No Action Alternative and the Preferred Alternative, which includes six Amtrak Cascades daily trains operating between Eugene and Portland, as well as the daily long-haul Coast Starlight train.

This chapter examines ridership changes since the Tier 1 DEIS was published. Ridership forecasts have been updated to reflect the current existing conditions of late 2019.

5.2 Methodology

Ridership and ticket revenue forecasts for proposed Amtrak Cascades service options were prepared for the Tier 1 DEIS using an incremental model that utilizes observed Amtrak ridership and ticket revenue data as well as socio-economic data and forecasts, Amtrak timetables and pricing.[27] Those forecasts were originally prepared in 2015 and documented in the 2018 Tier 1 DEIS. For this SDP, the Tier 1 DEIS ridership forecasts have been updated to consider recent ridership trends and other factors. This section describes the original modeling approach and also documents the updated demand forecasts.

The Amtrak national ridership and revenue model was used during the Tier 1 DEIS to forecast Amtrak Cascades corridor ridership and revenues. The Amtrak model application is regularly updated (typically, every five years) to reflect Amtrak's latest actual ridership and ticket revenues.

The key independent variables in the model include:

Passenger rail timetable(s), which provide departure/arrival times by train/bus and station, and thus define:

- Travel time
- Departure/arrival time-of-day slots
- Frequency/spacing of trains
- Type of service (through train, connecting train-train, connecting bus-train)
- Average fares, expressed as average revenue per passenger
- Socio-economic data/forecasts (for market growth and adding/dropping stations)
- Station locations, which define the catchment area for socio-economic measures

Travel time, frequency and fare sensitivities are derived from an analysis of historical data and "best practices" nationwide. Time-of-day factors were calibrated from actual ridership by train and day within the Amtrak Cascades markets.

The Amtrak national revenue and ridership model includes the following key features:

- Each individual train, bus and connection is modeled separately.
- Time-of-day factors apply to both ends of the trip: departure time from origin station and arrival time at destination station.
- Temporal train/bus spacing/coverage replaces the "frequency" or "headway" variable included in most models. Connections and service provided by buses are discounted to reflect their lower appeal (and lower observed usage).

Adjustments to the Tier 1 DEIS forecasts outlined in this chapter are identified based on multiple factors that have contributed to recent ridership changes. Factors examined include the introduction of competing BoltBus services, gas price changes and on-time performance (OTP). In all, the updated ridership forecasts are about 10 percent lower than previously estimated in the Tier 1 DEIS.

5.3 Study Area

The demand and revenue forecasts contained in the Tier 1 DEIS are focused and generally exclusive to passenger rail service on the Oregon segment of the PNWRC. The examination of adjustments to the ridership forecasts incorporates ridership model and other data on the Washington segment of the PNWRC.

5.4 Factors Affecting Short-term Ridership Trends

This section examines factors that have affected shorter-term ridership trends (those that have occurred from about 2010 to the present) and how these trends might affect the longer-term trends those that will occur between 2015 and the 2035 horizon year). This section examines factors affecting ridership changes since the Tier 1 DEIS was published. Using data from 2012-2018 constitutes a reasonable approach for a timeframe that better represents recent trends in the PNWRC ridership; these data are used to adjust and refine the Amtrak 2035 forecasts presented in this SDP.

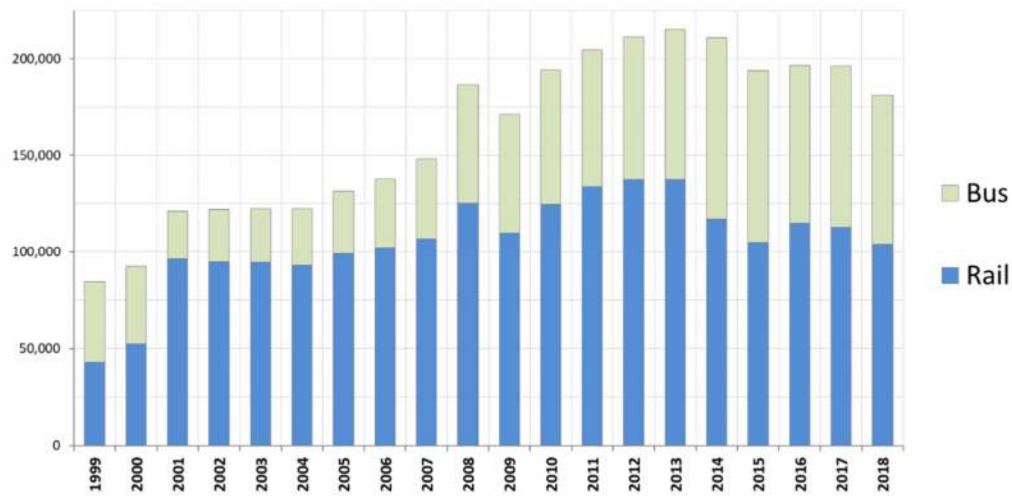
The key factors that might affect the forecasts for 2035 include:

- Fuel price, driving trends and traffic congestion
- Changes in scheduled train and bus services
- Reliability and OTP
- Competing transportation services

5.4.1 Ridership Trends

Overall, Oregon Amtrak Cascades ridership has declined since 2013 (see **Figure 5-1**). Since 2013, rail ridership has declined by 24 percent, though total ridership (including Cascades POINT/Thruway bus ridership) has declined by 16 percent.

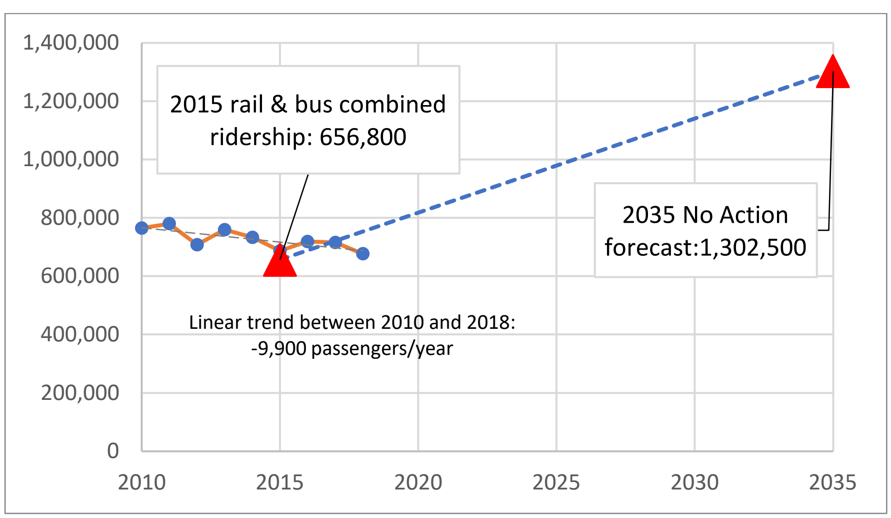
Figure 5-1 Annual Oregon Amtrak Cascades Ridership, 2009–2018



Source: ODOT Amtrak Cascades Data Report

Figure 5-2 shows a comparison of the recently observed ridership data trends between 2010 and 2018 compared to the original Amtrak ridership forecasts of 2015 to 2035 (included in the Tier 1 DEIS). Ridership has declined most years over the period of 2010 to 2018. This SDP analyzes a number of factors that have contributed to the ridership losses, including the primary contributors of competition from Bolt Bus[28] (starting in 2012), reduced gasoline costs, and a train derailment in 2017 near Dupont, Washington. More recently, scheduled track maintenance has caused longer Amtrak Cascades run times and reduced schedule reliability. These factors are discussed further below.

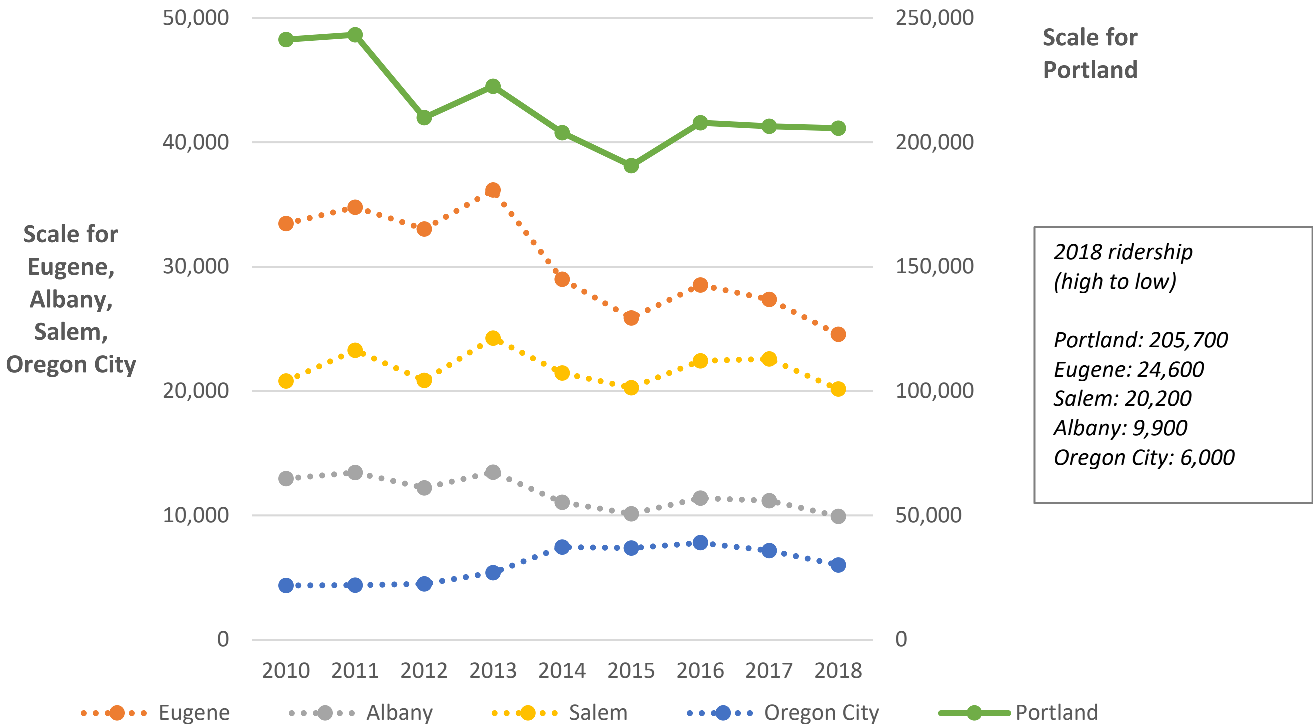
Figure 5-2 Annual Amtrak Cascades Train and Amtrak Cascades POINT Bus Station Ridership Activity in Oregon – Existing (2015) and 2035 Conditions for the Tier 1 DEIS No Action Alternative



Sources: Amtrak reported data and 2035 forecast from Tier 1 DEIS.

As **Figure 5-3** below shows, rail ridership for most stations in Oregon has experienced an overall decline in the last few years, reaching high points at most stations in 2013 and low points in 2015. The only exception is Oregon City, where ridership grew by nearly 40 percent in 2014 and has remained high since.

Figure 5-3 Station-specific Rail Boarding Counts in Oregon, 2010–2018



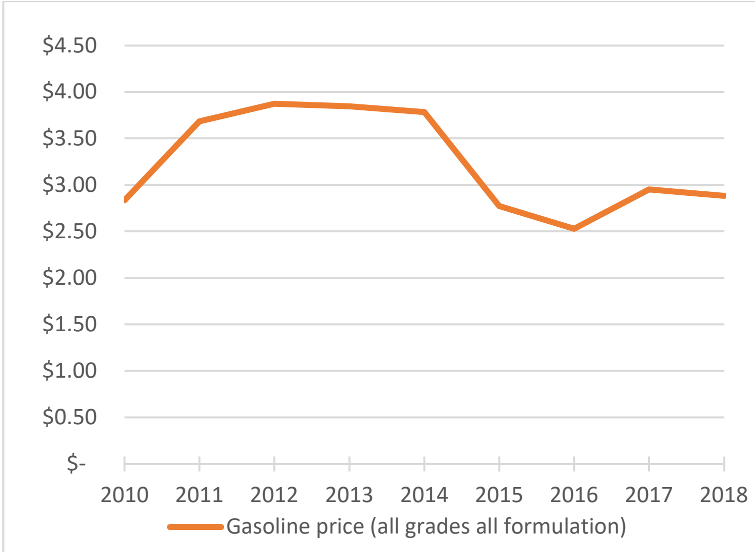
Source: Amtrak.

5.4.2 Fuel Price and Driving

Fuel prices contribute to the cost of driving, which could affect travel behaviors along the I-5 corridor and cause mode shifts that are not captured in the Amtrak ridership model. As **Figure 5-4** shows, the annual gas price leading up to 2015 remained around $3.50 per gallon (in 2010 dollars).[29] In late 2014, the gas price started to drop below $3 per gallon, which was accompanied by higher average annual daily traffic on major highways paralleling the Amtrak Cascades route[30] (see **Table 5-1**). Although these trends are not representative of specific Origin and Destination flows, they do indicate increased driving, possibly due to lower costs, which might have impacted ridership on Amtrak Cascades in 2015.

Because fuel prices can be volatile and unpredictable, it is difficult to base 2035 forecasts on estimates of future fuel prices; instead, scenarios around fuel prices can be designed to capture this uncertainty, and account for varying degrees of sensitivity of rail ridership and driving to fuel price. Additionally, future traffic forecasts were not used for the OPR Project, so discussions of 2035 fuel prices and traffic congestion are speculative.

Figure 5-4 Annual U.S. Gasoline Price Adjusted by Portland Region/West Region Consumer Price Index 2010–2018



Sources: U.S. Energy Information Administration; U.S. Bureau of Labor Statistics.[29]

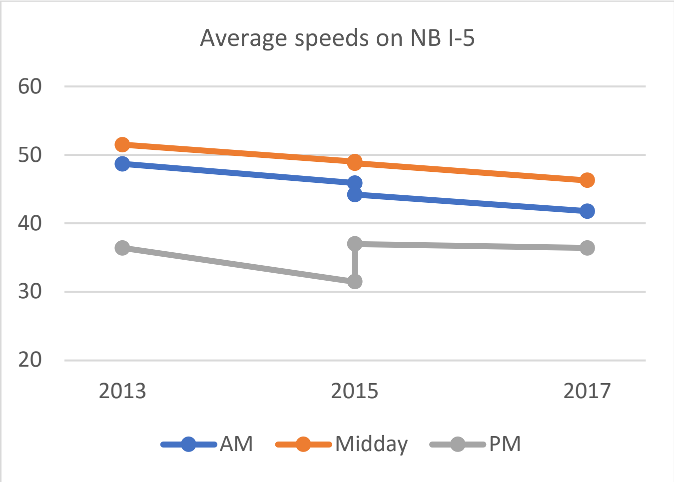
Table 5-1 Average Annual Daily Traffic (AADT) Near the Amtrak Cascades in Oregon, 2013–2017

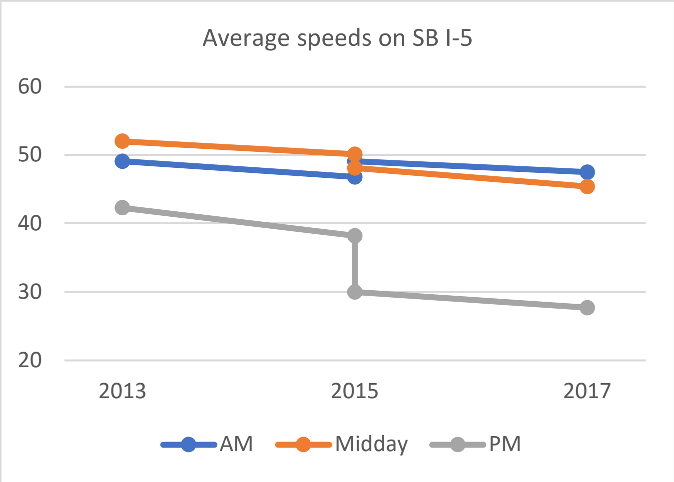
City	Highway	Counter Name	2013	2015	2017
Eugene	I-5	0.50 mile south of Eugene-Springfield Highway Interchange (I-105)	51,500	51,300	60,400
Albany	I-5	0.50 mile south of Albany-Junction City Highway Interchange (OR99E)	46,600	52,700	53,000
Salem	I-5	Salem-Kuebler Automatic Traffic Recorder, Sta. 24-021, 0.02 mile north of Turner Road Overcrossing	70,800	77,200	82,500
Woodburn	I-5	0.30 mile south of Hillsboro-Silverton Highway, milepost 271.55	84,300	88,400	92,400
Wilsonville	I-5	0.30 mile south of Wilsonville interchange (OR 214), milepost 283.58	122,600	127,00	127,000
Oregon City	OR99E	South city limits of Gladstone, north city limits of Oregon City, Clackamas River (McLoughlin Bridge)	34,100	37,900	39,700
Oregon City	I-205	No. 64 highway; 0.40 mile east of Pacific Highway East (OR99E), Oregon City Interchange	108,900	117,800	114,300
Portland	I-5	0.10 mile south of Stadium Freeway Interchange (I-405)	119,300	123,100	122,200

Sources: ODOT Traffic Reports.[33]

Average travel speeds along I-5 dropped between 2013 and 2017 (see **Figure 5-5**), which is also indicative of increased driving along the corridor. Despite congestion, driving is still the dominant mode of travel between these cities, because auto travel is typically much faster than transit travel (see **Table 5-2** and **Table 5-3**), which includes access, egress and wait times as well as the scheduled in-vehicle travel time. The reduced train travel time obtainable by the Preferred Alternative will be in direct contrast with increased driving times due to growing congestion in the southwestern Portland metropolitan area.

Figure 5-5 Average Northbound (NB) and Southbound (SB) Traffic Speeds on I-5 in Oregon, 2013–2017





Note: In 2015, the data source of traffic speeds reported by ODOT was changed from Federal Highway Administration to HERE. Data from both sources were reported for 2015, and the transition is reflected in the charts above.

Table 5-2 and **Table 5-3** show comparative travel times between city centers for autos and the Amtrak Cascades route. Note that the travel times are directional. The origin (O) cities are displayed along the left-most column, and the destination (D) cities appear across the top row. Amtrak schedule times include 5 minutes for station dwell, 19 extra minutes of “recovery” time and 131 minutes of pure running time.

Table 5-2 Average Drive Time for City Pairs on Amtrak Cascades, 2015 (in minutes)

O/D	Eugene	Albany	Salem	Oregon City	Portland
AM Peak Time					
Eugene	-	59	86	132	142
Albany	57	-	34	80	89
Salem	85	33	-	49	59
Oregon City	131	78	48	-	29
Portland	140	88	88	28	-
Midday Time					
Eugene	-	56	81	124	133
Albany	54	-	32	75	84
Salem	79	31	-	46	55
Oregon City	122	73	45	-	27
Portland	131	82	82	27	-
PM Peak Time					
Eugene	-	76	110	169	182
Albany	70	-	43	102	114
Salem	104	40	-	63	76
Oregon City	160	96	59	-	37
Portland	171	107	107	35	-

Note: Origins are left column, destinations are top row

Table 5-3 Scheduled Train Travel Time for City Pairs on Amtrak Cascades, 2016 (in minutes)

O-D	Eugene	Albany	Salem	Oregon City	Portland
Eugene	-	41	71	114	155
Albany	60	-	30	73	114
Salem	89	29	-	43	84
Oregon City	132	72	43	-	41
Portland	155	95	66	23	-

5.4.3 Scheduled Services

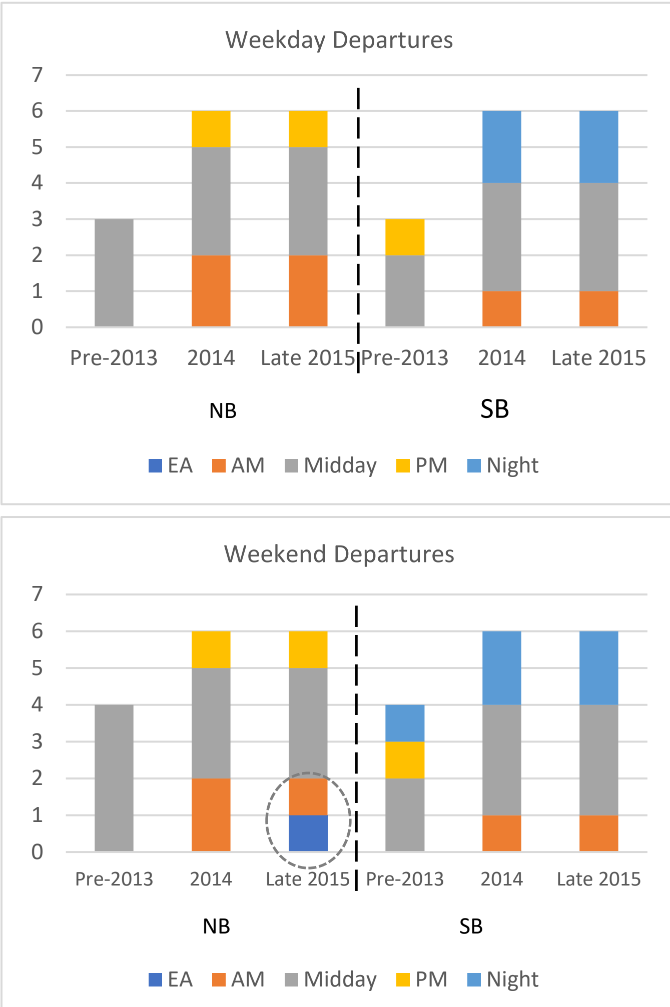
Changes in scheduled services were analyzed as possible contributors to ridership changes. The combined number of Cascades and Coast Starlight train services along the corridor has remained constant since mid-2010, while Cascades POINT/Thruway bus services in Oregon have been increasing. Starting in May 2011, all Cascades POINT/Thruway buses made a stop at the University of Oregon Eugene campus, adding one southbound midday trip and one northbound midday trip for University of Oregon riders. Between March 2013 and January 2014, five bus trips were added to the schedule during various times of day, almost doubling the original bus service frequency. The service adjustments are summarized in **Table 5-4**.

Changes in weekend and holiday northbound train and bus services in late 2015 appeared to reduce the trend of ridership decline from the previous five years. The only northbound early A.M. (3 a.m. to 6 a.m.) train became weekday-only in October 2015, while a weekend-only midmorning train service was added. Similarly, a weekend early A.M. bus was added, and one of the two northbound A.M. buses became weekday-only, thus limiting the flexibility of morning northbound riders boarding at University of Oregon in Eugene (see **Figure 5-6**). These schedule changes improved weekend and holiday ridership.

Table 5-4 Amtrak Service Changes between Eugene and Portland, 2013–2014

	Train	Bus
Southbound Portland → Eugene	Moved one night train to AM (2014)	Added one AM bus (2013) Moved one PM bus to midday (2014) Added one night bus (2014) Converted one night bus from Friday/Sunday service to daily service (2014)
Northbound Eugene → Portland	Moved one midmorning train to PM (2014)	Added one PM bus (2013) Added two AM buses (2014) Removed one Friday/Sunday midday bus (2014)

Figure 5-6 Distribution of Services to/from University of Oregon Eugene by Time of Day, 2013–2015

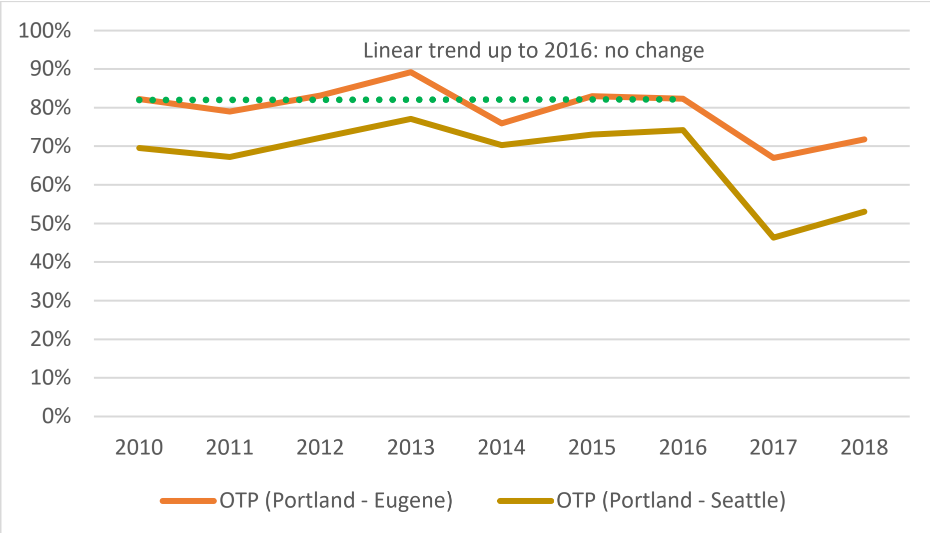


5.4.4 Reliability and OTP

The 2035 forecasts in the Tier 1 DEIS included assumptions that Amtrak service reliability would improve. As the trend line in **Figure 5-7** shows, OTP on the Amtrak Cascades route had been fairly stable up to 2016. The Tier 1 DEIS cited “an on-time performance of 82.3 percent in calendar year 2016” for services in Oregon and stated that the Preferred Alternative would serve to improve reliability. The Tier 1 DEIS did not address the lower OTP on the Portland-Seattle segment, which provides the majority of passenger flow boarding at Portland. Reduced reliability due to capacity limitations and future possible climate change impacts were also not considered in the 2035 No Action Alternative.

Based on discussions with Amtrak modeling staff since the publication of the Tier 1 DEIS, the OTP issues are expected to improve because ODOT, WSDOT and Amtrak have been improving the corridor infrastructure required for better OTP. Rail corridor improvements through American Recovery and Reinvestment Act of 2009 grant funding of the Point Defiance Bypass near Tacoma and U.S. Department of Transportation Fixing America’s Surface Transportation Act of 2015 funding of the North Portland Junction to Peninsula Junction (under way in 2020) will significantly improve OTP.

Figure 5-7 Amtrak Cascades On-time Performance (OTP), 2010–2018



5.4.5 Competing Services

5.4.5.1 Greyhound

Greyhound has been serving western Canada and the western United States since prior to the 1960s. Along the Amtrak Cascades route, bus stops include Springfield, Salem and Portland, with four roundtrips throughout the day from 6 a.m. to 11 p.m. As the next section discusses, Greyhound operates a subsidiary bus service (BoltBus) that complements its daily schedule.

5.4.5.2 BoltBus

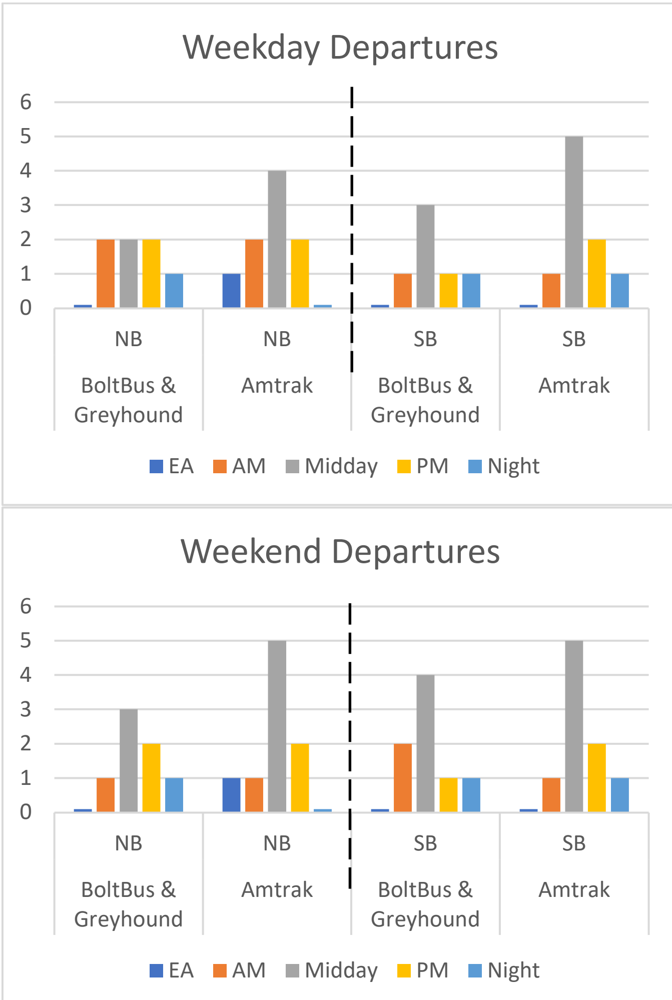
BoltBus, a subsidiary of Greyhound, expanded to the Pacific Northwest in May 2012 with its service between Seattle and Portland. The service was further expanded to Bellingham, WA, and Vancouver, BC, later in the same month and to Albany and Eugene later in 2012. The stations are at most two blocks away from the Amtrak stations in these cities.

Based on the 2019 BoltBus schedules and a Seattle Times article from 2013, the BoltBus service frequency has been stable and slightly increasing (see **Table 5-5**). News commentaries and posts on trip planning forums suggest that BoltBus services have been fairly reliable and offer competitive fares and travel times (see **Table 5-6** and**Table** 5-7). Similar to Amtrak pre-boarding, BoltBus riders are advised to arrive 20 to 30 minutes ahead of departure time.

Please note that the travel times can vary by time of day. Also, BoltBus fares can vary significantly, depending on demand. Consider the fares shown in **Table 5-7** as representative fares.

BoltBus and Greyhound services are coordinated so that buses in either direction depart approximately every three hours. **Figure 5-8** shows the distribution of the combined service by time of day alongside current Amtrak services. Note that Amtrak does not have northbound service after 7 p.m.—a gap possibly filled by BoltBus and Greyhound services.

Figure 5-8 Distribution of Combined BoltBus and Greyhound Service by Time of Day compared to Amtrak (August 2019): Eugene to Portland



Time-of-day definitions: EA is 3-6 a.m., AM is 6-9 a.m., Midday is 9 a.m.-4 p.m., PM is 4-7 p.m., and night is 7 p.m.-3 a.m.

Table 5-5 BoltBus Average Daily Service Frequency (number of round trips), 2014 vs. 2019

Service between…	Portland and Seattle	Portland and Vancouver, BC	Portland and Eugene
2014	7	2	3
2019	8	3	3.5

Table 5-6 2019 BoltBus vs. Amtrak Scheduled Travel Times between Major Cities on the Cascades Route (in minutes)

	Portland		Seattle		Vancouver, BC	
	BoltBus	Amtrak	BoltBus	Amtrak	BoltBus	Amtrak
Eugene-Springfield	140	155	375	380	-	-
Portland	-		195	210	480	480
Seattle			-		240	240

Table 5-7 2019 BoltBus vs. Amtrak Adult Regular Fares between Major Cities on the Cascades Route

	Portland		Seattle		Vancouver, BC	
	BoltBus	Amtrak	BoltBus	Amtrak	BoltBus	Amtrak
Eugene-Springfield	$14	$28	$35	$57	-	-
Portland	-		$16	$35	$50	$65
Seattle			-		$25	$35

The comparisons of BoltBus and Amtrak service attributes covered above are indicative of the appeal of BoltBus along the corridor served by Amtrak Cascades. The Amtrak ridership losses could be explained, in part, by BoltBus competition. That competition began in 2012, and is projected to continue with service through to 2035. It is assumed that Bolt Bus service will be consistent over time. However, please note that information on Bolt Bus ridership is not known, and service levels are understood through periodic web searches of bus schedules and run times. **Table 5-8** demonstrates the Amtrak ridership decrease that occurred at each station following the BoltBus service expansion. Colored cells show ridership increases (green) and decreases (red) on a year-over-year basis.

Table 5-8 Amtrak Cascades Ridership Changes Following BoltBus Service Expansion

	Eugene	Albany	Portland	Seattle	Bellingham	Vancouver, BC
2011	34,783	13,435	243,345	246,954	29,712	74,138
2012	33,042	12,196	209,969	208,851	27,870	62,246
2013	36,162	13,474	222,623	221,863	29,511	73,278
2014	28,994	11,056	203,918	221,679	28,227	74,183
2012 year-over-year % change	-5%	-9%	**-14%**	**-15%**	**-6%**	**-16%**
2013 year-over-year % change	9%	10%	6%	6%	6%	18%
2014 year-over-year % change	**-20%**	**-18%**	-8%	0%	-4%	1%

Note: Although BoltBus does not release information regarding ridership or OTP, it is possible to include this component in FY2035 ridership adjustment through scenario design by using the cross-elasticity values (i.e., how bus and train service attributes affect each other's ridership) (Fearnley 2018)) to design scenarios with varying assumptions about intercity bus service addition and pricing strategies.

5.4.6 Conclusions about Data Sources

Based on the evaluation of factors affecting recent Amtrak Cascades ridership trends, this analysis finds that the downturn in ridership will likely reverse and move upwards as OTP improves. However, ridership gains will be from a lower base, because other factors might continue to impact ridership. Nevertheless, the Preferred Alternative estimated overall ridership is expected to be robust enough to support the service increase.

5.5 Refined Travel Model Results

5.5.1 No Action Alternative

This section examines the 2015 base year ridership alongside the 2035 No Action Alternative. FEIS ridership and FEIS ridership forecasts are shown for the No Action Alternative. The FEIS shows a roughly 10 percent overall decrease in No Action Alternative ridership compared to the Tier 1 DEIS.

Despite the FEIS 2035 No Action Alternative forecasted ridership being lower than that forecasted in the Tier 1 DEIS, there is still significant growth anticipated over the 20-year horizon—ridership growth of 78 percent between 2015 and the 2035 FEIS forecast. Ridership growth is anticipated as a result of continued population growth in the corridor. Some of the factors that have negatively affected recent ridership trends are expected to change over the longer term, including achieving better OTP and assuming that fuel prices do not continue to decline over time. In addition, traffic congestion on I-5 (roughly paralleling the Amtrak Cascades route) will likely increase over time due to continued population and employment growth.

The ridership figures in **Table 5-9** include both the Amtrak Cascades train service and the Cascades POINT/Thruway bus service.

Table 5-9 Annual Amtrak Cascades Train and Cascades POINT Bus Station Activity – Existing (2015) and 2035 Conditions for Tier 1 DEIS No Action Alternative

Station	Station Activity (Number of riders both on and off)			
	Existing Conditions	No Action Alternative Tier 1 DEIS	No Action Alternative FEIS	No Action Alternative FEIS vs. DEIS Percent Change
	2015	2035	2035	
Eugene	85,800	172,500[1]	155,200	-10%
Albany	31,800	54,800[1]	50,200	-8%
Salem	65,300	97,100	90,700	-7%
Oregon City	15,100	17,000	16,600	-2%
Portland[2]	458,800	961,100	860,600	-10%
Total[3]	**656,800**	**1,302,500**	**1,173,300**	**-10%**

[1] There were no plans to extend the current Portland-to-Salem bus south to Eugene when the ridership forecasting was done. Therefore, numbers for Albany and Eugene do not include a seventh bus round trip.

[2] Activity at Portland's Union Station encompasses all Amtrak Cascades train and Cascades POINT bus passengers in Portland, including those from north of the Portland market.

[3] Numbers do not sum due to rounding.

Sources: Tier 1 DEIS - Amtrak Cascades Incremental Model Results [27]; FEIS.[10]

5.5.2 Preferred Alternative

The Preferred Alternative would have more than twice the Amtrak Cascades ridership than the No Action Alternative. **Table 5-10** shows the existing (2015) and 2035 forecasts for Amtrak Cascades (including Cascades POINT/Thruway Bus) ridership between Eugene and Portland. Bus ridership declines dramatically, because it is assumed that Cascades POINT/Thruway buses would be replaced by additional trains.

Table 5-10 Annual Amtrak Cascades Train and Cascades POINT Bus Ridership – Existing (2015) and 2035 Conditions for Tier 1 DEIS No Action Alternative and Preferred Alternative

	Actual 2015	No Action Alternative (2035)	Preferred Alternative (2035)
Train	105,000	153,600	519,500
Bus	89,000	106,000	20,300
Total	**194,000**	**259,600**	**539,800**

Sources: Tier 1 DEIS - Amtrak Cascades Incremental Model Results [27]

In 2035, total ridership (both Amtrak Cascades train and Cascades POINT/Thruway bus) for the Preferred Alternative is projected to be 539,800 annual passengers (including 519,500 train passengers) compared to 259,600 annual passengers under the No Action Alternative. Similar to the No Action Alternative, under the Preferred Alternative, Portland's Union Station and the Eugene Station would have the two highest numbers of passenger boardings and alightings (passengers getting on or off trains or buses) of all the stations, while the Oregon City Station and the Albany Station would have the two lowest. **Table 5-11** shows the existing station activity and the projected activity for the No Action Alternative and the Preferred Alternative in 2035.

Table 5-11 Annual Amtrak Cascades Train and Cascades POINT Bus Station Activity – Existing and 2035 Conditions for No Action Alternative and Preferred Alternative

Station	Station Activity (Number of riders both on and off)			Percent Growth	
	Existing Conditions (2015)	No Action Alternative FEIS (2035)	Preferred Alternative (2035)	Existing Conditions Compared to Preferred Alternative	No- Action Alternative Compared to Preferred Alternative
Eugene	85,800	155,200[1]	345,000[1]	80%	122%
Albany	31,800	50,200[1]	114,700[1]	64%	128%
Salem	65,300	90,700	197,300	39%	118%
Oregon City	15,100	16,600	40,100	10%	141%
Portland[2]	458,800	860,600	1,036,400	88%	20%
Total[3]	**656,800**	**1,173,300**	**1,733,800**	**79%**	**48%**

[1] There were no plans to extend the current Portland-to-Salem bus south to Eugene when the ridership forecasting was done. Therefore, numbers for Albany and Eugene do not include a seventh bus round trip.

[2] Activity at Portland's Union Station encompasses all Amtrak Cascades train and Cascades POINT bus passengers in Portland, including those from north of the Portland market.

[3] Numbers do not sum due to rounding.

Sources: Tier 1 DEIS - Amtrak Cascades Incremental Model Results [27]; FEIS.[10]

5.5.3 Summaries of Riders, Revenues and Passenger Miles of Travel

Based on the model results in the Tier 1 DEIS and the adjusted ridership forecasts in Oregon, forecasts for ridership, revenues and passenger miles of travel along the Amtrak Cascades route were developed for the 2035 No Action Alternative and the Preferred Alternative (see **Table 5-12**, **Table** 5-13 and **Table** 5-14).

For the Preferred Alternative, the ridership forecast for the Amtrak Cascades route north of Portland (sponsored by WSDOT) was updated to incorporate possible service improvement scenarios laid out in the WSDOT State Rail Plan (2020).[31] This analysis evaluates the Intermediate Growth Scenario, which reflects six round trips between Portland and Seattle, three round trips between Seattle and Vancouver, BC, and four round trips between Eugene and Portland by the year 2037. Revenues and passenger miles of travel were updated accordingly for better estimations of revenue and expense shares across operators.

Table 5-12 Amtrak Cascades Corridor Estimated Total Annual Ridership Year 2035

Route	No Action Alternative	Preferred Alternative		
	Future Ridership	Future Ridership	Increment	
Amtrak Cascades (Train)			**Estimate**	**% Change**
North of Portland	1,136,300	1,427,500	291,200	25.6%
South of Portland	153,600	519,500	365,900	238.2%
Total	1,289,900	1,947,000	657,100	50.9%
Amtrak Cascades Point/Thruway Bus				
Total	106,000	20,300	-85,700	-80.8%
Coast Starlight (Train)				
Total	655,400	643,800	-11,600	-1.8%
Route Total	**2,051,300**	**2,611,100**	**559,800**	**27.3%**

Sources: Tier 1 DEIS - Amtrak Cascades Incremental Model Results [27]; FEIS.[10]; WSDOT Amtrak Cascades Model.

Table 5-13 Amtrak Cascades Corridor Estimated Total Annual Revenues Year 2035

Route	No Action Alternative	Preferred Alternative		
	Future Revenue	Future Revenue	Increment	
Amtrak Cascades (Train)			**Estimate**	**% Change**
North of Portland	$70,007,000	$97,602,800	$27,595,800	39.4%
South of Portland	$4,311,200	$13,699,100	$9,387,900	217.8%
Total	$74,318,200	$111,301,900	$36,983,700	49.8%
Amtrak Cascades Point/Thruway Bus				
Total	$3,978,200	$965,700	$-3,012,500	-75.7%
Coast Starlight (Train)				
Total	$90,618,900	$89,801,400	$-817,500	-0.9%
Route Total	**$168,915,300**	**$202,069,000**	**$33,153,700**	**19.6%**

Sources: Tier 1 DEIS - Amtrak Cascades Incremental Model Results [27]; FEIS.[10]

Table 5-14 Amtrak Cascades Corridor Estimated Total Annual Passenger Miles of Travel (PMT) Year 2035

Route	No Action Alternative	Preferred Alternative		
	Future PMT	Future PMT	Increment	
Amtrak Cascades (Train)			**Estimate**	**% Change**
North of Portland	200,698,000	281,557,700	80,859,700	40.3%
South of Portland	13,612,600	45,327,800	31,715,200	233.0%
Total	214,310,600	326,885,500	112,574,900	52.5%
Amtrak Cascades Point/Thruway Bus				
Total	9,447,000	1,760,800	-7,686,200	-81.4%
Coast Starlight (Train)				
Total	317,203,400	314,903,400	-2,300,000	-0.7%
Route Total	**540,961,000**	**643,549,700**	**102,588,700**	**19.0%**

Sources: Tier 1 DEIS - Amtrak Cascades Incremental Model Results [27]; FEIS.[10]; WSDOT Amtrak Cascades Model.

5.5.4 Ridership Diversion from Other Modes

Trips diverted to rail from other modes in 2035 under the Preferred Alternative were calculated based on an estimate of recent mode shares along the Amtrak Cascades corridor that was developed from multiple data sources, including the Federal Highway Administration 2008 National Long Distance Origin Destination trip tables,[32] Oregon annual statewide vehicle miles traveled reports,[33] and the Airline Origin and Destination Survey by the Bureau of Transportation Statistics.[34] The estimated trips diverted to rail from other modes of travel are tied to the ridership forecasts shown in **Table 5-12** (above), and represent an estimate of how travel behavior could change in 2035 given implementation of the Preferred Alternative.

The majority of person trips in 2035 would be diverted from driving trips, because driving would remain the dominant mode of travel along the corridor. Air travel is more advantageous than bus travel in the segment north of Portland in terms of mode share and passenger flow, and thus there would be more air trips and fewer bus trips diverted in this segment than in the segment south of Portland under the Preferred Alternative in 2035. **Table 5-15** shows the number of person trips diverted from other modes of travel for both segments.

Table 5-15 Annual Person Trips Diverted from Other Modes of Travel

	South of Portland[1]	North of Portland
Rail	365,900	291,200
Auto	-272,900	-272,400
Air	-7,300	-13,500
Bus (including POINT bus)	-85,700	-5,300
[1]Includes Portland boardings.		

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Service Development Plan

Oregon Passenger Rail
Eugene - Portland
CHOOSING A PATH FORWARD

6 Operating Plan

6.1 Service Requirements

This section summarizes the technical basis for establishing increased Oregon Amtrak Cascades passenger rail service between Eugene and Portland. This section also translates the project Purpose and Need (established in Chapter 1) for the service into the technical parameters of increased passenger rail service in the corridor, which will fulfill the service requirements in a cost-effective manner. Requirements include what is necessary to design, build, operate and maintain the service as it expands incrementally through phased implementation. Details of the operations modeling and analysis are provided in **Appendix A**

6.1.1 Passenger Rail Operating Background

Amtrak was created in 1970 to take over the operations of intercity rail passenger service. In return for this the participating railroads provide Amtrak access rights to their lines and agreed to provide use of their tracks on an avoidable-cost basis. This level of compensation for use of the railroads track is much lower than a fully allocated basis, and commuter rail operations pay much higher rates to freight railroads for use of their trackage. A typical freight train provides much more revenue to a railroad than an intercity passenger train, and as a result, some railroads do not provide priority treatment to passenger movements, as required by law.

To address this issue, Amtrak added incentive payments to pay railroads for priority handling and high reliability. However, this is done on a nationwide basis and if a railroad falls below the threshold regularly, individual state-supported corridors may be impacted negatively. The Capitol Corridor Joint Powers Authority negotiated its own incentive program with Union Pacific to provide priority handling of Capitol Corridor passenger trains. As a result, Capitol Corridor trains are some of the most reliable in the nation. ODOT may wish to consider investigating this option to improve performance in the future.

6.2 Operations Simulation Modeling

6.2.1 Methodology

The study operations modeling examines the combined passenger rail and freight rail operations on UPRR's Brooklyn Subdivision between Eugene and Portland, and on BNSF's Fallbridge Subdivision between Portland and Vancouver, Washington.

6.2.1.1 Assumed Freight Operations

Freight volumes for 2035 were developed from previous project experience, historical averages, and discussions with Class I railroads. In consultation with FRA,[35] the study assumes an increase of 1.7 percent for domestic intermodal and an increase of 1.5 percent for manifest traffic and international intermodal are appropriate freight volume growth targets for this project. Growth was projected using a compounded annual rate of 1.5 percent to 1.7 percent for the through freight movements. UPRR and BNSF intermodal and manifest trains were also increased using this method. UPRR unit train growth was projected based on anticipated growth of new classes of traffic, including projected growth in oil and grain trains to California from the Upper Midwest and Canada. Two to three additional loaded trains per day (and their associated empty trains) were included to represent the potential traffic levels in this corridor. This is a very conservative assumption, as USDOT BTS figures[36] indicate that U.S. rail freight ton-miles for the 2006-2015 period actually declined by over two percent.

6.2.1.2 Passenger Rail Operating Scenarios

The passenger rail operation scenarios analyzed with Berkeley Simulations Software Rail Traffic Controller (RTC) simulation software. The operating scenarios are briefly summarized below:

- The **Base Case** is current year (2015), with existing freight traffic and passenger rail service and schedules. Passenger rail service includes two Oregon Amtrak Cascades round trips plus Amtrak's Coast Starlight (2+1).
- **No Action** – The No Action Alternative is modeled for year 2035, and assumes an increase in freight traffic (1.5 percent to 1.7 percent compounded annually) and no change in passenger rail service.
- **No Action Minimum Alternative** – Minor infrastructure improvements added to No Action Alternative simulation network to yield year 2035 delay statistics within 10% of the Base Case Alternative, and no change in passenger rail service levels. This alternative was developed to identify the rail infrastructure needed to maintain the status quo of freight rail operations through year 2035, assuming no increase in passenger rail service
- **DEIS Preferred Alternative** – Phase 1 **4+1 Service on No Action Minimum** – Minor infrastructure improvements added to No Action Minimum Alternative simulation network to yield year 2035 delay statistics within 10 percent of the Base Case Alternative, with two additional Amtrak Cascades round trips (4+1) added to the service.
- **DEIS Preferred Alternative** – Phase 2 **6+1 Service on the 4+1 Network** – Infrastructure improvements added to the Tier 1 DEIS Preferred Alternative 4+1 Service No Action Minimum simulation network. The infrastructure improvements yield year 2035 delay statistics within 10 percent of the Base Case Alternative, with four additional Amtrak Cascades round trips (6+1).

Multiple factors were considered in establishing new train departure and arrival times under the Preferred Alternative in Phase 1 (4+1) and Phase 2 (6+1) including: timed transfers (Portland Union Station) with scheduled train service between Portland and Seattle, greater choice in trip scheduling, general avoidance of scheduled freight train service in the corridor, and estimated availability of train equipment and crews.

Simulation modeling of all proposed operating scenarios was conducted using RTC simulation software to evaluate the impact of projected future freight rail and passenger operations on UPRR's Brooklyn Subdivision and BNSF's Fallbridge Subdivision. RTC is used by all Class I railroads in North America and is the accepted simulation tool for dynamic rail system analysis.

The output metrics of RTC modeling include:

- Initial Train Performance Calculator (TPC) runs for the proposed passenger trains on the Amtrak Cascades corridor, including existing corridor station stops and operating restrictions imposed by horizontal and vertical track characteristics (to establish a range of general performance).
- Stringline (time-distance) diagrams for the proposed passenger train schedules with freight stringlines overlaid for a typical week period for proposed 20-year traffic volumes after implementation of the proposed service.
- Estimated delay ratios for passenger and freight trains with and without proposed infrastructure and passenger train schedules, to demonstrate that the proposed infrastructure and operating plan provides sufficient mitigation to the host railroad's freight service. The model is structured to prioritize passenger trains over freight trains when conflicts occur, to increase passenger train performance and reliability.

6.2.2 Route Description

The existing Amtrak Cascades passenger trains between Eugene and Portland use the UPRR route (123 miles), as shown in **Figure 6-1**. A mix of freight and intercity passenger trains currently uses the UPRR trackage that also serves as the Amtrak Cascades route. BNSF owns the existing Amtrak route in Oregon north of Portland's Union Station, and UPRR owns the route south of Portland's Union Station.

Except for segments within the Portland urban area, the Amtrak Cascades route is single-track with sidings. The typical siding length of 1.4 miles and are 8.3 miles apart. UPRR implemented Positive Train Control (PTC) along the Amtrak Cascades route in 2018. PTC uses communication-based/processor-based train control technology to provide a system to prevent train-to-train collisions, derailments due to excessive speed and the movement of a train through a mainline switch in the wrong position.

Figure 6-1 Amtrak Cascades - Existing Corridor

6.2.3 RTC Modeling for Base Case, No Action and Preferred Alternative Scenarios

RTC analyses of all rail traffic were performed for the Preferred Alternative. Simulations were performed for the Base Case (2015), future (2035) No Action and Preferred Alternative scenarios. The Preferred Alternative simulations focused passenger operations on UPRR's Brooklyn Subdivision and BNSF's Fallbridge Subdivision, as described in the following paragraphs.

(2016 Revised Operational Analysis Report) provides detailed descriptions of the assumed infrastructure for each of the future alternatives and scenarios.

The Base Case, No Action and No Action Minimum scenario train volumes included the existing level of service (two daily Amtrak Cascades round trips and one Coast Starlight round trip (2+1)). For the Preferred Alternative the following RTC simulations were performed and analyzed by the two specific phases, described as follows:

Phase 1	Four (4+1) Amtrak Cascades round trips were analyzed along with an additional phasing simulation that added infrastructure improvements to the No Action Minimum scenario to accommodate four (4+1) Oregon Amtrak Cascades round trips.
Phase 2	Six (6+1) Amtrak Cascades round trips were analyzed along with the additional phasing simulation that added infrastructure to the No Action Minimum scenario. The six round-trip simulations are considered to be the full buildout of the Preferred Alternative.

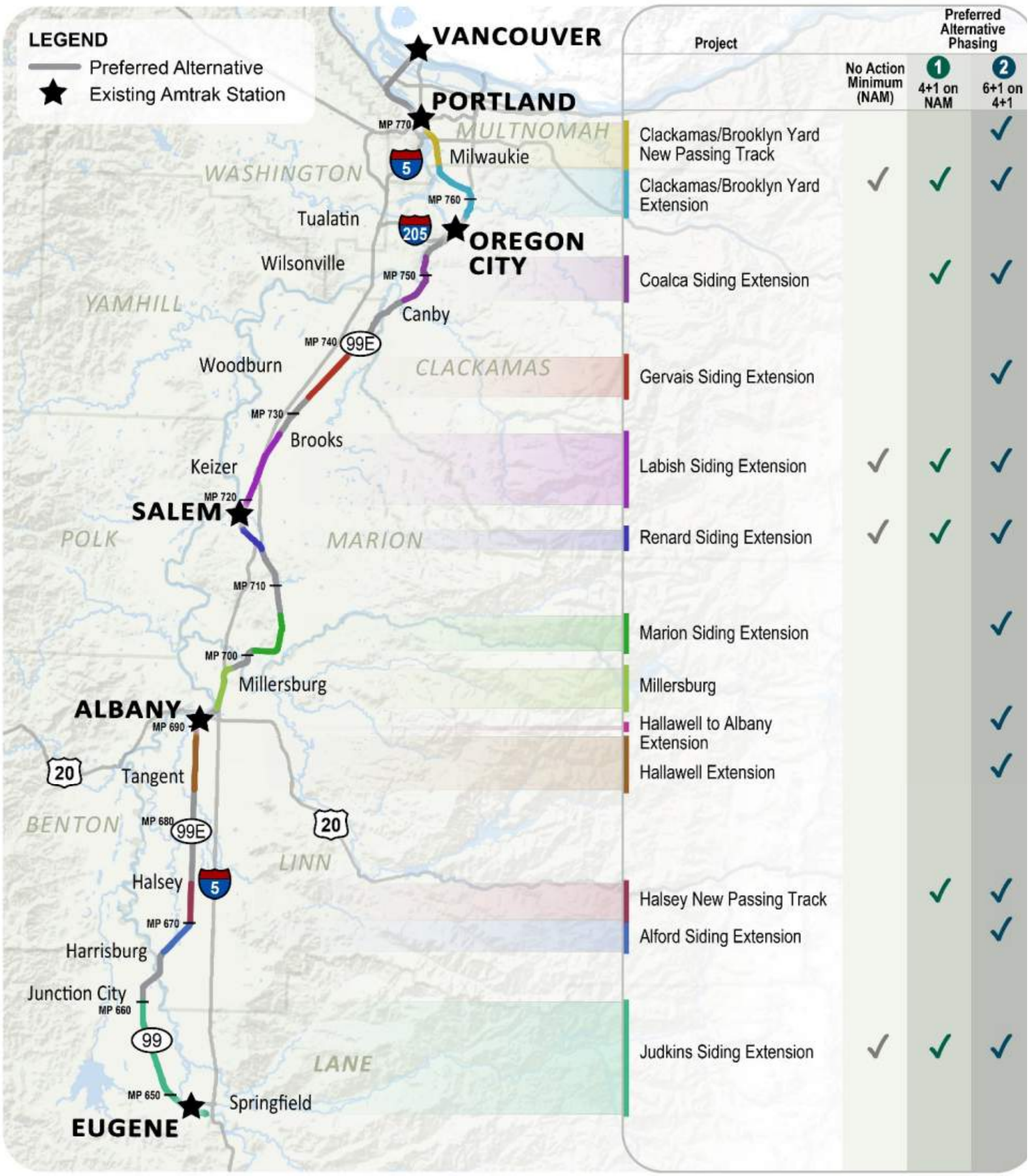
Figure 6-2 summarizes the proposed future rail infrastructure improvements assumed for the No Action Minimum and Preferred Alternative simulation scenarios on the UPRR Brooklyn Subdivision. Infrastructure improvements included new passing tracks, rail siding extensions and yard track extensions. Detailed descriptions of these proposed rail infrastructure improvements are included in the Tier 1 DEIS. reconnecting with the existing mainline at the north end of Halsey. A pair of crossovers 3 miles south of Halsey would facilitate passenger and freight movements through this track section.

6.2.3.1 Preferred Alternative Infrastructure Improvement

The Preferred Alternative alignment (the UPRR route between Eugene and Portland) has 148 existing at-grade crossings; nine of these are passive crossings (crossings without active warning devices, such as flashing lights and/or gates). ODOT and UPRR will be closing two of the nine passive at-grade crossings and upgrading three of the passive crossings with active warning devices. Within the sections proposed for track improvements under the Preferred Alternative, there are 73 at-grade crossings, including three of the aforementioned passive crossings that are planned to be upgraded or closed (also part of the No Action Alternative) to improve safety by reducing the risk of vehicle-train collisions at these locations.

Beginning at the southern end of the proposed alignment, approximately 1.5 miles southeast of the Eugene Amtrak station, the Preferred Alternative would build a new main track east of and parallel to the existing UPRR main line. This new second main line track would continue north approximately 13.5 miles to a location south of Junction City. The existing Swain siding in this area would be incorporated into the new second main line track.

Figure 6-2 Amtrak Cascades Rail Infrastructure Improvements



Chapter 8 defines the planned layover and maintenance facilities in the Eugene area. Adjacent to and directly west of the existing Eugene station, planned rail infrastructure improvements include the Eugene Layover Facility, which is a separate federal National Environmental Policy Act (NEPA) action that would add passenger train layover capacity to the Eugene station. Ultimately, the Eugene Layover Facility must be built in order to achieve the level of passenger and freight train operations planned for the OPR Project in the Preferred Alternative. Because construction funding for the Eugene Layover Facility is not yet reasonably foreseeable, the Preferred Alternative capital cost estimate includes the construction cost of this project (approximately $23.4 million).

The following section describe the other track infrastructure improvements that are part of the Preferred Alternative.

Judkins Siding Extension: Between the Eugene station and the location where the new main line track would reconnect with the existing main line south of Junction City, the Preferred Alternative includes the addition of six crossovers to facilitate freight and passenger train movements. Two new crossovers between the Eugene Amtrak station and the UPRR Eugene Yard would allow arrival and departure movement to/from the south end of the yard and the UPRR main line without significant operational impacts from additional passenger rail service at the station. Two new crossovers directly north of the UPRR Eugene Yard limits would facilitate moves into and out of the rail yard's north end. Two crossovers south of the reconnection to the main line near Junction City would allow trains to access the new main line to the south and the existing siding to the north. The result of these proposed improvements would be a fully double-tracked section between Eugene and Junction City that facilitates fluid train movements.

Alford Siding Extension and Halsey New Passing Track: The next set of improvements include a new main line track that would connect to the existing Alford siding north of Harrisburg and continue north for approximately 6.6 miles, and connect to an existing siding Hallawell and Hallawell to Albany Extensions: One mile south of Tangent, a new mainline track would be built that would run north to the Hallawell siding that is located approximately 2.7 miles north of Tangent. A crossover would be added just north of the center of Tangent to facilitate movement into and out of existing industries (freight customers), and a pair of crossovers located in the vicinity of the connection to the Hallawell siding would facilitate movements between the new main line track and the existing main line. This new main line track would connect to the north end of the Hallawell siding, reconnecting to the existing main line track at the southern end of UPRR's Albany Yard. Just south of the Albany Yard, the Albany & Eastern Railroad (AERC) line branches from the UPRR yard lead to the southeast toward Lebanon. The Preferred Alternative would add a series of turnouts through Albany and adjust the AERC connections to facilitate passenger operations into and out of the Albany Amtrak station.

Millersburg: A mile north of Albany, a new main line track approximately 1.6 miles in length would be built that would connect to an existing auxiliary track south of Millersburg. The existing auxiliary track, which serves local industries, would then connect to a new main line track that would continue north and connect to the existing Millersburg siding. The north end of the Millersburg siding would be extended an additional 1.5 miles, crossing under Interstate 5 (I-5). A new crossover in that northern section would facilitate movements between the existing UPRR main line and the new main line track.

Marion Siding Extension: This siding extension is a new main line track approximately 3.4 miles in length that would be built starting about 3 miles south of Marion that would connect to the existing Marion siding. The existing siding would also be extended north 1 mile. A set of crossovers near the mid-point of the existing siding would allow efficient use of the existing siding and ease train movements into Marion to the south and Turner to the north.

Renard Siding Extension: South of the existing UPRR Salem yard, the Preferred Alternative would include improved transitions that would allow freight trains to access the yard via the existing siding of Renard while passenger trains would use the existing UPRR main line. An industry track realignment and a pair of proposed crossovers between the main line tracks would allow freight train movements into and out of the Salem yard, thus facilitating freight service for area industries without impacting through freight or passenger trains moving this area.

Labish Siding Extension: North of downtown Salem, the Preferred Alternative would add a new 7,500-foot siding and modify rail connections to industries east of the alignment. North of Keizer and through Brooks, the Preferred Alternative would provide a new 6,700-foot siding, a pair of crossovers, modified connections to existing industries, and another new crossover to allow access to industries in Brooks.

Gervais Siding Extension: Starting at the north end of existing Gervais siding about 1.4 miles south of Woodburn, the Preferred Alternative would add a new main line track approximately 4.4 miles in length west of the existing UPRR mainline track through Woodburn, connecting back into the existing main line track at approximately 1 mile south of Hubbard.

Coalca Siding Extension: North of the Molalla River, the Preferred Alternative would add a new main line track approximately 4.7 miles long west of the existing UPRR main line track, starting at the south end of an existing auxiliary track. The new main line track would run north through Canby, eventually shifting over to the east side and then connecting to the existing siding of Coalca, 1 mile south of Rock Island. Connections to existing industries and to the Oregon Pacific Railroad at Canby would be modified, and a new set of crossovers would be added near the mid-point of this extended siding to allow access to and from the existing main line track.

Clackamas/Brooklyn Yard Extension: Two miles north of the Oregon City station, the Preferred Alternative would add a new main track west of the existing UPRR main track. This new track would shift over to the east of the UPRR main line near Milwaukie and run north to the Steel Bridge in Portland, adding approximately 12.5 miles of new mainline track in this area. Just east of where the UPRR main line goes under SE 82nd Avenue as it leaves Clackamas, the Preferred Alternative also includes the addition of a new crossover to facilitate access to the industries south of I-205. Local industries south of Milwaukie would also be connected to the new main line.

In Milwaukie, the new main line track that started north of the Oregon City station would turn north, continuing to parallel the existing main line track, and travel under several existing bridges—the Springwater Trail, SE Tacoma Street and Bybee Boulevard bridges. The new main line would cross over Johnson Creek. Several new crossovers would be added in this area to facilitate movement in and out of existing industries and UPRR’s Brooklyn yard.

At Brooklyn Yard, the new main track would run along the east side of Brooklyn yard, crossing under Holgate Boulevard and at the same time reconnecting to the existing industry tracks on the east. A new pair of crossovers would facilitate yard access and train positioning. The new main line would continue north toward central Portland, running on the east side of the existing UPRR main line and ending just south of the Steel Bridge that crosses the Willamette River.

Figure 6-3 above does not show any Amtrak Cascades project improvements north of Portland’s Union Station. Infrastructure improvements in that section would consist of those proposed in separate federal NEPA actions, specifically the proposed Willbridge Crossovers and North Portland/Peninsula Junction projects. These two projects must be built to achieve the level of passenger and freight train operations planned for the OPR Project. The North Portland portion of the North Portland/Peninsula Junction Project is funded for construction and will begin in 2021. However, it is not included in the Preferred Alternative costs. Because construction funding for the Willbridge Crossover Project (approximately $8.1 million) and the Peninsula Junction portion of the North Portland/Peninsula Junction Project (approximately $4.1 million, under construction) was not foreseen when this scoping was developed , the capital cost estimate for the Preferred Alternative includes the construction costs of those two projects. In 2019, funding was secured for the Peninsula Junction improvements.

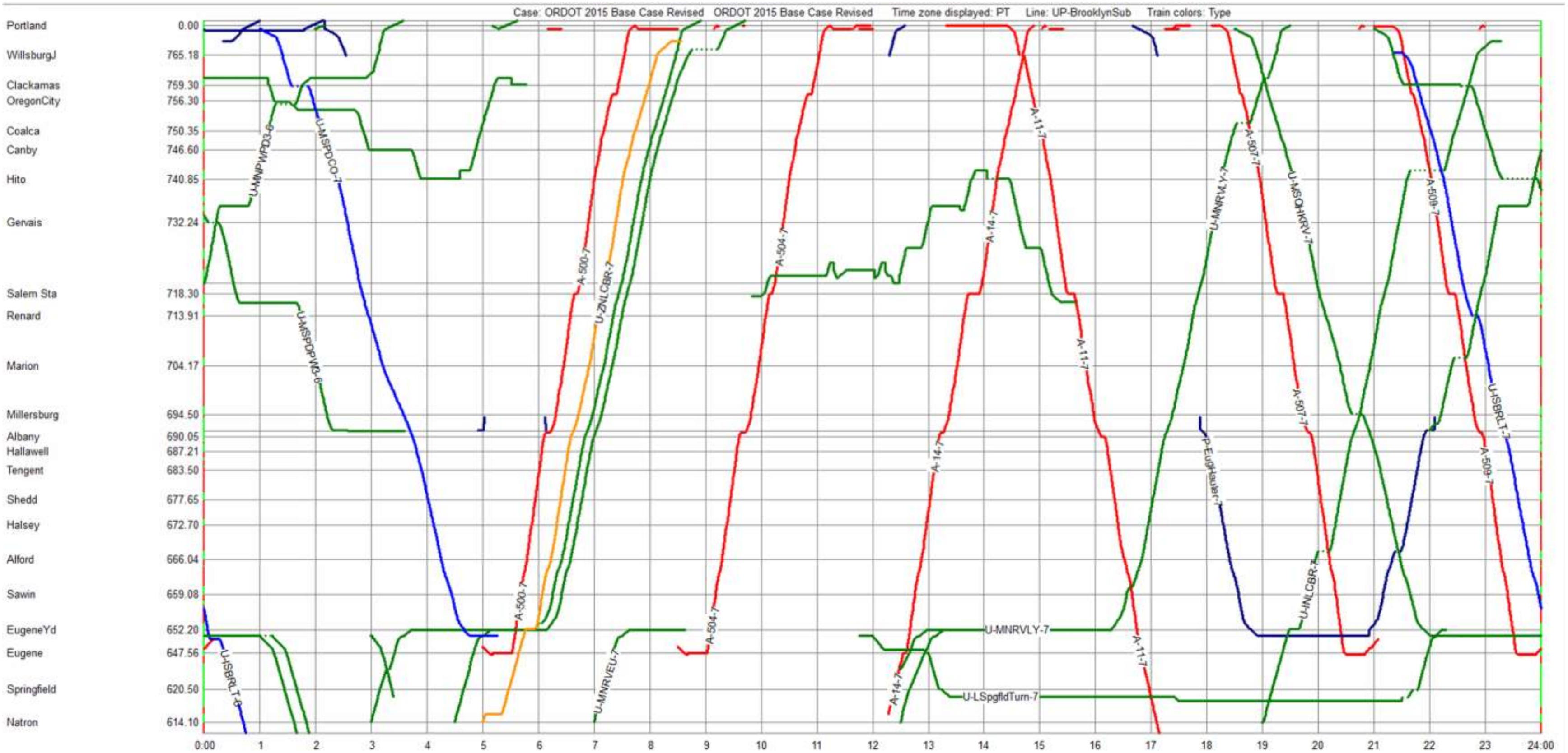
In total, proposed construction under the Preferred Alternative would include 395,200 feet (74.8 miles) of new track, 900 feet of elevated track, 9 crossovers and 41 stream crossings (19 bridges and 17 culverts), and a new bridge over a state highway. The Preferred Alternative would require upgrades or reconfigurations to 64 existing at-grade railroad crossings along this 125-mile route. When the project is completed, approximately 38 miles (31%) of the Oregon portion of the corridor would be single track. Improved sidings would be approximately 32,000 feet long, have midpoint crossovers, and, thus would be able to accommodate two maximum length Precision Scheduled Railroad (PSR) era freight trains or one freight and a passenger train.

6.2.3.2 RTC Model Simulations

Multiple rail operation model simulations were performed that took into account the Base Case, No Action and Preferred Alternative scenarios, involving increases in both freight and passenger train traffic on the existing Amtrak Cascades route. The results of the model simulations are summarized in multiple stringline (time/distance) diagrams.

The Base Case stringline diagram is shown in **Figure 6-3**, with existing (2015) freight trains and current (2+1) Amtrak Cascades passenger rail service in the corridor. **Figure 6-4** illustrates the future (2035) freight trains and current (2+1) Amtrak Cascades passenger rail service in the corridor under the No Action Alternative. **Figure 6-5** illustrates the future (2035) freight train service with proposed infrastructure improvements and expanded passenger rail service in Phase 1 (4+1) under the Preferred Alternative. **Figure 6-6Error! Reference source not found.** illustrates the future (2035) freight train service with proposed infrastructure improvements and expanded passenger rail service in Phase 2 (6+1) under the Preferred Alternative.

Figure 6-3 Time/Distance Diagram – 2015 Base Case



Color

Passenger Trains

Red - Amtrak Cascades trains

Reddish Brown – Amtrak Coast Starlight

Freight Trains

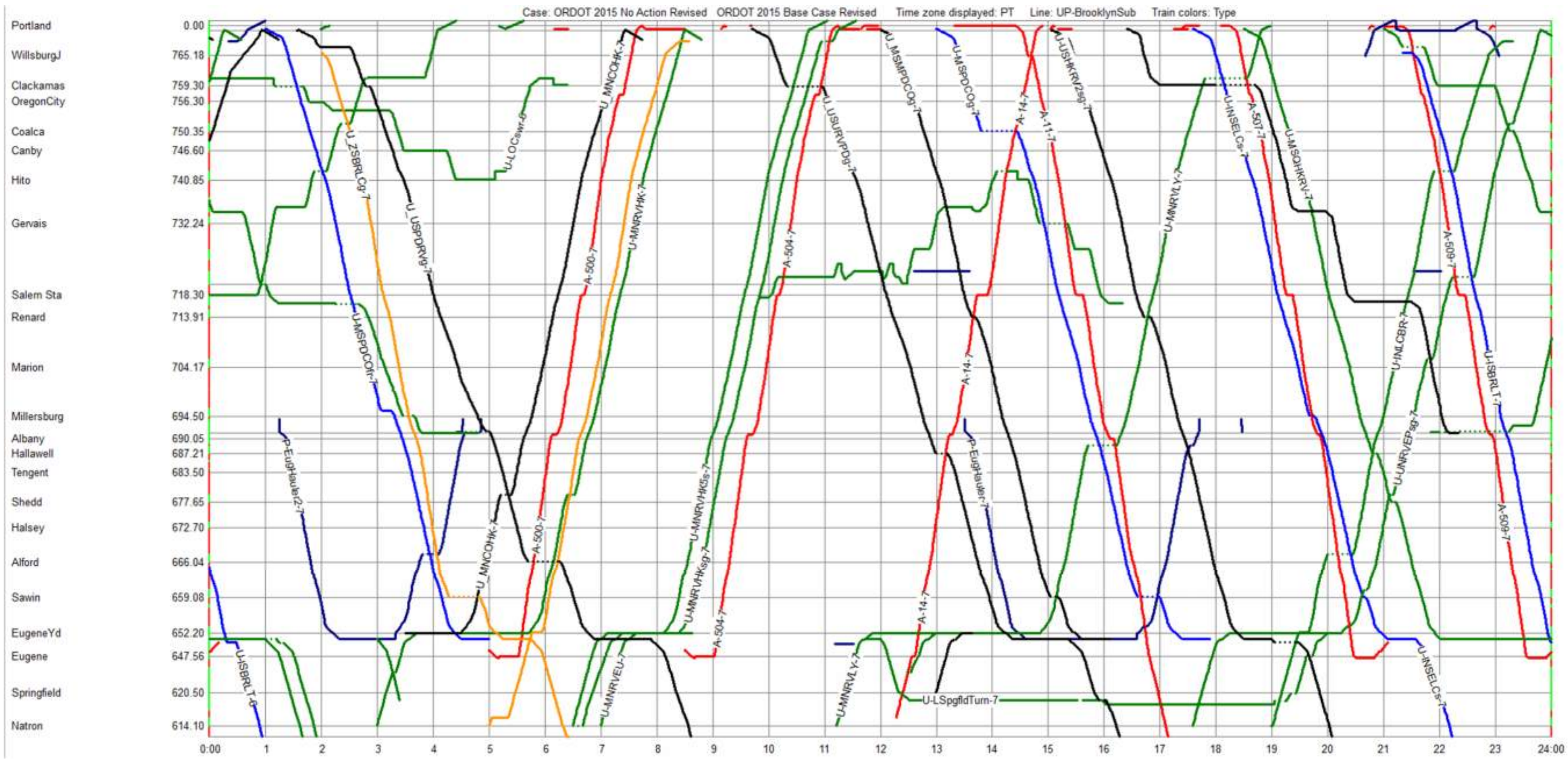
Gold – (Z trains) High priority containers for intermodal

Black – Unit Trains

Blue – (Q trains - Doublestack) Priority Intermodal

Green – Local and Merchandise trains

Figure 6-4 Time/Distance Diagram – 2035 No Action Alternative



Color

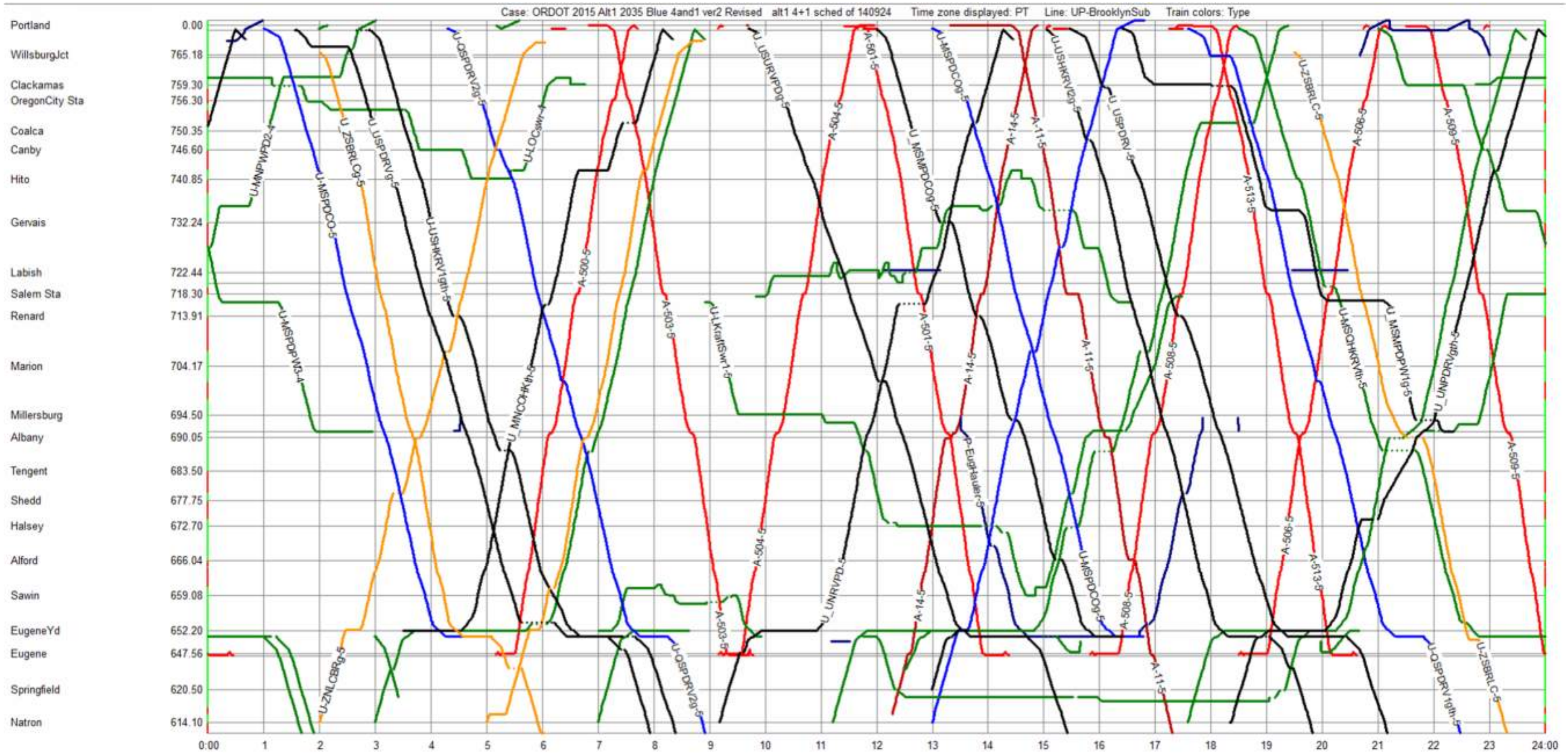
Passenger Trains

- Red - Amtrak Cascades trains
- Reddish Brown – Amtrak Coast Starlight

Freight Trains

- Gold – (Z trains) High priority containers for intermodal
- Black – Unit Trains
- Blue – (Q trains - Doublestack) Priority Intermodal
- Green – Local and Merchandise trains

Figure 6-5 Time/Distance Diagram – 2035 Preferred Alternative 4+1 Service on No Action Minimum (2)



Color

Passenger Trains

Red - Amtrak Cascades trains

Reddish Brown – Amtrak Coast Starlight

Freight Trains

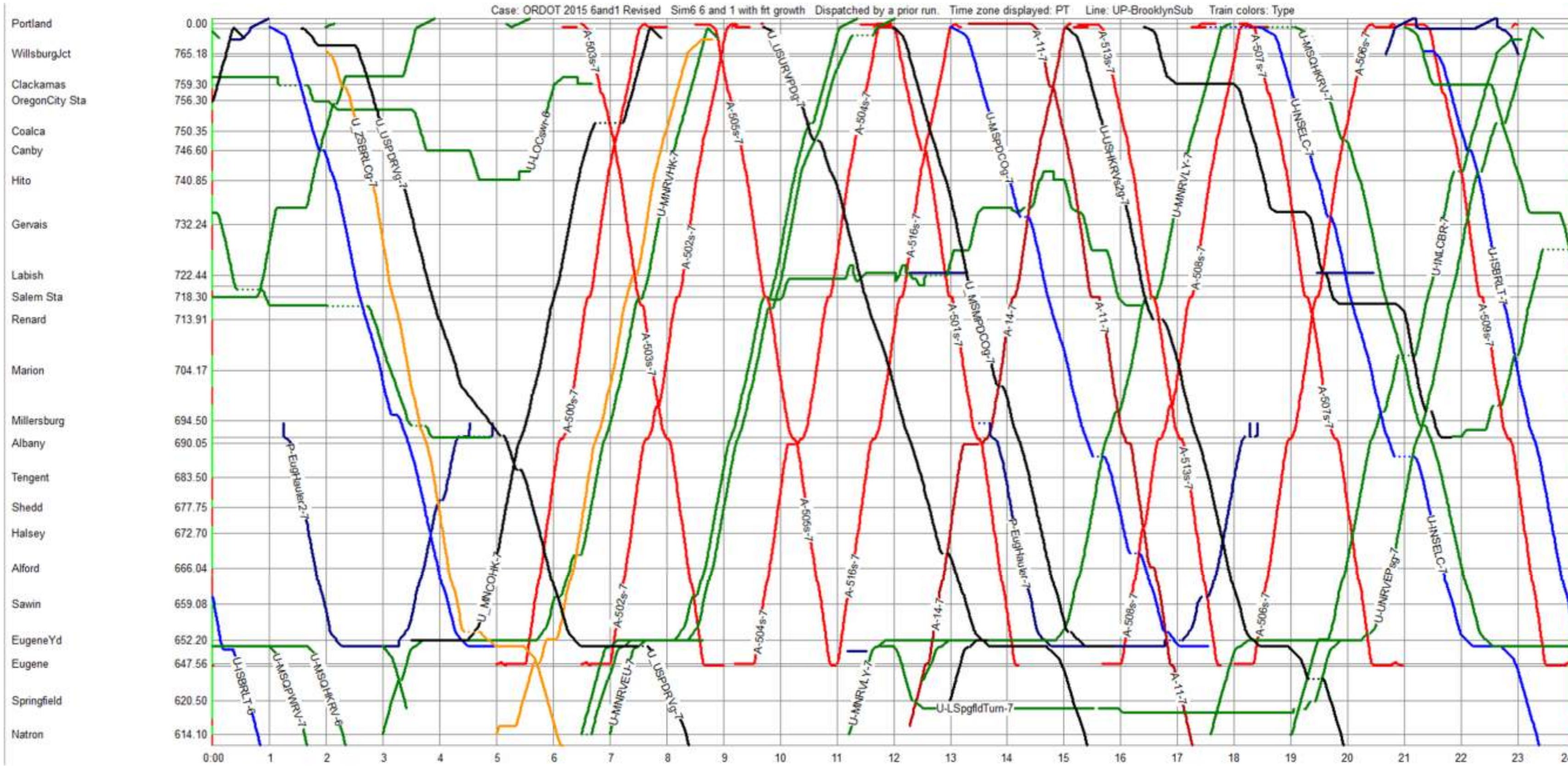
Gold – (Z trains) High priority containers for intermodal

Black – Unit Trains

Blue – (Q trains - Doublestack) Priority Intermodal

Green – Local and Merchandise trains

Figure 6-6 Time/Distance Diagram – 2035 Preferred Alternative – 6+1 Service on 4+1 Network



Color	Passenger Trains
Red	Red - Amtrak Cascades trains
Reddish Brown	Reddish Brown – Amtrak Coast Starlight
	Freight Trains
Gold	Gold – (Z trains) High priority containers for intermodal
Black	Black – Unit Trains
Blue	Blue – (Q trains - Doublestack) Priority Intermodal
Green	Green – Local and Merchandise trains

6.2.4 RTC Simulation Modeling Summary Findings

The RTC simulation model output provides summary statistics that describe the estimated level of train delay for both passenger and freight rail train service in the Amtrak Cascades corridor, inclusive of both the UPRR Brooklyn Subdivision (Eugene to Portland) and the BNSF Fallbridge (Portland to Vancouver, Washington) Subdivision. Four key RTC model output statistics help report the corridor operation characteristics:

Delay per 10 Miles – the average train delay in minutes per 10 miles operated
Delays > 30 Min – the average number of daily trains incurring more than 30 minutes of delay
Average Velocity – the average train velocity measured in miles per hour (mph)
Velocity Minus Dwell and Delay – the average train velocity minus the train speed when encountering delay and dwell times due to other operations, measured in mph

RTC modeling allows a quantitative comparison between the various service-level scenarios. Using the data derived from the unadjusted model runs, train delay ratios were calculated that result from the proposed infrastructure modifications. The 2015 Base Case model outputs establishes what level of delay (to the passenger and freight trains currently operating) might be considered normal. These baseline delay metrics are then compared with the delay metrics calculated for each scenario and used to validate the proposed set of track and signal improvements in order to maintain similar delay ratio metrics once future freight trains and passenger trains have been added to the analysis.

Table 6-1 summarizes the train delay and velocity statistics for the 2015 Base Case, 2035 No Action, 2035 No Action Minimum and 2035 Preferred Alternative scenarios. The table summarizes estimated delay and velocity statistics separately for passenger trains and freight trains.

Table 6-1 Summary of Delays – Brooklyn Subdivision

					PREFERRED ALTERNATIVE		
	Service Level:					**Phase 1**	**Phase 2**
				No Action		**4+1**	**6+1**
		Base	**No Action**	**Minimum**			
Delay/10 Miles (minutes)							
Passenger		0.6	0.5	0.6		0.3	0.3
Freight	Portland & Western Railroad (PNWR)	1.3	2.5	1.7		1.4	3.2
Freight	UP Expedited	1.5	2.1	1.4		1.5	2
Freight	UP Local	5.2	7.2	8.3		6.3	7.9
Freight	UP Manifest	1.7	4.2	2.1		2.5	2.8
Freight	UP Unit	6.9	3.9	3.2		2.7	2.9
	Total Freight	**2.4**	**3.7**	**2.6**		**2.5**	**3**
Delays > 30 minutes							
	Total Freight	**2**	**8.3**	**3**		**5.3**	**3.3**
Average Velocity (mph)							
Passenger		47.9	47.9	48.3		48.4	50.8
Freight	PNWR	11.3	18.3	18.9		19.4	17.7
Freight	UP Expedited	34.5	31.6	33.1		33.0	31.6
Freight	UP Local	7.7	7.4	7.4		7.5	7.3
Freight	UP Manifest	19.7	19.6	21		20.8	20.5
Freight	UP Unit	20.3	22.4	23		24.1	23.4
	Total Freight	**17.6**	**19.7**	**20.6**		**20.9**	**20.2**
Velocity minus Dwell and Delay (mph)							
Passenger		57	56.9	58.2		59.3	58.9
Freight	PNWR	22.3	46	46.6		48.8	52.2
Freight	UP Expedited	41.8	39.9	40.3		40.7	39.8
Freight	UP Local	28.9	27.4	27.7		28.4	26.8
Freight	UP Manifest	35	34.9	35		35.9	35.3
Freight	UP Unit	32.9	33.2	33.5		34.7	33.4
	Total Freight	**34.2**	**35.2**	**35.4**		**36.4**	**35.5**

6.2.4.1 Key RTC Model Findings

The results of RTC simulation modeling for the 2015 Base Case scenario indicate that the existing infrastructure along the Amtrak Cascades corridor is adequate for the current volume of traffic, mode of operation and train schedules.

In the future No Action scenario, the time/distance (stringline) diagrams and associated operation statistics indicate that the existing rail infrastructure is insufficient to efficiently support anticipated future freight traffic, with delays increasing. In the 2035 No Action Minimum scenario, the stringline diagrams and associated operation statistics indicate that the added (minor) infrastructure improvements in the corridor enable future freight operations with traffic delays within 10 percent of the 2015 Base Case scenario metrics.

In the future 2035 Preferred Alternative scenario, with increased passenger rail service (6+1) and assumed infrastructure investments, the stringline diagrams and associated operation statistics indicate that the added corridor infrastructure will enable the proposed passenger trains to operate at higher travel speeds and lower train delay than both the 2015 Base Case and future 2035 No Action scenarios. The simulated infrastructure investments will also support future freight rail growth more effectively and allow UPRR and BNSF to meet their through-transportation, shipper and interchange obligations more efficiently than in the 2035 No Action scenarios, as shown in the "Total Freight" delay ratio statistics.

Key operational findings of the RTC simulation analyses include:

- Both of the expanded passenger service phases for the Preferred Alternative (4+1 and 6+1) over the Brooklyn Subdivision between Portland and Eugene showed an improvement in freight operations metrics compared to the No Action Alternative.
- Passenger trains operate at a higher velocity under the Preferred Alternative. Both the average velocity and elapsed minus delay and dwell velocities were slightly greater than the velocities for the No Action Alternative.
- Freight velocity (average and minus dwell and delay) under the Preferred Alternative is slightly greater than under the No Action Alternative.
- The total freight delay minutes per 10 miles operated for the Preferred Alternative is significantly less than for the No Action Alternative.
- Improvements at Peninsula Junction and North Portland Junction (increasing speeds to 25 mph for freight traffic) are beneficial to all rail operations in North Portland on UPRR's and BNSF's networks in the area of the connection track under the six Amtrak Cascades, Coast Starlight and Empire Builder (6+2) passenger schedules.

6.3 Operating Plan and Schedules

6.3.1 Background

Phasing for the Preferred Alternative infrastructure improvements would be flexible and coordinated closely by ODOT with UPRR, BNSF and Amtrak (operator). UPRR has indicated that they will require additional operations modeling to confirm the needed projects and their prioritization. ODOT and UPRR may need to enter into a separate agreement to undertake additional operations modeling.

Because the Preferred Alternative follows the existing route, infrastructure investments could be broken up into relatively small, lower-cost elements, so that ODOT could implement the Preferred Alternative incrementally as funding becomes available. ODOT could also implement the elements deemed most valuable to support expanded service, and expand service incrementally from two round trips to the six round trips that are considered full buildout. This approach would allow ODOT to add round trips over time as the demand for additional passenger service grows.

6.3.2 Operating Plan

The operating plan was assembled using outcomes from the RTC simulation modeling process and resulting from the infrastructure improvements defined in the conceptual engineering for the OPR Project. The operating plan includes initial descriptions of equipment, infrastructure requirements and scheduling, maintenance facilities, stations, operational organization and operating methods.

6.3.2.1 No Action Alternative

The No Action Alternative for the OPR Project maintains the existing Amtrak Cascades passenger train route and service, including existing stations between Eugene and Vancouver, Washington. The current intercity passenger rail service in the study area consists of three round trips per day between Eugene and Portland (two Amtrak Cascades trains plus one Coast Starlight – a "2+1" passenger train schedule), and six round trips per day between Portland and Vancouver, Washington (four Amtrak Cascades trains plus the Coast Starlight and the Amtrak Empire Builder—a "4+2" passenger train schedule). The WSDOT has commitments to increase to a "6+2" schedule between Portland and Seattle; the No Action Alternative would provide the same frequency in 2035.

6.3.2.2 No Action Minimum Alternative

The No Action Minimum Alternative for the OPR Project maintains the existing Amtrak Cascades passenger train route and service, including existing stations between Eugene and Vancouver, Washington as in the No Action Alternative. However, the scenario includes a minimum level of capital improvements to the rail line to enable it to support the expected freight growth on the network and maintain similar operational metrics as today (that is, to maintain the operational status quo).

6.3.2.3 Preferred Alternative – Phase 1 - 4+1.

Phase 1 of the Preferred Alternative would continue service on the existing Amtrak Cascades route between Eugene and Vancouver, Washington, with capital improvements constructed adjacent to the existing UPRR track in specific locations, as shown in **Figure 6-2**. Planned infrastructure improvements consist of new main line track, sidings, crossovers and industry connections constructed or reconfigured as needed to optimize freight and passenger rail operations throughout the Amtrak Cascades route. Under Phase 1 of the Preferred Alternative, passenger trains would continue to share track with freight trains, and five passenger rail round trips per day—four Amtrak Cascades and one Coast Starlight (a "4+1" schedule) would serve the corridor.

6.3.2.4 Preferred Alternative – Phase 2 - 6+1

Under Phase 2 of the Preferred Alternative, passenger trains would continue to share track with freight trains as in Phase 1, and seven daily passenger rail round trips—six Amtrak Cascades and one Coast Starlight (a "6+1" schedule) would serve the corridor. Additional infrastructure improvements, as shown in **Figure 6-2**, would be constructed to support the Phase 2 schedule.

6.3.3 Passenger Train Schedule Development

Development of the future train schedules of the Preferred Alternative (each of the two phases) is predicated on:

- Assessments of the built environment supporting the Tier 1 DEIS assessment and RTC modeling
- Review of the requirements and guidelines of the Railroad Safety Improvement Act of 2008 (RSIA), Passenger Rail Investment and Improvement Act of 2008 (PRIIA) and the American Recovery and Reinvestment Act of 2009 (ARRA)

- Compliance with Federal Railroad Administration (FRA) guidelines that identify requirements for freight-train capacity and for safety improvements, and for practical methods to improve passenger-train speed, on-time performance, accountability and reliability

The No Action passenger train schedule was adjusted using the RTC-generated runs based on a trainset consisting of one locomotive plus 12 coaches, with the aims of providing reasonable and consistent running times between Eugene and Portland, and minimizing delay with freight rail service in the corridor. The schedule was coordinated with planned Amtrak Cascades service between Portland and Seattle and Sound Transit commuter rail schedules in the Central Puget Sound Region. **Table 6-2** summarizes the proposed schedule for the No Action Alternative. In addition to the two existing Amtrak Cascades round trips, the No Action Alternative assumes the continuation of seven roundtrips of the Cascades POINT/Thruway bus service within the Oregon Amtrak Cascades corridor.

Table 6-2 Amtrak Cascades and Cost Starlight Passenger Train and Bus Schedules – No Action Alternative

NORTHBOUND (read up)

STATIONS	502	500	B5502	B5506	504	B5516	518	EB28	B5528	14	B5518	506	508	B5578	B5548
SEATTLE	9:45 AM	12:00 PM			3:20 PM		6:45 PM			8:50 PM		8:50 PM	11:10 PM		
TUKWILA	9:20 AM	11:35 AM			2:55 PM		6:20 PM			7:59 PM		8:25 PM	10:45 PM		
TACOMA	8:46 AM	11:01 AM			2:21 PM		5:47 PM			7:24 PM		7:51 PM	10:11 PM		
LAKEWOOD	8:35 AM	10:50 AM			2:10 PM		5:35 PM			7:12 PM		7:40 PM	10:00 PM		
NISQUALLY (JCT.)	8:25 AM	10:40 AM			2:00 PM		5:25 PM			7:00 PM		7:30 PM	9:50 PM		
OLYMPIA	8:17 AM	10:32 AM			1:52 PM		5:17 PM			6:52 PM		7:22 PM	9:42 PM		
CENTRALIA	7:56 AM	10:11 AM			1:31 PM		4:56 PM			6:27 PM		7:01 PM	9:21 PM		
KELSO/LONGVIEW	7:15 AM	9:30 AM			12:50 PM		4:15 PM			5:44 PM		6:20 PM	8:40 PM		
VANCOUVER	6:40 AM	8:55 AM			12:15 PM		3:40 PM	2:02 PM		5:06 PM		5:45 PM	8:05 PM		
PORTLAND	6:25 AM	8:40 AM			12:00 PM		3:25 PM	1:40 PM		4:50 PM		5:30 PM	7:50 PM		
PORTLAND		8:25 AM	10:10 AM	11:45 AM		2:05 PM			3:45 PM	4:10 PM	5:25 PM		7:35 PM	7:45 PM	8:25 PM
OREGON CITY		7:44 AM		11:15 AM						...			6:54 PM		7:55 PM
WOODBURN			9:20 AM											6:50 PM	
SALEM		7:02 AM	8:50 AM	10:15 AM		12:55 PM			2:40 PM	2:33 PM	4:10 PM		6:12 PM	6:15 PM	6:55 PM
ALBANY		6:33 AM	8:10 AM	9:35 AM		12:20 PM			2:05 PM	2:00 PM	3:35 PM		5:43 PM		6:25 PM
EUGENE		5:50 AM	7:20 AM	8:40 AM		11:25 AM			1:15 PM	1:14 PM	2:45 PM		5:00 PM		5:30 PM

SOUTHBOUND (read down)

STATIONS	503	B5515	501	B5517	EB27	505	B5501	11	517	B5513	B5579	507	B5519	509	B5509	511
SEATTLE			6:00 AM			8:30 AM		10:00 AM	11:25 AM			2:10 PM		5:35 PM		7:45 PM
TUKWILA			6:12 AM			8:42 AM		10:12 AM	11:37 AM			2:22 PM		5:47 PM		7:57 PM
TACOMA			6:42 AM			9:12 AM		10:44 AM	12:07 PM			2:52 PM		6:17 PM		8:27 PM
LAKEWOOD			6:53 AM			9:23 AM		10:55 AM	12:18 PM			3:03 PM		6:28 PM		8:38 PM
NISQUALLY (JCT.)			7:03 AM			9:33 AM		11:07 AM	12:28 PM			3:13 PM		6:38 PM		8:48 PM
OLYMPIA			7:12 AM			9:42 AM		11:16 AM	12:37 PM			3:22 PM		6:47 PM		8:57 PM
CENTRALIA			7:33 AM			10:03 AM		11:40 AM	12:58 PM			3:43 PM		7:08 PM		9:18 PM
KELSO/LONGVIEW			8:14 AM			10:44 AM		12:24 PM	1:39 PM			4:24 PM		7:49 PM		9:59 PM
VANCOUVER			8:52 AM		10:48 AM	11:22 AM		1:03 PM	2:17 PM			5:02 PM		8:27 PM		10:37 PM
PORTLAND			9:20 AM		11:40 AM	11:50 AM		1:45 PM	2:45 PM			5:30 PM		8:55 PM		11:05 PM
PORTLAND	6:00 AM	7:00 AM		10:40 AM			12:15 PM	2:20 PM		3:35 PM	2:10 PM	5:45 PM	7:00 PM		9:30 PM	
OREGON CITY	6:21 AM							...				6:06 PM			10:05 PM	
WOODBURN		7:45 AM									4:55 PM					
SALEM	7:07 AM	8:20 AM		11;40 AM			1:15 PM	3:32 PM		4:45 PM	5:40 PM	6:52 PM	8:00 PM		10:55 PM	
ALBANY	7:36 AM	8:55 AM		12:20 PM			1:55 PM	4:05 PM		5:20 PM		7:21 PM	8:40 PM		11:35 PM	
EUGENE	8:35 AM	9:45 AM		1:10 PM			2:45 PM	4:55 PM		6:10 PM		8:20 PM	9:30 PM		1:25 AM	

EB27/28 Empire Builder
11/14 Coast Starlight
POINT Cascades Bus

Table 6-3 shows the preliminary schedule of the Preferred Alternative Phase 1 (4+1 Service). The addition of two Amtrak Cascade round trips in the Preferred Alternative will replace two of the Cascades POINT/Thruway daily bus trips. Northbound Amtrak Cascades trains will depart daily from Eugene at approximately 6:00 and 9:25 a.m., and 1:14 and 7:15 p.m. Southbound Amtrak Cascades trains will depart daily from Portland at about 7 a.m., and 12:05, 5:45 and 9:10 p.m.

Table 6-3 Amtrak Cascades and Coast Starlight Passenger Train and Bus Schedules - Preferred Alternative Phase 1: 4+1 Service on No Action Plus Minimum System

NORTHBOUND (read up)

STATIONS	502	500	504	EB28	B5518	518	B5528	14	B5506	506	508	B5578	520
SEATTLE	9:45 AM	12:00 PM	3:20 PM			6:45 PM		8:50 PM		8:50 PM	11:10 PM		
TUKWILA	9:20 AM	11:35 AM	2:55 PM			6:20 PM		7:59 PM		8:25 PM	10:45 PM		
TACOMA	8:46 AM	11:01 AM	2:21 PM			5:46 PM		7:24 PM		7:51 PM	10:11 PM		
LAKEWOOD	8:35 AM	10:50 AM	2:10 PM			5:35 PM		7:12 PM		7:40 PM	10:00 PM		
NISQUALLY (JCT.)	8:25 AM	10:40 AM	2:00 PM			5:25 PM		7:00 PM		7:30 PM	9:50 PM		
OLYMPIA	8:17 AM	10:32 AM	1:52 PM			5:17 PM		6:52 PM		7:22 PM	9:42 PM		
CENTRALIA	7:56 AM	10:11 AM	1:31 PM			4:56 PM		6:27 PM		7:01 PM	9:21 PM		
KELSO/LONGVIEW	7:15 AM	9:30 AM	12:50 PM			4:15 PM		5:44 PM		6:20 PM	8:40 PM		
VANCOUVER	6:40 AM	8:55 AM	12:15 PM	2:02 PM		3:40 PM		5:06 PM		5:45 PM	8:05 PM		
PORTLAND	6:25 AM	8:35 AM	12:00 PM	1:40 PM		3:25 PM		4:50 PM		5:30 PM	7:50 PM		
PORTLAND		8:20 AM	11:45 AM		3:05 PM		4:15 PM	4:10 PM	5:05 PM		7:35 PM	7:45 PM	9:35 PM
OREGON CITY		7:45 AM	11:10 AM								7:00 PM		9:00 PM
WOODBURN												6:50 PM	
SALEM		7:07 AM	10:32 AM		1:55 PM		3:10 PM	2:33 PM	3:50 PM		6:22 PM	6:15 PM	8:22 PM
ALBANY		6:38 AM	10:03 AM		1:20 PM		2:35 PM	2:00 PM	3:05 PM		5:53 PM		7:53 PM
EUGENE		6:00 AM	9:25 AM		12:25 PM		1:45 PM	1:14 PM	2:25 PM		5:15 PM		7:15 PM

SOUTHBOUND (read down)

STATIONS	503	501	B5501	EB27	505	11	517	B5517	B5579	507	B5519	509	511
SEATTLE		6:00 AM			8:30 AM	10:00 AM	11:25 AM			2:10 PM		5:35 PM	7:45 PM
TUKWILA		6:12 AM			8:42 AM	10:12 AM	11:37 AM			2:22 PM		5:47 PM	7:57 PM
TACOMA		6:42 AM			9:12 AM	10:44 AM	12:07 PM			2:52 PM		6:17 PM	8:27 PM
LAKEWOOD		6:53 AM			9:23 AM	10:55 AM	12:18 PM			3:03 PM		6:28 PM	8:38 PM
NISQUALLY (JCT.)		7:03 AM			9:33 AM	11:07 AM	12:28 PM			3:13 PM		6:38 PM	8:48 PM
OLYMPIA		7:12 AM			9:42 AM	11:16 AM	12:37 PM			3:22 PM		6:47 PM	8:57 PM
CENTRALIA		7:33 AM			10:03 AM	11:40 AM	12:58 PM			3:43 PM		7:08 PM	9:18 PM
KELSO/LONGVIEW		8:14 AM			10:44 AM	12:24 PM	1:39 PM			4:24 PM		7:49 PM	9:59 PM
VANCOUVER		8:52 AM		10:48 AM	11:22 AM	1:03 PM	2:17 PM			5:02 PM		8:27 PM	10:37 PM
PORTLAND		9:20 AM		11:40 AM	11:50 AM	1:45 PM	2:45 PM			5:30 PM		8:55 PM	11:05 PM
PORTLAND	7:00 AM		9:40 AM		12:05 PM	2:20 PM		3:00 PM	4:10 PM	5:45 PM	7:00 PM	9:10 PM	
OREGON CITY	7:21 AM				12:26 PM					6:06 PM		9:31 PM	
WOODBURN									4:55 PM				
SALEM	7:59 AM		10:40 AM		1:04 PM	3:32 PM		4:10 PM	5:40 PM	6:44 PM	8:00 PM	10:09 PM	
ALBANY	8:28 AM		11:20 AM		1:33 PM	4:05 PM		4:45 PM		7:13 PM	8:40 PM	10:38 PM	
EUGENE	9:20 AM		12:10 PM		2:25 PM	4:55 PM		5:35 PM		8:05 PM	9:30 PM	11:30 PM	

(green)	EB27/28	Empire Builder
(orange)	11/14	Coast Starlight
(blue)		POINT Cascades Buses

Table 6-4 shows the preliminary schedule of the Preferred Alternative Phase 2 (6+1 Service). The addition of four Amtrak Cascade round trips in the Preferred Alternative will replace five of the seven Cascades POINT/Thruway daily bus trips. Northbound Amtrak Cascades trains will depart daily from Eugene at about 6:05 a.m. and 9:25 a.m., and 12:50, 2:50, 5:15 and 7:15 p.m. Southbound Amtrak Cascades trains will depart daily from Portland at about 7 a.m. and 10:35 a.m., and 12:05, 3:00, 5:45 and 9:10 p.m.

The preliminary schedules of the Preferred Alternative are based on the outputs of the TPC and on performance improvements resulting from the infrastructure improvements.

Table 6-4 Amtrak Cascades and Coast Starlight Passenger Train and Bus Schedules - Preferred Alternative Phase 2: 6+1 Service on 4+1 System

NORTHBOUND (read up)

STATIONS	502	500	504	EB28	518	B5528	14	506	508	B5578	520
SEATTLE	9:45 AM	12:00 PM	3:20 PM		6:45 PM		8:50 PM	8:50 PM	11:10 PM		
TUKWILA	9:20 AM	11:35 AM	2:55 PM		6:20 PM		7:59 PM	8:25 PM	10:45 PM		
TACOMA	8:46 AM	11:01 AM	2:21 PM		5:46 PM		7:24 PM	7:51 PM	10:11 PM		
LAKEWOOD	8:35 AM	10:50 AM	2:10 PM		5:35 PM		7:12 PM	7:40 PM	10:00 PM		
NISQUALLY (JCT.)	8:25 AM	10:40 AM	2:00 PM		5:25 PM		7:00 PM	7:30 PM	9:50 PM		
OLYMPIA	8:17 AM	10:32 AM	1:52 PM		5:17 PM		6:52 PM	7:22 PM	9:42 PM		
CENTRALIA	7:56 AM	10:11 AM	1:31 PM		4:56 PM		6:27 PM	7:01 PM	9:21 PM		
KELSO/LONGVIEW	7:15 AM	9:30 AM	12:50 PM		4:15 PM		5:44 PM	6:20 PM	8:40 PM		
VANCOUVER	6:40 AM	8:55 AM	12:15 PM	2:02 PM	3:40 PM		5:06 PM	5:45 PM	8:05 PM		
PORTLAND	6:25 AM	8:40 AM	12:00 PM	1:40 PM	3:25 PM		4:50 PM	5:25 PM	7:50 PM		
PORTLAND		8:25 AM	11:45 AM		3:10 PM	4:15 PM	4:10 PM	5:10 PM	7:35 PM	7:45 PM	9:35 PM
OREGON CITY		7:53 AM	11:13 AM		2:48 PM		…	4:38 PM	7:03 PM		9:03 PM
WOODBURN		…	…		…			…		6:50 PM	…
SALEM		7:15 AM	10:35 AM		2:00 PM	3:10 PM	2:33 PM	4:00 PM	6:25 PM	6:15 PM	8:25 PM
ALBANY		6:46 AM	10:06 AM		1:31 PM	2:35 PM	2:00 PM	3:31 PM	5:56 PM		7:56 PM
EUGENE		6:05 AM	9:25 AM		12:50 PM	1:45 PM	1:15 PM	2:50 PM	5:15 PM		7:16 PM

SOUTHBOUND (read down)

STATIONS	503	501	EB27	505	11	517	B5579	507	B5519	509	511
SEATTLE		6:00 AM		8:30 AM	10:00 AM	11:25 AM		2:10 PM		5:35 PM	7:45 PM
TUKWILA		6:12 AM		8:42 AM	10:12 AM	11:37 AM		2:22 PM		5:47 PM	7:57 PM
TACOMA		6:42 AM		9:12 AM	10:44 AM	12:07 PM		2:52 PM		6:17 PM	8:27 PM
LAKEWOOD		6:53 AM		9:23 AM	10:55 AM	12:18 PM		3:03 PM		6:28 PM	8:38 PM
NISQUALLY (JCT.)		7:03 AM		9:33 AM	11:07 AM	12:28 PM		3:13 PM		6:38 PM	8:48 PM
OLYMPIA		7:12 AM		9:42 AM	11:16 AM	12:37 PM		3:22 PM		6:47 PM	8:57 PM
CENTRALIA		7:33 AM		10:03 AM	11:40 AM	12:58 PM		3:43 PM		7:08 PM	9:18 PM
KELSO/LONGVIEW		8:14 AM		10:44 AM	12:24 PM	1:39 PM		4:24 PM		7:49 PM	9:59 PM
VANCOUVER		8:52 AM	10:48 AM	11:22 AM	1:03 PM	2:17 PM		5:02 PM		8:27 PM	10:37 PM
PORTLAND		9:20 AM	11:40 AM	11:50 AM	1:45 PM	2:45 PM		5:30 PM		8:55 PM	11:05 PM
PORTLAND	7:00 AM	9:35 AM		12:05 PM	2:20 PM	3:00 PM	4:10 PM	5:45 PM	7:00 PM	9:10 PM	
OREGON CITY	7:21 AM	9:56 AM		12:26 PM	…	3:21 PM		6:06 PM		9:31 PM	
WOODBURN	…	…				…	4:55 PM			…	
SALEM	7:59 AM	10:34 AM		1:04 PM	3:32 PM	3:59 PM	5:40 PM	6:44 PM	8:00 PM	10:09 PM	
ALBANY	8:28 AM	11:03 AM		1:33 PM	4:05 PM	4:28 PM		7:13 PM	8:40 PM	10:38 PM	
EUGENE	9:20 AM	11:55 AM		2:25 PM	4:55 PM	5:20 PM		8:05 PM	9:30 PM	11:30 PM	

(green)	EB27/28	Empire Builder
(orange)	11/14	Coast Starlight
(blue)		POINT Cascades Buses

6.3.4 Future Higher Operating Velocities

The UPRR Brooklyn Subdivision currently has a maximum authorized speed of 79 mph for passenger trains and 60 mph for freight trains. These speeds are currently limited by the FRA track class and the existing signal system. Intercity rail passenger ridership studies have consistently indicated that having more frequent rail passenger service is key to growing ridership. In addition, having reliable service that people can depend on is another key factor. The improvements in this SDP are focused on adding frequency and reliability to increase ridership, rather than reducing travel times via higher operating speeds. Therefore, there are no infrastructure investments under the Preferred Alternative to allow for higher maximum train speeds.

6.3.5 Equipment Requirements

The equipment requirements of the proposed service are outlined in Section 6.4.

6.3.6 Passenger Stations

The Preferred Alternative would use the five existing stations served by the current Amtrak Cascades passenger rail service in Oregon, which are located in or near Central Business Districts. Chapter 7 provides a detailed discussion of the stations and access analysis. No station improvements or capital costs were identified to support the Preferred Alternative.

6.3.7 Maintenance Facility and Layover Track

In support of the Tier 1 FEIS, ODOT is preparing conceptual plans and designs for two facilities in Eugene: new layover track at the Eugene station, and a light maintenance facility near the Eugene rail yard.[37]

The proposed Eugene layover track includes a new stub track diverging off the existing rail siding just west of the Eugene station with capacity to serve arriving Cascades trains (southbound), where alighting passengers will be free from conflict with freight train operations. Cascades trains will remain on the layover track where they will receive passengers boarding the next northbound departures. Stand-by power (480 volts) will be available at the layover track for rudimentary daily service, inspections, and equipment turn around activities. Amtrak Cascades trainsets have a cab control car on one end, and a locomotive on the other, so they do not need to be physically turned around.

The location of a new Eugene maintenance facility, if funded, has not been determined yet. It may be located within the boundaries of the downsized Eugene Yard or some other nearby location. It would provide day-to-day maintenance service functionality (periodic cleaning and inspections, light repairs, drive-through exterior washing and restocking). Major maintenance functions will continue to be performed at the Seattle maintenance facility.

6.3.8 Operational Organization and Operating Methods

For the purposes of the SDP, Amtrak is assumed to be the operator of the passenger trains for each phase of the service implementation between Eugene and Portland under an agreement with ODOT. The host railroads will control, manage and maintain the corridor in which the Amtrak Cascades service will operate: UPRR from Eugene to Portland and BNSF from Portland to Vancouver, WA. Amtrak will oversee the train service from its offices in Chicago and via field management from the Central/Northwest division office in Seattle. Amtrak also monitors all train movements from its Consolidated National Operations Center in Wilmington, Delaware.

Method of Operation is a term for a body of practice, operating rules and regulations that encapsulate a specific method for operating trains on a railroad track. The method of operation on the UPRR portion of the route between Eugene and Portland, is Centralized Traffic Control (CTC).

All movements on UPRR are coordinated by a dispatcher in Omaha, Nebraska, who grants track authority to trains and engines by signal indication, radio, telephone (with restrictions) or facsimile device to occupy the main track outside of terminal areas. Movements off the main track within principal yards are often coordinated with train crews by a trainmaster or other field operations managers, who are located in the UPRR Pacific Northwest Service Unit's office in Portland and at Eugene.

The BNSF portion of the route between Portland and Vancouver, WA, is double track, signaled for operation in both directions on both tracks. Its method of operation is also CTC and includes some physical speed restrictions due to curvature and the 3 movable bridges spanning rivers between Portland Union Station and the Vancouver, Washington Amtrak station. BNSF dispatchers control all train movements on this route remotely from Fort Worth, Texas, and Northwest Division managers are based in Seattle and various outlying points, including Vancouver, Washington.

Operations over both segments are subject to the General Code of Operating Rules (GCOR), a uniform set of operating procedures, safety rules and regulations employed by most railroads in the western United States GCOR outlines field safety practices, procedures for proper train handling, accident management, signaling and any scenario that could potentially disrupt safe railroad operations. Each railroad supplements the GCOR with its own timetable, system and local special instructions, general orders, notices, air brake and train handling rules, and hazardous materials instructions custom tailored to fit each carrier's policies and style of operations. All Amtrak train and engine crews possess a copy of and adhere to the rules of the host railroads over which they are operating, as well as Amtrak's own policies and instructions pertinent to its operations.

6.4 Operating Equipment

6.4.1 Trainset and Locomotive Equipment Plan

ODOT estimates that two additional passenger rail trainsets and locomotives will be needed to accommodate increased service between Eugene and Portland under both Phase 1 (4+1) and Phase 2 (6+1) of the Preferred Alternative, and any new trainsets also will operate between Vancouver, BC and Eugene (see also Chapter 8). Both ODOT and WSDOT are coordinating Amtrak Cascades Fleet Procurement plans for passenger rail equipment. The passenger rail equipment procurement will follow the Amtrak Cascades Fleet Management Plan[38] long-term strategy for investing in new equipment. The strategy is in compliance with current FRA safety standards, Amtrak-approved specifications, and the Passenger Rail Investment and Improvement Act Section 305 Next Generation Corridor Equipment Pool (NGEC) guidelines or equivalent FRA-compliant specifications.

The Fleet Management Plan (FMP) developed a process for investing in new equipment to meet long-term service expansion goals for the service and replace the fleet when it reaches the end of its service life:

FMP Strategy 3: Investing in equipment (long-term)

A. Apply a set of established criteria for future acquisition programs.

B. Link replacement equipment to service-level increases.

C. Improve fleet flexibility to simplify operations.

D. Tie future acquisitions to service-level increases.

E. Confirm that replacement dates are flexible enough to meet the timeframe for additional acquisition and to maximize order quantities.

The proposed train consists of the Amtrak Cascades service will be based on the assumption that new equipment will meet or exceed the characteristics and seating capacities of the existing Oregon Amtrak Cascades train consists. **Table 6-5** illustrate the typical Cascades Amtrak train consist extant during the development of this plan.

6.4.2 Equipment Requirements

The equipment requirements for each trainset of the proposed service are summarized in **Table 6-5**. Each train consist is estimated to have seating capacity of 272 passengers.

Table 6-5 Amtrak Cascades Equipment Requirements

Equipment Requirements	
Train Length	*568 feet*
Train Weight	*280 tons*
Locomotive Type	*SC44 or equivalent*
Passenger Car Seating Capacity	*28-37 (Talgo)* *68-70 (Horizon)*
Passenger Train Seating Capacity	*272*

The trainsets will need locomotives to haul them as well. WSDOT owns eight Charger SC44 locomotives for Amtrak Cascades service. Additional locomotive purchases are outlined in the FMP for service expansion.

6.4.3 Equipment Cost Estimates

There are several states that have recently received FRA State of Good Repair Program grant awards for the acquisition of new passenger rail equipment: North Carolina, Washington, and Wisconsin in 2019. Washington's grant was a 50/50 match request with $37.5 million federal and state shares for a total of $75 million the estimated cost for three trainsets (See **Table 6-6** below for specific details) for the replacement of the Talgo Series VI rail car (not including locomotives). WSDOT's application specifically states that it will purchase new cars via the current Amtrak railcar procurement.

Table 6-6 WSDOT Passenger Railcar Replacement Project Cost Estimate

Task No.	Task Name	Cost $	Percent of Total Cost
1	RFP Review, Oversight, and Selection	900,000	1.2
2	Passenger Rail Car Construction, Testing and Delivery	67,500,000	90.0
3	Administrative Oversight and Quality Control	6,600,000	8.8
TOTAL PROJECT COST		**75,000,000**	**100.00**
FEDERAL FUNDS RECEIVED FROM PREVIOUS GRANT		0	0
SOGRP FEDERAL FUNDING REQUEST		**37,500,000**	**50.00**
NON-FEDERAL FUNDING MATCH		**37,500,000**	**50.00**
PORTION OF NON-FEDERAL FUNDING FROM PRIVATE SECTOR		0	0
PORTION OF TOTAL PROJECT COSTS SPENT IN A RURAL AREA		0	0
PENDING FEDERAL FUNDING REQUESTS		0	0

Wisconsin received $25,716,900 in federal funds for the purchase of nine single-level coaches and cab cars. Assuming the same 50/50 federal/state match, this would equate to $51.4 million for two trains, plus a spare cab and spare coach car. North Carolina received $76,888,000 in FRA grant funding for 13 new passenger coaches and to expand the existing locomotive and railcar maintenance facility. As this funding includes upgrades to the maintenance facility, it's difficult to estimate the pure equipment cost. The single-level coaches currently being finished for the Midwest and California equipment procurement were $2.5 million each in 2012 dollars. Based on this recent information, the cost of procuring the two new trainsets is estimated to be approximately $50 million in 2015 dollars.

The Charger locomotives that WSDOT purchased were delivered in 2017 and cost $7.3 million each, so two new locomotives to haul the new trainsets would cost approximately $16 million in 2015 dollars when spare parts are included. The cost for capital spare parts is estimated to be approximately 10 percent of the locomotive cost.

6.5 Rail Infrastructure Requirements

6.5.1 Overview

The physical characteristics of the Amtrak Cascades route were included in the modeling parameters for their influence on train schedules, costs and suitability for expanded passenger rail operations along the UPRR and BNSF host railroads. The service operating plan assumes that corridor investments will support expanded passenger train service while mitigating impacts on the host railroad freight capacity, speed, reliability, costs of operation, or operational flexibility. The physical characteristics of the corridor were used to develop the conceptual engineering documents (**Appendix B**) that describe, illustrate and quantify how proposed improvements were modified to address environmental, engineering and operational concerns.

6.5.2 Existing Infrastructure Conditions

Existing route/track mileage, and current freight speed and passenger train volume, speed and ridership are summarized in **Table 6-7.**

Table 6-7 Rail Infrastructure Existing Conditions

Oregon Corridor Metrics		
	UPRR Track Miles	*123 miles*
	BNSF Track Miles	*10 miles*
Freight Service	**Maximum Authorized Speed**	*60 mph*
Passenger Service	**Amtrak Cascades Passenger Volume**	*120,000 annual riders (2014)*
	Maximum Authorized Speed	*79 mph*

6.5.3 Proposed Infrastructure Improvements

Figure 6-7 summarizes the cost of future rail infrastructure improvements assumed for the No Action Minimum Alternative and Preferred Alternative (full buildout) in the Amtrak Cascades corridor. Planning-level cost estimates range from low to high, to account for variability. The total cost of rail yard and track siding extensions and new passing tracks under the Preferred Alternative (full buildout) is estimated to range from $1,104 million to $1,367 million.

Construction costs for the Preferred Alternative also include a total of $31.5 million for improvements to the Willbridge Crossover Tracks ($8.1 million) and Eugene Stub Tracks ($23.4 million), both projects subject to preliminary engineering and NEPA assessment in 2015.

Figure 6-7 Amtrak Cascades Oregon Rail Infrastructure Improvements and Estimated Costs

Project	Cost Estimate Low	Cost Estimate High	No Action Minimum (NAM)	Preferred Alternative Phasing: 1 4+1 on NAM	Preferred Alternative Phasing: 2 6+1 on 4+1
Clackamas/Brooklyn Yard New Passing Track	$170M	$199M			✓
Clackamas/Brooklyn Yard Extension	$59M	$118M	✓	✓	✓
Coalca Siding Extension	$118M	$143M		✓	✓
Gervais Siding Extension	$49M	$59M			✓
Labish Siding Extension	$124M	$147M	✓	✓	✓
Renard Siding Extension	$41M	$48M	✓	✓	✓
Marion Siding Extension	$75M	$89M			✓
Millersburg	$26M	$31M			
Hallawell to Albany Extension	$57M	$69M			✓
Hallawell Extension	$26M	$35M			✓
Halsey New Passing Track	$47M	$56M		✓	✓
Alford Siding Extension	$65M	$78M			✓
Judkins Siding Extension	$248M	$297M	✓	✓	✓

Phasing	Cost Estimate Low	Cost Estimate High
No Action Minimum	$472M	$609M
1 4+1 on NAM	$165M	$200M
2 6+1 on 4+1	$467M	$558M
Total	$1,104M	$1,367M

6.5.4 Right-of-Way

The existing right-of-way (ROW) was delineated based on UPRR track charts and State of Oregon Geographic Information System (GIS) mapping of property ownership along the Amtrak Cascades corridor. Based on those sources, potential ROW needs were identified for track work in locations where rail infrastructure requirements are identified under the Preferred Alternative. In most places, the new track for the Preferred Alternative would be offset 20 feet east of the existing UPRR mainline track; in these areas a 30-foot acquisition was assumed. Five generalized zoning categories were used and areas calculated. Property sales in the area of the corridor were analyzed by zone and unit prices were developed.

6.5.5 Signaling and Communications

As noted in section 6.2.2, PTC is now required by FRA on Class I railroad main tracks that host intercity passenger trains. PTC can substantially reduce the probability of train collisions, MOW worker casualties and excessive train speed incidents. UPRR installed PTC on the Brooklyn Subdivision in 2018. In addition to PTC, wayside signaling costs are identified in the Tier 1 DEIS (see **Appendix B**).

6.6 Equipment and Train Crew Scheduling

6.6.1 Equipment Rotation Plan

The overall Cascade service will require eight trainsets (plus one spare trainset to allow for maintenance procedures that cannot be performed in the normal overnight servicing time windows and on-time performance purposes) and approximately 19 train crews (five new crews) to accommodate five daily round trips between Eugene and Seattle, and one daily round trip between Eugene and Portland, seven days a week.[39] An equipment rotation plan has been developed to match this schedule.

Owing to the length of the route and duration of the proposed schedule, only seven of the eight trainsets would make a round trip each day, while the other trainset would make a one-way trip. The trainsets will operate in a push-pull configuration and will not require turning as a matter of routine practice. Future consists will be made up at Amtrak's Seattle yard and remain unbroken at the other terminals. Routine servicing and light maintenance will occur in both Seattle and Eugene.

6.6.2 Train Crew Scheduling

Crew requirements to accommodate the service are subject to agreements with Amtrak and the host railroads, UPRR and BNSF. It is anticipated that each of the 19 train crews will have four fully qualified people, and will include an engineer, conductor, assistant conductor and café/lounge service attendant.

The current Amtrak crew bases are in Seattle and Portland. Amtrak train and engine crews from Portland can operate either to Seattle or south to Eugene. Onboard Services (OBS) crews have different work rules and can operate through from Seattle to Eugene and return. Portland crews operating to Eugene can either layover in Eugene (to get their mandated rest) or return same day. This is in consideration of Federal Hours of Service regulations, which restrict operating department railroad employees to no more than 12 hours of work per shift. Most crews can make a Portland-Eugene round trip in 8 to 12 hours, depending on the length of layover in Eugene, including the time necessary to conduct a job briefing before the run and complete paperwork after the run.

6.6.3 Operating and Maintenance Cost Estimate

The estimated annual operating and maintenance costs for the added Amtrak Cascades service under the Preferred Alternative are based on historical trends in the shared operations and maintenance costs between Oregon and Washington covering existing Amtrak Cascades service. Chapter 9 contains the detailed discussion of the methodology and assumptions used to develop this cost estimate. **Table 6-8** summarizes the detailed operating and maintenance costs. ODOT has a separate maintenance contract with Talgo to provide maintenance on the two Series eight trainsets it owns. Talgo maintains the HVAC, seats, rest rooms, mechanical systems, electrical systems, brakes, wheels, etc. on the trains. This work is done by Amtrak employees, directly under Talgo supervision.

Table 6-8 Estimated Annual Operating and Maintenance Costs (in 2015 dollars)

Phase 3 (6+1) Preferred Alternative	Annual Cost
Third Party Costs (MOW, Fuel)	$3,290,600
Route Costs (T&E Labor, MoE)	$10,119,900
Amtrak T&E and MoE Additives	$3,419,000
Fixed Route Costs (Amtrak categories)	$17,466,800
Other Amtrak Additives	$1,114,500
Subtotal: Estimated Section 209 Costs	**$35,410,900**
Talgo Equipment Maintenance Estimate	$3,083,400
Total Operating and Maintenance Costs	**$38,494,300**

Dollars may not sum due to rounding.

6.7 Total Cost Estimate

Appendix B summarizes the methodology, unit costs and unit cost sources used to estimate the capital improvement, and Chapter 9 summarizes the methodology and units costs to estimate the operating and maintenance costs associated with the Preferred Alternative Phase 2 (6+1) as input to the Tier 1 DEIS and the SDP. The capital, operating and maintenance costs required to support operations of the additional two trainsets and Preferred Alternative operations (six daily round trips) are summarized in Error! Reference source not found. in 2015 dollars.

Table 6-9 Preferred Alternative Cost Estimate

Capital Costs	In Millions (2015 $s)
Rail Infrastructure Improvements	$1,104 - $1,367
Two Trainsets and Two Locomotives	$66
Willbridge Crossover Tracks and Eugene Stub Tracks	$31.5
Maintenance Yard/Layover Facility (Eugene)	$38.3
Operating and Maintenance Costs (annual)	**In Millions (2015 $s)**
Third Party Costs (MOW, Fuel)	$3.3
Route Costs (T&E Labor, MoE)	$10.1
Amtrak T&E and MoE Additives	$3.4
Fixed Route Costs (Amtrak categories)	$17.4
Other Amtrak Additives	$1.1
Talgo Equipment Maintenance Estimate	$3.1

7 Station and Access Analysis

This chapter summarizes the station and access analysis of the Preferred Alternative as identified in the OPR Project FEIS. The Preferred Alternative includes expanded Amtrak Cascades rail service with a total of six daily roundtrips between Eugene and Portland, serving each of the five existing Amtrak Cascades stations, as well as the existing one Amtrak Coast Starlight round trip (6+1) at four existing stations. For each Amtrak Cascades station, the chapter summarizes the following:

- Station Location Analysis – including a broad summary of the site suitability as well as prevailing land use and major attractions in proximity to each station
- Station Operations – a summary evaluation of station capacity to meet future passenger demand, including building characteristics and platform area
- Intercity Travel Connectivity – a description of intercity transportation services integrated through each station
- Station Access and Circulation – a summary assessment of station access by mode, including a detailed summary of vehicle and bicycle parking, local transit interconnectivity, and walk and bicycle networks serving each station
- Summary Assessment – a broad summary statement indicating how each station will accommodate the expected increase in Amtrak Cascades service

7.1 Portland

7.1.1 Station Location Analysis

7.1.1.1 Site Suitability

Constructed in 1896, the existing Portland Union Station is just north of Portland's downtown high-density office area, east of the Pearl District. **Figure 7-1** illustrates the existing Portland Union Station area. The Pearl District area has been undergoing significant urban renewal since the mid-1980s, when it was reclassified from industrial to mixed use, and now includes higher density mixed-use residential buildings. Besides serving as an Amtrak station, the train station building houses a restaurant and offices.

Figure 7-1 Portland Union Station Area and Major

The City of Portland owns Union Station and has plans to renovate and improve the terminal area and adjacent track infrastructure. This Union Station Project has a federal grant through the

Federal Railroad Administration (FRA) and is currently in the Preliminary Engineering/NEPA stage of development.

7.1.1.2 Land Use and Major Attractions

Portland is the largest city in Oregon. As shown in **Figure 7-1** , there are numerous attractions and employment opportunities in downtown and in the surrounding metropolitan area. There are also higher education institutions such as Portland State University, Oregon Health and Sciences University, and Portland Community College in the area. Like other large cities, Portland has a range of classical performing arts institutions, including the Oregon Ballet Theatre, Oregon Symphony, Portland Opera, and The Portland Art Museum. The Oregon Museum of Science and Industry (OMSI) and the Oregon Rail Heritage Center (ORHC) are located on the east bank of the Willamette River across from downtown Portland. Portland is home to two major league teams: Major League Soccer's Portland Timbers and the Portland Trail Blazers of the National Basketball Association. Portland also has a thriving restaurant and cultural scene that attracts visitors to downtown, the Pearl District, the Alberta Arts District, and other neighborhoods throughout the city.

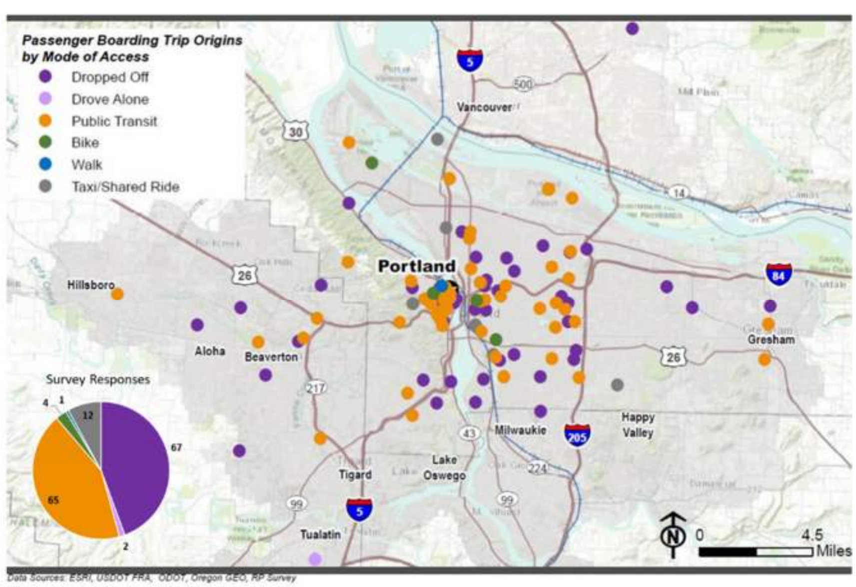
Zoning around the existing station in Old Town Chinatown is almost entirely designated "Central Commercial" as one of Portland's most urban and intense areas (see **Appendix C** for a detailed zoning map of the station area). This allows a broad range of uses to reflect Portland's role as a commercial, cultural, and governmental center. The designation also allows residential uses. The Pearl District area is designated "Central Employment". This zone allows mixed uses but is intended for areas in the center of the city that have predominantly industrial-type development. Residential uses are allowed. The Pearl District has experienced significant development of multistory residential apartments and condominiums immediately north and west of Union Station. The recently vacated U.S. Post Office Distribution site across NW Broadway from Union Station is slated for mixed-use, multistory redevelopment.

7.1.2 Station Operations

7.1.2.1 Mode of Access – Ridership Profile

Passengers accessing Portland's Union Station travel by a variety of modes. **Figure 7-2** maps the mode of access by passenger rail riders as identified in the 2014 Revealed Preference Survey.[40] The two predominant modes of access include *Dropped Off* and *Public Transit.* Those passengers who indicated that they ride transit to access Union Station use a mix of bus and rail throughout the region. Very few respondents indicated that they drive alone and park at Union Station.

Figure 7-2 Union Station Passenger Mode of Access



7.1.2.2 Operational Feasibility

Building Features: Portland Union Station is a three-story mixed-use building originally constructed in 1896. It provides significant indoor and outdoor facilities supportive of passenger rail service, is a visual landmark, and a destination for both transit and non-transit patrons. Upper floors provide leasable office space. summarizes key facility features at Union Station.

Passenger Queuing and Waiting Area: Forecasts of future passenger demand (on average, 473 passengers per train) are used to estimate the number of passengers departing and boarding individual trains at Union Station, assuming six Amtrak Cascades roundtrips of the Preferred Alternative, the one roundtrip of the Coast Starlight and the one round trip of the Empire Builder (north of Portland only). The level of passenger comfort within the station queuing/waiting area is calculated measuring the average space (square feet) per passenger (consistent with Transit Capacity and Quality of Service Manual).[41] Within Union Station, the projected standing, circulation, and queuing conditions will vary from free circulation to partially crowded during individual train arrival/departure times – see .[42]

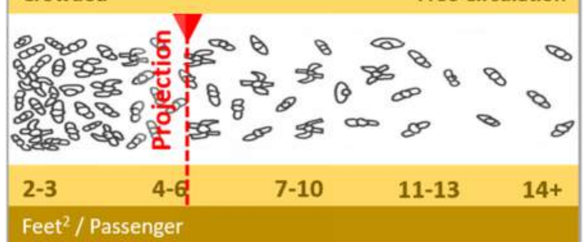
Platform Features: The original boarding platforms were constructed in the early 1900s and painted yellow stripes identify safe train setbacks for standing. summarizes the Union Station current platform characteristics. The City of Portland is currently in the Preliminary Engineering/NEPA stage of developing station and platform improvements to accommodate future intercity passenger train service.

Figure 7-3 Union Station Building and Platform Features

Building Features

Ticketing Area	Counter Service; Automated Ticket Machines (2)
Restrooms	Yes, ADA accessible
Support Services	Retail, Restaurant, Office Uses, Baggage Room
Queuing / Waiting Area	60' x 100'; +/- 100 Bench Seats

Future Queuing and Waiting Area



Platform Features

Number Platforms	2
Single or Double Loaded	Double
Length	Up to 1,800 ft
Width	12 ft
Pedestrian Weather Protection	Yes, continuous canopies
ADA Access	Mechanical Lift Required

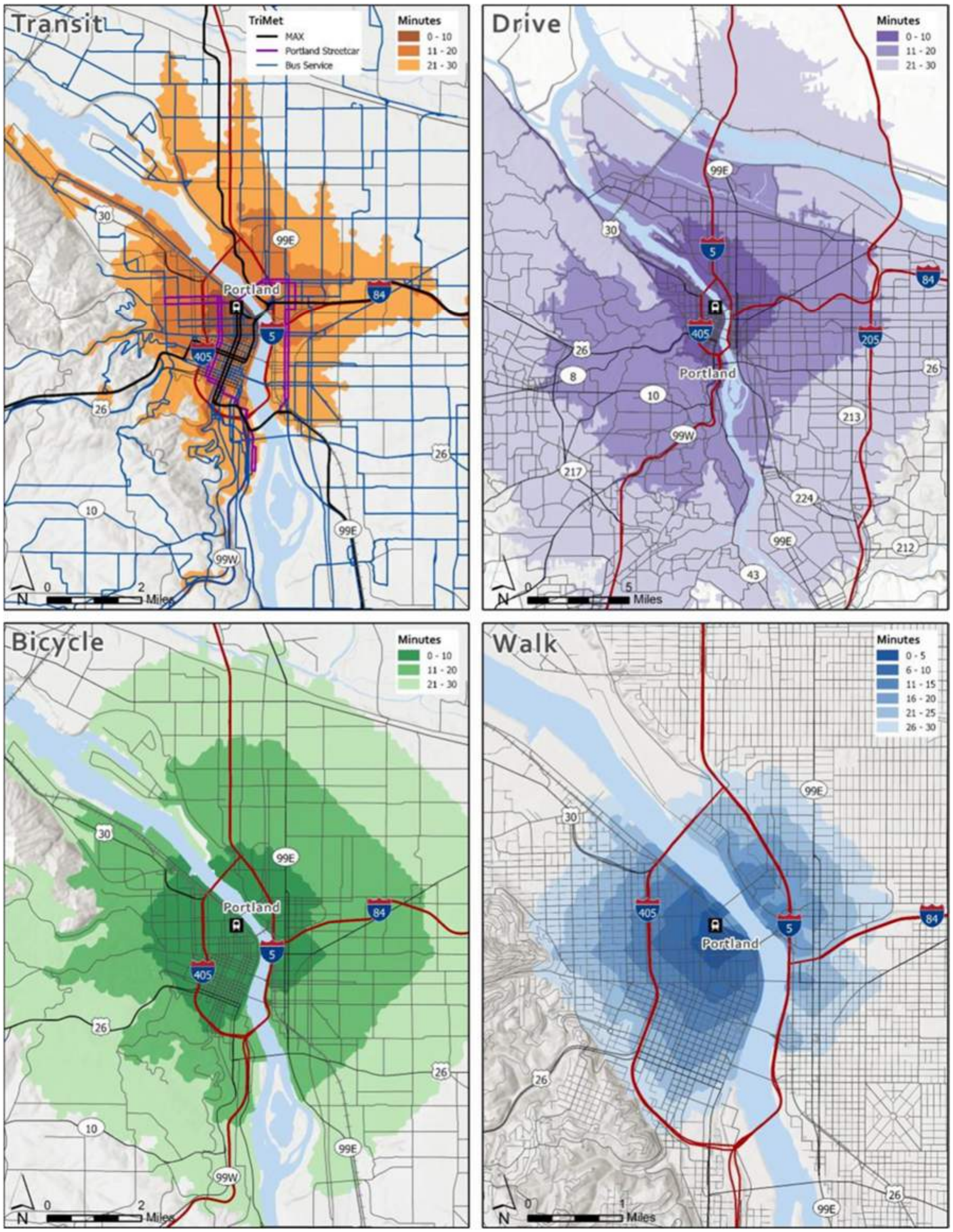
7.1.3 Intercity Travel Connectivity

Union Station serves as an intercity and intracity transportation hub for Portland. Amtrak operates daily service through Portland, including the Coast Starlight (Seattle – Los Angeles) and Empire Builder (Portland – Chicago) routes. Intercity bus services at Union Station include Cascades POINT/ *Thruway*, The Wave (Tillamook-Portland, twice daily), CC Rider (St. Helens-Portland, twice daily) Central Oregon Breeze (Bend-Portland, once daily), and NorthWest POINT (Astoria-Portland, twice daily). The Greyhound bus stop is located immediately north of Union Station (curbside) on NW Station Way.

7.1.4 Station Access and Circulation

Figure 7-4 below maps the Union Station interconnectivity, illustrating separate travel sheds for transit, auto, bicycle, and pedestrian access.

Figure 7-4 Portland Travel Sheds



7.1.4.1 Walk

Union Station is accessible via multiple routes, and the surrounding area has abundant sidewalks, as seen in **Figure 7-5**; therefore, pedestrian accessibility and network connectivity is very high. Most intersections have marked crosswalks, contributing to pedestrian safety. A pedestrian bridge connects the station to a neighboring development, which creates access to the Broadway Bridge and waterfront shared-use paths. Areas within a short walking distance include the Pearl District, Downtown, Eastbank Esplanade via the Steel Bridge, and Tom McCall Waterfront Park.

7.1.4.2 Transit

Union Station is located at the northern end of TriMet's transit mall. As shown in **Figure 7-5**, the transit mall provides connections to MAX Orange, Green, and Yellow line trains, which travel to north Portland, east to Gresham, and south to Milwaukie and Clackamas County. Blue and Red line MAX trains running on the transit mall serve east-west destinations from the airport and Gresham to Beaverton and Hillsboro. TriMet also provides local bus service to and from the station. Union Station is also only a short walk to both lines of the Portland Streetcar in the Pearl District.

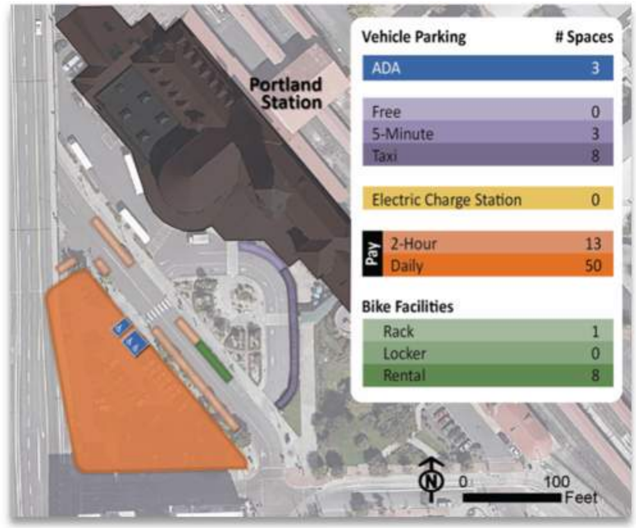
Figure 7-5 shows that 27 percent of zero-vehicle households within Portland's Urban Growth Boundary (UGB) are within the 30-minute transit trip of Union Station.[43] This means that more than 15,000 households living without a car in Portland are able to access Union Station within a half-hour via public transit.

Figure 7-5 Union Station Area Pedestrian Facilities and Transit Connections

7.1.4.3 Auto

The existing station is at the north end of the interstate loop that circles the city of Portland. As shown in **Figure 7-6**, the existing station provides multiple parking options, including a pick-up/drop-off zone, dedicated taxi and bus zones, paid short-term and daily parking, and an overnight parking garage one block north of the station. Pay-to-park spaces exist on the surrounding blocks; however, they are limited to short-term, mostly two-hour parking spaces.

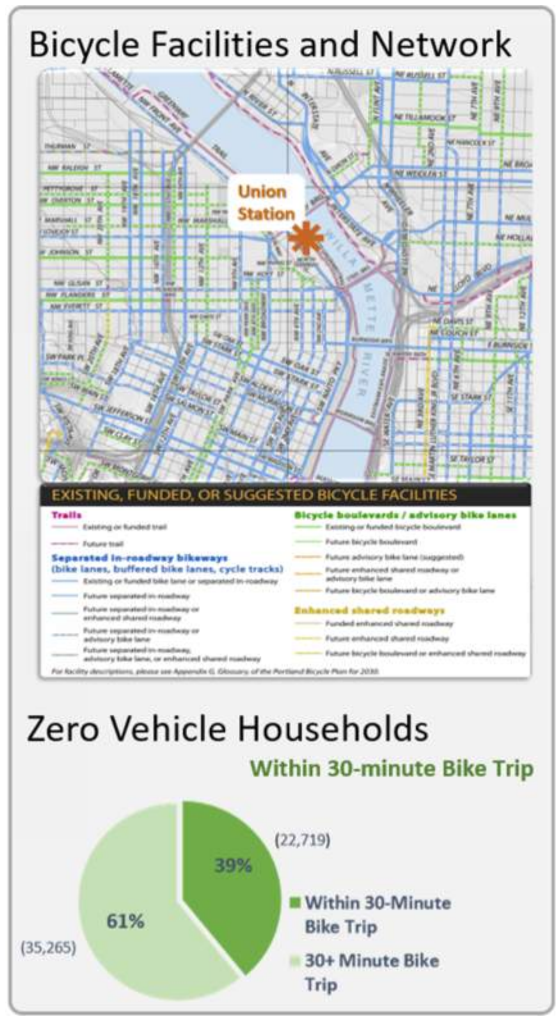
Figure 7-6 Union Station Vehicle and Bicycle Parking Facilities



7.1.4.4 Bicycle

Union Station is very accessible by bicycle; however, network connectivity is mostly limited to shared, low-volume streets in the immediate surrounding area. Dedicated and buffered bicycle lanes and shared-use paths are accessible within a couple of blocks of the station, and they offer access to Portland's abundant bicycle network. There is one undercover bicycle rack near the station's entrance and a bicycle-share docking station in front of the station. As shown in **Figure 7-7**, a variety of bicycle facilities exist in the area surrounding Union Station. **Figure 7-7** shows that 39 percent of zero-vehicle households within the region's urban area are within the 30-minute bicycle trip of Union Station.

Figure 7-7 Union Station Area Bicycle Facilities and Network



Source: City of Portland Bicycle Plan 2030 (2010)

7.1.5 Summary Assessment

Portland is the largest city in Oregon and the central city near Portland Union Station is the region's major employment center. There are numerous attractions within a short distance of Union Station.

The majority of Oregon Amtrak Cascades riders boarding at Union Station arrive by public transit, are dropped off by friends or family, or hire a taxi (or other ride-for-hire services). Union Station is located at the north end of TriMet's transit mall, and there are abundant local and regional transit and intercity bus connections within a very short walking distance of the station. Private vehicle and taxi drop-off/pick-up zones are adequately sized and located to meet the forecasted ridership of the Preferred Alternative. A sizeable number and portion of the region's transit-dependent population (households with zero cars) are within a 30-minute transit trip to Union Station.

Though private vehicle parking for Union Station is limited and varies in cost for short- and long-term utility, there is sufficient parking capacity nearby to accommodate the small portion of Amtrak Cascades riders who drive alone to access Union Station.

Local pedestrian and bicycle facilities within the Union Station area are also abundant. A sizeable number and portion of the region's zero-car households are also within a 30-minute bicycle trip to Union Station.

Prosper Portland (the City of Portland's economic and urban development agency) acquired the station in 1987 from the Portland Terminal Railroad (PTRR). In cooridnation with ODOT, Prosper Portland is completing NEPA analysis and seeking funding support of phased repairs to the existing Union Station buildings, platforms and canopies , and adjoining track infrastructure structures to meet current building, and seismic standards, and to accommodate future passenger rail traffic.

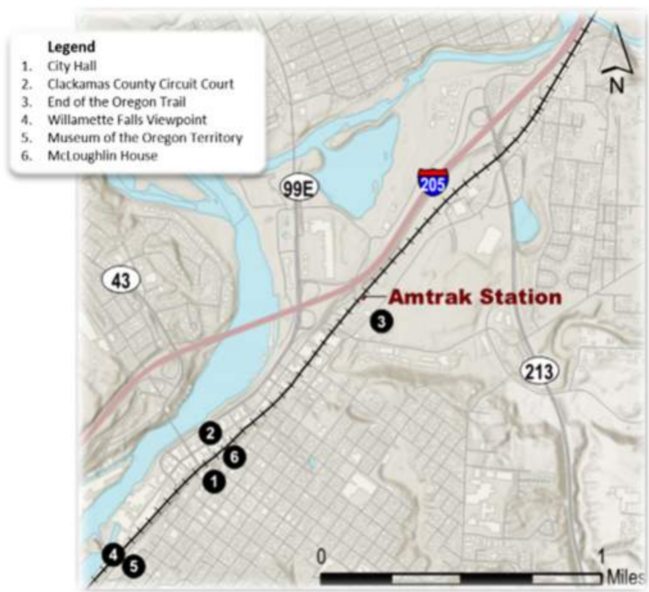
7.2 Oregon City

7.2.1 Station Location Analysis

7.2.1.1 Site Suitability

Oregon City is within the southern area of the Portland Metro Urban Growth Boundary (UGB) and is the county seat of Clackamas County. The existing station, platform and parking lot is owned by the City of Oregon City. The station includes a mostly uncovered platform with an adjacent small lot that has free short-term and overnight parking. The station area is near, but not immediately adjacent to, the existing historic downtown and central business district of Oregon City. The historic train station building is leased to a commercial tenant, not directly related to Amtrak operations. **Figure 7-8** illustrates the existing Oregon City station.

Figure 7-8 Oregon City Station Area and Major Attractions



7.2.1.2 Land Use and Major Attractions

The existing surrounding built environment is mostly single-story industrial and commercial warehouse structures along Washington Street, with some single-family residences interspersed. The surrounding area is designated as a mixed-use residential area (see **Appendix C** for a detailed zoning map of the station area). The station area offers redevelopment potential at both infill and underutilized industrial sites. Oregon City's downtown has a revitalization program to generate economic development, including attracting new businesses, restaurants, and housing development projects while preserving the city's unique historic and cultural landmarks and history.

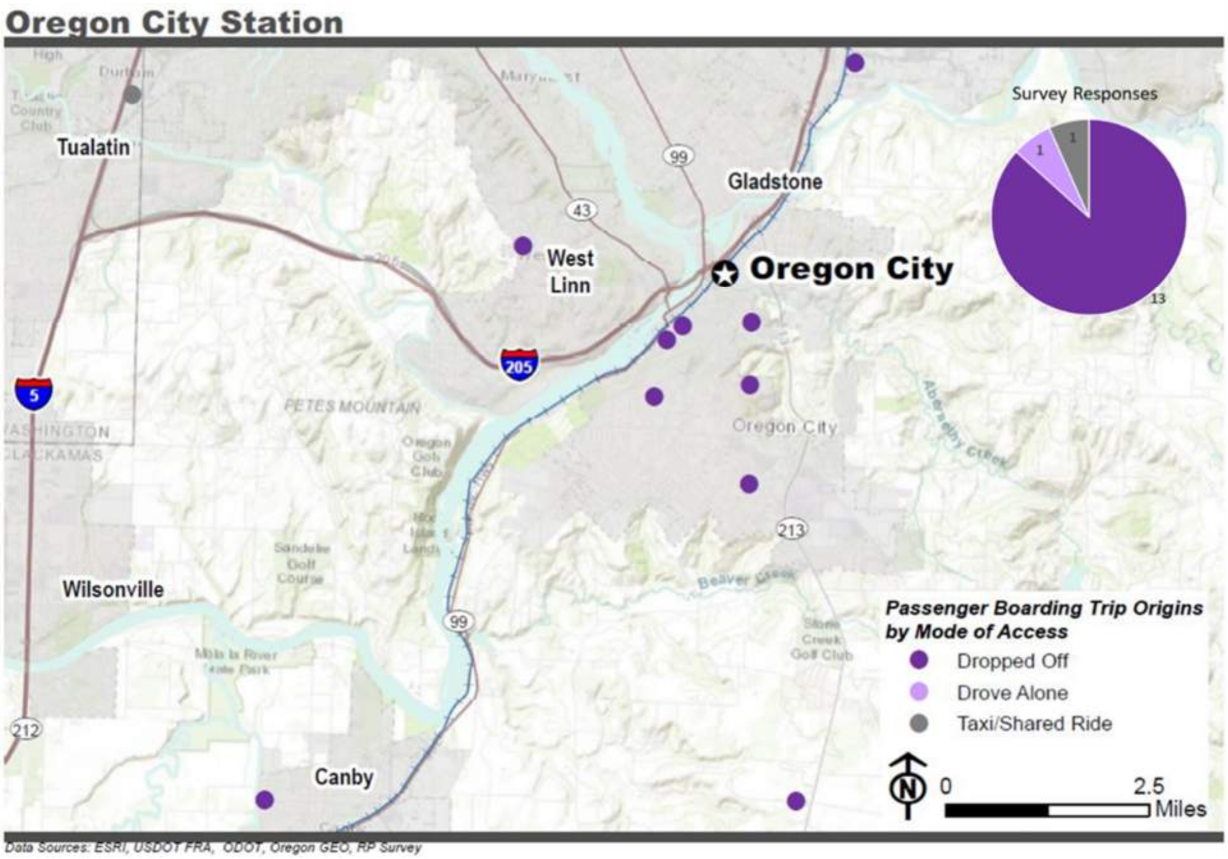
7.2.2 Station Operations

7.2.2.1 Mode of Access – Ridership Profile

Oregon City currently experiences the lowest ridership and the lowest diversity of mode of access of the five stations. **Figure 7-9** maps the mode of access by passenger rail riders as identified in the 2014

Revealed Preference Survey[40]. The predominant mode of access is *Dropped Off*. Zero respondents indicated that they take public transit) or bike to the station. Given the low number of respondents at Oregon City station during this survey, the survey data may not accurately represent the station's mode of access profile.

Figure 7-9 Oregon City Station Passenger Mode of Access



7.2.2.2 Operational Feasibility

Building Features: The Oregon City station (shelter) opened in 2004 and provides a limited number of facilities that support passenger rail service. The Oregon City station consists of a small, freestanding wood-framed shelter, Amtrak signage, a trash receptacle, and a phone booth for transit patrons. The shelter is open-air and has integrated seating. It is architecturally compatible with the adjacent historic station building (which has been repurposed as a privately operated destination restaurant). **Figure 7-10** summarizes key facility features at the Oregon City Station.

Passenger Queuing and Waiting Area: Projected future passenger demand (on average, 18 passengers per train) is used to estimate the number of passengers departing and boarding individual trains at Oregon City station, assuming six Amtrak Cascades roundtrips of the Preferred Alternative. The level of passenger comfort within the station queuing/waiting area is calculated by measuring the average space (square feet) per passenger.[42] Within the Oregon City station (shelter), the projected standing, circulation, and queuing conditions will vary from free circulation to partially crowded during individual train arrival/departure times. (see **Figure 7-10**).

Platform Features: The concrete boarding platform is in excellent condition and includes a bright yellow tactile warning strip, decorative light fixtures, and architectural metal fencing. Features of the Oregon City station platform are summarized in **Figure 7-10.**

7.2.3 Intercity Travel Connectivity

There is no intercity Cascades POINT/Thruway bus service at the Oregon City station.

7.2.4 Station Access and Circulation

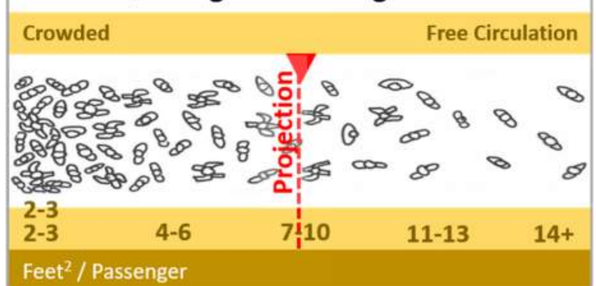
Figure 7-11 on the next page maps the Oregon City station interconnectivity, illustrating separate travel sheds for transit, auto, bicycle, and pedestrian access.

Figure 7-10 Oregon City Station Building and Platform Features

Building Features

Ticketing Area	None
Restrooms	No
Support Services	Restaurant Adjacent, Interpretive Sign
Queuing / Waiting Area	12' x 24'; +/- 10-12 Bench Seats

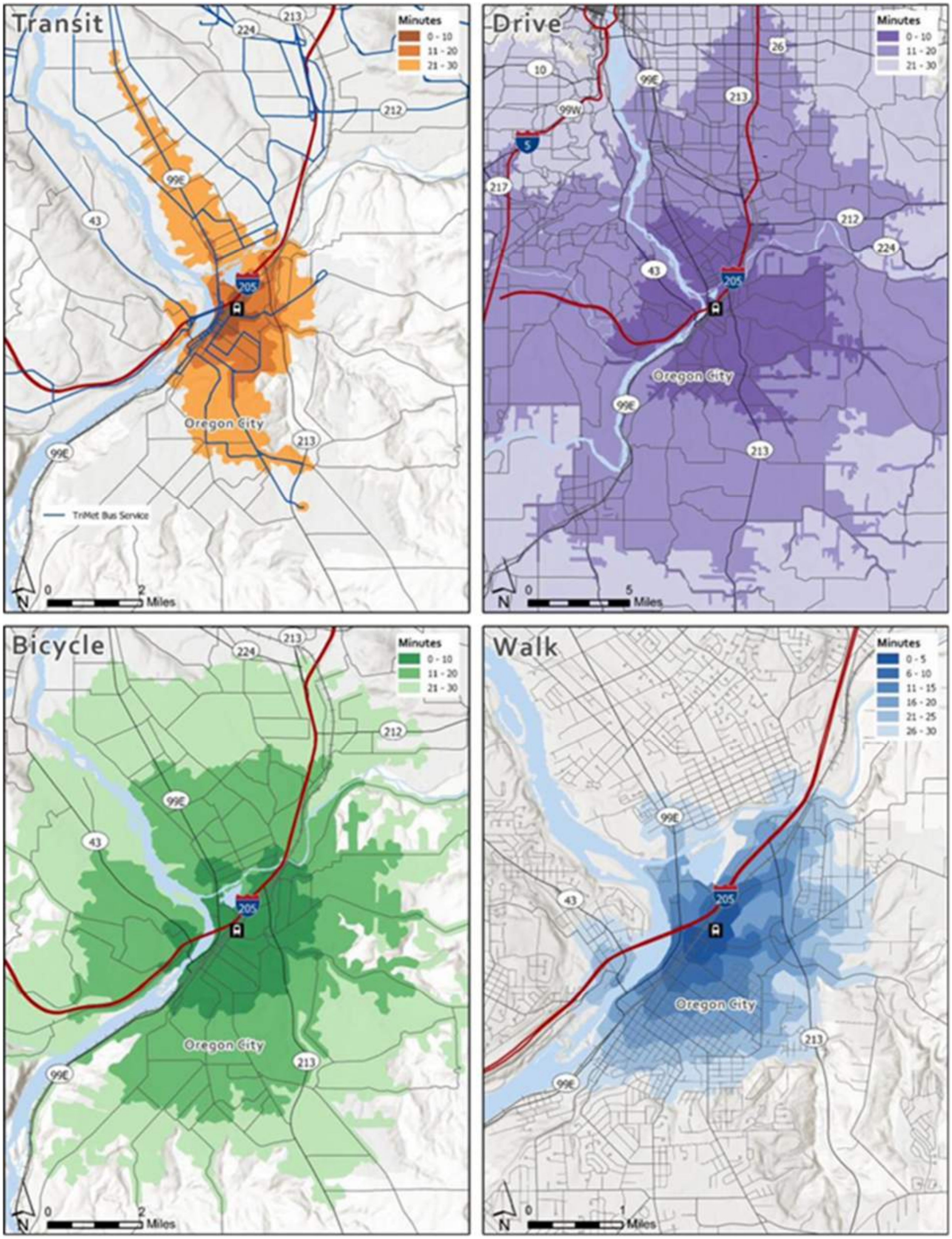
Future Queuing and Waiting Area



Platform Features

Number Platforms	1
Single or Double Loaded	Single
Length	700 ft
Width	12-15 ft
Pedestrian Weather Protection	None
ADA Access	Mechanical Lift Required

Figure 7-11 Oregon City Travel Sheds



7.2.4.1 Walk

Oregon City's existing pedestrian network is very limited and consists mostly of sidewalks on wide, high-volume arterial streets (see **Figure 7-12**). Within a quarter-mile of the station, network gaps exist and many streets do not have sidewalks. In addition to these barriers, natural and human-made features such as I-205, the UPRR tracks, the Willamette River, and the challenging topography in Oregon City can pose impediments to walking. However, the downtown area of Oregon City is composed of a relatively flat street grid that is more conducive to active transportation. Washington Avenue, which provides access from the Oregon City station to downtown Oregon City, has limited sidewalk connectivity, though it does provide a route to the city center.

7.2.4.2 Transit

As shown in **Figure 7-12**, TriMet operates two bus lines at or near the Oregon City station that have connections to the Oregon City Transit Center:

#79 – Oregon City – Clackamas Town Center (30-minute weekday service, 40- to 45-minute service on Saturday and Sunday)

#154 – Oregon City – West Linn – Clackamas Heights (hourly service on weekdays only)

The nearest bus stop is nearly a quarter-mile walking distance from the station. More frequent bus service to a variety of destinations is offered at the Oregon City Transit Center, which is about two-thirds mile from the Oregon City station.

Canby Area Transit (CAT) operates half-hour bus service on weekdays from Canby's city center to the Oregon City Transit Center, and hourly service on Saturdays.

Figure 7-12 shows that 44 percent of zero-vehicle households within Oregon City's UGB are within the 30-minute transit trip to the Oregon City station.

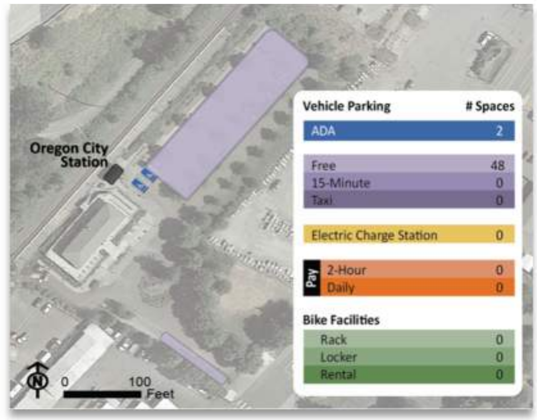
Figure 7-12 Oregon City Station Area Pedestrian Facilities and Transit Connection

7.2.4.3 Auto

Oregon City station is close to OR 99E, OR 43 and I-205, which provide auto access to various areas of Portland and the surrounding cities. The city center, shopping, and the Willamette River are all within a five-minute drive of the station.

Figure 7-13 illustrates the Oregon City station area parking, including 48 vehicle spaces and two handicap spaces, all of which are free. There is a large roundabout when entering the parking lot that provides ample pick-up and drop-off space for cars, taxis, and buses.

Figure 7-13 Oregon City Station Vehicle and Bicycle Parking Facilities

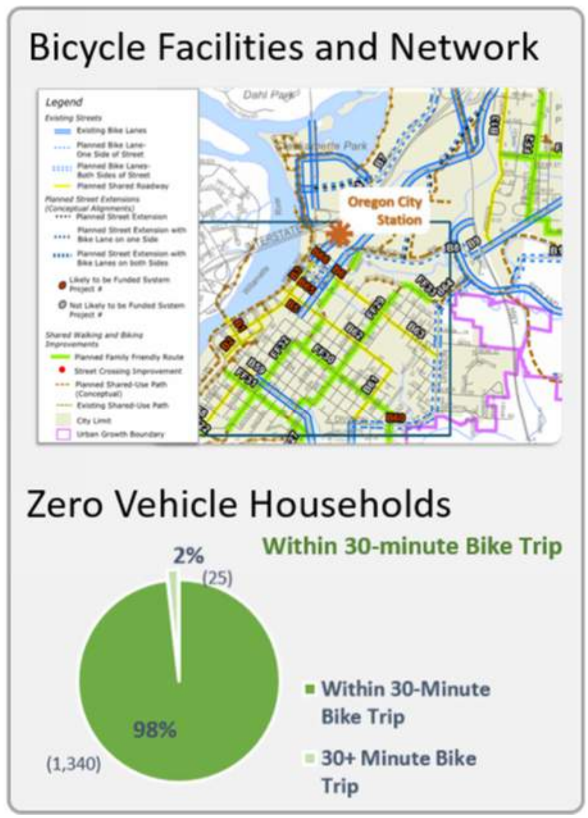


7.2.4.4 Bicycle

Oregon City station is accessible by bicycle, with bicycle lanes on both sides of the adjacent street that connects to the city center. However, several barriers to biking exist in Oregon City, similar to walking, as listed in section 7.2.4.1. The few existing bicycle lanes and poor network connectivity also pose challenges to reaching the station by bicycle. There are no bicycle racks or other bicycle facilities at the existing station. As shown in **Figure 7-14**, Oregon City is planning to expand its biking facilities both downtown and in the areas surrounding the station, which will increase accessibility in the future.

Figure 7-14 shows that 98 percent of zero-vehicle households within the Oregon City UGB are within the 30-minute bicycle travel shed. This is partially due to the fact that the UGB is relatively small, meaning that a cyclist can travel to most places in Oregon City within 30 minutes.

Figure 7-14 Oregon City Station Area Bicycle Facilities and Network



Source: City of Oregon City Transportation System Plan (2013)

7.2.5 Summary Assessment

The majority of Amtrak Cascades riders boarding at Oregon City are dropped off by friends or family, or hire a taxi (or other ride-for-hire services). The Oregon City station is located a short distance north of downtown Oregon City. There are limited, local transit service routes within a short walking distance of the station. A sizeable portion of the area's transit-dependent population (households with zero cars) is within a 30-minute transit trip to the Oregon City station.

Free, private vehicle parking is abundant and often underutilized at the Oregon City station. A private vehicle and taxi drop-off/pick-up zone is adequately sized and located within the Oregon City station to meet the forecasted ridership of the Preferred Alternative.

Local pedestrian and bicycle facilities within the Oregon City station area are present but limited. Nevertheless, a sizeable portion of the area's zero-vehicle households are also within a 30-minute bicycle trip to the Oregon City depot.

The Oregon City station was constructed in 2004. Passenger facilities are limited to a small, covered outdoor waiting structure, but it is sufficiently sized to accommodate the relatively low passenger boardings and alightings estimated under the Preferred Alternative. A single open air platform is sized and located to accommodate the single train departures and arrivals that are anticipated under the Preferred Alternative. Passengers boarding at the Oregon City depot must either pre-purchase their tickets or purchase them directly from the Amtrak train conductor. The Oregon City station does not include restroom facilities, but the station entrance is designated ADA-accessible and a mechanical lift is located on the station platform to assist mobility-impaired passengers.

7.3 Salem

7.3.1 Station Location Analysis

7.3.1.1 Site Suitability

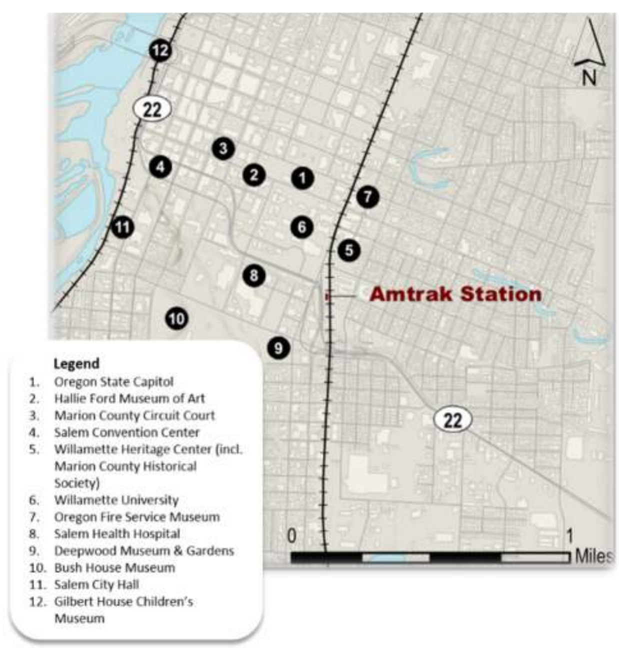
The existing Salem Station operates as the Amtrak passenger depot for the Cascades and Coast Starlight service, and is next door to Greyhound bus operations. **Figure 7-15** illustrates the existing Amtrak station facilities in Salem. The station is a Beaux-Arts-style structure listed on the National Register of Historic Places (NRHP). The Salem station is owned by ODOT, which completed a renovation of the station in 2000, and leases the station to Amtrak.

7.3.1.2 Land Use and Major Attractions

Willamette University and Salem Hospital are adjacent to the station on the west, as shown in **Figure 7-15**. The state of Oregon government offices and the central business district are located one-half mile north-northwest of the station. Single-family and multifamily residences are concentrated in nearby areas east and northeast of the station. Redevelopment of properties surrounding the station primarily would be infill. (See **Appendix C** for a detailed zoning map of the station area.)

The former Railway Express Agency freight depot (also listed on the NRHP) is located just south of the Amtrak station. In 2018, ODOT completed restoration of the express depot building and currently leases it to Greyhound.

Figure 7-15 Salem Station Area and Major Attractions

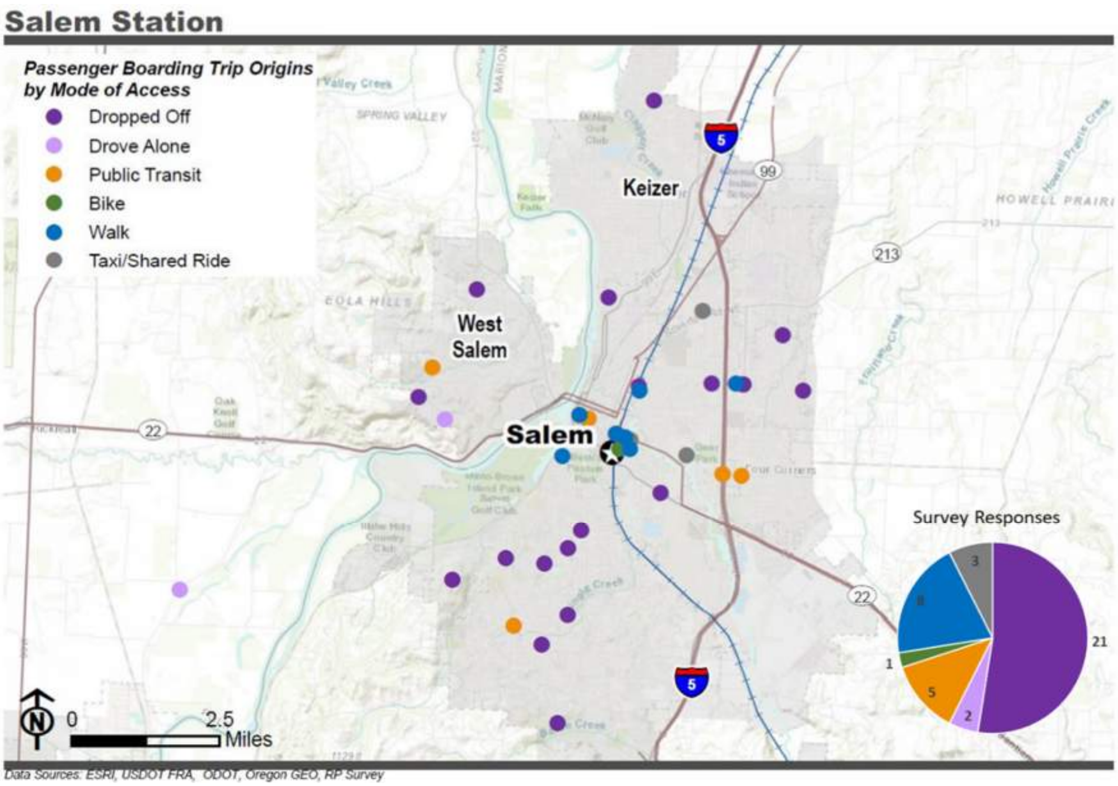


7.3.2 Station Operations

7.3.2.1 Mode of Access and Ridership Profile

Figure 7-16 maps the mode of access by passenger rail riders as identified in the 2014 Revealed Preference Survey.[40] Of the two most prevalent modes of access—*Dropped Off* and *Walk*—passengers walk to the station if they are located nearby and are dropped off if farther away. Few respondents indicated using public transportation or a taxi, and even fewer reported biking or driving alone and parking at the station.

Figure 7-16 Salem Station Passenger Mode of Access



7.3.2.2 Operational Feasibility

The Salem Station is served by the Amtrak Cascades and Coast Starlight routes, as well as Greyhound bus services and Cascades POINT/Thruway buses that operate as Cascades POINT service. The station is within walking distance to downtown Salem. The 20-minute drive time extends north to Keizer and Brooks, and the 30-minute drive time reaches southern Woodburn. The corresponding 30-minute travel sheds for walking, biking, and transit are more clustered around Salem itself.

Building Features: Salem Station provides significant indoor and outdoor facilities supportive of passenger rail service. The station was constructed in 1918, during an era of higher frequency of passenger rail service. It was restored in 2000 and serves as a visual landmark within the surrounding community. **Figure 7-17** summarizes the Salem Station building features.

Passenger Queuing and Waiting Area: Projected future passenger demand (on average, 90 passengers per train) is used to estimate the number of passengers departing and boarding individual trains at the Salem Station, assuming six Amtrak Cascades roundtrips of the Preferred Alternative, as well as one Coast Starlight round trip. The level of passenger comfort within the station queuing/waiting area is calculated by measuring the average space (square feet) per passenger.[42] As shown in **Figure 7-17**, within the Salem Station, the projected standing, circulation, and queuing conditions will vary from free circulation to partially crowded during individual train arrival/departure times.

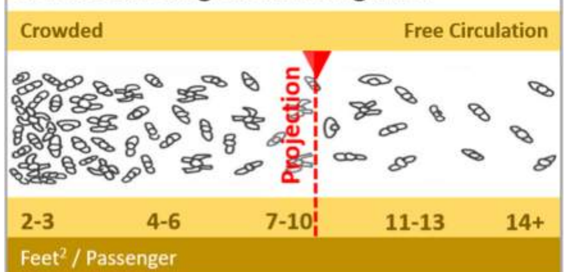
Platform Features: The concrete and asphalt boarding platform is in excellent condition and includes a bright yellow tactile warning strip, decorative light fixtures, and landscaping. **Figure 7-17** summarizes the Salem Station platform features.

Figure 7-17 Salem Station Building and Platform Features

Building Features

Ticketing Area	Counter Service; Automated Ticket Machine
Restrooms	Yes, ADA accessible
Support Services	Vending Machines, Interpretive Signs
Queuing / Waiting Area	30' x 60'; +/- 30 Bench Seats

Future Queuing and Waiting Area



Platform Features

Number Platforms	1
Single or Double Loaded	Single
Length	1,000 ft
Width	15 ft
Pedestrian Weather Protection	None
ADA Access	Mechanical Lift Required

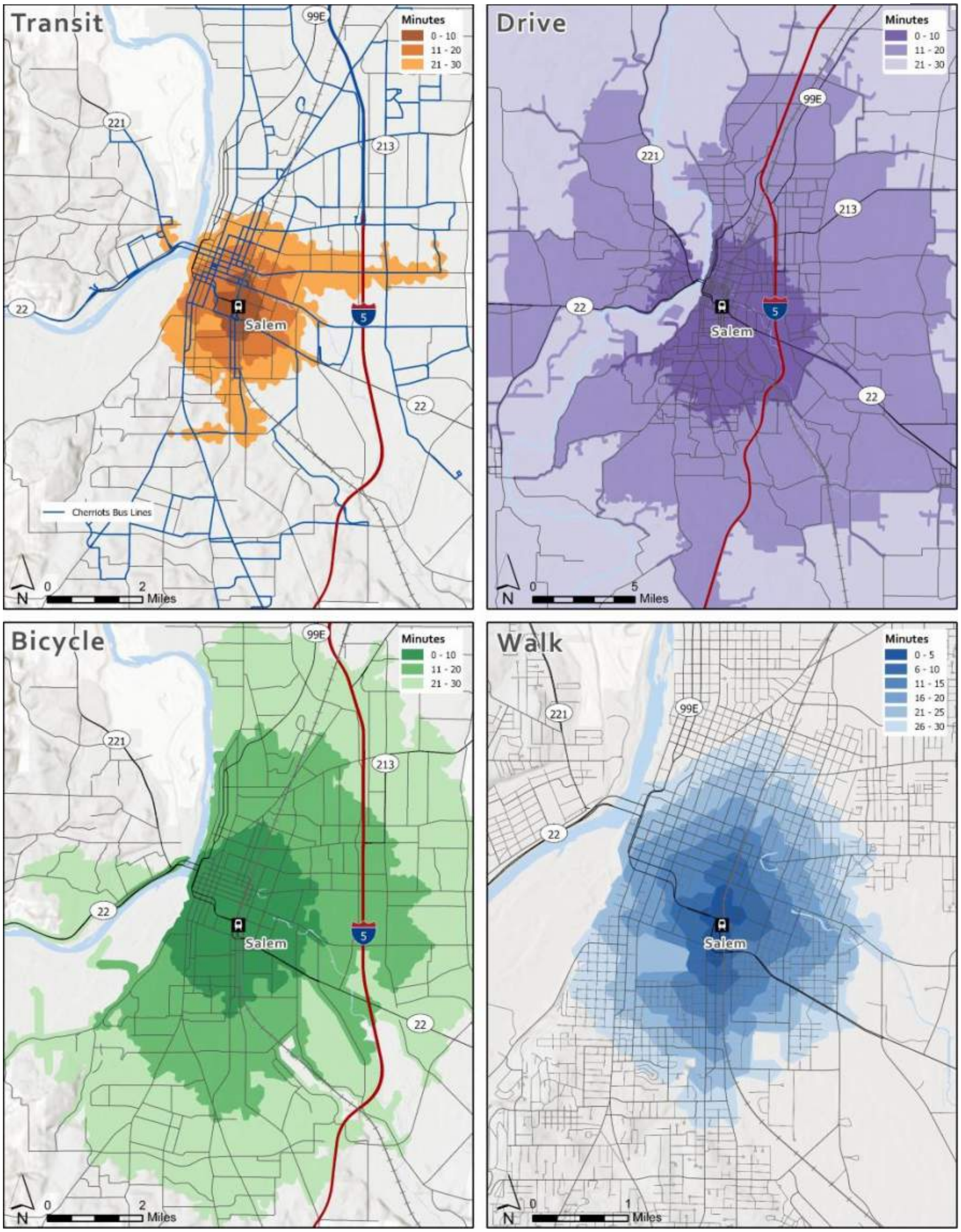
7.3.3 Intercity Travel Connectivity

The WAVE, operated by Tillamook County Transportation District, operates daily bus service between Lincoln City and the Salem Greyhound depot (two trips per day).

7.3.4 Station Access and Circulation

Figure 7-18 below maps the Salem Station interconnectivity, illustrating separate travel sheds for transit, auto, bicycle, and pedestrian access. See **Appendix C** for zero-vehicle households within the 30-minute bicycle and transit travel sheds.

Figure 7-18 Salem Travel Sheds



7.3.4.1 Walk

Sidewalks are abundant in the area surrounding the station, and network connectivity is relatively high, as shown in **Figure 7-19**. Designated crosswalks on 12th Street at the intersections of Highway 22 and Mill Street provide pedestrian access to the Salem Station.

7.3.4.2 Transit

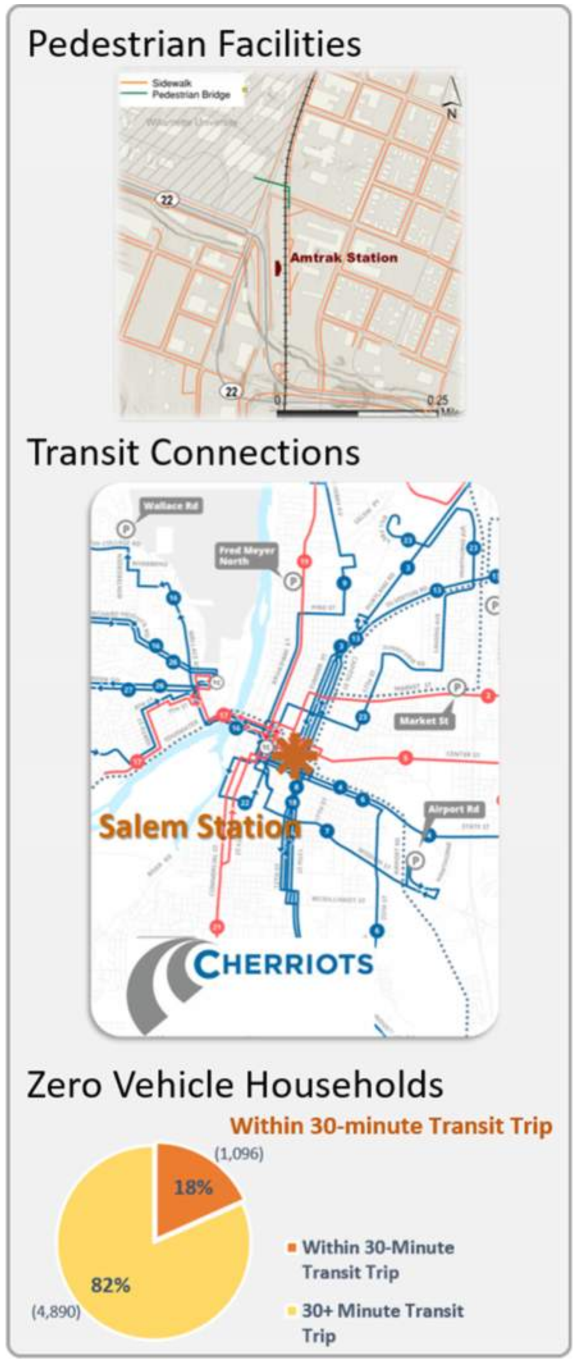
As shown in **Figure 7-19**, Cherriots (Salem Area Mass Transit District) operates two routes (#8 and #18) adjacent to the Salem Station, both with (alternating) hourly service between the downtown Transit Center (indicated by "TC" on the figure, located about 1 mile west of the Salem Station) and south Salem. Routes #8 and #18 have bus stops immediately adjacent to the Salem Station. The Salem transit mall is located approximately one mile northwest of the station. The downtown Transit Center provides a central transfer facility and hub for most Salem-Keizer bus routes, as well as the connection location for the Chemeketa Area Regional Transportation System (CARTS) that serves rural Marion and Polk counties, and the pickup location for intercity service to Wilsonville and Grand Ronde. **Figure 7-19** shows that 18 percent of zero-vehicle households within Salem's UGB fall within the 30-minute transit trip of the Salem Station.

7.3.4.3 Auto

Downtown Salem is approximately one mile northwest of Salem Station and can be accessed via OR 22. These highway facilities provide Salem with motor vehicle connections to the Oregon Coast, Corvallis/Albany, Central Oregon and the Cascade Mountains, and other parts of the Willamette Valley.

As shown in **Figure 7-20**, sufficient parking is present at the existing station. All public parking is free and includes pick-up/drop-off spaces for passenger vehicles and taxis, short- and long-term parking, and motorcycle parking. There is additional parking adjacent to the Greyhound bus station.

Figure 7-19 Salem Station Area Pedestrian Facilities and Transit Connections



7.3.4.4 Bicycle

Ride Salem has installed a bicycle rack at the north end of Salem Station for bike share rentals. Bicycle lockers are located at the north end of the station, and between the Amtrak and Greyhound stations.

On-street bicycle lanes connect the Salem Station to downtown, and there are adequate bicycle facilities connecting the station to the rest of the town via arterial bicycle lanes or shared low-volume roads (see **Figure 7-21**). A shared-use path runs parallel to the existing Union Pacific Railroad rail line along the east side from Mill Street crossing to North Salem High School. For these reasons, network connectivity and accessibility are both adequate. **Figure 7-21** shows that 78 percent of zero-vehicle households within the Salem UGB are within the 30-minute bicycle trip of the Salem Station.

Figure 7-20 Salem Station Vehicle and Bicycle Parking Facilities

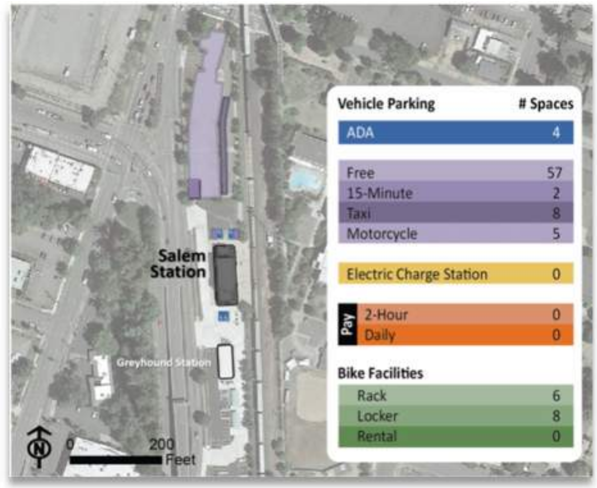
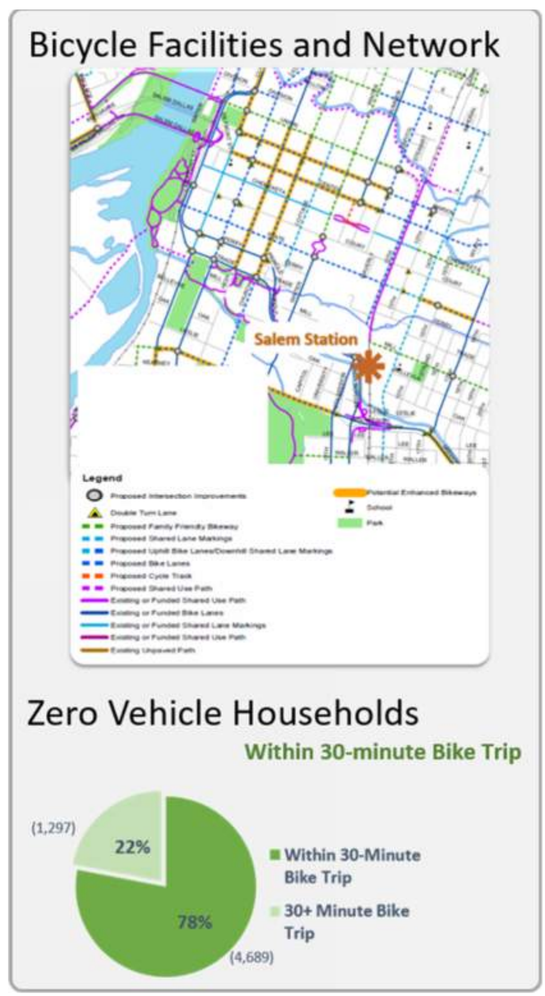


Figure 7-21 Salem Station Area Bicycle Facilities and Network



Source: City of Salem Transportation System Plan (2018)

7.3.5 Summary Assessment

While most Amtrak Cascades riders boarding at the Salem Station are dropped off or hire a taxi (or other ride-for-hire services), a fair number of riders walk to the station or take public transit, or drive alone, because there is abundant free parking available. A private vehicle and taxi drop-off/pick-up zone is adequately sized and located within the Salem Station to meet the forecasted ridership of the Preferred Alternative.

The Salem Station is located about one mile southeast of the Salem transit mall and city center. There are limited, local transit service routes within a short walking distance of the station. A small portion of the region's transit-dependent population (households with zero vehicles) is within a 30-minute transit trip to the Salem Station.

Local pedestrian and bicycle facilities are present within the Salem Station area. A large portion and number of the region's zero-car households are within a 30-minute bicycle trip to the Salem Station.

The Salem Station was renovated in 2000. The passenger queuing and waiting area is sufficiently sized to accommodate the estimated boardings and alightings under the Preferred Alternative.

A single, open-air platform is sized and located to accommodate the single train departures and arrivals that are anticipated under the Preferred Alternative. Passengers boarding at the Salem Station can purchase their tickets directly from the Amtrak counter (staffed) or from the Quik-Trak kiosk located within the station. The Salem Station includes restroom facilities. The restrooms and station building entrance are designated ADA-accessible. A mechanical lift is kept on the staffed station platform to assist mobility-impaired passengers.

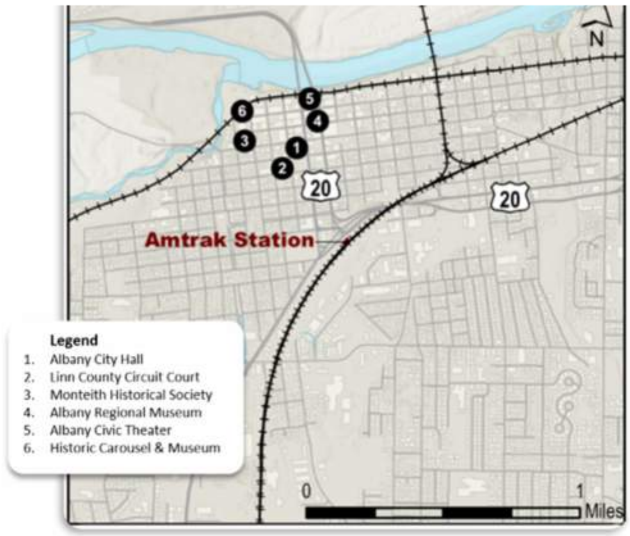
7.4 Albany

7.4.1 Station Location Analysis

7.4.1.1 Site Suitability

The historic Albany train depot (1908, owned by the City of Albany), which has undergone a renovation, is part of a recently completed Albany Multimodal Transportation Center project on a seven-acre site. **Figure 7-22** shows the location of the existing Albany depot and nearby attractions. The project included redevelopment of underutilized properties with deteriorated buildings. The depot is on the southern end of downtown Albany, which is intersected by OR 99E and the railroad tracks.

Figure 7-22 Albany Station Area and Major Attractions



7.4.1.2 Land Use and Major Attractions

Most of downtown Albany, including the area adjacent to the station, is part of a historic district. Zoning for mixed-use development is in place in much of downtown Albany. Undeveloped and underdeveloped properties in downtown provide an opportunity for infill near the station, including redevelopment of potential parking lots (see **Appendix C** for a detailed zoning map of the station area).

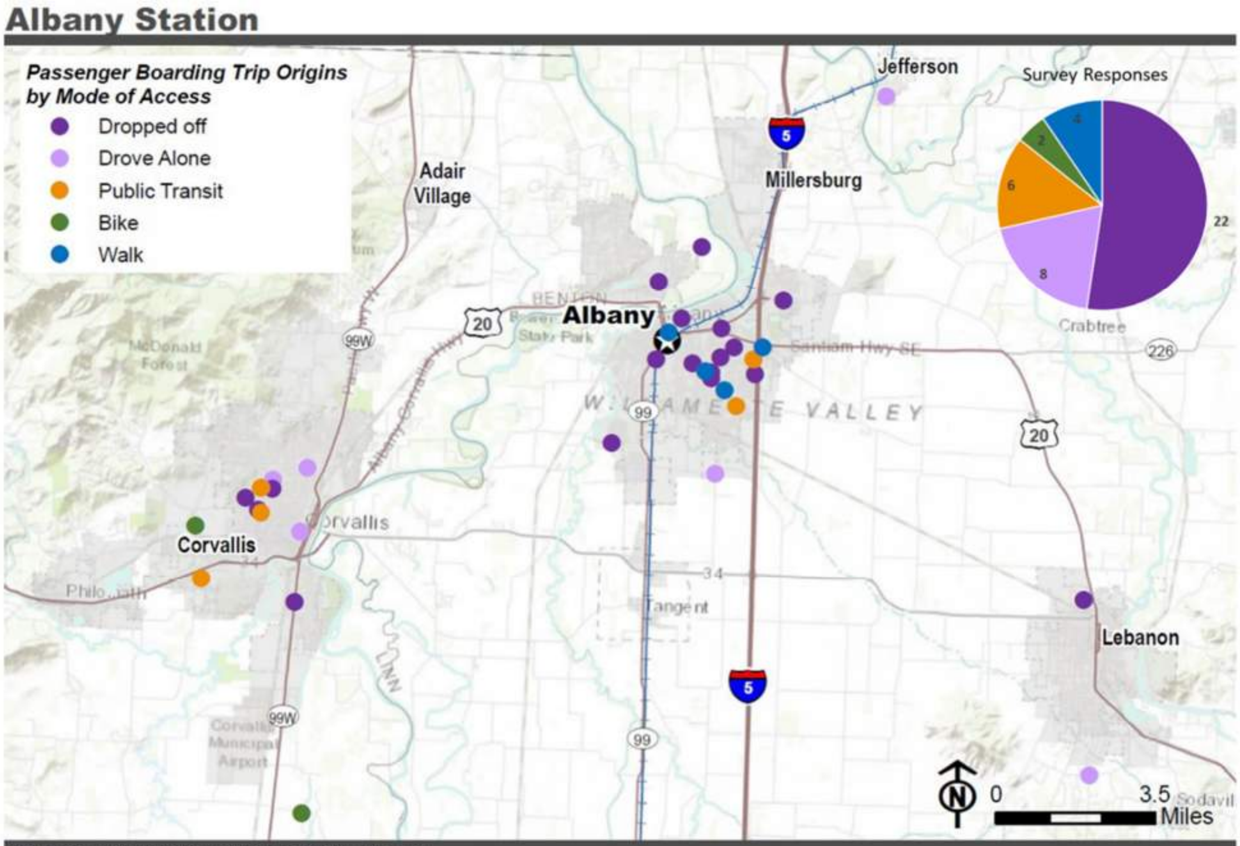
Adjacent to and east of the station, there is a rail yard. East of the rail yard are mostly industrial and public uses, such as the sheriff's office, the Albany-Lebanon Sanitization Station, a school bus depot, and the Linn County jail. Farther west of the station, there are underutilized larger commercial and mixed-use lots along the Willamette River that have redevelopment potential. Smaller residential lots are located to the south and north of the station.

7.4.2 Station Operations

7.4.2.1 Mode of Access and Ridership Profile

Figure 7-23 maps the mode of access by passenger rail riders to the Albany depot, as identified in the 2014 Revealed Preference Survey[40]. The most prevalent mode of access is *Dropped Off.* A significant number of respondents reported driving alone, taking public transit, or walking. Very few reported biking as their mode of access.

Figure 7-23 Albany Station Passenger Mode of Access



Data Sources: ESRI, USDOT FRA, ODOT, Oregon GEO, RP Survey

7.4.2.2 Operational Feasibility

Building Features: A one-story masonry building with adjacent iconic clock tower, the Albany station provides significant indoor and outdoor facilities supportive of passenger rail service. The masonry station was constructed in 1908 during an era of higher frequency and capacity of passenger rail service. It was renovated in 2006 and serves as a visual landmark and a destination for both transit and non-transit patrons. **Figure 7-24** summarizes the Albany depot building features.

Passenger Queuing and Waiting Area: As shown in **Figure 7-24**, projected future passenger demand (on average, 52 passengers per train) is used to estimate the number of passengers departing and boarding individual trains at the Albany station, assuming six Amtrak Cascades roundtrips of the Preferred Alternative, and one Coast Starlight roundtrip. The level of passenger comfort within the station queuing/waiting area is calculated by measuring the average space (square feet) per passenger[42]. Within the Albany station, the projected standing, circulation, and queuing conditions will allow free circulation.

Platform Characteristics: The asphalt boarding platform provides unobstructed pedestrian access. The area includes landscaping, as well as decorative bollards and light fixtures. Albany depot platform features are listed in **Figure 7-24**.

7.4.3 Intercity Travel Connectivity

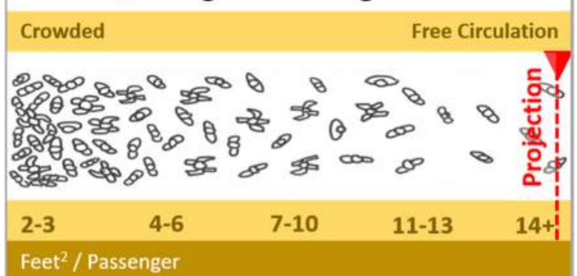
Intercity bus services at the Albany station include: Cascades POINT/Thruway, Coast To Valley Express (Newport to Albany, twice daily) and Corvallis to Amtrak Connector with daily service (five trips per day) between Corvallis and the Albany station, with coordinated schedules to match Amtrak Cascades and Cascades POINT/Thruway bus arrivals and departures.

Figure 7-24 Albany Station Building and Platform Features

Building Features

Ticketing Area	Counter Service; Automated Ticket Machine
Restrooms	Yes, ADA accessible
Support Services	Vending Machines, Interpretive Signs
Queuing / Waiting Area	30' x 60'; +/- 50 Bench Seats

Future Queuing and Waiting Area



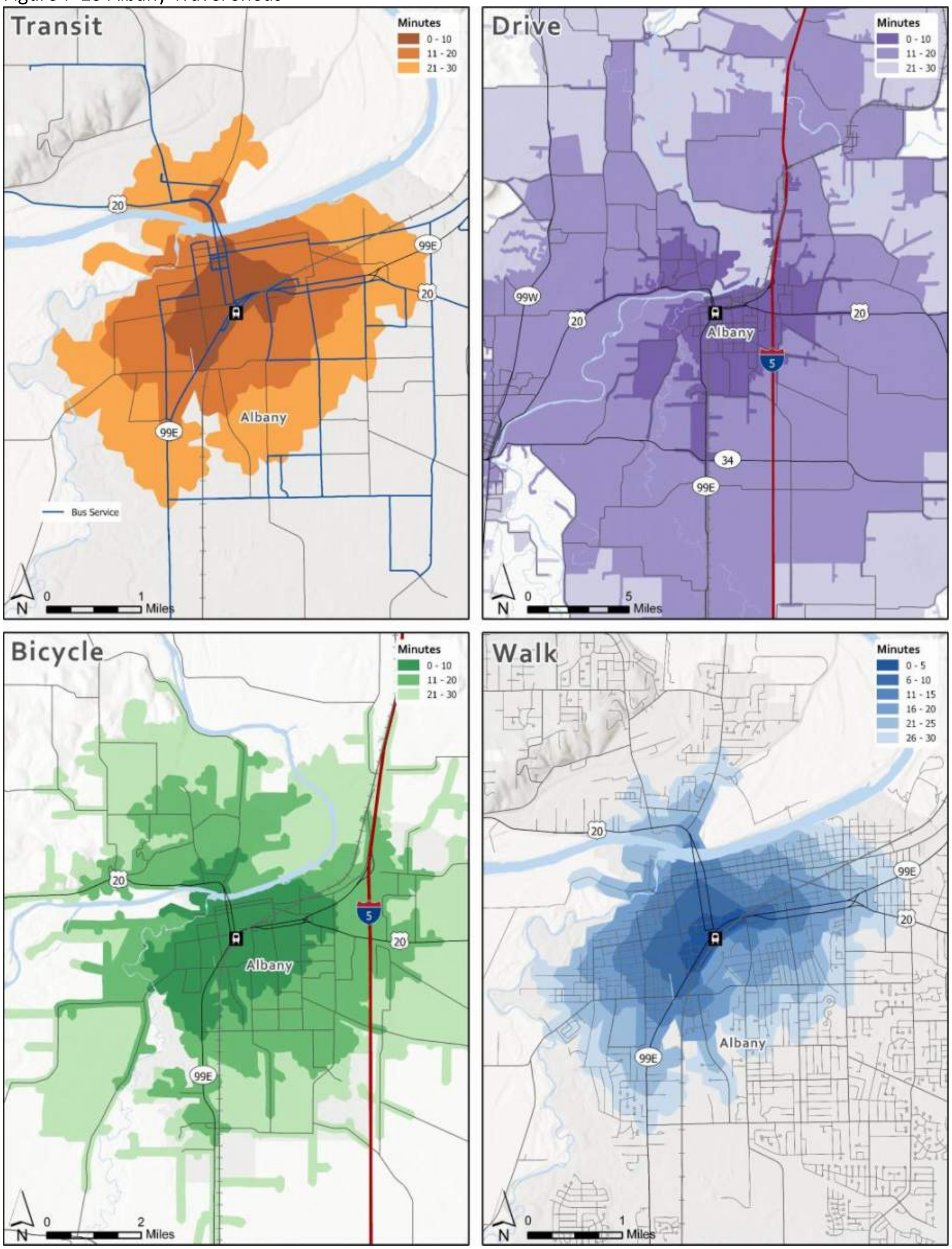
Platform Features

Number Platforms	1
Single or Double Loaded	Single
Length	1,400 ft
Width	12 ft
Pedestrian Weather Protection	Shelters w/ seating
ADA Access	Mechanical Lift Required

7.4.4 Station Access and Circulation

Figure 7-25 on the next page maps the Albany station interconnectivity, illustrating separate travel sheds for transit, auto, bicycle, and pedestrian access. See **Appendix C** for zero-vehicle households within the 30-minute bicycle and transit travel sheds.

Figure 7-25 Albany Travel Sheds



7.4.4.1 Walk

As shown in **Figure 7-26**, there are sufficient sidewalks along most major arterial streets in the central areas of Albany, with a few exceptions. Albany has an existing street grid, but the network suffers from major barriers that could contribute to the current low active transportation mode share. A new multimodal path is being planned that will be located under the Pacific Boulevard overpass to connect the Albany station with downtown, where the Willamette Valley Scenic Bikeway runs along 1st and 2nd Avenues. This planned multimodal path will improve pedestrian access to the station in the future.

7.4.4.2 Transit

The city of Albany operates two, one-way bus routes with connections and coordinated transfers at the Albany station (see **Figure 7-26**). Routes #2 and #3 operate only on weekdays, with hourly service beginning just after 9 a.m. Route #1 operates from about 6 a.m. to 9 a.m. and is generally a combination of Routes #2 and #3. Routes #2 and #3 link downtown Albany, Linn Benton Community College, North Albany, and neighborhoods in between.

Figure 7-26 shows that 18 percent of zero-vehicle households within Albany's UGB are within the 30-minute transit trip of Union Station.

7.4.4.3 Auto

Downtown Albany is less than one mile north of the station and can be accessed via U.S. 20, which runs east to west. State Route 99E also runs through downtown Albany north to south. These highway facilities provide Albany with motor vehicle connections to the Oregon Coast, the Cascade mountains, and other parts of the Willamette Valley. The station has multiple access points with appropriate wayfinding signs.

Figure 7-26 Albany Station Area Pedestrian Facilities and Transit Connections

Sufficient parking, both short- and long-term, is provided at the existing station, all of which is free (see **Figure 7-27)**. There is bicycle parking including both bicycle racks and lockers. There is sufficient space for loading and unloading of buses and taxis via a driveway and roundabout.

7.4.4.4 Bicycle

As shown in **Figure 7-28,** Albany is lacking abundant bicycle facilities; however, bicycle lanes do exist on major roadways, connecting downtown to other areas of town (though with some network connectivity issues). There is limited accessibility to the station by bicycle, and the surrounding roadway cross sections are mostly car-oriented.

Figure 7-28 shows that 96 percent of zero-vehicle households within the Albany UGB are within the 30-minute bicycle trip of the Albany station. This is a significant percentage, meaning that distance alone is most likely not the barrier for most passengers when deciding how to travel to the train station.

7.4.5 Summary Assessment

Despite an abundance of free parking, the majority of Amtrak Cascades riders boarding at Albany are dropped off. Free, private vehicle parking is abundant and somewhat underutilized at Albany's station. The private vehicle and taxi drop-off/pick-up zone is adequately sized and located within the Albany station grounds to meet the forecasted ridership of the Preferred Alternative.

Other passengers drive and park at the Albany depot, and a good portion of riders from Corvallis and Albany take transit to the station. A fair number of riders walk to the Albany Station from nearby neighborhoods. About half of the city's transit-dependent population (households with zero vehicles) is within a 30-minute transit trip to the Albany depot.

Local pedestrian and bicycle facilities within the Albany station area are present. There are abundant bicycle locker facilities located within the station. Nearly all of the local area zero-vehicle households are within a 30-minute bicycle trip to the Albany depot.

Figure 7-27 Albany Station Vehicle and Bicycle Parking Facilities

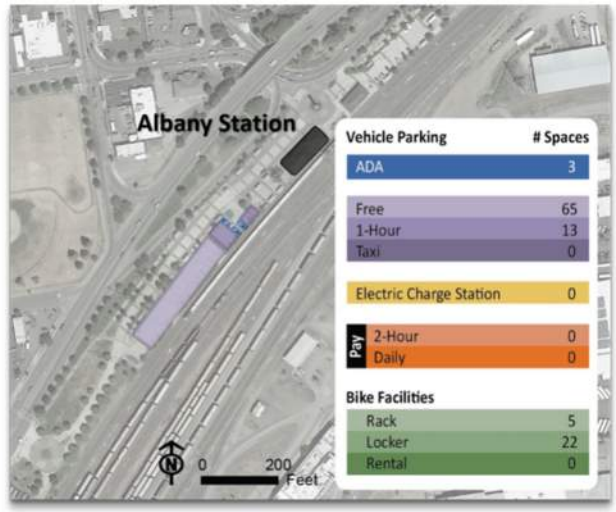
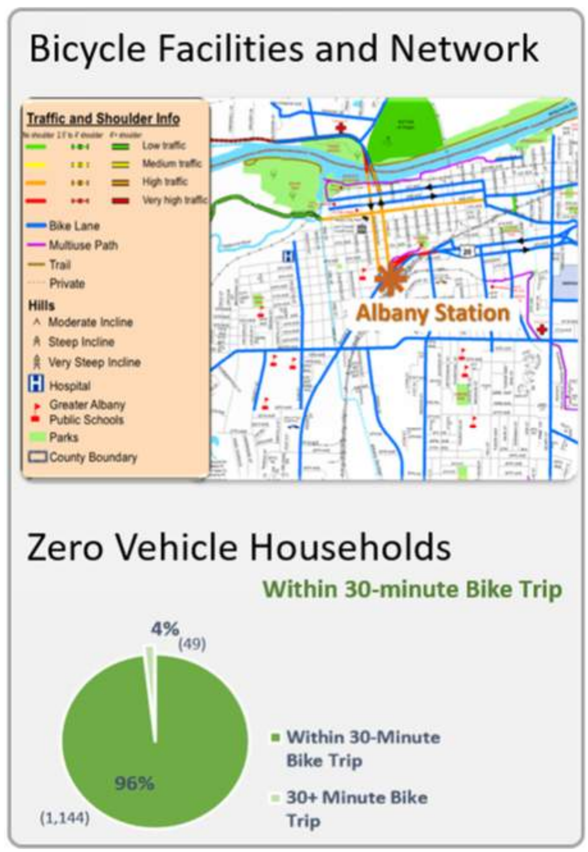


Figure 7-28 Albany Station Area Bicycle Facilities and Network



Source: Albany and Mid-Willamette Valley Bicycle and Pedestrian Map (2018)

The Albany station was renovated in 2006. The passenger queuing and waiting area is sufficiently sized to accommodate the estimated boarding and alightings under the Preferred Alternative.

A single, open-air platform is sized and located to accommodate the single train departures and arrivals that are anticipated under the Preferred Alternative. Passengers boarding at the Albany depot can purchase their tickets directly from the Amtrak counter or from the Quik-Trak kiosk located within the station. The station includes restroom facilities. The restrooms and station building entrance are designated ADA-accessible. A mechanical lift is located on the station platform to assist mobility-impaired passengers.

7.5 Eugene

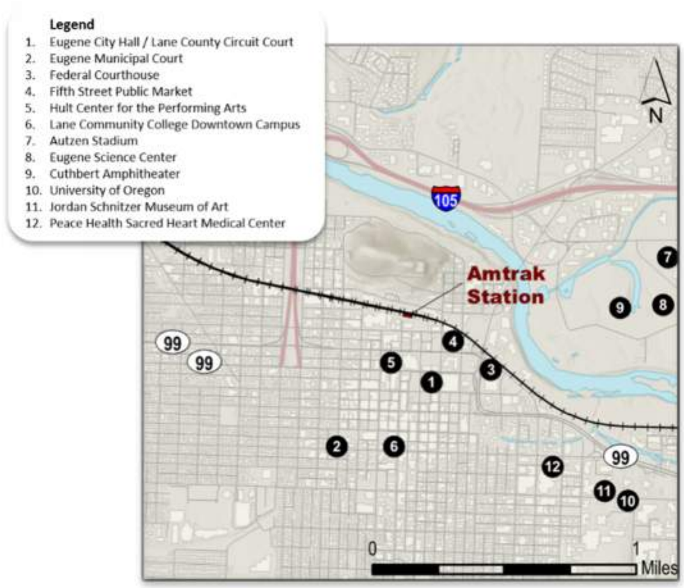
7.5.1 Station Location Analysis

7.5.1.1 Site Suitability

Downtown Eugene is the regional commercial and cultural center in the Lane County metro area. The downtown is surrounded by residential neighborhoods, major activity centers, and the University of Oregon. The downtown has undergone concerted urban revitalization efforts and significant investments in recent years, including the addition of the Lane Community College downtown campus and the 13th Avenue and Olive Street housing project.

The existing train depot is owned by the City of Eugene and has been in operation since 1908 and is on the NRHP; it was refurbished in 2004. The adjacent station track infrastructure was recently the subject of an FRA Preliminary Engineering/NEPA analysis. Planned improvements include track, signal and platform that will increase the number of trains that can be serviced at the station. The design would replace the existing track-level platform and add two more platforms. The three platforms will be built to 15 inches above the top of rail, and include improved lighting to make entering and existing the trains safer and more accessible **Figure 7-29** shows the location of the Eugene train depot and area attractions.

Figure 7-29 Eugene Station Area and Major Attractions



7.5.1.2 Land Use and Major Attractions

Eugene is the third-largest city in the state of Oregon and is the county seat of Lane County. Major regional cultural events such as the Oregon Bach Festival and the Oregon Festival of American Music occur here, and local opera, symphony, and ballet companies perform downtown at the Hult Center and the Shedd Institute for the Arts. As shown in **Figure 7-29**, downtown Eugene is home to municipal, county, state, federal, and other professional offices; most of the region's financial institutions are headquartered downtown, with branches located throughout the city.

Major activity centers are located just outside of the downtown core, including the University of Oregon, Lane Events Center at the Fairgrounds, and Autzen Stadium, where the University of Oregon football team plays.

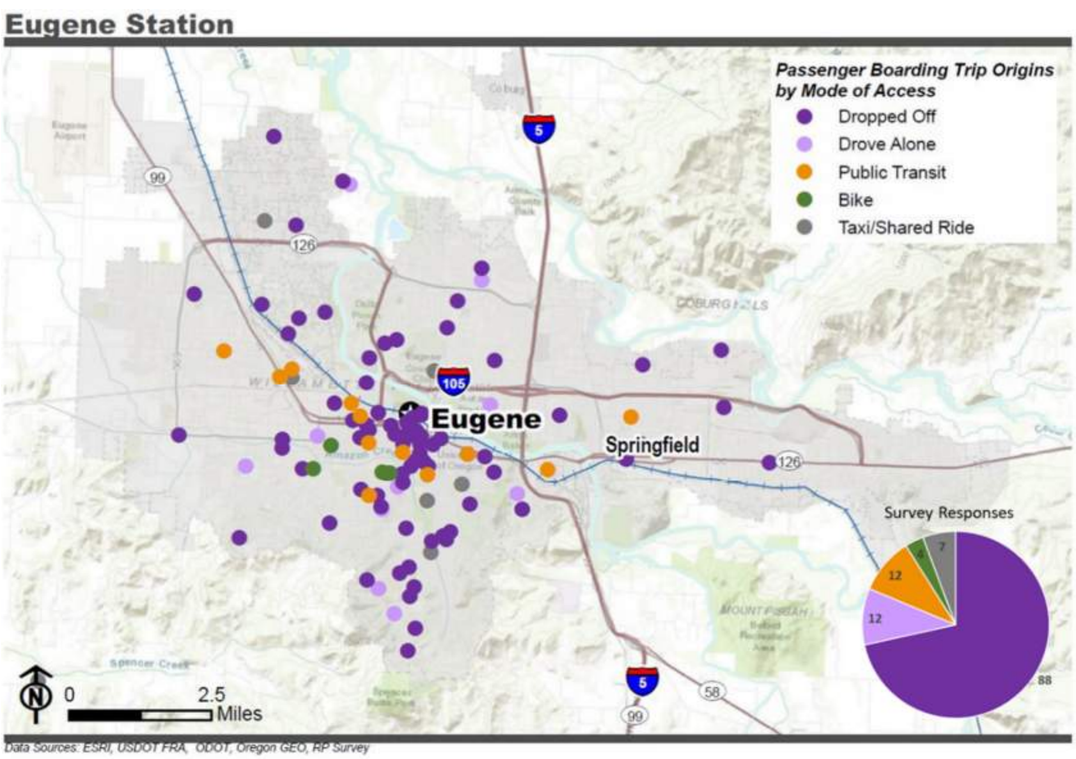
Much of the station area is designated and zoned for industrial uses. This area has been rezoned to allow commercial development compatible with the adjacent downtown area. Except for the station area itself, zoning in the proximity of the station is largely commercial (offices, hotels, and restaurants), public land (government offices and the county jail), and industrial. Most of downtown has a Transit Oriented Development Overlay Zone to promote the creation and retention of mixed land uses, and enhanced transit and pedestrian activity. **Appendix C** includes the detailed zoning map of the Eugene station area.

7.5.2 Station Operations

7.5.2.1 Mode of Access and Ridership Profile

Figure 7-30 maps the mode of access by passenger rail riders to the Eugene depot, as identified in the 2014 Revealed Preference Survey.[40] The two most prevalent modes of access are *Drove Alone* and *Public Transit*. The relatively high public transit mode of access is likely due to the high network connectivity of Eugene's Lane Transit District (LTD) bus network and the EmX bus rapid transit system.

Figure 7-30 Eugene Station Passenger Mode of Access



7.5.2.2 Operational Feasibility

Building Features: A one-story building, Eugene Station is staffed and provides indoor and outdoor facilities supportive of passenger rail service. The Craftsman/Romanesque brick masonry station was constructed in 1908 during an era of higher frequency and capacity of passenger rail service. It was renovated in 2004, and it serves as a visual landmark and a destination for both transit and non-transit patrons **Figure 7-31** summarizes the station's building features.

Passenger Queuing and Waiting Area: As shown in **Figure 7-31**, projected future passenger demand (on average, 158 passengers per train) is used to estimate the number of passengers departing and boarding individual trains at Eugene station, assuming six Amtrak Cascades roundtrips of the Preferred Alternative, and one Coast Starlight roundtrip. The level of passenger comfort within the station queuing/waiting area is calculated by measuring the average space (square feet) per passenger.[42] Within the Eugene depot, the projected standing, circulation, and queuing conditions will vary from free circulation to partially crowded during individual train arrival and departure times.

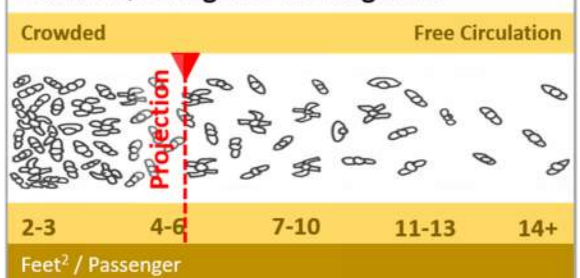
Platform Characteristics: The asphalt open-air boarding platform provides unadorned and unobstructed pedestrian access. Eugene Station platform features are summarized in **Figure 7-31.**

Figure 7-31 Eugene Station Building and Platform Features

Building Features

Ticketing Area	Counter Service; Automated Ticket Machine
Restrooms	Yes, ADA accessible
Support Services	Vending Machines, Retail Located Nearby
Queuing / Waiting Area	30' x 60'; +/- 80 Bench Seats

Future Queuing and Waiting Area



Platform Features

Number Platforms	1
Single or Double Loaded	Single
Length	1,150 ft
Width	15-20 ft
Pedestrian Weather Protection	None
ADA Access	Mechanical Lift Required

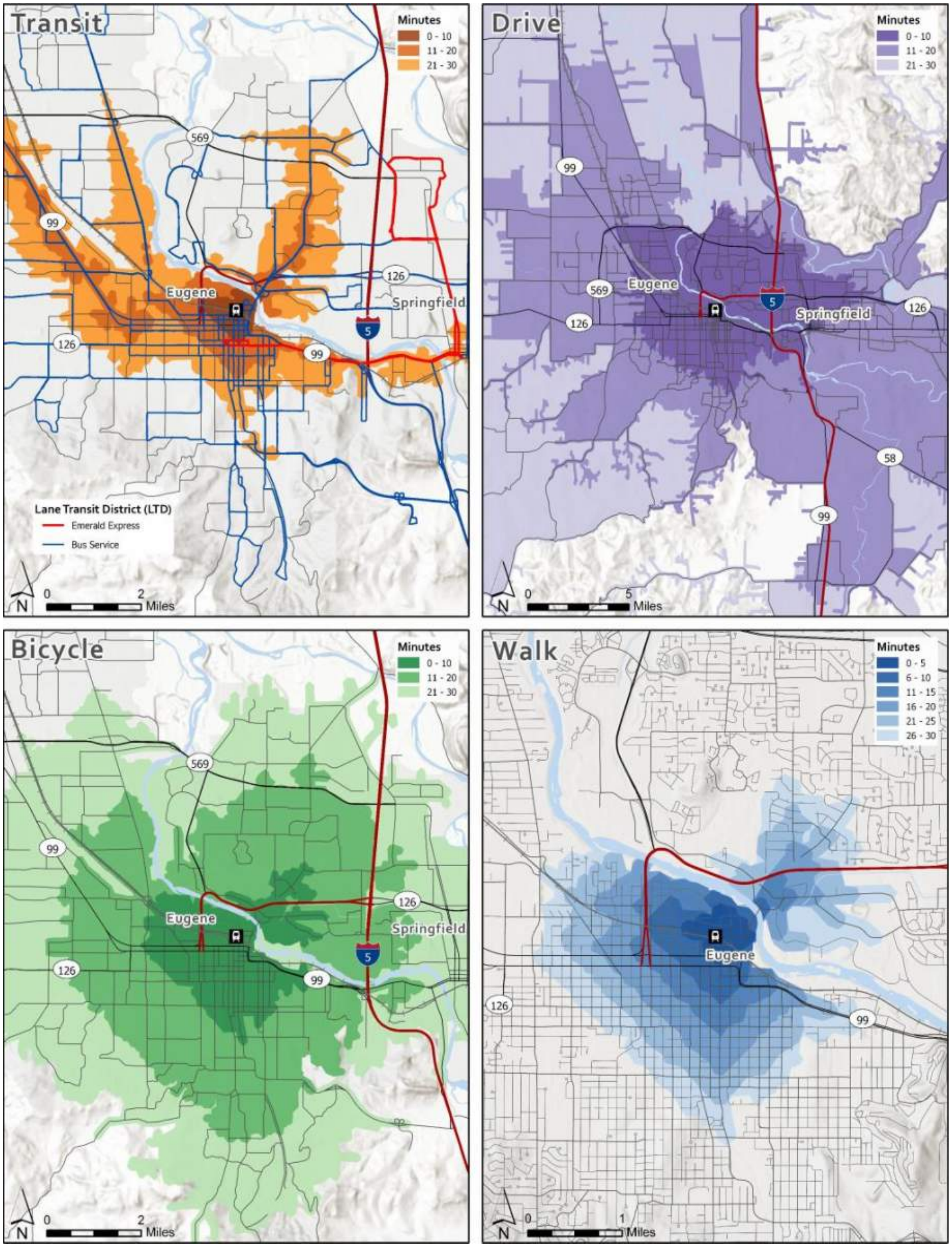
7.5.3 Intercity Travel Connectivity

Intercity bus services at the Eugene station includes the Cascades POINT/Thruway and Pacific Crest bus lines, with one trip per day between Coos Bay and Bend and a stop at the Eugene Station. The Eugene Greyhound bus station is located five blocks south of the Eugene depot.

7.5.4 Station Access and Circulation

Figure 7-32 below maps the Eugene station interconnectivity, illustrating separate travel sheds for transit, auto, bicycle, and pedestrian access. See **Appendix C** for zero-vehicle households within the 30-minute bicycle and transit travel sheds.

Figure 7-32 Eugene Travel Sheds



7.5.4.1 Walk

The Eugene station is at the north edge of the downtown grid. As shown in **Figure 7-33**, the downtown area has abundant sidewalks and signalized crosswalks at most intersections that enhance pedestrian safety. Accessibility and network connectivity are very high. The surrounding streets are low-speed and low-volume, creating a relaxed walking environment. The regional multiuse trail located three blocks east of the station can be easily reached by foot. The regional trail system provides connections over the Willamette River to North Eugene and east to Springfield.

7.5.4.2 Transit

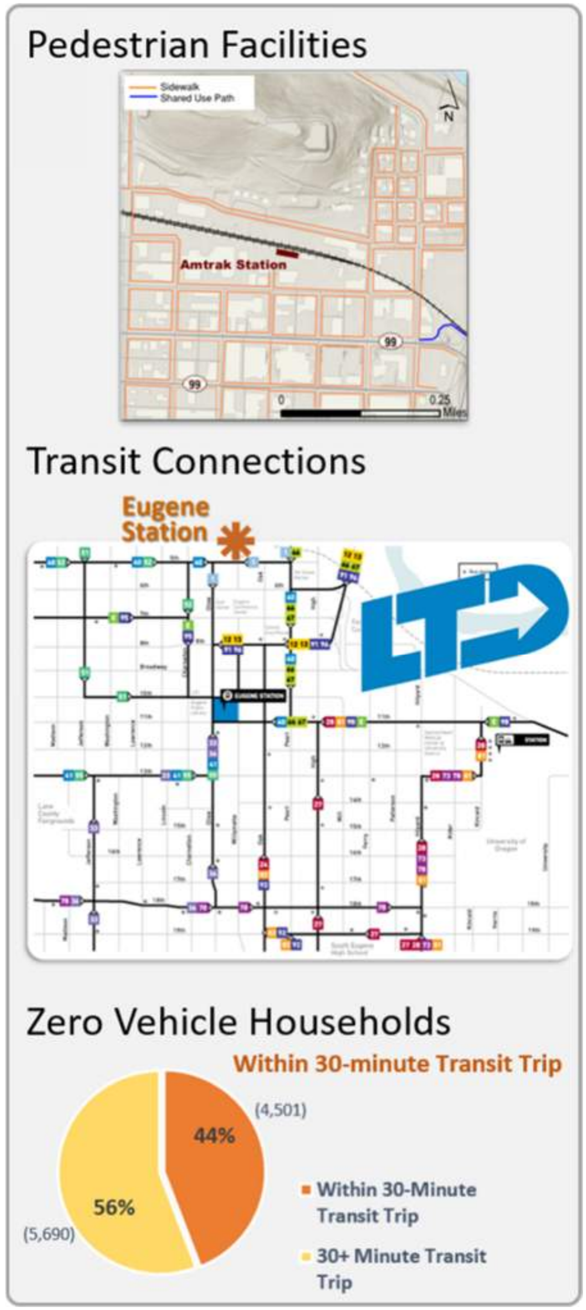
LTD provides public transit in Lane County. Eugene's station is currently served by several bus lines that stop at or within a few blocks of the station: #1 (Campbell Center), #40 (Echo Hollow), #52 (Irving), and #66 (Valley Regional Center). All four routes converge on LTD's City Center Station, the city's transit center, located six blocks south, as shown in **Figure 7-33**. With one exception, each route operates every 30 minutes on weekdays and every 60 minutes on weekend days. Route #1 operates every 15 minutes on weekdays. The downtown transit center is where the EmX (the bus rapid transit) terminates. The EmX provides connections to Springfield and West Eugene with stops along the 12-mile route, including stops at the University of Oregon.

Figure 7-33 shows that 44 percent of zero-vehicle households within Eugene's UGB are within a 30-minute transit trip of the Eugene depot.

7.5.4.3 Auto

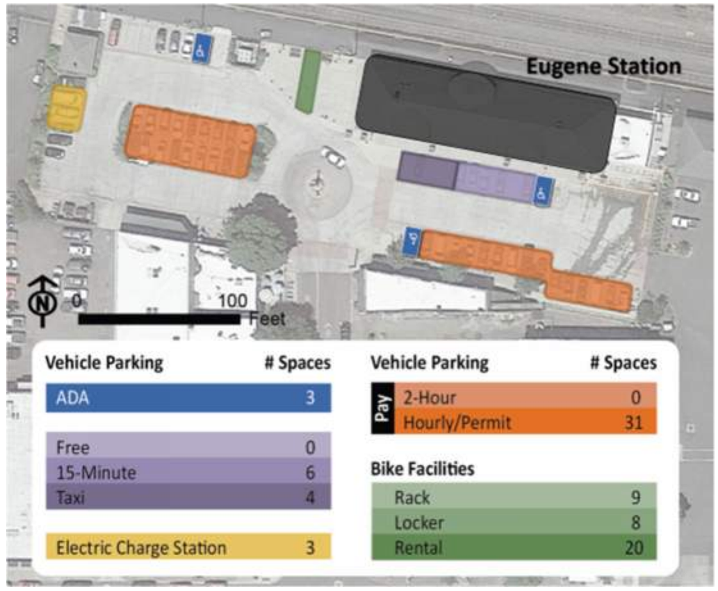
The existing Eugene station is located on the north end of the downtown grid, creating easy auto accessibility via multiple routes. It is well-connected to downtown and all other parts of Eugene, and to Springfield.

Figure 7-33 Eugene Station Area Pedestrian Facilities and Transit Connections



As shown in **Figure 7-34**, limited, paid parking is available at the existing station. Parking permits are also available for extended and frequent use.

Figure 7-34 Eugene Station Vehicle and Bicycle Parking Facilities



7.5.4.4 Bicycle

Abundant bicycle racks and lockers exist, and a bicycle-share station is located on-site. Eugene is one of Oregon's most bicycle-friendly cities, with bicycle facilities constantly being built throughout town. As shown in **Figure 7-35**, the majority of Eugene's topography is flat and thus provides an easy ride for most bicycle users. Adjacent to the station, a buffered bicycle lane exists along E. 5th Avenue and connects the station to the rest of Eugene's bicycle network. Though most of the surrounding streets downtown are shared low-speed roadways, overall bicycle accessibility is high as a result of dedicated bicycle lanes that connect most parts of town. There is also a network of shared low-volume streets that connects downtown Eugene with the University of Oregon and other surrounding activity areas and neighborhoods. The existing station is connected to the regional multiuse trail located three blocks east of the station. The regional trail system provides connections over the Willamette River to North Eugene and east to Springfield.

Figure 7-35 shows that 78 percent of zero-vehicle households within the Eugene UGB are within a 30-minute bicycle trip to the Eugene station.

7.5.5 Summary Assessment

The majority of Amtrak Cascades riders boarding at Eugene are dropped off or drive to the station. A private vehicle and taxi drop-off/pick-up zone is adequately sized and located within the Eugene station to meet the forecasted ridership of the Preferred Alternative.

Some passengers take transit to the station, because there are multiple bus routes serving the station, as well as additional bus and bus rapid transit routes serving the Eugene transit center located six blocks south of the station. Almost half of the region's transit-dependent population (households with zero vehicles) is within a 30-minute transit trip to the Eugene depot.

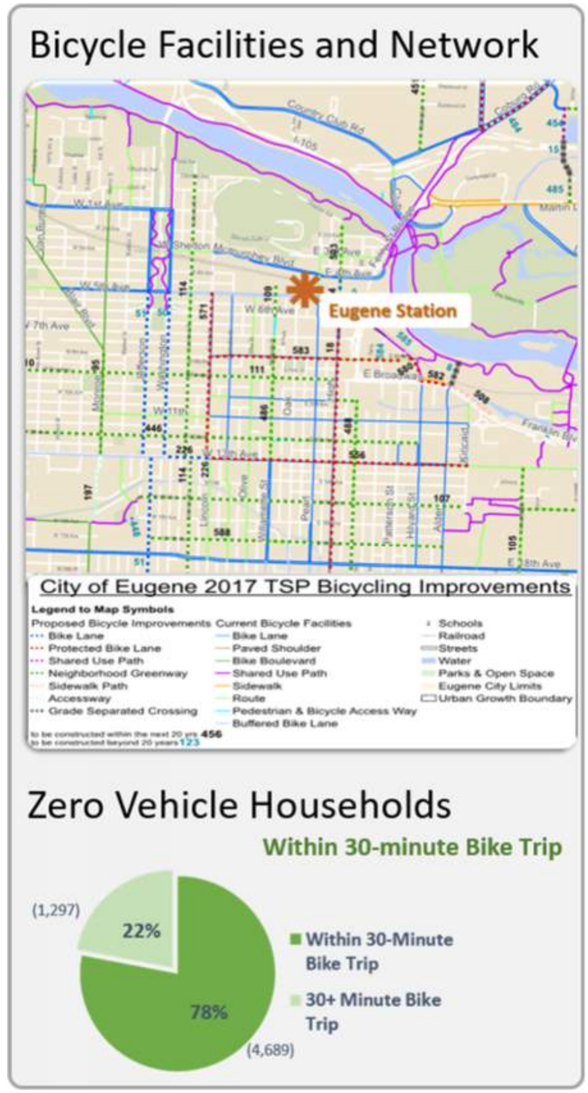
Private off-street vehicle parking (paid) is well utilized, and there are metered, short-term parking spaces available on nearby city streets.

Local pedestrian and bicycle facilities within the Eugene Station area are present. There are bicycle locker facilities located within the station and a bike share adjacent to the station. Nearly 85 percent (approximately 8,500 households) of the region's zero-vehicle households are within a 30-minute bicycle trip to the Eugene depot.

The Eugene station was renovated in 2004. The passenger queuing and waiting area is sufficiently sized to accommodate the estimated boardings and alightings under the Preferred Alternative.

A single, open-air platform is sized and located to accommodate the single train departures and arrivals that are anticipated under the Preferred Alternative. Passengers boarding at the Eugene depot can purchase their tickets directly from the Amtrak counter or from the Quik-Trak kiosk located within the station. The Eugene station includes restroom facilities. The restrooms and station building entrance are designated ADA-accessible. A mechanical lift is located on the station platform to assist mobility-impaired passengers.

Figure 7-35 Eugene Station Area Bicycle Facilities and Network



Source: City of Eugene Pedestrian and Bicycle Master Plan (2012)

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8 Conceptual Engineering and Capital Programming

This section describes the conceptual engineering efforts utilized to identify improvements required to the existing infrastructure to expand passenger rail service through the Oregon Amtrak Cascades corridor. The conceptual engineering was completed in a manner to allow for phased implementation of the service including increases in service frequency.

8.1 Capital Cost Estimating Methodology

Infrastructure needs were developed based on review of previous studies, discussions with host railroads, field review, and the results of operations simulation modeling completed as part of this study. The proposed track infrastructure needs are detailed in the schematics located in **Appendix 8-A**. A capital cost estimate was developed based on a review at 100-foot intervals of proposed track structure: number of tracks, bridges, and grade crossings. The estimates were developed based on the quantities generated from the 100-foot intervals.

8.2 Project Description

8.2.1 Corridor Infrastructure

Infrastructure capacity improvements will be necessary to support the various phases and frequencies of passenger rail service as well as to mitigate passenger-train caused delays or capacity loss to existing and future freight rail traffic on the lines of the host railroads. See **Figure 8-1**.

8.2.1.1 No Action Alternative

According to the RTC modeling analysis, minimum track improvements will be required on UPRR main track between Eugene and Portland in order to accommodate the projected increase in freight traffic (2035) while maintaining current Oregon Amtrak Cascades schedule (2+1). This future scenario, named No Action with Minimums (NAM) adds the following infrastructure:

- Judkins Siding Extension: Second main track between Judkins (MP 644.7) and Swain (MP 660.6).
- Renard Siding Extension: Second main track connecting the north end of Renard Siding (MP 715.6) to the south lead track into Salem Yard (MP 716.68).
- Labish Siding Extension: Second main track from MP 720.3 at the south end of Labish Siding to Brooks at MP 727.5, with a universal crossover at MP 722.6.
- Clackamas Siding Extension: Second main track between Willsburg Jct. (MP 765.2) and MP 758.7 (south of the south end of Clackamas Siding). Includes a universal crossover at MP 761.2.

8.2.1.2 3+1 Modeling Analysis

During the development of the Portland-to-Eugene simulation modeling analysis, a 3+1 scenario that entailed adding one round trip between Eugene and Portland, for a total of three daily round trips, was studied. The 3+1 scenario is not a defined phase in the Tier 1 DEIS, but it was part of the overall analysis and is detailed in the Tier 1 DEIS documentation.

Figure 8-1 **Amtrak Cascades Rail Infrastructure Improvements**

Project	Cost Estimate Low	Cost Estimate High	No Action Minimum (NAM)	Preferred Alternative Phasing: 1 4+1 on NAM	Preferred Alternative Phasing: 2 6+1 on 4+1
Clackamas/Brooklyn Yard New Passing Track	$170M	$199M			✓
Clackamas/Brooklyn Yard Extension	$59M	$118M	✓	✓	✓
Coalca Siding Extension	$118M	$143M		✓	✓
Gervais Siding Extension	$49M	$59M			✓
Labish Siding Extension	$124M	$147M	✓	✓	✓
Renard Siding Extension	$41M	$48M	✓	✓	✓
Marion Siding Extension	$75M	$89M			✓
Millersburg	$26M	$31M			
Hallawell to Albany Extension	$57M	$69M			✓
Hallawell Extension	$26M	$35M			✓
Halsey New Passing Track	$47M	$56M		✓	✓
Alford Siding Extension	$65M	$78M			✓
Judkins Siding Extension	$248M	$297M	✓	✓	✓

Phasing	Cost Estimate Low	Cost Estimate High
No Action Minimum	$472M	$609M
1 4+1 on NAM	$165M	$200M
2 6+1 on 4+1	$467M	$558M
Total	$1,104M	$1,367M

8.2.1.3 Preferred Alternative–Phase 1 (4+1)

According to the RTC modeling, the following additional track improvements will be required on UPRR main track between Eugene and Portland to accommodate the increased freight traffic (2035) and an increase in the Oregon Amtrak Cascades operations under the Preferred Alternative Phase 1 (4+1) operation scenario:

- Second main track between MP 670.0 and MP 674.0 (Halsey).
- Second main track between MP 746.48 and MP 751.89 (Coalca). Includes a universal crossover at MP 748.39.

Construction costs for the Preferred Alternative in Phase 1 also include a total of $31.5 million for improvements to the Willbridge Crossover Tracks ($8.1 million) and Eugene Stub Tracks ($23.4 million), both projects subject to preliminary engineering and NEPA assessment in 2015.

8.2.1.4 Preferred Alternative–Phase 2 (6+1)

According to the RTC modeling the following additional track improvements will be required on UPRR main track between Eugene and Portland to accommodate the increased freight traffic (2035) and an increase in the Oregon Amtrak Cascades operations under the Preferred Alternative Phase 2 (6+1) operation scenario:

- Second main track from MP 666.04 to MP 670.0 utilizing Alford Siding as the south end and connecting to the second main track from Phase 1 at MP 670.0.
- Second main track from 683.5 to 690.1 utilizing Hallawell Siding. Single crossover at MP 684.89 and universal crossover at MP 687.29 and universal crossover at MP 690+/-.
- Second main track from MP 693.0 to MP 697.5 utilizing Millersburg Siding.
- Second main track from MP 701.0 to MP 707.0 utilizing Marion Siding. Universal crossover at MP 704.2.
- Second main track from MP 732.24 to MP 738.0 utilizing Gervais Siding.
- Third track from East Milwaukie at MP 764.94 to the Steel Bridge at MP 770.17.

8.2.1.5 Delay Improvements

The proposed infrastructure improvements described above for each phase are analyzed in further detail for their operational characteristics and freight railroad mitigation in Operations Reports in the appendices of the Tier 1 DEIS document. One additional RTC model was performed to facilitate the phased implementation of the Preferred Alternative, and the supplemental operation report is located in **Appendix A**. A summary of delay statistics for each phase can be found in section 6.2.4.

8.2.1.6 Communications and Signaling

Upgrades or new installation of wayside signaling equipment, traffic control, and dispatching systems, communications platforms and grade crossing protection is necessary to support the trains of the Preferred Alternative. At present (before implementation of any phases of the Preferred Alternative), the UPRR mainline is equipped with CTC and PTC on this portion of the route. Signaling estimates are on a per-mile basis.

8.2.1.7 Stations

Currently there are five stations in Oregon served by Amtrak Cascades: Portland, Oregon City, Salem, Albany and Eugene. The Preferred Alternative would use the five existing stations served by the current Amtrak Cascades passenger rail service in Oregon. No station improvements or costs are identified in support of the Preferred Alternative.

8.2.1.8 Maintenance Facility and Layover Track

Two new facilities will be needed in Eugene to accommodate additional passenger train frequencies. First, a layover track will be necessary at Eugene to facilitate maintenance, cleaning and resupply of consumables for cars and locomotives; secure and stage passenger trains when not in operation; and store supplies and spare equipment.

In support of the Tier 1 DEIS, ODOT is preparing plans and designs for new layover track and maintenance facilities servicing the Eugene station and rail yard.[44]

The proposed Eugene station layover track includes an added stub track that would diverge off the existing rail siding just west of the Eugene depot and have capacity to serve up to two arriving Amtrak Cascades trains (southbound), where alighting passengers will be free from conflict with other train operations. Amtrak Cascades trains will remain parked on the layover track at the station, where they will receive passengers boarding the next northbound departure. Stand-by power (480 volts) will be available at the layover track for basic servicing activities. This track will enable two passenger trains to vacate track also used for freight, improving overall line capacity.

Secondly, a new Eugene maintenance facility, possibly situated within the footprint of Eugene Yard, will provide day-to-day maintenance service functionality (periodic cleaning and inspections, under-train service, drive-through washing and restocking) in support of major maintenance functions that will continue at the Seattle maintenance facility.

8.2.1.9 Operating Equipment

Amtrak Cascades service currently runs from Eugene to Seattle and Vancouver, BC. ODOT, WSDOT and Amtrak share in a negotiated split of the costs of this service. At the end of 2020, the Amtrak Cascades equipment fleet consisted of two Talgo trainsets owned by Oregon and two trains comprised of Amtrak-owned Horizon equipment. This shrunken fleet was sufficient to protect pandemic-reduced service and permit restoration of some suspended schedules as travel demand rebuilds. However, because four Talgo trainsets owned by WSDOT and Amtrak were retired in 2020, more equipment will be needed to reinstate the pre-pandemic service timetable. For this analysis, Amtrak provided division-level calculations to provide increased service on the Oregon Amtrak Cascades from Eugene to Portland. It should be noted that these are regional calculations only based on pre-pandemic equipment levels and are subject to change:

- Oregon's current (2+1) service requires five train sets to operate between Vancouver, BC and Eugene, with one spare (sixth) train set used for servicing, and rotation
- Phase 1 (4+1) service requires seven trainsets to operate between Vancouver, BC and Eugene. Amtrak suggests an eighth trainset for servicing and rotation purposes.
- Phase 2 (6+1) service requires eight train sets to operate between Vancouver, BC and Eugene. Amtrak suggests a ninth trainset for servicing and rotation purposes.

ODOT estimates that two additional passenger trainsets will be needed to accommodate increased service between Eugene and Portland, and the two new train sets will also operate between Vancouver, BC and Portland. Both ODOT and WSDOT are coordinating plans to procure new passenger rail consists. The procurement of passenger rail will follow the Amtrak Cascades FMP[45] long-term strategy for investing in new equipment. The strategy is in compliance with current FRA safety standards, Amtrak-approved specifications, and the Passenger Rail Investment and Improvement Act Section 305 NGEC guidelines or equivalent FRA-compliant specifications. The specific need for and ownership of a spare trainset will be determined at a later date, as part of the fleet management planning efforts.

The proposed train consists of the Amtrak Cascades service will be based on the assumption that new equipment will meet or exceed the dimensions and capacities of the existing Oregon Amtrak

Cascades train consists. **Table 6-5** illustrates the typical Amtrak Cascades train consists. Each trainset will be initially made-up at the Seattle maintenance facility.

8.3 Service Capital Cost Estimates

The service cost-estimate is high-level and conceptual, as appropriate to a Tier 1 NEPA analysis. Detailed cost-estimates would be prepared as part of the OPR Project's preliminary engineering. The general cost-estimate methodology is to be conservative and thereby not create unrealistic expectations about the cost to implement the service.

The capital cost estimate has been itemized into several categories of similar improvements to allow for identification of major cost categories and application of appropriate contingencies to each category.

8.3.1 Track Structures and Track

Portions of the Preferred Alternative involve upgrading existing track, constructing a second main, bridges, and making crossing upgrades on the UPRR main line between Eugene and Portland. This category was further split into structural items and track items, with multiple subcategories for each section. Using five major categories and 18 subcategories, the design team counted track, siding, and other improvements proposed within each phase (see **Table 8-1**). Using these quantities and unit costs (described below), cost estimates were calculated. Non-construction costs, including professional services, utility relocation and environmental mitigation, were incorporated as percentages of the total cost, and are summarized in **Table 8-2**. A contingency of 30 percent was applied to develop a total cost estimate. Unit costs were based on previous engineering cost estimates for similar projects, historical data, labor indices, equipment and construction materials. A full description of unit cost assumptions is included in the Conceptual Engineering Refinements Report (see **Appendix B).**

8.3.2 Site Work, Right-of-Way and Land

The existing right-of-way was determined based on UPRR track charts and state of Oregon Geographic Information System (GIS) mapping of property ownership along the Amtrak Cascades corridor. Based on those sources, approximate ROW needs were identified for track work in locations where rail infrastructure requirements are identified under the Preferred Alternative. In most places, the new track for the Preferred Alternative would be offset 20 feet east of the existing UPRR main line; in these areas a 30-foot acquisition was assumed due to the flat topography of the Willamette Valley. However, there is a potential for more ROW needs to accommodate slopes, drainage, and retaining walls. Project-specific impacts would be addressed in the future environmental documents. Six generalized zoning categories were used and areas calculated:

- Agricultural – Areas of agricultural/forest zoning classifications more than 20 acres
- Rural Residential – Areas of agricultural/forest zoning classifications less than 20 acres
- Residential
- Commercial – Portland
- Commercial – outside Portland
- Industrial

Sales in the area of the corridor were analyzed by zone, and unit prices were developed.

8.3.3 Communications and Signaling

To accommodate the increased service of the Preferred Alternative, communications and signaling need to be expanded/upgraded. Discussions with ODOT, along with previous experience, set the unit cost of the upgrade as a per mile cost for all new/upgraded track.

8.3.4 At-grade Crossings

Public highway/rail at-grade crossing upgrades, whether active or passive, were split into two categories where new track crossed existing roads: grade crossings for up to four lanes of traffic and grade crossings for more than four lanes of traffic. The unit cost per crossing includes a minimal amount of earthwork and preparation along with the installation of a concrete crossing surface, gated crossing signals and some street modifications.

Table 8-1 Construction Cost Categories and Descriptions

1.	**Track Structure and Track**	
	a. At-grade	At-grade track assumes minimal earthwork, sub-ballast, ballast, ties, rails and fasteners.
	b. At-grade Track with Earthwork	This is for an area that will require some cut or fill, maybe some small ballast walls. Typical application would be adjacent to a highway embankment where a bench may be needed. Includes sub-ballast, ballast, ties, rails and fasteners.
	c. Retained Fill	This is used for approach structures and other areas requiring retaining walls. Assumes two walls at an average wall height of 15'. Includes sub-ballast, ballast, ties, rails and fasteners.
	d. Elevated/Viaduct	This can be a pier or straddle bent structure. Includes direct fixation fasteners and rails.
	e. Open Trench/Retained Cut	This is used for approach structures and other areas requiring retaining walls. Assumes two walls at an average wall height of 20'. Includes sub-ballast, ballast, ties, rails and fasteners.
	f. Bridges - Road over Rail	New roadway structure over tracks. 23'-6" standard vertical clearance over tracks. Maximum length of 200' per bridge (use multiple as needed). Includes abutments.
	g. Bridges - Rail Bridge	New rail bridge over roadway, river, etc. 16'-6" standard vertical clearance over roadways (National Highway System and High Routes may require greater clearances: 17'-0" and 17'-4", respectively). Maximum length of 300'; otherwise, falls to elevated/viaduct. Includes abutments, sub-ballast, ballast, ties, rails, guard rail and fasteners.
2.	**Stations, Terminals, Intermodal**	
	a. Stations	No new stations are proposed between Eugene and Portland.
3.	**Support Facilities: Yards, Shops, Administrative Buildings**	
	a. Layover Facility b. Maintenance Facility	No costs for these support facilities were calculated in the original cost estimates. Since that time, a layover/maintenance facility has been introduced at Eugene.

4.	Site Work, ROW, Land, Existing Improvements	
	a. Grade Crossings - Up to 4 lanes	This is for at-grade crossing for up to 4 lanes of traffic. Assumes panels, gate arms, flashers, roadway signal upgrades and roadway reconstruction of 100' off track centerlines in both directions.
	b. Grade Crossings - over 4 lanes	This is for at-grade crossing for over 4 lanes of traffic. Assumes panels, gate arms, flashers, roadway signal upgrades, medians and roadway reconstruction of 100' off track centerlines in both directions.
	c. ROW Impacts	See section 6.5.4 for discussion of ROW impacts.
5.	Communications and Signaling	
	a. Wayside Signaling Equipment	

8.3.5 Professional Services

To take the corridor from the current planning stage through design and into implementation, professional services will be required to complete preliminary and final design of each segment as well as perform any necessary environmental studies. Additional services will be required for project management during design and construction as well as construction administration and management. The costs of additional services were estimated as a percentage of the total capital costs (see **Table 8-2**).

Table 8-2 Non-construction Cost Categories Used in OPR Project Cost Estimates

PROFESSIONAL SERVICES		Item Total	Category Total
	Design Engineering	10%	
	Insurance and Bonding	2%	
	Program Management	4%	
	Construction Management and Inspection	6%	
	Engineering Services During Construction	2%	
	Integrated Testing and Commissioning	2%	
	Subtotal Professional Services		26%
UTILITY RELOCATION			
	Percentage of Route That Is In Urban Areas	40%	
	Percentage of Route That Is Outside of Urban Areas	60%	
	Through Urban Areas (% of sub-total construction elements)	6%	6%
	Outside of Urban Areas (% of sub-total construction elements)	3%	3%
ENVIRONMENTAL MITIGATION			
	Noise Mitigation	1%	
	Hazardous Waste	1%	
	Erosion Control	0.5%	
	Sub-total Environmental Mitigation		2.5%

8.3.6 Maintenance-of-Way

Maintenance-of-way (MOW) costs for increased service includes the cost of maintaining signals, buildings, structures and bridges. These costs are part of the operating costs and are covered in section 9.2.

8.4 Service Schedule and Prioritization

8.4.1 Implementation Schedule

Phased implementation planned for the passenger rail service between Eugene and Portland systematically increases service from the existing 2+1 operating schedule to a 4+1 schedule and finally to the Preferred Alternative, (a 6+1 schedule). WSDOT is also developing incremental service increases in Washington state along the Amtrak Cascades route. Close coordination between ODOT, WSDOT and Amtrak with regards to future planning and activities related to scheduling service increases is imperative to take advantage of efficiencies as service throughout the region expands.

8.4.1.1 Tier 2 Project NEPA and Preliminary Engineering

If the state of Oregon decides to move forward with implementation of the service increases and funding is secured, Tier 2 studies and NEPA documentation would be advanced for the logical progression of the phased implementation in the corridor. Separate Tier 2 NEPA documentation would be prepared for each of the phases identified. Preliminary engineering, design would be conducted in support of those Tier 2 studies.

8.4.1.2 Final Design

Based on the outcome of the Tier 2 studies and the preliminary engineering process, and in collaboration with ODOT and WSDOT, Amtrak, and host railroad (UPRR), a final design of each phase of the phase implementation of the service will be crafted. Final Design phase elements include generation of final engineering plans, project specifications, and construction schedule and cost estimates, as well as completion of the environmental permitting process.

8.4.1.3 Construction

The complexity of the service and the multiple partners involved require an integrated and organized approach toward project delivery. The outputs of the Final Design phase will be used to gain project approval, create agreements with the host railroads and solicit bids from prospective contractors. Alternatively, the railroads may perform some or all of the work. Design and construction contracts will be structured in a logical manner to ensure coordination of not only the design and performance of related elements of work, but also the construction schedules, a critical consideration for a service of this magnitude with many interrelated elements of work let under separate contracts. Economies of scale, in addition to systems integration considerations, favor a unified approach under a single contract.

8.4.1.4 Amtrak Cascades Frequency Increases

The phased implementation of the service allows for an increase in the frequency of passenger trains on the Oregon Amtrak Cascades route between Eugene and Seattle. The first proposed frequency increase would involve growth from two round trips to four round trips between Eugene and Portland in approximately 2027, and the second proposed frequency increase would involve growth from four round trips to six round trips between Eugene and Portland in 2035.

Any increase in the number of trains in the corridor would have to take into account the cost-effectiveness of additional infrastructure and equipment needs and would be subject to the verification of capacity on the host railroad through a detailed modeling process. Infrastructure improvements required to implement frequency increases and accommodate comingled passenger and freight operations safely and efficiently on the host railroads could include construction of track, signaling, structures and stations; acquisition of additional equipment (locomotives and passenger cars); and implementation of amenities at stations or onboard trains.

9 Operating and Maintenance Costs and Capital Replacement Forecast

9.1 Costing Methodology and Assumptions

Operating and maintenance (O&M) costs have been approximated for the Preferred Alternative of the Oregon portion of the Amtrak Cascades. Oregon currently shares the O&M costs of the Amtrak Cascades with Washington state. The current cost split between Oregon and Washington, as provided in their respective operating agreements with Amtrak, may change with negotiations between ODOT, WSDOT, Amtrak and the host railroads depending upon conditions extant when service is increased. O&M cost estimates in the SDP are derived from high-level costs summarized by Amtrak for both the Amtrak Cascades service and national totals.

Section 209 of the Passenger Rail Investment and Improvement Act (PRIIA) of 2008 prescribed that Amtrak, and states with state-supported Amtrak routes develop and implement, "a single, nationwide standardized methodology for establishing and allocating the operating and capital costs among states and Amtrak…" The PRIIA Section 209 Cost Methodology Policy was developed and has been utilized by Amtrak and the states since 2013. The methodology for determining operating costs (or Service Fee as Amtrak calls it) is:

- Third Party costs: 100 percent of actual costs charged to the state.
- Route Costs: 100 percent of the verifiable route costs associated with the Corridor Service charged to the state.
- Support Fees (Additives): Fixed as percentage for allocating additional regional or national support costs (not included in route costs) provided to state services.

As the Amtrak Cascades is classified as a "Corridor Service" these costs as well as revenues must then be allocated to each respective state in an "equitable manner". Washington and Oregon have agreed to allocate revenues based upon passenger miles within their respective "service area" and allocate total Amtrak Cascades "Route Costs" by the percentage of train miles run in the respective service areas. This allocation is provided in each state's operating agreement with Amtrak. **Table 9-1** shows how the methodology specifically forecast the allocation of costs and revenues for Fiscal Year 2019.

Table 9-1 Amtrak Cascades Forecast Year 2019 Revenue and Expense by Route and State

	FY2019 Forecast		
Cascades	**Route**	**Oregon Share**	**Washington Share**
REVENUES			
Ticket Revenue	$33,965,340	$2,615,331	$31,350,009
Food Beverage	3,701,774	285,037	3,416,738
Other Revenue	680,381	52,389	627,992
Total Passenger & Other Revenue	**$38,347,495**	**$2,952,757**	**$35,394,739**
EXPENSES			
Third Party Costs			
Host Railroad MOW and Performance Incentives	$6,571,866	$874,058	$5,697,808
Fuel and Power	2,692,542	507,275	$2,185,267
Subtotal: Third Party Costs	**$9,264,408**	**$1,381,333**	**$7,883,075**
Route Costs			
Train & Engine Crew Labor	$11,558,015	$2,177,530	$9,380,485
Car & Locomotive Maintenance and Turnaround	9,361,796	1,763,762	7,598,034
Onboard Passenger Technology	295,126	55,602	239,524
OBS-Crew	3,017,330	568,465	2,448,865
Commissary Provisions	1,353,268	254,956	1,098,312
Route Advertising	0	0	0
Reservations & Call Centers	1,689,981	318,393	1,371,589
Stations - Route	1,154,872	217,578	937,294
Vancouver Police		0	
Stations - Shared	7,355,791	1,385,831	5,969,960
Station Technology	74,349	14,007	60,342
Commissions	998,454	188,109	810,346
Customer Concessions	2,971	560	2,411
Connecting Motor Coach	0	0	0
Regional/Local Police	288,180	54,293	233,887
Block & Tower Operations	0	0	0
Terminal Yard Operations	914,162	172,228	741,934
Terminal MOW	13,109	2,470	10,639
Insurance	1,891,770	356,410	1,535,361
Subtotal: Route Costs	**$39,969,174**	**$7,530,194**	**$32,438,983**
Additives			
Marketing	$475,515	$89,587	$385,928
T&E	3,744,797	705,520	3,039,277
MoE	2,537,047	477,980	2,059,067
OBS-Crew	437,060	82,342	354,718
Police	654,654	123,337	531,317
Shared Support Services	1,298,998	244,731	1,054,267
Subtotal: Additives	**$9,148,071**	**$1,723,497**	**$7,424,574**
Total Expenses	**$58,381,653**	**$10,635,024**	**$47,746,632**
Estimated State Operating Payment or (Credit)	**$20,034,158**	**$7,682,267**	**$12,351,893**
Equipment Capital Use Charge	$902,977	$170,121	$732,856
Total PRIIA 209 State Charge (Credit)	**$20,937,135**	**$7,852,388**	**$13,084,749**

The current Oregon share of the Amtrak Cascades service costs is based on the train miles of the two round trips per day operating between Eugene and Portland. The allocation of future operating and maintenance costs for the entire Amtrak Cascades corridor is based on the number of additional trips (train miles) added in Oregon under each Preferred Alternative phase (4+1 and 6+1), proportionate to Amtrak Cascades service operated by Washington State. For purposes of this SDP, WSDOT's service level was assumed to be only six daily round trips between Portland and Seattle, as well as current service (two daily round trips) between Seattle and Vancouver, BC. It is important to point out that this is different than some scenario assumptions used in the 2017 Amtrak Cascades Fleet Management Plan, in which up to 12 Seattle-Portland round trips were assumed. As WSDOT will be updating its Service Development Plan in the near future, longer range service assumptions for Vancouver, BC-Seattle-Portland service may be revised. Utilizing these conservative Seattle-Portland service level assumptions, along with the planned increase in Amtrak Cascades train miles within Oregon under the Preferred Alternative phases, the percentage split for Oregon's share of future Amtrak Cascades service costs were estimated accordingly and are shown below in **Table 9-2**.

The Oregon share of passenger rail revenues is estimated based on similar assumptions that allocate revenues between both states. Passenger Ticket Revenue is allocated on passenger miles traveled, summarized separately for the Oregon and Washington portions of the Amtrak Cascades corridor. Chapter 5 contains detailed information about demand revenue forecasts.

Table 9-2 Projected Cascades Train Miles and Estimated Cost/Revenue Allocation Percentages

Cost Driver	Washington	Oregon Existing (2015) - 2+1	Oregon Phase 1 - 4+1	Oregon Phase 2 – 6+1
Train Miles	1,045,408	177,140	364,874	547,310
Route Cost Split: Oregon Share		18.97%	25.67%	34.13%

9.2 O&M Costs

Operating costs for the Oregon portion of the Amtrak Cascades includes those costs required to run the service on a daily basis. As mentioned earlier, some costs of the overall service between Eugene and Seattle are split at negotiated rates. A complete list and detailed description of operating cost categories used in the PRIIA methodology are in **Appendix F**. Major operating cost categories include:

- **Maintenance-of-Way and Performance Incentives** – Cost of maintaining the signals, buildings, structures, bridges, etc. and railroad access and performance incentive payments. These MOW costs are paid by the states of Washington and Oregon to UPRR and BNSF as Third-Party Costs through Amtrak. These costs are specifically allocated based on the "ODOT Service Area" and "WSDOT Service Area."
- **Maintenance of Equipment** – Cost of train layover and turnaround servicing, preventive maintenance, rolling stock repairs and contractor maintenance/inspections.
- **Operations and Transportation** (train movement) – Cost of train and engine personnel, any additional bus connections (beyond normal scheduling, in the event of any train cancellations), train fuel, propulsion power, and on-board services.

- **Sales and Marketing** – Includes the cost of advertising, marketing, reservations, information, customer concessions and commissions. Oregon's share of sales and marketing estimated based on the increase in Oregon train miles under the Preferred Alternative (by phase) compared to the Washington train miles.
- **Station** – Cost of station staffing (ticketing, baggage, red caps, porters, etc.), building rent, cleaning/maintenance, utilities, security. All of the stations in the Preferred Alternative are existing Amtrak stations. It is assumed that the staffed station costs would increase with the increases in Amtrak Cascades service in Oregon.
- **General and Administrative** – The cost of insurance is the primary cost under the General and Administrative category. Oregon's share of insurance costs are estimated based on the increase in Oregon train miles under the Preferred Alternative (by phase) compared to Washington train miles.
- **Capital Equipment Overhaul** – Equipment overhaul costs for coaches and locomotives are derived from Amtrak forecasts. Oregon's share of capital equipment overhaul costs are estimated based on the increase in Oregon train miles under the Preferred Alternative (by phase) compared to the Washington train miles. This could change depending on future equipment selection/ownership.
- **Police, Security, Environmental/Safety** – Oregon's share of police, security and environmental/safety costs are estimated based on the increase in Oregon train miles under the Preferred Alternative (by phase) compared to the Washington train miles.
- **Fixed Additives** – These are specific costs that are a fixed percentage of the calculated Route Costs. This includes Amtrak support costs for marketing, train and engine, maintenance of equipment, on-board services, police and general administration. Oregon's share of fixed additive costs are estimated based on the increase in Oregon train miles under the Preferred Alternative (by phase) compared to the Washington train miles and multiplied by the fixed additive percentage.

9.3 Summary of O&M Costs and Financial Analysis Results by Phase

The O&M cost estimates for the Preferred Alternatives (by phase) were derived for expanded Amtrak Cascades service in Oregon and Washington by utilizing combined forecasted train miles and passenger miles for the year 2015. Cost split percentages for Washington and Oregon were calculated as a percentage of train miles (see **Table 9-2**). The financial analysis results for each phase are summarized in this section.

Table 9-3 summarizes the projected O&M costs exclusive to the Oregon portion of the Amtrak Cascades service, for the future (year 2035) No Action and Preferred Alternative, by phase. Estimated annual O&M costs are in 2015 dollars.

Table 9-3 Estimated Annual 2035 O&M Costs – Oregon Cascades Only

		Preferred Alternative	
Cost Item	**Future No Action**	**Phase 1 (4+1)**	**Phase 2 (6+1)**
	Costs	**Cost**	**Cost**
Diesel Locomotives	$27,286	$71,352	$126,471
Superliner [1]	$48,282	$126,253	$223,783
Equipment Capital Use Charge	**$75,568**	**$197,605**	**$350,254**
Host Railroad (MOW and Incentives)	$565,783	$1,131,566	$1,697,350
Fuel and Power	$531,083	$1,062,167	$1,593,250
Subtotal, Third-Party Costs	**$1,096,867**	**$2,193,733**	**$3,290,600**
Train & Engineer (T&E) Crew Labor	$1,943,977	$4,512,853	$6,559,103
Train Maint. & Turnaround (MoE)	$1,780,384	$2,670,576	$3,560,767
Subtotal, Route Costs	**$3,724,361**	**$7,183,429**	**$10,119,870**
T&E	$629,849	$1,462,164	$2,125,149
MoE	$482,484	$723,726	$964,968
Shared Support Services	$121,042	$233,461	$328,896
Subtotal, Additives	**$1,233,374**	**$2,419,352**	**$3,419,013**
Onboard Passenger Technology	$44,873	$78,226	$103,991
OBS (Onboard Services) - Crew	$445,680	$1,693,811	$3,272,680
Commissary Provisions	$200,139	$697,802	$1,391,453
Route Advertising	$0	$0	$0
Station Technology	$927	$3,231	$10,626
Reservations & Call Centers	$269,499	$939,631	$1,873,673
Stations - Route	$134,803	$134,803	$134,803
Stations - Shared	$1,053,378	$3,672,685	$7,323,529
Credit Card Commissions	$119,527	$416,742	$1,370,499
Customers Concessions	$1,324	$2,308	$3,068
Regional Local Police	$30,974	$107,994	$215,346
Terminal Yard Operations	$128,264	$335,402	$594,497
Terminal MOW	$1,059	$2,769	$4,907
Insurance	$167,967	$585,629	$1,167,774
Subtotal, Fixed Route Costs	**$2,598,414**	**$8,671,031**	**$17,466,846**
Marketing	$78,124	$78,124	$78,124
OBS	$64,582	$239,161	$466,413
Police - rate per passenger	$690	$944	$2,335
Shared Support Services	$84,448	$281,809	$567,672
Subtotal, Fixed Additives	**$227,845**	**$600,038**	**$1,114,545**
Total Section 209 Expenses	**$8,880,861**	**$21,067,583**	**$35,410,874**

[1] Superliners are regularly used on Amtrak Cascades as substitute equipment.

Insurance costs are allocated by train miles today, but in reality, costs for insurance are generally based on claims history. Exploring the feasibility of a state-supported insurance pool, separate from Amtrak's insurance, may result in some cost savings, better coverage, or a combination of both.

9.4 Annual Operating Revenues and Costs

A key performance measure of the proposed Oregon Cascades intercity passenger rail service plan is the degree to which future operating costs are recovered through ticket revenues or other sources of revenue. Outside of the NE Corridor, all conventional speed (79 mph) Amtrak corridor services require some level of federal or state operating support to cover annual operations.

The farebox recovery ratio is an important measure of the viability and performance of the proposed Oregon Cascades service plan. The farebox recovery ratio is expressed in terms of the percent of operating costs recovered by operating revenues. The greater the farebox recovery ratio, the better the route performance. An increasing trend in farebox recovery over time is an indicator of the long-term viability of the service plan.

Table 9-4 summarizes year 2019 and 2035 estimates of operating expense and revenue for the Oregon section of Amtrak Cascades service. Year 2035 estimates are provided for the No Action and Preferred Alternative, reflecting an increase of four daily round trips between Eugene and Portland. Revenue and ridership estimates were derived from forecasts for the corridor prepared by Amtrak (see Chapter 5) for the No Action and Preferred Alternative. Subtracting revenue from operating expense indicates the level of operating support required to cover annual operations.

From year 2019 to year 2035 under the No Action scenario, the farebox recovery ratio increases positively from 38 percent to 49 percent, reflecting the strong growth in ridership estimated in the corridor. At full implementation of increased passenger rail service under the Preferred Alternative in 2035, the farebox recovery ratio is estimated at 39 percent, slightly higher than year 2019 (38 percent). This is due to the higher costs of expanded operations and maintenance of additional trains required to serve the corridor, more than a four-fold increase (299%) compared to the No Action scenario, and a lower rate of change in ridership (238%) and revenue (218%). The farebox recovery ratio is expected to increase following the full implementation of added round trip service in 2035 under the Preferred Alternative, with continued ridership growth in the corridor.

Table 9-4 Operating Expense, Revenue and Ridership Projections for the Oregon Cascades Service Plan

Annual	2019	Year 2035		
		No Action	Preferred Alternative	% Change
Operating Expense	$7,852,388 [1]	$8,880,81 [2]	$35,410,874	299%
Revenue	$2,952,757 [1]	$4,311,200 [3]	$13,699,100	218%
Operating Support Required	$4,899,631	$4,569,661	$21,711,774	
Farebox Recovery Ratio	38%	49%	39%	
Ridership		153,600 [4]	519,500	238%
Passenger Miles of Travel		13,612,600 [5]	45,327,800	233%

[1] *See Table 9-1 Amtrak Cascades Forecast Year 2019 Revenue and Expense*
[2] *See Table 9-3 Estimated Annual 2035 O&M Costs – Oregon Cascades Only*
Tier 1 DEIS Amtrak Cascades Incremental Model Results;[20] FEIS;[22] WSDOT Amtrak Cascades Model
[3] *See Table 5-13 Amtrak Cascades Corridor Estimated Total Revenues*
[4] *See Table 5-12 Amtrak Cascades Corridor Estimated Total Ridership*
[5] *See Table 5-14 Amtrak Cascades Corridor Estimated Total Passenger Miles of Travel Year 2035 (south of Portland)*

9.5 Equipment Capital Replacement Costs

Passenger rail equipment capital replacement costs are anticipated in future years, as outlined in the Amtrak Cascades 2017 Fleet Management Plan.[46] These replacement costs cover depreciation, and lifecycle limitations of the infrastructure and rolling stock. Very different from yearly regular maintenance costs outlined above, capital equipment acquisition will be necessary to replace assets at the end of their useful life and to maintain the safety of passengers, employees and the general public.

There are several states that have recently received FRA State of Good Repair Program grant awards for the acquisition of new passenger rail equipment: North Carolina, Washington, and Wisconsin in 2019. Washington's grant was a 50/50 match request with equal $37.5 million federal and state shares totaling $75 million, the estimated cost for three trainsets (see **Table 6-7** for specific details) to replace three Talgo Series VI trains. WSDOT's application specifically states that it will purchase new equipment in concert with Amtrak's current railcar procurement.

Wisconsin received $25,716,900 in federal funds for the purchase of nine single-level coaches and cab cars. Assuming the same 50/50 federal/state match, this would equate to $51.4 million for two trains, plus a spare cab and spare coach car. North Carolina received $76,888,000 in FRA grant funding for 13 new passenger coaches and to expand an existing locomotive and railcar maintenance facility. As this funding includes upgrades to the maintenance facility, it's difficult to estimate the pure equipment cost. The single-level coaches currently being finished for the Midwest and California equipment procurement were $2.5 million each in 2012 dollars. Based on this recent information, the cost of procuring two new trainsets is estimated to be approximately $50 million in 2015 dollars.

The Charger locomotives that were delivered to WSDOT in 2017 cost approximately $7.3 million each, so two new locomotives to haul new trainsets would cost $16 million in 2015 dollars. The cost for capital spare parts is estimated to be 10 percent of the locomotive cost.

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10 Public Benefits of the Service

10.1 Introduction

This chapter describes the public benefits that the OPR Project (Service) is expected to deliver. The public benefits stemming from the OPR Project are summarized separately for those benefits that can be monetized from those that cannot be monetized.

10.1.1 Non-monetized Benefits

Non-monetized benefits of intercity passenger rail improvements are often defined in broad terms describing improvements related to environmental sustainability and community livability. Improvements in environmental sustainability can be illustrated through reductions in motor fuel consumption, reductions in air emissions including greenhouse gases, and reductions in infrastructure capacity increases that would otherwise be required for airports and highways. Improvements in community livability can be described through measures that help illustrate reductions in transportation congestion and improved access to transportation, particularly for the elderly, disabled and people who cannot afford personal autos or airline transportation, or who are not able to drive or fly.

Given the unique economic, geographic and demographic profile of the PNWRC, non-monetized benefits of the OPR Project summarized in this chapter (in Section 10.2) are more specifically categorized as follows:

- Supporting Livable Communities
- Improving Public Transportation Access
- Providing an Equitable Mobility Investment
- Improving Transportation Network Resiliency
- Meeting the Needs of a Changing Marketplace

10.1.2 Monetized Benefits and Economic Assessment

Monetized benefits of the OPR Project are those benefits that create economic value.

Monetized benefits can be categorized into two types: non-user benefits and user benefits. *Non-user benefits* are those benefits that create economic value from changes in externalized cost of transportation such as reduced highway congestion, improved highway safety, reduced highway maintenance and reduced air emissions. *User benefits* are those benefits that create economic value from services provided to the traveling public in the form of time spent in travel.

The OPR Project Benefit-Cost Analysis (BCA) focuses exclusively on monetized benefits (user and non-user) of the OPR Project. The BCA analysis addresses whether society is better off by performing a certain action (such as investing in improved rail service) than by doing nothing. BCA describes the viability of a project in terms of the ratio of benefits to costs and in terms of net value (benefits, less costs).

Further, an Economic Impact Analysis (EIA) was performed to identify the economic impacts of the construction projects necessary to build, operate and maintain the OPR Project. An EIA addresses how an economy is likely to change in response to an action. Specifically, the EIA describes the impacts of a project in terms of its impacts on a region's employment, wages, Gross Regional Product or Gross State Product, and taxes. The EIA for the OPR Project analyzes the impacts on job creation, spending of employee wages and salaries, and related economic-development benefits stemming from the OPR Project investment.

The BCA and EIA detailed in this chapter build upon the information presented in the passenger demand and revenue forecasts found in Chapter 5 and the Operating Plan in Chapter 6. Those two chapters and the analyses used to develop them provide the basis for operating costs, ridership and passenger miles for the alternative deployment scenarios.

10.1.3 Chapter Organization

This chapter is organized as follows:

- Section 10.2 contains the summary of non-monetized benefits of the OPR Project.
- Section 10.3 outlines and defines the general return on investment statement of the OPR Project.
- Section 10.4 summarizes the monetized benefits of the OPR Project and details the findings of the BCA and the results of a BCA sensitivity analysis.
- Section 10.5 summarizes the EIA and the regional impacts of the OPR Project.
- Section 10.6 presents the conclusions of the OPR Project's economic assessment.
- Section 10.7 summarizes the chapter findings and conclusions.

10.2 Non-monetized Benefits of the OPR Project

The OPR Project will likely yield several tangible benefits within the PNWRC region that cannot easily be monetized. Non-monetized benefits of the OPR Project are summarized in this section.

10.2.1 Supporting Livable and Sustainable Communities

One of the goals of the OPR Project is to promote community health and quality of life for communities along the PNWRC, as well as to benefit the communities and minimize negative impacts. This is consistent with ODOT's work to reduce transportation emissions and meet the requirements in the Governor's Executive Order 20-04 on Greenhouse Gas reduction. Improving public transit service and increasing the adoption of alternative modes are key strategies for reducing greenhouse gas and other transportation emissions in Oregon. Passenger rail service has an important role of providing an alternative mode to driving an automobile for intercity travel. One indicator that community health and quality of life is enhanced is a declining rate of Vehicle Miles Traveled (VMT) per capita. Nationwide, VMT per capita fell 7 percent in 2012; in Oregon, VMT per capital fell more than 11 percent in 2012, in part because of high rates of alternative mode investment.[47] Since 1999, VMT per capita in Oregon has declined 12 percent, one of the highest rate drops in the country. Oregon has established itself as one of the national leaders in declining levels of automobile use. By improving intercity passenger-rail service, the OPR Project could also help attract individuals actively seeking to live in walkable, transit-oriented environments that already exist or will continue to grow in the downtowns where each of the PNWRC rail stations is located.

10.2.2 Improving Public Transportation Access

As noted in Chapter 7, each of the PNWRC Oregon station areas is supported by frequent and reliable local transit service (proportionate to each city's population size), and facilities for walking and bicycling to the rail station. These "last mile" connections are the responsibility of the local transit agency or city. They include a range of services, from local bus, streetcar, bus rapid transit and light rail transit connections; to car, scooter, and bicycle parking and sharing programs; to on-demand taxi services and other new technologies. Active transportation facilities also provide improved access to stations (in the form of sidewalks, bicycle lanes, and multi-use paths).

10.2.3 Providing an Equitable Mobility Investment

Almost half of Amtrak Cascades riders, either by choice or because of life circumstances, do not have access to personal vehicles to make their trips. Access to a convenient and reliable transportation system can widen opportunities for some of the most vulnerable populations, including low-income, minority, elderly and youth populations, and people with physical disabilities that prevent them from driving. This benefit is particularly important with respect to increasing access to employment centers, schools and health care services. Several demographic trends illustrate the equity implications that are emerging. For example, minority population growth is outpacing growth at the national level, especially of Hispanics, whose growth in Oregon was 20 percentage points higher between 2000 and 2010 than their national population growth.[48] The high cost of automobile ownership can perpetuate mobility inequity by increasing unemployment and underemployment.[49] Without a convenient and reliable transit service, employment opportunities for households without access to a personal vehicle are effectively reduced to those that can be reached by bicycle or on foot. Nationally, almost 20 percent of African-American households and 14 percent of Hispanic households do not have access to a personal vehicle, compared to 5 percent of Caucasian households.[50]

Automobile-centric transportation systems similarly diminish opportunities for access to quality health care and educational services. The growing diversity of the state's population will place additional pressures on the existing passenger-rail system along the PNWRC. Improved passenger rail can offset some of the disproportionate mobility impacts associated with a lack of car ownership that face low-income, retired, and minority individuals and their families.

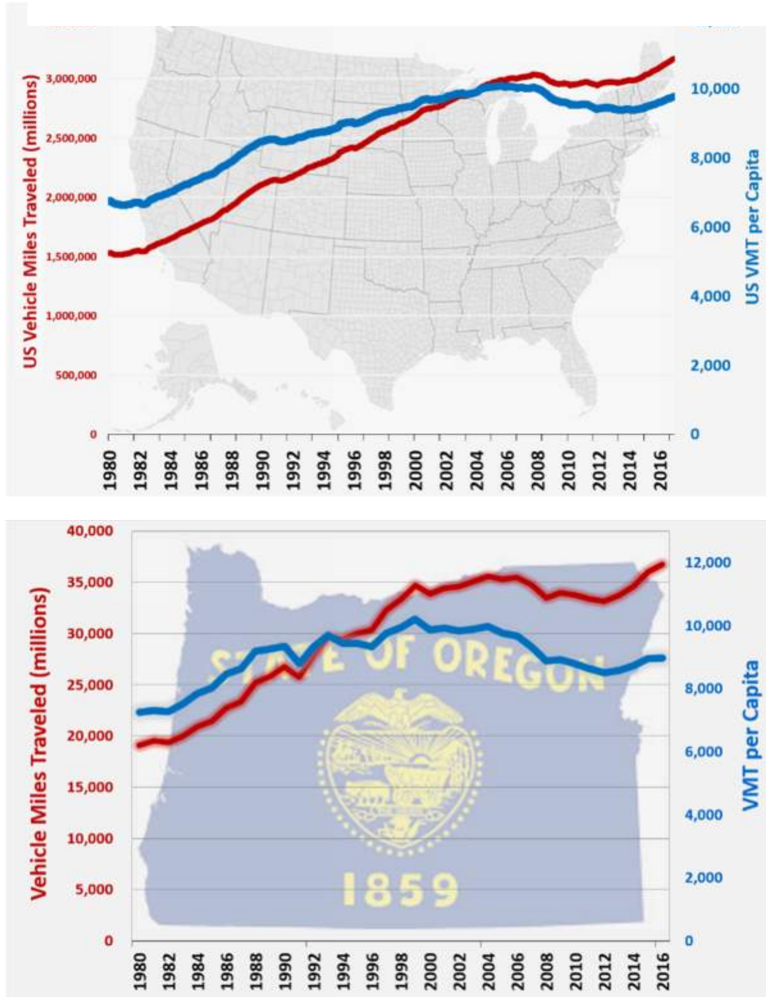
10.2.4 Improving Transportation Network Resiliency

Expansion of intercity passenger rail service could strengthen the resiliency of Oregon's transportation system in the event of a natural or human-caused disaster. Having a redundant system with several parallel routes reduces the effects of single points of failure (such as damaged bridges or overpasses) and allows critical passenger and freight movement during emergency periods. Oregon is especially susceptible to earthquakes: There is a 40 percent chance of a major earthquake occurring along the Cascadia Subduction Zone in the next 50 years.[51] While well-maintained Class I railroads (such as the UPRR corridor) are generally in good condition, retrofitting or replacing bridges along the route would bring the Oregon segment of the PNWRC up to seismic code and help provide a lifeline corridor and an alternative to I-5 in the event of an emergency.

10.2.5 Meeting the Needs of a Changing Marketplace

After decades of continued increases in nationwide VMT, as shown in **Figure 10-1**, personal vehicle use dropped in 2008 during the recession and remained relatively stagnant until 2014, when nationwide VMT increased. *On the other hand*, the number of miles driven *per capita* peaked in 2004 and had decreased every year since (by more than 7 percent total) until 2014, when once again VMT per capita began to increase.

Figure 10-1 Trends in Vehicle Miles Traveled: Oregon and the United States



David Evans and Associates, Inc.

Data Source: Federal Highway Administration (FHWA) Office of Highway Policy Information, 2016 U.S. Census Bureau, 2016

VMT growth in Oregon, also shown in **Figure 10-1**, showed earlier decline and leveling off beginning in 2000, and then an uptick in 2014. Although Oregon's population has steadily grown over the past two decades, Oregon residents are driving significantly less than the national average, as indicated by Oregon's continued VMT per capita downward trend since 1999. Local economic and evolving lifestyle measures are influencing change in the travel behavior of Oregon residents. Population growth is shifting to cities within the Willamette Valley, and the state's concerted and historic land use and transportation planning policies continue to support greater walking, bicycling and public transportation use.

VMT per capita reached a peak several years before the depth of the 2008 recession. Even as the economy showed signs of improving, VMT per capita rates continued to decline in Oregon, notwithstanding a minor uptick in 2014 to 2015. Factors that are contributing to the reduction of per capita VMT include the following:

- An older population, particularly the baby boom generation, is retiring and is expected to drive less in the future.
- A declining per-capita household income is leading to lower rates of automobile ownership and use.
- The rates of two-worker households are stabilizing, after years of women joining the workforce, contributing historically to higher levels of personal vehicle ownership and VMT.

- Declining levels of personal vehicle ownership, where the number of vehicles available per person, per household, and per licensed driver reached their peaks between 2001 and 2006, and then leveled off.
- Rising fuel prices, which lead to lower VMT.
- Increasing delays due to congestion, because highway construction has slowed since the 1980s.
- The percentage of the nation's population that lives in urban areas continues to increase, and now accounts for over 80 percent of the total population.[52]
- Urban lifestyles typically result in shorter trips and more travel mode choices.
- Commute times have reached their practical limits. Time spent commuting has leveled off since 2001.
- Increased mode split after years of decline in the portion of trips made by walking, bicycling, and transit.
- State- and city-based growth management policies and plans that encourage greater travel options and more efficient land-use patterns.

Reports from the U.S. PIRG (a federation of state Public Interest Research Groups) indicate that younger Americans (age 16 to 34) demonstrated the largest decrease in VMT per capita over the previous decade. Part of this trend can be attributed to their preference for living in compact, mixed-use neighborhoods at considerably higher rates than prior generations; in addition, they obtain driver's licenses at lower rates, and they rely more on non-automobile methods of travel than older generations.[53] This generation also tends to be more conscious of the impact of their lifestyle choices on their wallets and the environment. Furthermore, research has shown that the percentage of licensed drivers among individuals younger than the age of 40 has decreased in the last 25 years by as much as 20 percentage points compared to similar-aged respondents in the 1980s.[54]

10.3 Return on the Public Investment

The OPR Project will create broad-based public benefits (monetized) such as reductions in vehicle emissions and greenhouse gases, highway congestion, and highway maintenance costs; improvements in highway safety; and user benefits such as improved access to transportation, improved reliability of transportation and lower transportation costs.

The OPR Project will contribute to passenger diversions from personal vehicles and highway miles to rail, reduction in greenhouse gases, and improvement in cross-modal transportation within the PNWRC corridor. For a 30-year time horizon following implementation of the OPR Project service (2029-2058), the projected potential cross-modal impacts of the OPR Project include:

- 102 million VMT removed from the Oregon and Washington highway systems;
- 4 million gallons less of auto and truck fuel consumed; and
- 708,200 short tons reduction in carbon dioxide

The OPR Project would divert travelers who would otherwise use a personal vehicle (545,300 annual auto person-trips), scheduled airline service (20,800 annual air -rips), or scheduled intercity bus service (91,000 annual bus person-trips), as well as provide transportation growth capacity and capability for passengers who would otherwise have no viable transportation choice. See Chapter 5 for more detailed discussion of travel diversion. The OPR Project's projected diversion rates are 83 percent from personal vehicles, 3 percent from air and 14 percent from bus.

10.4 Monetized Benefits of the OPR Project

Several of the OPR Project benefits were calculated and monetized through a formal BCA process that is described in **Appendix G**, "Economic Assessment." This analysis adheres to guidance issued by USDOT and FRA, and calculates the net present value (NPV) of the benefits using a 7 percent discount rate over a 30-year period after service implementation.

The monetized benefits of the OPR Project can be described as user benefits, such as reduced vehicle operating costs, and social benefits, such as emissions reductions and the reduction in damage to humans resulting from crash incidents. The economic assessment analysis covers the following benefit categories:

- Vehicle Operating Cost Savings
- Travel Time Savings
- Safety Benefits
- Reduced Emissions and Environmental Cost Savings
- State of Good Repair Benefits

The analysis uses standardized factors provided by governmental and industry sources to efficiently determine the monetized value of user and social benefits resulting from the OPR Project improvements. These benefits include the reduction of existing costs or the prevention of future costs related to the operation and use of the existing road facility. **Table 10-1** shows the OPR Project's long-term benefits.

Table 10-1 Oregon Passenger Rail Project - Benefits by Long-term Outcome Category, in Millions of 2015 Dollars

Long-Term Outcome	Benefit Category	Benefit Description	7% Discount (in Millions of 2015 dollars)
Economic Competitiveness	Vehicle Operating Costs Savings	Reduced vehicle operating costs	$318.2
	Travel Time Savings	Value of time saved traveling by rail	$23.4
Safety	Reduced Crash Incidents	Reduction in fatalities and injuries	$92.9
Environmental Sustainability	Reduced Emissions	Enhancement of the natural environment	$1.1
State of Good Repair	Reduced Roadway O&M Costs	Reduced VMT on roads resulting in reduced maintenance costs	$6.1
Total			$441.7

Source: Cambridge Systematics, Inc.

10.4.1 OPR Project Costs

10.4.1.1 Capital Costs

The capital costs associated with the OPR Project are for trainsets, maintenance yard and rail infrastructure for a period of analysis beginning in 2026 and ending in 2035. Capital costs for the OPR Project would total **$831 million** (in undiscounted 2015 dollars) and **$286 million** (when discounted at 7 percent).

10.4.1.2 O&M Costs

The difference between O&M costs for the No Action Alternative and the Preferred Alternative represents the ongoing costs to maintain and operate the enhanced service levels associated with the OPR Project. Annual O&M costs for Phase 1 of the Preferred Alternative would be $14 million (in undiscounted 2015 dollars) for the years 2029-2034. From 2035 through 2058, annual O&M costs are $30 million (in undiscounted 2015 dollars) for Phase 2 of the Preferred Alternative. Over 30 years of enhanced service (2029 to 2058), the increase in O&M costs is **$812** million (in undiscounted 2015 dollars) and **$124 million** when discounted at 7 percent.

10.4.1.3 Life Cycle Costs

Total capital and O&M life cycle costs (costs over the life of the OPR Project) are **$1,643** million (in undiscounted 2015 dollars) and **$410 million** when discounted at 7 percent.

10.4.1.4 Residual Value of Capital Assets

The capital assets acquired under the OPR Project will have a useful life exceeding the 30-year benefit-cost study time horizon. Therefore, in accordance with US DOT guidance,[55] assets with useful lives beyond 30 years were valued for the remaining useful lifetime (using straight-line depreciation) and discounted at the year 30 (2058) discount value. The residual value of the assets is a project benefit. The trainsets are assumed to have a useful life of 30 years, therefore no residual value is assumed for these assets. Other capital assets (e.g. rail infrastructure and maintenance yard investments) are assumed to have a useful life of 50 years, therefore, the other assets would retain 40 percent of their initial value in 2058. The calculated residual value of the total project assets is **$353 million** (in undiscounted 2015 dollars) and **$19 million** (when discounted at 7 percent).

10.4.2 Benefit-Cost Analysis

The BCA converts potential gains (benefits) and losses (costs) from the OPR Project into monetary units and compares them. The following common benefit-cost evaluation measures are included in this BCA:

- Net Present Value (NPV): NPV compares the net benefits (benefits minus costs) after the net benefits are discounted to present values using the real discount rate assumption. The NPV provides a perspective on the overall dollar magnitude of cash flows over time in terms of today's dollars.
- Benefit-Cost Ratio (BCR): The present value of incremental benefits is divided by the present value of incremental costs to yield the BCR. Therefore, the BCR expresses the relation of discounted benefits to discounted costs as a measure of the extent to which a project's benefits either exceed or fall short of the costs.

Table 10-2 presents the evaluation results for the OPR Project. Results are presented in undiscounted amounts (in 2015 dollars) and discounted amounts (discounted to present values using the real discount rate assumption of 7 percent). All benefits and costs were estimated in constant 2015 dollars over an analysis period extending 30 years beyond system completion in 2029.

Table 10-2 Oregon Passenger Rail OPR Project - Evaluation Measures

BCA Metric	OPR Project Life Cycle	
	Undiscounted (Millions of $2015)	Discounted at 7% (Millions of $2015)
Benefits =B	$3,732	$442
O&M Increased Costs = OMCS	$812	$124
Net OPR Project Benefits = B - OMCS = PB	$2,920	$318
Residual Asset Value = RAV	$353	$19
Total OPR Project Benefits = B - OMCS + RAV = PB	$3,273	$337
Total OPR Project Costs = PC	$831	$286
Net Present Value = PB - PC = NPV	$2,442	$51
Benefit-Cost Ratio = BCR = PB / PC	3.9 to 1	1.2 to 1

Source: Cambridge Systematics, Inc.

The total net benefits from the OPR Project improvements for the analysis period are $337 million in 2015 dollars (including the O&M cost increases and asset residual value) when discounted at 7 percent. In accordance with USDOT BCA guidance, O&M cost increases are treated as “negative” benefits and are subtracted from the total benefits.

The total costs of the OPR Project are calculated to be **$286 million** in 2015 dollars when discounted at 7 percent. The difference between the discounted benefits and the costs equals an NPV of **$51 million** in 2015 dollars, resulting in a BCR for the OPR Project of 1.2 to 1.

10.5 Economic Impact of the OPR Project

The purpose of an EIA is to forecast personal income, employment, and business impacts for a defined project, program or policy. Using the 2018 Economic Impact Analysis for Planning (IMPLAN) model for the state of Oregon, the economic impacts of the OPR Project are estimated in terms of employment (number of job-years supported), labor income (compensation of employees), Gross State Product (economic output less intermediate inputs, accounting for the additional output created at that stage of production) and tax revenues.

IMPLAN is an Input-Output (I-O) model used to estimate the economy-wide effects on the state economy of direct impacts of an action and its related inputs. For the OPR Project, the model estimates the capital and O&M expenses associated with the OPR Project versus the “No Action Alternative.”

As these initial direct impacts ripple through the state economy, jobs and economic activity are generated through multiplier effects. The analyses conducted for the OPR Project calculated three types of impacts: direct, indirect and induced. These terms are also commonly referred to as the initial, secondary and tertiary impacts the economy when a change is made to a given input level. These impacts are described as follows:

- The direct impact of an economic disturbance is an initial change in the economy such as the direct outlays for the OPR Project, such as spending on materials, equipment, labor, and other inputs.
- The indirect, or secondary, impact is due to the suppliers of the inputs purchasing their inputs for production and hiring workers to meet demand.
- The induced, or tertiary, impact results from the workers of suppliers purchasing more goods and services.

The total economic impact on Oregon's economy is the sum of the direct, indirect and induced effects.

It should be noted that IMPLAN, as an I-O model, is based on current relationships between industries and is best applied to relatively short (three- to five-year) planning horizons. In reality, it would be expected that the makeup of the Oregon economy in the future, especially over the long-term planning horizon for the OPR Project, will be different than it is today. However, by using IMPLAN, the assumption is that the economy of the future will react to the inputs as it would currently.

The EIA is meant to complement the BCA and to provide additional important information for policymakers. The EIA results should be considered along with the BCA but are not additive to the BCA results. **Appendix E** summarizes the results of the economic impacts of the OPR Project over the 32-year period of 2026 to 2058.

To summarize, the OPR Project (and its ongoing operations from 2026 to 2058) would have the following economic impacts:

- The OPR Project would create 25,000 job-years of employment (in 2015 dollars these jobs are worth $1.6 billion in wages).
- The value added to the state's economy (Gross State Product) would be nearly $1.8 billion in 2015 dollars.
- Tax revenues would increase $475 million in 2015 dollars ($68 million at the sub-county and county level, $91million in state taxes and $317 million in federal taxes, all in 2015 dollars).

10.6 Summary of Economic Assessment

The BCA focused on monetized benefits related to modelled passenger travel by mode. These quantifiable benefits include the costs/avoided costs of travel of rail versus automobile, bus/motor coach and air travel. These travel-related, monetized benefits include transportation costs paid by users of the different modes, travel time savings, reduced vehicle crash occurrences and their human consequences, reduction in roadway maintenance and reduced air emissions.

The study showed significant benefits of the OPR Project over a 30-year period (2029 to 2058) following completion of initial construction to improve service from 2+1 to 4+1 in 2029. Benefits also increased significantly following additional investment to bring service to 6+1 starting in 2035.

Over the study period, the OPR Project is expected to generate a BCR of 1.2 to 1 and an NPV of $51 million in 2015 dollars at a 7 percent discount rate.

Sensitivity analysis showed, in terms of 2015 discounted dollars (using a 7 percent discount rate):

- A 10 percent increase/decrease in capital expenditures equates to a $27 million decrease/increase in NPV.
- A 10 percent increase/decrease in ridership equates to a $44 million increase/decrease in NPV.
- The discount rate chosen for the BCA has the greatest impact on NPV of the factors examined. At the USDOT recommended discount rate of 7 percent, the OPR Project breaks even within the study period (in year 2053). The OPR Project would see significantly shorter financial breakeven periods with lower discount rates. For example, at 3 percent, 4 percent and 5 percent discount rates, financial breakeven would occur in the years 2047, 2048 and 2050, respectively.

The regional economic benefits of construction, operation and maintenance of the improved rail service, plus the value of travel time savings, would be substantial:

- For every $1 billion in OPR Project expenditures on the OPR Project, 15,500 job-years, worth $1 billion in wages are created.
- For each $1 billion in OPR Project spending, Gross State Product and tax revenues are estimated to increase by nearly $1.1 billion and $300 million, respectively.

Not included in these analyses are factors such as impacts on congestion and travel time reliability; accessibility to employment, health and human services, education, shopping, and entertainment; and other quality of life considerations.

10.7 Conclusion

As demonstrated by ODOT’s 25- year history of supporting Amtrak intercity passenger rail service, and its substantial investments in rail line and station improvements along the corridor, the State of Oregon is committed to realizing and sustaining the environmental benefits of the expanded OPR Project service. The expanded passenger rail service will provide environmental, economic and transportation benefits for generations to come.

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Oregon Passenger Rail
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CHOOSING A PATH FORWARD

Appendix A

2016 Revised Operational Analysis Report

Revised: October 18, 2016

Prepared by: **David Evans and Associates, Inc. and Mainline Management**

Oregon Department of Transportation

U.S. Department of Transportation
Federal Railroad Administration

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1. Introduction

The Oregon Department of Transportation (ODOT) requested that the simulations previously performed for Alternative 1 and Alternative 2 of the Oregon Passenger Rail project be revised to standardize certain aspects of simulated passenger and freight operations. The initial simulations were performed in 2013 and 2014. The Alternative 1 simulations focused passenger operations on Union Pacific Railroad's (UPRR's) Brooklyn Subdivision between Eugene and Portland, Oregon, and on BNSF's Fallbridge Subdivision between Portland and Vancouver, Washington. The Alternative 2 simulation focused on a route that was mainly a greenfield route along the Interstate (I-5) corridor with some operations on the UPRR's Brooklyn Subdivision north of Oregon City. Although the simulation network ended at Vancouver, Washington, the Amtrak Cascades trains continue to Vancouver, British Columbia.

Estimates of 2035 freight volumes were developed from previous project experience and discussions with Class I Railroads. It was determined that an increase of 1.7% for domestic intermodal and 1.5% for manifest traffic and international intermodal an appropriate growth target for this project. Growth was projected using a compounded annual rate of 1.5 to 1.7% for the through freight movements. UPRR and BNSF intermodal and manifest trains were also increased using this method. Union Pacific unit train growth was projected based on anticipated growth of new classes of traffic. Projected growth of oil and grain trains to California from the upper Midwest and Canada drove this growth. Two to three loaded trains per day (and their associated empty trains) were included to represent the potential traffic levels in this corridor.

The alternatives analyzed are briefly summarized below:

- Base Case Alternative is modeled for the current year, with existing freight traffic and passenger rail service and schedules.
- No Action – the No Action Alternative is modeled for the 2035 year and assumes increase in freight traffic of 1.5 to 1.7% compounded annually and no change in passenger rail service.
- Alternative 1 - Alternative 1 generally follows the existing Amtrak Cascades route, along or near the Union Pacific Railroad line between Eugene-Springfield and Portland. It crosses the Willamette River in Portland near Union Station before continuing north, either on or near existing BNSF tracks, to Vancouver, Washington.
- Alternative 2 - Alternative 2 runs along or near Interstate 5 from Eugene-Springfield to Keizer, then follows the Oregon Electric rail line from Keizer to Wilsonville, follows I-5 and I-205 between Wilsonville and Oregon City, where it merges with the existing Amtrak alignment.

In the 2013 and 2014 analyses, the number of Amtrak Cascades round trips between Portland and Vancouver were varied between simulations. Base and No Action train volumes included two Amtrak Cascades and one Amtrak Coast Starlight round trip per day (2+1); in other simulations four and six Amtrak Cascades round trips were analyzed (4+1 and 6+1).

For this latest round of revised simulations, the following aspects were standardized between the runs:

1. All passenger operations between Portland and Vancouver, Washington, were standardized to six Amtrak Cascades round trips per day, one Coast Starlight round trip per day and one Empire Builder (Spokane/Portland Section) round trip per day. This schedule will be referred to as the 6+2 passenger schedule.

2. Operations at the Eugene Amtrak Station were also standardized in the revised simulations. In the Revised Base and Revised No Action simulations, the existing infrastructure configuration for the station was left in place and operations reflected that configuration. In the Amtrak Cascades growth simulations, a new infrastructure configuration for the station was included (Option 4) and passenger operations were modified accordingly.

3. The configuration of Eugene Yard was also standardized in all simulations to better reflect actual operations. The configuration that was utilized is described later in the report and is shown in the schematics that are associated with each simulation network.

4. Track improvements that UPRR has recently completed were also included in the Revised Base simulation; in previous work, these improvements were not known and therefore were not included in the Base simulation. The track upgrade improvements were included in all of the subsequent simulations of alternatives that were performed in 2013 and 2014, and were also included in all of the revised simulations.

5. Improvements included between Portland and Vancouver primarily were the planned upgrade improvements at North Portland Junction (NPJ)/Peninsula Junction and Willbridge Junction to allow 25 mph operations. Both projects are under development for PE/NEPA and were assumed to be constructed by 2035 for this analysis. The No Action and Base Case scenarios are the only simulations that did not include the improvements.

It should be noted that a newer version of the RTC model was used for the 2015 analyses than was used for the 2013 and 2014 analyses. Berkeley Simulation Software updated the model based on issues that had been identified over time with previous versions of the model. Once a new version is released, all license holders are expected to upgrade to that version, and support for previous versions is discontinued.

Primary Conclusions for the Revised Simulations

- All three of the expanded passenger service cases for Alternative 1 (3+1, 4+1 and 6+1) over the Brooklyn Subdivision between Portland and Eugene showed an improvement in freight operations compared to the No Action alternative, based on the assumptions used in the revised simulations. Because the 4+1 and 6+1 alternatives used the same network, and the 3+1 alternative is a subset of that network, infrastructure will not be wasted under any alternative if an incremental approach is considered.
- The improvements at Peninsula Junction and NPJ (increasing the speeds to 25 mph for freight traffic) proved to be very beneficial to all rail operations in North Portland on

UPRR's and BNSF's networks in the area of the connection track under the six Amtrak Cascades*,* Coast Starlight and Empire Builder (6+2) passenger schedules.

The main alternatives for this study—Alternative 1 (revised), Alternative 2 and the No Action with Minimums Alternative—are detailed in the body of this report. Other Alternative 1 options that vary by schedule and infrastructure were run through the modeling software and analyzed. Although these other options are mentioned throughout this report in comparisons, the description of these options and the results of their analysis are included in the supplemental material attached to this report (see Appendices A–F).

2. Revised Alternative 1

Introduction

Alternative 1 (6+1) was revised to standardize the assumptions that were included in the analysis. Like all of the revised analyses, the number of passenger trains between Portland and Vancouver were standardized at six Amtrak Cascades round trips, and the station configuration at Eugene was standardized to the Option 4 configuration. In addition, between Portland and Vancouver, the planned track and the turnouts at NPJ/Peninsula Junction and Willbridge Junction were assumed to be upgraded to allow 25 mph operation.

In addition, six Amtrak Cascades round trips were included between Portland and Eugene in the Revised Alternative 1 (6+1) analysis. However, a major difference between the initial 6+1 case and the Revised 6+1 case was the infrastructure, which was included in an attempt to mitigate the impacts of the additional passenger trains. In the initial 6+1 analysis, a second main track was included for the entire distance between Portland and Eugene. This configuration was found impractical because of the cost to improve certain locations, including those portions going through cities and across major rivers. Instead, the Alternative 1 (4+1) network was utilized in the analysis for the Revised Alternative (6+1). The Analysis Team was asked to utilize this network for the analysis in order to determine whether the improvements associated with the 4+1 network(s) would accommodate six Amtrak Cascades round trips while still improving UPRR's operations over the Revised No Action alternative (for which no additional round trips and no improvements would be added).

Revised Alternative 1 (6+1) Operating Modifications

The only freight modification made on either UPRR's Brooklyn Subdivision or on BNSF's Fallbridge Subdivision was the addition of the Albina Yard to Lake Yard Local. All other projected freight traffic, including growth traffic, was carried over from the Revised No Action simulation, the Revised 3+1 simulation or the Revised 4+1 simulation.

Portland to Eugene Amtrak Cascades round trips were increased to six per day. At the same time, Portland to Vancouver (and north) Amtrak Cascades round trips were reduced from 12 in the initial 6+1 analysis to six in the Revised 6+1 analysis. No other operating modifications were made in this revised Alternative 1 (6+1) case.

Revised Alternative 1 (6+1) Network Modifications

As described previously, the Revised Alternative 1 (6+1) case utilized the Revised Alternative 1 (4+1) improvements that are listed in Appendix D for UPRR's Brooklyn Subdivision. The schematic included in Appendix D for the Revised 4+1 network also reflects the improvements made along the Brooklyn Subdivision that were included in the analysis for the Revised 6+1 case.

Between Portland and Vancouver, the same planned improvements that were included in the Revised 4+1 network were also included in the Revised 6+1 network, primarily the track and the turnout improvements at NPJ/Peninsula Junction and Willbridge Junction to allow 25 mph operation.

Revised Alternative 1 (6+1) Brooklyn Subdivision Results

The premise that the improvements associated with the Alternative 1 (4+1) network could support up to six Amtrak Cascades round trips was correct. The results of the analysis showed that the delay minutes per 10 miles operated were 3.0 for the Revised Alternative 1 (6+1) case. This level of delay remained more than 20% below the delay minutes associated with the Brooklyn Subdivision under the 2035 Revised No Action alternative (see Figure 1, below).

That level of delay minutes per 10 miles operated indicates that the Brooklyn Subdivision was running efficiently under the Revised Alternative 1 (6+1) case on the 4+1 network. Analysis of the major delays and their locations confirms this conclusion.

The Revised Alternative 1 (6+1) case had 3.3 delays per day that exceeded 30 minutes (see Figure 2, below). As Figure 3 below shows, most of those delays were the result of Amtrak meets or freight meets. There were some delays associated with on-line switching, and there were also delays that occurred around various rail yards.

The 6+1 passenger schedules created meets that varied widely over the course of a day. Unlike the 4+1 case, under which most meets occurred between Clackamas and East Milwaukie, the 6+1 meets occurred in five different locations. These were:

- Between Steel Bridge (MP770) and East Milwaukie (MP765)
- Between Coalca (MP750) and Canby (MP746)
- Between Salem (MP718) and Renard (MP714)
- Between Marion (MP704) and Albany (MP690)
- Between Halsey (MP672) and Shedd (MP666)

Analysis of the meet/pass data showed that only one or two freight trains per day were delayed in a single location near where two passenger trains met. This analysis was confirmed by the data on the number of delays exceeding 30 minutes that were caused by Amtrak trains: In the Revised 6+1 analysis, there were only 1.3 such delays per day (see Figure 3, below). Because essentially the same number of delays that exceeded 30 minutes per day could be attributed to freight meets, passenger-passenger meets were not a major cause of repetitive delays in the Revised Alternative (6+1) case analysis.

The Analysis Team believes that the amount of second main track that was included in the 4+1 network protected freight traffic from the passenger meets. Many of the passenger-passenger meets occurred in a segment that featured a second main track, allowing the two trains to pass each other quickly and without a major impact to following or opposing freight traffic. This same benefit was observed on the 4+1 network when only four Amtrak Cascades round trips were included in the Revised Alternative 1 (4+1) case analysis.

Figure 5 also confirms that there was no systematic issue with any single location along the Brooklyn Subdivision. The delays that occurred were spread relatively evenly between Portland and Eugene.

The delays associated with on-line switching occurred at Labish and Albany. As in a previous case, the Labish delay was caused by two trains that had on-line switching duties arriving simultaneously, causing one train to wait. At Millersburg, a train working the industries around Albany (picking up or delivering cars) blocked the Millersburg train from entering Albany Yard. A Portland & Western Railroad (PNWR) train also contributed to this particular conflict. That train had to wait on UPRR's main line for traffic at PNWR's Millersburg Yard to clear. The PNWR train could not leave the Brooklyn Subdivision until switching at that yard ceased, which created additional congestion around Albany on UPRR's track.

Finally, there were some delays associated with entering and exiting yards. One such conflict occurred around Eugene when a single southbound train trying to enter the yard at Irving was delayed by two northbound trains departing the yard at that same location. As was discussed previously, this is a feature of Eugene Yard that is likely to create additional conflicts as traffic volumes increase.

The other yard conflict occurred at Albany when two southbound trains arrived as a northbound train arrived, and another train tried to depart the yard. The model held the departing train in the yard to clear the through traffic, which led to the delay.

Even with the isolated delays that occurred, the Analysis Team believes that, based on the analysis, the 4+1 network efficiently accommodated the 2035 projected freight volumes with the six Amtrak Cascades round trips.

Revised Alternative 1 (6+1) Brooklyn Subdivision Velocity Comparison

The following table provides the velocity of the various train classes on the Brooklyn Subdivision for the Revised Alternative 1 (6+1) case analysis.

Table 1. Revised Alternative 1 (6+1) on 4+1 Infrastructure

Group	Delay	Dwell	Elapsed Time	Miles	Del/10*	Total Elapsed Velocity	Velocity Minus Delay and Dwell
Passenger	2:44:47	11:33:57	103:47:00	5273.8	0.3	50.8	58.9
PNWR	2:29:27	14:48:00	26:09:44	463.3	3.2	17.7	52.2
UP Expedited	8:12:11	7:36:09	76:30:35	2413.9	2.0	31.6	39.8
UP Local	9:10:37	60:26:04	95:41:49	699.6	7.9	7.3	26.8
UP Manifest	19:51:33	68:24:10	210:35:31	4313.3	2.8	20.5	35.3
UP Unit	12:31:18	21:01:11	111:35:48	2609.1	2.9	23.4	33.4
Total Freight	**52:15:05**	**172:15:34**	**520:33:26**	**10499.2**	**3.0**	**20.2**	**35.5**

*Delay/10 = delay minutes per 10 miles operated.

Passenger trains continued to operate at a high velocity using the Revised 6+1 network. Both total elapsed, and elapsed minus delay and dwell velocities were slightly greater than the velocities for the Revised No Action alternative and Revised 4+1 case. The Analysis Team believes that meets that occurred primarily on two main tracks as well as the higher number of passenger trains contributed to this result.

Similar to the results of unit train velocity in the No Action alternative analysis versus the Base analysis, there were additional passenger trains in the Revised Alternative 1 (6+1) case analysis. Since these additional passenger trains added miles where trains were operating at higher speeds, the average velocity of all passenger trains in the network was increased.

Freight velocity was also greater than for the Revised No Action alternative; however, it was slightly lower than for the Revised Alternative 1 (4+1) case. The freight velocity numbers were very similar to those of the Revised Alternative 1 (3+1) case, and, not surprisingly, the delay minutes per 10 miles operated for the Revised Alternative 1 (6+1) and (3+1) cases were very similar as well.

Based on these results, it appears that network configurations used in the Revised Alternative1 (6+1) analysis and the Revised Alternative 1 (3+1) analysis provided approximately the same additional freight capacity with the varied passenger train volumes.

Revised Alternative 1 (6+1) Portland to Vancouver Results

Delays exceeding 30 minutes (D>30 delays) associated with the Revised Alternative 1 (6+1) case analysis were the same as the D>30 delays in the Revised Alternative 1 (3+1) and (4+1) cases. For all of these cases, the delays were notably reduced from the Revised No Action alternative simulation. With the same amount of freight traffic on the segment, the number of delays was reduced to 1.3 per day from 4.7 per day in the Revised No Action alternative (see Figure 7, below). As described previously, the number of Amtrak Cascades and Amtrak round trips (Cascades, Coastal Starlight and Empire Builder) remained the same between the two cases.

As with the Revised Alternative 1 (3+1) and (4+1) cases, the main contributor to the improved performance was the increased speed on UPRR's connection between Peninsula Junction and NPJ, along with the upgraded turnouts at each end of the connecting track. Movements that could continue from BNSF's Fallbridge Subdivision onto the UPRR connection track at 25 mph cleared the area much more quickly, thus reducing delays for UPRR traffic and BNSF traffic operating in the area.

Also, as in the previous cases, the local train working between Willbridge Yard and Lake Yard experienced delay in the Revised Alternative 1 (6+1) case analysis. As previously described, this is a timing issue rather than a specific capacity issue.

The results of the Revised Alternative 1 (6+1) case again support the conclusion that Brooklyn Subdivision passenger and freight operations have little to no effect on Fallbridge Subdivision operations (and vice versa), under the assumptions that were used for these revised analyses.

3. Revised Alternative 2

Two aspects of the Alternative 2 simulation that was performed and analyzed in 2013 were not consistent with other analyses of the various track and train configurations between Vancouver, Washington, and Eugene. These two aspects were: the number of passenger trains between Portland and Vancouver (continuing on to Seattle or Spokane) and an analysis of train velocity over the Brooklyn Subdivision.

Reduced Amtrak Cascades Schedules between Portland and Vancouver

At the time the original Alternative 2 analysis was performed, the Analysis Team was directed to include 12 Amtrak Cascades round trips in addition to one Coast Starlight round trip and one Empire Builder (Spokane Section) round trip between Portland and Vancouver. These numbers of round trips were based on Washington Department of Transportation's long-range projection of passenger round trips that potentially would operate between Portland and Seattle. In subsequent simulations, the Analysis Team was instructed to reduce the number of Amtrak Cascades round trips between Portland and Seattle to six, and to keep the Coast Starlight and Empire Builder round trips the same (one each).

This reduction of Amtrak Cascades round trips was tested in multiple scenarios that focused on Portland to Eugene passenger trains using the Brooklyn Subdivision (as described in other sections of this report and in the appendices), but was never tested for the Alternative 2 network. The results from the multiple Brooklyn Subdivision simulations with the reduced Amtrak Cascades operations between Portland and Vancouver were very similar: the reduced number of passenger trains improved the operation of freight traffic between Vancouver and Portland, and had little impact on freight operations south of Portland.

The Analysis Team strongly believes this same result would be seen if the number of Amtrak Cascades round trips in Alternative 2 was reduced from twelve to six. The main support for this belief is that the track improvements and operational modifications that were used in all of the subsequent Brooklyn Subdivision simulations were also included in the Alternative 2 simulation.

The Alternative 2 network included the planned track improvements at NPJ/Peninsula Junction and near Willbridge Yard between Portland and Vancouver. These improvements were critical in the simulated operations in all scenarios, with or without the reduced Amtrak Cascades operations, because they allowed freight traffic to operate at higher speeds between Portland and Vancouver. Along with reduced passenger operations in the corridor, freight trains encountered fewer conflicts with both passenger and other freight operations, which led to improved performance for all freight traffic. The Analysis Team believes that this effect would be replicated in the Alternative 2 simulation if the Amtrak Cascades round trips were reduced to six.

Additionally, in the Alternative 2 analysis, PNWR trains running from Albany to Vancouver were routed via Beaverton, Banks, United Junction and Willbridge Junction rather than via Labish, Willsburg Junction and the Steel Bridge. This rerouting of PNWR trains improved operations around Portland Union Station in subsequent simulations, whether the Portland to Eugene passenger trains were routed via the Brooklyn Subdivision or via the Alternative 2 network. The Analysis Team has no reason to believe that this improvement in operations would not occur, or would be different, if the number of Amtrak Cascades round trips between Portland and Vancouver were reduced in the Alternative 2 scenario.

Therefore, although the Alternative 2 simulation was never tested with only six Amtrak Cascades round trips between Portland and Vancouver, the Analysis Team is confident that a simulation that reduced the number of round trips would show results similar to the other five scenarios for which the reduced passenger volumes were used. For this reason, the decision was made to not rerun the entire Alternative 2 simulation, but to rerun only that portion that would provide the velocity output needed for further comparisons.

Alternative 2 Velocity Analysis

The second analysis that was not included in the initial Alternative 2 simulation is a comparison of train velocity of various train groups over the Brooklyn Subdivision. Velocity was not analyzed during the initial Alternative 1 and 2 simulations; it was added in later simulations as an additional comparative analysis to complement the delay analyses that were performed.

The Analysis Team conducted the velocity analysis for the Alternative 2 simulation to standardize the analysis of all simulations. The statistics were available in the output of the model; therefore, with some additional breakout of train types, the velocity figures could be developed. The following tables include those velocity figures and a brief analysis of how they compare with the velocities from the other simulations.

Table 2. Brooklyn Subdivision Alternative 2 Train Velocities

Group	Delay	Dwell	Elapsed Time	Miles	Del/10	Total Velocity Elapsed	Velocity Minus Delay and Dwell
Passenger	0:00:00	5:39:00	23:22:46	738.6	0.0	31.6	41.7
PNWR	2:04:11	13:18:00	25:29:21	463.3	2.7	18.2	45.8
UP Expedited	6:53:47	6:06:08	66:03:22	2125.2	1.9	32.2	40.1
UP Local	7:00:22	60:19:04	91:22:41	693.3	6.1	7.6	28.8
UP Manifest	29:23:08	79:54:03	270:46:04	5680.7	3.1	21.0	35.2
UP Unit	10:02:13	11:00:04	68:33:01	1513.7	4.0	22.1	31.9
Total Freight	**55:23:41**	**170:37:19**	**522:14:29**	**10476.1**	**3.2**	**20.1**	**35.4**

Table 3. PNWR OE (Oregon Electric) District Alternative 2 Train Velocities

Group	Delay	Dwell	Elapsed Time	Miles	Del/10	Total Velocity Elapsed	Velocity Minus Delay and Dwell
Passenger	0:54:54	1:12:00	16:10:09	1096.2	0.5	67.8	78.0
PNWR / Total Freight	59:08:23	215:03:15	441:08:43	3588.4	9.9	8.1	21.5

Brooklyn Subdivision

In the following table, the last two columns of Table 2 above have been recreated using the same last two columns from the Revised No Action alternative analysis. The Revised No Action alternative analysis is the simulation that is most similar to the Alternative 2 simulation with respect to infrastructure and train volumes on the Brooklyn Subdivision.

Table 4. Brooklyn Subdivision Alternative 2 Train Velocities vs. Revised No Action Alternative

	Alternative 2		Revised No Action	
Group	Total Velocity Elapsed	Velocity Minus Delay and Dwell	Total Velocity Elapsed	Velocity Minus Delay and Dwell
Passenger	31.6	41.7	47.9	56.9
PNWR	18.2	45.8	18.3	46.0
UP Expedited	32.2	40.1	31.6	39.9
UP Local	7.6	28.8	7.4	27.4
UP Manifest	21.0	35.2	19.6	34.9
UP Unit	22.1	31.9	22.4	33.2
Total Freight	**20.1**	**35.4**	**19.7**	**35.2**

As can be seen in the comparison of the two analyses, the velocities of the various freight train types are similar. This result was expected in the Alternative 2 analysis, because most of the Brooklyn Subdivision was left as a single-track railroad with sidings in the simulation, which was the same configuration that was used in the Revised No Action alternative simulation.

There was a slight improvement in velocities of the Expedited, Local, and Manifest freight categories in the Alternative 2 analysis, because, in the Revised No Action simulation, there were two Amtrak Cascades round trips and a Coast Starlight round trip that continued to operate between Portland and Eugene. In the Alternative 2 simulation, the increased passenger trains operated on the Brooklyn Subdivision only between their layover facility and the I-5 connection in Eugene (approximately 1 mile), and between Oregon City and Portland Union Station. The rest of the subdivision saw no passenger trains, which created fewer conflicts for the freight traffic between Oregon City and Eugene Yard, thus leading to slightly higher velocities over the entire route between Portland and Eugene.

The differences in the passenger velocities stem from the different locations where the passenger trains operated in the Alternative 2 simulation compared to the Revised No Action alternative simulation. As mentioned previously, in the Alternative 2 simulation, the passenger trains were on the Brooklyn Subdivision only between Portland Union Station and the connection just south of Oregon City, whereas in the Revised No Action alternative simulation, the two existing Amtrak Cascades round trips and the Coast Starlight round trip operated over the entire distance between Portland and Eugene. The maximum track speeds between Portland and Oregon City were generally lower than across other locations of the Brooklyn Subdivision, which is why the passenger velocities in the Alternative 2 simulation were less than the passenger velocities in the Revised No Action alternative simulation.

PNWR OE (Oregon Electric) District

Unlike previous simulations that were focused on the Brooklyn Subdivision, passenger operations in the Alternative 2 simulation utilized the PNWR's OE District between Wilsonville and Keizer (North Salem). Therefore, in the Alternative 2 simulation, velocity was calculated for PNWR OE District freight traffic as well as for the UPRR's Brooklyn Subdivision freight traffic.

However, in the previous velocity analyses, no OE District traffic was analyzed, because passenger operations did not operate over the District, nor did they affect OE District freight operations. Therefore, the Analysis Team revisited the Revised No Action alternative simulation and calculated the PNWR freight velocity over the OE District, which provided some comparison to the Alternative 2 velocity that is shown Table 5, below.

The following table compares the PNWR Alternative 2 velocity with the Revised No Action alternative velocity for PNWR's OE District:

Table 5. PNWR Velocities for OE District

Group	Alternative 2		Revised No Action	
	Total Velocity Elapsed	Velocity Minus Delay and Dwell	Total Velocity Elapsed	Velocity Minus Delay and Dwell
Passenger	67.8	78.0	n/a	n/a
PNWR	8.1	21.5	8.2	20.5
Total Freight	**8.1**	**21.5**	**8.2**	**20.5**

As can be seen in Table 5, the PNWR Alternative 2 total elapsed velocity was essentially equal to the Revised No Action alternative total elapsed velocity. However, the Alternative 2 velocity minus delay and dwell was higher than the Revised No Action alternative velocity. The explanation for these results is provided by examining the area that the passenger trains operated over.

There are multiple industries that PNWR serves between Keizer and Wilsonville. In the model, these are simulated by having a local (or multiple locals) stop at the appropriate locations and dwell for a period of time. This was done in both the No Action alternative and the Alternative 2 simulations.

In addition, there was some delay to PNWR trains that had to wait for passenger trains entering or exiting the section between Keizer and Wilsonville. Both the dwell for industry work and the occasional delays at Keizer or Wilsonville are included in the total velocity elapsed statistics.

When total elapsed velocity is considered with the stoppages and delays, the increased track speed that was associated with introducing the passenger operations had little impact on the velocity of PNWR's freight operations. However, when the delays and dwells were removed from the calculations, the increased freight operating speed is apparent. Because only the portion of the OE District between Keizer and Wilsonville was upgraded for the passenger trains, the rest of the OE District remained at existing track speeds. The Analysis Team believes that is why there is only a small increase in velocity.

It is also interesting to note that the average passenger velocity over the PNWR in the Alternative 2 simulation is 78.0 mph when dwell at the proposed Wilsonville station is removed from the calculation. This velocity is very close to the maximum track speed of 79 mph that was assigned to the PNWR track that hosted the passenger trains. The loss of 1 mile per hour is likely due to the acceleration and deceleration of the passenger trains from the Wilsonville station stop.

There was no passenger operation in the Revised No Action alternative simulation on PNWR's OE District; therefore, there is nothing to compare that velocity to in any other simulation scenario.

4. All Revised Simulation Graphics

The following section contains the revised graphics referenced in this report for all of the revised simulations, including those in the appendices.

Figure 1. Freight Delay Minutes/10 miles Operated

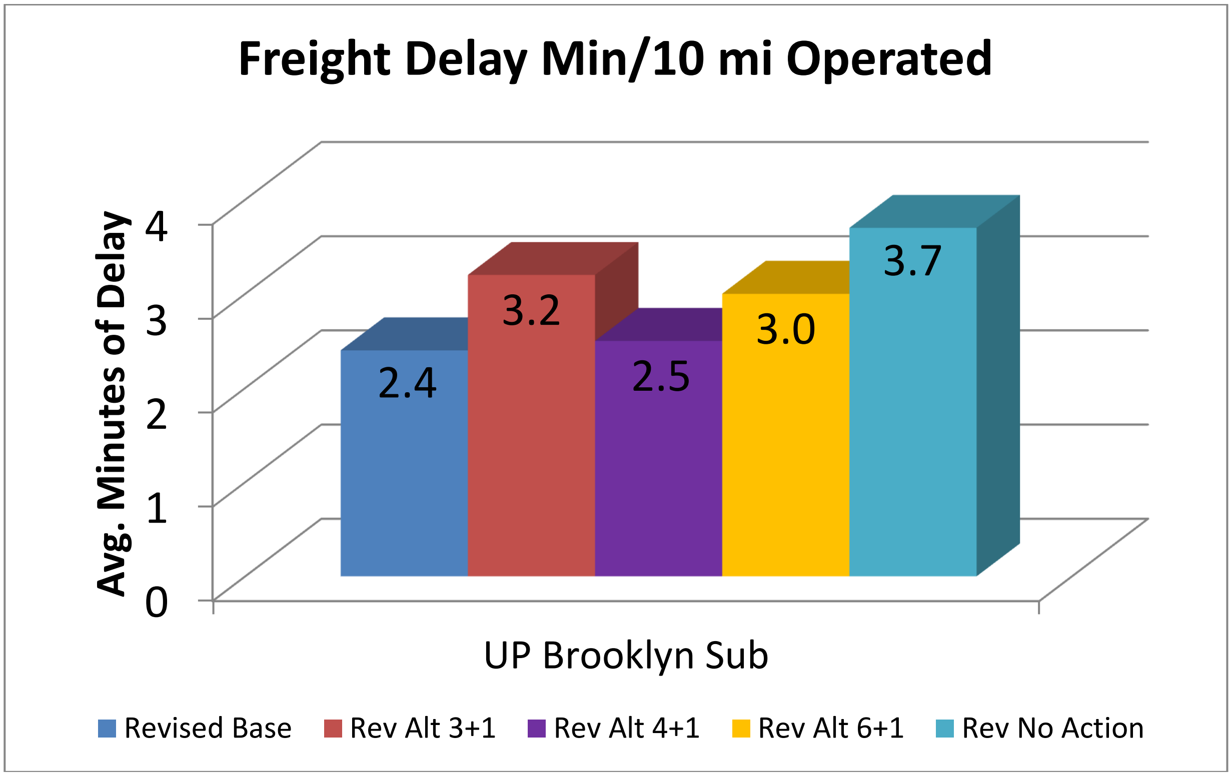


Figure 2. Daily Freight Only Delays Exceeding 30 Minutes (D>30)

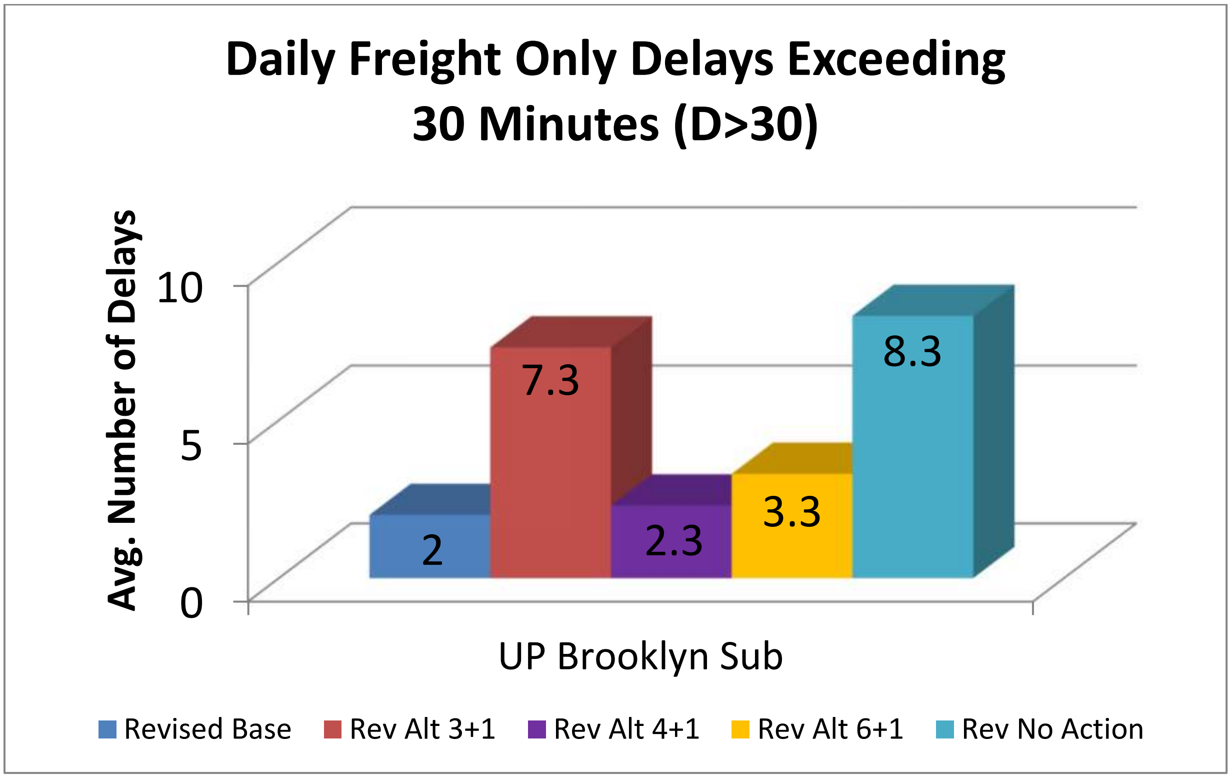


Figure 3. UP Average Freight Only Daily D>30 Causes (3+1, 4+1, 6+1)

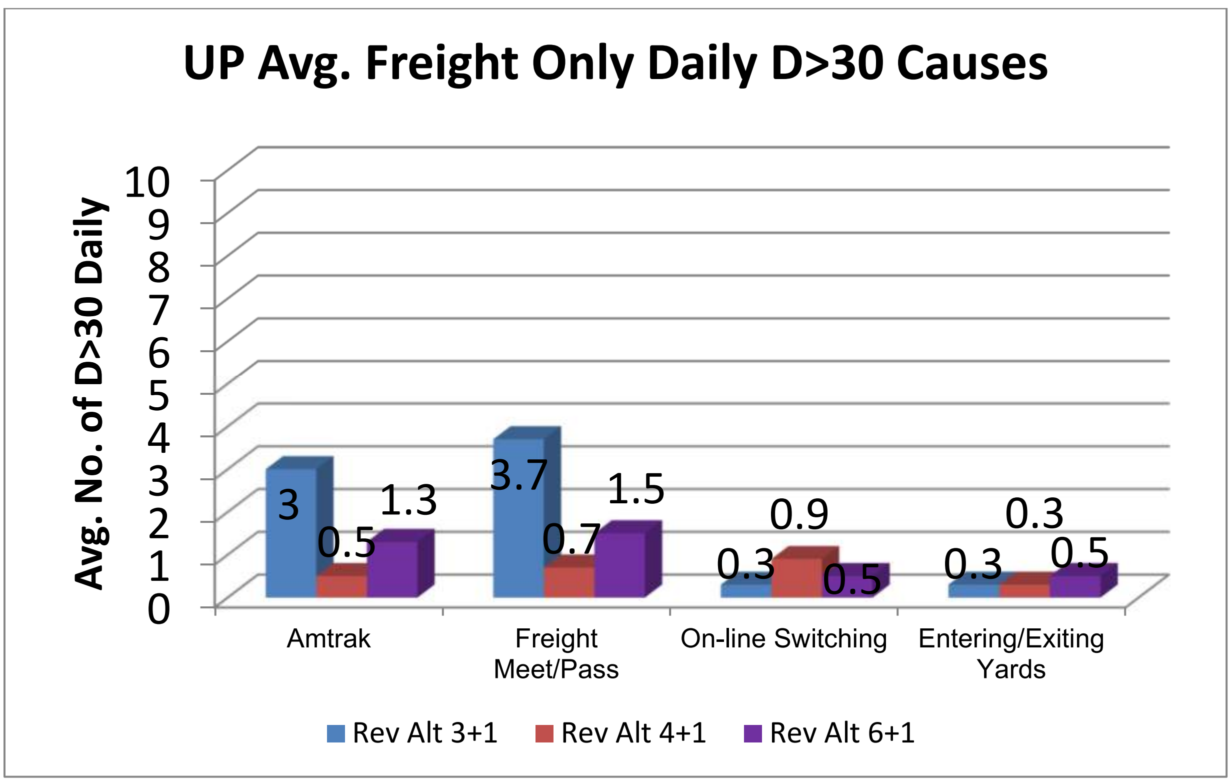


Figure 4. UP Average Freight Only Daily D>30 Causes (Revised Base, Revised No Action)

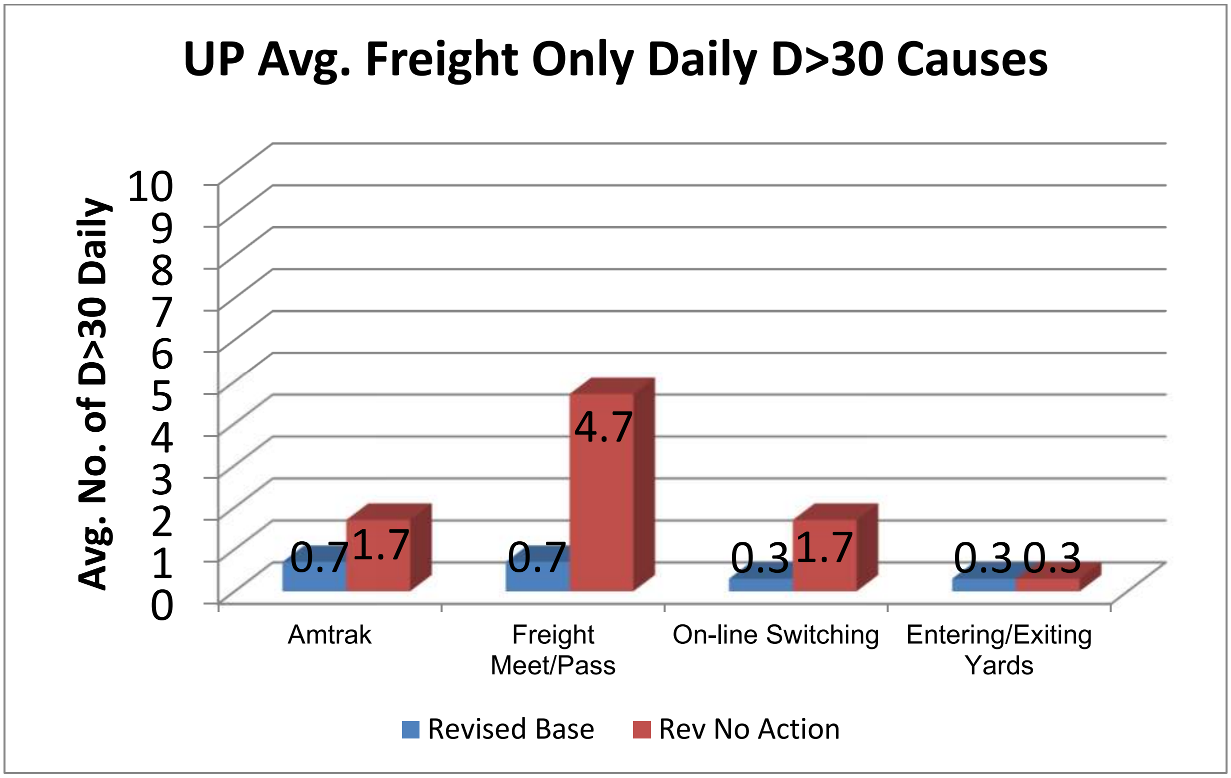


Figure 5. UP Average Freight Only Daily D>30 Locations

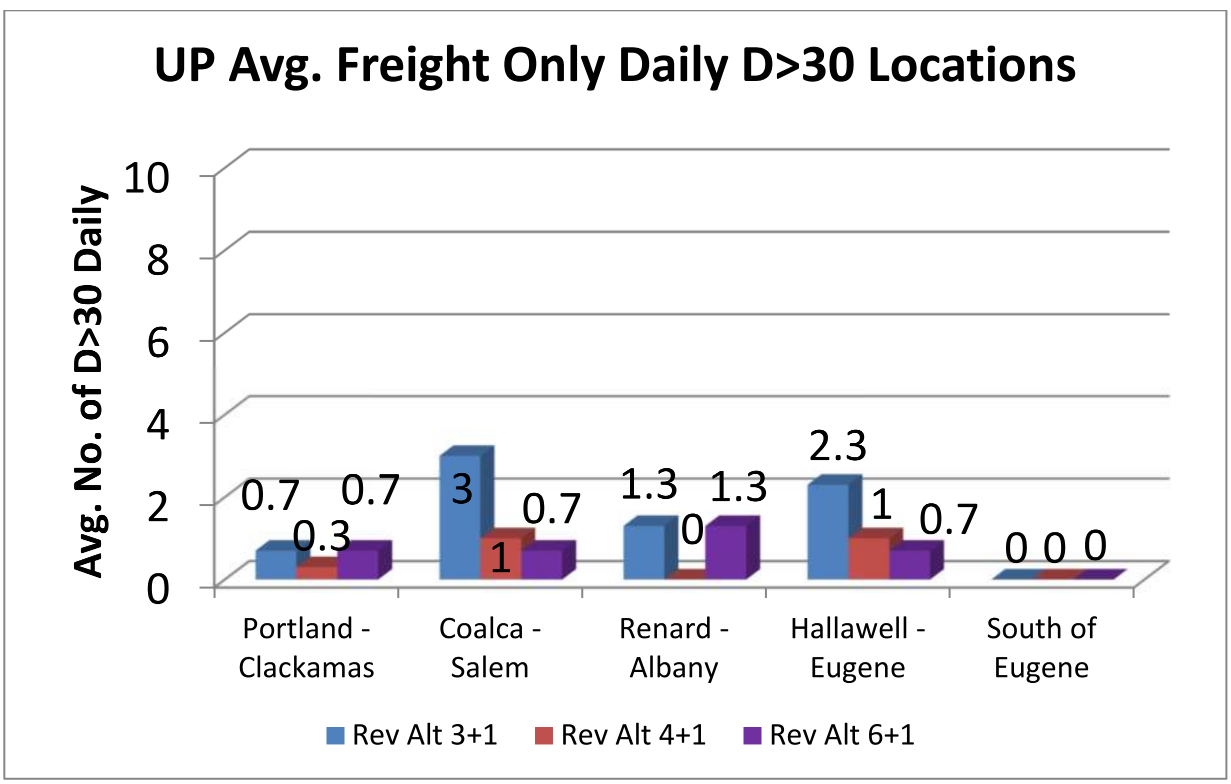


Figure 6. UP Average Freight Only Daily D>30 Locations

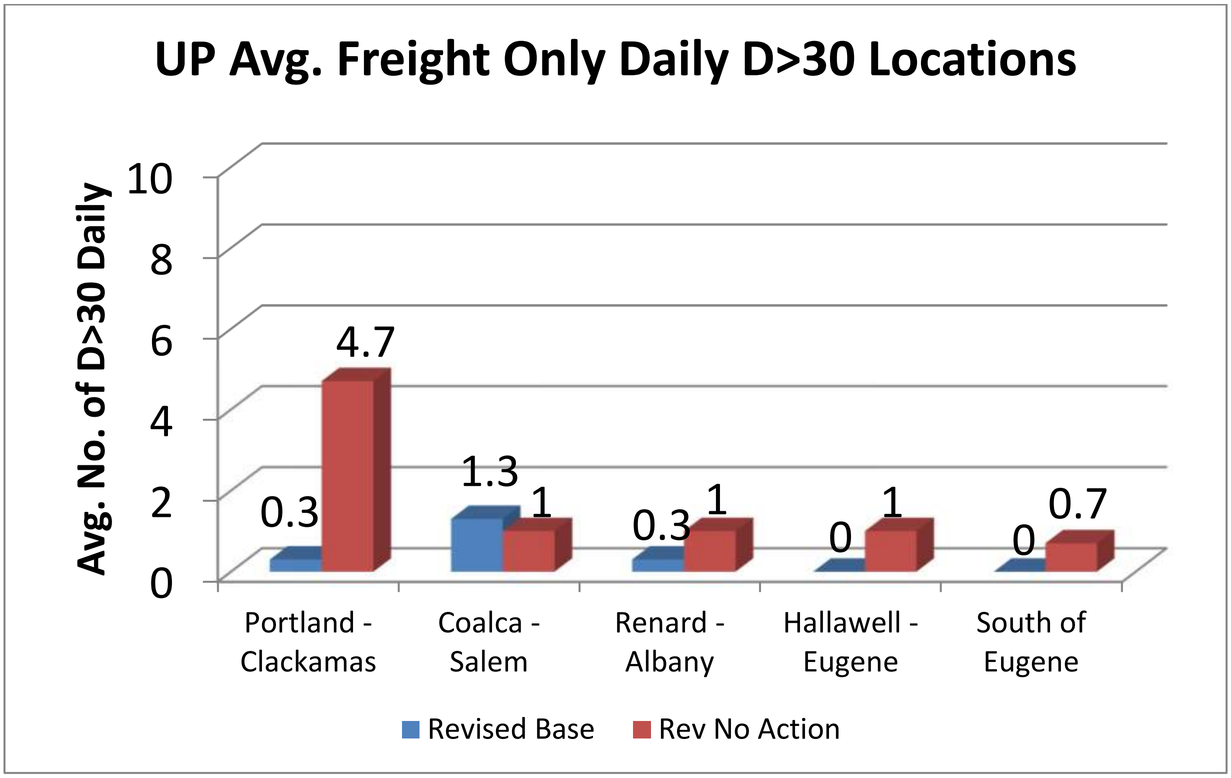


Figure 7. Average Daily D>30 Delays, Portland to Vancouver

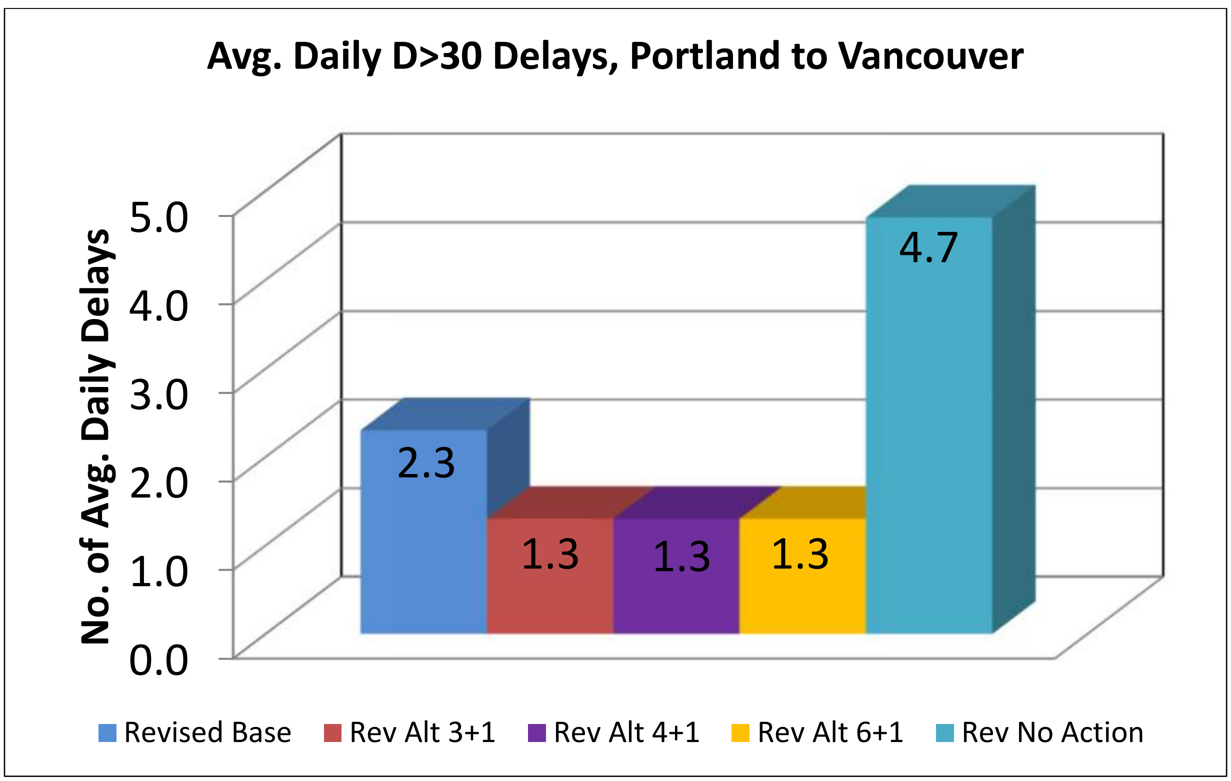


Figure 8. Initial Cause of D>30 Delays, Portland to Vancouver

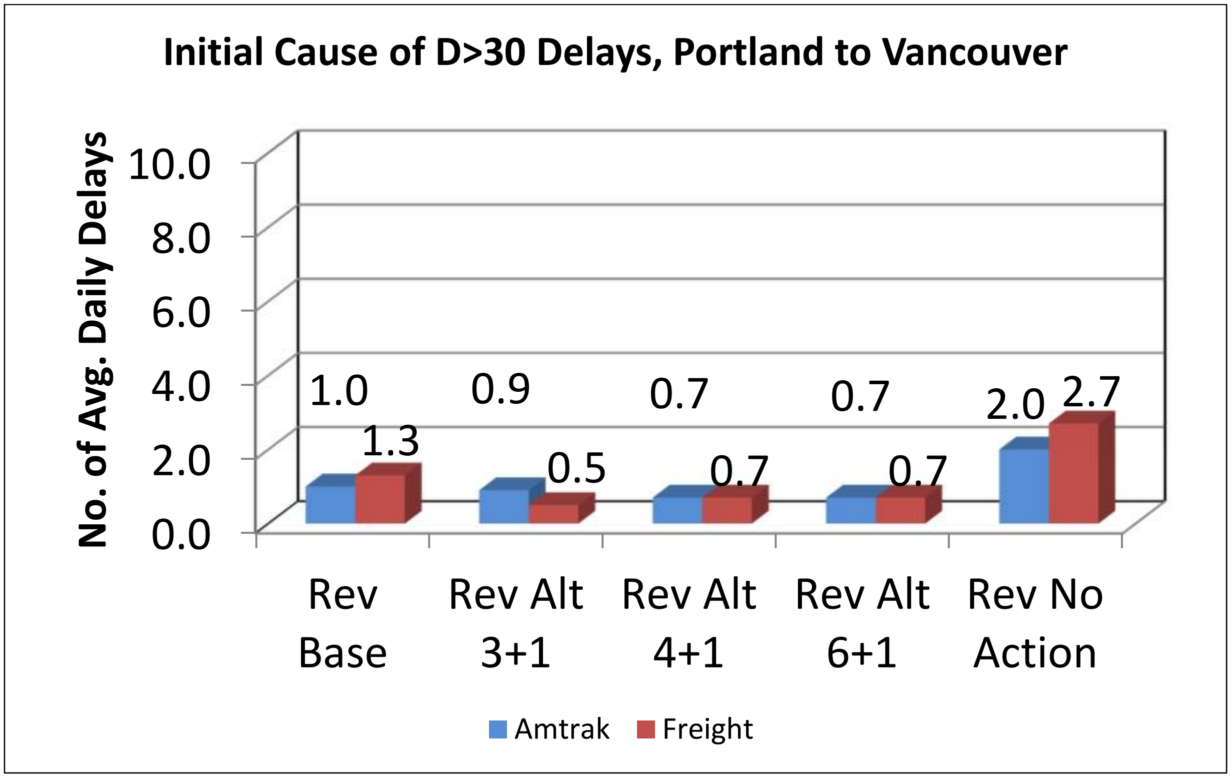
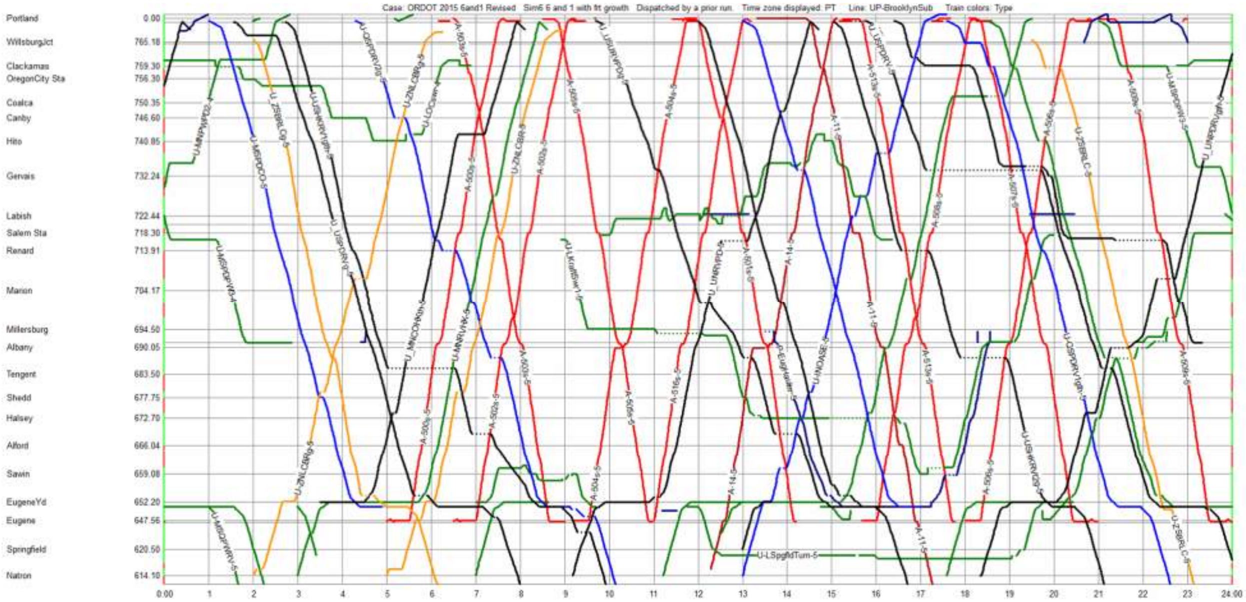
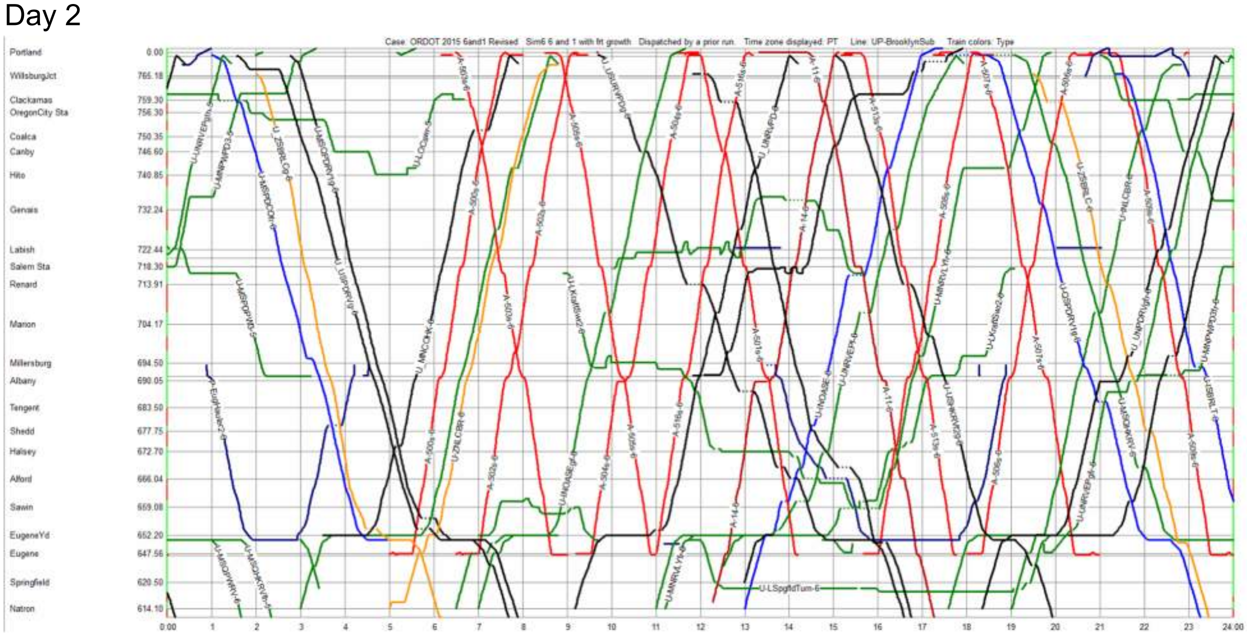


Figure 9. Revised Alternative 1 Stringlines – Day 1-3

Day1

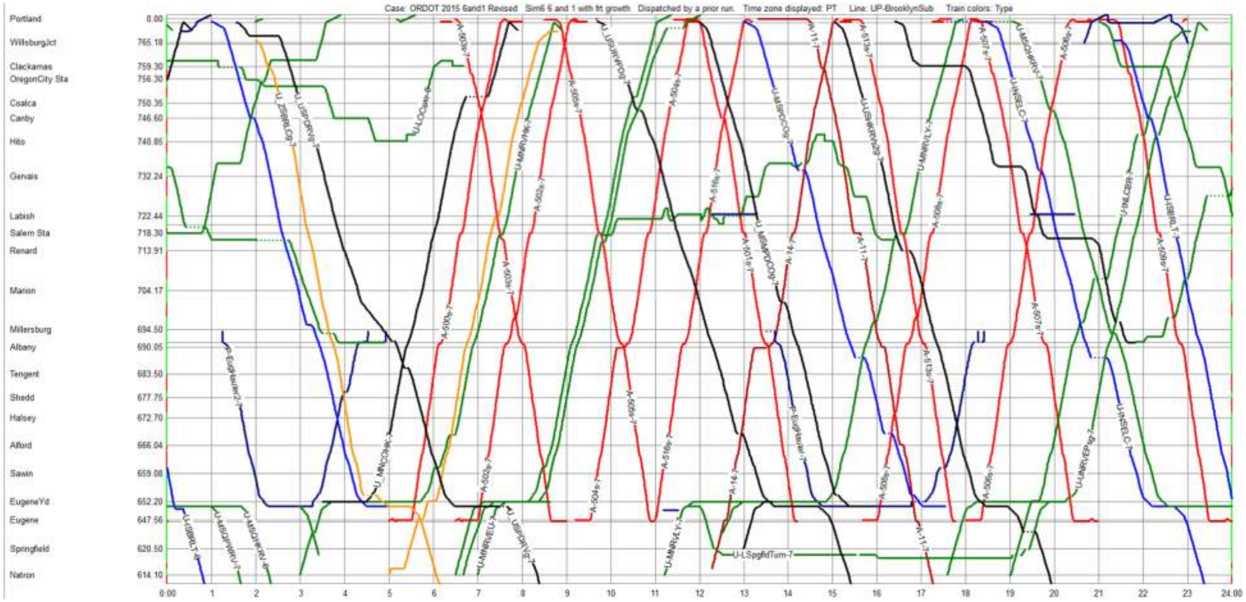


Day 2



Color	Passenger Trains
(red line)	Red - Amtrak Cascades trains
(reddish brown line)	Reddish Brown – Amtrak Coast Starlight
	Freight Trains
(gold line)	Gold – (Z trains) High priority containers for intermodal
(black line)	Black – Unit Trains
(blue line)	Blue – (Q trains - Doublestack) Priority Intermodal
(green line)	Green – Local and Merchandise trains

Day 3



Color	
	Passenger Trains
Red line	Red - Amtrak Cascades trains
Reddish brown line	Reddish Brown – Amtrak Coast Starlight
	Freight Trains
Gold line	Gold – (Z trains) High priority containers for intermodal
Black line	Black – Unit Trains
Blue line	Blue – (Q trains - Doublestack) Priority Intermodal
Green line	Green – Local and Merchandise trains

Table 6. Summary Table of Delays by Type

Delay/10 Miles (Minutes)	Base	No Action	Alternative 1 Rev 3+1	Alternative 1 Rev 4+1	Alternative 1 Rev 4+1 On 3+1 Net	No Action Minimum
Passenger	0.6	0.5	1.0	0.3	0.3	0.6
PNWR	1.3	2.5	3.6	1.4	1.4	1.7
UP Expedited	1.5	2.1	1.8	1.7	1.3	1.4
UP Local	5.2	7.2	10.2	6.1	5.9	8.3
UP Manifest	1.7	4.2	2.8	2.6	2.2	2.1
UP Unit	6.9	3.9	3.0	2.3	3.0	3.2
Total Freight	2.4	3.7	3.2	2.5	2.5	2.6

Avg. Velocity (mph)	Base	No Action	Alternative 1 Rev 3+1	Alternative 1 Rev 4+1	Alternative 1 Rev 4+1 On 3+1 Net	No Action Minimum
Passenger	47.9	47.9	43.8	49.3	48.6	48.3
PNWR	11.3	18.3	17.7	19.0	19.2	18.9
UP Expedited	34.5	31.6	32.4	32.2	33.7	33.1
UP Local	7.7	7.4	7.1	7.5	7.6	7.4
UP Manifest	19.7	19.6	20.6	20.7	21.0	21.0
UP Unit	20.3	22.4	23.4	24.2	23.4	23.0
Total Freight	17.6	19.7	20.2	20.7	20.8	20.6

Velocity minus Dwell and Delay (mph)	Base	No Action	Alternative 1 Rev 3+1	Alternative 1 Rev 4+1	Alternative 1 Rev 4+1 On 3+1 Net	No Action Minimum
Passenger	57.0	56.9	59.1	58.5	58.3	58.2
PNWR	22.3	46.0	46.0	54.7	47.5	46.6
UP Expedited	41.8	39.9	40.4	40.1	40.9	40.3
UP Local	28.9	27.4	27.3	27.2	27.6	27.7
UP Manifest	35.0	34.9	35.5	35.6	35.5	35.0
UP Unit	32.9	33.2	33.8	34.1	34.0	33.5
Total Freight	34.2	35.2	35.7	35.9	35.9	35.4

Delays > 30 min	Base	No Action	Alternative 1 Rev 3+1	 Rev 4+1	 Rev 4+1 On 3+1 Net	No Action Minimum
Passenger	0.0	0.0	0.0	0.0	0.0	0.0
PNWR	0.0	0.0	0.3	0.0	0.3	0.0
UP Expedited	0.7	1.7	1.3	1.0	0.0	0.3
UP Local	0.0	0.7	2.7	0.3	1.0	0.7
UP Manifest	0.3	4.3	1.7	0.7	0.7	0.7
UP Unit	1.0	1.7	1.3	0.3	2.7	1.3
Total Freight	2.0	8.3	7.3	2.3	4.7	3.0

Table 7. Table of Infrastructure Improvements by Case, Alternative 1

	Infrastructure Improvements By Case													Scenarios Included In		
Project Name	Existing Passing Track Begin MP	Existing Passing Track End MP	Existing Passing Track Length (ft.)	Road Crossings on Existing Passing Track	New Passing Track Begin MP	New Passing Track End MP	New Passing Track Length (ft.)	New Track Construction Length (ft.)	New Track on Existing Roadbed (ft.)	New Track on New Roadbed	Undergrade Bridges for New Roadbed	Culverts on for New Roadbed	Road Crossings on New Track	No Action with Mins	4+1 on 3+1 , Revised 3+1	Revised 6+1, Revised 4+1
Judkins Siding Extension	644.6	645.68	5702.4	0	644.6	660.06	81628.8	75926.4	5390	70536.4	6	3	21	✓	✓	✓
Alford Siding Extension	666.1	667.6	7920	1	666.1	670.32	21489.6	13833.6	0	13833.6	3	1	3	□		✓
Halsey New Passing track					670.32	674.07	19800	19800	5096	14704	1	3	4		✓	✓
Hallawell Extension	687.2	688.8	8448	1	683.5	687.28	19958	20064	4753	15311	4	4	4	□	□	✓
Hallawell to Albany Extension					687.28	690	14361.6	1108.8	0	1108.8	2	1	1		✓	✓
Millersburg Extension	694.33	696.12		0	693	697.5	23760	23760	0	23760	2	3	2	□		✓
Marion Siding Extension	704.2	705.8	8448	0	701.17	705.8	24446.4	16843.2	0	16843.2	5	0	3	□	✓	✓
Marion Siding Extension II				0	705.8	706.95	6072	6072	0	6072	-	-	2			✓
Reynard Siding Extension	713.93	715.5	8289.6	0	713.93	716.76	14942.4	6758.4	0	6758.4	1	0	1	✓		✓
Labish Siding Extension	720.4	721.8	7392	2	719.5	727.5	42240	35323.2	8117	27206	1	1	8	✓		✓
Gervais Siding Extension	732.3	733.8	7920	0	732.3	738	30096	22492.8	5733	16759	1	3	5			✓
Coalca Siding Extension	750.1	751.89	9451.2	0	746.48	751.89	28564.8	20380	0	20380	1	3	5		✓	✓
Clackamas/ Brooklyn Yard Extension					758.21	765	35851.2	35851.2	0	25757.25	2	1	5	✓	✓	✓
Clackamas/ Brooklyn Yard New Passing Track					765	770.17	27297.6	27297.6	10094	27297.6	2	0	11		✓	✓

Appendix A-A – Revised Base Case

Revised: October 18, 2016

Revised Base Case

The initial Base Case simulation was performed in 2013. The existing track network at the time was included in the model; as discussed below, that network was revised for the latest Base Case simulation.

Traffic data for the initial Base Case was gathered from various internet sources as well as local knowledge and developed into the simulation. There were only minimal modifications to those train files that were made in the Revised Base Case as noted below.

Revised Base Case Operational Modifications

Two operational modifications were made to the Revised Base Case. The first was the addition of an Amtrak Cascades dead head movement between the Eugene Station and Eugene Yard. The move was made each night and morning to represent storing the last Amtrak Cascades train set in Eugene Yard overnight and repositioning it back to the station for the first movement out in the morning.

The second operational change was inclusion of a Union Pacific local from Albina Yard to Lake Yard and return to handle BNSF interchange traffic. All other trains remained the same between the Revised and initial 2013 Base Cases.

Since a Base Case reflects current operations, but current operations will change between Portland and Vancouver in in 2017, the 2+1 passenger schedule was utilized between Portland and Eugene and the six Amtrak Cascades round trips were included between Portland and Vancouver, WA in the Revised Base Case..

Revised Base Case Network Configuration Modifications

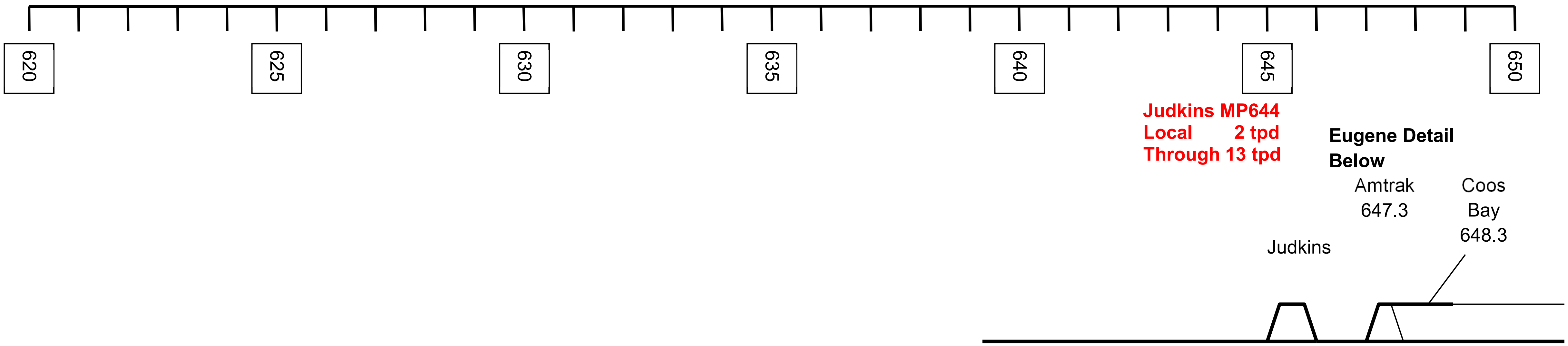
The Revised Base Case network featured two major modifications from the original 2013 Base Case. The first was the inclusion of increased track speeds that UP provided ODOT. These track speed increases affected high priority intermodal trains and passenger trains. The freight trains' maximum speeds were increased from 60 mph to 70 mph and speed zones were set to UP proposed limits for freight and passenger.

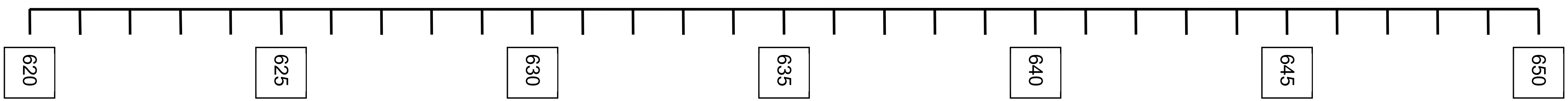
The second improvement was the reconfiguration of UP's Eugene Yard. In the original Base Case, a simplified yard was included because the Analysis Team did not have current track schematics of the yard. Once those schematics were acquired, the yard was updated in all subsequent ODOT/Amtrak Cascades simulations. Upon revising the Base Case, Eugene Yard was reconfigured to match all other simulation cases.

The new configuration of the yard provided more arrival and departure tracks and an additional route to enter or depart the yard. This eased congestion in the Eugene area in the Revised Base Case analysis. An updated schematic representation of the yard and the Eugene Station is shown on the last page of the Base Analysis Network track schematic that is included below.

Freight train counts over various segments have also been included on the schematic; they have been broken into Local movements and Through movements. A Local movement included road switchers that returned to the station they originated from and were responsible for serving local industry along a section of the route. A Through movement ran from one station and terminated at another station, regardless of how far apart those stations were.

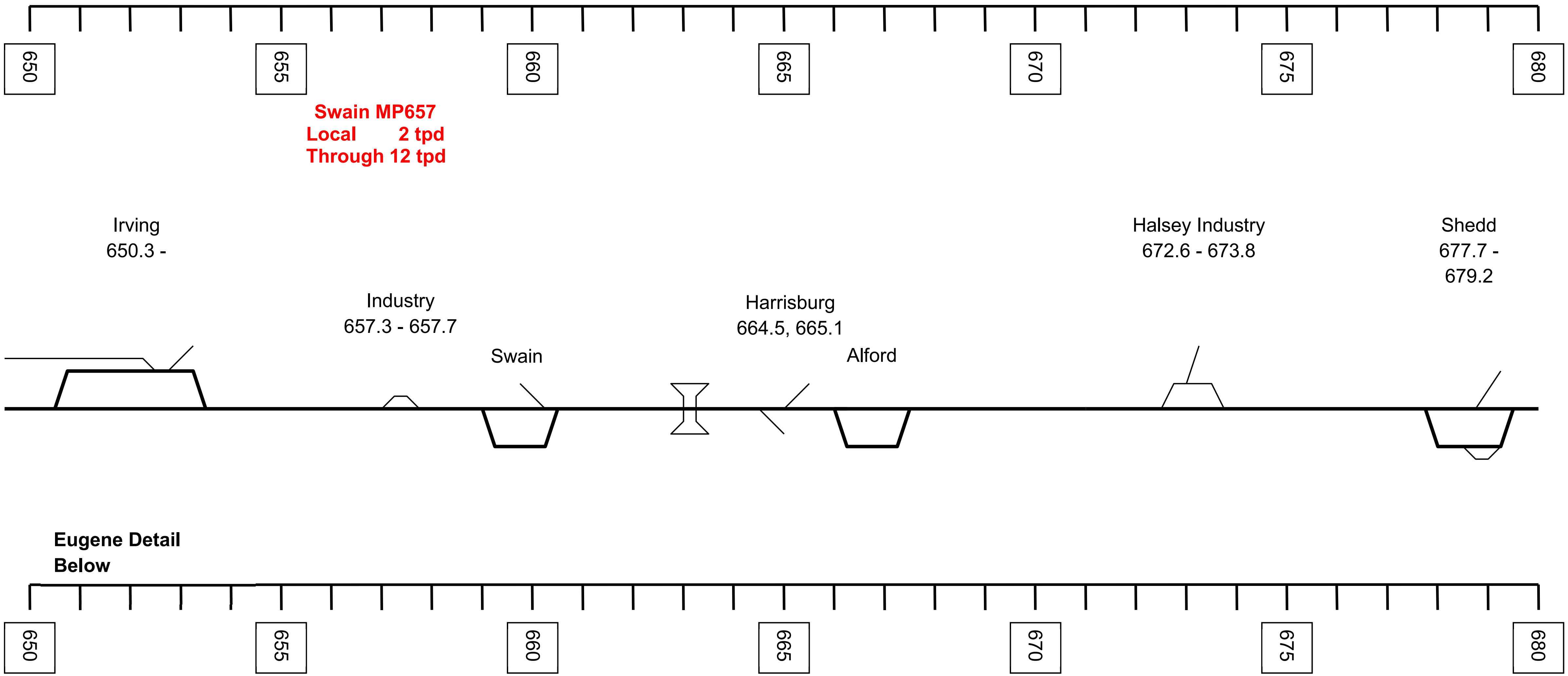
As a general rule, train counts are provided on either side of a yard or terminal. Counts are provided north and south of Eugene, Albany, Salem and Brooklyn Yard. Counts into Albina, across the Steel Bridge and from the Graham Line to/from the south are also included. Passenger train counts have been excluded because those numbers vary by scenario and are described in the Introduction to each scenario.





Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.
Heavy red is new main track or crossovers
UXO = universal crossover (double XO)

Base Analysis Network



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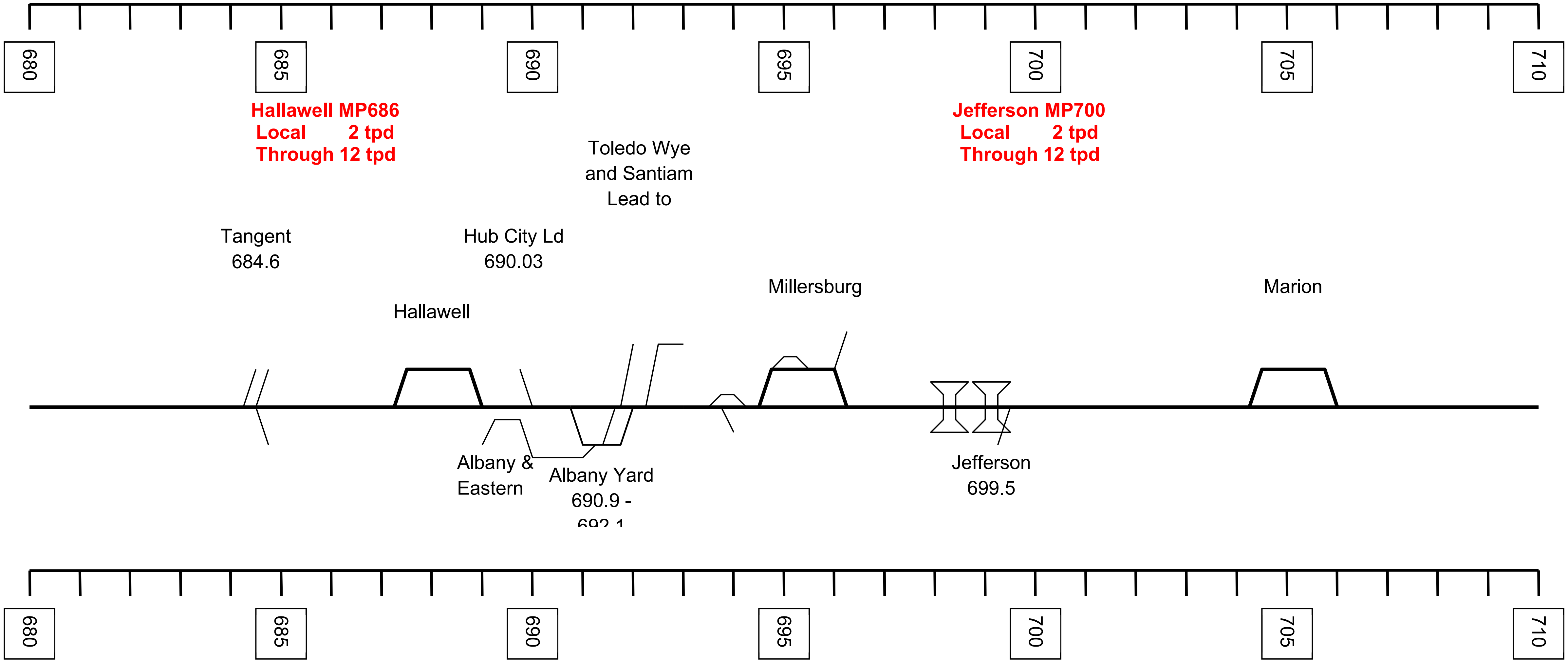

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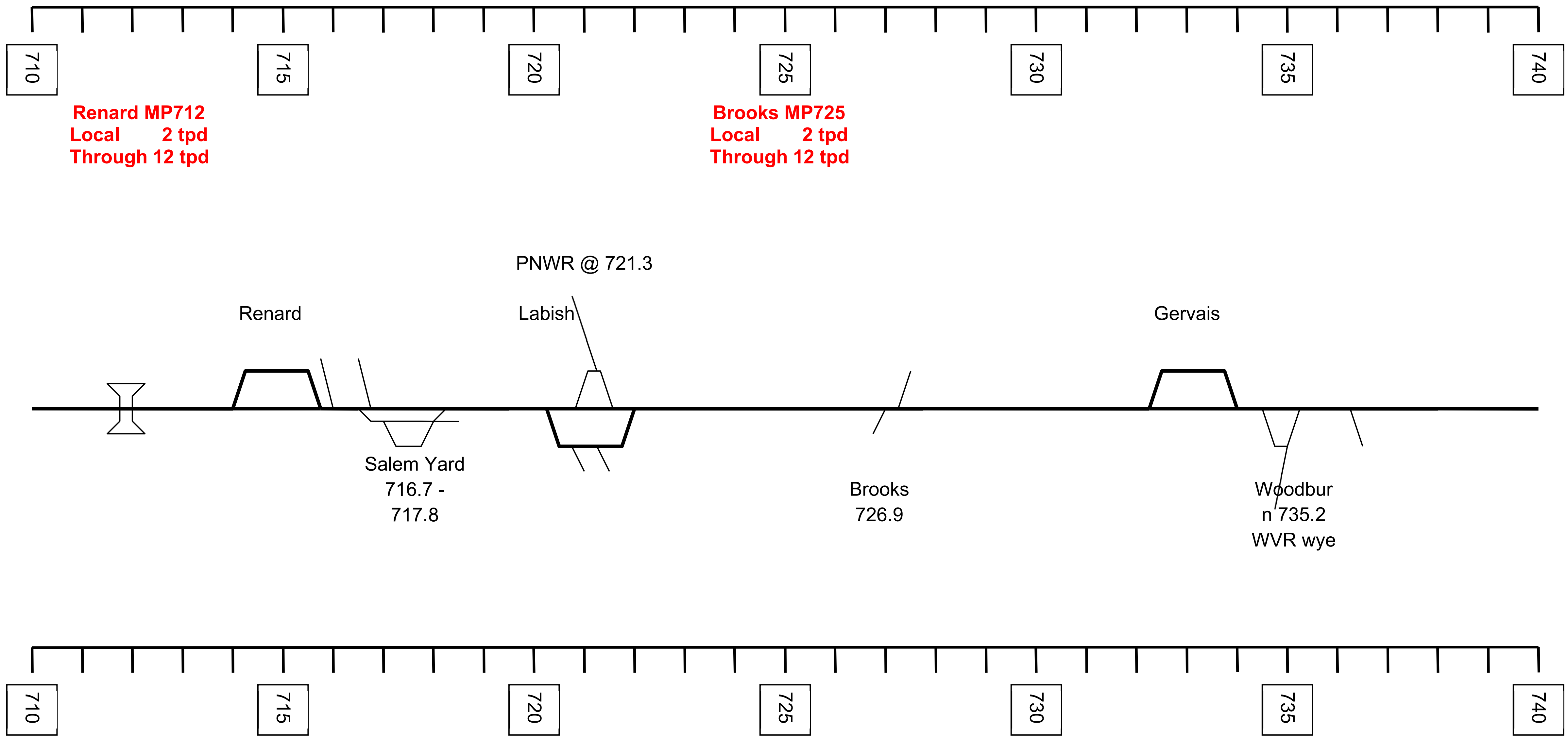

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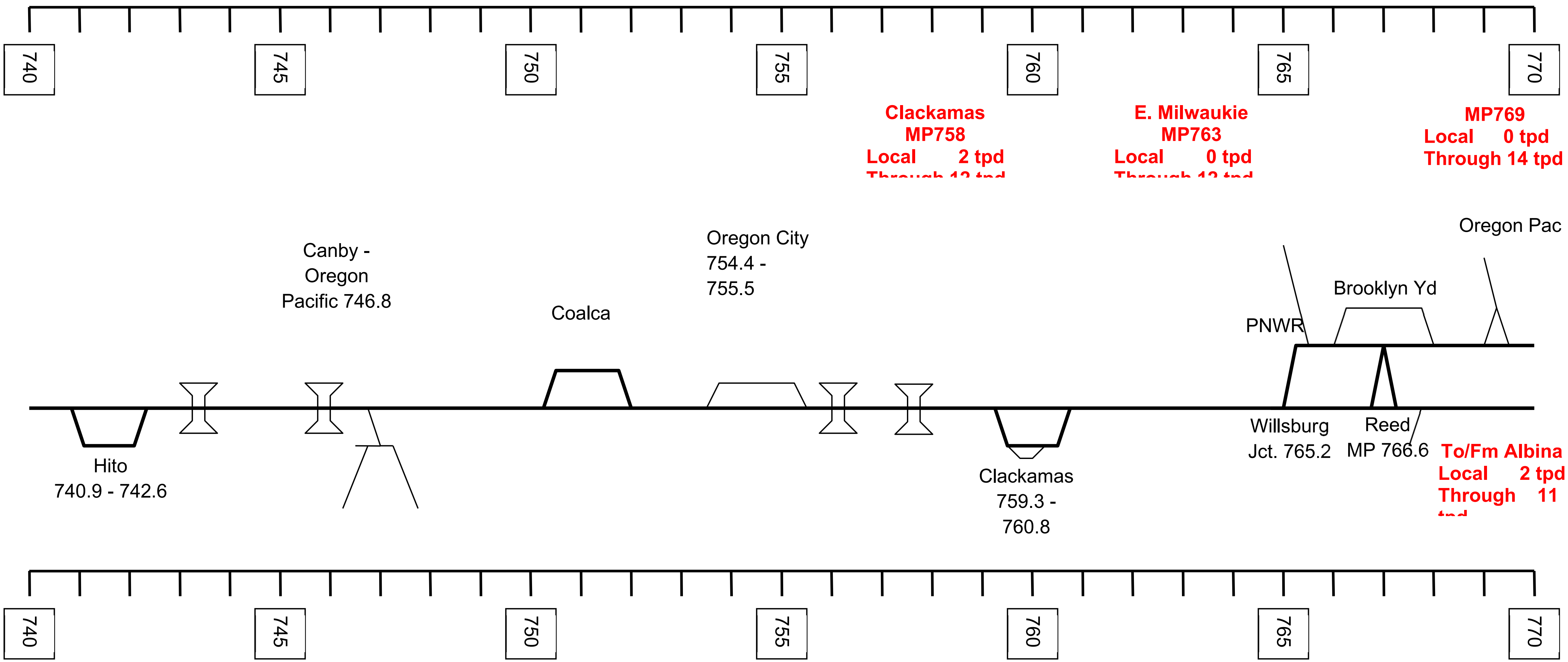

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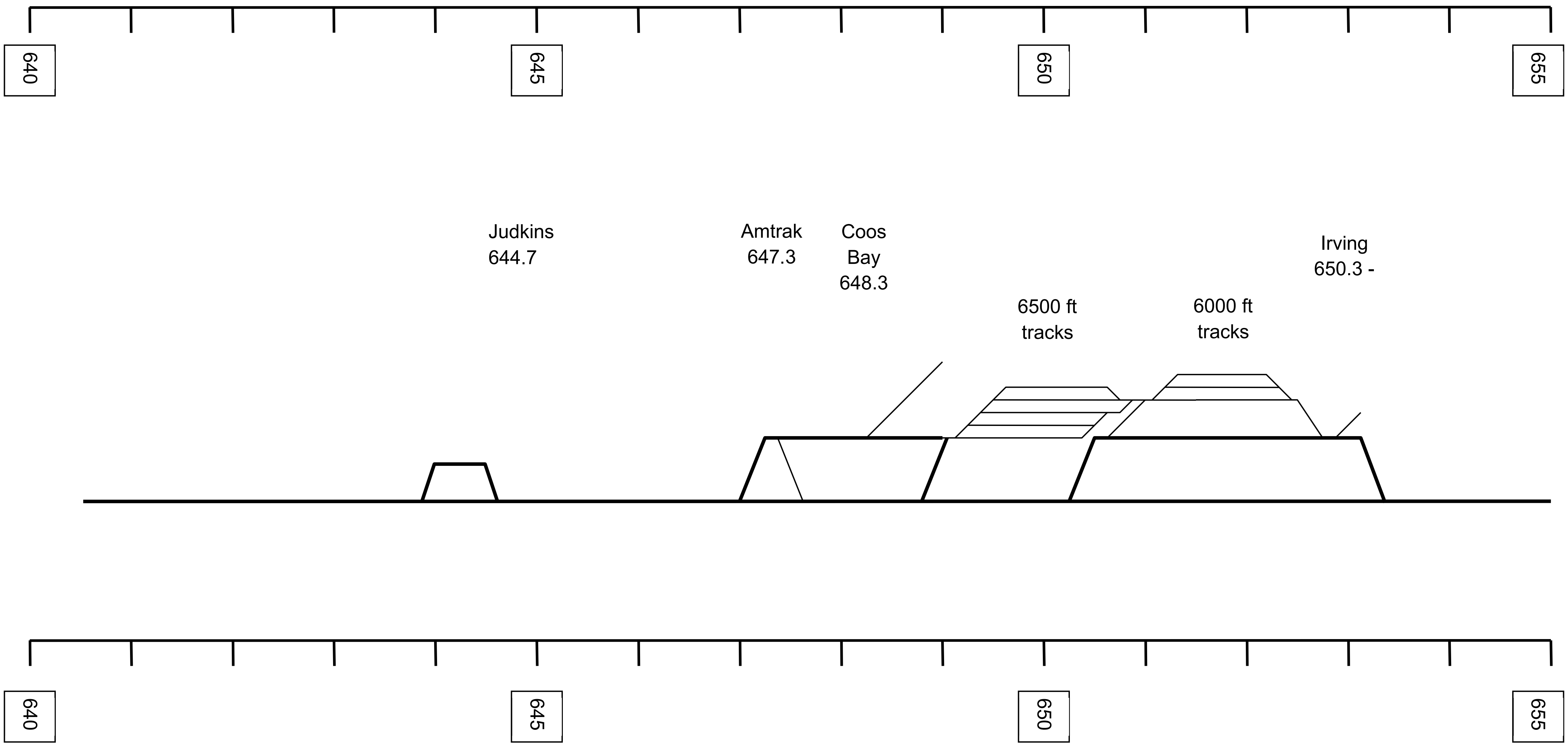
To/From Steel Bridge
Local 2 tpd
Through 3 tpd

Graham to/from South
Local 0 tpd
Through 0 tpd

Base Analysis Network



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Eugene Detail

Revised Base Case Brooklyn Subdivision Results

Per the attached track schematic, the Revised Base Case configuration remained a single track railway with sidings from Natron (MP 616) to East Milwaukie (MP 765). There was a second main track from East Milwaukie to the Steel Bridge (MP 770). As was seen in the initial Base Case analysis, this long section of single track resulted in multiple meet or overtake (meet/pass) delays as trains had to stop in sidings to allow other trains to pass.

There was a reduction in D/10 delay minutes between the initial Base Case and the Revised Base Case. In the initial case, D/10 was 3.3 minutes/10 miles operated as compared to 2.4 minutes/10 miles in the revised case. This suggests the line was operating efficiently under the Revised Base traffic levels.

At the same time, delays exceeding 30 minutes were reduced from seven per day to two per day between the initial and the Revised Base Cases. Analysis of the results indicated that there were two reasons that the Revised Base Case experienced a reduction in delays and delay minutes. The first was the speed increases that UP provided and the second was the updating of the Eugene track network and yard configuration. The most prominent reductions occurred in two areas; between Clackamas (MP 760) and Salem (MP 718) and between Hallawell (MP 687) and Natron.

As previously mentioned, the speed increases affected the passenger trains and the highest priority intermodal trains. Those speed increases reduced delays to other UP traffic that was waiting for either of those train types. Overtakes by the faster trains required less time than in the previous model because of the track speed increases. Also, meet delays with higher priority trains were reduced because of the increased speed of the approaching trains.

This was particularly evident between Clackamas and Salem. In the initial Base Case, there were four delays per day that exceeded 30 minutes. In the Revised Base Case, that number dropped to 0.7 per day. The increase in speeds changed the timing of trains over the entire Brooklyn Sub network, and with those changes, some of the longer delays were reduced.

It also appeared that the new version of the model did not hold freight trains as far away from meet points with Amtrak trains as did the previous model version. There were fewer Amtrak/freight meets that exceeded 30 minutes in the Revised Base Case as compared to the initial Base Case.

Another factor was the modification of the Eugene Yard complex to better represent movements into and from the yard. In the initial 2013 Base Case, there were 2.5 delays per day that exceeded 30 minutes in the general area of the Eugene Yard. Based on analysis, it appeared that many of those delays were associated with entering or exiting the yard because of the simplified infrastructure configuration that was used. In the Revised Base Case, the yard infrastructure configuration was expanded to better represent the actual track lay-out, and that reduced the D>30 to no occurrences in the three days of the most recent simulation.

Revised Base Case Portland to Vancouver Results

In the Revised Base Case, the line segment between Portland and Vancouver was operating efficiently. There were 2.3 delays per day that exceeded 30 minutes during the 2015 simulation.

Review of the delays showed there was a split between the initial causes of the delays. Just under half the delays that exceeded 30 minutes were caused by passenger train conflicts, while just over half were caused by freight conflicts.

The delays initiated by freight movements occurred in two particular locations. The first was in the area of North Portland Jct. and involved UP operations. Since the Revised Base Case did not feature the improved connection between Peninsula Jct. and NPJ, UP trains operated into and over that segment at speeds below 10 mph. This created delays to UP traffic moving from BNSF's Fallbridge Sub to Peninsula Jct., and to BNSF movements trying to leave from the Port of Portland's T6 facility.

The other location that experienced repetitive freight initiated conflicts was in the area of Willbridge Yard. A local switch engine that had to work at Lake Yard was regularly held at Willbridge because another switch assignment was already working in Lake Yard. The second main track could not be used because of an Amtrak Cascades train departing from Portland towards Seattle at the same time. Therefore, the second local movement had to wait until both the Amtrak Cascades train and the switch engine cleared before being able to advance.

Delays initiated by Amtrak trains occurred in multiple locations ranging from Vancouver Yard to Willbridge. The timing of the freight movements and the 6+2 Amtrak Cascade/Coast Starlight/Empire Builder (Spokane/Portland Section) schedules determined where many of the delays occurred. The new local that was added that operated between Albina Yard and Lake Yard (and return) was not affected by either passenger or freight operations in the simulation.

Graphs comparing the Revised Base Case statistics with other cases are included later in the report.

Revised Base Case Brooklyn Sub Velocity

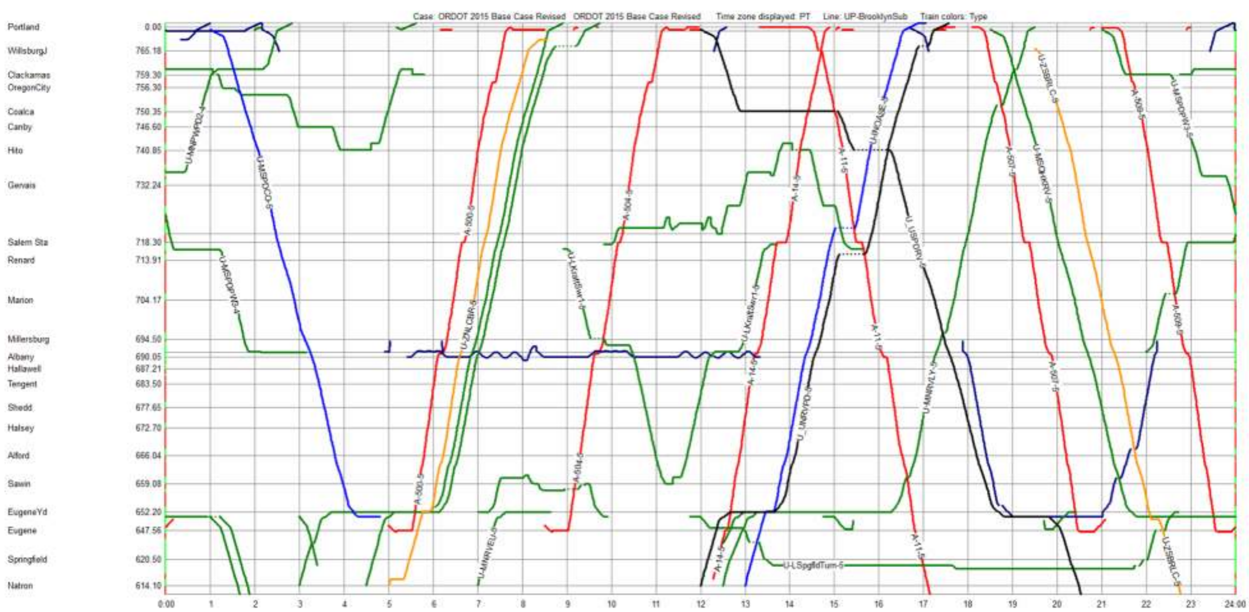
The following table breaks down the velocity of traffic types that operated over the Brooklyn Sub in the Base Case. Velocity of each train group was calculated using the miles that the group operated divided by either 1) the Elapsed Time for the group or 2) the Elapsed Time minus the Delay and Dwell totals for the group. The Total Freight velocity is the same calculations using a sum of all freight mileage, Elapsed Time, Delay and Dwell.

The Portland & Western (PNWR) statistics included in the table refer to only PNWR operations that occurred on UP's Brooklyn Sub. Other PNWR operations on PNWR's OE District or on the Westside District were not analyzed or included in the velocity calculations that are included in this report.

Alternative Revised Base **Group**	**Delay**	**Dwell**	**Elapsed Time**	**Miles**	**Del/10**	**Velocity** **Total** **Elapsed**	**Velocity** **minus Delay** **and Dwell**
Passenger	2:08:21	5:36:21	48:35:48	2330.0	0.6	47.9	57.0
PNWR	0:52:43	16:25:00	34:50:56	392.1	1.3	11.3	22.3
UPExp	4:05:49	4:02:05	46:23:04	1599.1	1.5	34.5	41.8
UPLocal	6:03:42	61:08:51	91:28:21	700.1	5.2	7.7	28.9
UPMani	7:46:46	54:00:33	141:38:27	2794.0	1.7	19.7	35.0
UPUnit	4:47:57	3:00:02	20:24:54	414.6	6.9	20.3	32.9
Total Freight	23:36:57	138:36:31	334:45:42	5899.9	2.4	17.6	34.2

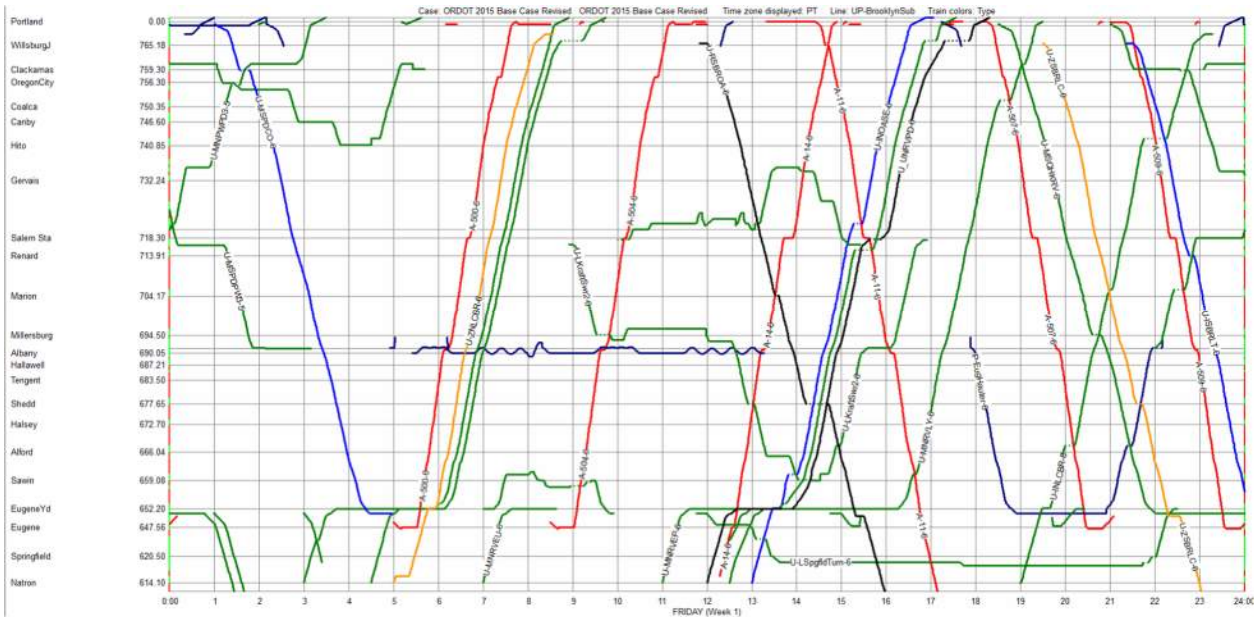
Base Case Stringlines

Day 1

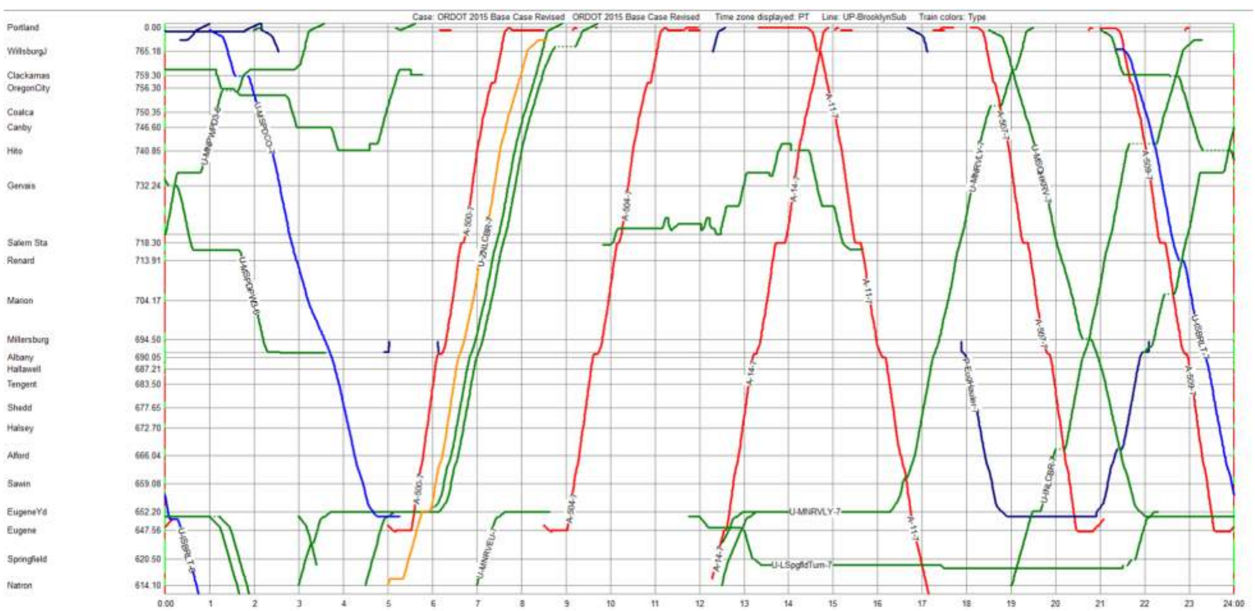


Color	**Passenger Trains**
	Red - Amtrak Cascades trains
	Reddish Brown – Amtrak Coast Starlight
	Freight Trains
	Gold – (Z trains) High priority containers for intermodal
	Black – Unit Trains
	Blue – (Q trains - Doublestack) Priority Intermodal
	Green – Local and Merchandise trains

Day 2



Day 3



Color	Passenger Trains
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	Freight Trains
Gold line	Gold – (Z trains) High priority containers for intermodal
Black line	Black – Unit Trains
Blue line	Blue – (Q trains - Doublestack) Priority Intermodal
Green line	Green – Local and Merchandise trains

Appendix A-B – Revised No Action

Revised: October 18, 2016

2035 Revised No Action Alternative

Introduction

Under the 2035 Revised No Action simulation, the existing Base Case track infrastructure was used, however freight traffic was increased to projected 2035 freight growth levels. This scenario represented the level of service that UP and BNSF would be expected to experience if no further action was pursued to expand passenger operations.

2035 Revised No Action Operational Modifications

Freight growth was added to the 2035 Revised No Action Case. Growth was projected using a compounded annual rate of 1.5 to 1.7% for the through freight movements. UP and BNSF intermodal and manifest trains were increased using this method.

Union Pacific unit train growth was projected based on anticipated growth of new classes of traffic. Projected growth of oil and grain trains to California from the upper Midwest and Canada drove this growth. Two to three loaded trains per day (and their associated empty trains) were included to represent the potential traffic levels in this corridor.

The local between Albina Yard and Lake Yard was also added to the 2035 Revised No Action Case.

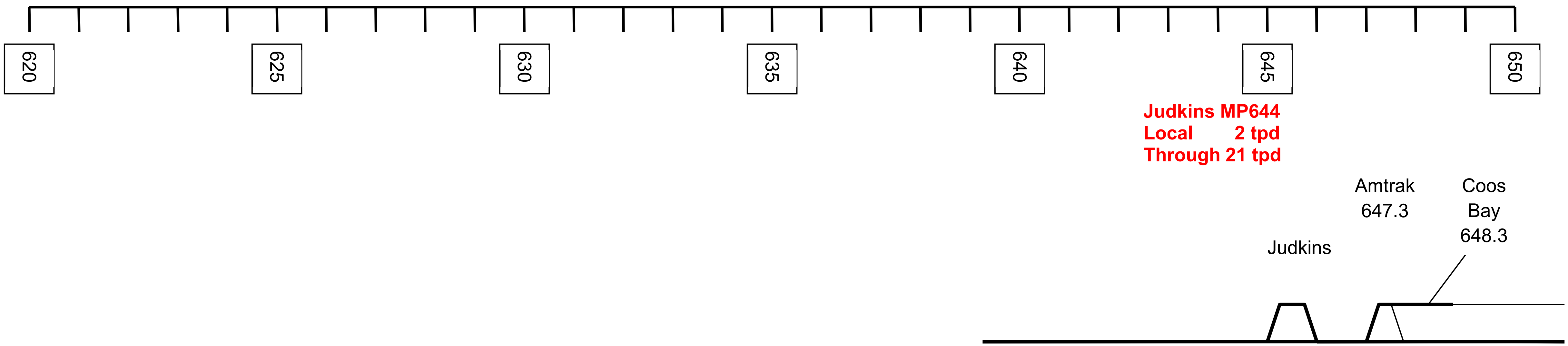
Portland to Eugene passenger traffic was not modified in this analysis. Two Amtrak Cascades round trips and the single Coast Starlight round trip (2+1) were included in the simulation over the Brooklyn Sub. Portland to Vancouver passenger operations continued to use the 6+2 schedule of the Revised Base Case as well. This was a reduction of passenger traffic in this corridor from the initial No Action Case, which included 13 Amtrak Cascades round trips between Portland and Vancouver (and continuing north.

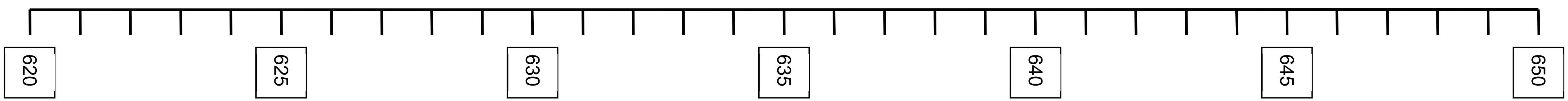
2035 Revised No Action Infrastructure Modifications

There were no infrastructure modifications between the Revised Base Case and the 2035 Revised No Action alternative along the Brooklyn Sub. There were also no improvements made to the network between Portland and Vancouver on either BNSF's Fallbridge Sub or on UP's connection track between Peninsula Jct. and NPJ.

Freight train counts over various segments have again been included on the 2035 Revised No Action schematic, which has been included below. As with the Base Network Schematic, the train volumes have been broken into Local movements and Through movements, which are described above. The locations of where the train counts were taken are the same as in the Base Network, so a comparison of growth can be made from location to location.

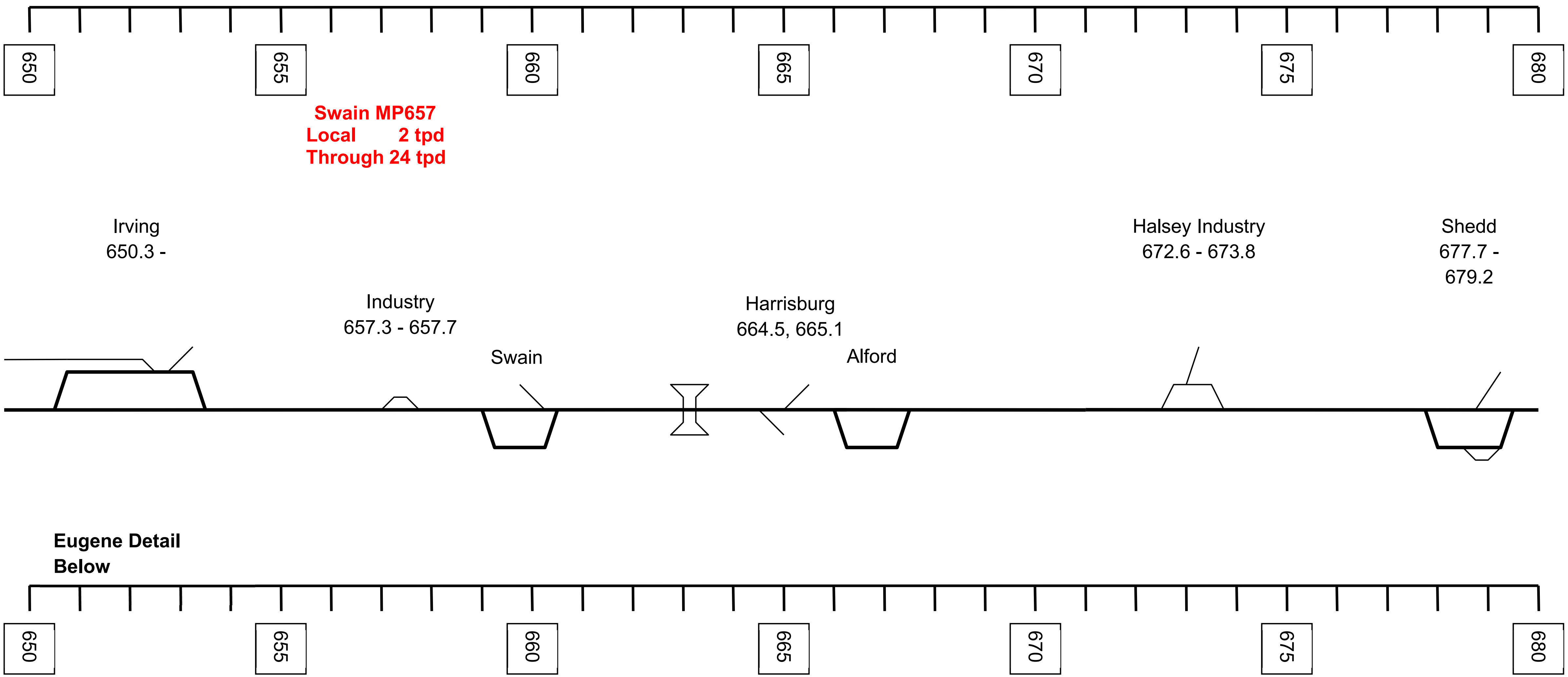
The train counts in the 2035 Revised No Action also represent the train volumes that were included in all additional 2035 passenger scenarios. These counts can be referenced for all of the following alternatives if train volumes are required.





Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.
Heavy red is new main track or crossovers
UXO = universal crossover (double XO)

No Action Analysis Network



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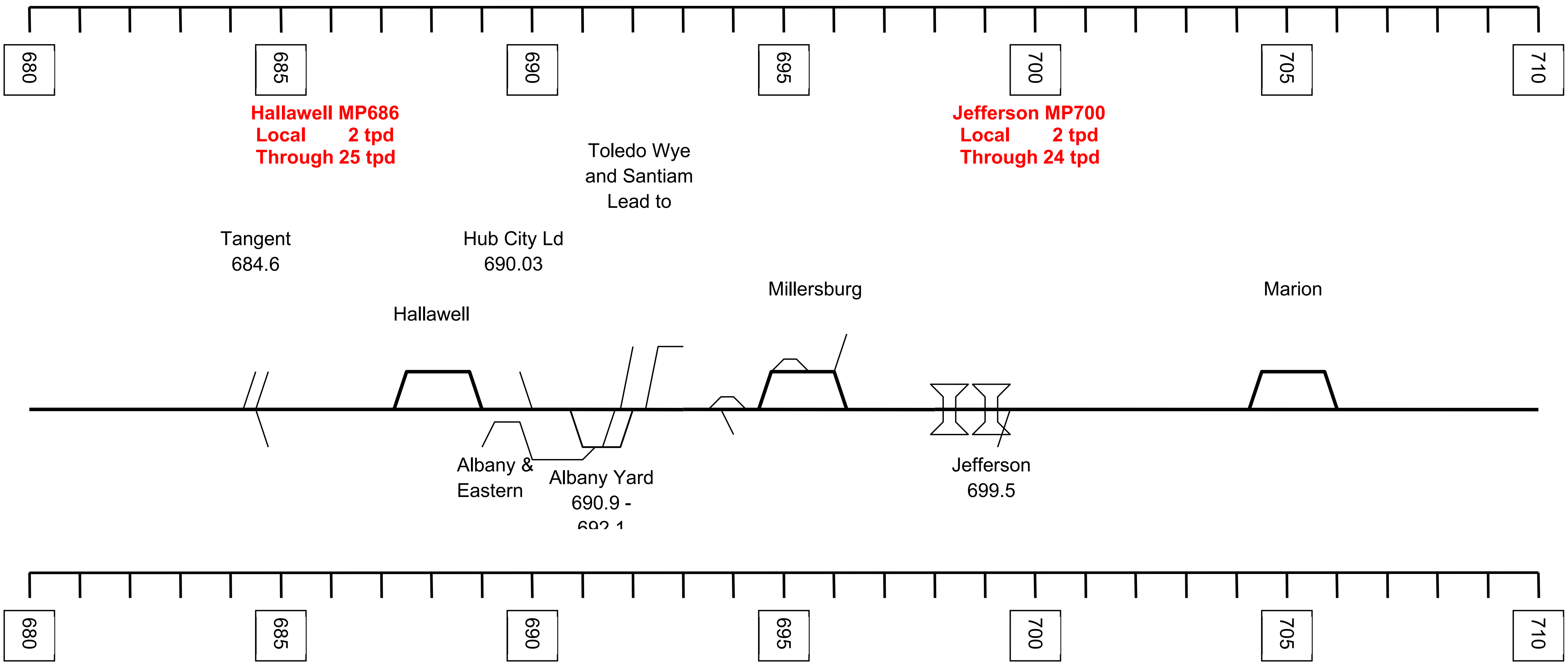

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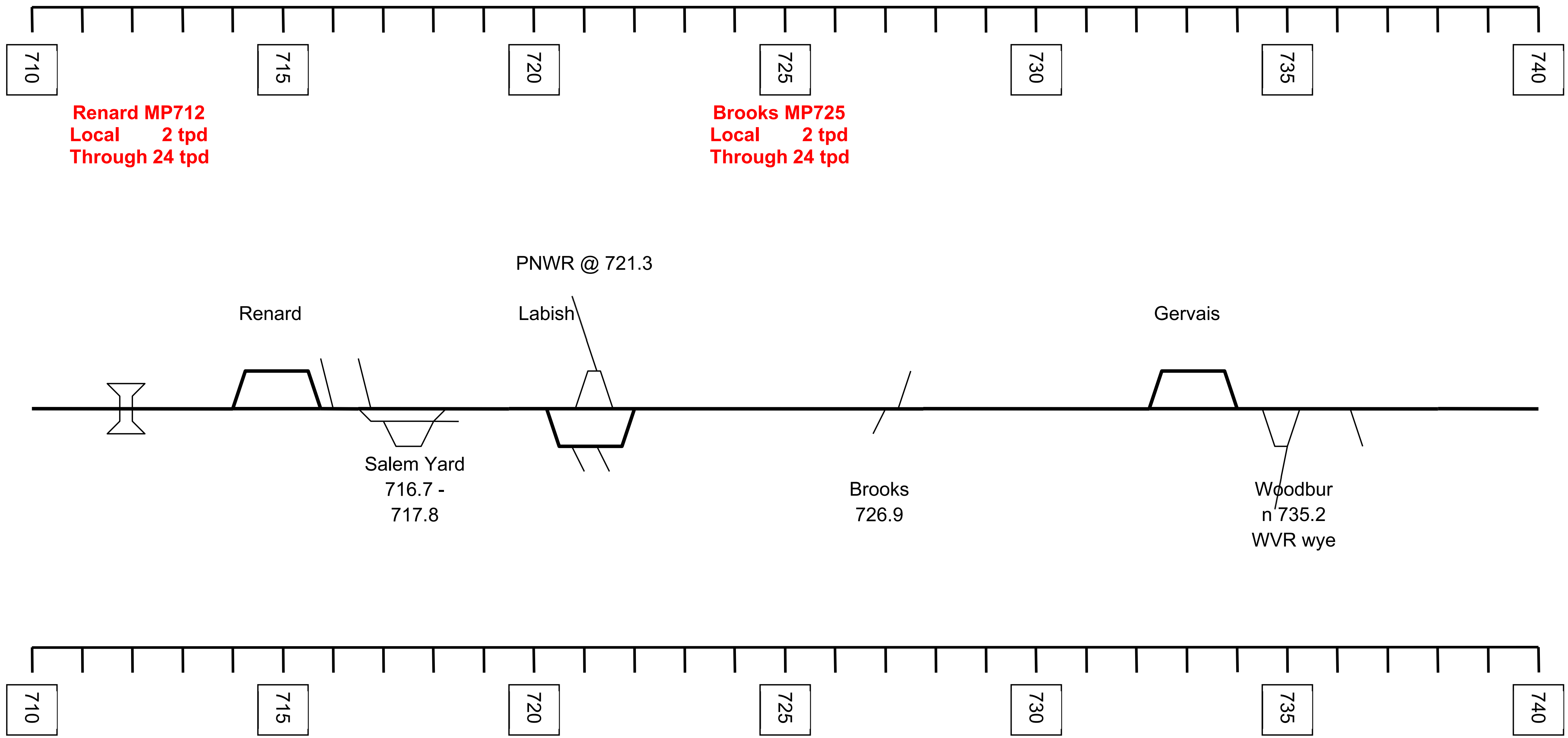

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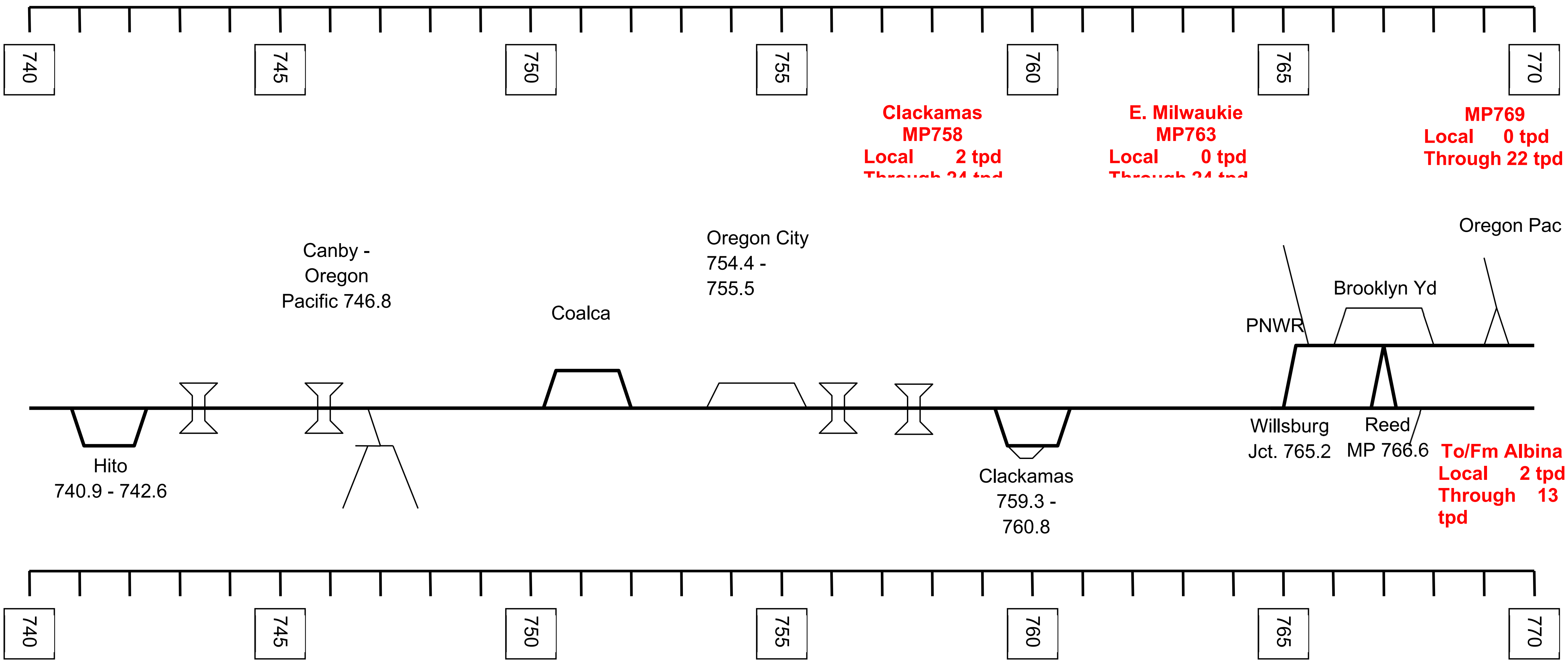
No Action Analysis Network



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No Action Analysis Network

2035 Revised No Action UP Brooklyn Sub Results

The delay minutes per 10 miles operated (D/10) increased in the 2035 Revised No Action Case compared to the Revised Base Case. D/10 was 3.7 minutes per 10 miles operated vs. 2.4 minutes per 10 miles in the Revised Base Case (Graph 1 below). This result indicated that while the line segment was more congested with the freight growth, the line continued to operate efficiently.

The increase in delay was not unexpected. 2035 growth projections added additional trains to the line segment which created more potential conflicts. Since the line remained a single track network with sidings between East Milwaukie and Natron, all meets and passes had to occur at a siding, which caused a delay to one of the trains involved. With greater freight traffic levels, more meets or overtakes that involved three or more trains occurred.

Delays that exceeded 30 minutes increased from two per day to 8.3 per day under the 2035 Revised No Action Case (Graph 2 below). Many of these delays occurred from meets/overtakes that involved more than a single train meeting or overtaking another single train. Delays associated with on line switching or entering yards also caused some of the delays that exceeded 30 minutes (Graph 4 below).

With additional freight trains on the route, there was an increase in meets with passenger and other freight traffic. As Graph 4 shows, there were many more freight-freight meets that caused delays than freight-passenger meets. Since passenger train volumes were not increased in this analysis on the Brooklyn Sub, this was not unexpected. Most of the conflicts that led to delays that exceeded 30 minutes were meets or overtakes by multiple trains; single train meets rarely caused a delay that exceeded 30 minutes.

There were delays caused by on line switching in the 2035 Revised No Action Case. With increased on line freight work and through trains, there were more opportunities for one group to be delayed by the other group. In some cases, the through trains waited until the on line switching was completed, and in other cases, the switching trains were delayed until the through trains completed their operations.

This was particularly true around Clackamas in the 2035 Revised No Action Case, where there were a number of on line switching and meet delays. When multiple trains were switching in the area (the local trains switching industry and through trains that were setting out or picking up cars), other through trains became blocked. The blocked trains remained between East Milwaukie and the Steel Bridge, or in the Coalca (MP 750) and Hito (MP 741) sidings.

In the evening, a high priority intermodal train from Brooklyn Yard was scheduled to operate to the south at the same time that much of the switching was taking place. That train forced some of the switching activities to be delayed until the high priority freight was clear of the area. This further delayed trains in the sidings or on the second main track on either side of Clackamas.

Graph 6 shows the location of many of the delays that exceeded 30 minutes. The results reflect the delays that were caused by the track configuration and traffic levels around Clackamas.

Another location that experienced some delays associated with on line switching was between Eugene and Hallawell. Again, a local that was assigned to work at locations between those two points conflicted with through traffic moving to or from Eugene. In most cases, RTC delayed the local in the Alford (MP 666) or Swain (MP 660) sidings until the through train traffic cleared.

The single track section between the south end of Eugene Yard (MP 649, MP 650) and Natron also contributed to some delays that exceeded 30 minutes. Northbound trains waiting in Natron siding for trains coming out of Eugene Yard experienced those types of delays. Frequently, the northbound train had to wait for at least two southbound trains from Eugene to clear before being able to proceed. In many cases, the southbound trains had to run first to clear tracks in Eugene Yard so the northbound train had a clear track in which to arrive.

Judkins Siding is between Natron and Eugene. The siding is only 5,200 feet in length. Since all of the through trains in the analysis exceeded 6,000 feet in length, only local trains that were less than 5,000 feet could utilize Judkins in the model. In reality, some through trains are less than 5,000 feet, so they would be able to use that siding which was not reflected in the model.

Revised No Action Brooklyn Sub Velocity Comparisons

The following table provides the velocities of the various traffic groups for the 2035 Revised No Action analyses. As previously discussed, the PNWR results only reflect PNWR operations that occur on UP's Brooklyn Subdivision.

Alternative Revised No Action						Velocity	Velocity
						Total	minus Delay
Group	Delay	Dwell	Elapsed Time	Miles	Del/10	Elapsed	and Dwell
Passenger	2:04:34	5:36:21	48:38:18	2330.4	0.5	47.9	56.9
PNWR	1:55:29	13:18:00	25:17:51	463.3	2.5	18.3	46.0
UPExp	8:15:50	7:46:09	76:34:19	2418.3	2.1	31.6	39.9
UPLocal	8:21:57	60:26:04	94:17:23	699.7	7.2	7.4	27.4
UPMani	30:53:49	69:24:11	228:12:45	4466.5	4.2	19.6	34.9
UPUnit	16:48:57	21:02:05	116:17:54	2608.3	3.9	22.4	33.2
Total Frt	66:16:01	171:56:29	540:40:11	10656.0	3.7	19.7	35.2

The velocities in the Revised No Action Case are somewhat mixed compared to the Revised Base Case. Passenger velocities are essentially the same between the two cases. This indicates that passenger traffic in both cases was treated equally by the model on the Brooklyn Sub.

From the freight perspective, PNWR and UP unit train velocities are slightly greater in the No Action Case, and UP expedited and UP local velocities are slightly less in the No Action Case. UP manifest traffic velocity remained essentially constant between the two cases.

The overall average velocity (total elapsed time) actually increases in the Revised No Action Case as compared to the Revised Base Case. This is because the total velocity of freight trains is a weighted average of all trains on the corridor. In particular, the increase in UP unit traffic in the Revised No Action Case (2608 miles operated vs. 414 miles operated in the Revised Base Case) created a higher overall freight velocity by outweighing the types of trains where velocity was equal or slightly less in the No Action Case. The higher velocity for unit traffic in the Revised No Action Case is a function of how this category of trains was dispatched, when they ran and the number of conflicts that they incurred in the simulation.

Revised No Action Portland to Vancouver Results

Similar to the Brooklyn Sub, BNSF's Fallbridge Sub experienced an increase in delays exceeding 30 minutes in the 2035 Revised No Action Case (Graph 7 below). The number of delays increased from 2.3 to 4.7 between the Revised Base Case and the 2035 Revised No Action Case. The increase in freight traffic in the corridor was responsible for this upsurge.

As Graph 8 below shows, the breakdown between delays initially caused by passenger trains vs. those caused by freight trains indicates that freight traffic initiated a greater number of those delays. There were three locations that experienced repetitive freight congestion.

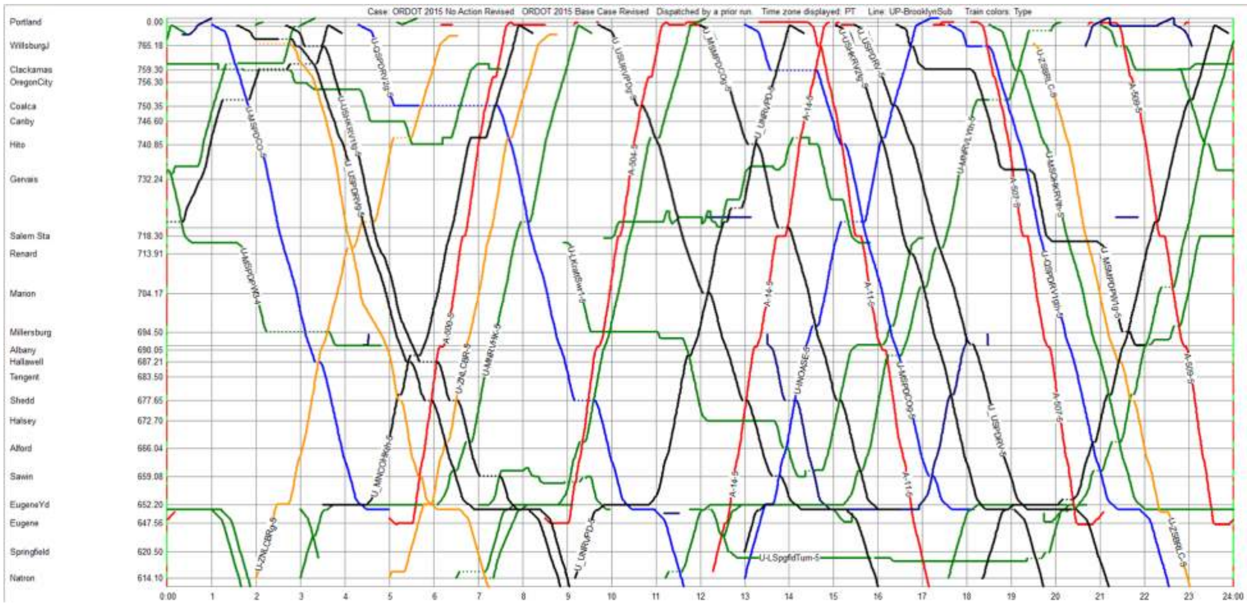
The first area was Vancouver for southbound trains. Southbound UP and BNSF traffic as well as westbound BNSF traffic from the Fallbridge Sub frequently stopped and waited on northbound UP trains entering the network at North Portland Junction. The southbound traffic coming from Seattle waited at Vancouver until the traffic cleared; the westbound trains from the Fallbridge Sub waited between the Columbia River Bridge and McLoughlin until the train traffic cleared. Some of the southbound trains also affected switch engines that could not leave BNSF's Vancouver Yard until the traffic cleared.

North Portland Jct. was another location that experienced multiple delays. Again, since no infrastructure improvements were included on UP's connection between Peninsula Jct. and NPJ, trains operated at less than 10 mph into, over and through that segment of track. This led to trains being stopped on BNSF's Fallbridge Sub waiting for UP trains coming from Portland via Peninsula Jct. Some of the trains waiting at NPJ delayed other train traffic in the Vancouver area which was previously discussed.

UP trains also had to wait around Peninsula Jct. for passenger and other high priority north-south traffic on BNSF's Fallbridge Sub at NPJ. The increased traffic flow combined with the slow track speed contributed to many of the delays around this area.

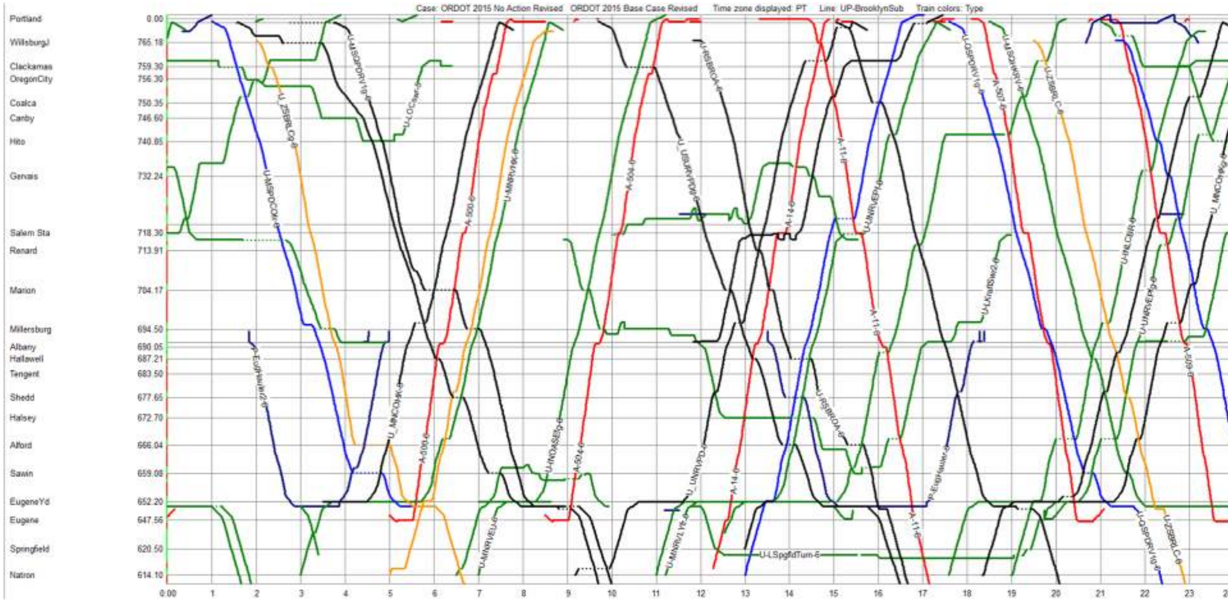
Revised No Action Stringlines

Day 1

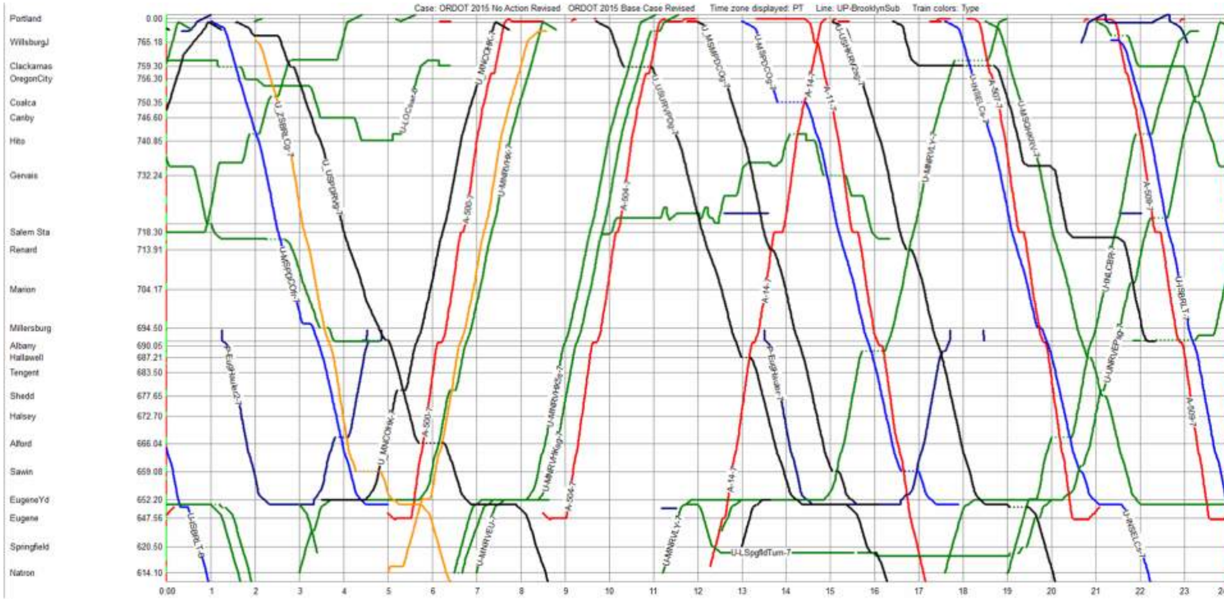


Color	Passenger Trains
Red	Red - Amtrak Cascades trains
Reddish Brown	Reddish Brown – Amtrak Coast Starlight
	Freight Trains
Gold	Gold – (Z trains) High priority containers for intermodal
Black	Black – Unit Trains
Blue	Blue – (Q trains - Doublestack) Priority Intermodal
Green	Green – Local and Merchandise trains

Day 2



Day 3



Color	
	Passenger Trains
(red line)	Red - Amtrak Cascades trains
(reddish brown line)	Reddish Brown – Amtrak Coast Starlight
	Freight Trains
(gold line)	Gold – (Z trains) High priority containers for intermodal
(black line)	Black – Unit Trains
(blue line)	Blue – (Q trains - Doublestack) Priority Intermodal
(green line)	Green – Local and Merchandise trains

Appendix A-C – Revised Alternative 1 (3+1)

Revised: October 18, 2016

Prepared by: Mainline Management

Revised Alternative 1 (3+1) Analysis

Introduction

A Revised Alternative 1 (3+1) Analysis was also performed to standardize assumptions between all cases. The analysis featured the inclusion of one additional Amtrak Cascades round trip between Portland and Eugene. It also included estimated infrastructure that would likely be required to support that additional train.

In addition to the Amtrak Cascades train and associated infrastructure, the Revised Alternative 1 (3+1) analysis also included an updated track design at the Eugene Station. The new track design (Option 4) would allow for two Amtrak Cascades trains to be staged at the station overnight so they would not have to transit to Eugene Yard in the evening and from the yard in the morning.

Revised Alternative 1 (3+1) Operational Modifications

There were no operational modifications for UP traffic on the Brooklyn Sub in the Revised Alternative 1 (3+1) simulation other than the projected increase in freight traffic to 2015 levels as previously discussed. The Albina Yard to Lake Yard local was added in this case as in the Revised Base and Revised No Action cases. No changes were made to BNSF traffic between Vancouver and Portland as well.

The only operational changes were the additional Amtrak Cascades round trip that was added between Eugene and Portland, the staging of the Amtrak Cascades trains within the Eugene Station tracks at night. Portland to Vancouver passenger trains continued to operate under the 6+2 schedule as described earlier.

Infrastructure Modifications

The following is a list of modifications from the initial Alternative 1 (3+1) analysis. These same modifications were included in the Revised Alternative 1 (3+1) Case.

- Southern Section

    1. Second Main Track (SMT) from Judkins (644.66) to Swain (660.6)
    2. Crossovers from SMT to existing crossovers or yard entrance tracks (MP647, MP648, MP650, MP653.2, MP653.5)
    3. Universal crossover MP658.0
    4. SMT from MP 670.0 to MP 674.0.
    5. SMT south end Hallawell (MP 687.3) to Albany Yard (690.9).
    6. Crossover MP 690.1.

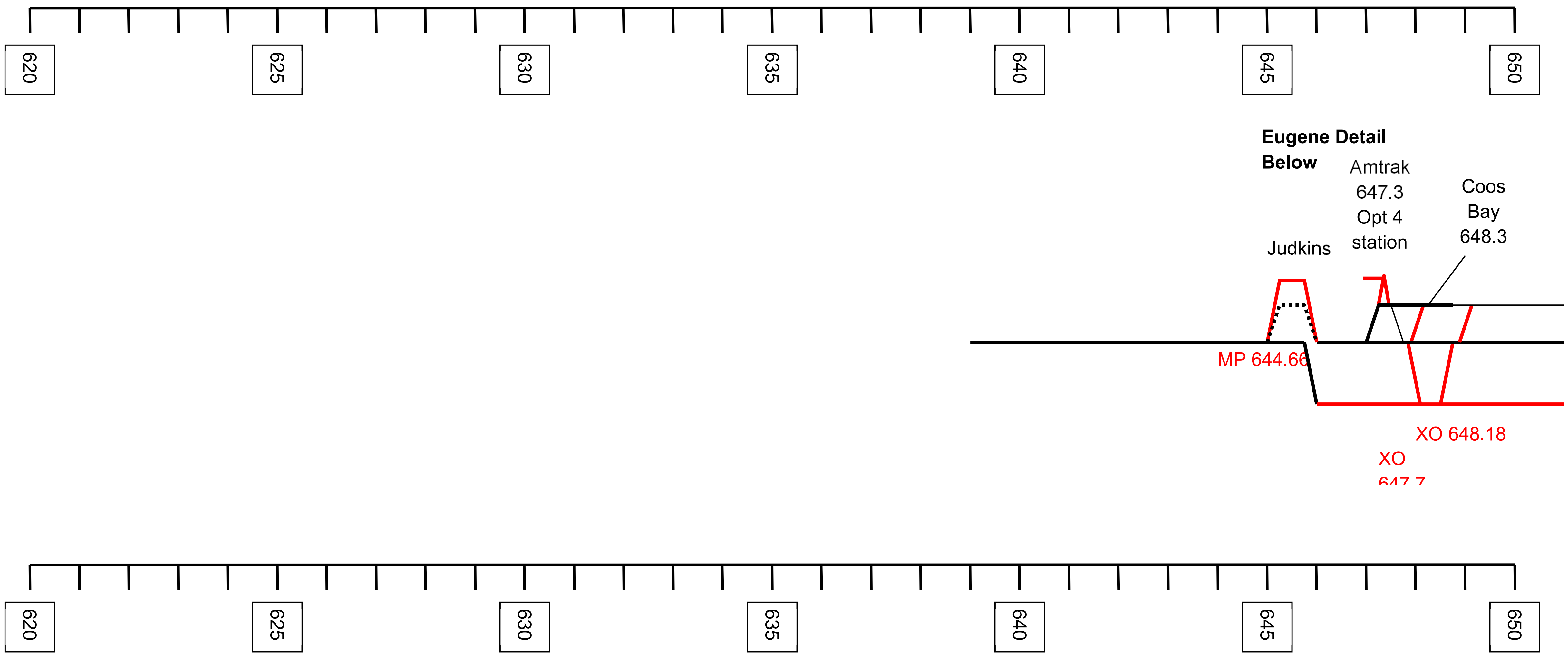
- Central Section

1. SMT MP 701.0 to north end Marion (705.76).
2. Add new siding at Brooks, MP 725.0 to MP 727.0.

- Northern Section

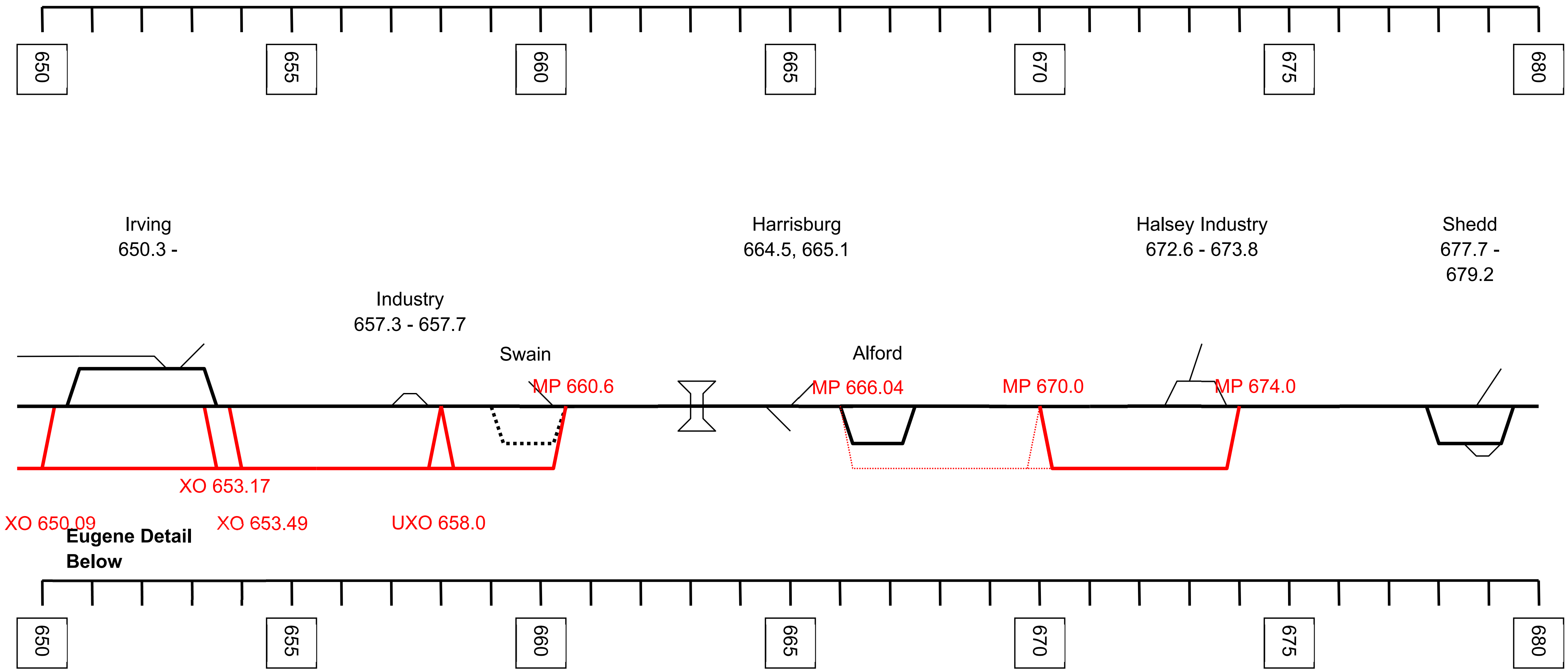
1. Second main track Canby (746.48) to north end Coalca (751.89).
2. Universal crossovers MP 748.39
3. Second main track Clackamas (758.68) to East Milwaukie (MP764.5).
4. Single crossover MP 761.22
5. Third main track East Milwaukie to Steel Bridge (770.0)
6. Universal crossovers Reed MP764.41
7. Universal crossovers MP768.72

The following schematic shows the improvements that were included in the Revised Alternative 1 (3+1) analyses. The Alternative 1 (3+1) infrastructure improvements were a subset of the Alternative 1 (4+1) analysis that was performed prior to the Alternative 1 (3+1) analysis in 2014. The thin red lines are the improvements included in the Alternative 1 (4+1) analysis, while the heavy red lines are the improvements that were included in the Alternative 1 (3+1) analysis. The Revised 4+1 analysis will be described later in this memo, but the associated improvements have been left on the Revised 3+1 schematic to assist a reader to understand how the Alternative 1 (3+1) improvements are a subset of the Alternative 1 (4+1) improvements.



Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.
Heavy red is new main track or crossovers
UXO = universal crossover (double XO)

Revised Alternative 1 (3+1)

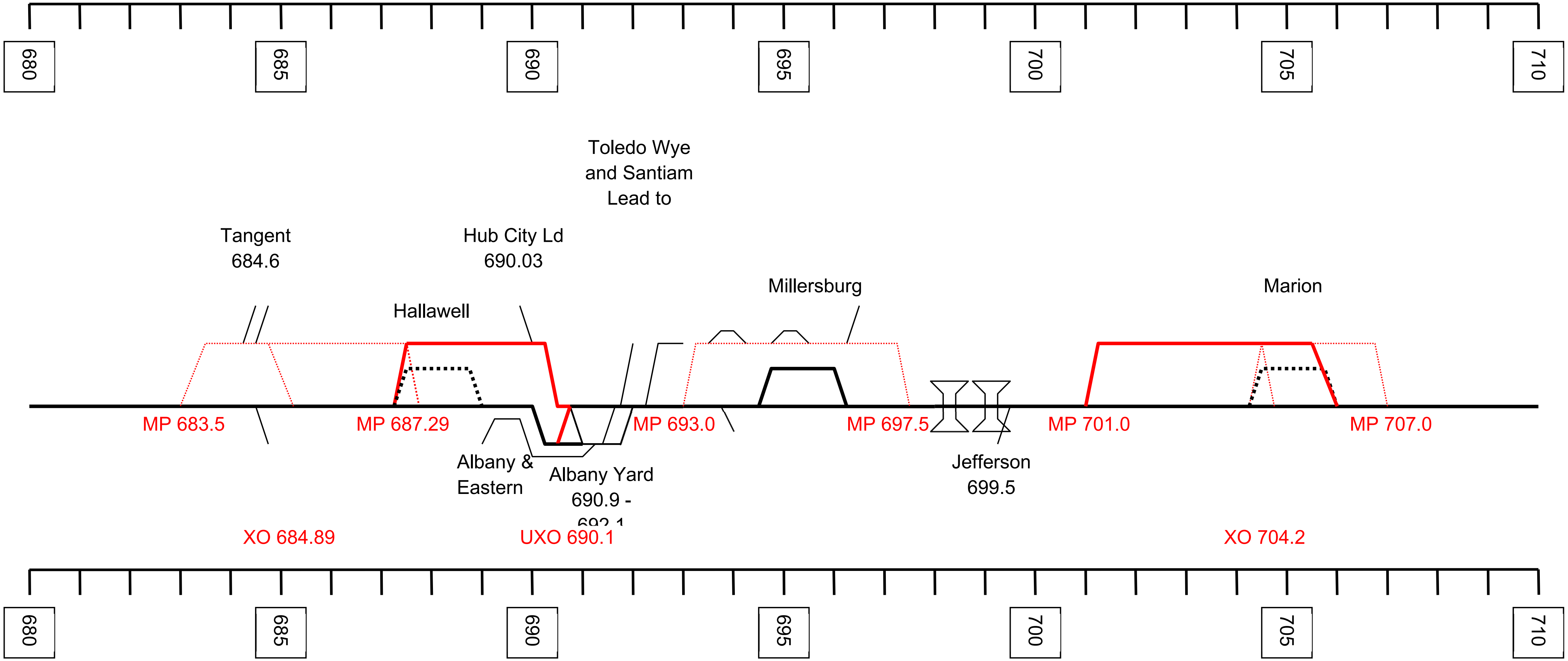


Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.

Heavy red is new main track or crossovers

UXO = universal crossover (double XO)

Revised Alternative 1 (3+1)

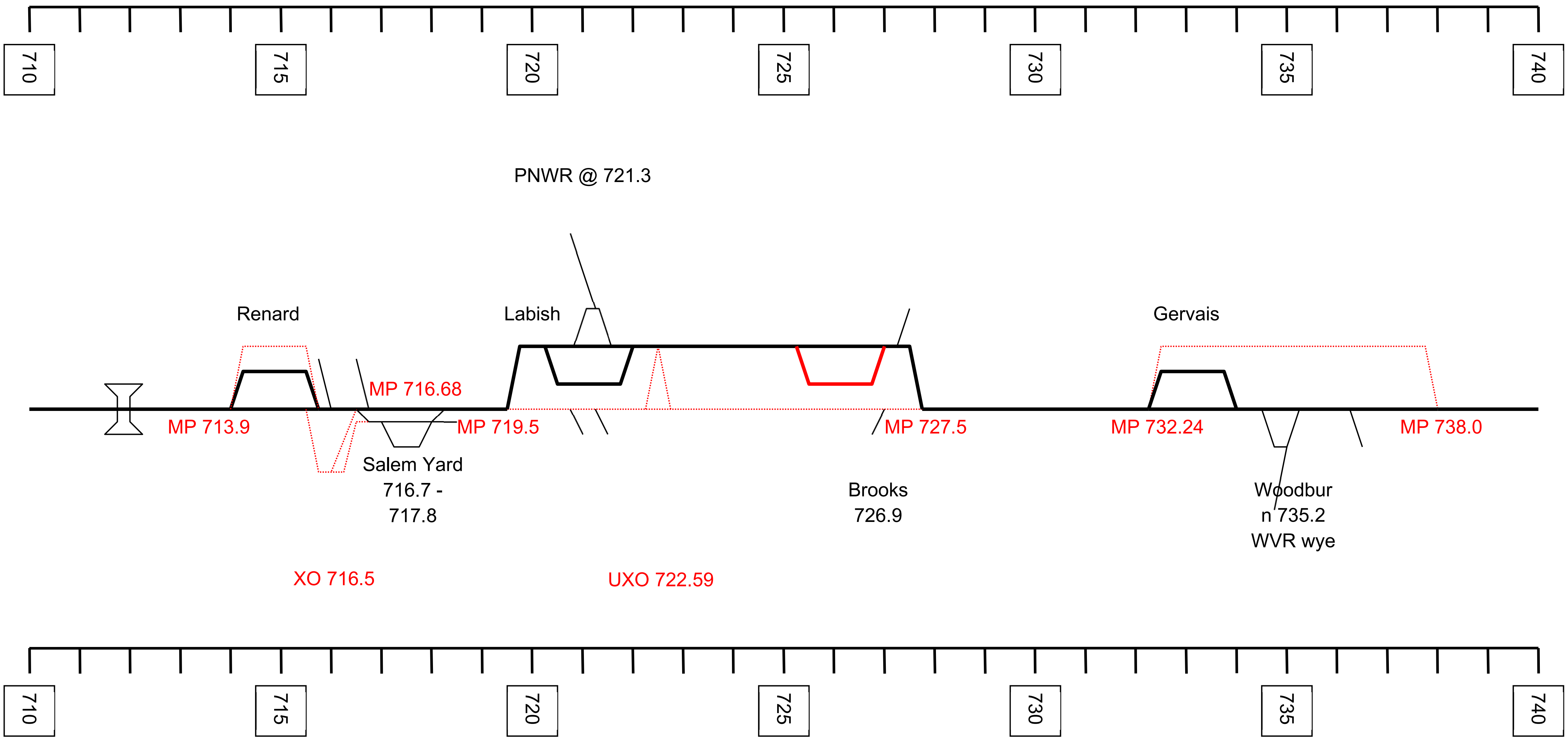


Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.

Heavy red is new main track or crossovers

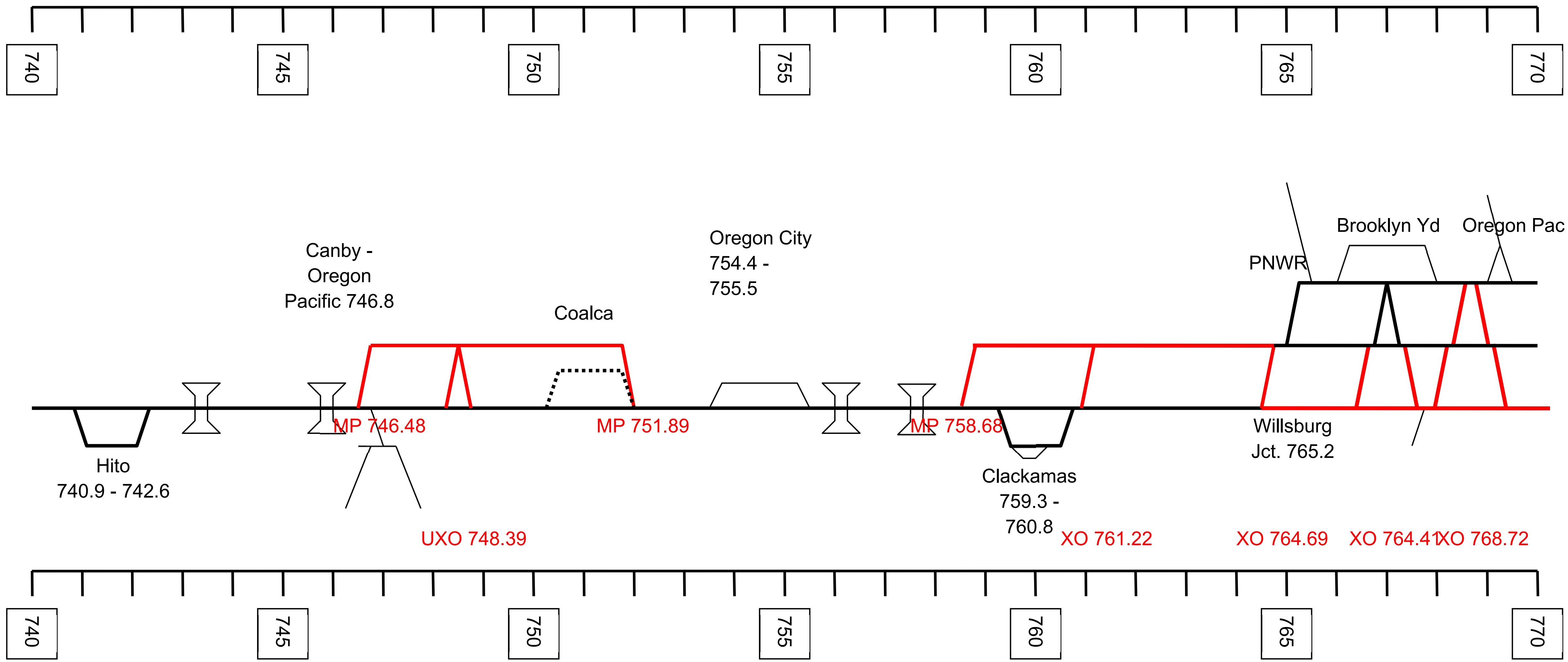
UXO = universal crossover (double XO)

Revised Alternative 1 (3+1)



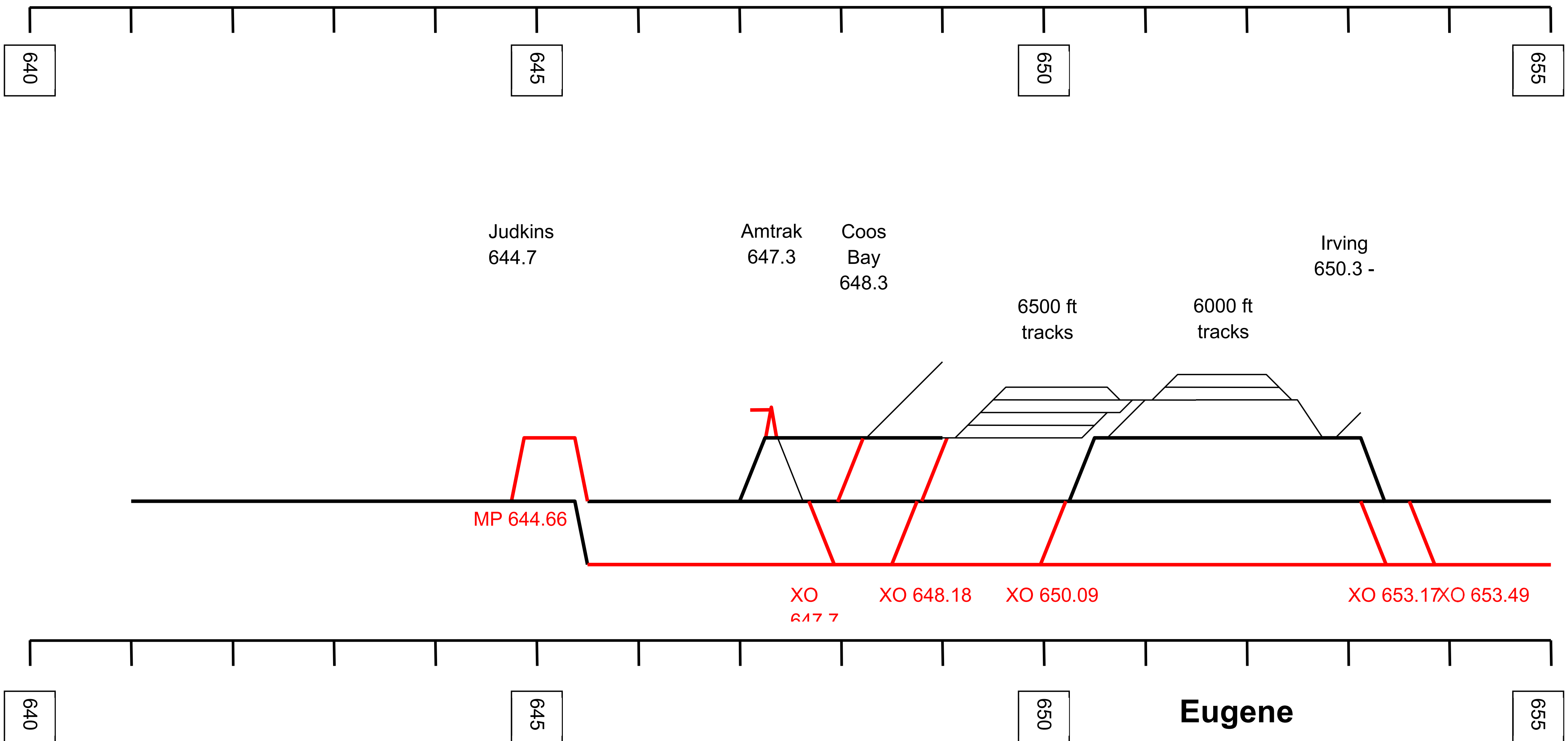
Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.
Heavy red is new main track or crossovers
UXO = universal crossover (double XO)

Revised Alternative 1 (3+1)



Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.
Heavy red is new main track or crossovers
UXO = universal crossover (double XO)

Revised Alternative 1 (3+1)



Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.
Heavy red is new main track or crossovers
UXO = universal crossover (double XO)

Revised Alternative 1 (3+1)

In addition to the capacity improvements that were included between Portland and Eugene, the Eugene Amtrak Station was modified to reflect the Option 4 design provided to the Analysis Team. In that design, the station platforms were moved from the east side of the station (adjacent to the main track and siding) to the west side of the station. One track was connected to the existing tracks at both ends, while the second track was a stub track capable of holding an entire Amtrak Cascades train set. This modification is reflected by the inverted red “V” with the short stub in the preceding schematic.

Between Portland and Vancouver, the track and turnout upgrades at UP’s North Portland/Penninsula Jct. and upgrades to Willbridge Junction on BNSF’s Fallbridge Subdivision was improved to support 25 mph movements. This compares to the Revised Base and Revised No Action Cases where trains using this connection were limited to 10 mph or less.

Revised Alternative 1 (3+1) Brooklyn Sub Results

There were 3.2 minutes of delay per 10 miles operated (D/10) for the Revised Alternative 1 (3+1) simulation. This result was greater than the Revised Base Case, but less than the Revised No Action Case (Graph 1 below). Therefore, the additional second main track and sidings that were added improved UP’s freight performance as compared to the Revised No Action analysis, even with the inclusion of one additional Amtrak Cascades round trip. This was the primary goal of the Revised 3+1 network.

The results fell within an expected range of results because even with the improvements, the network remained primarily a single track network with sidings and some sections of second main track. The results of the simulation suggested the network will not be quite as efficient as the existing Brooklyn Sub network under assumed existing traffic levels; however the results of the analysis included projected freight growth as well as an additional Amtrak Cascades round trip.

The number of delays that exceeded 30 minutes increased to 7.3 per day in the Revised 3+1 Analysis (Graph 2 below). Most of the delays that exceeded 30 minutes were meet/pass delays. There was a slight bias towards freight meets and overtakes (Graph 3 below) as compared to passenger meets or overtakes.

The passenger schedules that were utilized and the adjusted network infrastructure dictated where many of the longest delays occurred in the Revised Alternative 1 (3+1) analysis. Many of the longer meet or overtake delays occurred to freight traffic near where passenger trains met other passenger trains. In the Revised 3+1 analysis, passenger-passenger meets occurred in Hito Siding, at Salem and between Albany (MP 690) and Eugene. These schedules led to many of the longer freight delays occurring between Coalca (MP 750) and Salem and between Hallawell and Eugene (Graph 5 below).

This effect was explained in the initial 3+1 analyses. As discussed, freight trains approaching the location of the passenger train meet were stopped to allow the first approaching passenger train to meet or pass the freight train. After the first passenger train passed, the freight train remained stopped in the same location until the second passenger train passed or met it from the other direction. Waiting for the two passenger trains created long delays which were captured by the D>30 analysis.

There were additional repetitive delays that exceeded 30 minutes besides those associated with passenger-passenger meets. Some congestion remained around Clackamas because of locals switching industry, trains stopping on line for setouts or pickups, and higher priority through freight traffic. However, the extended second main track from East Milwaukie to just beyond Clackamas alleviated many of the exceptionally congested periods that were observed in the Revised No Action Case.

Some on line switching delays continued to occur between Halsey (MP672) and Swain (MP660). This was a function of local trains needing to hold a main line for industrial switching, trains entering and exiting Eugene Yard and passenger operations in or near the area. In multiple cases, lower priority locals were not allowed to access the industry locations until after passenger trains had passed. However, since other freight traffic was also waiting for the passenger trains to clear, those trains followed the passenger trains. The locals then had to wait for some of the freight traffic to clear as well before being allowed to access the industrial locations.

There were no delays between Eugene and Natron in the Revised Alternative 1 (3+1) analysis. As has been described in the results of previous analyses, the extension of a second main track from Judkins to Swain (MP 644 to MP 660) through Eugene provided additional capacity for UP freight operations, minimizing conflicts with other freight trains and expanded passenger operations into and from Eugene's Amtrak station.

The new configuration for the Amtrak Cascades layover tracks was operationally effective in the Alternative 1 (3+1) simulation. There were no major delays associated with passenger operations into or around the Eugene Station.

Revised Alternative 1 (3+1) Brooklyn Sub Velocity Comparison

The following table provides the velocity of the various train classes on the Brooklyn Sub for the Revised Alternative 1 (3+1) analysis. As previously discussed, the PNWR results only reflect PNWR operations that occur on UP's Brooklyn Subdivision.

Alternative Revised 3+1						**Velocity**	**Velocity**
						Total	**minus Delay**
Group	**Delay**	**Dwell**	**Elapsed Time**	**Miles**	**Del/10**	**Elapsed**	**and Dwell**
Passenger	5:18:02	12:45:12	69:38:09	3047.3	1.0	43.8	59.1
PNWR	2:47:51	13:18:00	26:10:26	463.3	3.6	17.7	46.0
UPExp	7:09:06	7:36:10	74:18:46	2407.7	1.8	32.4	40.4
UPLocal	11:51:07	60:26:04	97:54:09	699.8	10.2	7.1	27.3
UPMani	20:14:59	68:22:10	210:41:05	4334.1	2.8	20.6	35.5
UPUnit	13:11:12	21:01:05	111:27:20	2611.0	3.0	23.4	33.8
Total Freight	55:14:14	170:43:29	520:31:45	10516.0	3.2	20.2	35.7

Passenger train elapsed time velocity decreased as compared to the Revised No Alternative and Base Case levels. The Analysis Team believes the primary reason for this is that four of the meets that the eight Amtrak trains experienced were in sidings, rather than on a second main track. When the meets occur in sidings, there is some delay to one of the trains. This decreased the elapsed time velocity by four mph.

When delay and dwell were removed from the calculation, the velocity of the passenger trains increased. The additional second main track contributed to this improvement. With a second main track in place, the passenger trains had more opportunities to meet or overtake freight traffic without slowing down. In the previous analyses, the passenger trains did slow because they were following or meeting freight trains that were diverging into sidings.

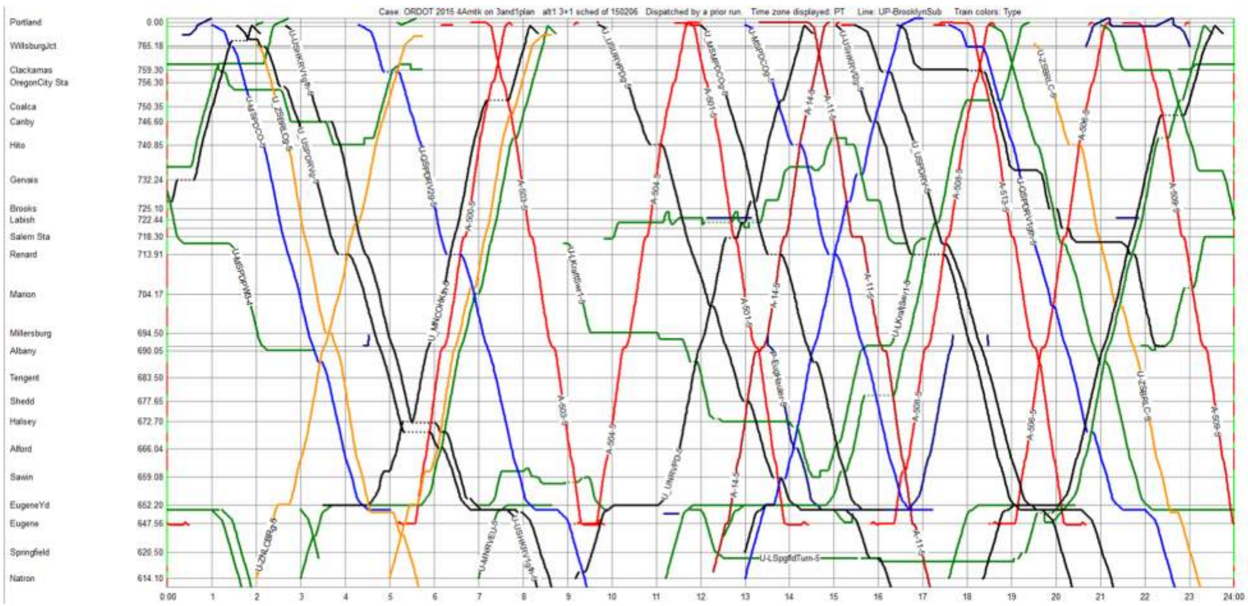
Brooklyn Sub freight traffic velocity also increased showing an improvement in the Revised Alternative 1 (3+1) case. It appears that the sections of second main track allowed most types of UP trains to decrease their total delay, while running miles remained relatively constant. This led to increased velocity over the subdivision.

Revised Alternative 1 (3+1) Portland to Vancouver Results

Delays exceeding 30 minutes were notably reduced in the Revised Alternative 1 (3+1) analysis case as compared to the Revised No Action Case. With the same amount of freight traffic on the segment, the number of delays was reduced to 1.3 per day from 4.7 per day in the Revised No Action Case. The main contributor to the improved performance was the increased speed on UP's connection between Peninsula Jct. and NPJ, along with the upgraded turnouts at each end of the connecting track. Movements that could continue from BNSF's Fallbridge Sub onto the UP connection track at 25 mph cleared the area much more quickly, which reduced delays for UP traffic and for BNSF traffic operating in the area.

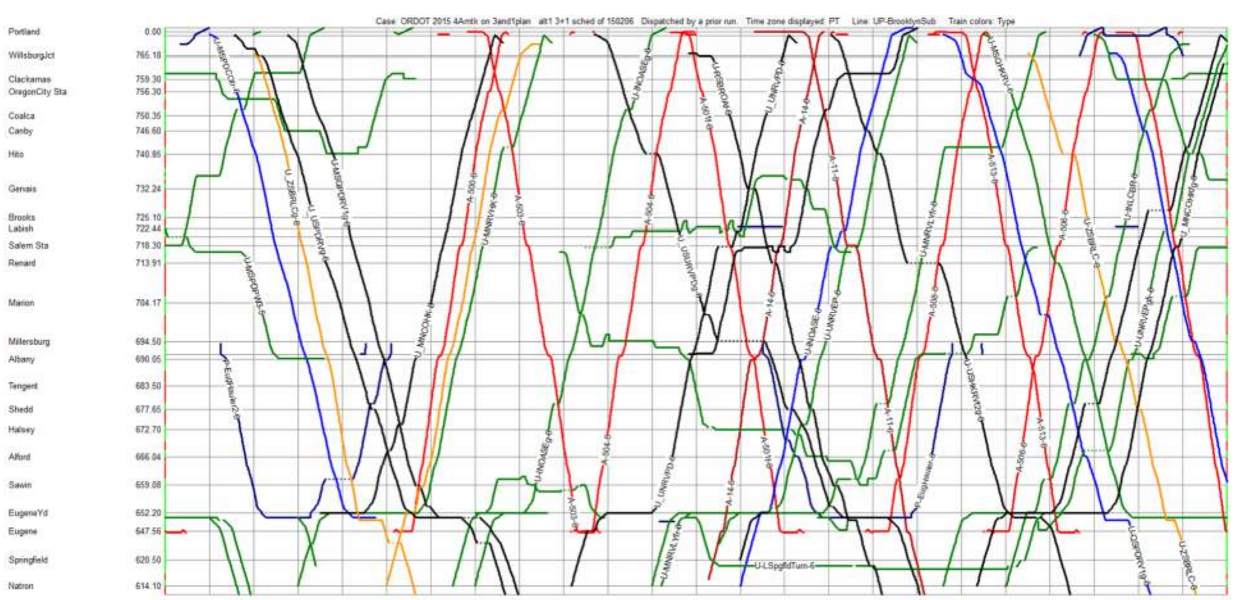
The one location that did see repetitive delay was at Willbridge. The local working at Willbridge was repeatedly delayed by a switch engine working at Lake Yard. As previously described, a passenger train leaving Portland towards Vancouver contributed to this delay. It appears it is strictly a timing issue; if either of the two locals is a little earlier or later, the delay would likely not occur.

Revised Alternative 3+1 Stringlines
Day 1

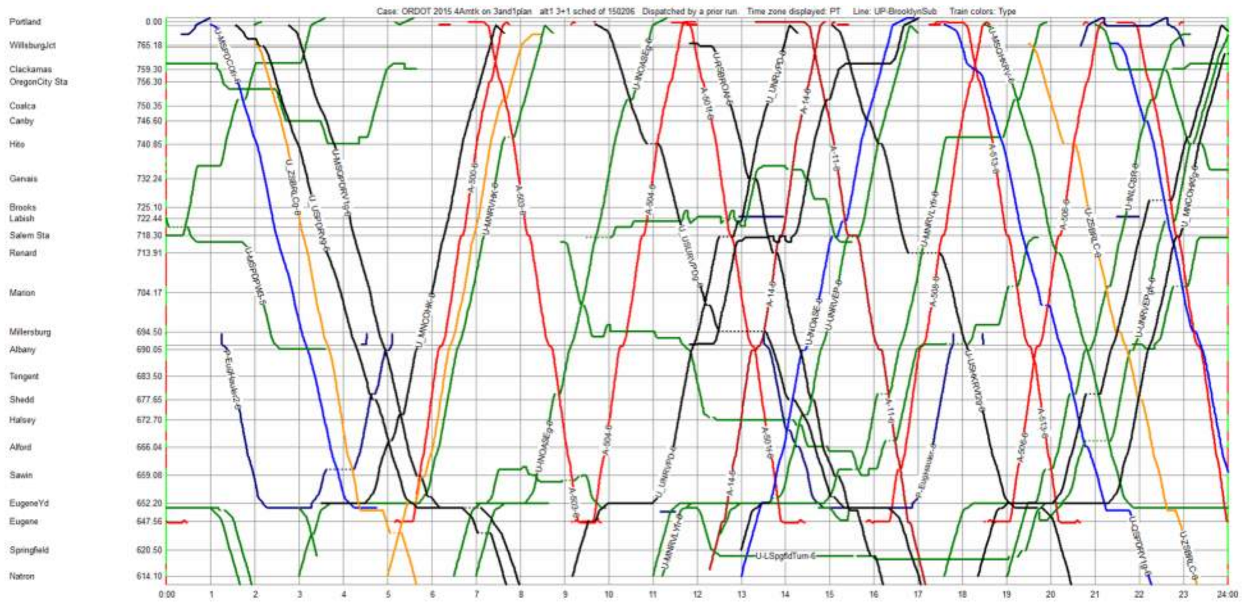


Color	Passenger Trains
Red line	Red - Amtrak Cascades trains
Reddish brown line	Reddish Brown – Amtrak Coast Starlight
	Freight Trains
Gold line	Gold – (Z trains) High priority containers for intermodal
Black line	Black – Unit Trains
Blue line	Blue – (Q trains - Doublestack) Priority Intermodal
Green line	Green – Local and Merchandise trains

Day 2



Day 3



Color	Passenger Trains
Red line	Red - Amtrak Cascades trains
Reddish brown line	Reddish Brown – Amtrak Coast Starlight
	Freight Trains
Gold line	Gold – (Z trains) High priority containers for intermodal
Black line	Black – Unit Trains
Blue line	Blue – (Q trains - Doublestack) Priority Intermodal
Green line	Green – Local and Merchandise trains

Appendix A-D – Revised Alternative 1 (4+1)

Revised: October 18, 2016

Prepared by: Mainline Management

Revised Alternative 1 (4+1) Analysis

Introduction

Another alternative that was analyzed previously and then revised to standardize all assumptions was the Revised Alternative 1 (4+1) option. As implied by the name, the Revised 4+1 option increased the number of Amtrak Cascades round trips from two in the Revised Base Case to four. This required a different configuration of track that will be discussed later in this section.

The Revised Alternative 1 (4+1) analysis was standardized by modifying three aspects of the initial 4+1 analysis. First, Eugene Station was modified to reflect the Option 4 configuration that was developed to allow overnight lay over capability for up to two Amtrak Cascades train sets at the station. As previously discussed, this eliminated the need to dead head a train set from the station to UP's Eugene Yard at night and then return it to the station in the morning. The second modification was to standardize the number of Portland to Vancouver (and beyond) Amtrak Cascades round trips from 12 in the initial analysis to six in the Revised Alternative 1 (4+1) analysis. The third modification was the inclusion of the track upgrades at Peninsula Junction and Willbridge, allowing 25 mph operation for UP traffic.

Revised Alternative 1 (4+1) Operational Modifications

As briefly discussed, the only freight modification that was made in the Revised Alternative 1 (4+1) analysis was the addition of the Albina Yard to Lake Yard local that was added to all of the revised simulations. All other projected 2035 UP and BNSF freight operations remained the same, whether on UP's Brooklyn Sub or BNSF's Fallbridge Sub.

Passenger operations on the Brooklyn Sub were modified to the extent that a fourth Amtrak Cascades round trip was added to the Revised 3+1 option (or two round trips were added to the Revised Base or No Action options).

The modification at the Eugene Amtrak station also allowed the dead head (positioning passenger equipment to the station for use in the morning) movement to be modified. As briefly discussed, the Option 4 configuration allows up to two Amtrak Cascade train sets to be staged at night at the station without affecting the main lines. Therefore, no dead head moves to or from Eugene Yard were required in the Revised analysis.

Finally, Portland to Vancouver Amtrak Cascades round trips were reduced from 12 round trips in the initial 4+1 analysis to six round trips in the Revised analysis.

Revised Alternative 1 (4+1) Network Modifications

The initial Alternative 1 (4+1) network was a subset of the initial Alternative 1 (6+1) track configuration. The 6+1 configuration was requested by UP; they asked for a continuous additional main track from the Steel Bridge to Eugene. This was referred to as the "Alternative 1 Plan".

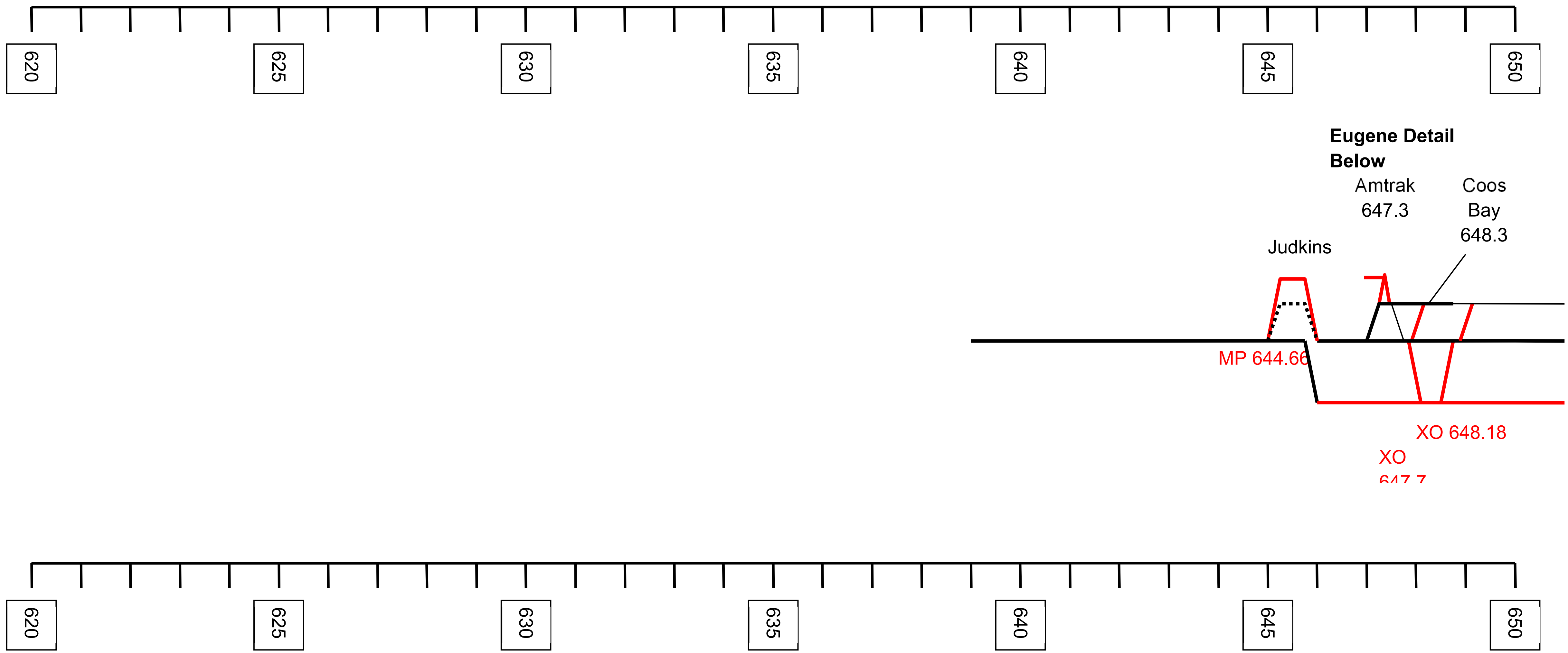
To reduce cost, the number of projected Amtrak Cascades round trips was reduced from six to four, and the Analysis Team was instructed to reduce the infrastructure accordingly in an attempt to reduce its infrastructure cost. The additional main track was removed from high cost locations such as large bridges and through cities such as Salem, Albany and Oregon City. The four round trip Amtrak Cascades trains were then operated on the reduced infrastructure to ascertain the impact of those reductions.

A list of the improvements from the initial 4+1 analysis is included below.

1. Second Main Track (SMT) from MP 644.66 (south end Judkins) to MP 660.6. It utilized the Judkins Siding as the south end of the SMT and Swain Siding as north end of the SMT. Crossovers from SMT to existing crossovers or yard entrance tracks (MP 647, MP 648, MP 650, MP 653.2, MP 653.5) were added. Universal crossovers were added at MP 658.0 +/-.
2. Single track MP 660.6 to 666.04.
3. SMT from MP 666.04 to 674.0 utilizing Alford Siding as the south end of SMT. Universal crossovers were added at MP 670 +/-.
4. Single track MP 674.0 to 683.5. Shedd Siding was included per the UP track chart.
5. SMT 683.5 to 690.1 utilizing Hallawell Siding as part of the SMT. All crossovers remained per the Alternative 1 plan (single crossover at MP 684.89 and universal crossovers at MP 687.29). The new SMT was connected to the Albany lead track and universal crossovers were added at MP 690+/- so northbound freight trains can be operated from either of the main tracks onto an existing single main track through Albany.
6. Single track from MP 690.1 to 693.0 (Albany Yard). All crossovers between the Albany Lead and main track as well as the connection to the Toledo Branch were included.
7. SMT MP 693.0 to MP 697.5 utilizing the Millersburg Siding as part of SMT.
8. Single track MP 697.5 to MP MP 701.0.
9. SMT MP 701.0 to MP 707.0 utilizing Marion Siding as part of the SMT. Universal crossovers were added at MP 704.2 (existing south end Marion Siding).
10. Single track MP 707.0 to MP 713.9.
11. SMT MP 713.9 to MP 716.68 utilizing Renard Siding as south end of SMT. The SMT was connected to the Salem Yard Lead at MP 716.68. Universal crossovers were added at MP 716.5 +/- to allow northbound freight trains from either track to operate over the existing single main track through Salem.
12. Single track MP 716.68 to MP 719.5. All yard leads and connections through Salem per UP's track charts were included.
13. SMT MP 719.5 to MP 727.5 utilizing Labish Siding as part of the SMT. All other industry tracks at Labish were per the Alternative 1 concept which included universal crossovers at MP 722.59. The "new" Brooks siding per the Alternative 1 plan was removed at MP722.8.
14. Single track MP 727.5 to MP 732.24.
15. SMT MP 732.24 to MP 738.0 utilizing Gervais Siding as the south end of SMT. The "new" Gervais siding from the Alternative 1 plan (MP732.3) and the universal crossovers at MP 736.74 were removed. The industrial siding at Woodburn (MP 734.51) and all of the connections were included.

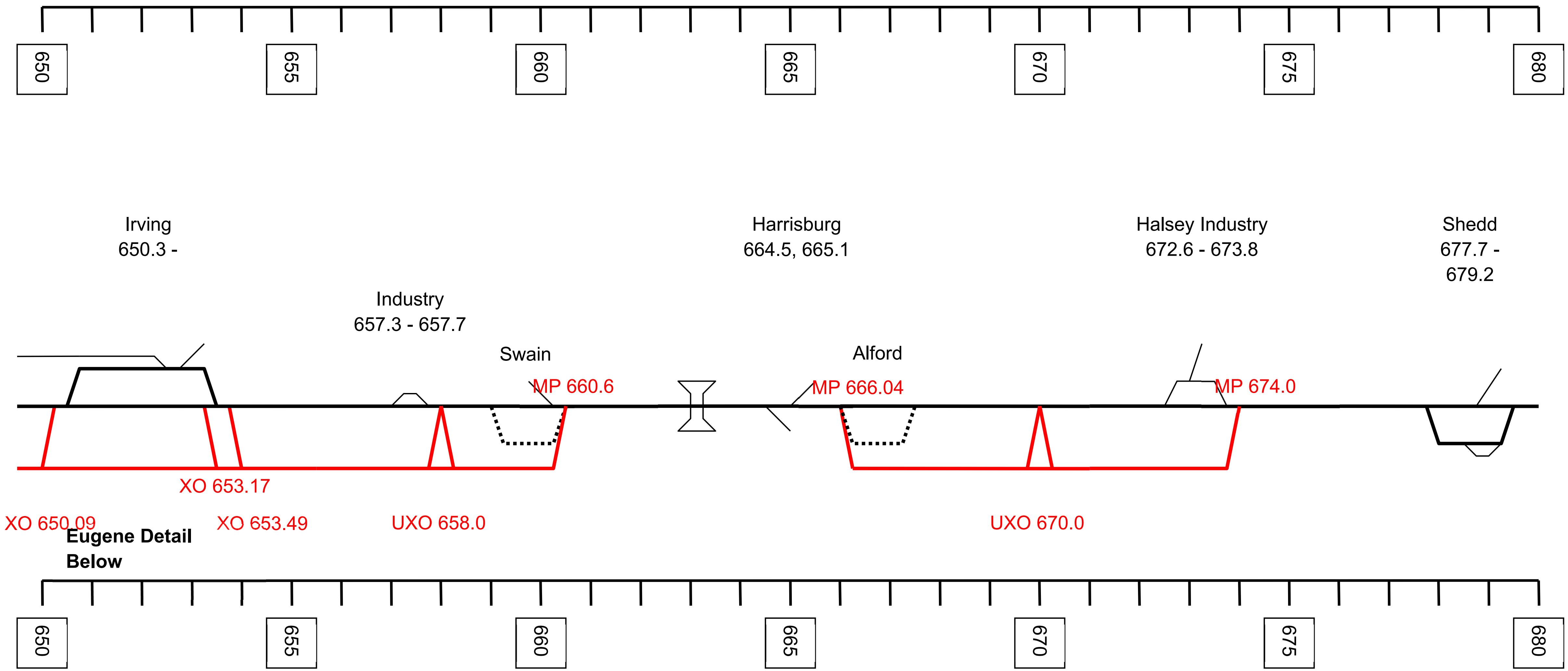
16. Single track MP 738.0 to MP 746.48. Hito Siding was included per UP's track charts.
17. SMT MP 746.48 to MP 751.89 utilizing Coalca Siding as the north end of the SMT. The Canby industrial siding at MP 746.60 and all of the connections to and from the industrial siding were included, along with universal crossovers at MP 748.39.
18. Single main track MP 751.89 to MP 758.68.
19. SMT MP 758.68 to MP 764.94 and a third main track from East Milwaukie at MP 764.94 to the Steel Bridge at MP 770.17. All crossovers and connections per the Alternative 1 plan between Clackamas and Steel Bridge were included as well as an additional siding and multiple industrial sidings at Clackamas (MP 759.23). All connections and the drill track at Willsburg Junction and Brooklyn were also included.

A schematic representation of the improvements follows to provide a visual review of the modifications.



Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.
Heavy red is new main track or crossovers
UXO = universal crossover (double XO)

Revised Alternative 1 (4+1)

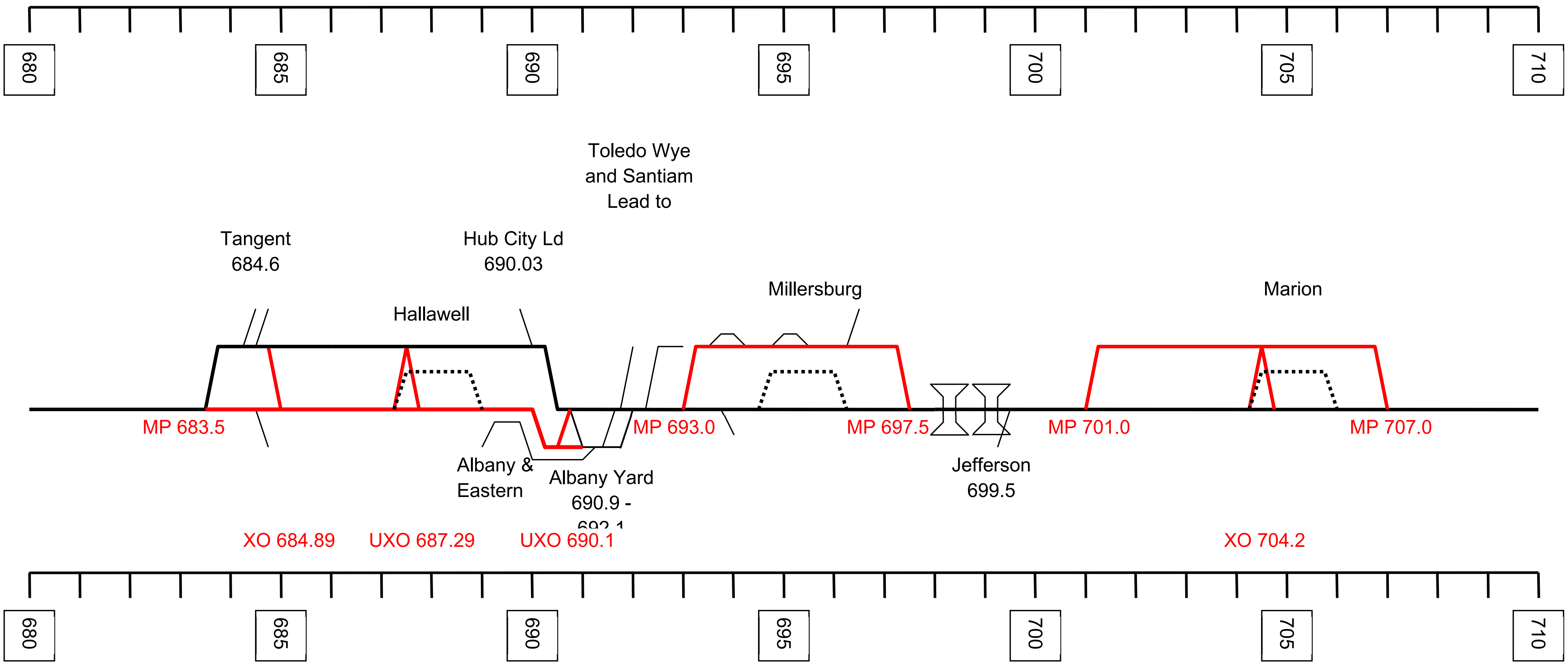


Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.

Heavy red is new main track or crossovers

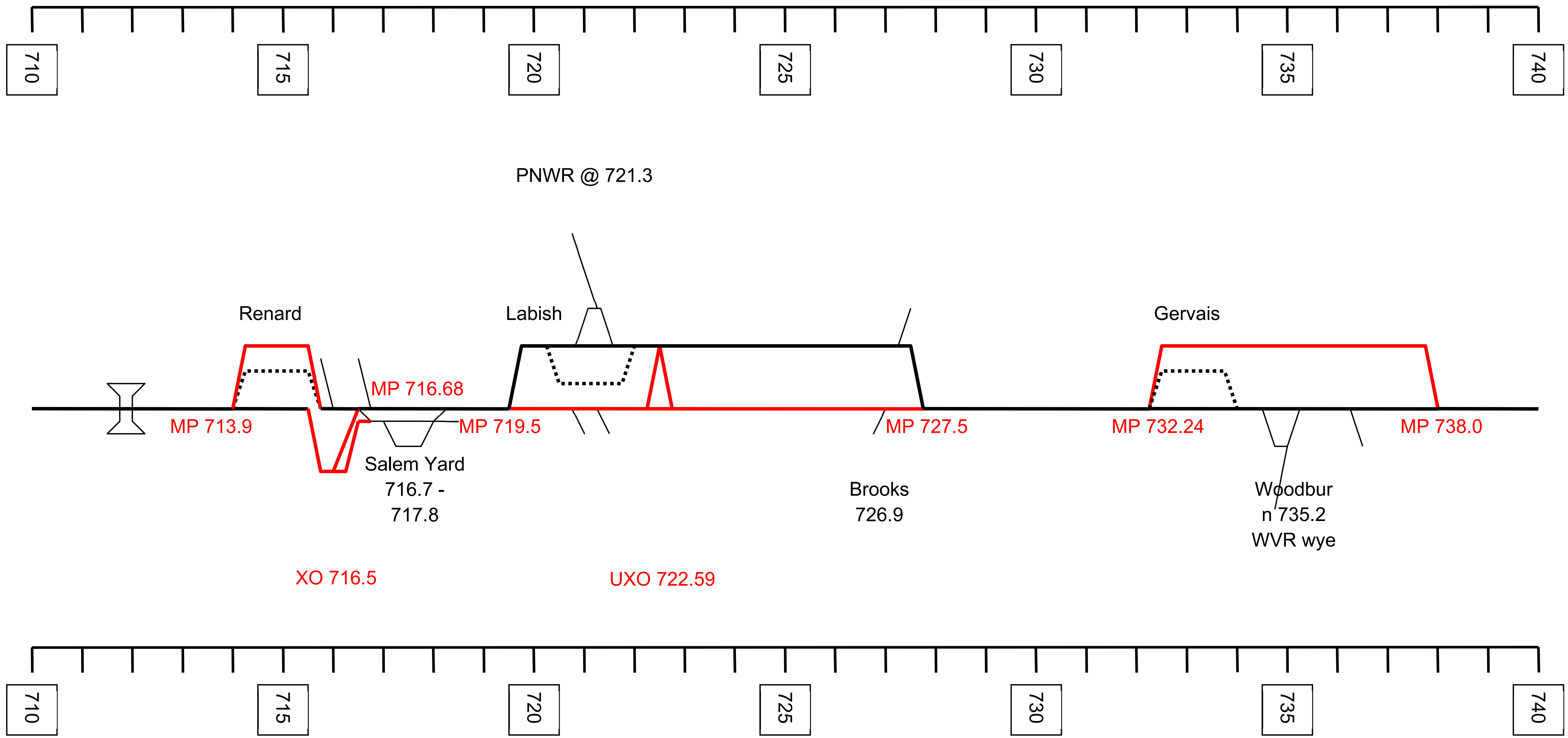
UXO = universal crossover (double XO)

Revised Alternative 1 (4+1)



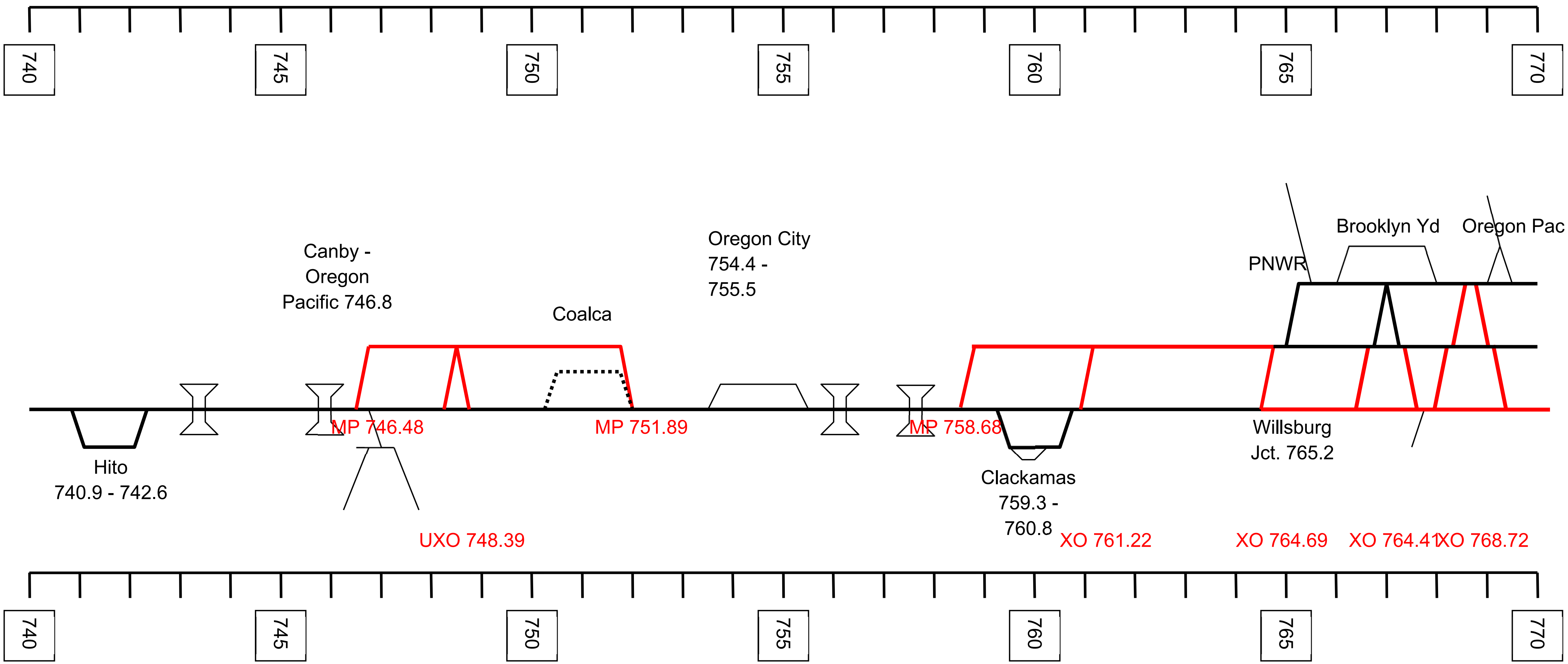
Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.
Heavy red is new main track or crossovers
UXO = universal crossover (double XO)

Revised Alternative 1 (4+1)



Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.
Heavy red is new main track or crossovers
UXO = universal crossover (double XO)

Revised Alternative 1 (4+1)

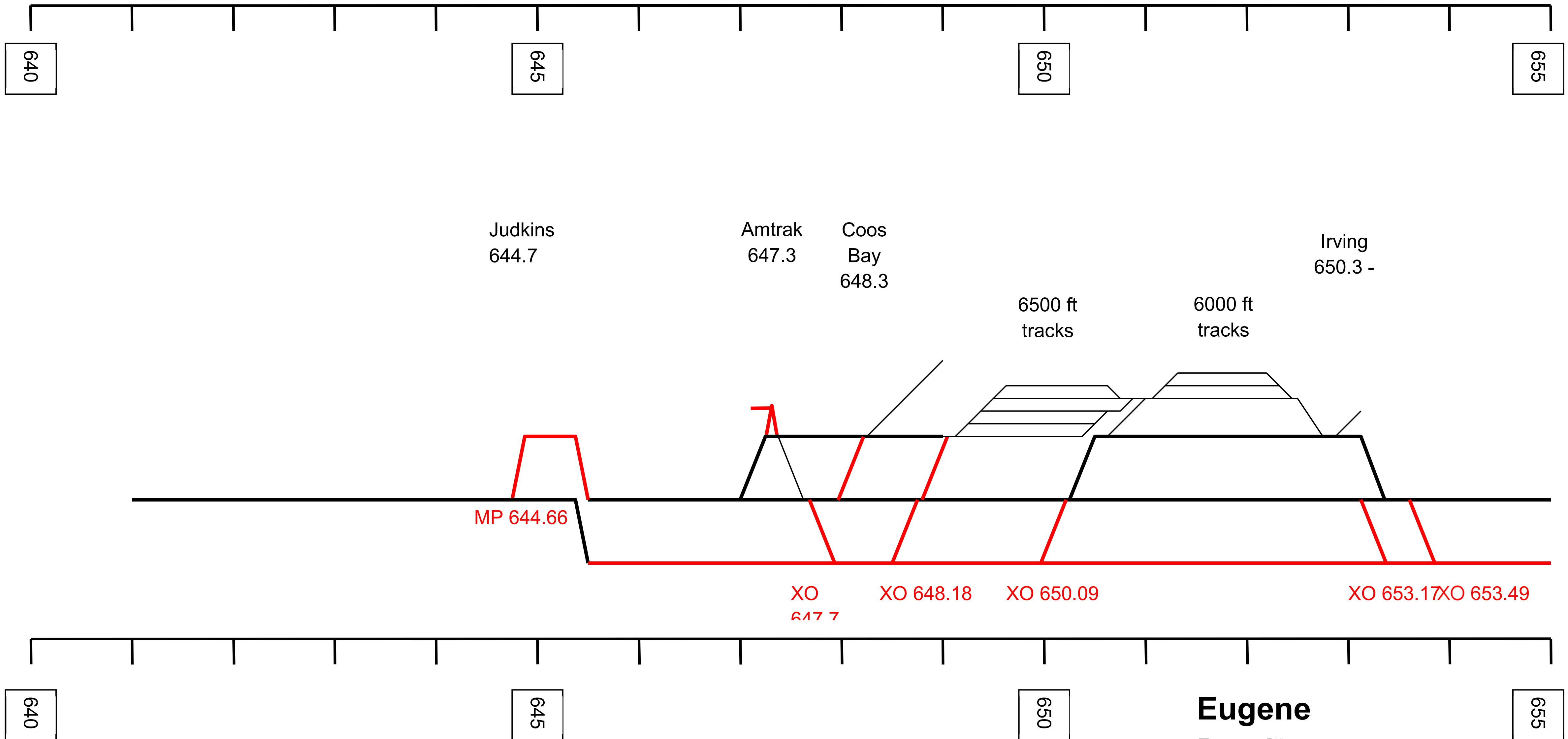


Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.

Heavy red is new main track or crossovers

UXO = universal crossover (double XO)

Revised Alternative 1 (4+1)



Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.
Heavy red is new main track or crossovers
UXO = universal crossover (double XO)

Revised Alternative 1 (4+1)

Between Portland and Vancouver, the Revised Alternative 1 (4+1) analysis included the upgraded connection between UP's North Portland/Peninsula Jct. and Willbridge. as well as the upgraded turnout connections at both of those locations. As has been previously described, this allowed UP trains to operate at speeds up to 25 mph as compared to the existing connection which is restricted to 10 mph.

Revised Alternative 1 (4+1) Brooklyn Sub Results

There were 2.5 minutes of delay per ten miles operated for the Revised 4 + 1 simulation (Graph 1 below). As the graph shows, this was slightly greater than the Revised Base Case but less than the Revised No Action Case. This was the primary goal of the Revised 4+1 configuration.

The level of delay indicates that the Brooklyn Sub was operating efficiently with the increased Amtrak Cascades round trips and the associated infrastructure. The numbers suggest that the projected operation was almost as efficient as the existing operation that features far fewer freight and passenger trains. The results also indicate that UP's operation would be notably improved with the additional passenger trains and infrastructure as compared to the Revised No Action alternative.

The number of delays per day that exceeded 30 minutes was 2.3 (Graph 2 below). This too is an indication of how efficiently the route was operating. Compared to the Revised No Action case, this represents a reduction of six major delays per day.

The causes of the delays exceeding 30 minutes that did occur were spread evenly over the various categories (Graph 3 below). Combined, freight and passenger meets were the largest contributor to the delays; however there were delays associated with on line switching and yard congestion as well. The relatively small number of those occurrences each day suggests that there was not a systematic problem.

Even the location of the delays suggested there was no reoccurring issue with the track configuration. Delays were distributed across the line segment, with no one area experiencing a high volume of delays. This result confirms that the track infrastructure that was utilized in the Revised 4+1 analysis was sufficient to accommodate the increased passenger operations while at the same time maintaining or even improving UP's freight operation.

Under the Revised 4+1 passenger schedules, the Amtrak Cascades and Amtrak trains were scheduled to meet between Clackamas and East Milwaukie and between Albany and Alford. The trains met at locations where a second main track had been added. There was little delay introduced for passenger-passenger meets in this analysis.

The locations of the passenger-passenger meets also improved freight operations. Since the meets were mostly in locations of second main track, the number of delays to freight traffic waiting for those meets to occur and the second passenger train to pass was greatly reduced. The Analysis Team believes this is one reason why passenger and freight meet delays that exceeded 30 minutes were reduced as compared to other analyses.

The on line switching delays occurred around Labish and Swain in the Revised Alternative 1 (4+1) analysis. The delay at Swain occurred when a local was working an industry on one of the main tracks while two northbound trains were leaving Eugene Yard. The southbound train following the local had to wait for the two northbound trains to pass before being able to go around the local train.

At Labish, the delay occurred because two trains (one northbound, one southbound) that both had "work" at Labish arrived at the same time. Since both could not access the industrial tracks at the same time, one of the trains was delayed until the first train finished its operation and departed.

There was also one delay at Irvin (north end of Eugene Yard). It occurred when a southbound train had to wait for two northbound trains to leave the yard at the same location. One flaw in the design of Eugene Yard is that all northbound trains must depart the yard at Irvin (because of the yard lead configuration), and this is also the only yard access route for southbound trains. Therefore, congestion is likely to occur in this location if a high percentage of Brooklyn Sub trains are required to enter the yard.

Revised Alternative 1 (4+1) Brooklyn Sub Velocity Comparison

The following table provides the velocity of the various train classes on the Brooklyn Sub for the Revised Alternative 1 (4+1) analysis. As previously discussed, the PNWR results only reflect PNWR operations that occur on UP's Brooklyn Subdivision.

Alternative Revised 4+1 Group	Delay	Dwell	Elapsed Time	Miles	Del/10	Velocity Total Elapsed	Velocity minus Delay and Dwell
Passenger	1:53:54	10:20:33	77:25:38	3814.6	0.3	49.3	58.5
PNWR	1:05:33	14:48:00	24:21:30	463.3	1.4	19.0	54.7
UPExp	6:59:19	7:36:09	74:39:31	2406.7	1.7	32.2	40.1
UPLocal	7:08:42	60:26:04	93:19:35	699.6	6.1	7.5	27.2
UPMani	18:23:12	68:24:10	208:10:38	4318.1	2.6	20.7	35.6
UPUnit	10:12:14	21:01:10	107:43:54	2609.0	2.3	24.2	34.1
Total Freight	43:48:59	172:15:33	508:15:07	10496.6	2.5	20.7	35.9

As the table indicates, the passenger velocities were increased in the 4+1 alternative as compared with the Revised 3+1 and Revised No Action alternatives. As described, the Analysis Team believes this is because the passenger schedules created passenger-passenger meets on sections of two main tracks rather than in sidings. This allows both trains to continue running at track speed, rather than slowing or stopping in a siding.

Freight velocities in the Revised 4+1 alternative were very similar to those in the Revised 3+1 alternative. There was a small improvement in the amount of delay local, manifest and unit trains experienced, while the expedited category experienced a very slight increase in delay. This affected the velocities of the four traffic groups, however, the impact was slight. The overall consequence to freight traffic was that velocities were slightly increased in the Revised Alternative 1 (4+1) analysis as compared to the Revised 3+1 and the Revised No Action Cases.

Revised Alternative 1 (4+1) Portland to Vancouver Results

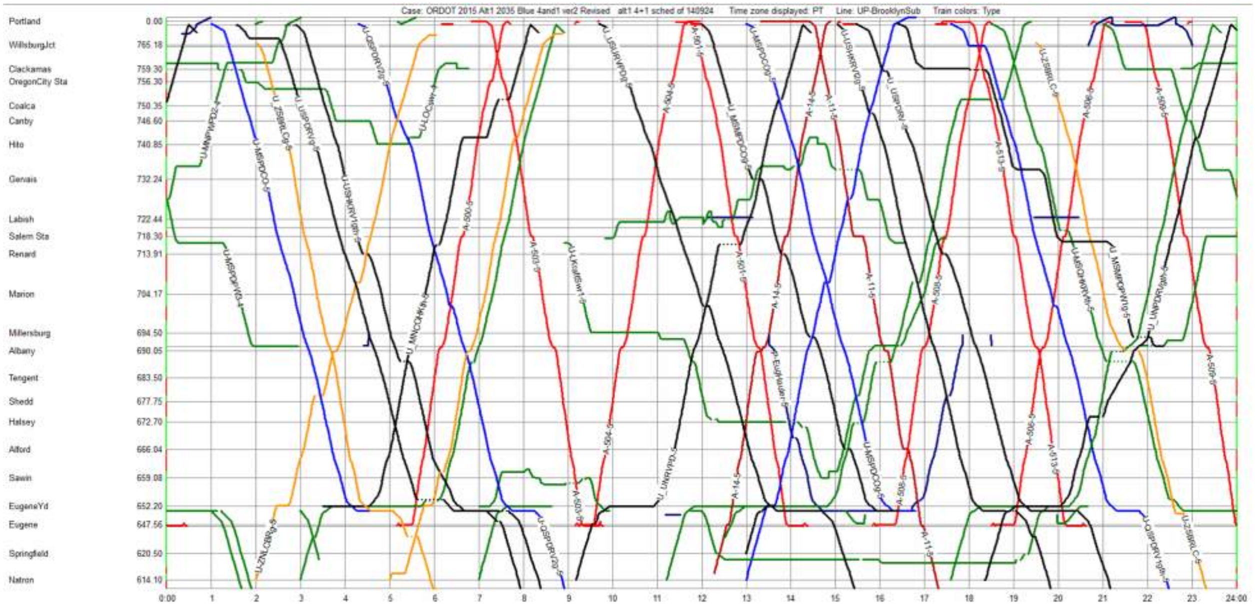
Delays exceeding 30 minutes were notably reduced in the Revised Alternative 1 (4+1) analysis case as compared to the Revised No Action Case, and were the same as the D>30 delays in the Revised Alternative 1 (3+1) case. With the same amount of freight traffic on the segment, the number of delays was reduced to 1.3 per day from 4.7 per day in the Revised No Action Case (Graph 7 below). As described previously, the number of Amtrak Cascades and Amtrak round trips remained the same between the two cases.

As with the Revised Alternative 1 (3+1) Case, the main contributor to the improved performance was the increased speed on UP's connection between Peninsula Jct. and NPJ, along with the upgraded turnouts at each end of the connecting track. Movements that could continue from BNSF's Fallbridge Sub onto the UP connection track at 25 mph cleared the area much more quickly, which reduced delays for UP traffic and for BNSF traffic operating in the area.

Also, the local train working between Willbridge Yard and Lake Yard again experienced delay in the Revised Alternative 1 (4+1) analysis. As described previously, this is a timing issue with the three trains that are involved in the delay. If the locals' operations were slightly adjusted, the delay would not have occurred. Since the model can only use what was included in the input files, the delay is repetitive from day to day as well as between analysis cases.

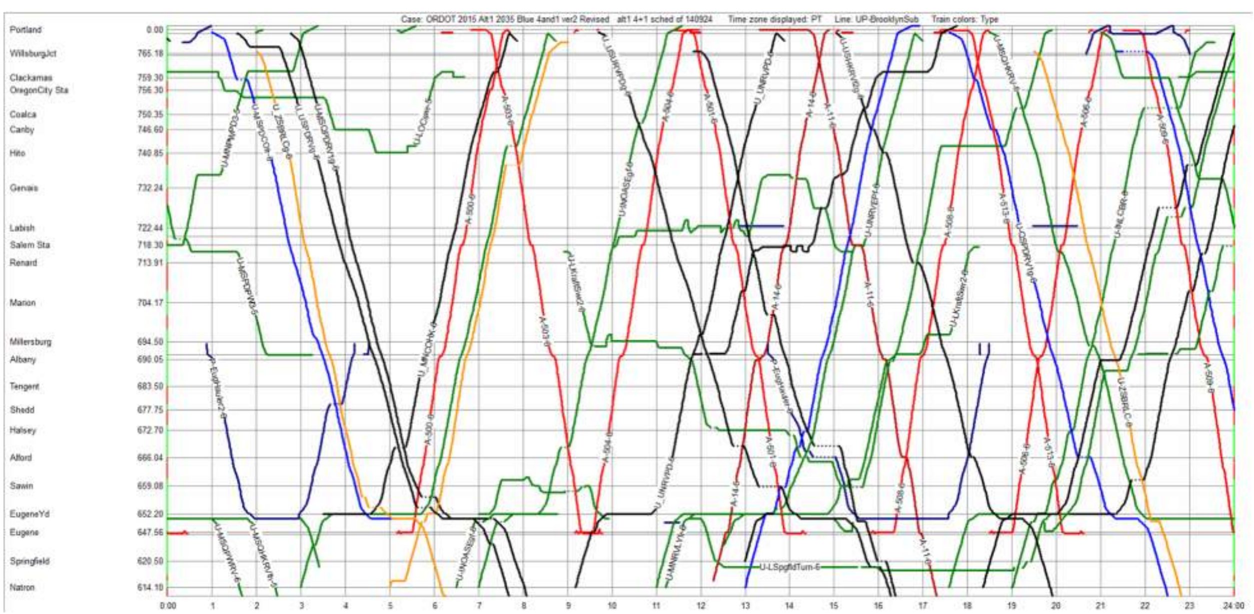
The similarity in delays between the Revised 3+1 and Revised 4+1 analyses in the Portland to Vancouver corridor underscores how separated the two corridors segments are. Even though passenger traffic and infrastructure were modified on the Brooklyn Sub, there was no change in the operational patterns between Portland and Vancouver. It can therefore be concluded that Brooklyn Sub operations have little to no effect on Fallbridge Sub operations, or vice versa using current freight train operations and simulated Amtrak schedules provided by ODOT.

Revised Alternative 4+1 Stringlines
Day 1

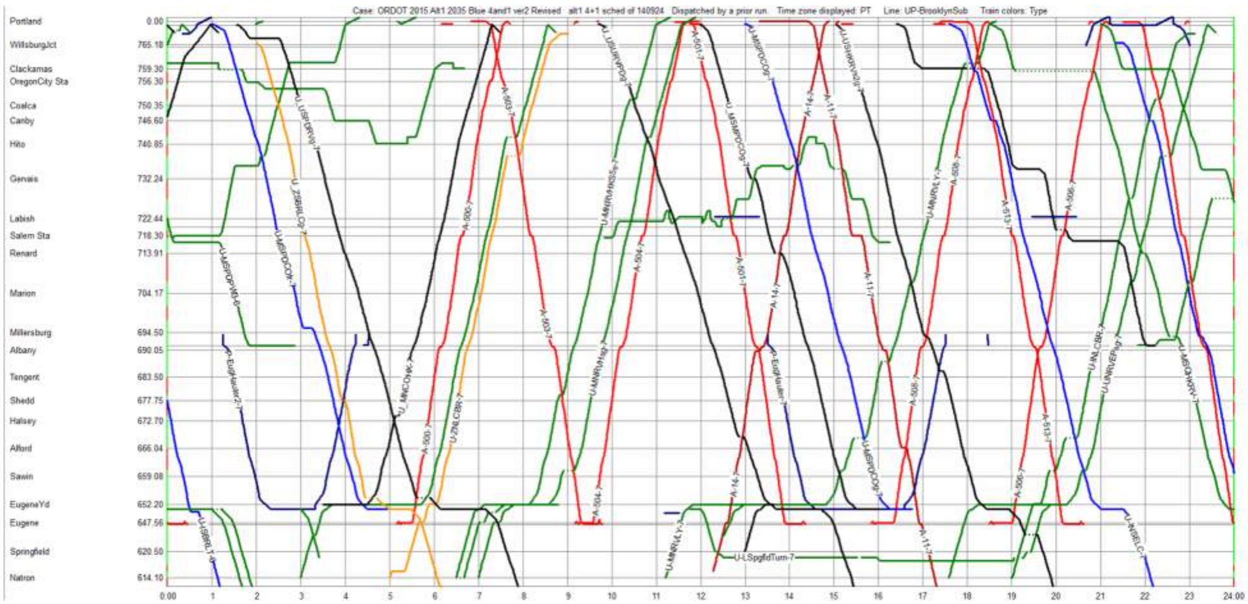


Color	Passenger Trains
	Red - Amtrak Cascades trains
	Reddish Brown – Amtrak Coast Starlight
	Freight Trains
	Gold – (Z trains) High priority containers for intermodal
	Black – Unit Trains
	Blue – (Q trains - Doublestack) Priority Intermodal
	Green – Local and Merchandise trains

Day 2



Day 3



Color	Passenger Trains
Red line	Red - Amtrak Cascades trains
Reddish brown line	Reddish Brown – Amtrak Coast Starlight
	Freight Trains
Gold line	Gold – (Z trains) High priority containers for intermodal
Black line	Black – Unit Trains
Blue line	Blue – (Q trains - Doublestack) Priority Intermodal
Green line	Green – Local and Merchandise trains

Appendix A-E – Revised Alternative 4+1 Operations on Alternative 1 (3+1) Infrastructure

Revised: October 18, 2016

Prepared by: Mainline Management

4+1 Passenger Operations on Alternative 1 (3+1) Infrastructure

Introduction

The Analysis Team was tasked with simulating a four Amtrak Cascades, one Coast Starlight round trip schedule (4+1) on the same Brooklyn Sub track network that was utilized in the Revised Alternative 1 (3+1) analysis. The goal of this analysis was to determine if additional track infrastructure could be reduced while maintaining an efficient freight operation over the Brooklyn Subdivision between Portland and Eugene.

4+1 Passenger Operations on Alternative 1 (3+1) Network Operational Modifications

The only operational modification that was made in the 4+1 Passenger Operations on Alternative 1 (3+1) Network (referred to as “4+1 on 3+1”) was the change in passenger trains between Portland and Eugene. The train input files from the Revised Alternative 1 (3+1) simulation were utilized except the passenger train files for the Revised Alternative 1 (4+1) analysis were substituted into the train input files. This was significant because it meant that the freight files were exactly the same between the 4+1 on 3+1 analysis and the Revised Alternative 1 (3+1) analysis. The relevance of having a replicated freight train file will be explained in more detail in the Results section below.

4+1 Passenger Operations on Alternative 1 (3+1) Network Infrastructure Modifications

The Revised Alternative 1 (3+1) Network for the Brooklyn Sub was used in the 4+1 on 3+1 analysis. The track infrastructure improvements that were made to the existing Brooklyn Sub network can be reviewed in the Revised Alternative 1 (3+1) Analysis notes above. There is also a schematic representation of the improvements for the 3+1 network in those notes that can be reviewed.

4+1 Passenger Operations on Alternative 1 (3+1) Network Brooklyn Sub Results

There were 2.5 minutes of delay per ten miles operated for the 4+1 on 3+1 simulation (Graph 13 below). There were also 4.7 delays per day that exceeded 30 minutes (Graph 14 below). This result was less than the Revised No Action Case, which was an expected outcome of the analysis.

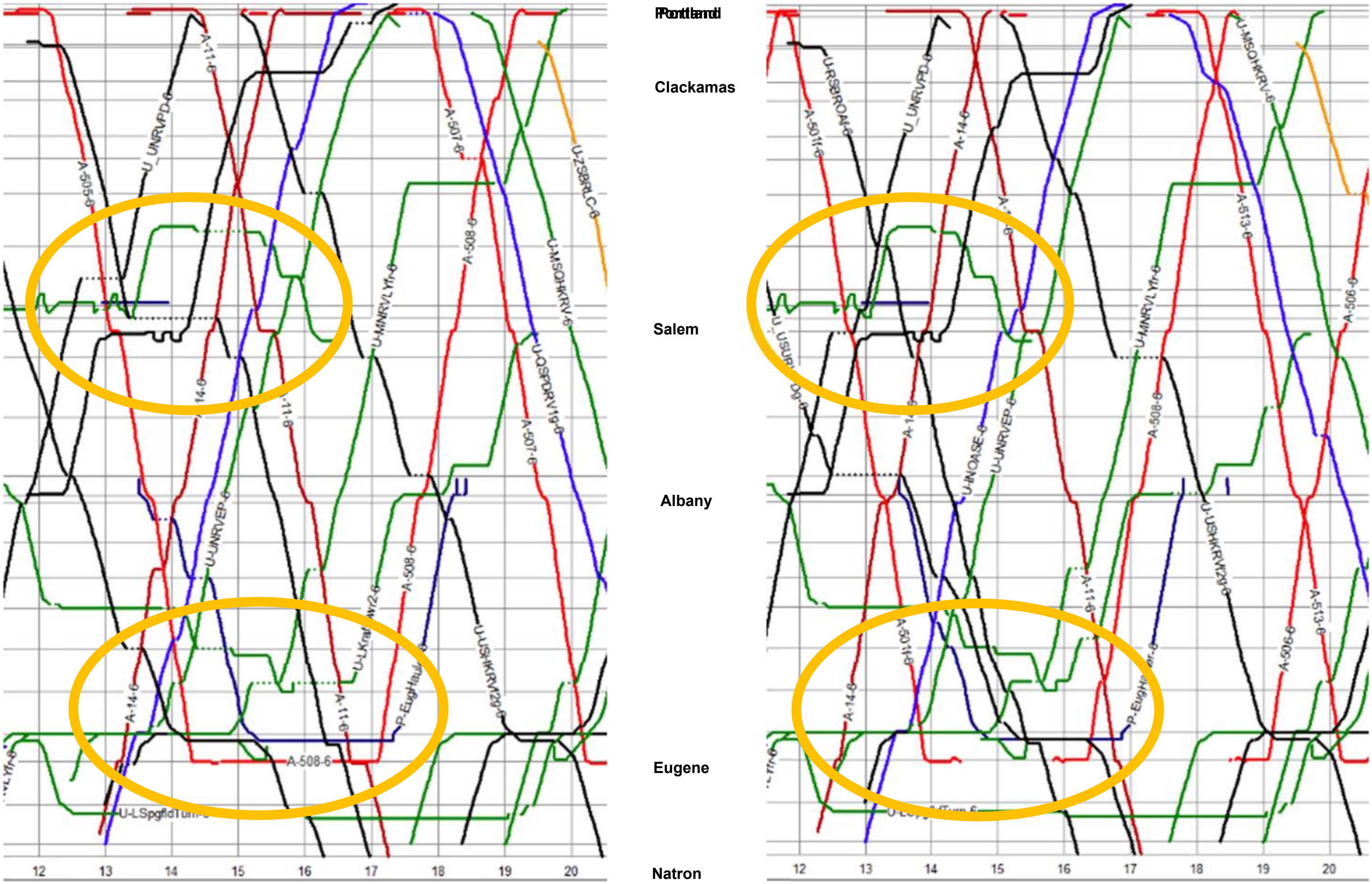
However, the D/10 delay minutes and the D>30 delays were also less than the Revised Alternative 1 (3+1) results, which was an unexpected result. Considering that the track network was the same, the freight operations were the same, but the latest simulation had one additional Amtrak Cascades round trip, a D/10 that was slightly greater than the Alternative 1 (3+1) result was expected. After detailed review of the results output, the Analysis Team believes the reduced D/10 delay minutes outcome occurred because of the passenger schedules used in the 4+1 on 3+1 simulation as compared to those used in the Alternative 1 (3+1) simulation.

A review of the passenger - passenger meets and where they occurred was undertaken for both the Revised Alternative 1 (3+1) analysis and the 4+1 on 3+1 Network analysis. As described in the Revised Alternative 1 (3+1) analysis notes above, there were four passenger - passenger meets that occurred. These occurred at Hito Siding (two), Renard Siding (one) and Shedd Siding (one). In the 4+1 on 3+1 Network simulation, six meets between passenger trains occurred because of the additional set of Amtrak Cascades trains. The meets occurred near East Milwaukie on second main track (three), between Albany and Hallawell on second main track (two) and between Swain and Irvin on second main track (one).

As can be seen, the 4+1 on 3+1 simulation meets occurred on multiple main tracks. As has been previously described, when a passenger - passenger meet occurred where there are mostly sidings in the area, a freight train in that same area frequently had to wait for the first passenger train to meet (or overtake) it, then remain in the siding until the second passenger train overtook (or met) it. The simulation results indicated that this is what happened in the Revised Alternative 1 (3+1) simulation, where the passenger-passenger meets occurred in sidings.

In the 4+1 on 3+1 simulation, however, with the passenger-passenger meets occurring on sections of second main track, there was not the same impact on the freight operations. With a second main track, the freight trains only had to intermittently wait for one of the passenger trains, and in some cases, did not have to stop at all. This modification in meet/pass resolution also changed the freight train running times, which affected other freight meets and passes throughout the simulation. So even though there were more passenger-passenger meets in the 4+1 on 3+1 analysis, the impact to freight traffic was notably less than in the Revised Alternative 1 (3+1) analysis.

The Analysis Team has included small sections of the time-distance graphs ("string line graphs") for the Revised Alternative 1 (3+1) analysis and the 4+1 on 3+1 simulation to demonstrate this point. As described previously, the freight departure schedules were the same in the Alternative 1 (3+1) and the 4+1 on 3+1 simulations. Also as described, the track network used for the two simulations was identical. The only operating change that was made was the modification of the passenger schedules from the 3+1 configuration to the 4+1 configuration. Therefore, any change in freight operations had to be caused by the passenger changes. The time-distance graphs show this effect.



Revised Alt 1 (3+1), 1200 to 2000

4+1 on 3+1 Network, 1200 to 2000

In the time-distance graphs, red (Amtrak Cascades) and reddish brown (Coast Starlight) lines represent passenger trains as they move between Portland (top of graph) and Natron (bottom of graph) over time, which is shown along the horizontal axis at the bottom of each graph. The other blue, green and black lines represent different types of freight traffic. Trains are stopped when a line is horizontal; trains are delayed when the horizontal line is dotted.

The change in timing of the passenger trains (the additional pair of trains as well as the departure times of the sets of Amtrak Cascades trains) is obvious between the Revised Alternative 1 (3+1) time-distance graph on the left and the 4+1 on 3+1 Network graph on the right. Additionally it is obvious that the passenger train count and schedule modification changed the meet patterns for freight traffic.

It can be seen that the freight trains begin their trip at Albina Yard (near Portland) or Natron at the same times in both time-distance graphs, but the meet patterns change once they interact with the passenger trains. In the Revised Alternative 1 (3+1) time-distance graph, there are multiple delays to freight traffic (dotted horizontal lines) in both of the highlighted areas. The delays all occur to freight traffic operating between passenger train movements (red and reddish brown lines). At the same time, in the 4+1 on 3+1 graph, there are very few delays in those same time periods (almost no horizontal dotted lines).

These graphs illustrate the impact passenger schedules and meets had on freight trains in the Revised Alternative 1 (3+1) analysis as compared to the 4+1 on 3+1 simulation. Similar differences between the two analyses occurred on other days of the simulations as well. The Analysis Team believes these differences are responsible for the reduction in D/10 delay minutes and D>30 delays between the two analyses.

Even with the change in the location of passenger - passenger meets, some delays continued to be caused by passenger and freight meets (Graph 15 below). Many of the delays caused by passenger meets occurred when a freight - freight meet took place and then the stopped freight train had to wait on a following passenger train. In some of those cases, the delayed freight train was a local waiting to switch an on-line industry on single track, so the model could not allow the local switcher out until the passenger train had passed.

The distribution of delays over the line segment continued to indicate that there was no repetitive issue with the 3+1 configuration under the 4+1 passenger schedules (Graph 16 below). No one segment of the Brooklyn Sub experienced a high number of delays that exceeded 30 minutes, which indicated that there was nothing associated with the network track configuration that promoted delays.

Overall, it appears that the schedule of the projected Amtrak Cascades trains has a notable consequence on UP's freight performance over the Brooklyn Sub. The timing between departures from Portland and Eugene as well as where passenger trains meet will have an impact on where capital improvements will be necessary to maintain or improve UP's freight operations as additional Amtrak Cascades roundtrips are added.

4+1 Passenger Operations on Alternative 1 (3+1) Network Brooklyn Sub Velocity Comparison

The following table provides the velocity of the various train classes on the Brooklyn Sub for the 4+1 on 3+1 analysis.

4+1 on 3+1 Network Group	Delay	Dwell	Elapsed Time	Miles	Del/10	Velocity Total Elapsed	Velocity minus Delay and Dwell
Passenger	1:48:39	11:20:00	78:33:24	3816.0	0.3	48.6	58.3
PNWR	1:02:35	13:18:00	24:05:58	463.3	1.4	19.2	47.5
UPExp	5:15:59	7:27:05	71:35:31	2409.6	1.3	33.7	40.9
UPLocal	6:51:48	59:41:05	91:54:27	699.8	5.9	7.6	27.6
UPMani	16:18:06	68:24:08	207:41:40	4360.4	2.2	21.0	35.5
UPUnit	13:10:16	21:31:03	111:30:57	2610.2	3.0	23.4	34.0
Total Frt	42:38:43	170:21:21	506:48:32	10543.2	2.5	20.8	35.9

Passenger train velocities are slightly less in the 4+1 on 3+1 simulation as compared to the Revised Alternative 1 (4+1) simulation (48.6 mph vs 49.3 mph). Both of these simulations included the same number of passenger round trips between Portland and Eugene. The slight reduction in passenger velocity was likely because the passenger trains were slowed somewhat by freight traffic that had to meet and pass over the 3+1 network, which included fewer track infrastructure improvements than the Alternative 1 (4+1) network.

However, the passenger velocities were notably higher in the 4+1 on 3+1 simulation as compared to the passenger velocities in the Revised Alternative 1 (3+1) simulation (48.6 mph vs 43.8 mph). This again supports the conclusion that the location of the passenger - passenger meets plays a major role in the efficiency of a conceptual rail network. As described, the 4+1 on 3+1 simulation featured passenger meets on multiple main tracks, while the Revised Alternative 1 (3+1) analysis featured those meets in sidings. As has been previously described, when a meet occurs in a siding, one passenger train usually has to stop to wait which reduces the velocity of the entire group.

The average freight velocities were also greater in the 4+1 on 3+1 simulation compared to the Revised Alternative 1 (3+1) analysis (20.8 mph vs 20.2 mph). This also reflects the previous discussion about how freight traffic did not receive the level of delay in the 4+1 on 3+1 simulation because the passenger schedules were less disruptive to freight operations.

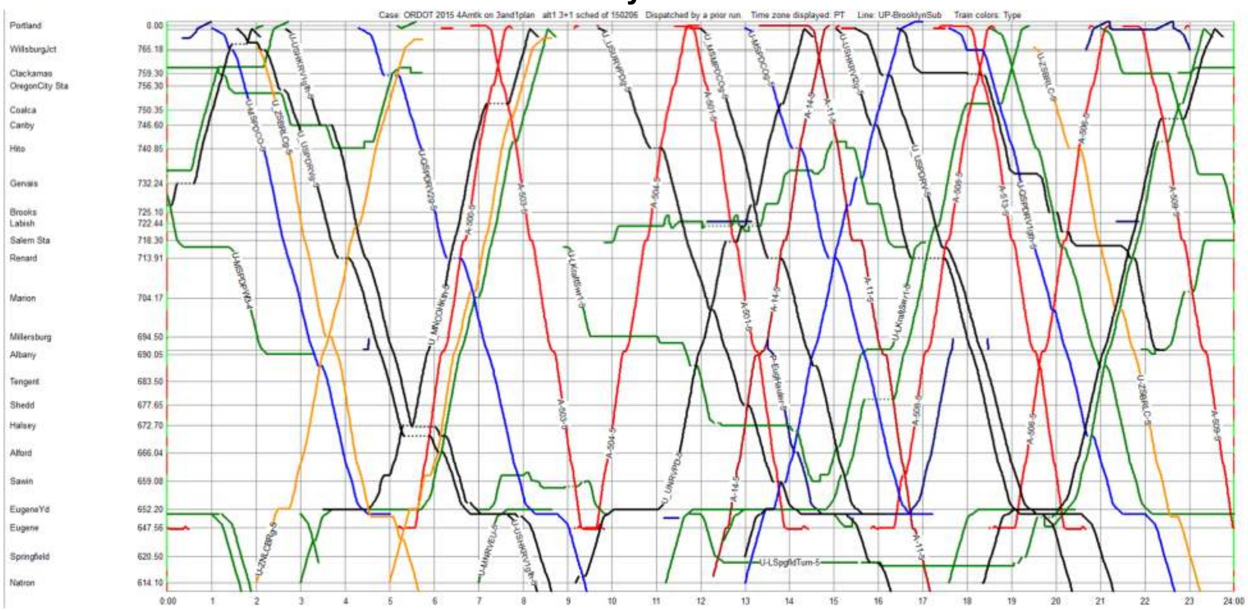
The 4+1 Passenger Operations on Alternative 1 (3+1) Network - Portland to Vancouver Results

Similar to both the Revised 3+1 and 4+1 analyses, there were few delays between Portland and Vancouver under the six Amtrak Cascades, one Coast Starlight and one Empire Builder (6+2) passenger schedules. The greatest contributor to this development was the track speed modifications to UP's connection between Peninsula Jct. and North Portland Jct., which continued to facilitate more efficient freight movements in the Portland - Vancouver corridor.

The one repetitive delay that was experienced in the 4+1 on 3+1 simulation was at Willbridge Yard. As has been noted previously, this appeared to be a timing issue between two locals that are scheduled to work in Lake Yard at the same time. This delay has been seen in many of the previous analyses and likely would be eliminated with a change in either of the locals' schedule or a more fully developed Lake Yard configuration in the model.

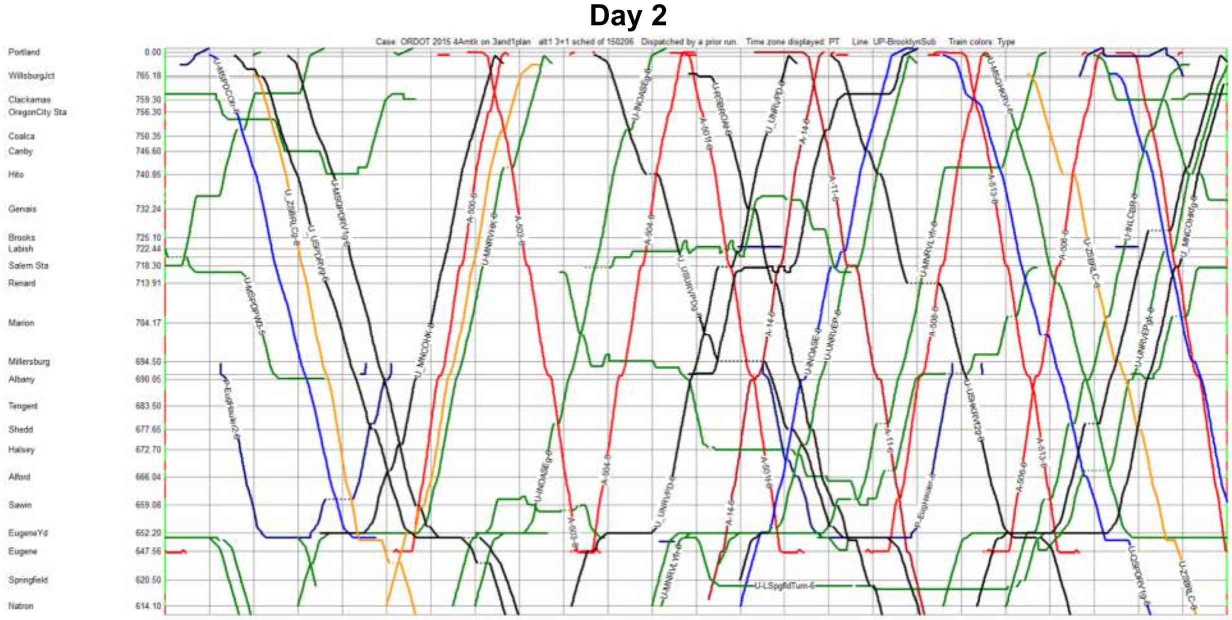
Revised Alternative 1 (4+1) on (3+1) Infrastructure

Day 1

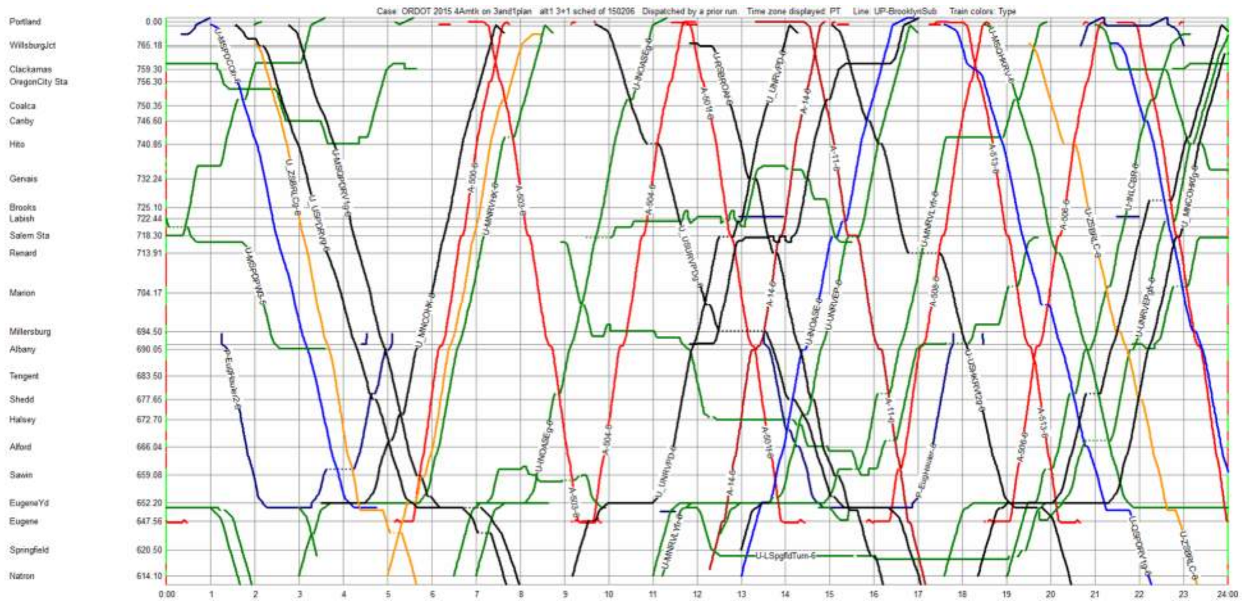


Color	Passenger Trains
	Red - Amtrak Cascades trains
	Reddish Brown – Amtrak Coast Starlight
	Freight Trains
	Gold – (Z trains) High priority containers for intermodal
	Black – Unit Trains
	Blue – (Q trains - Doublestack) Priority Intermodal
	Green – Local and Merchandise trains

Day 2



Day 3



Color	**Passenger Trains**
red line	Red - Amtrak Cascades trains
reddish brown line	Reddish Brown – Amtrak Coast Starlight
	Freight Trains
gold line	Gold – (Z trains) High priority containers for intermodal
black line	Black – Unit Trains
blue line	Blue – (Q trains - Doublestack) Priority Intermodal
green line	Green – Local and Merchandise trains

Appendix A-F – 2035 No Action Minimum

Revised: October 18, 2016

Prepared by: Mainline Management

2035 No Action Minimum Simulation

An additional simulation that was suggested by FRA to ODOT was to take the 2035 No Action simulation and add enough infrastructure to return the delay statistics to within 10% of the Base Case delay statistics. The Analysis Team was told this simulation's results were to be used at some later time.

The Analysis Team estimated some improvements for a first iteration of the 2035 No Action Minimum simulation based on results from previous simulations. At the conclusion of the first iteration, the statistics were not within 10% of the Base Case results, so some additional infrastructure improvements were added to the simulation network. The final results of the second iteration were within 10% of the Base Case statistics, and those results will be described below.

2035 No Action Minimum Operating Modifications

There were no freight operating modifications made in the 2035 No Action Minimum simulation as compared to the 2035 No Action simulation. All projected 2035 growth was included for UP, BNSF and PNWR traffic on the network.

Similarly, there were no modifications to passenger operations between the two simulations. 2+1 passenger operations were included between Portland and Eugene (two Amtrak Cascades, one Coast Starlight round trip) and 6+2 passenger operations were included between Portland and Vancouver (six Amtrak Cascades, one Coast Starlight and one Spokane Section Empire Builder round trip).

2035 No Action Minimum Network Modifications

As described, the total track infrastructure modifications that were made in the 2035 No Action Minimum simulation were included in two iterations. In the first iteration, there were two areas that received additional track. These were between East Milwaukie and Clackamas and between Judkins and Swain.

A second main track was added between East Milwaukie and MP 758.7 (south of the south end of Clackamas Siding). A universal crossover was also added at MP 761.2. The purpose of the infrastructure improvement was to facilitate traffic flow between Clackamas and Brooklyn Yard. Industry switching, access and egress from Brooklyn Yard and heavy traffic flows created delays in this segment in previous simulations. The improvements included in the 2035 No Action Minimum first iteration were designed to address those conflicts.

A second main track between Judkins (MP 644.7) and Swain (MP 660.6) was also included in the first iteration along with multiple crossovers. The purpose of this track was to create additional routes past and to or from Eugene Yard. The configuration between Judkins and Swain used in the 2035 No Action Minimum network was the same improved configuration that was used in the Revised Alternative 1 (3+1), (4+1) and (6+1) networks.

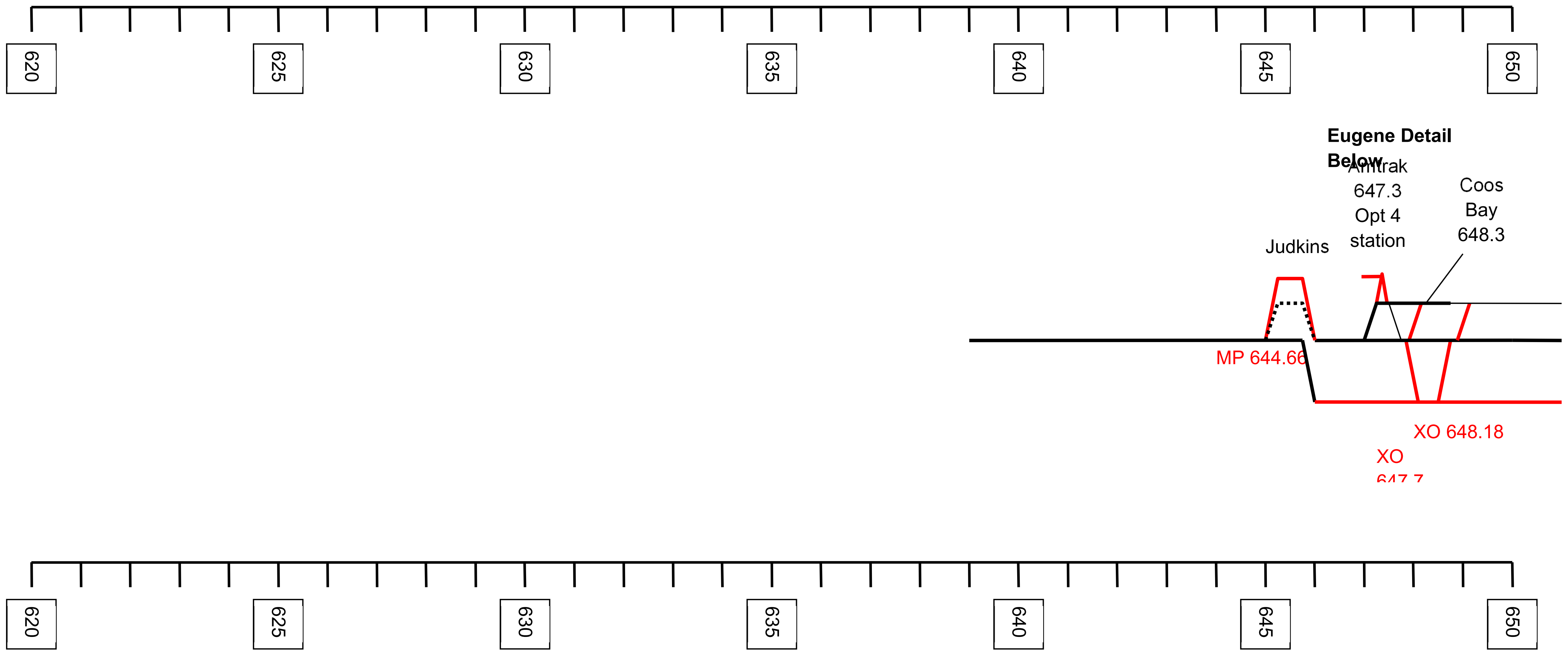
These two areas of infrastructure improvements reduced the first iteration of the 2035 No Action Minimum simulation's D/10 delay minutes from 3.7 minutes per 10 miles operated to 2.9 minutes per 10 miles operated. With Base Case D/10 minutes calculated at 2.4 minutes per 10 miles operated, the results did not meet the "within 10%" requirement.

The output from the first iteration of the 2035 No Action Minimum simulation was reviewed and multiple repetitive delays were identified around Salem. Therefore, in the second iteration, two additional improvements were added and the simulation was rerun.

The first additional infrastructure improvement that was added was a second main track connecting the north end of Renard Siding (MP 715.6) to the south lead track into Salem Yard (MP 716.68). A crossover was added at MP 716.5 to allow through trains to enter the single main track through the city.

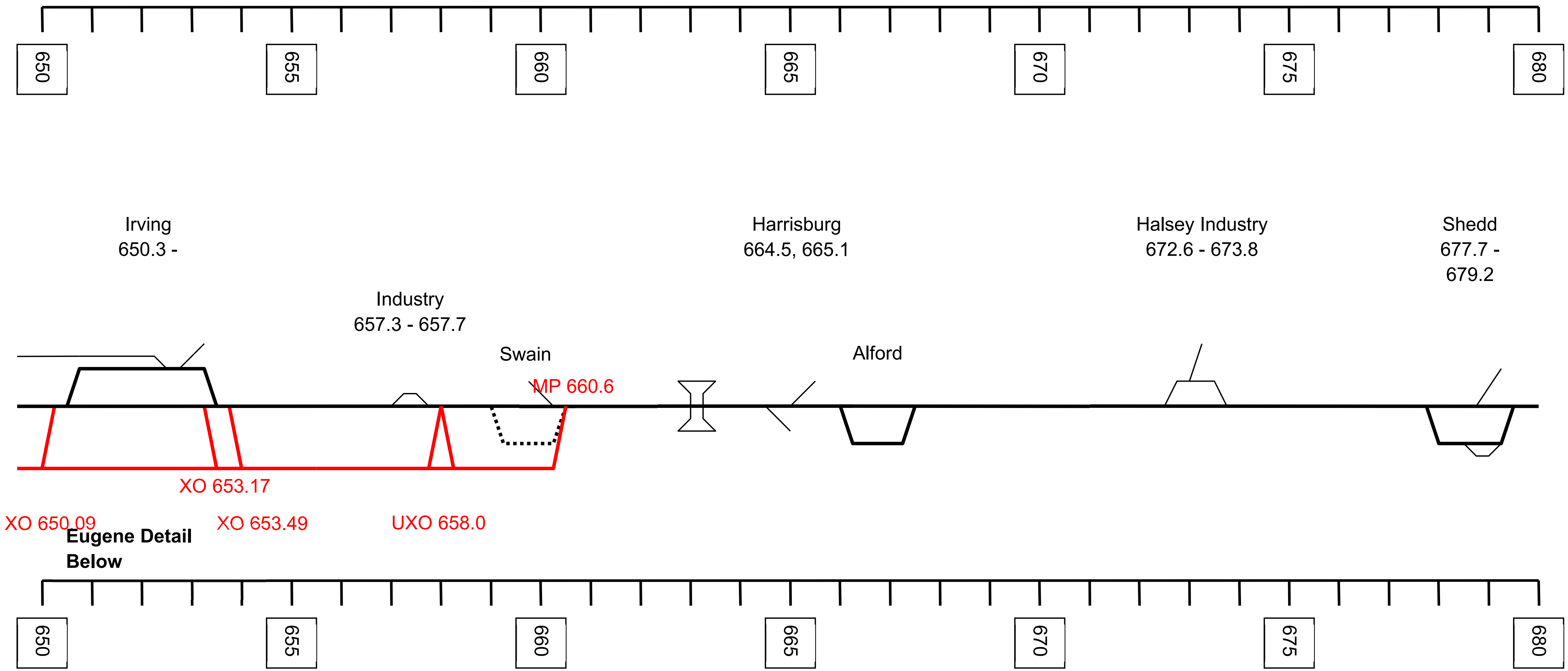
The second additional infrastructure improvement was a second main track from MP 719.5 at the south end of Labish to Brooks at MP 727.5. A universal crossover was also added at MP 722.6. This improvement allowed trains that were switching between Labish and Brooks to stop on a main track, while leaving the second main track available for through trains. The crossovers at MP 722.6 further allowed through trains to be routed around trains that were stopped for switching.

Both of the improvements that were added as part of the second iteration of the 2035 No Action Minimum simulation were used in the Revised Alternative 1 (4+1) and (6+1) simulations. The following schematic represents the modifications that were included in the 2035 No Action Minimum network.



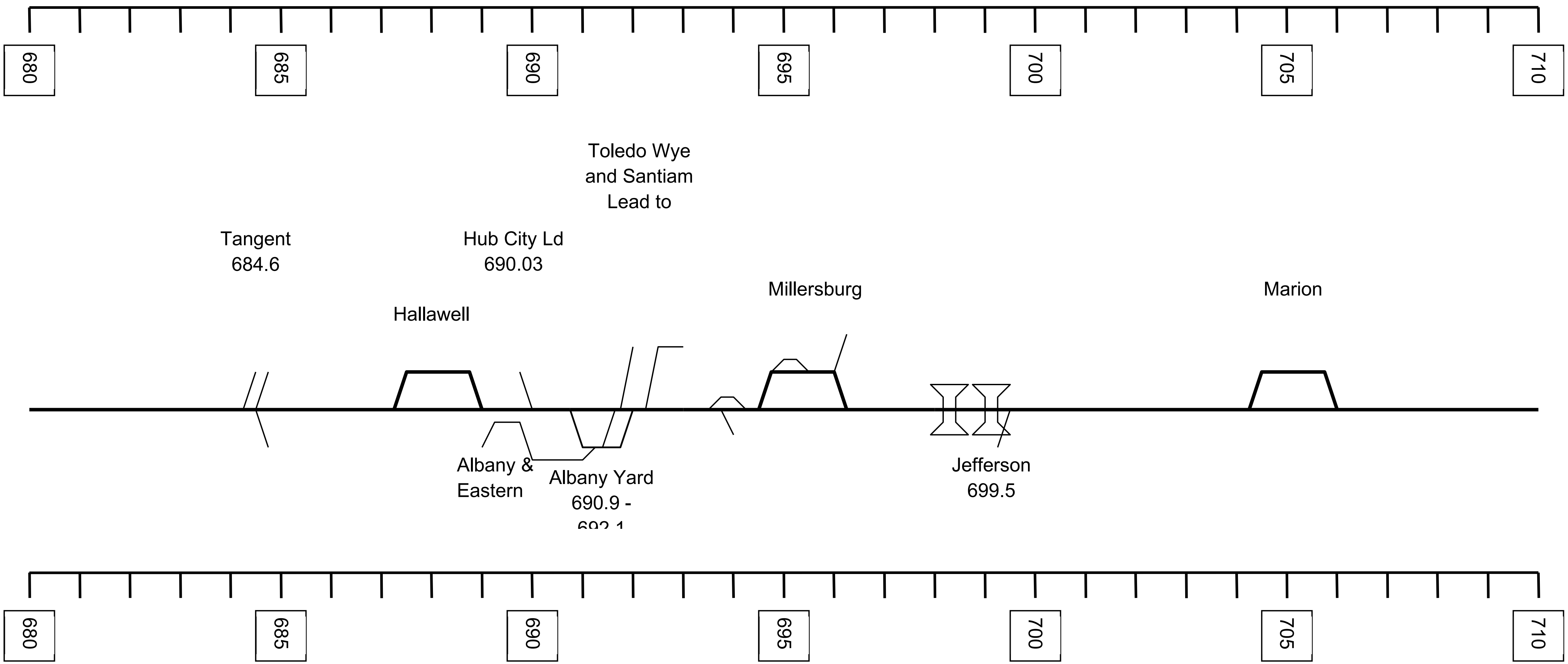
Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.
Heavy red is new main track or crossovers
UXO = universal crossover (double XO)

Revised No Action with Minimum



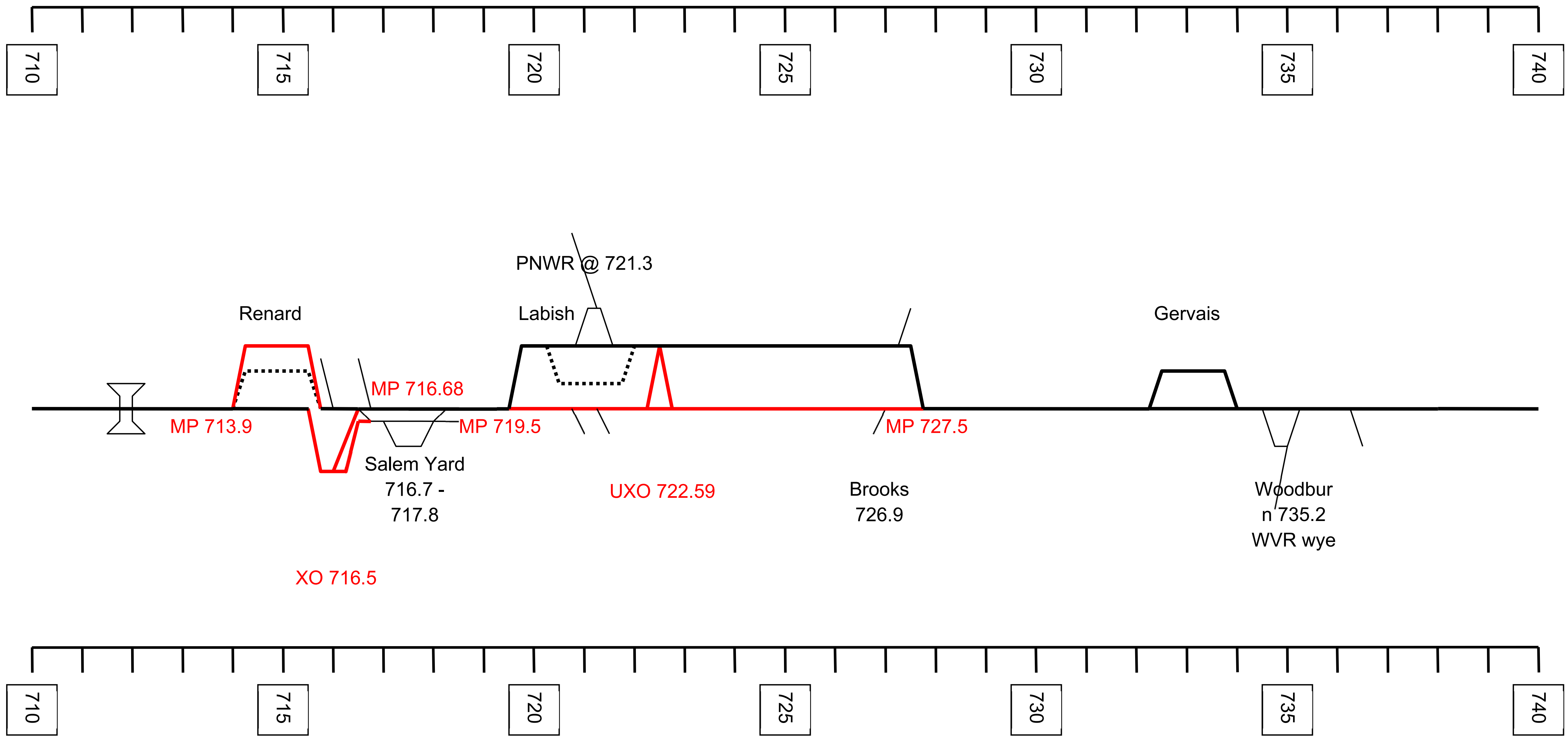
Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.
Heavy red is new main track or crossovers
UXO = universal crossover (double XO)

Revised No Action with Minimum



Heavy black is main line, or passing siding.   Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.
Heavy red is new main track or crossovers
UXO = universal crossover (double XO)

Revised No Action with Minimum

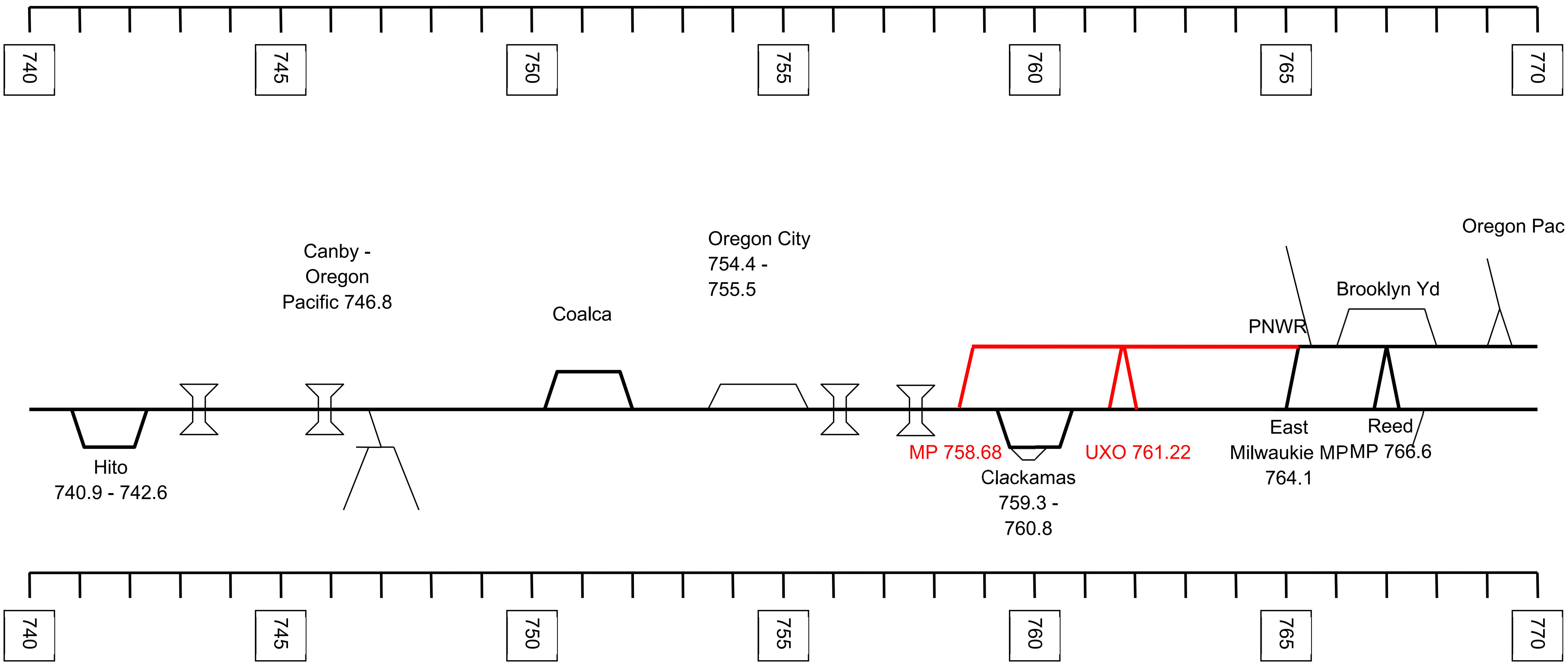


Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.

Heavy red is new main track or crossovers

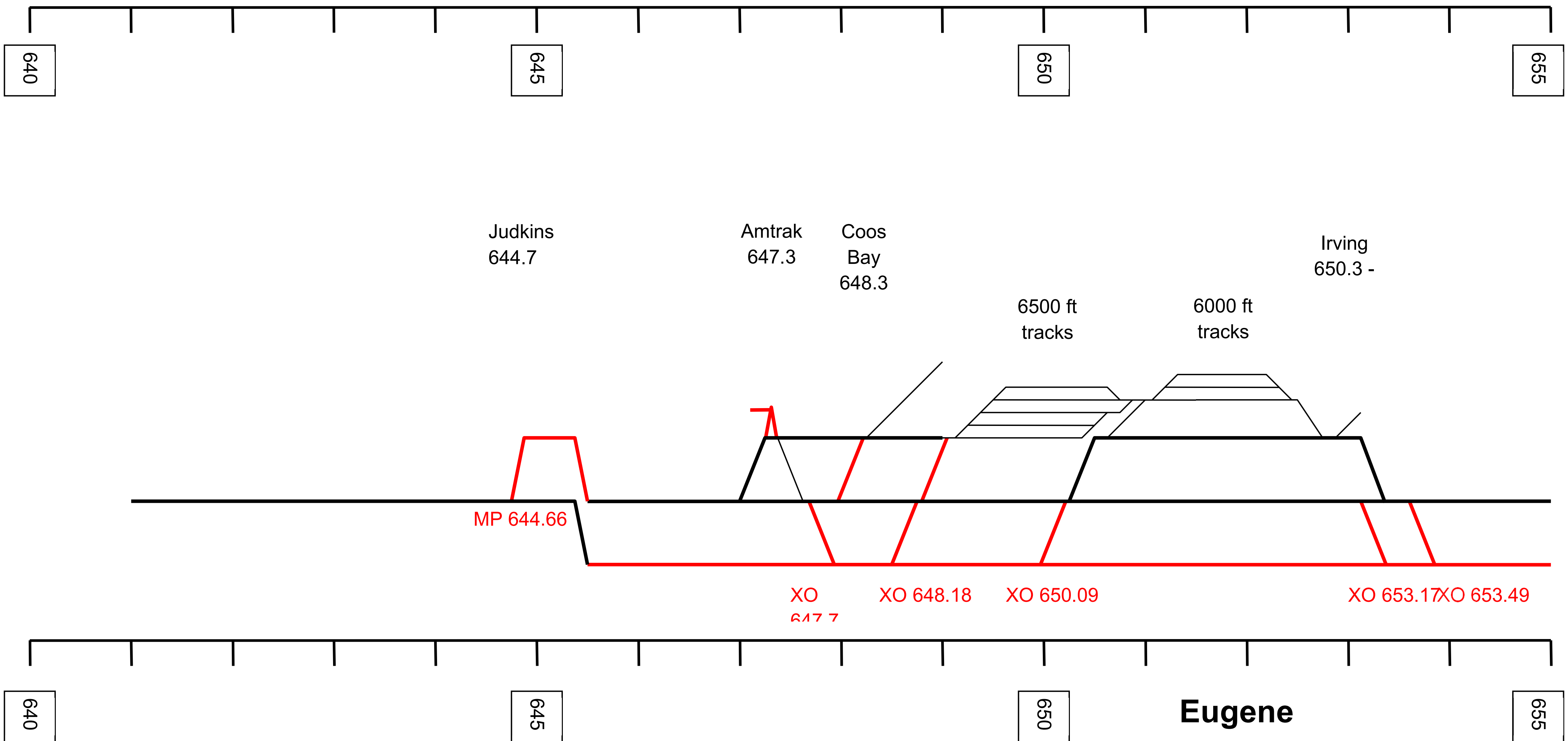
UXO = universal crossover (double XO)

Revised No Action with Minimum



Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.
Heavy red is new main track or crossovers
UXO = universal crossover (double XO)

Revised No Action with Minimum



Eugene Detail

Heavy black is main line, or passing siding. Thin black is industry track or yard. Dotted black is siding that becomes part of second main track.
Heavy red is new main track or crossovers
UXO = universal crossover (double XO)

Revised No Action with Minimum

Brooklyn Sub 2035 No Action Minimum Results

The infrastructure improvements that were included in the second iteration of the 2035 No Action Minimum simulation reduced the D/10 minutes to 2.6 minutes per 10 miles. This can be compared to the 2035 No Action case, which had a D/10 figure of 3.7 minutes per 10 miles and the Base Case, which was 2.4 minutes per 10 miles (Graph 9 below). The second iteration of the 2035 No Action Minimum simulation met the criteria of reducing the delay to within 10% of the Base Case delay.

Conflicts remained even with the infrastructure improvements. There continued to be delays where a single train met two or more opposing trains; in some of these cases, a passenger train was one of the two opposing trains. Also, on line switching continued to delay through trains (or vice versa) in multiple locations (Graph 11 below).

There were two locations that experienced the major delays associated with meeting two or more opposing trains. The first location was at the end of the second main track just south of Clackamas (MP 758.7). In all three days of the simulation, a single freight train met an opposing freight and passenger train at this location. Each delay exceeded 30 minutes.

The second location where a single train met multiple trains was in Hallawell Siding. At that location, two freight trains met an opposing freight that was holding in the siding. Again, the delay that resulted exceeded 30 minutes.

The other type of conflict that regularly occurred on the Brooklyn Sub was delay associated with on line switching. This occurred at least once per day for all three days of the simulation. The locations varied, but the highest percentage occurred between Oregon City and the new second main track at Brooks.

Local trains and through trains were affected by on line switching delays. In some cases, the model dispatched the local onto a single track segment, which caused delays to a through train. In other cases, the through train was allowed to proceed and the local had to wait for the area to clear.

Graph 12 below illustrates the location of many of the longer delays. As can be seen, there were an average of two delays exceeding 30 minutes per day between Clackamas and Salem. This result reflects the delay that occurred at the end of the second main track south of Clackamas, as well as the on line switching delays that occurred between Oregon City and Brooks.

It appears that multiple segments of second track will be required if 2035 projected growth traffic is expected to operate to approximately the same levels of delay as current delay levels on the Brooklyn Sub. It is unclear whether UP will attempt to pursue this result. However, if they do, tracks around terminal areas and in locations where there appears to be a high level of on line industrial switching should be considered to achieve that goal.

Portland to Vancouver 2035 No Action Minimum Results

There was no track or operational changes made between Portland and Vancouver in the 2035 No Action Minimum simulation as compared with the 2035 No Action simulation. Therefore, there were no improvements made around North Portland Jct. on either the UP's connection track between Peninsula Jct. and NPJ or on BNSF's Fallbridge Sub at NPJ.

As expected, the lack of improvement in the NPJ area led to multiple daily delays that exceeded 30 minutes in the area. Some trains were delayed as far back as BNSF's Vancouver Yard, while other trains were delayed between East St. Johns and the Columbia River Bridge. Regardless of where the affected trains were held, the lack of improvement at NPJ was the cause of the conflicts.

There were also some continuing delays around Willbridge Yard in the 2035 No Action Minimum simulation. Many of these delays were similar to delays that were previously experienced. At times, some of the delays involved Amtrak trains using both main tracks moving to and from Portland Union Station. In other cases, other locals working adjacent yards had an impact on some of the delayed trains. This type of delay was less common than the delays that occurred at NPJ, but they were still evident.

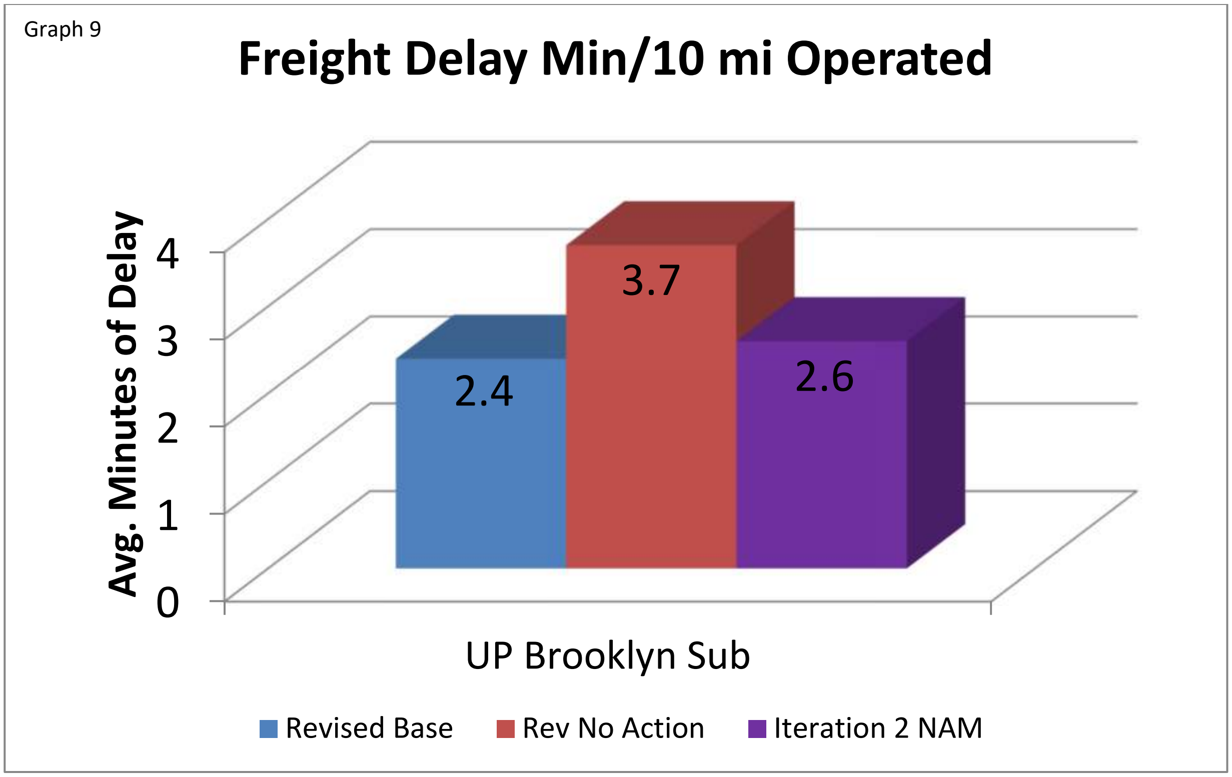
No Action Minimum Brooklyn Sub Velocity Comparison

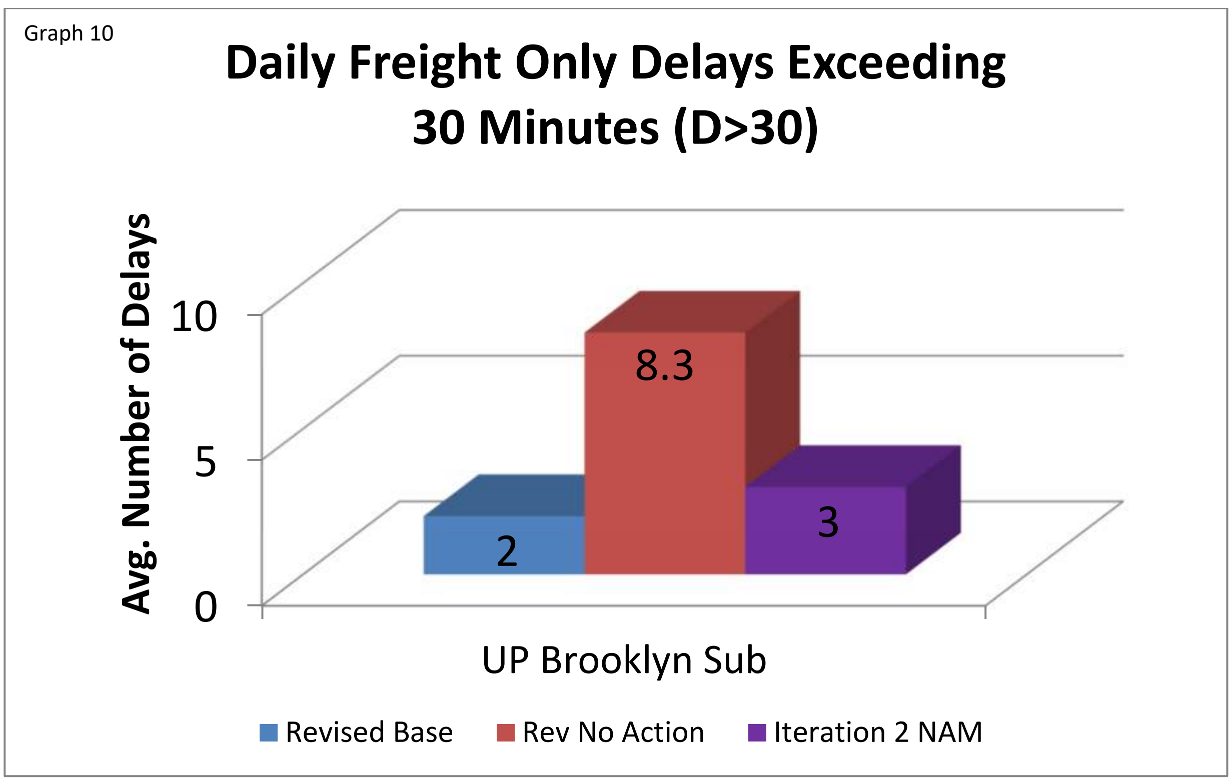
The following table provides the velocity of the various train classes on the Brooklyn Sub for the No Action Minimum analysis.

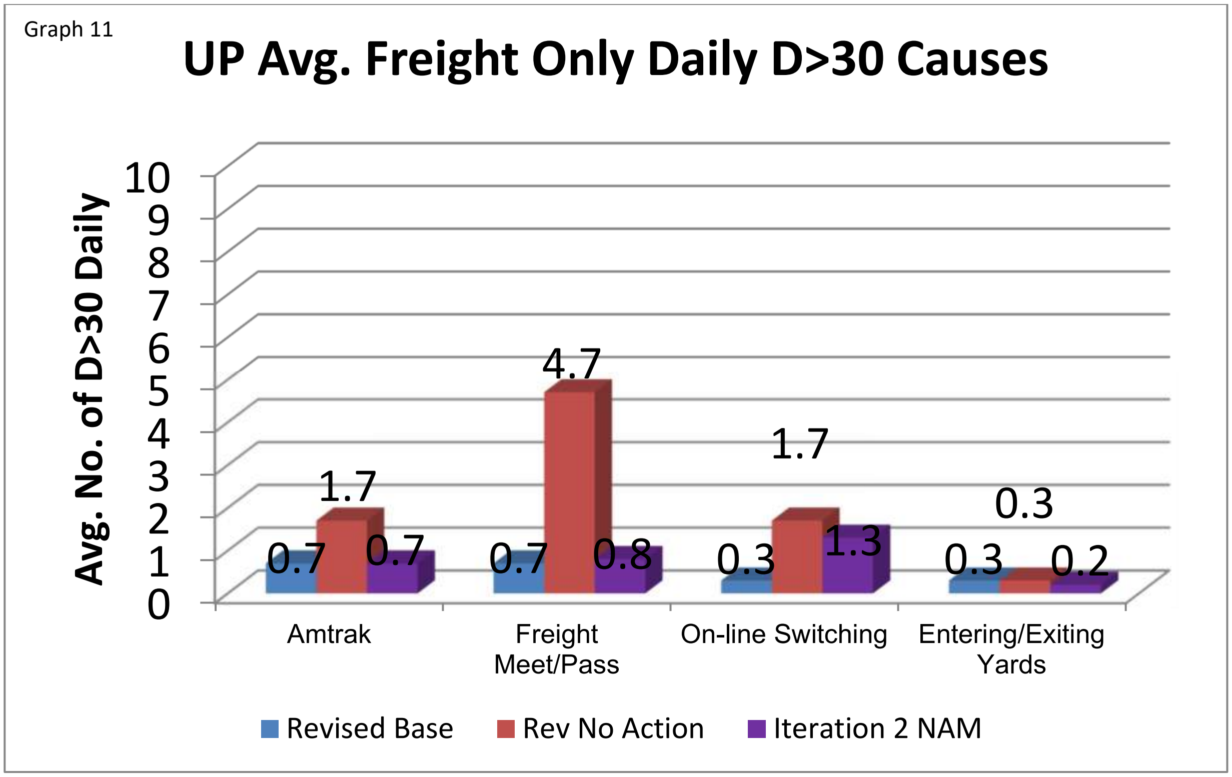
No Action Minimum						**Velocity**	**Velocity**
						Total	**minus Delay**
Group	**Delay**	**Dwell**	**Elapsed Time**	**Miles**	**Del/10**	**Elapsed**	**and Dwell**
Passenger	2:10:48	6:00:21	48:00:40	2316.6	0.6	48.3	58.2
PNWR	1:18:53	13:18:00	24:32:50	463.3	1.7	18.9	46.6
UPExp	5:28:12	7:38:09	72:56:46	2412.4	1.4	33.1	40.3
UPLocal	9:42:23	59:41:06	94:36:38	699.6	8.3	7.4	27.7
UPMani	15:25:12	69:03:07	211:20:49	4440.7	2.1	21.0	35.0
UPUnit	14:03:51	21:32:05	113:39:22	2611.5	3.2	23.0	33.5
Total Frt	45:58:30	171:12:27	517:06:24	10627.5	2.6	20.6	35.4

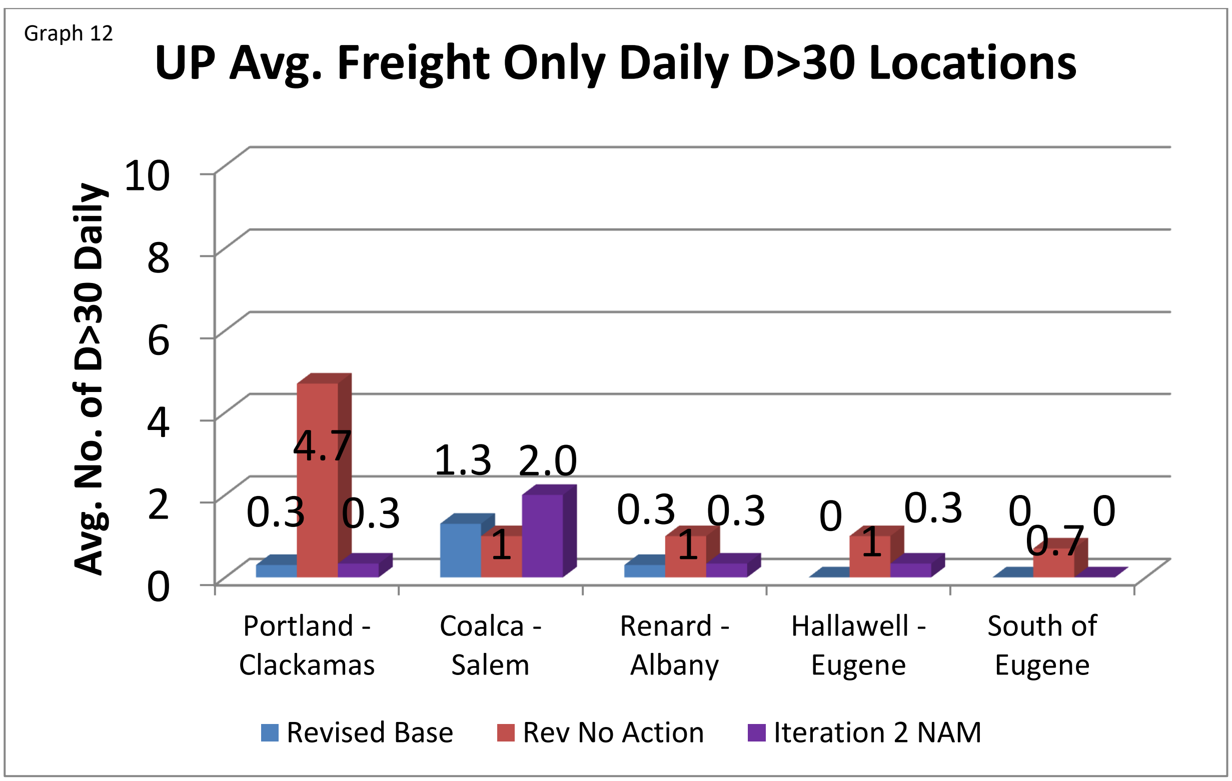
Comparison of the train velocities between the 2035 No Action Minimum simulation and velocities from the 2035 No Action simulation shows the value of the three areas of infrastructure improvements. Not only was the delay reduced from 3.7 minutes per 10 miles operated to 2.6 minutes per 10 miles operated, but the velocity of all freight trains improved from 19.7 mph to 20.6 mph. Every train type benefitted from the infrastructure improvements that were included in the 2035 No Action Minimum analysis.

2035 No Action Minimum Graphics


Graph 9
Freight Delay Min/10 mi Operated
Avg. Minutes of Delay
0
1
2
3
4
2.4
3.7
2.6
UP Brooklyn Sub
Revised Base
Rev No Action
Iteration 2 NAM

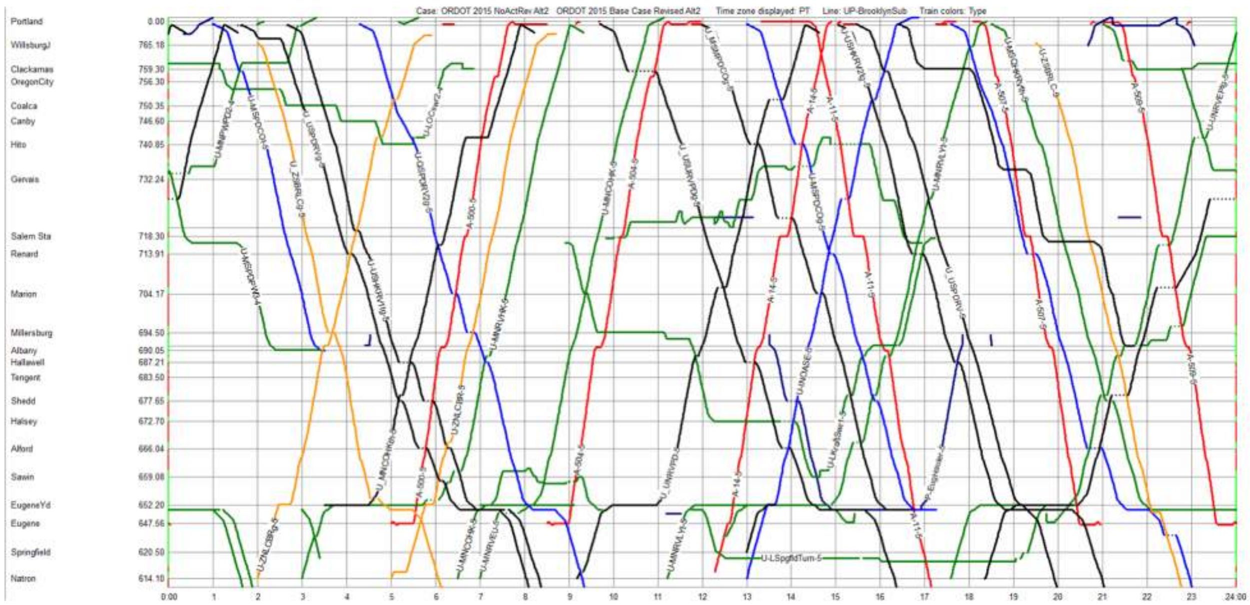

Graph 10
Daily Freight Only Delays Exceeding 30 Minutes (D>30)
Avg. Number of Delays
0
5
10
2
8.3
3
UP Brooklyn Sub
Revised Base
Rev No Action
Iteration 2 NAM


Graph 11
UP Avg. Freight Only Daily D>30 Causes
Avg. No. of D>30 Daily
10
9
8
7
6
5
4
3
2
1
0
1.7
0.7
0.7
4.7
0.7
0.8
1.7
0.3
1.3
0.3
0.3
0.2
Amtrak
Freight Meet/Pass
On-line Switching
Entering/Exiting Yards
Revised Base
Rev No Action
Iteration 2 NAM


Graph 12
UP Avg. Freight Only Daily D>30 Locations
Avg. No. of D>30 Daily
10
8
6
4
2
0
4.7
0.3
0.3
1.3
2.0
1
0.3
0.3
1
0
0.3
1
0
0
0.7
Portland - Clackamas
Coalca - Salem
Renard - Albany
Hallawell - Eugene
South of Eugene
Revised Base
Rev No Action
Iteration 2 NAM

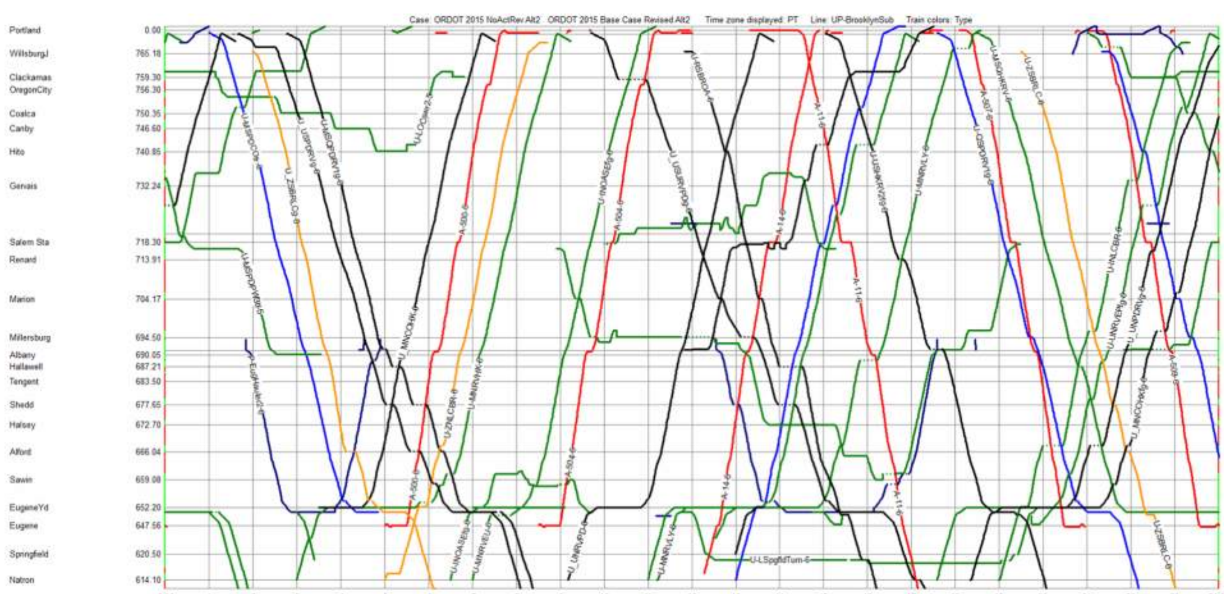
No Action with Minimums Stringlines

Day 1

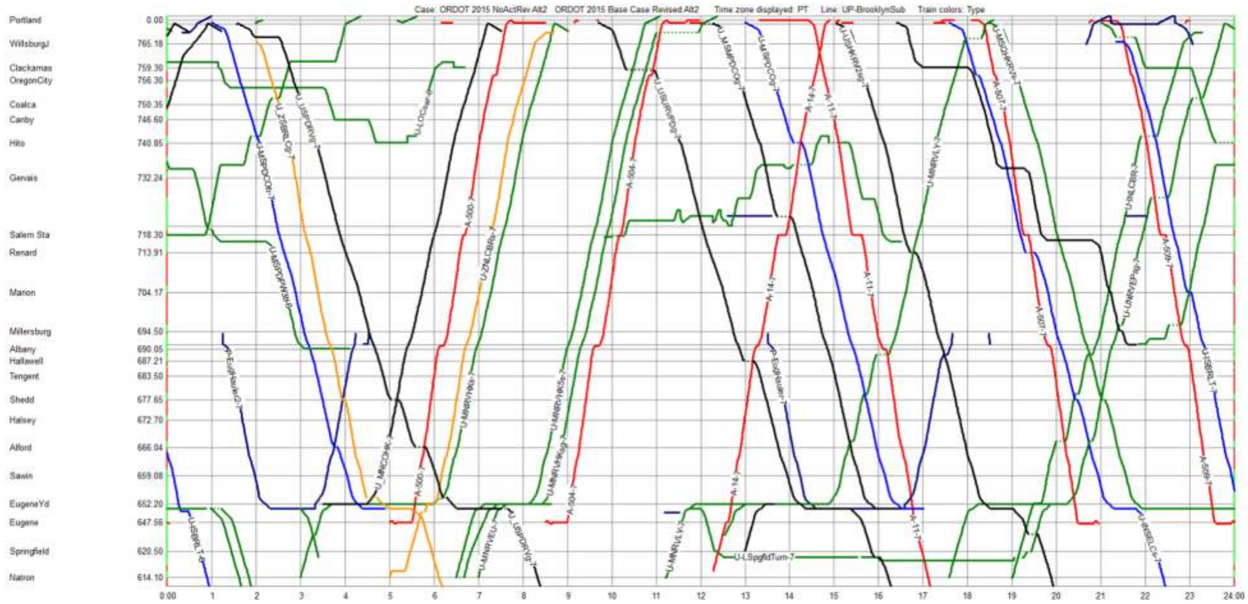


Color	Passenger Trains
(red line)	Red - Amtrak Cascades trains
(reddish brown line)	Reddish Brown – Amtrak Coast Starlight
	Freight Trains
(gold line)	Gold – (Z trains) High priority containers for intermodal
(black line)	Black – Unit Trains
(blue line)	Blue – (Q trains - Doublestack) Priority Intermodal
(green line)	Green – Local and Merchandise trains

Day 2



Day 3



Color	
	Passenger Trains
Red line	Red - Amtrak Cascades trains
Reddish brown line	Reddish Brown – Amtrak Coast Starlight
	Freight Trains
Gold line	Gold – (Z trains) High priority containers for intermodal
Black line	Black – Unit Trains
Blue line	Blue – (Q trains - Doublestack) Priority Intermodal
Green line	Green – Local and Merchandise trains

Oregon Passenger Rail
Eugene - Portland
CHOOSING A PATH FORWARD

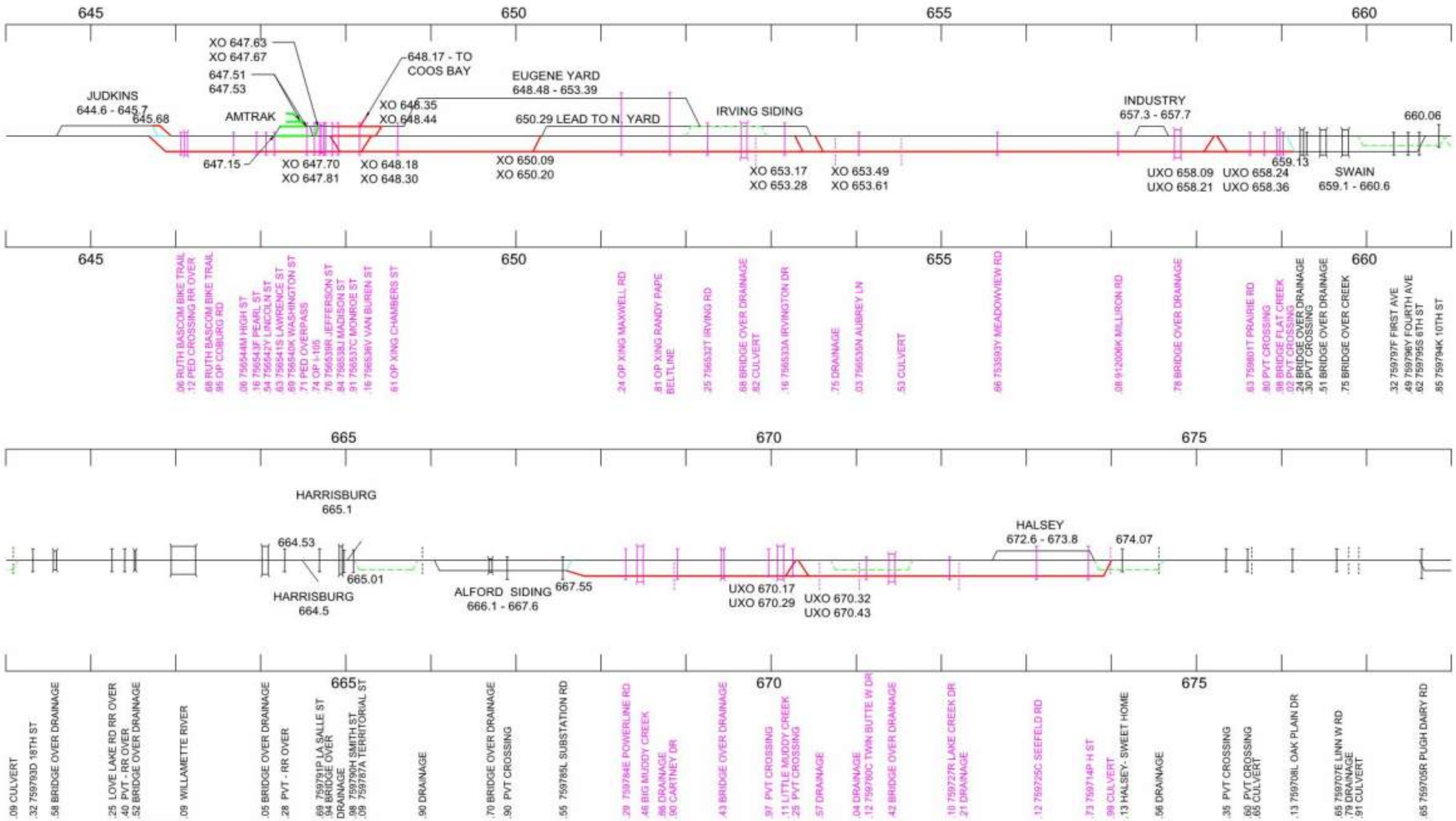
Appendix A-G – Updated Schematics with Infrastructure Improvements

Revised: October 18, 2016

Oregon Department of Transportation

U.S. Department of Transportation
Federal Railroad Administration

Revised Alternate 1 6+1 and 4+1

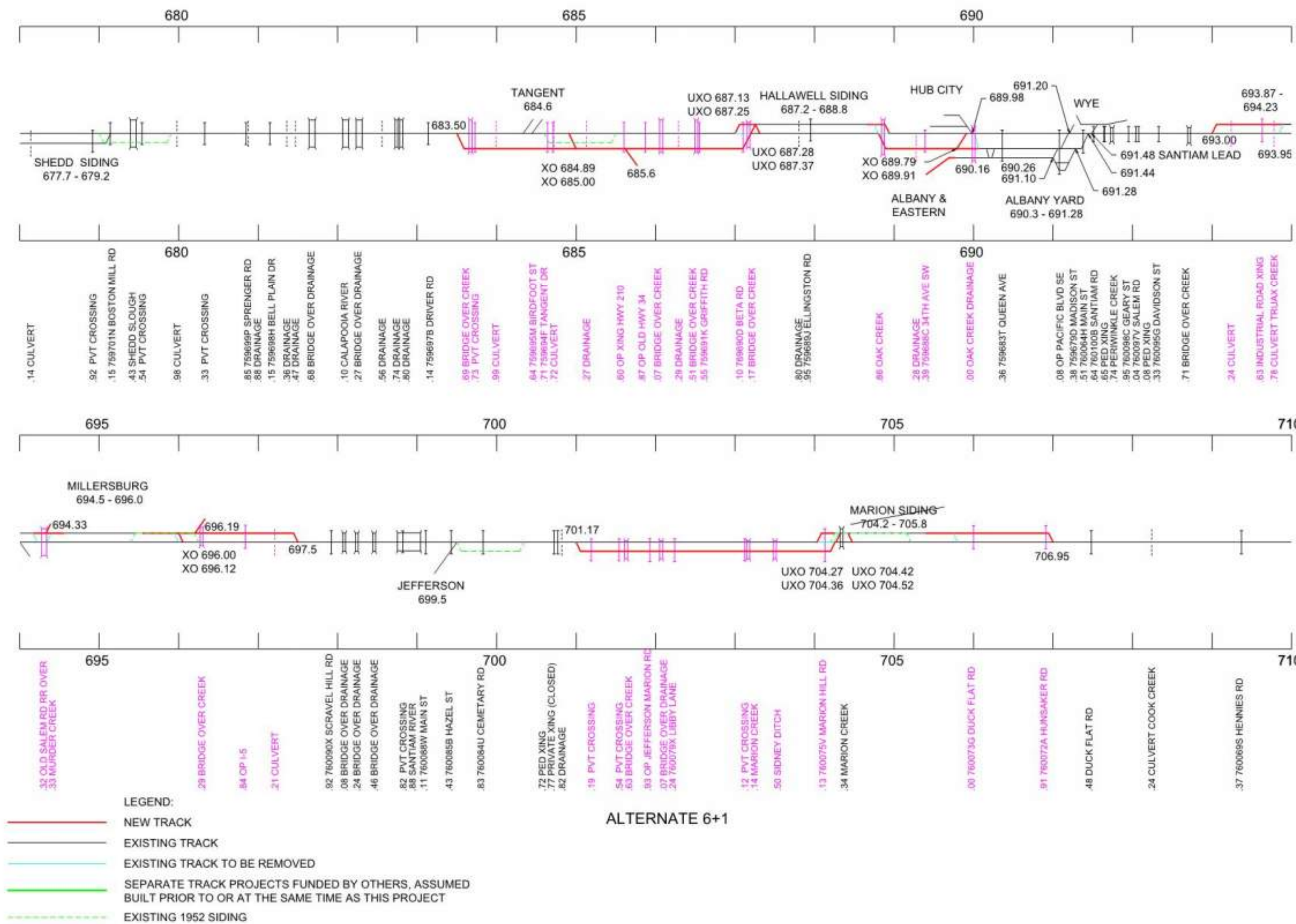


LEGEND:

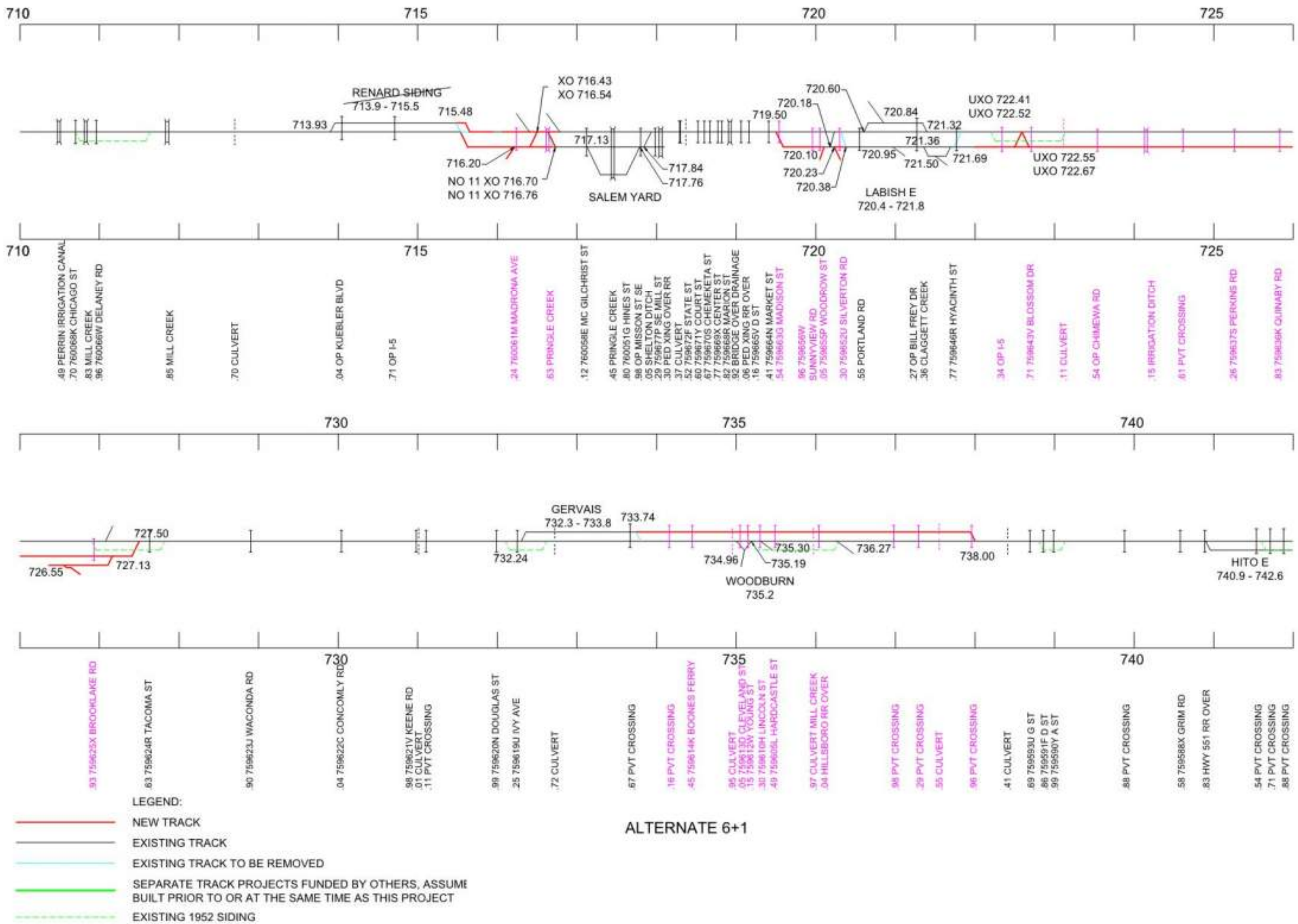
- NEW TRACK
- EXISTING TRACK
- EXISTING TRACK TO BE REMOVED
- SEPARATE TRACK PROJECTS FUNDED BY OTHERS, ASSUMED BUILT PRIOR TO OR AT THE SAME TIME AS THIS PROJECT
- EXISTING 1952 SIDING

ALTERNATE 6+1

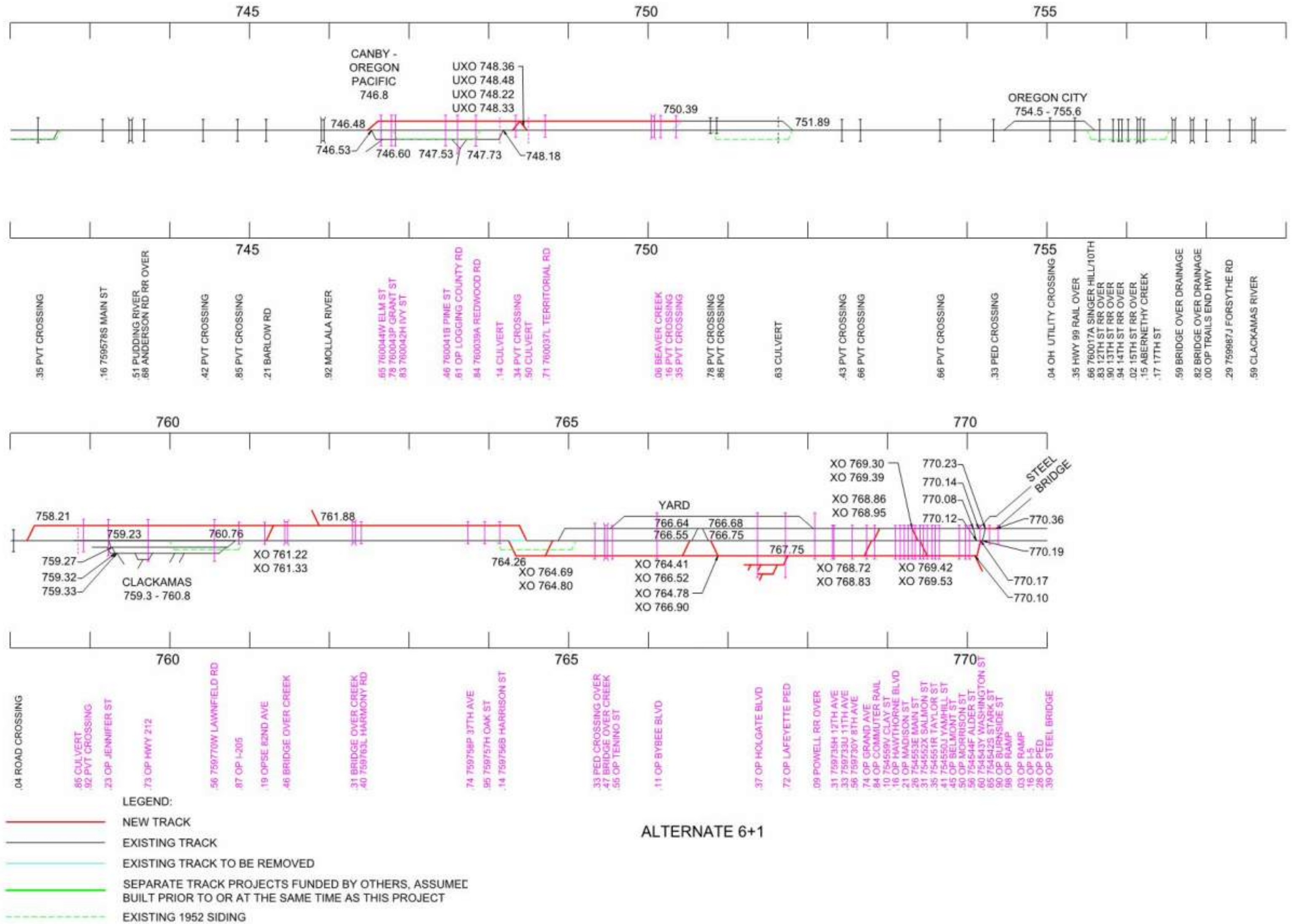
1


680
685
690
TANGENT
684.6
UXO 687.13
UXO 687.25
HALLAWELL SIDING
687.2 - 688.8
HUB CITY
691.20
689.98
WYE
693.87 -
694.23
683.50
SHEDD SIDING
677.7 - 679.2
XO 684.89
XO 685.00
685.6
UXO 687.28
UXO 687.37
XO 689.79
XO 689.91
690.16
690.26
691.10
691.48 SANTIAM LEAD
693.00
693.95
691.44
691.28
ALBANY &
EASTERN
ALBANY YARD
690.3 - 691.28
695
700
705
710
MILLERSBURG
694.5 - 696.0
694.33
696.19
XO 696.00
XO 696.12
697.5
JEFFERSON
699.5
701.17
MARION SIDING
704.2 - 705.8
UXO 704.27
UXO 704.36
UXO 704.42
UXO 704.52
706.95
LEGEND:
NEW TRACK
EXISTING TRACK
EXISTING TRACK TO BE REMOVED
SEPARATE TRACK PROJECTS FUNDED BY OTHERS, ASSUMED
BUILT PRIOR TO OR AT THE SAME TIME AS THIS PROJECT
EXISTING 1952 SIDING
ALTERNATE 6+1

2

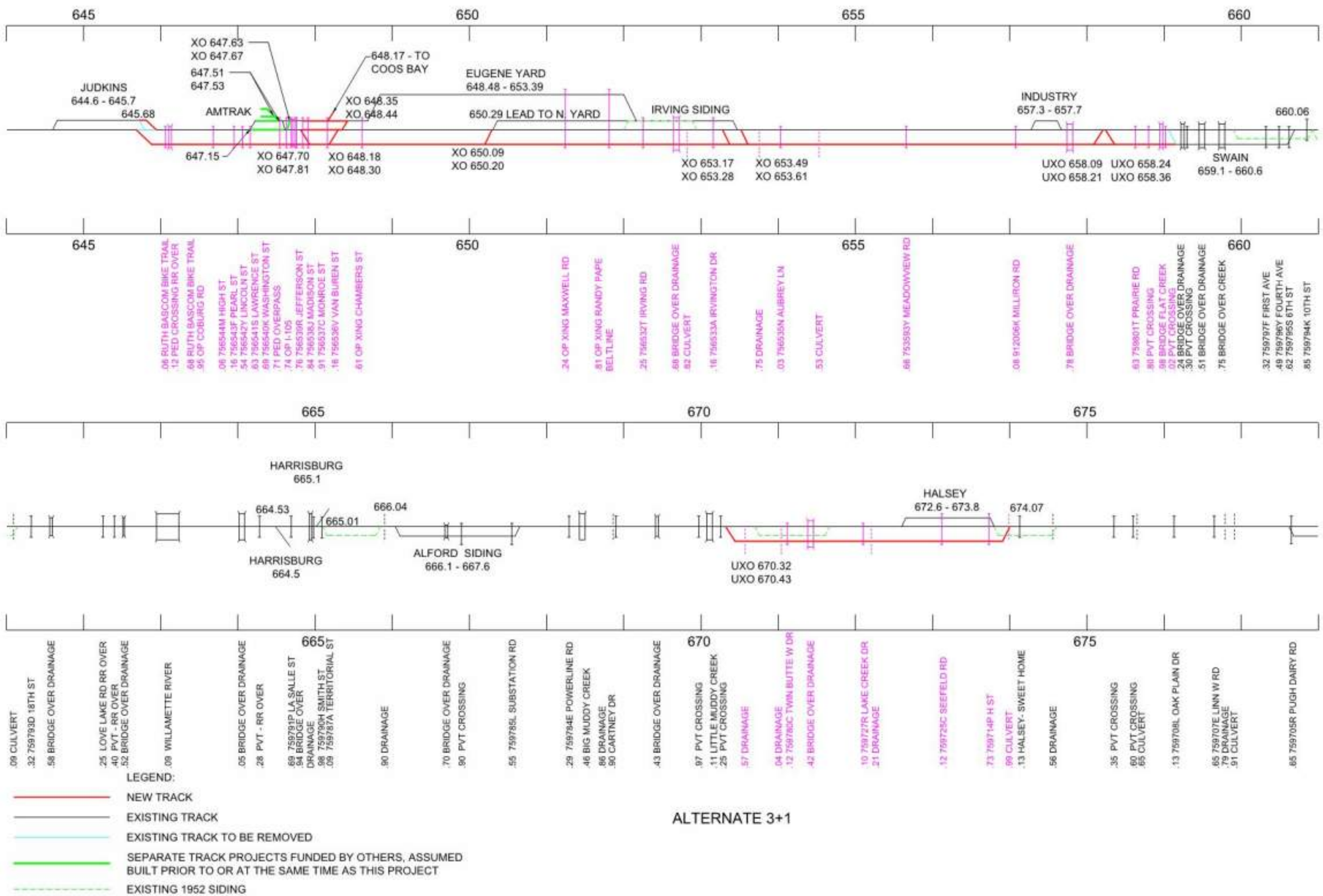

710
715
720
725
RENARD SIDING
713.9 - 715.5
713.93
715.48
716.20
NO 11 XO 716.70
NO 11 XO 716.76
XO 716.43
XO 716.54
717.13
717.84
717.76
SALEM YARD
719.50
720.18
720.60
720.10
720.23
720.38
720.84
720.95
721.32
721.36
721.50
721.69
LABISH E
720.4 - 721.8
UXO 722.41
UXO 722.52
UXO 722.55
UXO 722.67
730
735
740
GERVAIS
732.3 - 733.8
733.74
727.50
727.13
726.55
732.24
734.96
735.30
735.19
736.27
738.00
WOODBURN
735.2
HITO E
740.9 - 742.6
LEGEND:
NEW TRACK
EXISTING TRACK
EXISTING TRACK TO BE REMOVED
SEPARATE TRACK PROJECTS FUNDED BY OTHERS, ASSUME BUILT PRIOR TO OR AT THE SAME TIME AS THIS PROJECT
EXISTING 1952 SIDING
ALTERNATE 6+1

3


745
750
755
CANBY - OREGON PACIFIC 746.8
UXO 748.36
UXO 748.48
UXO 748.22
UXO 748.33
746.48
746.53
746.60
747.53
747.73
748.18
750.39
751.89
OREGON CITY 754.5 - 755.6
760
765
770
758.21
759.23
760.76
761.88
759.27
759.32
759.33
CLACKAMAS 759.3 - 760.8
XO 761.22
XO 761.33
764.26
XO 764.69
XO 764.80
YARD
766.64
766.55
766.68
766.75
XO 764.41
XO 766.52
XO 764.78
XO 766.90
767.75
XO 769.30
XO 769.39
XO 768.86
XO 768.95
XO 768.72
XO 768.83
XO 769.42
XO 769.53
770.23
770.14
770.08
770.12
STEEL BRIDGE
770.36
770.19
770.17
770.10
LEGEND:
NEW TRACK
EXISTING TRACK
EXISTING TRACK TO BE REMOVED
SEPARATE TRACK PROJECTS FUNDED BY OTHERS, ASSUMED BUILT PRIOR TO OR AT THE SAME TIME AS THIS PROJECT
EXISTING 1952 SIDING
ALTERNATE 6+1

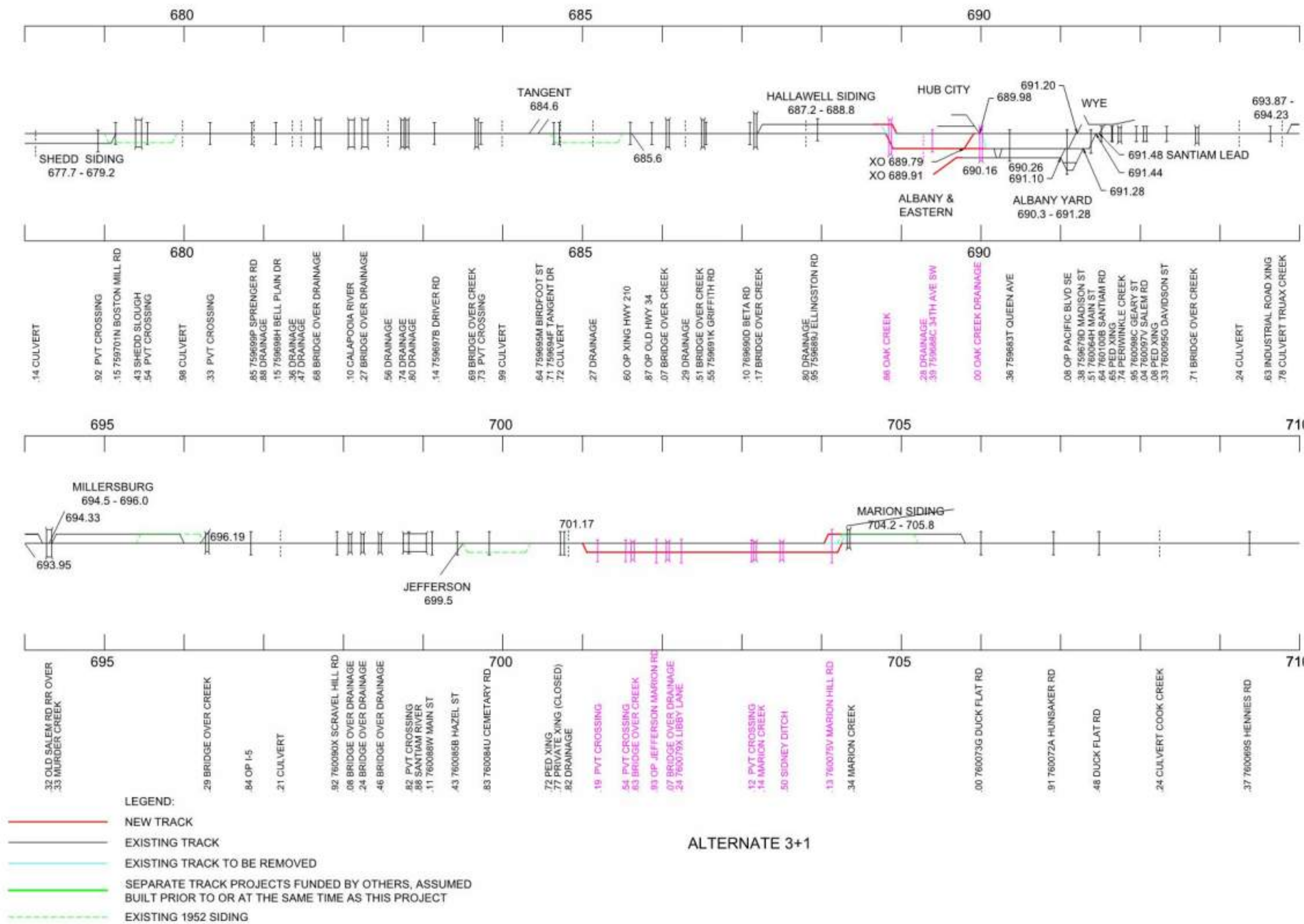
4

Alternate 4+1 on 3+1 Infrastructure / Revised Alternate 1 3+1



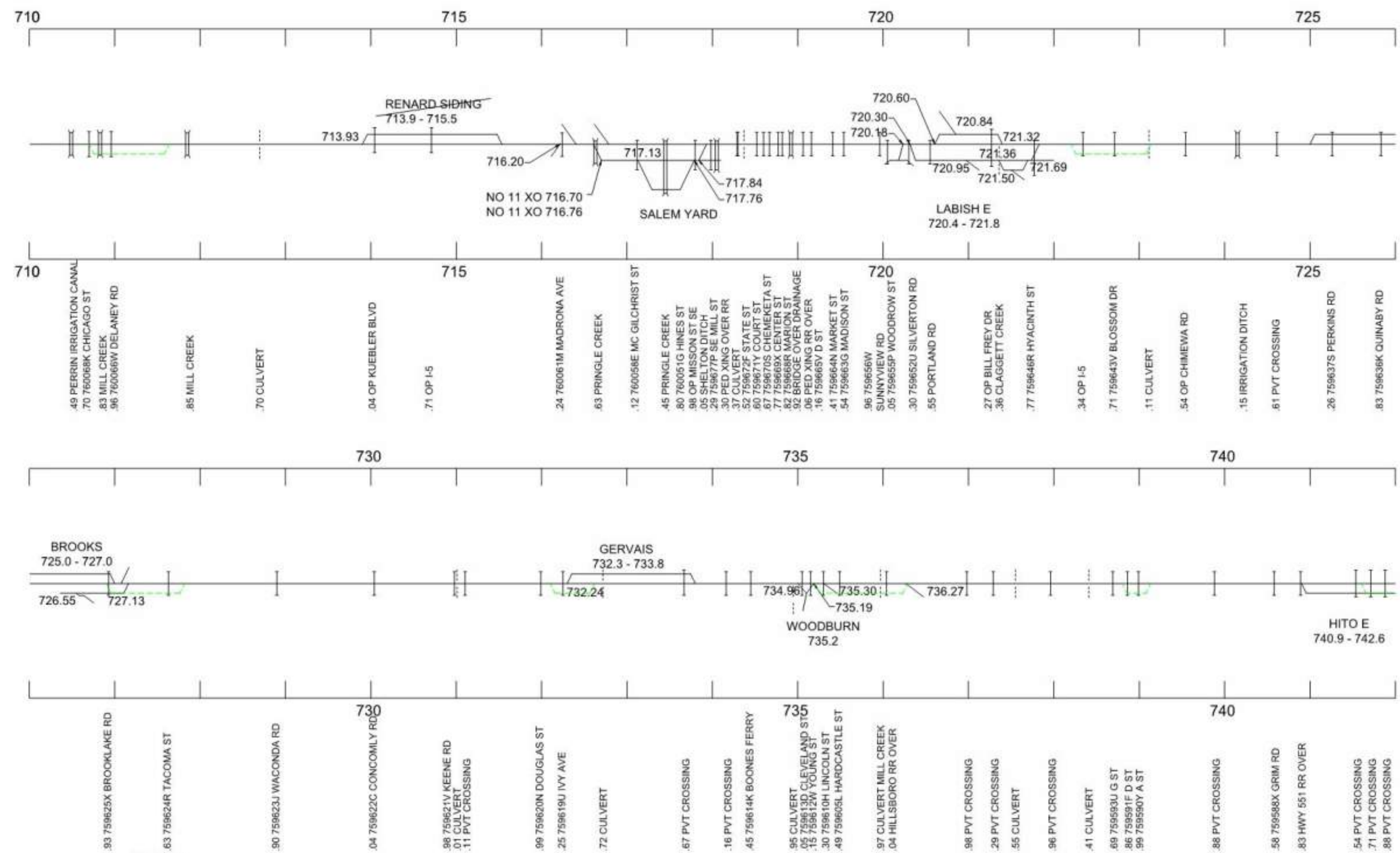
ALTERNATE 3+1

1



2

October 18, 2016



LEGEND:

NEW TRACK

EXISTING TRACK

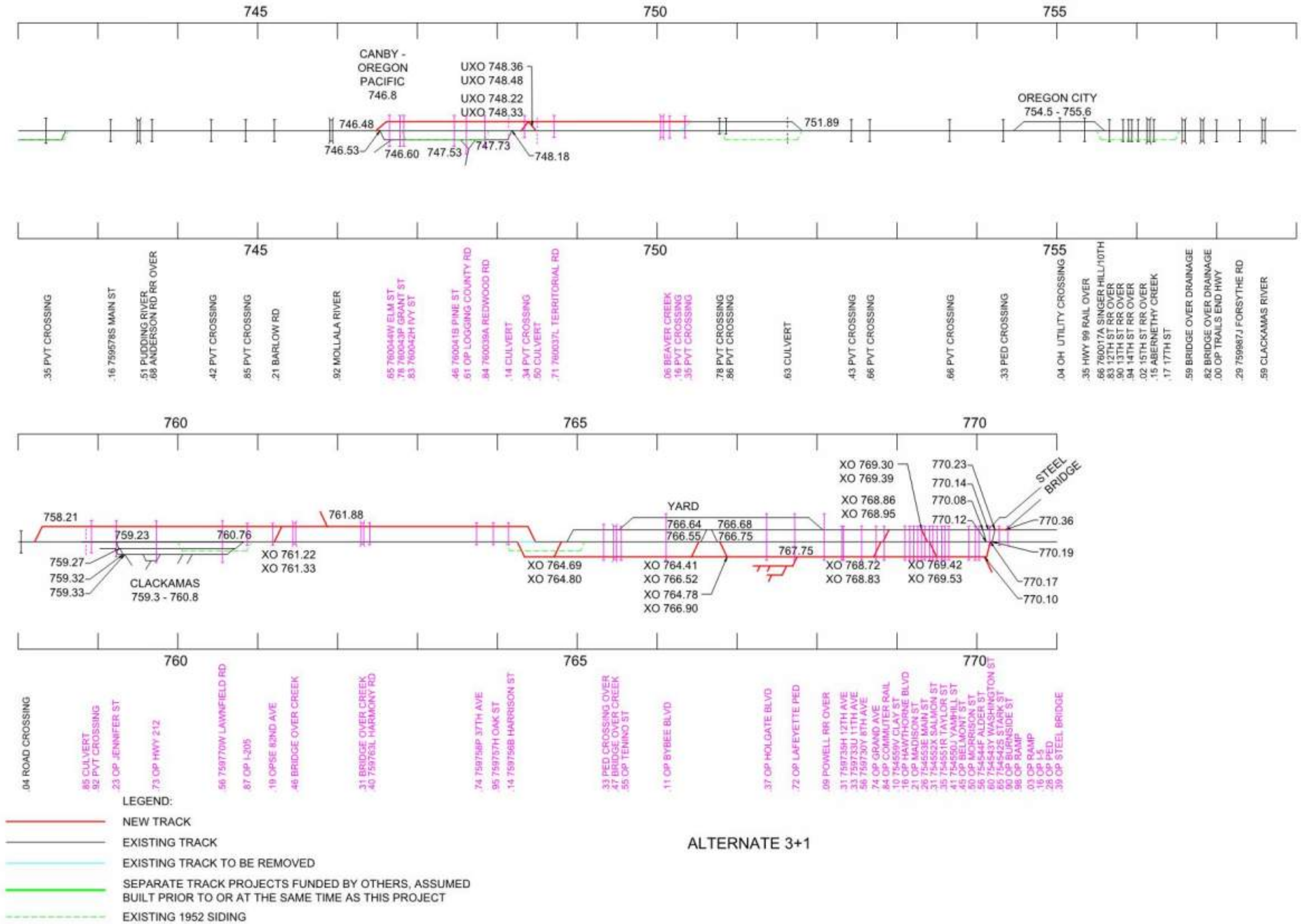
EXISTING TRACK TO BE REMOVED

SEPARATE TRACK PROJECTS FUNDED BY OTHERS, ASSUMED BUILT PRIOR TO OR AT THE SAME TIME AS THIS PROJECT

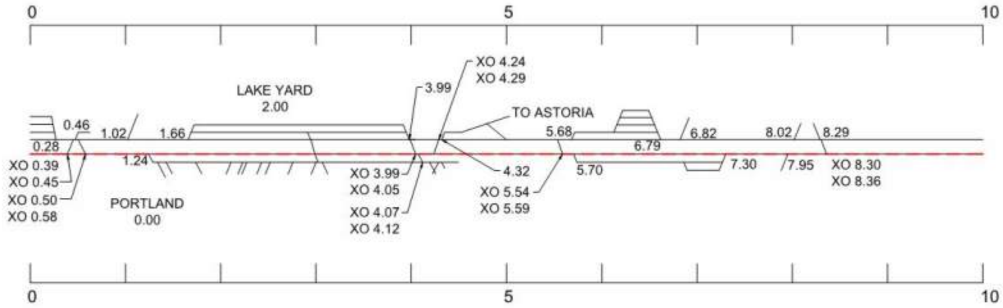
EXISTING 1952 SIDING

ALTERNATE 3+1

3


745
750
755
CANBY - OREGON PACIFIC 746.8
UXO 748.36
UXO 748.48
UXO 748.22
UXO 748.33
746.48
746.53
746.60
747.53
747.73
748.18
751.89
OREGON CITY 754.5 - 755.6
.35 PVT CROSSING
.16 759578S MAIN ST
.51 PUDDING RIVER
.68 ANDERSON RD RR OVER
.42 PVT CROSSING
.85 PVT CROSSING
.21 BARLOW RD
.92 MOLLALA RIVER
.65 760044W ELM ST
.78 760043P GRANT ST
.83 760042H IVY ST
.46 760041S PINE ST
.61 OP LOGGING COUNTY RD
.84 760039A REDWOOD RD
.14 CULVERT
.34 PVT CROSSING
.50 CULVERT
.71 760037L TERRITORIAL RD
.06 BEAVER CREEK
.16 PVT CROSSING
.35 PVT CROSSING
.78 PVT CROSSING
.86 PVT CROSSING
.63 CULVERT
.43 PVT CROSSING
.66 PVT CROSSING
.66 PVT CROSSING
.33 PED CROSSING
.04 OH UTILITY CROSSING
.35 HWY 99 RAIL OVER
.66 760017A SINGER HILL/10TH
.83 12TH ST RR OVER
.90 13TH ST RR OVER
.94 14TH ST RR OVER
.02 15TH ST RR OVER
.15 ABERNETHY CREEK
.17 17TH ST
.59 BRIDGE OVER DRAINAGE
.82 BRIDGE OVER DRAINAGE
.00 OP TRAILS END HWY
.29 759987J FORSYTHE RD
.59 CLACKAMAS RIVER
760
765
770
758.21
759.23
760.76
759.27
759.32
759.33
CLACKAMAS 759.3 - 760.8
761.88
XO 761.22
XO 761.33
XO 764.69
XO 764.80
YARD
766.64
766.55
766.68
766.75
767.75
XO 764.41
XO 766.52
XO 764.78
XO 766.90
XO 769.30
XO 769.39
XO 768.86
XO 768.95
XO 768.72
XO 768.83
XO 769.42
XO 769.53
770.23
770.14
770.08
770.12
STEEL BRIDGE
770.36
770.19
770.17
770.10
.04 ROAD CROSSING
.85 CULVERT
.92 PVT CROSSING
.23 OP JENNIFER ST
.73 OP HWY 212
.56 759770W LAWNFIELD RD
.87 OP I-205
.19 OP SE 82ND AVE
.46 BRIDGE OVER CREEK
.31 BRIDGE OVER CREEK
.40 759763L HARMONY RD
.74 759758P 37TH AVE
.95 759757H OAK ST
.14 759756B HARRISON ST
.33 PED CROSSING OVER
.47 BRIDGE OVER CREEK
.55 OP TENINO ST
.11 OP BYBEE BLVD
.37 OP HOLGATE BLVD
.72 OP LAFEYETTE PED
.09 POWELL RR OVER
.31 759735H 12TH AVE
.33 759733U 11TH AVE
.56 759730Y 8TH AVE
.74 OP GRAND AVE
.84 OP COMMUTER RAIL
.10 754559V CLAY ST
.16 OP HAWTHORNE BLVD
.21 OP MADISON ST
.26 754553E MAIN ST
.31 754552X SALMON ST
.35 754551R TAYLOR ST
.41 754550J YAMHILL ST
.45 OP BELMONT ST
.50 OP MORRISON ST
.56 754544F ALDER ST
.60 754543Y WASHINGTON ST
.65 754542S STARK ST
.90 OP BURNSIDE ST
.98 OP RAMP
.03 OP RAMP
.16 OP I-5
.26 OP PED
.39 OP STEEL BRIDGE
LEGEND:
NEW TRACK
EXISTING TRACK
EXISTING TRACK TO BE REMOVED
SEPARATE TRACK PROJECTS FUNDED BY OTHERS, ASSUMED BUILT PRIOR TO OR AT THE SAME TIME AS THIS PROJECT
EXISTING 1952 SIDING
ALTERNATE 3+1

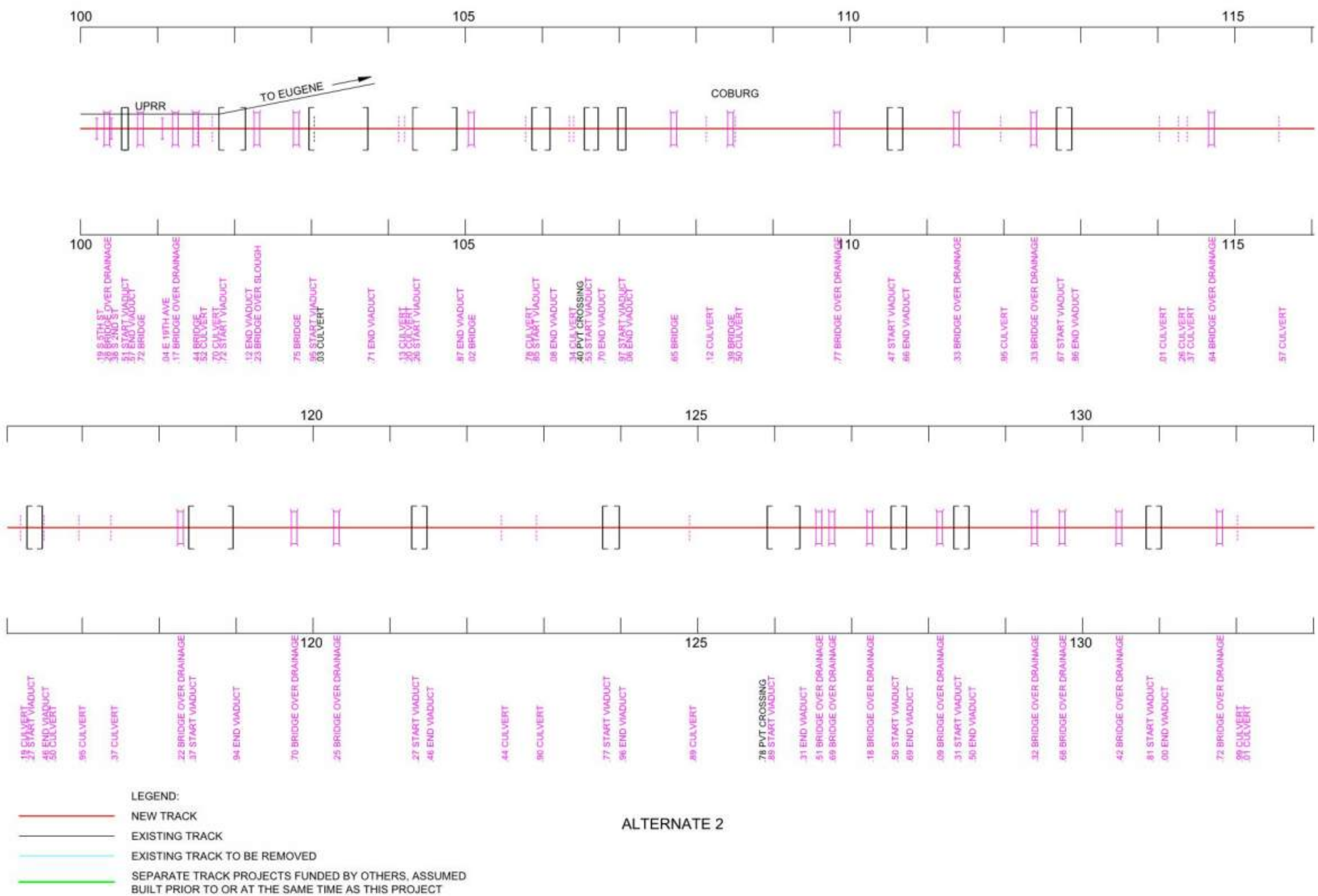
4



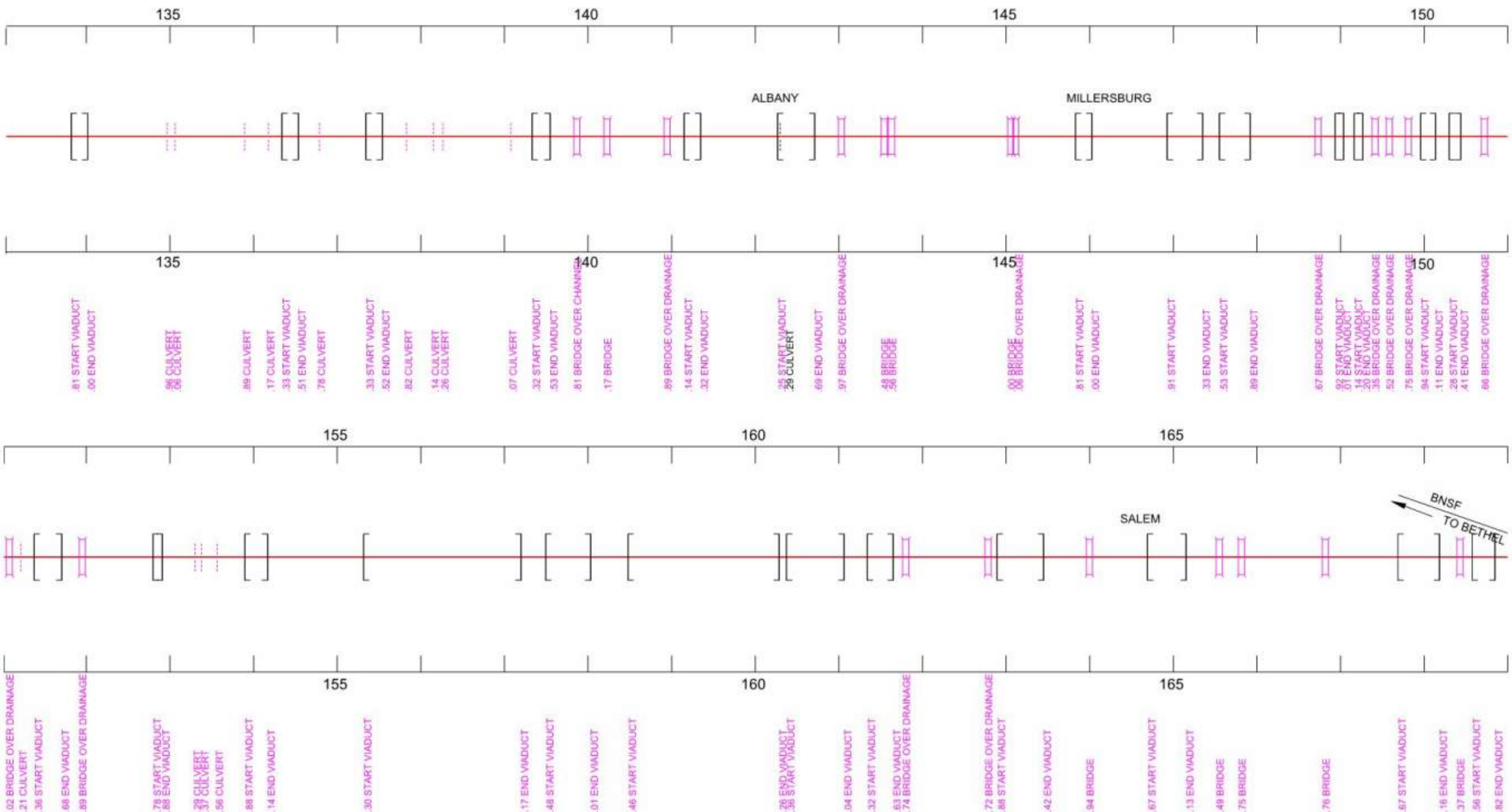
ALTERNATE 3+1

5

Revised Alternate 2


100
105
110
115
UPRR
TO EUGENE
COBURG
120
125
130
LEGEND:
NEW TRACK
EXISTING TRACK
EXISTING TRACK TO BE REMOVED
SEPARATE TRACK PROJECTS FUNDED BY OTHERS, ASSUMED BUILT PRIOR TO OR AT THE SAME TIME AS THIS PROJECT
ALTERNATE 2

1



LEGEND:

NEW TRACK

EXISTING TRACK

EXISTING TRACK TO BE REMOVED

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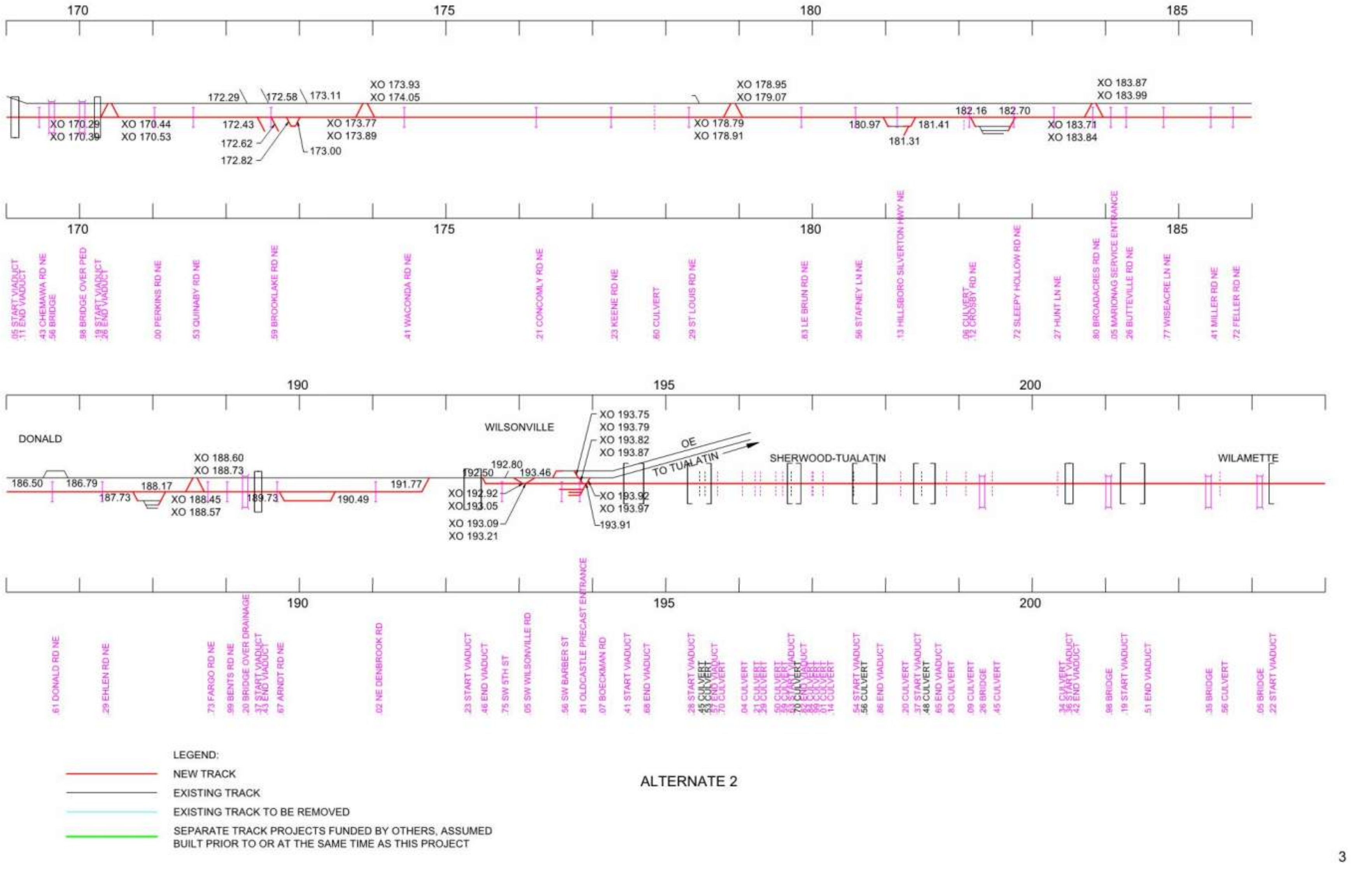
ALTERNATE 2

2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XO 173.93
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XO 173.77
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XO 178.79
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195
200
DONALD
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186.79
187.73
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XO 188.73
XO 188.45
XO 188.57
189.73
190.49
191.77
WILSONVILLE
192.50
192.80
193.46
XO 192.92
XO 193.05
XO 193.09
XO 193.21
XO 193.75
XO 193.79
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XO 193.87
XO 193.92
XO 193.97
193.91
OE
TO TUALATIN
SHERWOOD-TUALATIN
WILAMETTE
LEGEND:
NEW TRACK
EXISTING TRACK
EXISTING TRACK TO BE REMOVED
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ALTERNATE 2
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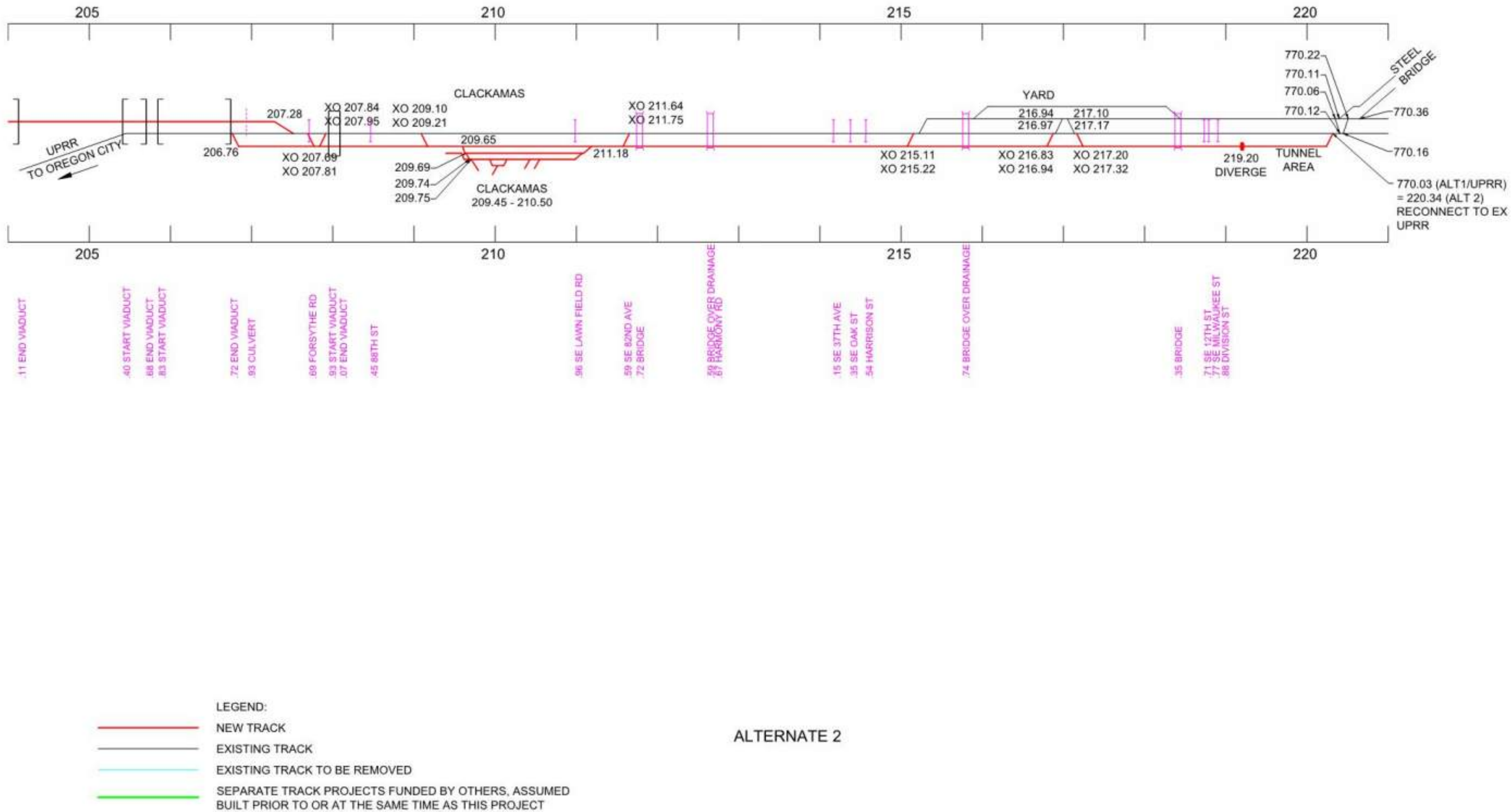
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210
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UPRR
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CLACKAMAS
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209.75
CLACKAMAS
209.45 - 210.50
211.18
XO 211.64
XO 211.75
XO 215.11
XO 215.22
YARD
216.94
216.97
217.10
217.17
XO 216.83
XO 216.94
XO 217.20
XO 217.32
219.20
DIVERGE
TUNNEL
AREA
770.22
770.11
770.06
770.12
STEEL BRIDGE
770.36
770.16
770.03 (ALT1/UPRR)
= 220.34 (ALT 2)
RECONNECT TO EX
UPRR
.11 END VIADUCT
.40 START VIADUCT
.68 END VIADUCT
.83 START VIADUCT
.72 END VIADUCT
.93 CULVERT
.69 FORSYTHE RD
.93 START VIADUCT
.07 END VIADUCT
.45 88TH ST
.96 SE LAWN FIELD RD
.59 SE 82ND AVE
.72 BRIDGE
.15 SE 37TH AVE
.35 SE OAK ST
.54 HARRISON ST
.74 BRIDGE OVER DRAINAGE
.35 BRIDGE
.71 SE 12TH ST
.88 DIVISION ST
LEGEND:
NEW TRACK
EXISTING TRACK
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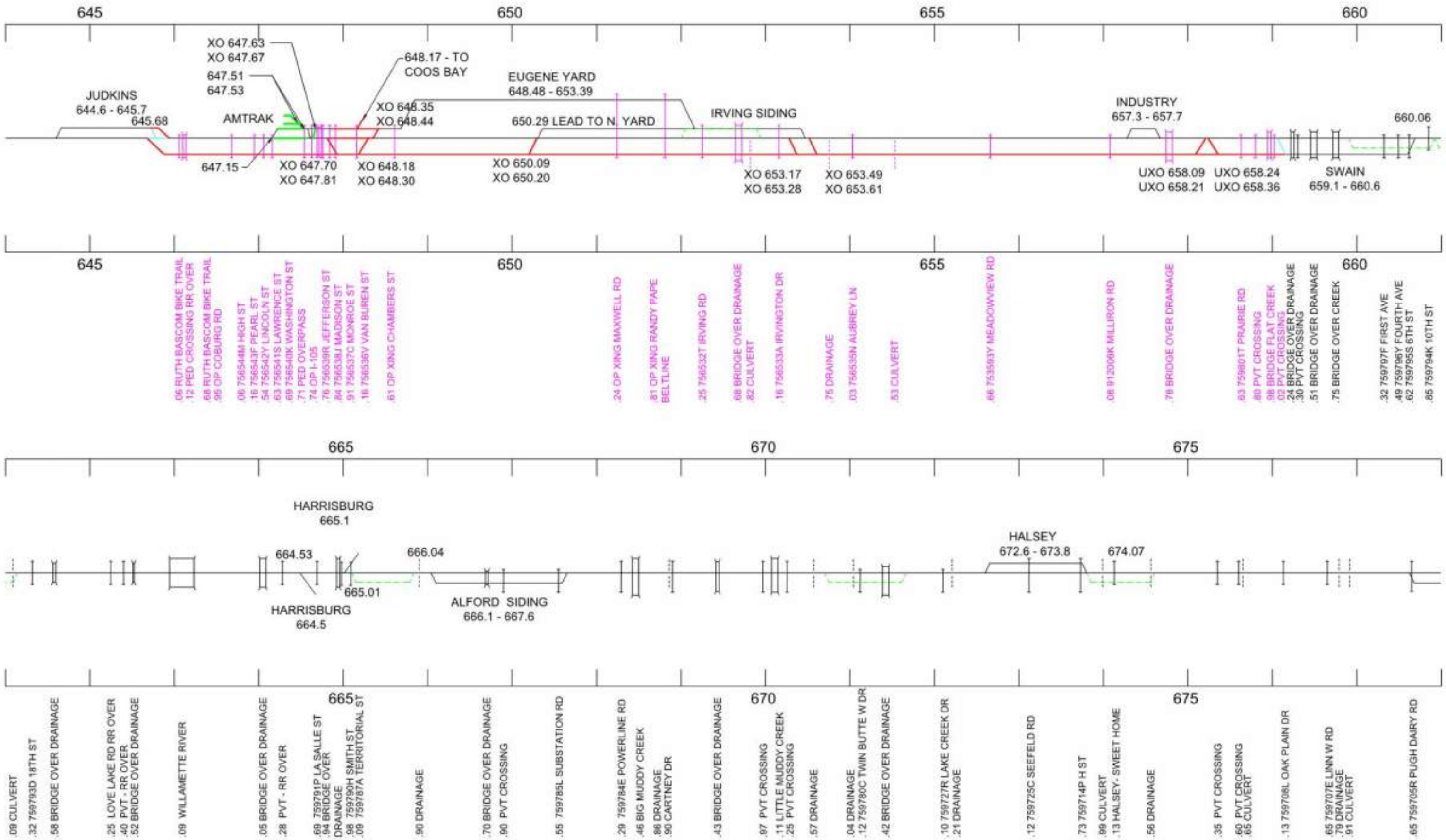
BUILT PRIOR TO OR AT THE SAME TIME AS THIS PROJECT
ALTERNATE 2

4

No Action with Minimums



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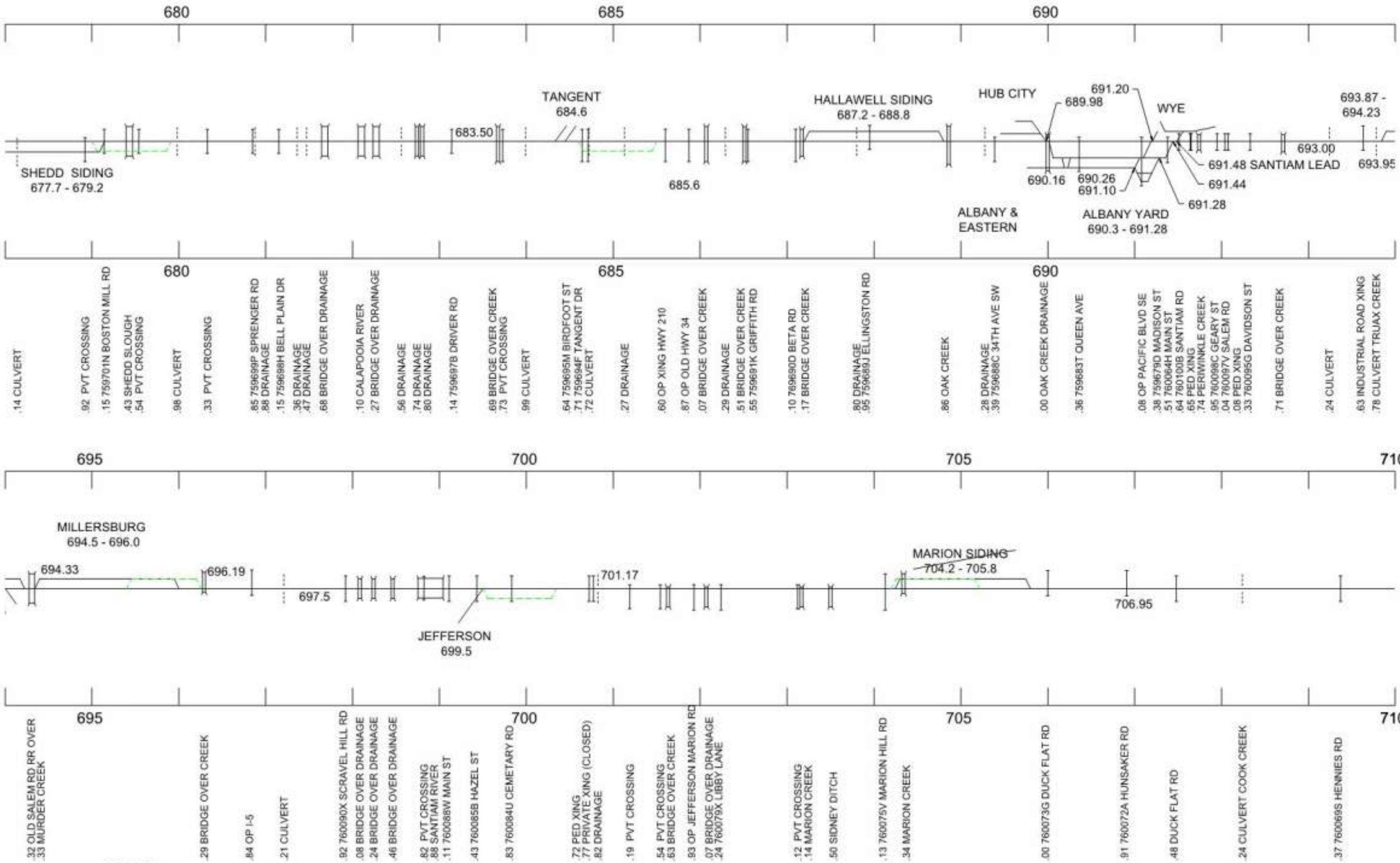
- EXISTING TRACK
- EXISTING TRACK TO BE REMOVED
- SEPARATE TRACK PROJECTS FUNDED BY OTHERS, ASSUMED BUILT PRIOR TO OR AT THE SAME TIME AS THIS PROJECT
- EXISTING 1952 SIDING

NO ACTION WITH MINIMUMS

1



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NEW TRACK

EXISTING TRACK

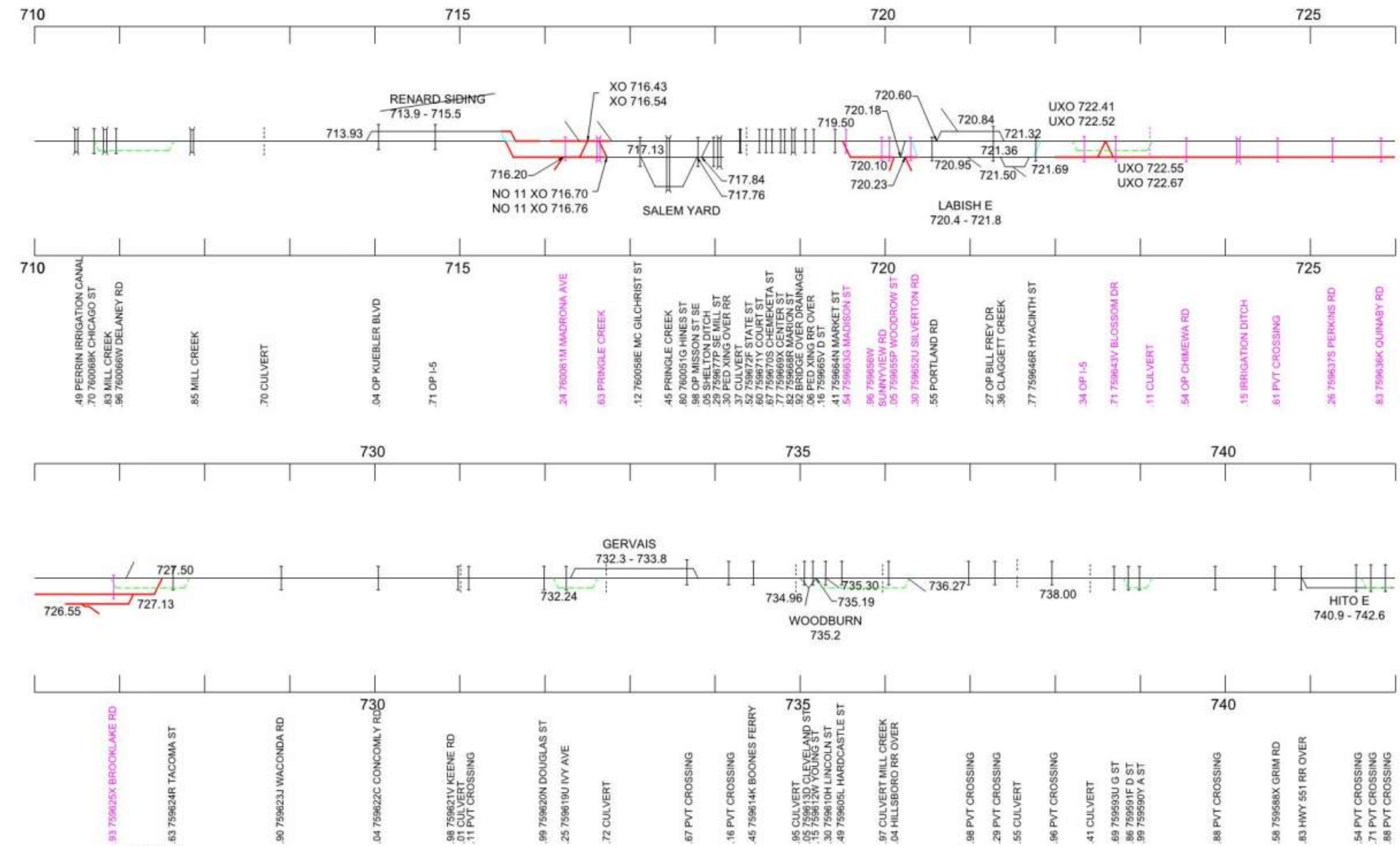
EXISTING TRACK TO BE REMOVED

SEPARATE TRACK PROJECTS FUNDED BY OTHERS, ASSUMED BUILT PRIOR TO OR AT THE SAME TIME AS THIS PROJECT

EXISTING 1952 SIDING

NO ACTION WITH MINIMUMS

2



LEGEND:

NEW TRACK

EXISTING TRACK

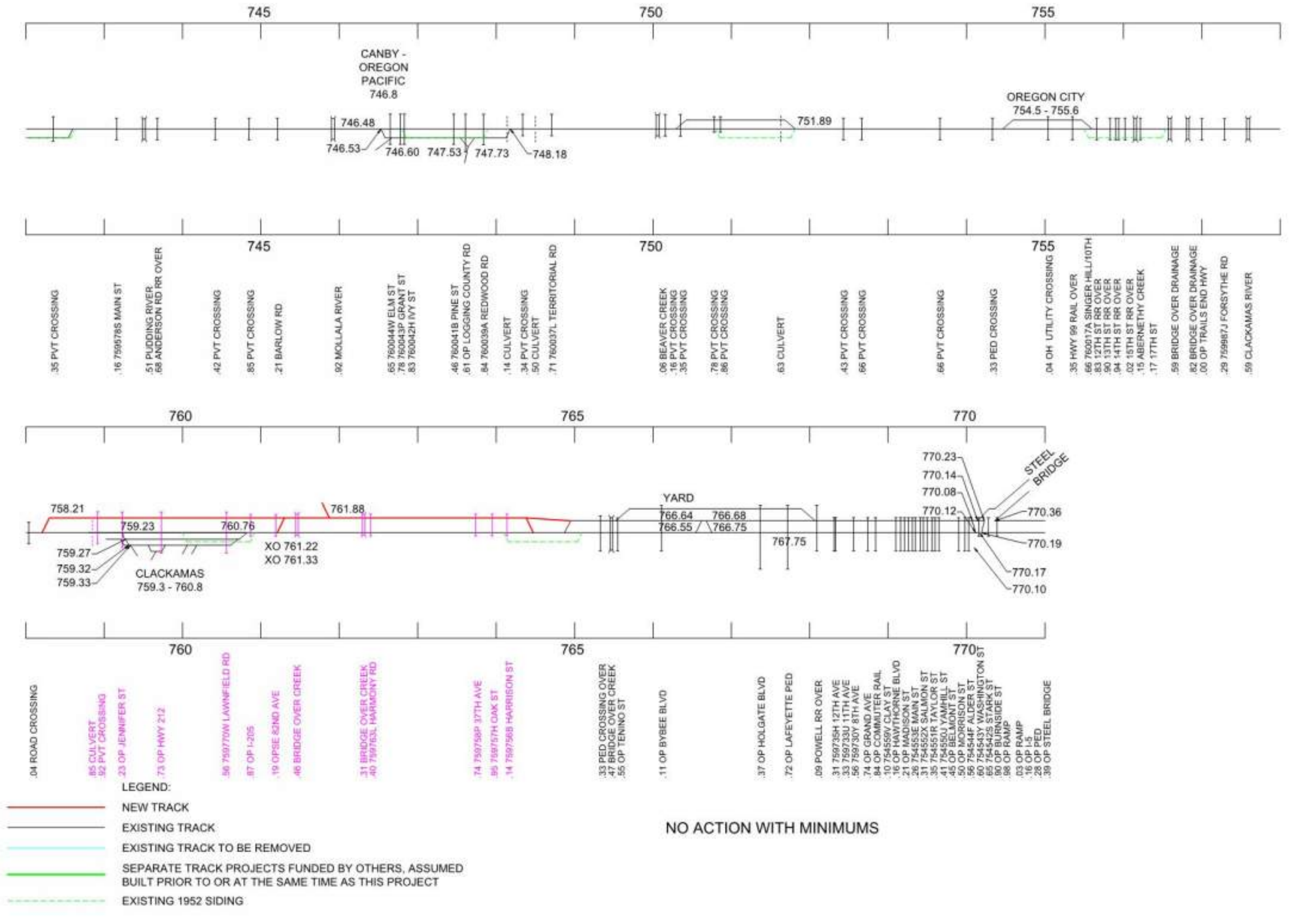
EXISTING TRACK TO BE REMOVED

SEPARATE TRACK PROJECTS FUNDED BY OTHERS, ASSUMED BUILT PRIOR TO OR AT THE SAME TIME AS THIS PROJECT

EXISTING 1952 SIDING

NO ACTION WITH MINIMUMS

3



NO ACTION WITH MINIMUMS

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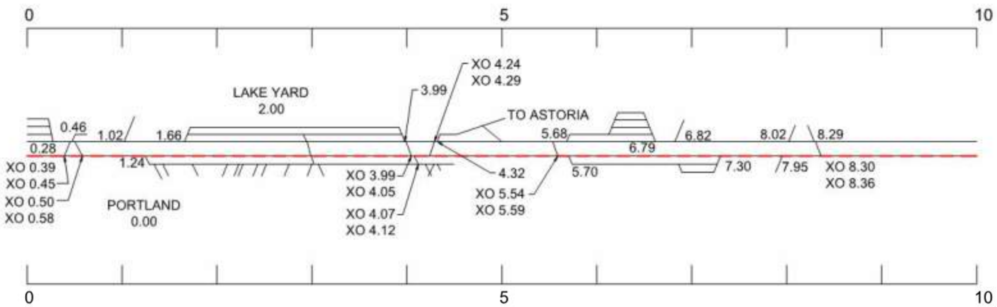


NO ACTION WITH MINIMUMS

Oregon Passenger Rail
Eugene - Portland
CHOOSING A PATH FORWARD

Appendix B

Conceptual Engineering Refinements Report

May 28, 2014

Oregon Department of Transportation

U.S. Department of Transportation
Federal Railroad Administration

Contents

List of Tables and Figures

1. Introduction

The goals of this Conceptual Engineering Refinements Report are to: (1) document the areas that were examined during the refinement process; and (2) describe how the alignments were modified (or not) to address environmental, engineering, and operational concerns. A description of each area and the type of individual refinement for each alternative are provided in Chapters 3 and 4.

In summary, refinement of the alternatives includes engineering to evaluate connections between the red and purple preliminary alternative alignments in Keizer and Wilsonville, and connections between the red and blue preliminary alternative alignments in Oregon City, and extent of existing potential right-of-way (ROW) impacts and potential modifications to the existing transportation system within the urban areas of Eugene- Springfield, Albany, Salem-Keizer, Wilsonville, Oregon City, Milwaukie, and Portland.

Refinement of the engineering alignments addressed specific concerns related to vertical profiles, potential grade separations, and topographically constricted areas. Google Earth™ and Oregon Department of Transportation provided Lidar panels were used in the analysis of areas of special concern. The areas not visible by Google Earth ™ or under roadway overpasses should be reviewed in more detail in a later stage of the Tier 1 or in a Tier 2 study.

Design Criteria

The engineering team used the following design criteria in developing the original alignments, and for this refinement analysis. However, there were some variances made due to the existing Union Pacific (UPRR) alignment and other constraints. A full explanation of these variances is described below.

Table 1. OPR Eugene to Portland - Design Criteria

Speed	Design Factor Assumptions	
0 mph > V < = 79 mph	Minimum Radius	600'
	Minimum Curve Length	5*V
	Minimum Tangent Length	5*V
	Abs min curve/tangent Length	100'
	Maximum total superelevation	8"
79 mph > V <= 100 mph	Minimum Radius	4,000'
	Minimum Curve Length	5*V
	Minimum Tangent Length	5*V
	Abs min curve/tangent length	100'
	Maximum total superelevation	6"
100 mph > V <= 125 mph	Minimum Radius	6,500'
	Minimum Curve Length	5*V
	Minimum Tangent Length	5*V
	Abs min curve/tangent length	100'
	Maximum total superelevation	6"
Other Factors	T/R to underside of structure	23'6"
	horizontal clearance (to CL)	25'
	Rail structure depth	8'

Note: V = velocity

The main difference between the Alternatives in the adherence to the design criteria is Alternative 1 parallels and assumes joint operation with the UPRR Mainline. The existing UPRR alignment from Eugene to Portland utilizes freight rail geometric criteria, which varies greatly from the above passenger rail criteria. There are areas throughout this corridor where the passenger rail criteria could not be met in Alternative 1 without extensive redesign of UPRR main line. Significant redesign/reconstruction is not being considered as a characteristic of Alternative 1.

Alternative 2, which mainly parallels I-5, has much more flexibility to incorporate the passenger rail standards into the conceptual alignment development, resulting in an alignment that meets the design criteria for train speeds greater than 79mph.

Design Speeds

An analysis of potential travel time savings was conducted for Alternative 1 to evaluate the feasibility of increasing the maximum speed to 90 MPH from 79 MPH along portions of the UPRR line. The potential speed increase in several segments between Eugene and Aurora (a total of 53.5 miles) showed a time savings of 4.8 minutes, or 4% of the total travel time. The segments analyzed included significant portions of tangent track or isolated curves that would be modified to allow higher speed operation. The portion of the UPRR line north of Aurora was not studied due to short segments of tangent track. The project team recommends that five minutes of travel time savings would not justify the major investment of UPRR upgrades and geometry adjustments required for 53.5 miles of UPRR trackage. In summary, speeds of 90 MPH for passenger trains are not recommended for further consideration on Alternative 1 because:

- Based on equipment operational dynamics, increasing train speeds from 79 MPH to 90 MPH would require an extra 1 mile of acceleration and deceleration (.75 miles to accelerate and .25 miles to decelerate). This limits where 90 mph segments could be efficiently developed.
- Upgrading 53.5 miles of existing UPRR mainline track would require a significant investment. In our opinion, this investment would more effectively decrease the total travel time if it were made on segments of Alternative 1 where constraints keep speeds below 50 mph.

Project Background

The Federal Railroad Administration (FRA) and the Oregon Department of Transportation (ODOT) are leading the Oregon Passenger Rail (OPR) project team in the study of options for improved intercity passenger rail service along the Oregon segment of the Pacific Northwest Rail Corridor (PNWRC). This project was initiated on August 17, 2012 via publication of a Notice of Intent in the *Federal Register*. In association with this project, the FRA and ODOT will jointly prepare a Tier 1 Environmental Impact Statement (EIS) and Service Development Plan (SDP).

Alternatives Recommended for Study in the Tier 1 Draft EIS and Draft SDP

After screening and evaluating the full range of alternatives, the following build alternatives are recommended for study in the Tier 1 Draft EIS and Draft SDP:

Alternative 1 (existing alignment) – This alternative follows the UPRR and BNSF Railway Company (BNSF) rail corridor with existing Amtrak service. This alignment was referred to as the “Blue” corridor during the screening and evaluation process.
Potential station communities for Alternative 1 include: Eugene, Albany, Salem, Oregon City, and Portland.

- Alternative 2 (new alignment) – This alternative constitutes a primarily new passenger rail corridor. This alignment is a hybrid of portions of the “Red,” “Purple” and “Blue” corridors assessed during the screening and evaluation process. This mostly new passenger rail corridor would include:
    - Interstate 5 (“Red”) corridor from Springfield to Keizer;
    - Oregon Electric (“Purple”) rail corridor from Keizer to Wilsonville;
    - Interstates 5 and 205 (“Red”) corridor from Wilsonville to Oregon City; and
    - The UPRR and BNSF (“Blue”) rail corridors from Oregon City to Vancouver, WA.

  Potential station communities for Alternative 2 include: Springfield, Albany, Salem or Keizer, Wilsonville, and Portland.

Figure 1 shows the Leadership Council’s recommended build alternatives for further study in the Draft EIS and Draft SDP.

Following the Leadership Council’s recommendation, a number of engineering refinements were necessary before conducting further analysis of the alignments.

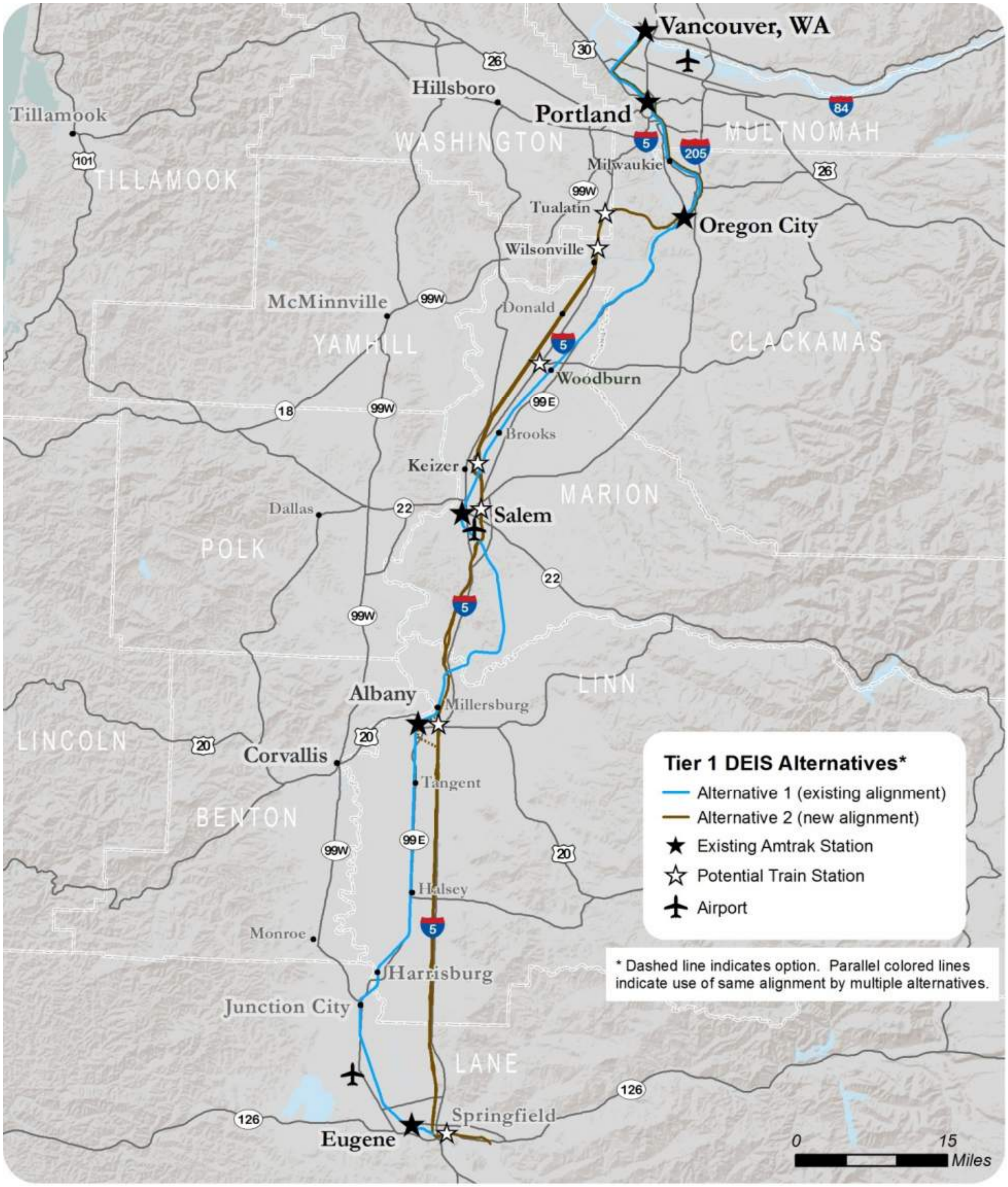


Figure 2. Recommended Alternatives for Study in the Tier 1 Draft EIS and Draft SDP

2. Alternative 1 "Blue" Alignment

Alternative 1 essentially parallels the UPRR main line from Portland south to Eugene (see **Appendix A**, **Exhibit 13** for the typical cross sections). The changes made from the previous study include the choice to not include additional sidings that were unused by the initial three-day operations modeling runs. Some of those sidings, instead of being completely removed from the proposed infrastructure, were incorporated into the infrastructure by utilizing a track shift facilitated by the use of transitional curves , essentially connecting existing main to the previously named siding, and connecting the new main to the existing main alignment. Also, crossover locations were evaluated and adjusted to better serve the rail operations as they are currently understood.

The majority of refinements have been adjustments to the horizontal geometry of the proposed track. There are several segments of Alternative 1 that were reviewed with respect to the cross section impacts of adding a second track adjacent to the UPRR main line. The following sections outline these areas of Alternative 1 that received additional study and/or refinement due to specific land-use or operational complications.

Eugene Area

With respect to passenger operations, Alternative 1 begins at the existing Eugene Amtrak Station. A preliminary review determined that proposed track improvements should begin at the northern end of the existing Judkins siding. Extending the alignment from Eugene station south to incorporate the Judkins siding would enable it to be used as a second main for staging of UPRR freight trains. The extension to the Judkins siding would add approximately one mile of new main line and increase efficiency for operations.

North of the Eugene Station, the proposed alignment (east of the existing UPRR main line) travels under the pedestrian bridge as well as the overpass for I-105. More detailed engineering review will need to be performed in this area to determine if a proposed second main track will affect the substructure of the pedestrian crossing or I-105 overpass.

Crossovers are needed to facilitate operations between the south end of the Eugene Yard and Eugene Station. Implementation of these crossovers will require the proposed new main and existing UPRR main line in this area, including the connection to the Coos Bay line, to be shifted. No further adjustments near the existing UPRR Eugene Yard are anticipated.

Junction City – 1st Avenue

In Junction City, the possibility of grade separating 1st Avenue over the tracks was considered. Three tracks would cross 1st Avenue: the existing UPRR main, the new main, and a new siding to replace the one that lies east of the existing main (see **Exhibit 1** in **Appendix A**). Utilizing maximum ascending and descending roadway grades of 6%, minimum clearances of 23'6" from top of rail to bottom of bridge structure, and a minimum structure depth of 7', the elevated profile of 1st Avenue would extend approximately 700 feet east and west of the existing crossing. There is an active BNSF/PNWR main line that runs parallel to and 650 feet west of the UPRR mainline. There are also local businesses that line both the north and south side of 1st Avenue on either side of this intersection that will be severely impacted. This option for an overpass will impact the BNSF main line unless steeper ascending and descending grades are utilized. For this analysis, we recommend keeping 1st Avenue as an at-grade crossing with active crossing protections. This recommendation is based on the low percentage increase to the total number of trains due to passenger service and the impacts of implementing a grade separation.

Harrisburg – Territorial Street

In Harrisburg, the possibility of grade separating Territorial Street was considered. The current crossing at Territorial Street consists of the existing UPRR main and an existing industry track 55 feet west of the main track. The challenge to grade separating this crossing is the existing BNSF main line track that lies roughly 500 feet west of the existing UPRR main (see **Exhibit 2** in **Appendix A**). As it became evident in Junction City, any obstacle within 750' of the existing crossing would either need to be relocated, or the grade separation would need to incorporate the obstacle. Incorporation of the BNSF mainline would in turn have a cascading effect to the west, namely impacts to 3rd Avenue. For this analysis, we recommend keeping Territorial Street as an at-grade crossing with active crossing protections.

Halsey - Hwy 228 (MP 674.10)

In Halsey, grade separating the Hwy 228 crossing was reviewed. The current crossing at Hwy 228 consists of the existing UPRR main line (see **Exhibit 3** in **Appendix A**). The challenges facing grade separating this intersection are numerous. Hwy 99 runs parallel to the rail alignment and 450' west of the proposed crossing, business entrances would need modifications (to access HWY 99 instead of Hwy 228), and east of the crossing are three entrances to Hwy 228 for a residential neighborhood .. Those entrances could be combined into one entrance at E 3rd Street to the west, although, using the maximum 6% descending grade still makes the connection to E 3rd Street challenging. The impacts to Hwy 99 on the west would either require Hwy 99 to be relocated, or be incorporated into the grade separation. We recommend keeping Hwy 228 as an at-grade crossing with active crossing protections. This recommendation is based on the low percentage increase to the total number of trains due to passenger service and the extensive impacts in implementing a grade separation.

Shedd -Boston Mill Grade Separation (MP 679.10)

In Shedd, grade separating Boston Mill Drive was considered (see **Exhibit 4** in **Appendix A**). Albany Junction City Highway lies 525 feet west of the crossing. As noted in previous evaluations, unless the minimum grade of the descending roadway can be greater than 8%, then the impacts will cascade westerly with regard to infrastructure. North of Boston Mill Drive is farmland, but south is a mixture of residential and commercial business areas. An overcrossing at this point would need to consider an alternative alignment of Railroad Avenue, a road for residential access. For this analysis, we recommend keeping Boston Mill Drive an at-grade crossing with active crossing protections.

Albany - 34th Ave (MP 689.4)

Just south of Albany, 34th Ave crosses the existing UPRR line and a grade separated crossing was evaluated during this engineering refinement (see **Exhibit 5** in **Appendix A**). The existing roadway has two lanes in either direction separated by a median. Land use near this area consists of businesses and manufacturing warehouses. Grade separating this intersection poses some challenges: west of the crossing (approximately 550') is a roadway/driveway entrance that appears to serve four or five industries. For this analysis, we recommend leaving this as an at-grade crossing with active crossing protection. The consideration of grade-separated this crossing with additional analysis to assess the traffic impacts and the feasibility of rerouting the users of these industries north to 30th Ave SW or modifying the entrance to reconnect farther west on 34th Avenue is recommended for further analysis. Close proximity to Albany station, within one mile, would also need to be investigated to determine the benefits to grade separating this intersection as trains would already be slowing down as they approach the station.

Albany - SW Queen Ave (MP 690.4)

The first street south of the Albany Amtrak station is SW Queen Avenue (see **Exhibit 6** in **Appendix A**). The current at grade crossing has four tracks through the intersection. The south end of the Albany yard will have some modifications as to allow Albany and Eastern's current access to be maintained. Highway 99 lies 450 west of the existing crossing. There are businesses with access off SW Queen Avenue along with Washington Street, SW Ferry Street, and SW Calipooia St which run parallel and are within 500' of the crossing. A grade separation is not recommended although further study to the impacts to both SW Queen Avenue and Pacific Boulevard, and the potential impacts to surrounding businesses and residential areas may be considered.

Albany – Salem Ave (MP 692.0)

North of Albany Yard lies Salem Avenue. Salem Avenue is at an extreme skew to the existing railroad layout. A grade separation was considered for at this location. Conceptually the bridge and approach would be at a minimum of 1500 feet long and would, as at other sites, have cascading impacts both east and west of the crossing itself (see **Exhibit 7** in **Appendix A**). For this analysis, we recommend keeping this as an at-grade crossing with active crossing protections. This recommendation is based on the low percentage increase to the total number of trains due to passenger service and the significant impacts in implementing a grade separation.

Salem – 12th Street Study (MP 718.5)

North of the Salem Amtrak station, on the east side of the existing rail line is a paved mixed-use pathway that runs parallel to the tracks for approximately one half mile. In this conceptual stage, a typical section of the existing layout was created (see **Exhibit 8** in **Appendix A**). The additional options provided in this report include removing one lane of traffic and shifting the existing track accordingly and the new main west, leaving the walkway on the east side of the corridor. The second option removes one lane of traffic and places the walkway between the road on the west and the rail lines on the east. Conceptually, it appears both options are feasible from a railroad perspective. The walkway and its effect on pedestrian movements will require a more detailed analysis into pedestrian habits and the optimum safe crossing of the rail lines. Also traffic impacts of reducing street width should be evaluated

Woodburn – South Boones Ferry Road (MP 734.5)

South Boones Ferry Road, in southern Woodburn, crosses the existing rail line at an extreme skew just south of the rail siding (see **Exhibit 9** in **Appendix A**) where it connects to several industries served by UPRRRR. Grade separating this roadway would be a challenge due to the close proximity of the Parr Road and South Boones Ferry Road intersection roughly 450' north of the existing at-grade railroad crossing. Parr Road initially parallels the existing main line to the north, then turns west and intersects with South Boones Ferry Road. Further study, at a later date, could be warranted if future traffic analysis provided justification for potential cost of grade separating this intersection. At this conceptual stage of analysis it is recommended that this intersection remain an at-grade railroad crossing with active warning devices.

Oregon City – (MP 754 – 757.5)

Oregon City area poses significant design and construction challenges in adding a second main line through this area. Currently the UPRR main line runs adjacent to Pacific Hwy East (99E) along the east bank of the Willamette River. A cross sectional analysis was performed from approximately MP 754 to MP 757.5 (see **Exhibit 13, Appendix A**). Four typical sections through this area were highlighted as representative of the potential impacts of double tracking this area. The first 2 sections, MP 754.1 and MP 754.7 depict a standard double track cross section with both a "standard" 2:1 sided slope, and a retaining wall constructed 20 feet from the proposed main line. The two options provided for each cross section portray the magnitude of the impacts in this area. A typical 2:1 slope does not catch the existing ground for nearly 200-250' horizontally from the proposed main. Walls in this area would be between 30 and 100 feet tall and extremely challenging to build. The third section, MP 755.3 is the section just south of where Pacific Hwy East crosses under the existing main line. Further study in this area is suggested due to the constraints that lie to the east and west of the existing main. The last section, MP 755.8 is located after the existing main line is on the existing 2000' trestle. In addition to vertical and horizontal constraints, we would expect the existing UPRR main line must remain operational at all times during construction. This requirement would be very difficult to meet. It is suggested that the 1400' railroad trestle that supports the existing UPRR main line (station 16310+00 to 16327+00) be evaluated to determine the feasibility of leaving it intact while building a new trestle for the new main, or if a new double track trestle be constructed in its place. It is recommended that the option of not double tracking this segment be modeled for operational impacts to the rail system. It is also recommended the Oregon City segment of Alternative 1 for additional engineering, structural, and constructability reviews and analysis. .

Milwaukie – Harmony Road (MP 762.4)

The intersection of Harmony Road and SE Lake Road is adjacent to the east of the existing at-grade crossing on the existing UPRR main line (see **Exhibit 10** in **Appendix A**). Grade separating these roadways over the railroad would impact an apartment building, residential areas, and businesses. The other option that was studied entailed raising the railroad on an elevated viaduct. This would conceptually involve approximately 1300' of retained earth fill and approximately 2000' of an elevated viaduct. Either of these options would suggest further analysis as to the impacts and costs compared to the benefits. For this stage of study, we recommend keeping this as an at-grade crossing with active crossing protections.

Eastmoreland– Golf Course Cross Sectional Study (MP 766)

In the vicinity of MP 766, the existing UPRR main runs adjacent to the Eastmoreland Golf Course. This study analyzed a typical track section with an additional main line track on the east side of the corridor. The area is fairly level therefore additional vertical impacts would not be present. The golf course currently maintains approximately a 30' natural buffer from the existing railroad right of way. Acquiring an additional 30' for proposed main line right of way would have a considerable impact on, if not completely remove the existing buffer. It is recommended that this section also be modeled without the additional main line to determine the impacts to rail operations for both freight and passenger trains (see **Exhibit 11** in **Appendix A**).

Brooklyn Yard – Cross Sectional Study South of SE Holgate Boulevard (MP767)

In the vicinity of MP 767 (Brooklyn Yard) the existing UPRR main line runs adjacent to the west side of existing buildings that are accessible off of SE 24th Avenue (see **Exhibit 12 in Appendix A**). This study provided a typical section through Brooklyn Yard. It does not appear feasible to shift the existing tracks west toward the yard to accommodate a second main on the east side of the main line. Impacts to existing buildings and businesses adjacent to the existing UPRR eastern right of way may be significant if an additional 35' right of way be acquired for the additional main line. The east edge of the existing UPRR right of way appears to be the west edge of the buildings east of Brooklyn Yard. To acquire 35 additional feet to the east would demolition of those buildings. It is recommended that this area be modeled with both the single track option and the double track option so track operations it can be determined if impacting the buildings on the east is necessary.

3. Alternative 2 Alignment

The following chapter outlines the areas of Alternative 2 that required additional study and/or refinement due to specific land-use or operational complications. Unlike Alternative 1 which largely follows the UPRR main line, Alternative 2 is a hybrid of the "Red," "Purple" and "Blue" corridors assessed during the screening and evaluation process. Due to this complexity, greater detailed refinement was needed to ensure smooth transitions between the different corridors. The following section outlines the engineering assumptions and modifications made throughout this refinement.

Springfield/Eugene Area

Alternative 2 begins 1,000' east of S 5th Street near the existing Springfield Bus Station (Sta. 10230/MP100.00). The station platform to be placed on tangent at least 100' away from S 5th Street so the train will not interfere with the signals while at the platform. A 500' long platform is sufficient for passenger rail but 1,000' will be required if Amtrak will use it. Although not included in this study, it is recommended that a layover location just east of the Springfield Station be added.

S 5th Street (Sta. 10240/MP100.19), S 2nd Street (Sta. 10250/MP100.38) and E 19th Avenue (Sta. 10285/MP101.04) are the only existing at-grade crossings between the beginning of the alignment and the I-5 Willamette River crossing. For this stage of study, we recommend keeping all three crossings at-grade with active crossing protections, due to the existing condition, low speeds, small traffic impacts and existing rail connections.

Sta. 10230/MP100.00 to 10325/MP101.80 is assumed to be double track construction (new line plus rebuilt existing line). The existing rail bridge over Willamette River at Sta. 10260/MP100.57 will be replaced.

The I-5 Willamette River crossing will be on the east side of the existing bridge. This alignment provides the horizontal distance needed to gain vertical clearance over Hwy 126 and minimizes conflicts with pedestrian bridge and park on west side.

Eugene to Albany

Alternative 2 will remain on the east side of I-5. The environmental footprint (100' to either side of the centerline) is assumed to be wide enough to account for any alignment shifts necessary to avoid transmission towers along the east side of I-5 north of the I-5 Willamette River crossing; however, it is likely that at least two transmission towers will have to be modified to allow the train to pass below the power lines at an adequate clearance (see **"Eugene Willamette River Crossing"** in **Appendix B**). Unless specifically stated otherwise, all street and ramp crossings north of the I-5 Willamette River crossing are assumed to be grade-separated on bridge or viaduct. The following design refinements were made to this section of Alternative 2:

- New bridges will be required over the Patterson Slough at Sta. 10350/MP102.27 and over the McKenzie River at Sta. 10580/MP106.63.
- There will be significant cut required (100' to 150') into rock/hillside between Sta. 10585/MP106.72 and 10600/MP107.01.
- The alignment was pulled to the east to avoid the Premier RV Resort at Sta. 10660/MP108.14.
- Consideration should be given to the realignment of Mt. Tom Drive between Sta. 10903/MP112.75 and 10961/MP113.84 to avoid elevated segments and/or cutting off local access.
- The alignment was pulled to the east to avoid crossing above the on/off-ramps at Diamond Hill Drive at Sta. 11200/MP118.37.
- The alignment was pulled to the east to avoid crossing above the on/off-ramps at Hwy 228 at Sta. 11597/MP125.89.

Albany

Proposed changes by ODOT to the I-5 corridor between Santiam Hwy 20 and Jefferson Hwy 99/164 made an east side running alignment problematic due to proximity to airport structures, conflicts with the proposed Collector-Distributor roads, and interference with access to local neighborhoods. Due to these proposed changes, south of the Santiam Hwy (Sta. 12460/MP142.23) the Alternative 2 alignment will transition from the east side of I-5 to the median of I-5 where it will remain until south of the Jefferson Hwy (Sta. 12730/MP147.35) where it will transition back to the east side of I-5. The median running alignment will remain elevated to the third level from Sta. 12460/MP142.23 until north of the Santiam Hwy interchange. There will be new bridge structures over existing roads at Knox Butte Road and Old Salem Road. The alignment will be elevated to the third level over the proposed crossing structure near Sta. 12655/MP145.93. It will be elevated to the third level from the existing crossing structure between Sunnyview Drive and Viewcrest Drive (Sta. 12712/MP147.01) until it transitions to the east side of I-5 (Sta. 12730/MP147.35). A drainage system will need to be investigated and developed along the median running alignment in order to address impacts to the current storage and conveyance system.

Albany – Optional Alignment

An optional flyover is proposed immediately north of 7 Mile Lane SE (Sta. 12312/MP139.43) to transition to run parallel to existing AERC/UPRR track to the Albany Amtrak station. This segment is assumed to be double track construction (new line plus rebuilt existing line). The Albany Option will continue along the existing track route to serve the Albany Amtrak station and will then continue along the west side of I-5 until elevating and crossing to the east side of I-5, joining the Alternative 2 baseline, at Sta. 12752/MP147.77 (Albany Option Sta. 12882/MP150.23). See **“Seven Mile Crossing”** in **Attachment B** for the vertical profile of this flyover.

Albany to Salem

This Alternative would require cut into the hillside from Sta. 12775/MP148.20 to 12800/MP148.67. The alignment was pulled to the west (closer to I-5) between Sta. 12850/MP149.62 and 12980/MP152.08 in order to avoid impacts to rest area north of Santiam River at Sta. 12880/MP150.19 and to parcels to the north.

Salem Hills (south) to Keizer

Between Sta. 13110/MP154.55 and 13250/MP157.20, the alignment has been shifted to the west (closer to the freeway) which includes a realignment of Enchanted Way SE to the east as to eliminate conflicts with Enchanted Way SE. There will be large cuts throughout the Salem hills due to steep embankments adjacent to the freeway; there will also be long stretches of elevated track required in order to maintain operating grades and to clear ramps and interchanges. The hill between 13150/MP155.30 and 13210/MP156.44 will require the track to run at grades between 3.5% and 4% for approximately 6000’. This is more than twice the advisable length for that grade. The grade may be lessened by raising the elevation of the track at the bottom of the hill and/or reconstructing the OC north of Cloverdale Drive to allow the track to pass below (see “**Salem Hills VA & UPRR Crossing”** verticals in **Attachment B**).

Lowering of the UPRR line at Sta. 13469/MP161.34 will be required in order to clear the Salem Airport runway clearance line. It is estimated that 2’ of lowering will be required so that a future catenary line and pantograph will clear the runway clearance line.

Keizer to Wilsonville

Alternative 2 crosses up and over from the east to the west side of I-5 at Sta. 13850/MP168.56. The alignment will touch down to grade prior to the crossing of Salem Expressway/99E where it will run parallel to the existing PNWR track. The existing rail bridge will be replaced. Sta. 13870/MP168.94 to 15192/MP193.98 is assumed to be double track construction (new line plus a rebuild of the existing line). Alternative 2 diverges from the PNWR track alignment at Sta. 15192/MP193.98. The crossing of Boeckman Road will be at-grade as there is inadequate distance to attain the elevation required for a grade separation. The Alternative 2 alignment will run along the west side of I-5 until it achieves adequate elevation to cross over SB I-5 to the median of I-5 at Sta. 15230/MP194.70. See the **“OE Line South Crossing”** and **“OE Line North Crossing”** verticals in **Attachment B**.

Wilsonville to Oregon City

Alternative 2 is assumed to be a median running alignment from Wilsonville (Sta. 15230/MP194.70) north along I-5 and continuing north along the median of I-205 until south of 10th Street (Sta. 15680/MP203.22). A drainage system will need to be investigated and developed along the median running alignment in order to address impacts to the current storage and conveyance system. The alignment was moved to the east side of I-205 at Sta. 15680/MP203.22 to avoid proposed ODOT improvements north of 10th Street that effectively eliminate the median. The alignment will remain on the east side of the freeway from south of 10th Street until across the Willamette River (see **“Oregon City Willamette River Crossing”** exhibit in **Attachment B**). This will require either cut walls to support the freeway or an elevated section between Sta. 15728/MP204.13 and 15784/MP205.19. Excavation into rock will be required between Sta. 15811/MP205.70 and 15818/MP205.83. Alternative 2 will merge with Alternative 1 at Sta. 15900/MP207.39, north of the Willamette River crossing and north of Oregon City. Sta. 15900/MP207.39 to 16525/MP219.22 is assumed to be double track construction (new line and a rebuilding of the existing line).

Southeast Portland

Alternative 2 will diverge from Alternative 1 at Sta. 16520/MP219.13 and enter a cut and cover tunnel that will run below SE 2nd Avenue in Portland's industrial district (see **"SE 2nd Ave Cut and Cover Tunnel"** vertical in **Attachment B**). This tunnel will require reconstruction and realignment of the SE 3rd Avenue and SE Division Street intersection, and may impact the existing streetcar bridge over the UPRR tracks between SE 2nd Place and SE Martin Luther King Jr. Boulevard. The southern portal location is at Sta. 16535/MP219.41, approximately 200 feet south of SE Market Street. The northern portal location is at Sta. 16570/MP220.08, approximately 200 feet north of SE Stark Street. Alternative 2 will rejoin Alternative 1 south of the Burnside Bridge at Sta. 16581/MP220.28. Sta. 16581/MP220.28 to 17152/MP231.10 is assumed to be double track construction (new line plus a rebuild of the existing line).

4. Cost Estimates

Using the conceptual designs for each of the preliminary alternatives as described above, the Rail Design Team analyzed track characteristics within each 100' segment ("station range") to quantify the proposed track improvements and/or new alignments.

Using four major categories and thirteen subcategories (see **Table 1**), the Design Team counted track, sidings, and other improvements proposed within each station range of the alternatives. Using these quantities and unit costs (described below), station range cost estimates were calculated. When aggregated, these station range estimates form the alternatives' Design Cost Estimates. Please note that while ROW cost estimates were calculated and considered in evaluating Alternatives 1 and 2, for the purpose of this report, ROW costs will not be considered. The complete cost estimates for the refined Alternatives will be completed at a future date.

Unit costs were based on previous engineering cost estimates for similar projects, historical data, labor indices, equipment, and construction materials. A full description of unit cost assumptions is included as **Appendix F.**

Construction Costs

The following table shows the construction cost categories and short descriptions of each category's engineering assumptions that were used during the conceptual review process.

Table 2 Construction Cost Categories and Descriptions

1	**Track Structure and Track**	
	a. At-Grade	At-grade track assumes minimal earthwork, subballast, ballast, tie, rails and fasteners.
	b. At-Grade Track w/ Earthwork	This is for an area that will require some cut or fill, maybe some small ballast walls. Typical application would be adjacent to a highway embankment where a bench may be needed. Includes subballast, ballast, tie, rails and fasteners.
	c. Retained Fill	This is used for approach structures and other areas requiring retaining walls. Assumes two walls at an average wall height of 15'. Includes subballast, ballast, tie, rails and fasteners.
	d. Elevated/Viaduct	This can be a pier or straddle bent structure. Includes direct fixation fasteners and rails.
	e. Open Trench/Retained Cut	This is used for approach structures and other areas requiring retaining walls. Assumes two walls at an average wall height of 20'. Includes subballast, ballast, tie, rails and fasteners.
	f. Tunnel - Cut and Cover	Includes tunnel bottom, 2 walls and cover along with required earthwork. Assumes an aver cover of 20'. Assumes tunnel section to be 20' wide and 25' high (I.D.) for a single track, 45' wide and 25' (I.D.) for double track. Includes direct fixation fasteners and rails.
	g. Tunnel - Bored	Includes bored tunnel using TBM. 30' I.D. for single track, 50' I.D. for double track. Assumes 2 diameters of cover minimum. Includes direct fixation fasteners and rails.
	h. Bridges - Road over Rail	New roadway structure over tracks. 23'-6" standard vertical clearance over tracks. Maximum length of 200' per bridge (use multiple as needed). Includes abutments.
	i. Bridges - Rail Bridge	New rail bridge over roadway, river, etc. 16'-6" standard vertical clearance over roadways (NHS and High Routes may require greater clearances - 17'-0" and 17'-4", respectively). Maximum length of 300'; otherwise, falls to elevated/viaduct. Includes abutments, subballast, ballast, tie, rails, guard rail and fasteners.
2.	**Stations, Terminals, Intermodal**	
	a. Stations	
3.	**Support Facilities: Yards, Shops, Administrative Buildings**	
	a. Layover Facility	
	b. Maintenance Facility	
4.	**Site Work, ROW, Land, Existing Improvements**	
	a. Grade Crossings - Up to 4 lanes	This is for at-grade crossing for up to 4 lanes of traffic. Assumes panels, gate arms, flashers, roadway signal upgrades and roadway reconstruction of 100' off track centerlines in both directions.
	b. Grade Crossings - over 4 lanes	This is for at-grade crossing for over 4 lanes of traffic. Assumes panels, gate arms, flashers, roadway signal upgrades, medians and roadway reconstruction of 100' off track centerlines in both directions.
	c. ROW Impacts	Please see attachment.
5.	**Communications and Signaling**	
	a. Wayside Signaling Equipment	

Note: **Attachment F** offers a unit or per-mile cost for each major cost category.

Non-Construction Costs

Non-construction costs include professional services, utility relocation, and environmental mitigation. During this stage percentages of the total cost were applied for each cost. Table 2 shows the percentages were applied to the total estimated construction cost (high and low):

Table 3. Non-Construction Cost Categories Used in OPR Cost Estimates

PROFESSIONAL SERVICES		Item total	Category total
	Design Engineering	10%	
	Insurance and Bonding	2%	
	Program Management	4%	
	Construction Management & Inspection	6%	
	Engineering Services During Construction	2%	
	Integrated Testing and Commissioning	2%	
	Sub-total Professional Services		26%
UTILITY RELOCATION			
	Percentage of Route that is in Urban Areas	%	
	Percentage of Route that is Outside of Urban Areas	%	
	Through Urban Areas (% of sub-total construction elements)	6%	6%
	Outside of Urban Areas (% of sub-total construction elements)	3%	3%
ENVIRONMENTAL MITIGATION			
	Noise Mitigation	1%	
	Hazardous Waste	1%	
	Erosion Control	0.5%	
	Sub-total Environmental Mitigation		2.5%

Contingency Cost Estimates

The construction and non-construction costs were summed for each alternative by section, and a 30% contingency was applied to develop a total estimated cost.

As the project is further defined through freight and passenger modeling, the preliminary alternatives and cost estimates may be revised to account for changes in infrastructure needed to meet passenger service targets while minimizing impacts to freight operations.

Refined Cost Estimates

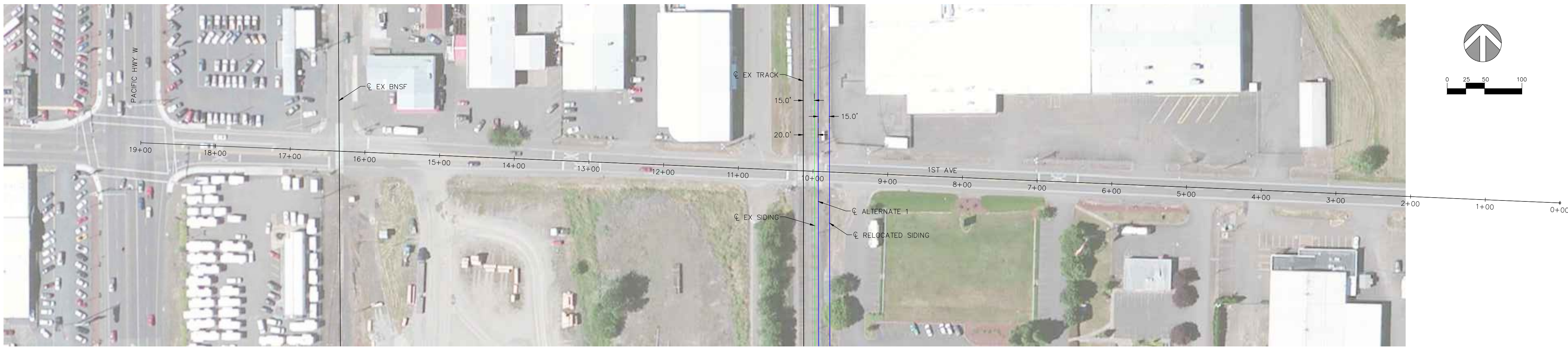
Based on the engineering refinements completed at this level of analysis, new cost estimates were drawn.

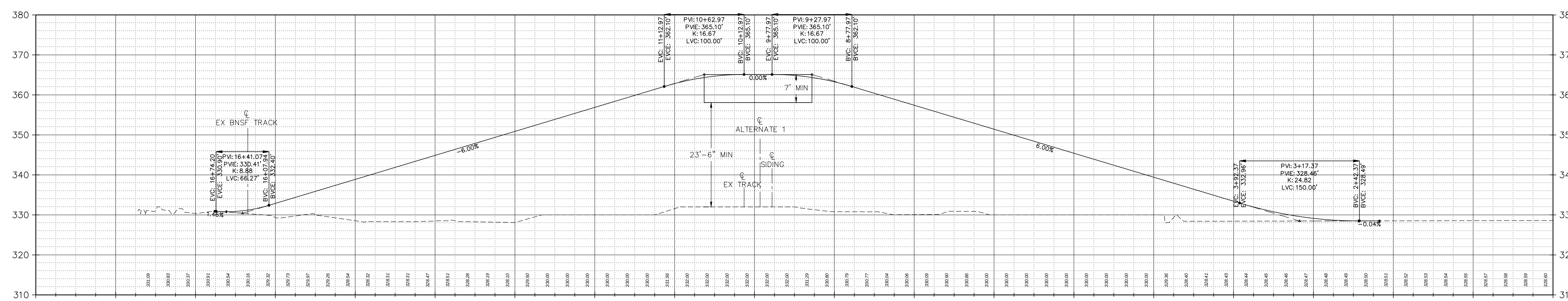
Oregon Passenger Rail
Eugene - Portland
CHOOSING A PATH FORWARD

Appendix B-A
Alternative 1 Exhibits of Vertical Analysis

Oregon Department of Transportation

U.S. Department of Transportation
Federal Railroad Administration





PROFILE VIEW: 1ST AVE MP 660.30 – JUNCTION CITY

1ST AVE MP 660.30
JUNCTION CITY, OREGON

OREGON PASSENGER RAIL
EUGENE - PORTLAND

DAVID EVANS AND ASSOCIATES INC.
3700 Pacific Hwy. East, Suite 311
Tacoma Washington 98424
Phone: 253.922.9780

REVISIONS: APPD.

DATE: 2014/05/12
DESIGN: MFM
DRAWN: CDB
CHECKED: JWE
REVISION NUMBER:

SCALE:

PROJECT NUMBER: ODOT00000791

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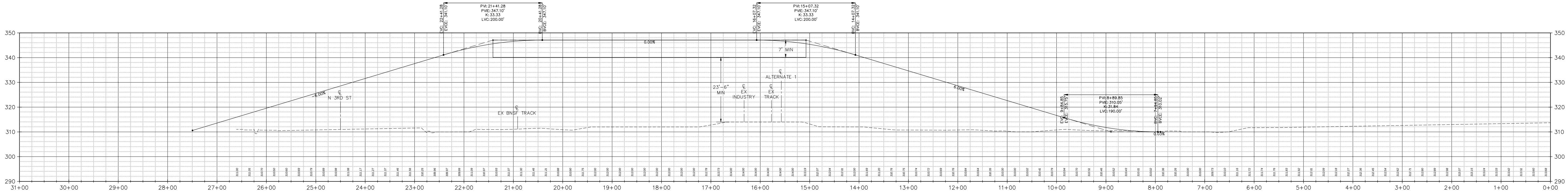

PROFILE VIEW: TERRITORIAL ST MP 665.10 – HARRISBURG

TERRITORIAL ST MP 665.10
HARRISBURG, OREGON

OREGON PASSENGER RAIL
EUGENE - PORTLAND

DAVID EVANS AND ASSOCIATES INC.

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DATE: 2014/05/12
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CHECKED: JWE
REVISION NUMBER:

SCALE:

PROJECT NUMBER: ODOT00000791

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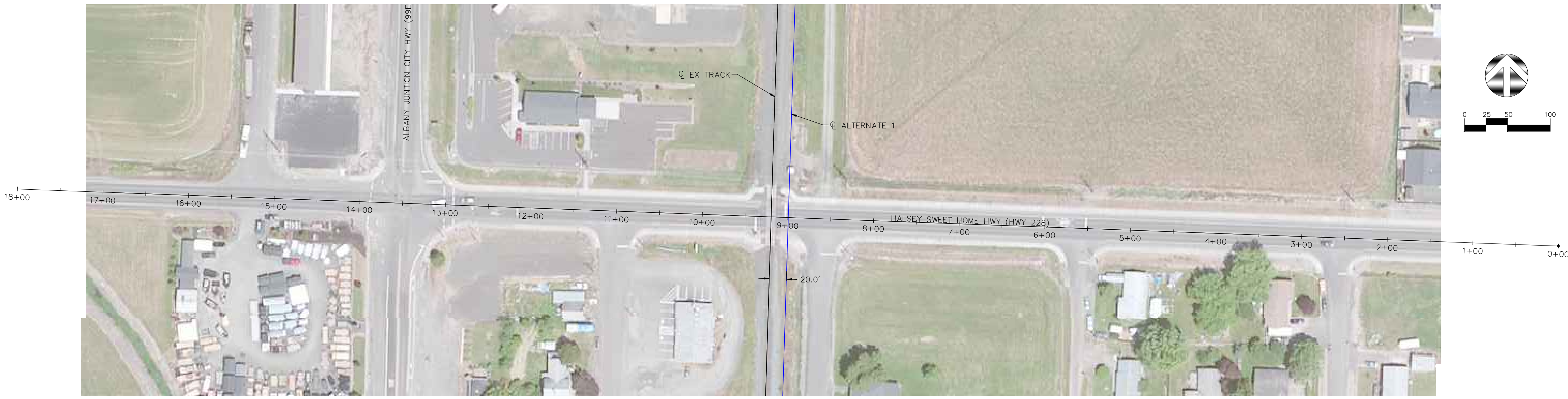

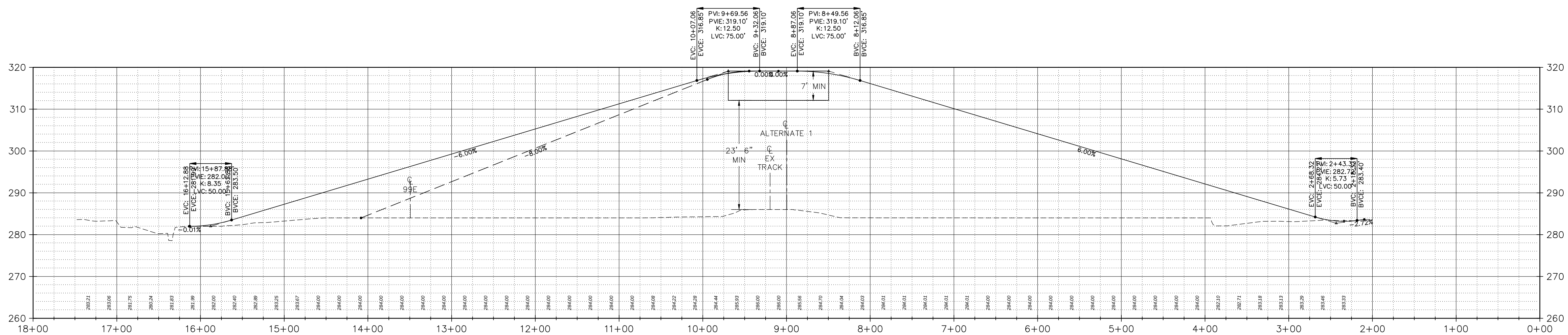

PROFILE VIEW: HWY 228 MP 674.10 – HALSEY

HWY 228 MP 674.10
HALSEY, OREGON
OREGON PASSENGER RAIL
EUGENE - PORTLAND

DAVID EVANS AND ASSOCIATES INC.
3700 Pacific Hwy. East, Suite 311
Tacoma, Washington 98424
Phone: 253.922.9780

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DESIGN: MFM
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PROJECT NUMBER: ODOT00000791
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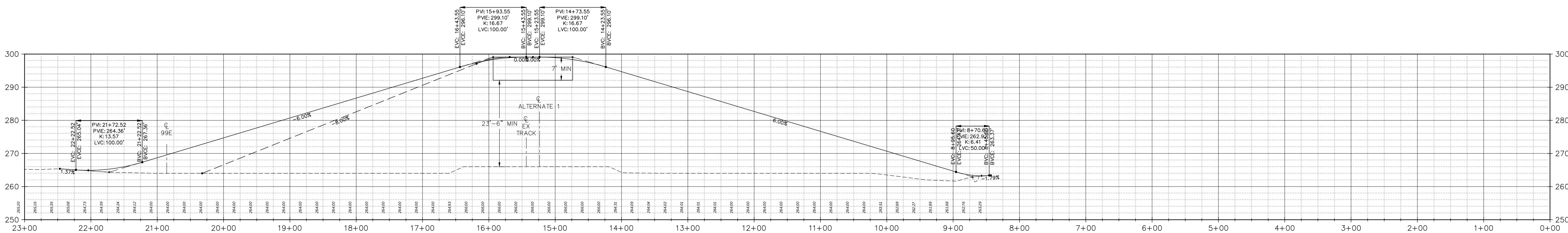

PROFILE VIEW: BOSTON MILL RD MP 679.10 – SHEDD

BOSTON MILL RD MP 679.10
SHEDD, OREGON

OREGON PASSENGER RAIL
EUGENE - PORTLAND

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Tacoma Washington 98424
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REVISIONS: APPD.

DATE: 2014/05/12
DESIGN: MFM
DRAWN: CDB
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SCALE:

PROJECT NUMBER:
ODOT00000791

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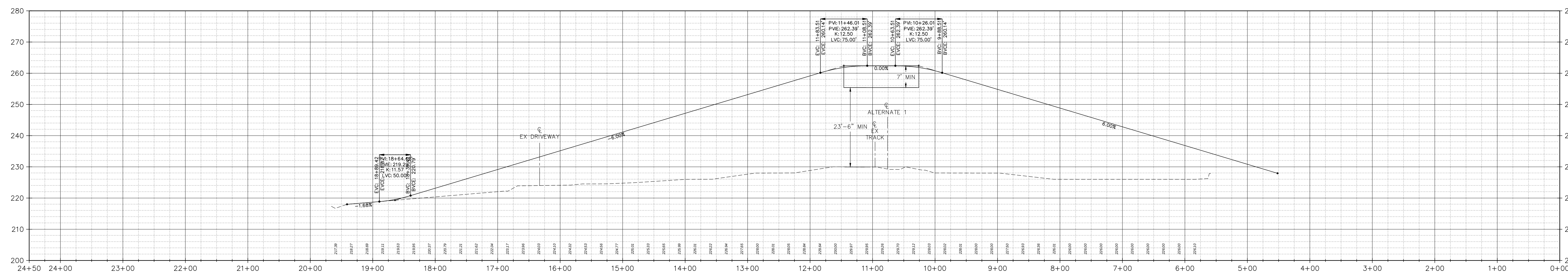

PROFILE VIEW: 34TH AVE MP 689.40 – ALBANY

34TH AVE MP 689.40
ALBANY, OREGON

OREGON PASSENGER RAIL
EUGENE - PORTLAND

DAVID EVANS AND ASSOCIATES INC.
3700 Pacific Hwy. East, Suite 311
Tacoma Washington 98424
Phone: 253.922.9780

REVISIONS:	APPD.

DATE: 2014/05/12
DESIGN: MFM
DRAWN: CDB
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REVISION NUMBER:

SCALE:

PROJECT NUMBER: ODOT00000791

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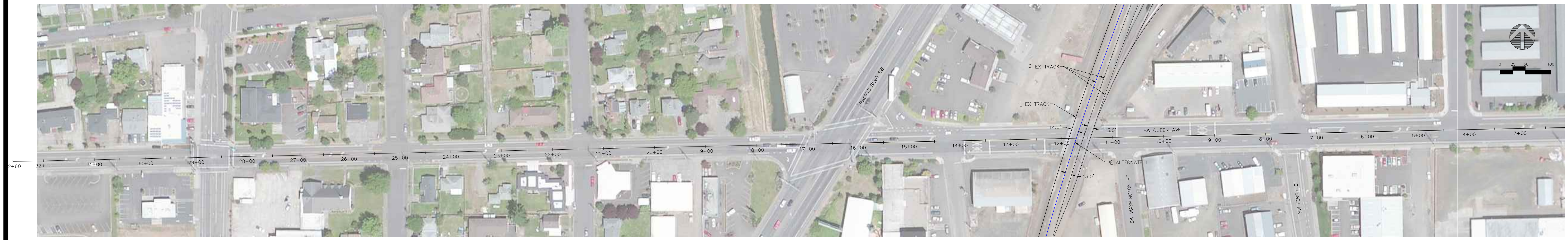

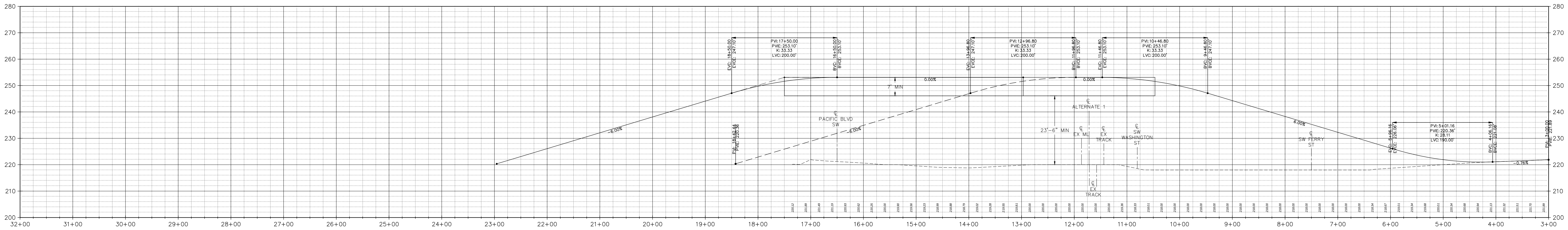

PROFILE VIEW: SW QUEEN AVE MP 690.40 – ALBANY

SW QUEEN AVE MP 690.40
ALBANY, OREGON

OREGON PASSENGER RAIL
EUGENE - PORTLAND

DAVID EVANS AND ASSOCIATES INC.
3700 Pacific Hwy. East, Suite 311
Tacoma Washington 98424
Phone: 253.922.9780

REVISIONS:	APPD.

DATE: 2014/05/12
DESIGN: MFM
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REVISION NUMBER:

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PROJECT NUMBER:
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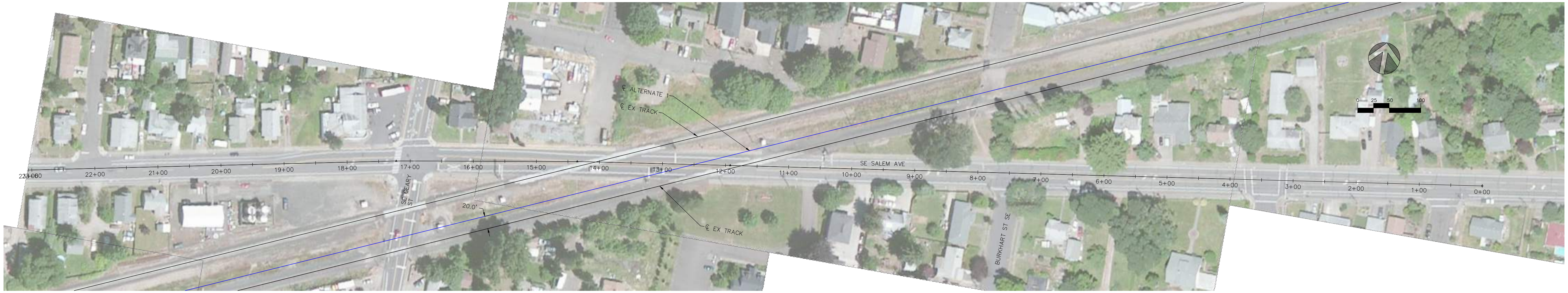

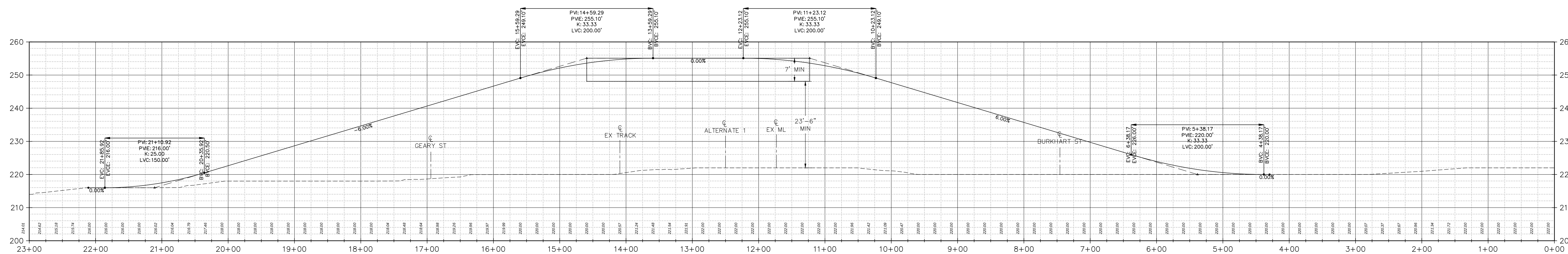

PROFILE VIEW: SALEM AVE MP 692.04 – SALEM

SALEM AVE MP 692.04
SALEM, OREGON
OREGON PASSENGER RAIL
EUGENE - PORTLAND

DAVID EVANS AND ASSOCIATES INC.
3700 Pacific Hwy East, Suite 311
Tacoma Washington 98424
Phone: 253.922.9780

REVISIONS:	APPD.

DATE: 2014/05/12
DESIGN: MFM
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CHECKED: JWE
REVISION NUMBER:

SCALE:

PROJECT NUMBER:
ODOT00000791

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salem ave grade separation.dwg

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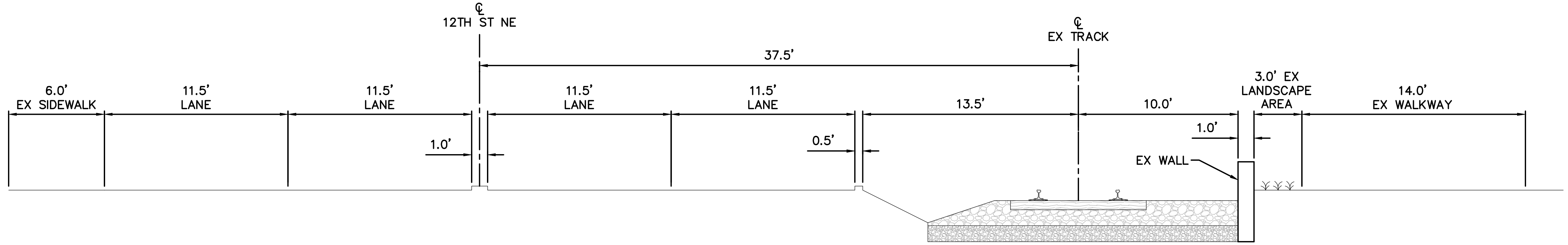
Exhibit 8. Salem - 12th Street Study (MP 718)



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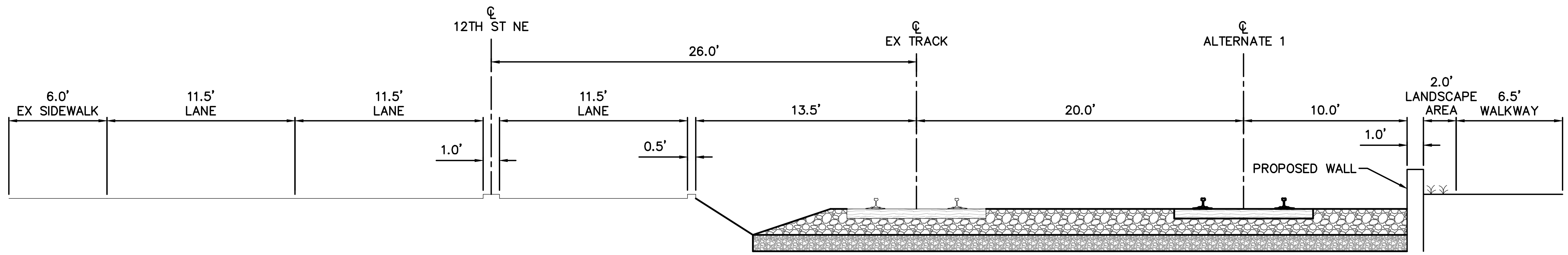

2 / 1 PROPOSED SECTION 12TH ST NE - OPTION 1
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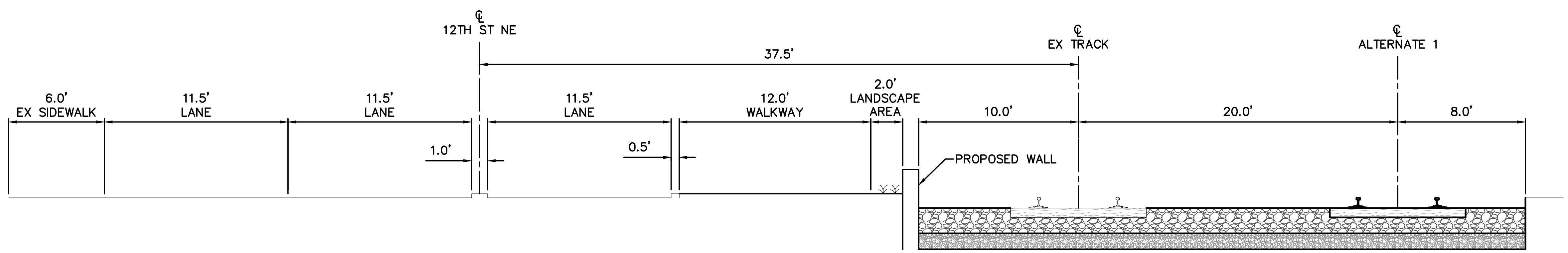


3 / 1 PROPOSED SECTION 12TH ST NE - OPTION 2
SCALE:1"=4'

12TH ST NE SECTION
MP 718.5± SALEM, OREGON
OREGON PASSENGER RAIL
EUGENE - PORTLAND

DAVID EVANS AND ASSOCIATES INC.
3700 Pacific Hwy. East, Suite 311
Tacoma Washington 98424
Phone: 253.922.9780

PRELIMINARY CONTENT SUBJECT TO CHANGE

REVISIONS: APPD.

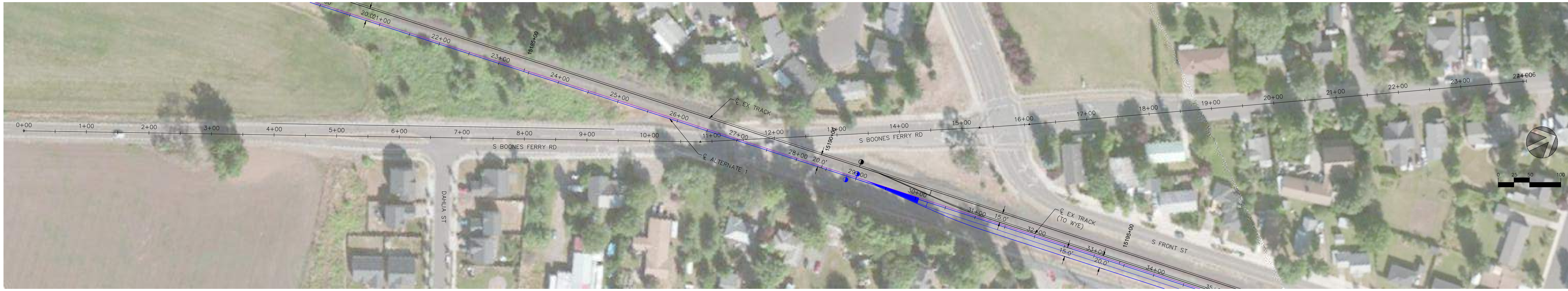
DATE: 2014/04/11
DESIGN: MFM
DRAWN: CDB
CHECKED: JWE
REVISION NUMBER:

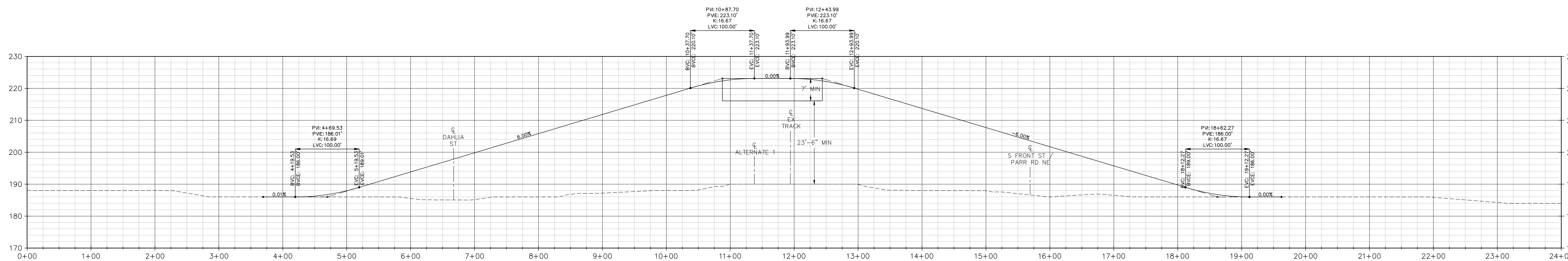
SCALE: 1"=4'

PROJECT NUMBER: ODOT00000791

DRAWING FILE: 12th st study.dwg

SHEET NO. 1
SHEET 1 OF 1





PROFILE VIEW: BOONES FERRY RD MP 734.50 – WOODBURN

BOONES FERRY RD MP 734.50
WOODBURN, OREGON

OREGON PASSENGER RAIL
EUGENE - PORTLAND

DAVID EVANS AND ASSOCIATES INC.
3700 Pacific Hwy East, Suite 311
Tacoma Washington 98424
Phone: 2539223780

REVISIONS: APPD.

DATE: 2014/05/12
DESIGN: MFM
DRAWN: CDB
CHECKED: JWE
REVISION NUMBER:

SCALE:

PROJECT NUMBER: ODOT00000791

DRAWING FILE: boones ferry grade separation.dwg

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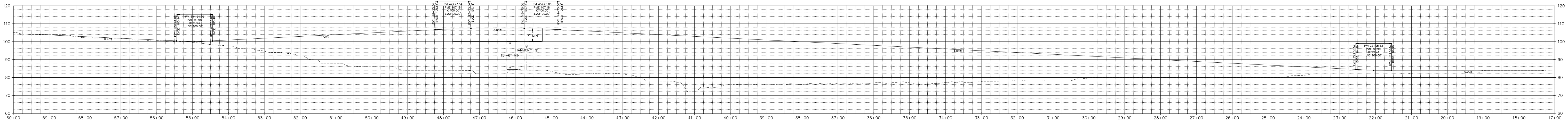

PROFILE VIEW: ALTERNATE 1 PTR AT HARMONY RD MP 762.40 – LINWOOD

HARMONY RD MP 762.40
LINWOOD, OREGON

OREGON PASSENGER RAIL
EUGENE - PORTLAND

DAVID EVANS AND ASSOCIATES INC.
3700 Pacific Hwy. East, Suite 311
Tacoma Washington 98424
Phone: 253.922.9780

REVISIONS:	APPD.

DATE: 2014/05/12
DESIGN: MFM
DRAWN: CDB
CHECKED: JWE
REVISION NUMBER:

SCALE:

PROJECT NUMBER:
ODOT00000791

DRAWING FILE:
harmony rd grade seperation.dwg

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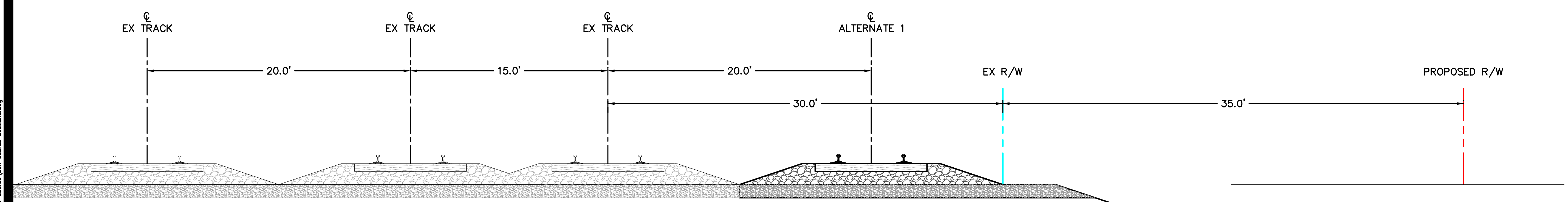
Exhibit 11. Eastmoreland - Golf Course Section (MP 766)



EXISTING RIGHT OF WAY
PROPOSED RIGHT OF WAY
ALTERNATE 1 TRACK ALIGNMENT
EXISTING TRACK

MP 766± - EASTMORELAND, OREGON
TYPICAL CROSS SECTION AT GOLF COURSE
OREGON PASSENGER RAIL
EUGENE - PORTLAND

DAVID EVANS AND ASSOCIATES INC.
3700 Pacific Hwy. East, Suite 311
Tacoma Washington 98424
Phone: 253.922.9780

PRELIMINARY CONTENT SUBJECT TO CHANGE

REVISIONS: APPD.

DATE: 2014/04/28
DESIGN: MFM
DRAWN: CDB
CHECKED: JWE
REVISION NUMBER:

SCALE: 1"=50'

PROJECT NUMBER: ODOT00000791

DRAWING FILE: golf course sections.dwg

SHEET NO. 1

SHEET 1 OF 1

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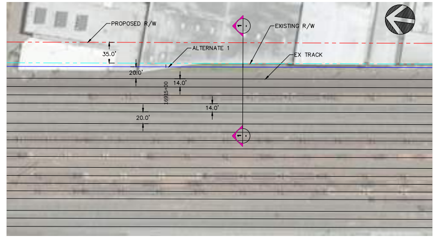
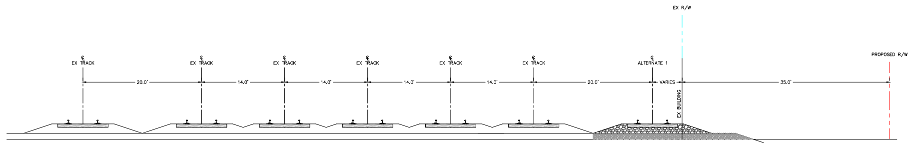




TYPICAL SECTION
SCALE: NOT TO SCALE

EXISTING RIGHT OF WAY
PROPOSED RIGHT OF WAY
ALTERNATE 1 TRACK ALIGNMENT
EXISTING TRACK

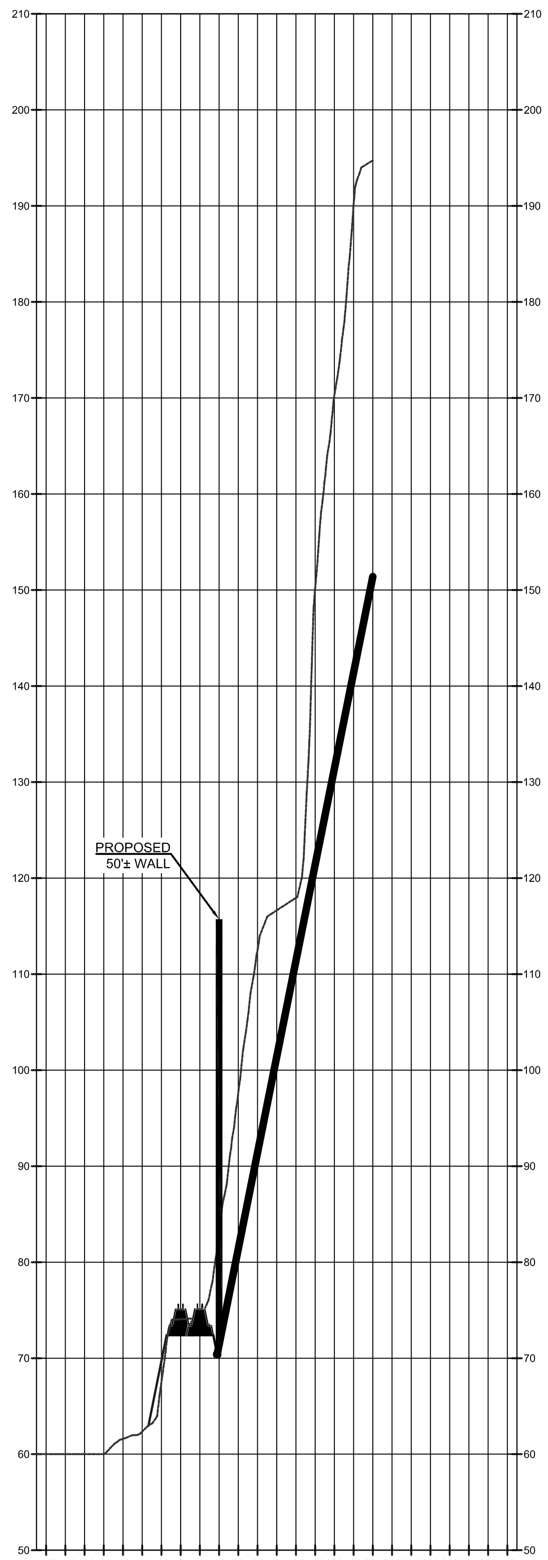
BROOKLYN YARD MP 767± – BROOKLYN, OREGON

BROOKLYN YARD MP 767±
BROOKLYN, OREGON
OREGON PASSENGER RAIL
EUGENE - PORTLAND

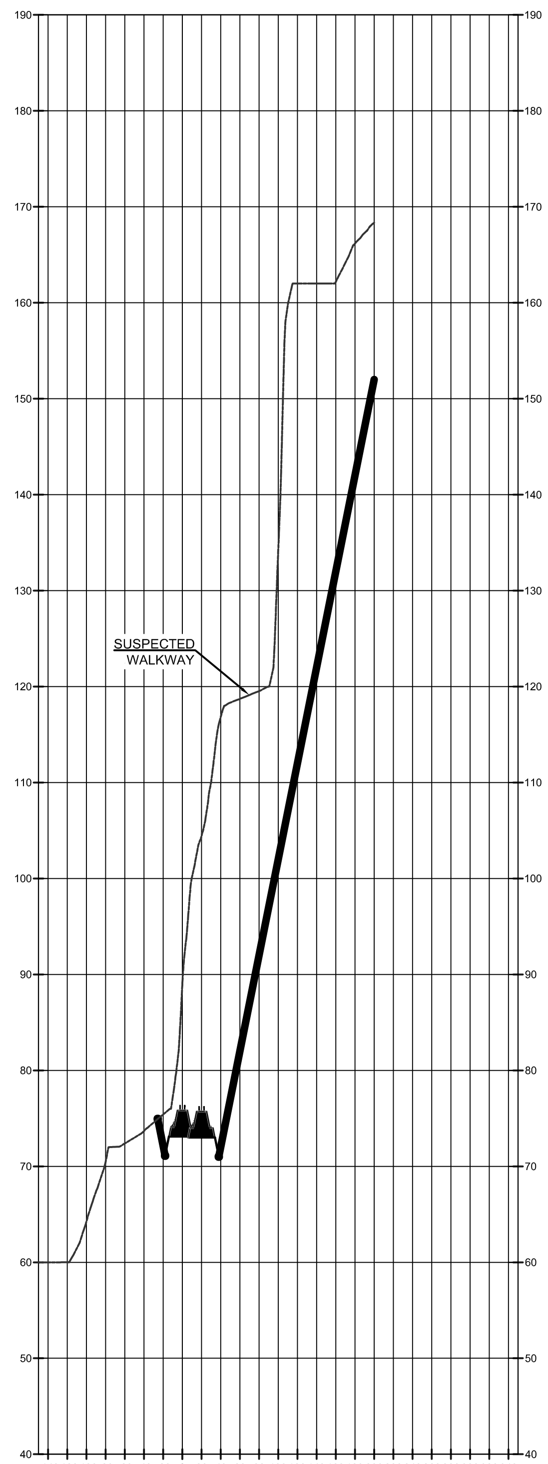
DAVID EVANS AND ASSOCIATES INC.

REVISIONS: APPD.

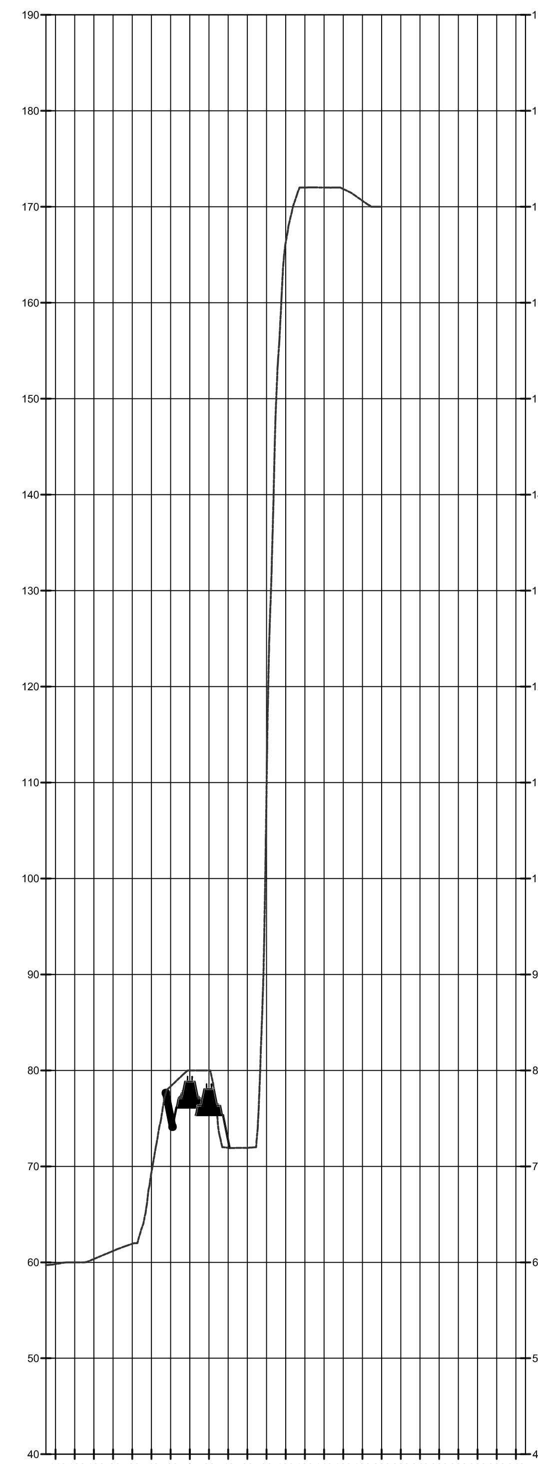
DATE:
DESIGN:
DRAWN:
CHECKED:
REVISION NUMBER:
SCALE:
PROJECT NUMBER:
DRAWING FILE:
SHEET NO.
SHEET OF



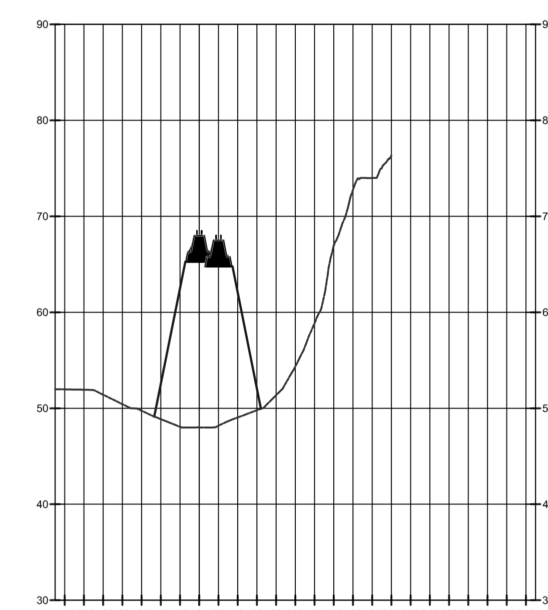
MP 754.1



MP 754.7



MP 755.3



MP 755.8

OREGON CITY MP754 TO MP756 TYPICAL SECTIONS

OREGON PASSENGER RAIL
EUGENE - PORTLAND

DAVID EVANS AND ASSOCIATES INC.
3700 Pacific Hwy. East, Suite 311
Tacoma Washington 98424
Phone: 253.922.9780

PRELIMINARY CONTENT SUBJECT TO CHANGE

REVISIONS: APPD.

DATE: 2014/05/27
DESIGN: MFM
DRAWN: CDB/SMH
CHECKED: JWE
REVISION NUMBER:

SCALE:

PROJECT NUMBER:
ODOT00000791

DRAWING FILE:
odot-0769 typical sections.dwg

SHEET NO.

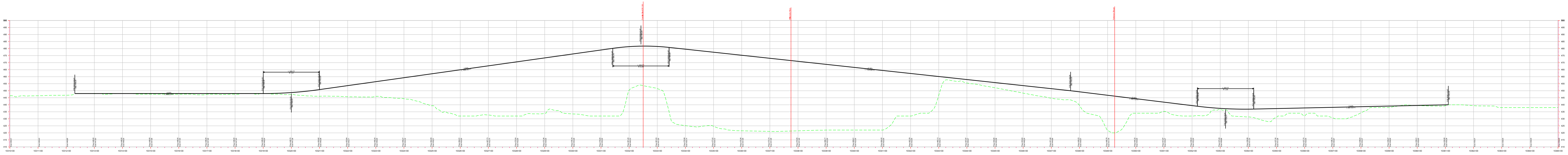
SHEET 1 OF 1

Oregon Passenger Rail
Eugene - Portland
CHOOSING A PATH FORWARD

Appendix B-B
Alternative 2 Exhibits of Vertical Analysis

Oregon Department of Transportation

U.S. Department of Transportation
Federal Railroad Administration

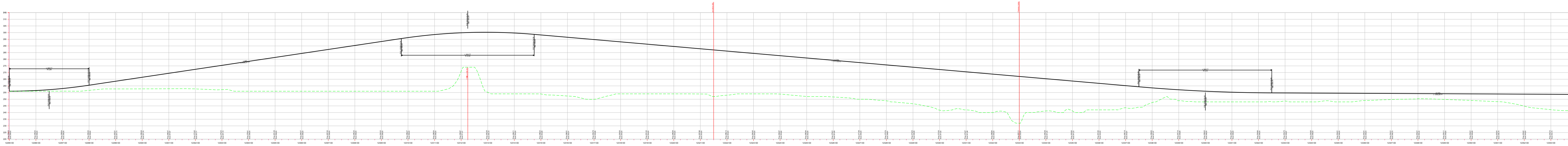


EUGENE WILLAMETTE RIVER CROSSING

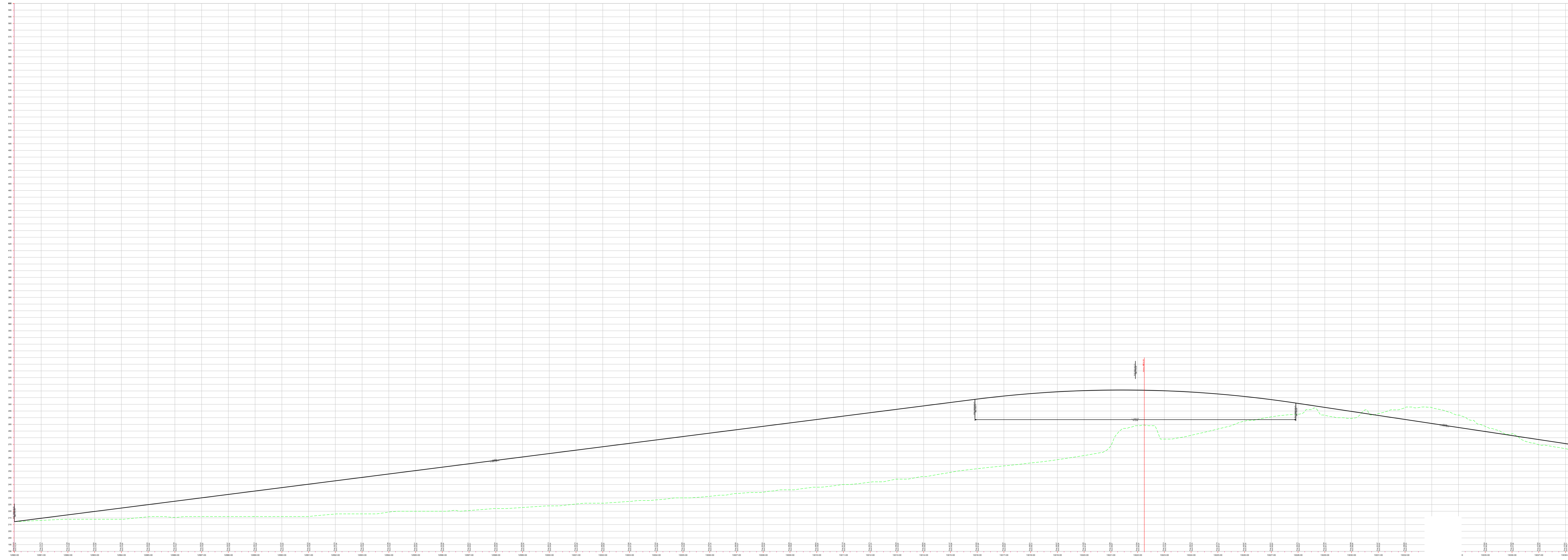
SW QUEEN AVE MP 690.40
ALBANY, OREGON
OREGON PASSENGER RAIL
EUGENE - PORTLAND

DAVID EVANS AND ASSOCIATES INC.

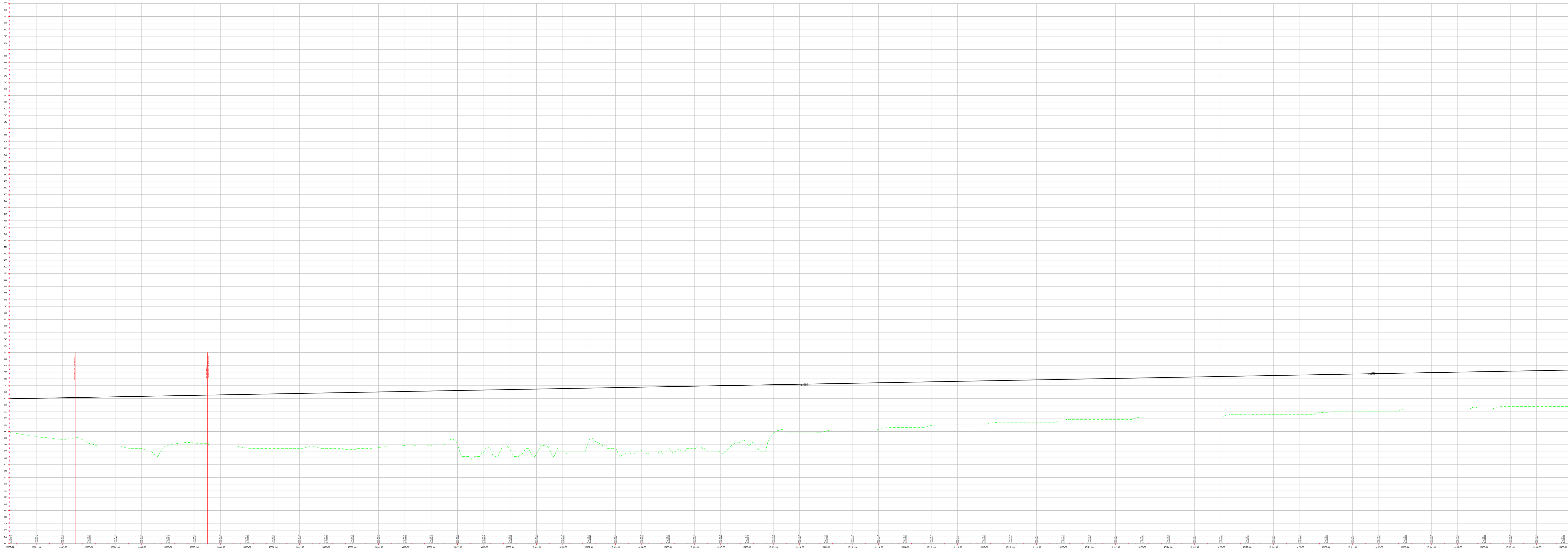
DATE: 2014/05/12
DESIGN: MFM
DRAWN: CDB
CHECKED: JMC
REVISION NUMBER:
SCALE:
PROJECT NUMBER: ODOT00000791
DRAWING FILE: ####
SHEET NO.
SHEET OF



SEVEN MILE CROSSING

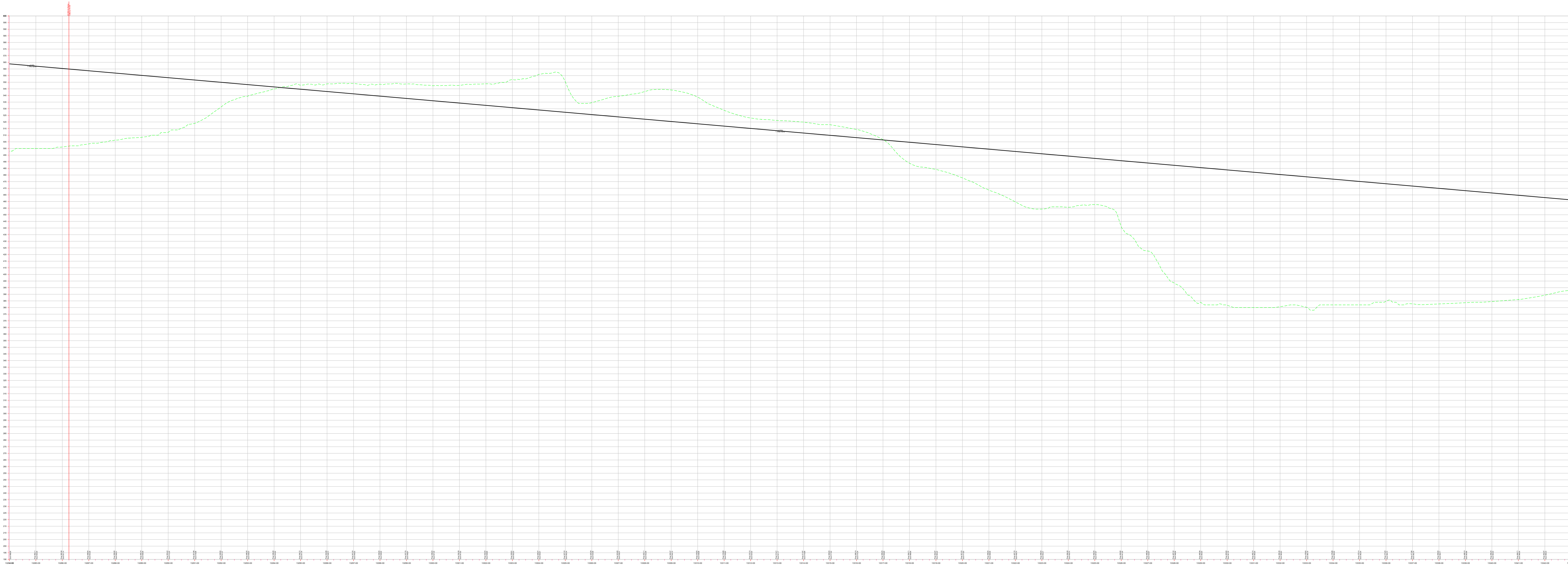


SALEM HILLS VA & UP CROSSING



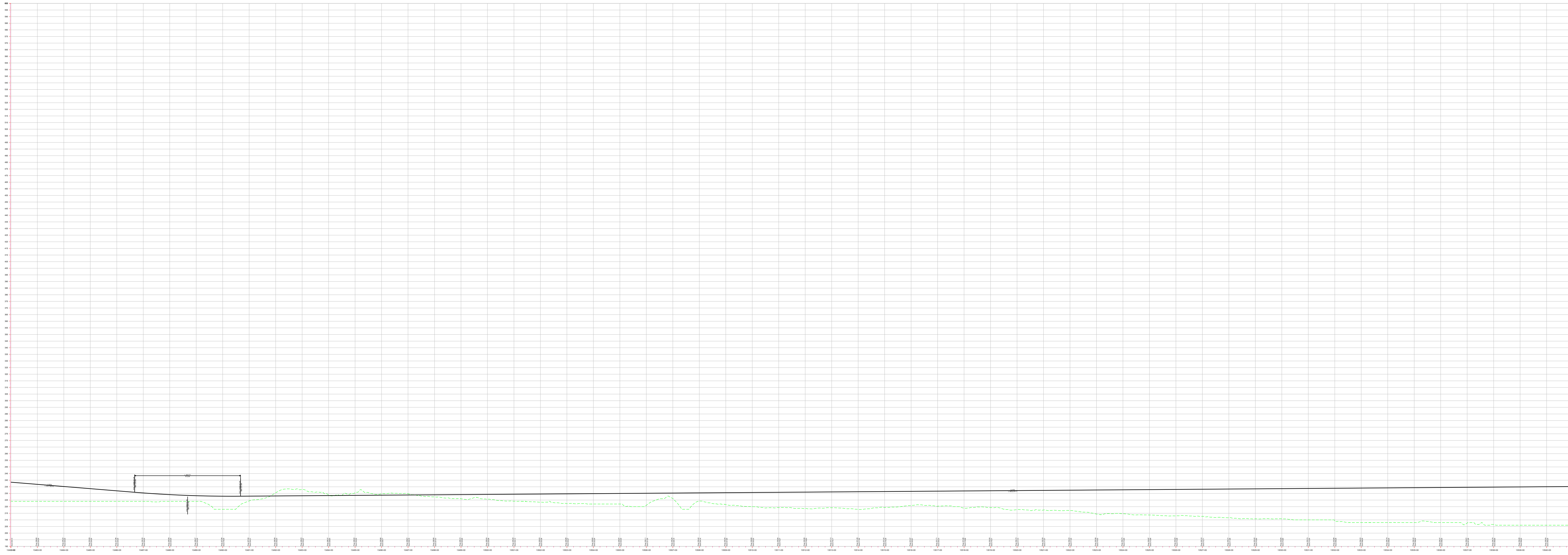
SALEM HILLS VA & UP CROSSIN

SALEM HILLS VA & UP CROSSIN

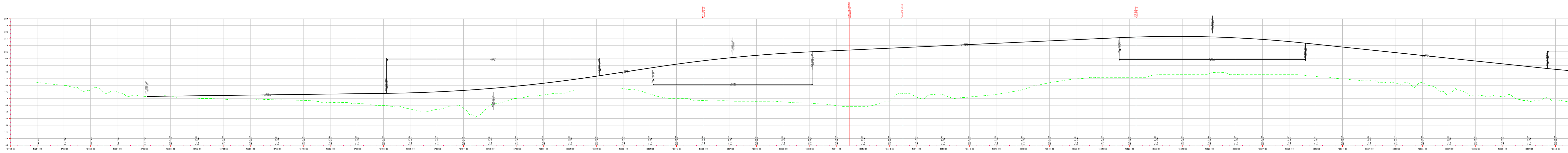


SALEM HILLS VA & UP CROSSIN

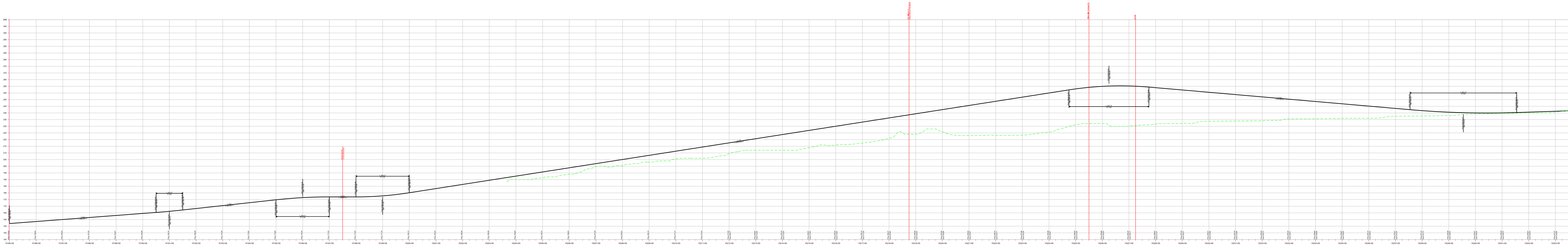
SALEM HILLS VA & UP CROSSING - 5 OF 6



SALEM HILLS VA & UP CROSSING - 6 OF 6



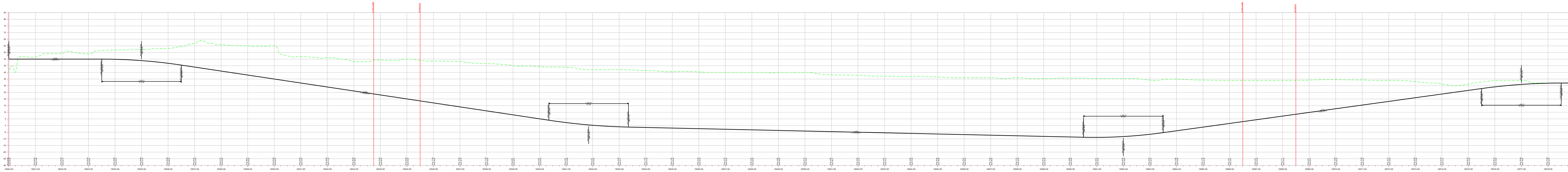
LINE SOUTH C



LINE NORTH CROSSING

BEGIN VA STA NOW = 15815+91.26

OREGON CITY WILLAMETTE RIVER CR SSING



BEGIN VA STA NOW = 16521+44.95

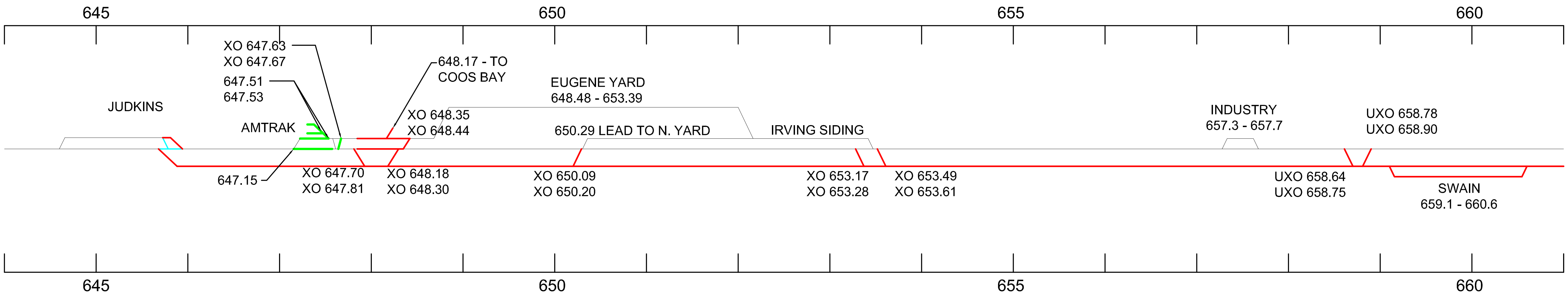
SE 2ND AVE CUT AND COVER TUNNEL

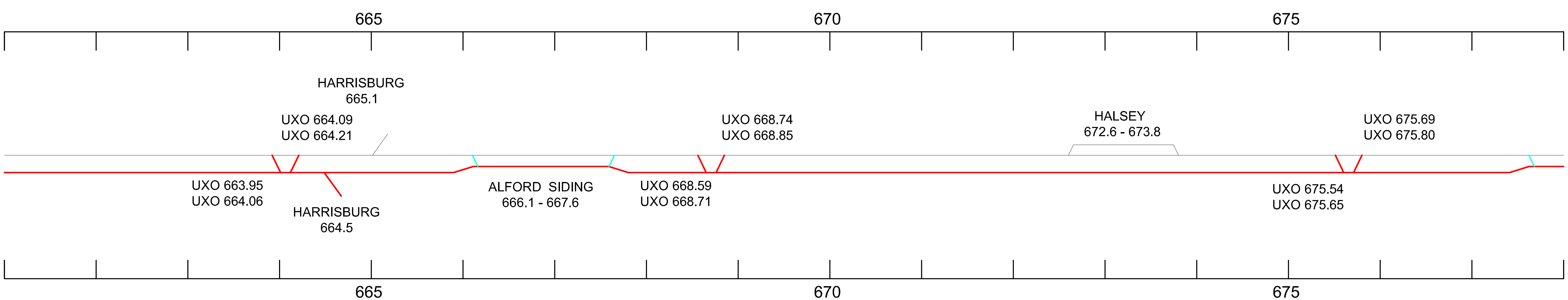
Oregon Passenger Rail
Eugene - Portland
CHOOSING A PATH FORWARD

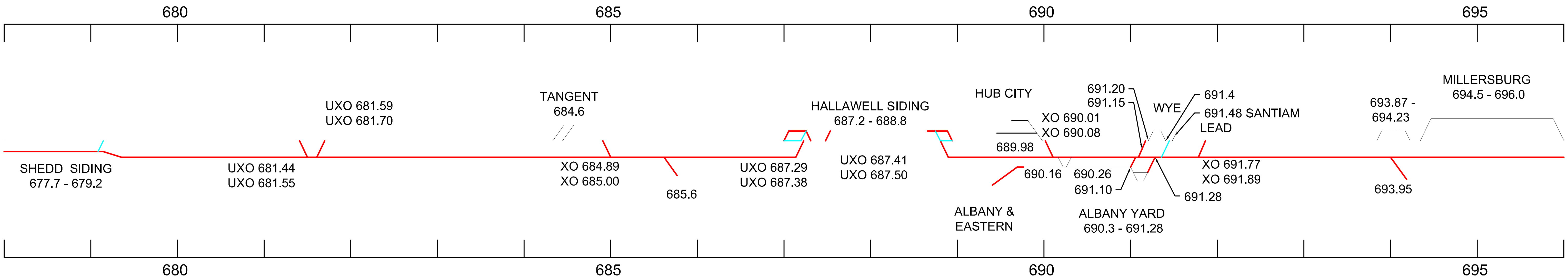
Appendix B-C
Alternative 1 Schematics

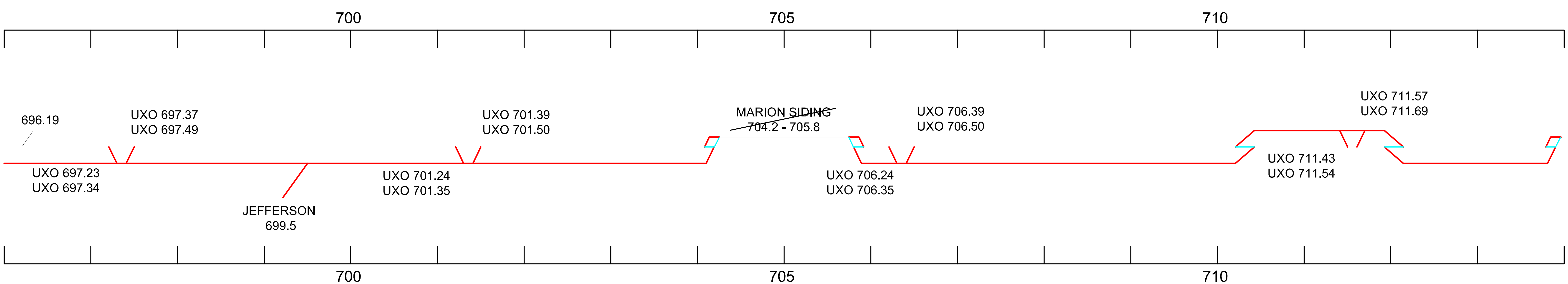
Oregon Department of Transportation

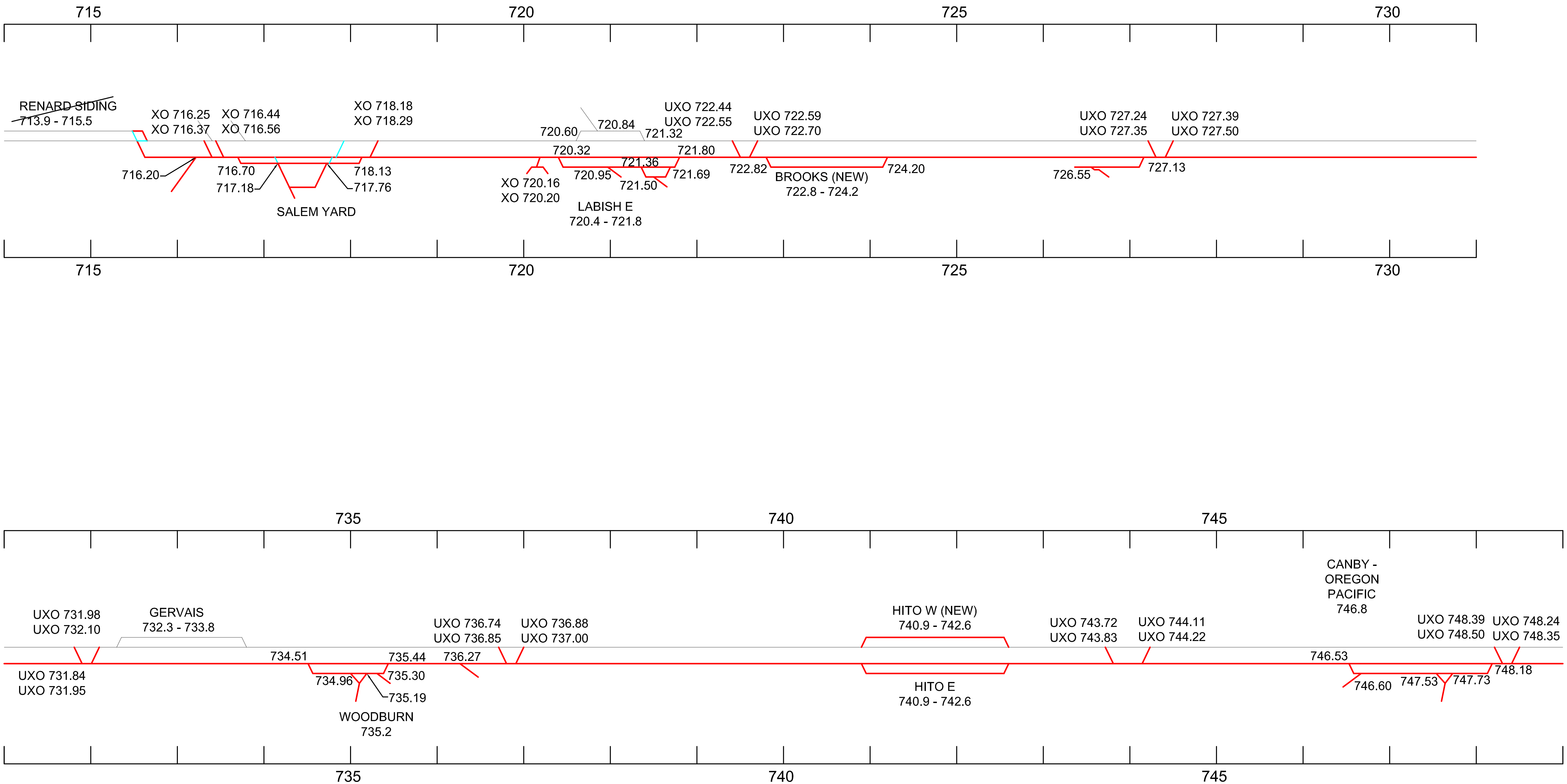
U.S. Department of Transportation
Federal Railroad Administration


645
650
655
660
XO 647.63
XO 647.67
647.51
647.53
648.17 - TO
COOS BAY
EUGENE YARD
648.48 - 653.39
JUDKINS
AMTRAK
XO 648.35
XO 648.44
650.29 LEAD TO N. YARD
IRVING SIDING
INDUSTRY
657.3 - 657.7
UXO 658.78
UXO 658.90
647.15
XO 647.70
XO 647.81
XO 648.18
XO 648.30
XO 650.09
XO 650.20
XO 653.17
XO 653.28
XO 653.49
XO 653.61
UXO 658.64
UXO 658.75
SWAIN
659.1 - 660.6
645
650
655
660

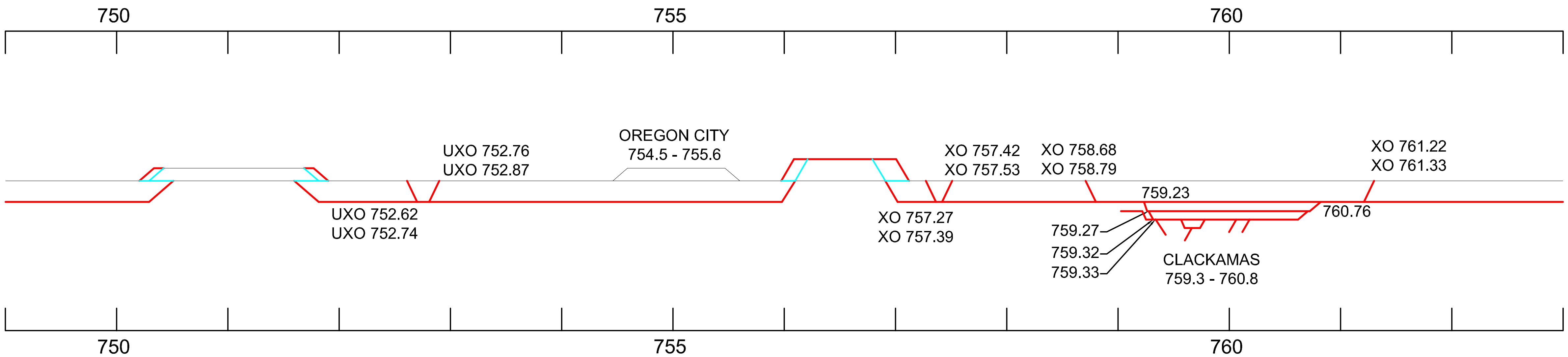

665
670
675
HARRISBURG
665.1
UXO 664.09
UXO 664.21
UXO 668.74
UXO 668.85
HALSEY
672.6 - 673.8
UXO 675.69
UXO 675.80
UXO 663.95
UXO 664.06
HARRISBURG
664.5
ALFORD SIDING
666.1 - 667.6
UXO 668.59
UXO 668.71
UXO 675.54
UXO 675.65
665
670
675

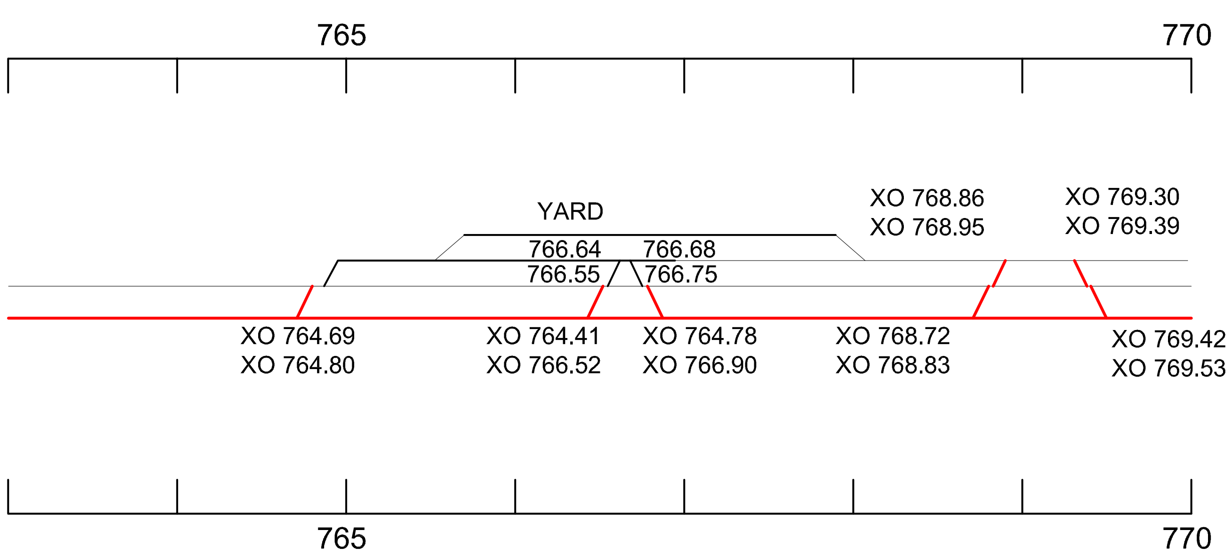

680
685
690
695
SHEDD SIDING
677.7 - 679.2
UXO 681.44
UXO 681.55
UXO 681.59
UXO 681.70
TANGENT
684.6
XO 684.89
XO 685.00
685.6
UXO 687.29
UXO 687.38
HALLAWELL SIDING
687.2 - 688.8
UXO 687.41
UXO 687.50
HUB CITY
XO 690.01
XO 690.08
689.98
690.16
ALBANY &
EASTERN
690.26
691.10
691.20
691.15
WYE
691.4
691.48 SANTIAM
LEAD
XO 691.77
XO 691.89
691.28
ALBANY YARD
690.3 - 691.28
693.87 -
694.23
693.95
MILLERSBURG
694.5 - 696.0
680
685
690
695


700
705
710
696.19
UXO 697.37
UXO 697.49
UXO 697.23
UXO 697.34
JEFFERSON
699.5
UXO 701.39
UXO 701.50
UXO 701.24
UXO 701.35
MARION SIDING
704.2 - 705.8
UXO 706.24
UXO 706.35
UXO 706.39
UXO 706.50
UXO 711.43
UXO 711.54
UXO 711.57
UXO 711.69
700
705
710



715
720
725
730
RENARD SIDING
713.9 - 715.5
XO 716.25
XO 716.37
XO 716.44
XO 716.56
XO 718.18
XO 718.29
716.20
716.70
717.18
718.13
717.76
SALEM YARD
720.60
720.84
721.32
UXO 722.44
UXO 722.55
UXO 722.59
UXO 722.70
720.32
721.36
721.80
XO 720.16
XO 720.20
720.95
721.50
721.69
722.82
BROOKS (NEW)
722.8 - 724.2
724.20
LABISH E
720.4 - 721.8
UXO 727.24
UXO 727.35
UXO 727.39
UXO 727.50
726.55
727.13
735
740
745
UXO 731.98
UXO 732.10
GERVAIS
732.3 - 733.8
UXO 731.84
UXO 731.95
734.51
735.44
736.27
UXO 736.74
UXO 736.85
UXO 736.88
UXO 737.00
734.96
735.30
735.19
WOODBURN
735.2
HITO W (NEW)
740.9 - 742.6
HITO E
740.9 - 742.6
UXO 743.72
UXO 743.83
UXO 744.11
UXO 744.22
CANBY - OREGON PACIFIC
746.8
746.53
746.60
747.53
747.73
748.18
UXO 748.39
UXO 748.50
UXO 748.24
UXO 748.35


750
755
760
UXO 752.76
UXO 752.87
OREGON CITY
754.5 - 755.6
XO 757.42
XO 757.53
XO 758.68
XO 758.79
XO 761.22
XO 761.33
UXO 752.62
UXO 752.74
XO 757.27
XO 757.39
759.23
760.76
759.27
759.32
759.33
CLACKAMAS
759.3 - 760.8
750
755
760

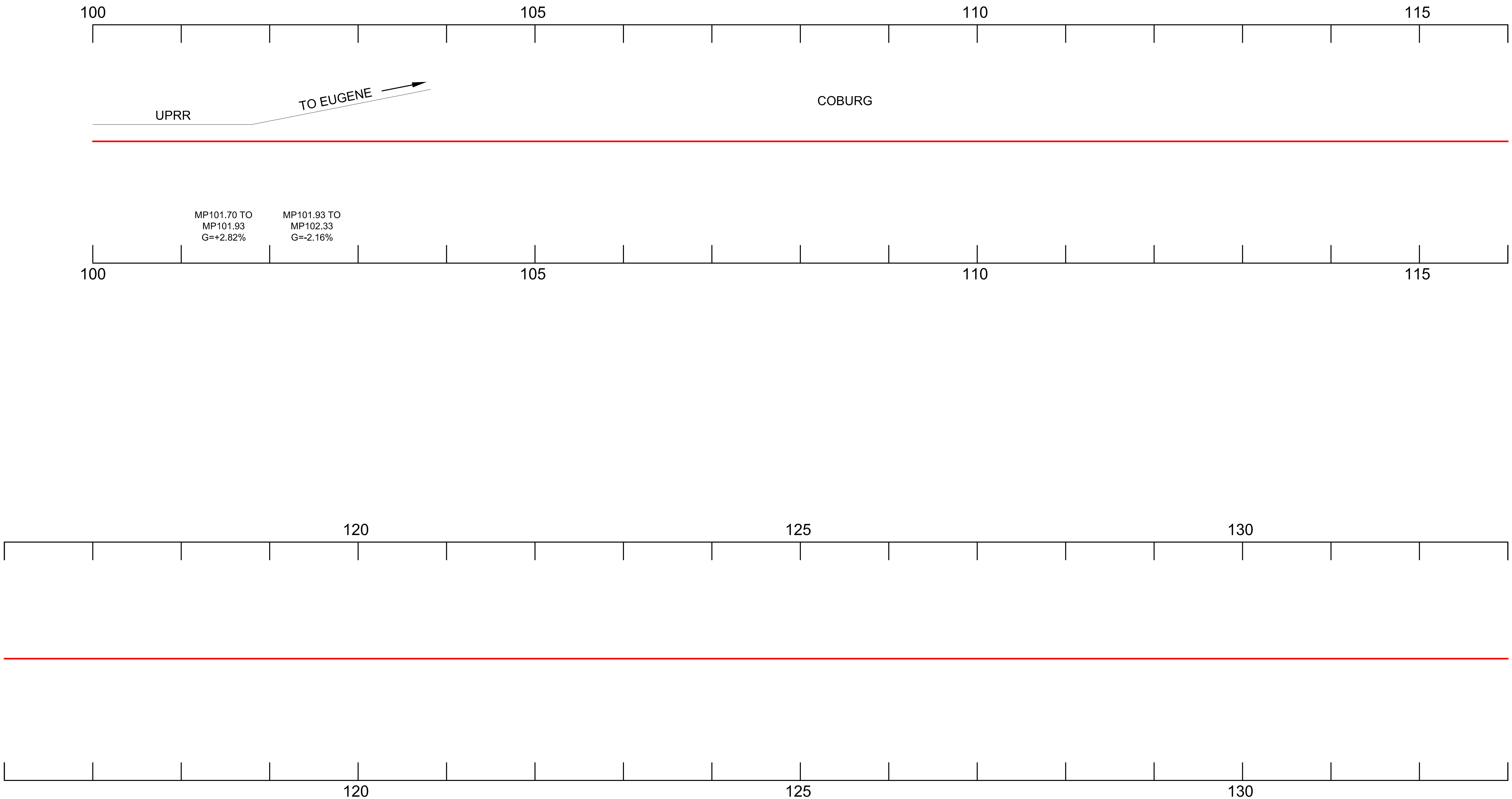

765
770
YARD
XO 768.86
XO 768.95
XO 769.30
XO 769.39
766.64
766.68
766.55
766.75
XO 764.69
XO 764.80
XO 764.41
XO 766.52
XO 764.78
XO 766.90
XO 768.72
XO 768.83
XO 769.42
XO 769.53
765
770

Oregon Passenger Rail
Eugene - Portland
CHOOSING A PATH FORWARD

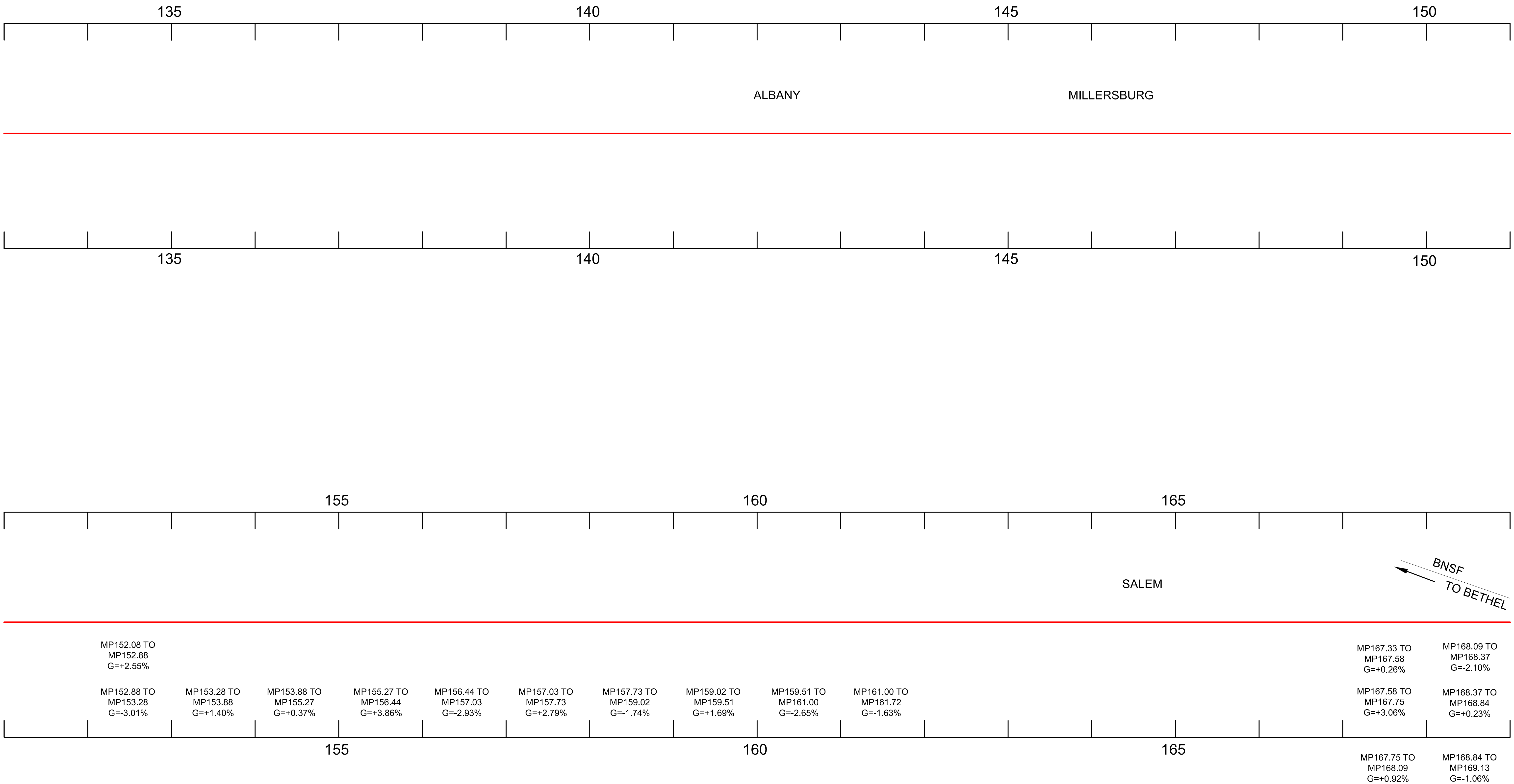
Appendix B-D
Alternative 2 Schematics

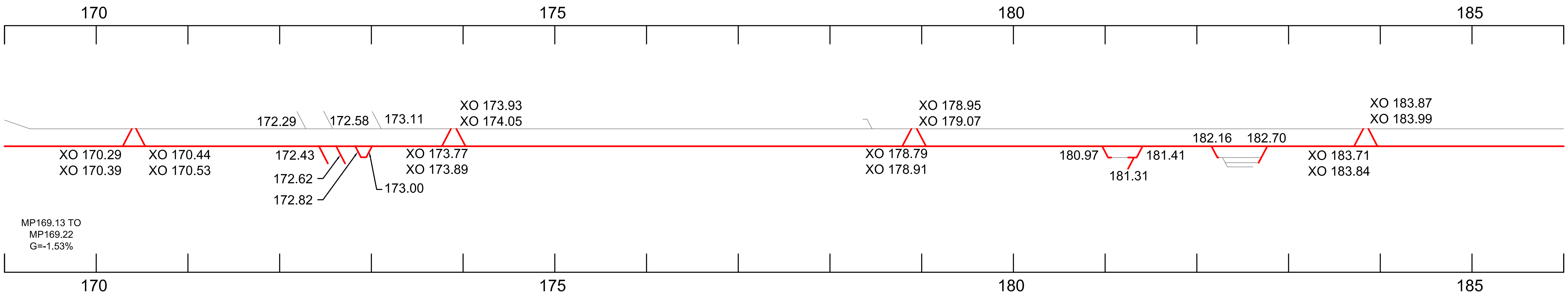
Oregon Department of Transportation

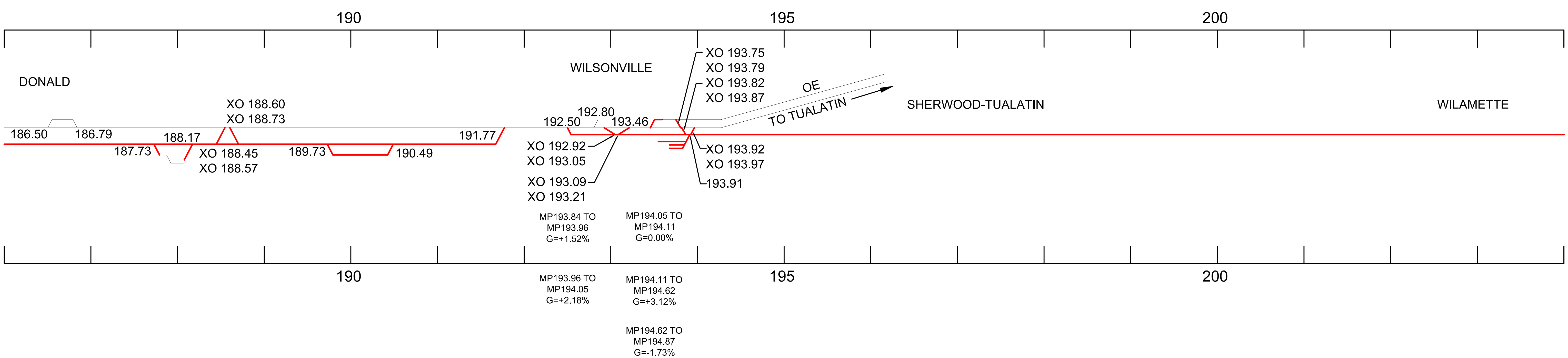
U.S. Department of Transportation
Federal Railroad Administration

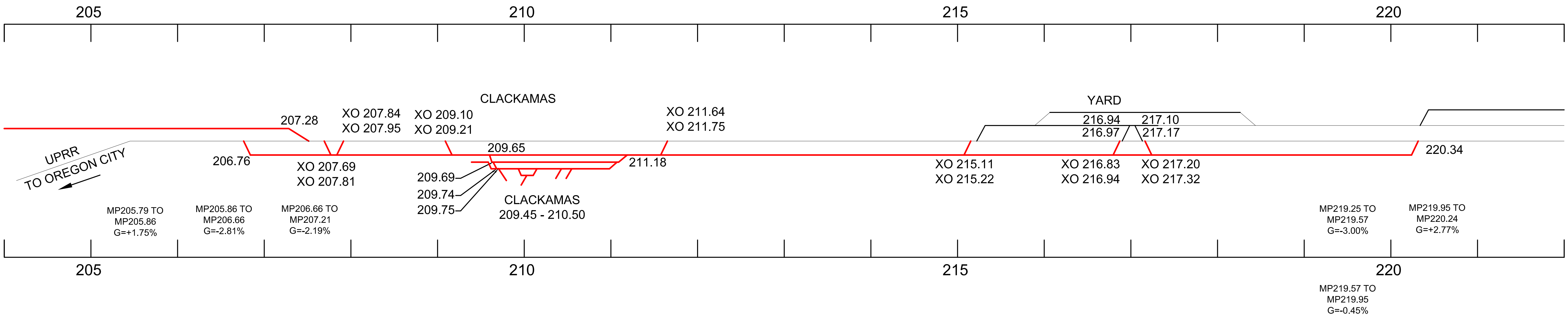


100
105
110
115
UPRR
TO EUGENE
COBURG
MP101.70 TO MP101.93 G=+2.82%
MP101.93 TO MP102.33 G=-2.16%
120
125
130


135
140
145
150
ALBANY
MILLERSBURG
135
140
145
150
155
160
165
SALEM
BNSF
TO BETHEL
MP152.08 TO
MP152.88
G=+2.55%
MP152.88 TO
MP153.28
G=-3.01%
MP153.28 TO
MP153.88
G=+1.40%
MP153.88 TO
MP155.27
G=+0.37%
MP155.27 TO
MP156.44
G=+3.86%
MP156.44 TO
MP157.03
G=-2.93%
MP157.03 TO
MP157.73
G=+2.79%
MP157.73 TO
MP159.02
G=-1.74%
MP159.02 TO
MP159.51
G=+1.69%
MP159.51 TO
MP161.00
G=-2.65%
MP161.00 TO
MP161.72
G=-1.63%
MP167.33 TO
MP167.58
G=+0.26%
MP167.58 TO
MP167.75
G=+3.06%
MP167.75 TO
MP168.09
G=+0.92%
MP168.09 TO
MP168.37
G=-2.10%
MP168.37 TO
MP168.84
G=+0.23%
MP168.84 TO
MP169.13
G=-1.06%
155
160
165


170
175
180
185
XO 173.93
XO 174.05
XO 178.95
XO 179.07
XO 183.87
XO 183.99
172.29
172.58
173.11
182.16
182.70
XO 170.29
XO 170.39
XO 170.44
XO 170.53
172.43
172.62
172.82
173.00
XO 173.77
XO 173.89
XO 178.79
XO 178.91
180.97
181.41
181.31
XO 183.71
XO 183.84
MP169.13 TO
MP169.22
G=-1.53%
170
175
180
185


190
195
200
DONALD
WILSONVILLE
XO 193.75
XO 193.79
XO 193.82
XO 193.87
OE
TO TUALATIN
SHERWOOD-TUALATIN
WILAMETTE
XO 188.60
XO 188.73
192.80
192.50
193.46
186.50
186.79
188.17
191.77
187.73
XO 188.45
XO 188.57
189.73
190.49
XO 192.92
XO 193.05
XO 193.09
XO 193.21
XO 193.92
XO 193.97
193.91
MP193.84 TO
MP193.96
G=+1.52%
MP194.05 TO
MP194.11
G=0.00%
190
195
200
MP193.96 TO
MP194.05
G=+2.18%
MP194.11 TO
MP194.62
G=+3.12%
MP194.62 TO
MP194.87
G=-1.73%


205
210
215
220
CLACKAMAS
YARD
207.28
XO 207.84
XO 207.95
XO 209.10
XO 209.21
XO 211.64
XO 211.75
216.94
216.97
217.10
217.17
UPRR
TO OREGON CITY
206.76
XO 207.69
XO 207.81
209.65
211.18
209.69
209.74
209.75
CLACKAMAS
209.45 - 210.50
XO 215.11
XO 215.22
XO 216.83
XO 216.94
XO 217.20
XO 217.32
220.34
MP205.79 TO
MP205.86
G=+1.75%
MP205.86 TO
MP206.66
G=-2.81%
MP206.66 TO
MP207.21
G=-2.19%
MP219.25 TO
MP219.57
G=-3.00%
MP219.95 TO
MP220.24
G=+2.77%
205
210
215
220
MP219.57 TO
MP219.95
G=-0.45%

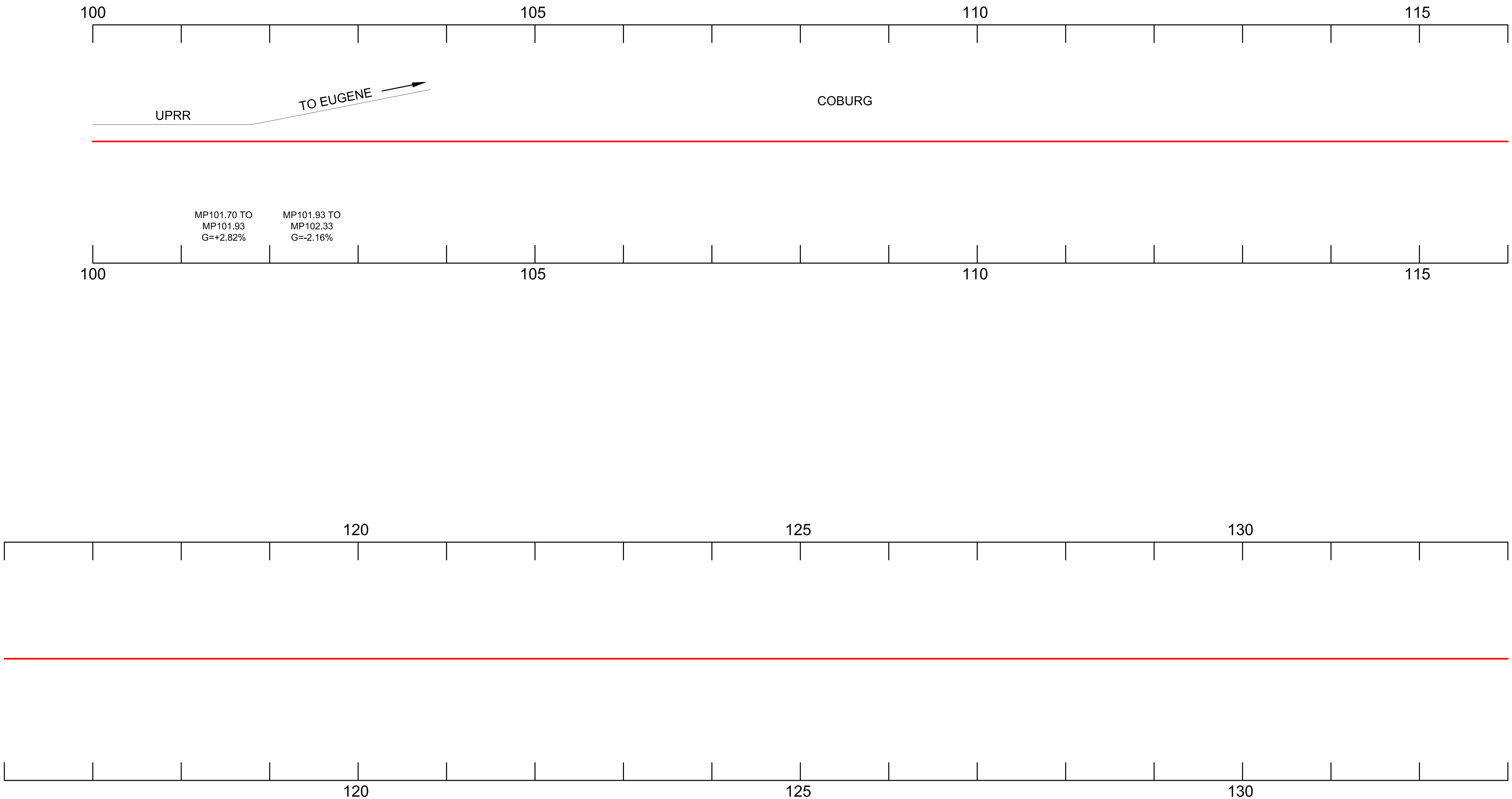

225
225

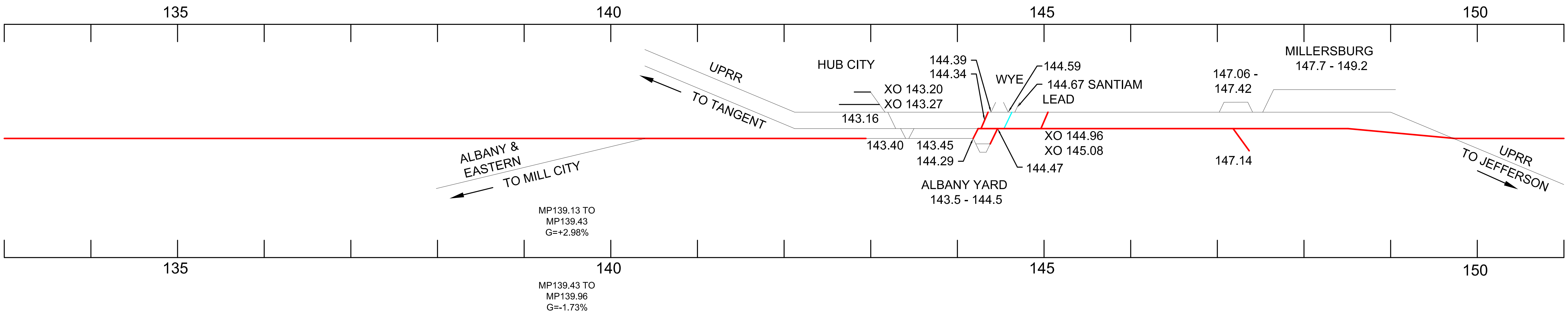
Oregon Passenger Rail
Eugene - Portland
CHOOSING A PATH FORWARD

Appendix B-E
Albany Option Schematics

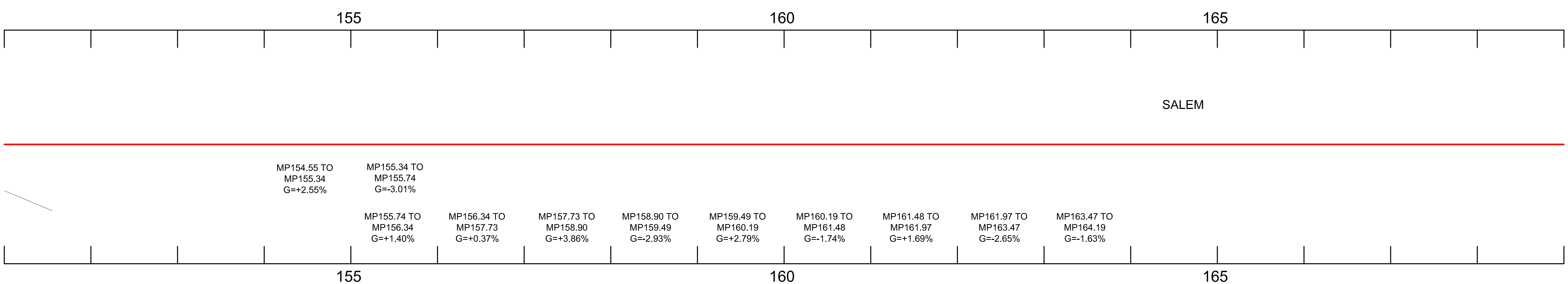
Oregon Department of Transportation

U.S. Department of Transportation
Federal Railroad Administration

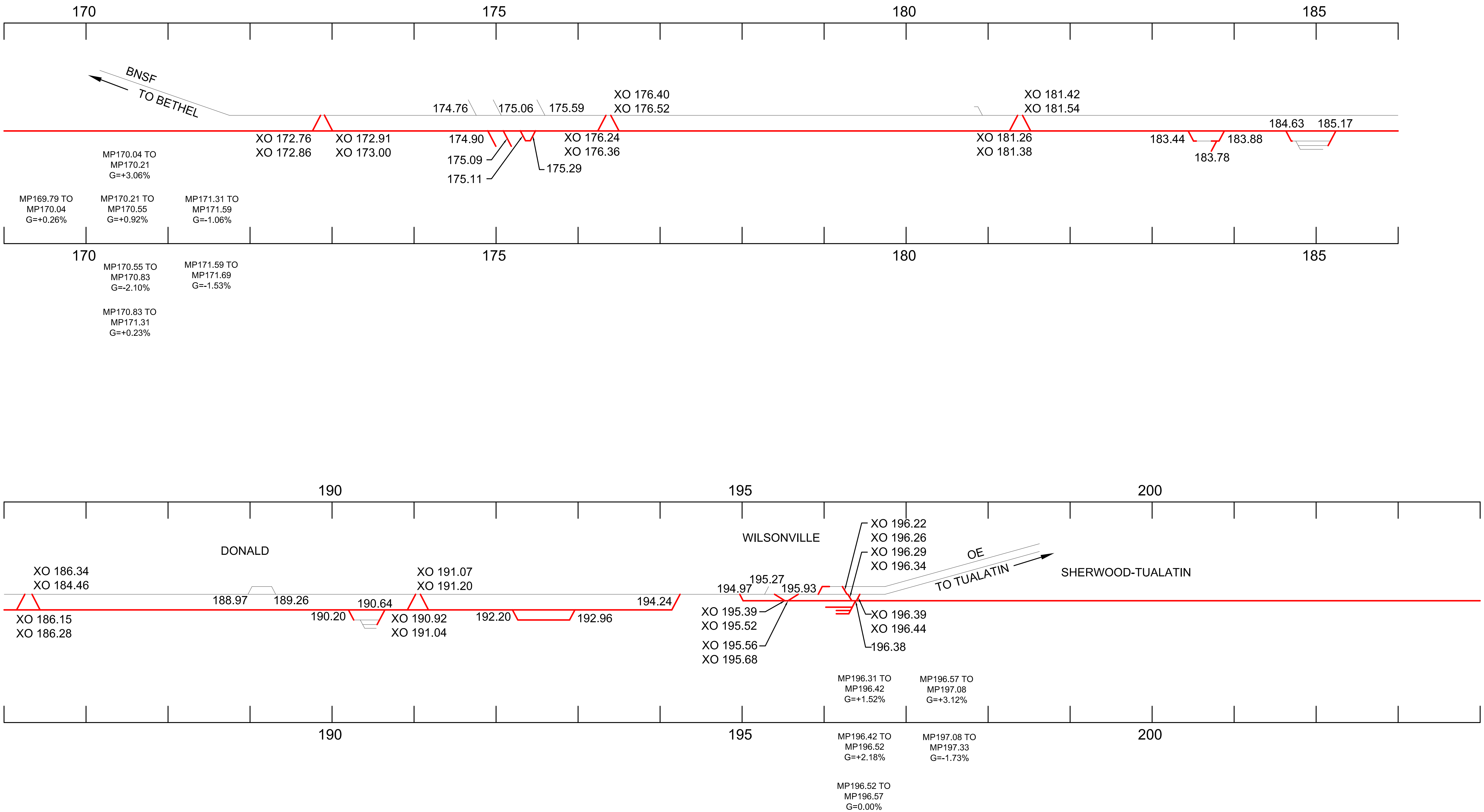

100
105
110
115
UPRR
TO EUGENE
COBURG
MP101.70 TO
MP101.93
G=+2.82%
MP101.93 TO
MP102.33
G=-2.16%
100
105
110
115
120
125
130
120
125
130



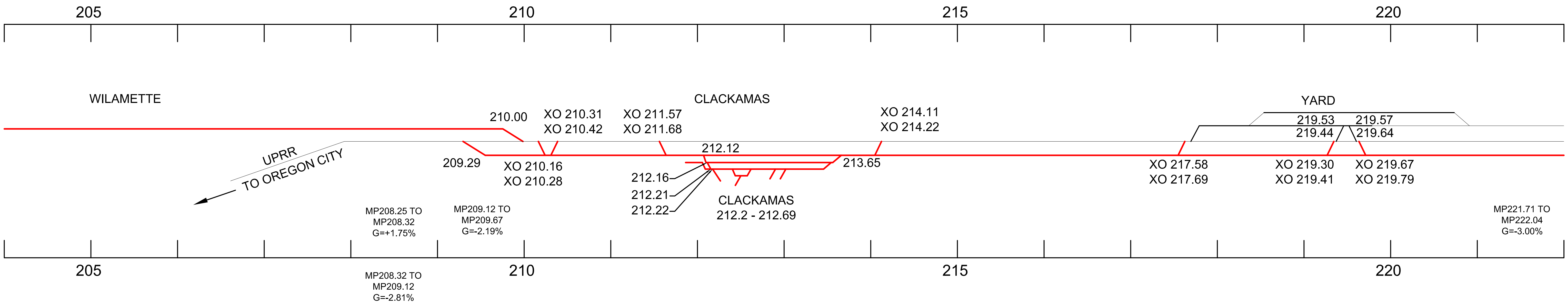
135
140
145
150
UPRR
TO TANGENT
HUB CITY
XO 143.20
XO 143.27
143.16
144.39
144.34
WYE
144.59
144.67 SANTIAM
LEAD
147.06 -
147.42
MILLERSBURG
147.7 - 149.2
ALBANY &
EASTERN
TO MILL CITY
143.40
143.45
144.29
XO 144.96
XO 145.08
144.47
147.14
ALBANY YARD
143.5 - 144.5
UPRR
TO JEFFERSON
MP139.13 TO
MP139.43
G=+2.98%
135
140
145
150
MP139.43 TO
MP139.96
G=-1.73%



155
160
165
SALEM
MP154.55 TO
MP155.34
G=+2.55%
MP155.34 TO
MP155.74
G=-3.01%
MP155.74 TO
MP156.34
G=+1.40%
MP156.34 TO
MP157.73
G=+0.37%
MP157.73 TO
MP158.90
G=+3.86%
MP158.90 TO
MP159.49
G=-2.93%
MP159.49 TO
MP160.19
G=+2.79%
MP160.19 TO
MP161.48
G=-1.74%
MP161.48 TO
MP161.97
G=+1.69%
MP161.97 TO
MP163.47
G=-2.65%
MP163.47 TO
MP164.19
G=-1.63%
155
160
165



170
175
180
185
BNSF
TO BETHEL
174.76
175.06
175.59
XO 176.40
XO 176.52
XO 181.42
XO 181.54
184.63
185.17
XO 172.76
XO 172.86
XO 172.91
XO 173.00
174.90
175.09
175.11
175.29
XO 176.24
XO 176.36
XO 181.26
XO 181.38
183.44
183.88
183.78
MP170.04 TO
MP170.21
G=+3.06%
MP169.79 TO
MP170.04
G=+0.26%
MP170.21 TO
MP170.55
G=+0.92%
MP171.31 TO
MP171.59
G=-1.06%
170
175
180
185
MP170.55 TO
MP170.83
G=-2.10%
MP171.59 TO
MP171.69
G=-1.53%
MP170.83 TO
MP171.31
G=+0.23%
190
195
200
XO 196.22
XO 196.26
XO 196.29
XO 196.34
WILSONVILLE
DONALD
OE
SHERWOOD-TUALATIN
TO TUALATIN
XO 186.34
XO 184.46
XO 191.07
XO 191.20
195.27
194.97
195.93
188.97
189.26
190.64
194.24
XO 186.15
XO 186.28
190.20
XO 190.92
XO 191.04
192.20
192.96
XO 195.39
XO 195.52
XO 195.56
XO 195.68
XO 196.39
XO 196.44
196.38
MP196.31 TO
MP196.42
G=+1.52%
MP196.57 TO
MP197.08
G=+3.12%
190
195
200
MP196.42 TO
MP196.52
G=+2.18%
MP197.08 TO
MP197.33
G=-1.73%
MP196.52 TO
MP196.57
G=0.00%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210
215
220
WILAMETTE
CLACKAMAS
YARD
210.00
XO 210.31
XO 210.42
XO 211.57
XO 211.68
XO 214.11
XO 214.22
219.53
219.44
219.57
219.64
UPRR
TO OREGON CITY
209.29
XO 210.16
XO 210.28
212.12
213.65
212.16
212.21
212.22
CLACKAMAS
212.2 - 212.69
XO 217.58
XO 217.69
XO 219.30
XO 219.41
XO 219.67
XO 219.79
MP208.25 TO
MP208.32
G=+1.75%
MP209.12 TO
MP209.67
G=-2.19%
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MP222.04
G=-3.00%
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210
215
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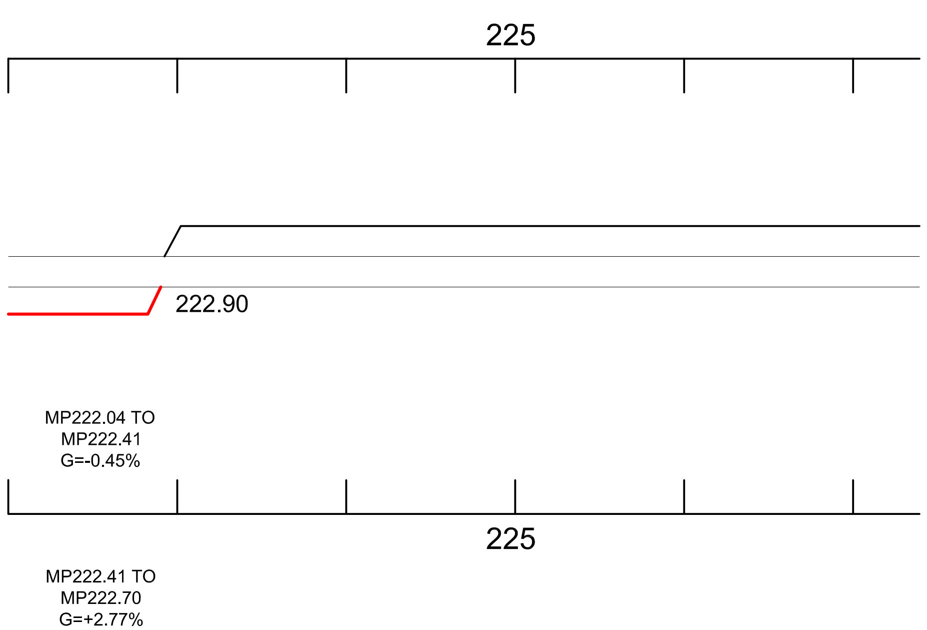
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MP222.70
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Oregon Passenger Rail
Eugene - Portland
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Appendix B-F
Unit Cost Assumptions

Oregon Department of Transportation

U.S. Department of Transportation
Federal Railroad Administration

Description	Bid Quantity	Unit	Unit Cost	Total	General Conditions (15%)	Subtotal	OH&P (15%)	Grand Total
AT GRADE TRACK								
SGL TRACK - BALLASTED	**1.0**	**RM**	**$2,059,000**	**$2,059,000**	**$308,850**	**$2,367,850**	**$355,178**	**$2,723,000**
GUIDEWAY PREPARATION - SGL TRACK	1.0	RM	$62,000	$62,000				
SUBBALLAST - SGL TRACK	1.0	RM	$329,000	$329,000				
BALLAST - SGL TRACK	1.0	RM	$348,000	$348,000				
SGL TRACK INSTALL - TIES/RAIL/FASTENERS - 1	1.0	RM	$1,320,000	$1,320,000				
DBL TRACK - BALLASTED	**1.0**	**RM**	**$4,012,000**	**$4,012,000**	**$601,800**	**$4,613,800**	**$692,070**	**$5,306,000**
GUIDEWAY PREPARATION - DBL TRACK	1.0	RM	$77,000	$77,000				
SUBBALLAST - DBL TRACK	1.0	RM	$598,000	$598,000				
BALLAST - DBL TRACK	1.0	RM	$697,000	$697,000				
DBL TRACK INSTALL - TIES/RAIL/FASTENERS - 1	1.0	RM	$2,640,000	$2,640,000				
AT GRADE TRACK W/ EARTHWORK								
SGL TRACK - BALLASTED	**1.0**	**RM**	**$2,795,000**	**$2,795,000**	**$419,250**	**$3,214,250**	**$482,138**	**$3,696,000**
GUIDEWAY PREPARATION - SGL TRACK	1.0	RM	$616,000	$616,000				
GUIDEWAY EARTHWORK - SGL TRACK	1.0	RM	$182,000	$182,000				
SUBBALLAST - SGL TRACK	1.0	RM	$329,000	$329,000				
BALLAST - SGL TRACK	1.0	RM	$348,000	$348,000				
SGL TRACK INSTALL - TIES/RAIL/FASTENERS - 1	1.0	RM	$1,320,000	$1,320,000				
DBL TRACK - BALLASTED	**1.0**	**RM**	**$4,825,000**	**$4,825,000**	**$723,750**	**$5,548,750**	**$832,313**	**$6,381,000**
GUIDEWAY PREPARATION - DBL TRACK	1.0	RM	$632,000	$632,000				
GUIDEWAY EARTHWORK - DBL TRACK	1.0	RM	$258,000	$258,000				
SUBBALLAST - DBL TRACK	1.0	RM	$598,000	$598,000				
BALLAST - DBL TRACK	1.0	RM	$697,000	$697,000				
DBL TRACK INSTALL - TIES/RAIL/FASTENERS - 1	1.0	RM	$2,640,000	$2,640,000				
RETAINED FILL								
SGL TRACK, BALLASTED, 15' AVE WALL HEIGHT	**1.0**	**RM**	**$11,428,000**	**$11,428,000**	**$1,714,200**	**$13,142,200**	**$1,971,330**	**$15,114,000**
GUIDEWAY PREPARATION - SGL TRACK	1.0	RM	$62,000	$62,000				
GUIDEWAY EARTHWORK - SGL TRACK	1.0	RM	$182,000	$182,000				
RETAINING WALL (FILL)	1.0	RM	$9,187,000	$9,187,000				
SUBBALLAST - SGL TRACK	1.0	RM	$329,000	$329,000				
BALLAST - SGL TRACK	1.0	RM	$348,000	$348,000				
SGL TRACK INSTALL - TIES/RAIL/FASTENERS - 1	1.0	RM	$1,320,000	$1,320,000				
DBL TRACK, BALLASTED, 15' AVE WALL HEIGHT	**1.0**	**RM**	**$13,457,000**	**$13,457,000**	**$2,018,550**	**$15,475,550**	**$2,321,333**	**$17,797,000**
GUIDEWAY PREPARATION - DBL TRACK	1.0	RM	$77,000	$77,000				
GUIDEWAY EARTHWORK - DBL TRACK	1.0	RM	$258,000	$258,000				
RETAINING WALL (FILL)	1.0	RM	$9,187,000	$9,187,000				
SUBBALLAST - DBL TRACK	1.0	RM	$598,000	$598,000				
BALLAST - DBL TRACK	1.0	RM	$697,000	$697,000				
DBL TRACK INSTALL - TIES/RAIL/FASTENERS - 1	1.0	RM	$2,640,000	$2,640,000				
ELEVATED/VIADUCT								
SGL TRACK, DF, 30' T/R	**1.0**	**RM**	**$38,726,000**	**$38,726,000**	**$5,808,900**	**$44,534,900**	**$6,680,235**	**$51,215,000**
GUIDEWAY PREPARATION - SGL TRACK	1.0	RM	$24,000	$24,000				
AERIAL STRUCTURE - SGL TRACK	1.0	RM	$36,960,000	$36,960,000				
DF SGL TRACK - TIES/RAIL/FASTENERS - 136# C	1.0	RM	$1,742,000	$1,742,000				
DBL TRACK, DF, 30' T/R	**1.0**	**RM**	**$82,709,000**	**$82,709,000**	**$12,406,350**	**$95,115,350**	**$14,267,303**	**$109,383,000**
GUIDEWAY PREPARATION - DBL TRACK	1.0	RM	$24,000	$24,000				
AERIAL STRUCTURE - DBL TRACK	1.0	RM	$79,200,000	$79,200,000				
DF DBL TRACK - TIES/RAIL/FASTENERS - 136# C	1.0	RM	$3,485,000	$3,485,000				
OPEN TRENCH/RETAINED CUT								
RETAINED CUT - SGL TRACK, BALLASTED, 20' AVE DEPTH	**1.0**	**RM**	**$14,934,000**	**$14,934,000**	**$2,240,100**	**$17,174,100**	**$2,576,115**	**$19,750,000**
GUIDEWAY PREPARATION - SGL TRACK	1.0	RM	$62,000	$62,000				
GUIDEWAY EARTHWORK - SGL TRACK	1.0	RM	$532,000	$532,000				
RETAINING WALL (CUT)	1.0	RM	$12,672,000	$12,672,000				
BALLAST - SGL TRACK	1.0	RM	$348,000	$348,000				
SGL TRACK INSTALL - TIES/RAIL/FASTENERS - 136# CWR	1.0	RM	$1,320,000	$1,320,000				
RETAINED CUT - DBL TRACK, BALLASTED, 20' AVE DEPTH	**1.0**	**RM**	**$16,983,000**	**$16,983,000**	**$2,547,450**	**$19,530,450**	**$2,929,568**	**$22,460,000**
GUIDEWAY PREPARATION - DBL TRACK	1.0	RM	$77,000	$77,000				
GUIDEWAY EARTHWORK - DBL TRACK	1.0	RM	$897,000	$897,000				
RETAINING WALL (CUT)	1.0	RM	$12,672,000	$12,672,000				
BALLAST - DBL TRACK	1.0	RM	$697,000	$697,000				
DBL TRACK INSTALL - TIES/RAIL/FASTENERS - 136# CWR	1.0	RM	$2,640,000	$2,640,000				
TUNNEL								
CUT & COVER BOX - 1 TRACK / 1 BOX (45' AVG. EXC. D	**1.0**	**RM**	**$91,009,000**	**$91,009,000**	**$13,651,350**	**$104,660,350**	**$15,699,053**	**$120,359,000**
GUIDEWAY PREPARATION - SGL TRACK	1.0	RM	$62,000	$62,000				
GUIDEWAY EARTHWORK - SGL TRACK	1.0	RM	$3,299,000	$3,299,000				
CUT & COVER BOX STRUCTURE - SGL TRACK	1.0	RM	$85,536,000	$85,536,000				
DF SGL TRACK - TIES/RAIL/FASTENERS - 136# CWR	1.0	RM	$2,112,000	$2,112,000				
CUT & COVER BOX - 2 TRACK / 1 BOX (45' AVG. EXC. D	**1.0**	**RM**	**$128,165,000**	**$128,165,000**	**$19,224,750**	**$147,389,750**	**$22,108,463**	**$169,498,000**
GUIDEWAY PREPARATION - DBL TRACK	1.0	RM	$77,000	$77,000				
GUIDEWAY EARTHWORK - DBL TRACK	1.0	RM	$4,536,000	$4,536,000				
CUT & COVER BOX STRUCTURE - DBL TRACK	1.0	RM	$121,440,000	$121,440,000				
DF DBL TRACK - TIES/RAIL/FASTENERS - 136# CWR	1.0	RM	$2,112,000	$2,112,000				
BORED SGL TRACK TUNNEL 30FT ID IN SOFT ROCK (POOR)	**1.0**	**RM**		**$119,475,000**	**$17,921,250**	**$137,396,250**	**$20,609,438**	**$158,006,000**
TBM PURCHASE	2.0	EA	$21,695,000	$4,339,000				
TUNNEL LINER PURCHASE	10.0	RM	$29,040,000	$29,040,000				
LAUNCH SHAFT	2.0	EA	$29,158,000	$5,831,600				
BORED SGL TRACK TUNNEL - 30FT ID	10.0	RM	$37,182,000	$37,182,000				
EXTRACTION SHAFT	1.0	EA	$57,584,000	$5,758,400				
EMERGENCY ACCESS SHAFT	10.0	EA	$9,000,000	$9,000,000				
VENTILATION SHAFT	21.0	EA	$6,000,000	$12,600,000				
CROSS PASSAGES	53.0	EA	$0	$0				
MECH/VENT/ELECT ALLOWANCE	10.0	RM	$13,600,000	$13,600,000				
DF SGL TRACK - TIES/RAIL/FASTENERS - 136# CWR	10.0	RM	$2,124,000	$2,124,000				
BORED DBL TRACK TUNNEL 50FT ID IN SOFT ROCK (POOR)	**1.0**	**RM**		**$246,984,000**	**$37,047,600**	**$284,031,600**	**$42,604,740**	**$326,636,000**
TBM PURCHASE / SET UP	2.0	EA	$35,195,000	$7,039,000				
TUNNEL LINER PURCHASE	10.0	RM	$39,600,000	$39,600,000				
LAUNCH SHAFT	2.0	EA	$40,648,000	$8,129,600				
BORED TUNNEL - 50FT ID	10.0	RM	$138,120,000	$138,120,000				
EXTRACTION SHAFT	1.0	EA	$57,584,000	$5,758,400				
EMERGENCY ACCESS SHAFT	10.0	EA	$9,000,000	$9,000,000				
VENTILIZATION SHAFT	21.0	EA	$6,000,000	$12,600,000				

Description	Bid Quantity	Unit	Unit Cost	Total	General Conditions (15%)	Subtotal	OH&P (15%)	Grand Total
CROSS PASSAGES	53.0	EA	$0	$0				
MECH/VENT/ELECT ALLOWANCE	10.0	RM	$22,300,000	$22,300,000				
DF DBL TRACK - TIES/RAIL/FASTENERS - 136# CWR	10.0	RM	$4,437,000	$4,437,000				
RAILROAD BRIDGES								
SGL TRACK BRIDGE - BALLASTED, UP TO 300' LONG	**1.0**	**EA**	**$2,559,000**	**$2,559,000**	**$383,850**	**$2,942,850**	**$441,428**	**$3,384,000**
GUIDEWAY PREPARATION - SGL TRACK	300.0	TF	$1,200	$360,000				
AERIAL STRUCTURE - SGL TRACK	300.0	TF	$7,000.00	$2,100,000				
AERIAL SGL TRACK - TIES/RAIL/FASTENERS - 136# CWR	300.0	TF	$330.00	$99,000				
DBL TRACK BRIDGE - BALLASTED, UP TO 300' LONG	**1.0**	**EA**	**$5,058,000**	**$5,058,000**	**$758,700**	**$5,816,700**	**$872,505**	**$6,689,000**
GUIDEWAY PREPARATION - DBL TRACK	300.0	TF	$1,200	$360,000				
AERIAL STRUCTURE - DBL TRACK	300.0	TF	$15,000.00	$4,500,000				
AERIAL DBL TRACK - TIES/RAIL/FASTENERS - 136# CWR	300.0	TF	$660.00	$198,000				
STATIONS								
STATION BUILDINGS: PRIMARY (500 PARKING SPACES)	**1.0**	**EA**	**$5,891,000**	**$5,891,000**	**$883,650**	**$6,774,650**	**$1,016,198**	**$7,791,000**
AT-GRADE SIDE PLATFORM - 2 VEHICLE	1.0	EA	$1,890,000	$1,890,000				
AT-GRADE SIDE PLATFORM - CANOPIES	1.0	EA	$538,000	$538,000				
AT-GRADE STATION - TICKET KIOSKS	1.0	EA	$213,000	$213,000				
AT-GRADE STATION PARK & RIDE	1.0	LS	$3,250,000	$3,250,000				
STATION BUILDINGS: SECONDARY	**1.0**	**EA**	**$250,000**	**$250,000**	**$37,500**	**$287,500**	**$43,125**	**$331,000**
STATION BUILDINGS: SECONDARY	1.0	EA	$250,000	$250,000				
LAYOVER FACILITY	**1.0**	**EA**	**$5,000,000**	**$5,000,000**	**N/A**	**$5,000,000**	**N/A**	**$5,000,000**
EARTHWORK & PREPARATION	1.0	LS	$1,000,000	$1,000,000				
BUILDINGS & AMENITIES	1.0	LS	$3,000,000	$3,000,000				
YARD/STORAGE TRACK	1.0	TF	$1,000,000	$1,000,000				
HEAVY MAINTENANCE FACILITY								
MAINTENANCE FACILITY	**1.0**	**EA**	**$23,000,000**	**$23,000,000**	**N/A**	**$23,000,000**	**N/A**	**$23,000,000**
EARTHWORK & PREPARATION	1.0	LS	$2,000,000	$2,000,000				
BUILDINGS & AMENITIES	1.0	LS	$20,000,000	$20,000,000				
YARD/STORAGE TRACK	1.0	TF	$1,000,000	$1,000,000				
ROADWAY BRIDGE								
ROADWAY OVER RAILROAD - UP TO 200'	**1.0**	**EA**	**$4,283,000**	**$4,283,000**	**$642,450**	**$4,925,450**	**$738,818**	**$5,664,000**
EARTHWORK & PREPARATION	1.0	LS	$360,000	$360,000				
RETAINING WALLS (FILL)	15,920.0	SF	$58	$923,000				
AERIAL STRUCTURE	200.0	LF	$15,000	$3,000,000				
GRADE CROSSINGS								
GRADE CROSSING - UP TO 4 LANES OF TRAFFIC	**1.0**	**EA**	**$356,000**	**$356,000**	**$53,400**	**$409,400**	**$61,410**	**$471,000**
EARTHWORK & PREPARATION	60.0	TF	$750	$45,000				
GRADE CROSSING SGL TRACK INSTALLATION - 136#	60.0	TF	$600	$36,000				
STREET MODIFICATIONS	1,000.0	SF	$75	$75,000				
GATED CROSSING SIGNALS	1.0	EA	$200,000	$200,000				
GRADE CROSSING - MORE THAN 4 LANES OF TRAFFIC	**1.0**	**EA**	**$558,800**	**$558,800**	**$83,820**	**$642,620**	**$96,393**	**$739,000**
EARTHWORK & PREPARATION	84.0	TF	$750	$63,000				
GRADE CROSSING DBL TRACK INSTALLATION - 136#	84.0	TF	$1,200	$100,800				
STREET MODIFICATIONS	1,600.0	SF	$75	$120,000				
GATED CROSSING SIGNALS	1.0	EA	$275,000	$275,000				
WAYSIDE SIGNALING EQUIPMENT	**1.0**	**LS**	**$1,898,000**	**$1,898,000**	**N/A**	**$1,898,000**	**N/A**	**$1,898,000**
TRAIN CONTROL (ETCS L2), WAYSIDE PTN SYS, FO BACKB	1.0	RM	$1,898,000	$1,898,000				
TRACTION POWER DISTRIBUTION: CATENARY AND THIRD I	**1.0**	**LS**	**$1,842,900**	**$1,842,900**	**N/A**	**$1,842,900**	**N/A**	**$1,842,900**
TRACTION POWER DISTRIBUTION CATENARY	1.0	RM	$1,842,900	$1,842,900				

Oregon Passenger Rail
Eugene - Portland
CHOOSING A PATH FORWARD

Appendix C

Station Area Analysis

October 2020

Oregon Department of Transportation

U.S. Department of Transportation
Federal Railroad Administration

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Figures

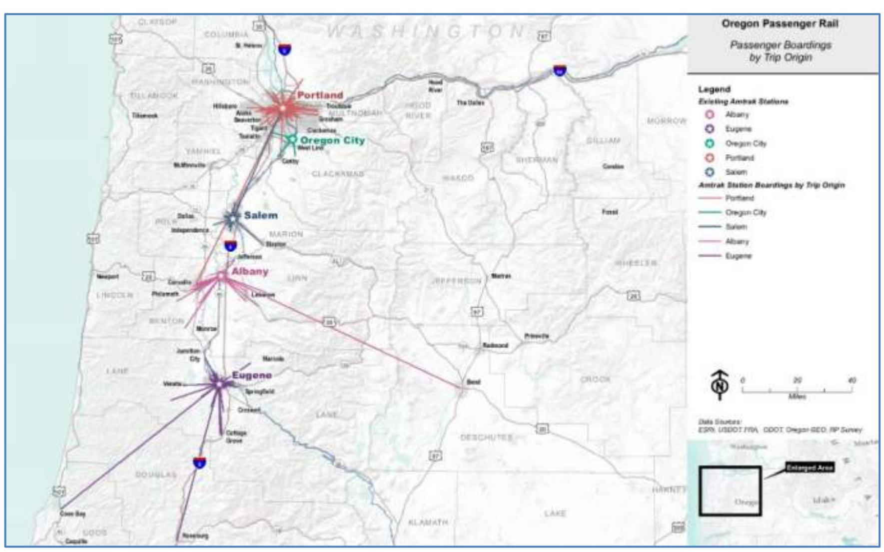
Tables

Appendix C

This appendix summarizes station and access analyses supporting Chapter 7 (Station and Access Analysis) of the Service Development Plan (SDP). The analyses are exclusive to the Preferred Alternative as identified in the OPR Project Final Environmental Impact Statement (FEIS). The Preferred Alternative includes expanded Amtrak Cascades rail service with a total of six daily roundtrips between Eugene and Portland, serving each of the five existing Amtrak Cascades stations. For each Amtrak Cascades station, the Appendix summarizes the following:

- **Site Suitability** – Includes a broad summary of the general station site suitability and land use zoning within the immediate areas surrounding each station as summarized in the Oregon Passenger Rail Station Area Assessments report (2014). The local, host city land zoning designations are mapped for each Amtrak Cascades station.
- **Station Area Demographics** – Includes a summary of general population and employment statistics and density within a one-, five- and 10-mile radii of each station. These data are summarized for both build alternatives considered in the Draft Environmental Impact Statement (DEIS), contained in the Oregon Passenger Rail Station Area Assessments. This section also includes a more detailed evaluation of transit-dependent populations within each Amtrak Cascades station area by mapping of zero-auto ownership households in each station area. Zero-auto households are more likely to travel by train or plane on longer intercity trips than households with one or more cars available. To gauge the quality of local bus and bicycle system connectivity within each of the Amtrak Cascades station area, zero-auto household data are mapped and overlaid by transit and bicycle travelshed metrics (see Multimodal Interconnectivity) to calculate the percent and number of zero-auto households within a 30-minute bus or bicycle trip of each station. Housing and population data are sourced to the U.S. Census, and employment data are sourced to Oregon's Quarterly Census of Employment and Wages.
- **Mode of Access** – Includes a summary map of the 2014 Revealed Passenger Survey of Amtrak Cascades passengers, indicating their trip origin and mode of access taken to access each of the five Amtrak Cascades stations. A statewide summary map of the survey findings is illustrated in Figure C-1. ODOT conducted and summarized the Revealed Preference Survey in 2013 as part of the Oregon Passenger Rail Project.

Figure C-1. Amtrak Cascades Passenger Boardings by Trip Origin



- **Multimodal Interconnectivity** – Includes a summary map of 30-minute travel sheds from each Amtrak Cascades station, by separate transit, drive, bicycle and walk modes. Auto, bicycle and pedestrian travel time estimates are sourced to Google General Transit Specification (GTFS), as reported in 2018. Google transit travel times reflect both walk access time and dwell times when transit vehicles stop for boardings and alightings.

C.1 Portland

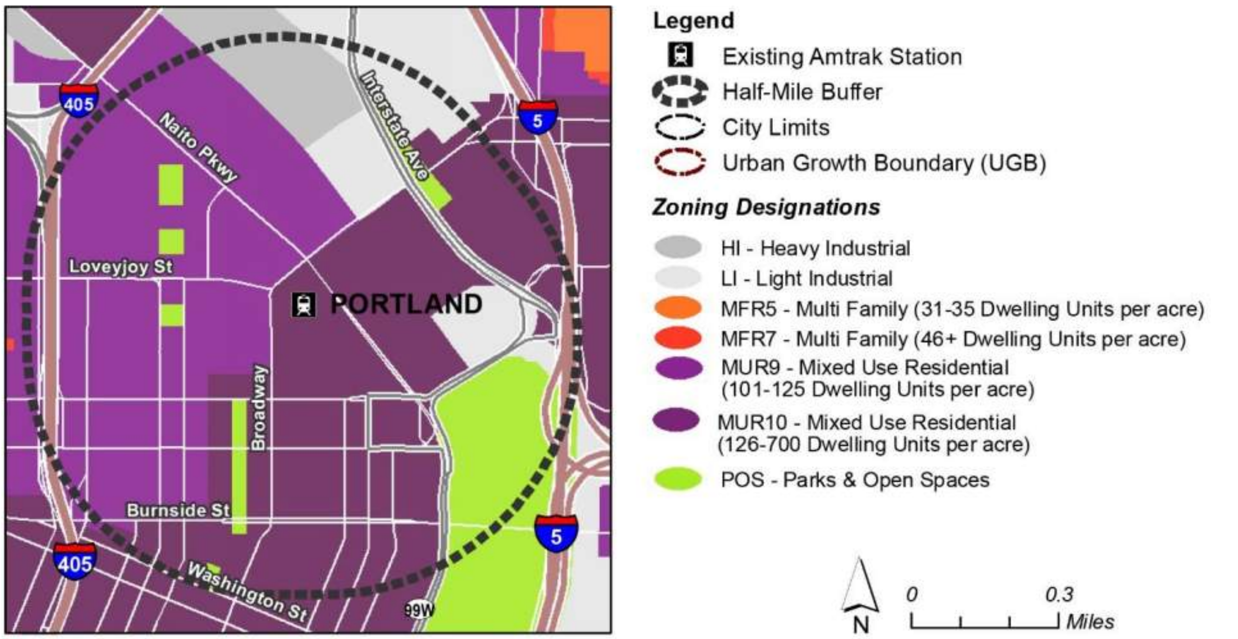
C.1.1 Site Suitability

Constructed in 1896, the existing Union Station is just north of Portland's downtown high density office area in the Old Town Chinatown section of downtown and just east of the Pearl District. Figure C-2 illustrates the existing Amtrak/Union Station area. The Pearl District is an area that has been undergoing significant urban renewal since the mid-1980s, when it was reclassified as mixed use from industrial, and now includes higher density mixed-use residential buildings. Besides serving as an Amtrak station, the train station building houses a restaurant and offices.

Figure C-2. Portland Station Aerial

Zoning around the existing station in Old Town Chinatown is almost entirely Central Commercial for Portland's most urban and intense areas, see Figure C-3. The designation allows a broad range of uses to reflect Portland's role as a commercial, cultural, and governmental center. The designation also allows household living. The Pearl District area is designated Central Employment. The zone allows mixed-uses, but is intended for areas in the center of the city that have predominantly industrial type development. Residential uses are allowed. Although the Pearl District has experienced significant development, there is substantial redevelopment potential in the area surrounding the station, such as the existing Post Office Distribution site, numerous surface parking lots, and underutilized buildings. The North Pearl District Plan (Adopted 2008) instigated zoning code changes to allow for increased development potential (floor area requirement, or FAR) as well as changes related to increased building height, to guide the massing and character of taller, larger buildings in the North Pearl plan area. Amendments to the development bonus system, which are intended to provide incentives to create family housing and community amenities, are also proposed.

Figure C-3. Portland Station Zoning



Data Sources: Metro RLIS; Benton, Lane, Linn, Marion, and Polk Counties; Cities of Eugene and Albany; ESRI; and ODOT 2009-2013

C.1.2 Station Area Demographics

Portland is the largest city in Oregon. The existing station is adjacent to downtown Portland. Downtown functions as the center in a larger metropolitan area, as is demonstrated by the population and employment densities as summarized in Table C-1 and shown in Figure C-4 and Figure C-5. Portland's importance as an employment area that people commute into is evident in the higher number of employees in the one-mile radius versus the population. Within five miles of the station, population and employment numbers are similar.

Table C-1. Portland Station Population and Employment

	1-Mile Radius	5-Mile Radius	10-Mile Radius
Population	24,355	372,882	1,018,339
Population Density (people per sq. mile)	7,755	4,749	3,242
Total Employees	93,539	302,569	589,944
Employee Density (employees per sq. mile)	29,786	3,854	1,878

Figure C-4. Portland Station Population

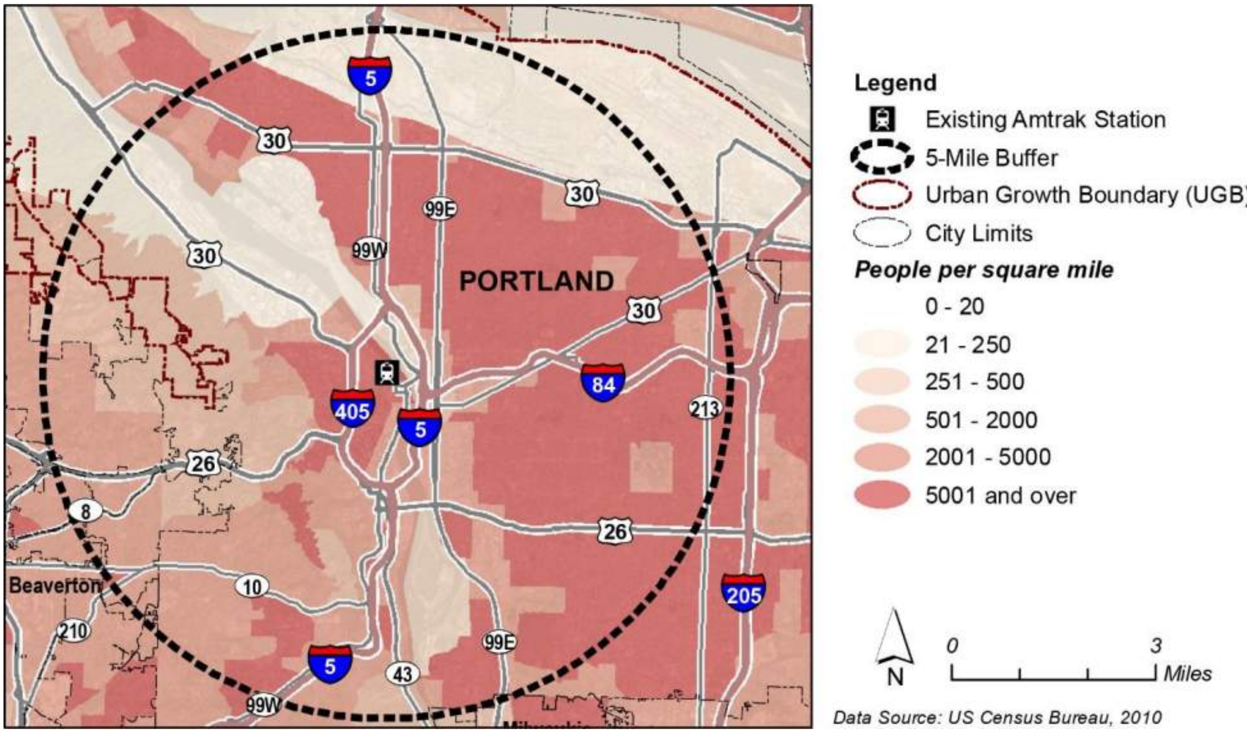


Figure C-5. Portland Station Employment

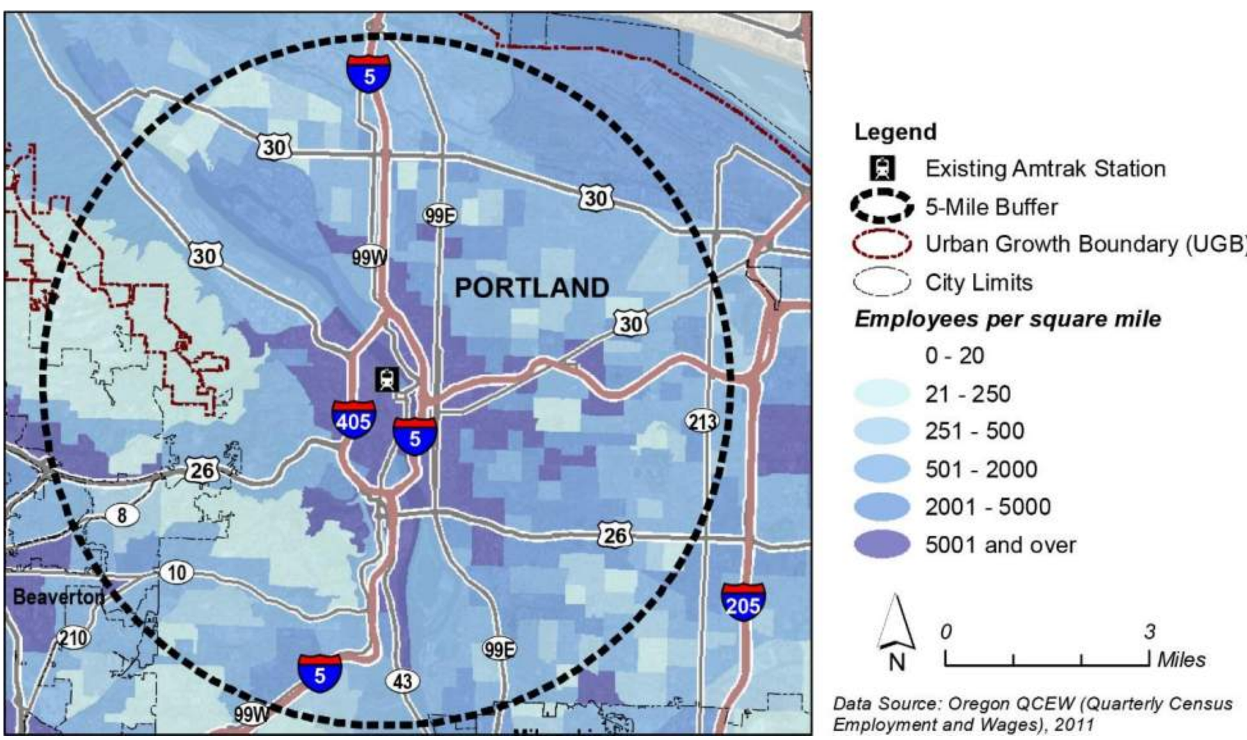
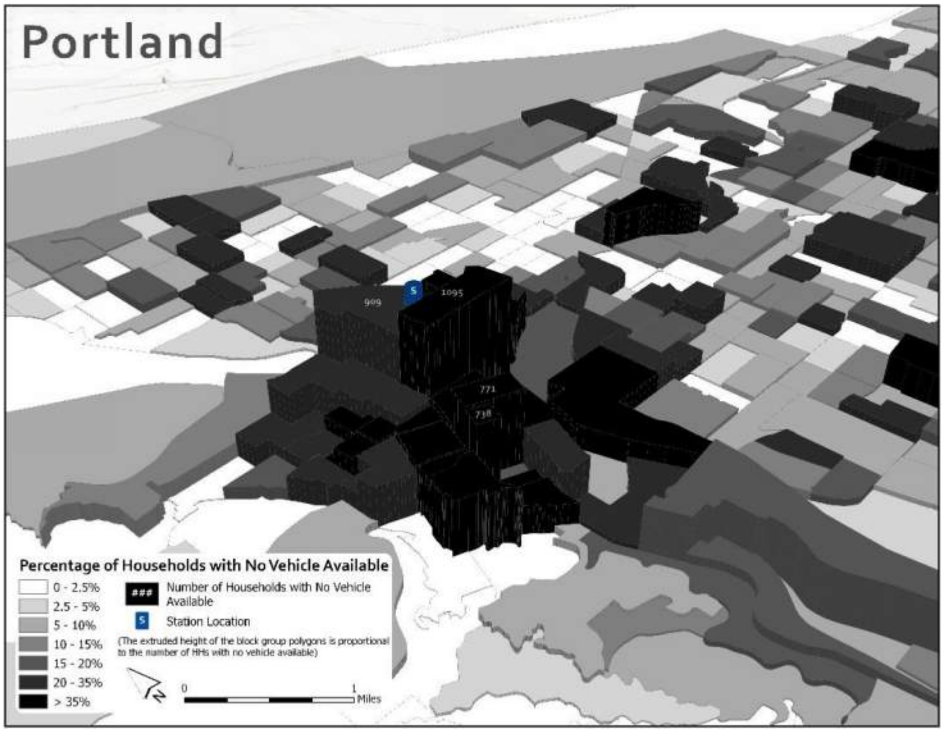


Figure C-6 summarizes the relative density and number of zero-auto households within the Portland station areas. Within a one-mile radius of Union Station, there are a significant number of zero-auto households. These areas include the central city, Pearl District, and high-density residential areas of northwest and northeast Portland.

Figure C-6. Portland Zero-Auto Households

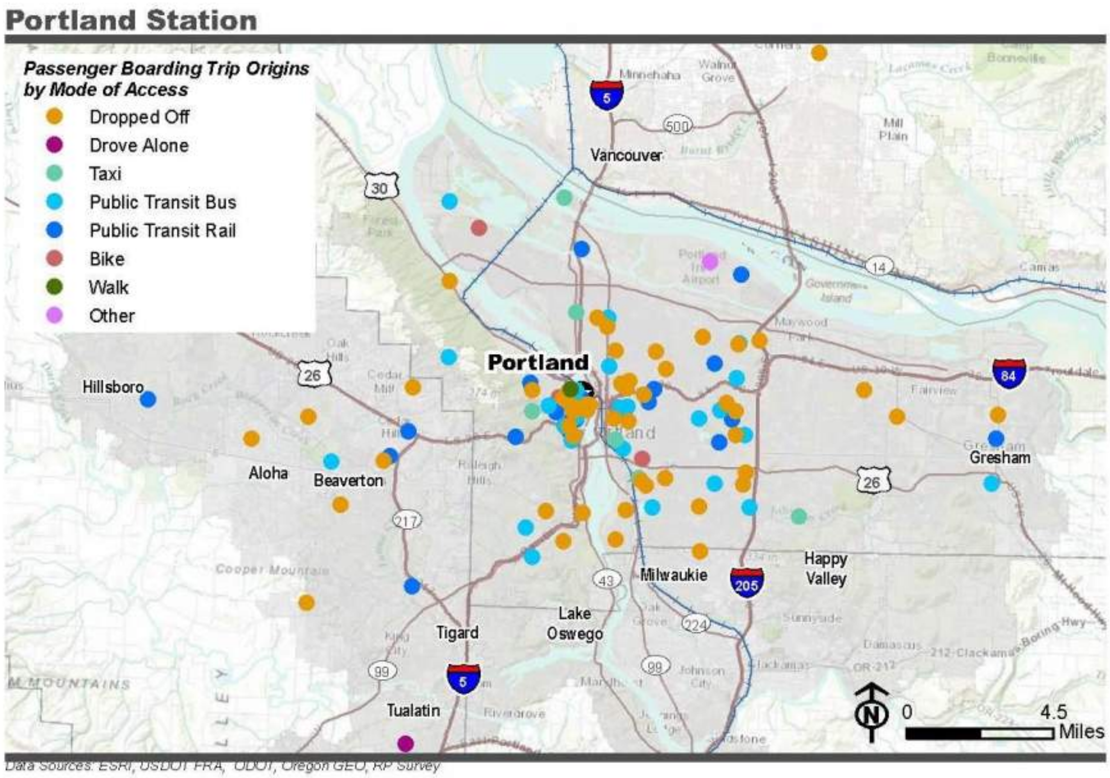


Data Source: U.S. Census Bureau. (2017). *2017 American Community Survey 5-Year Estimates, Table B25044 (Tenure by Vehicles Available).*

C.1.3 Mode of Access

Passengers accessing Portland's Union Station travel by a variety of modes. Figure C-7 maps the mode of access by passenger rail riders as identified in the 2014 Revealed Preference Survey. The two predominant modes of access include *Dropped Off* and *Public Transit.* Those passengers who indicated that they ride transit to access Union Station use a mix of bus, streetcar, and light rail throughout the region. Very few respondents indicated that they drive alone and park at Union Station.

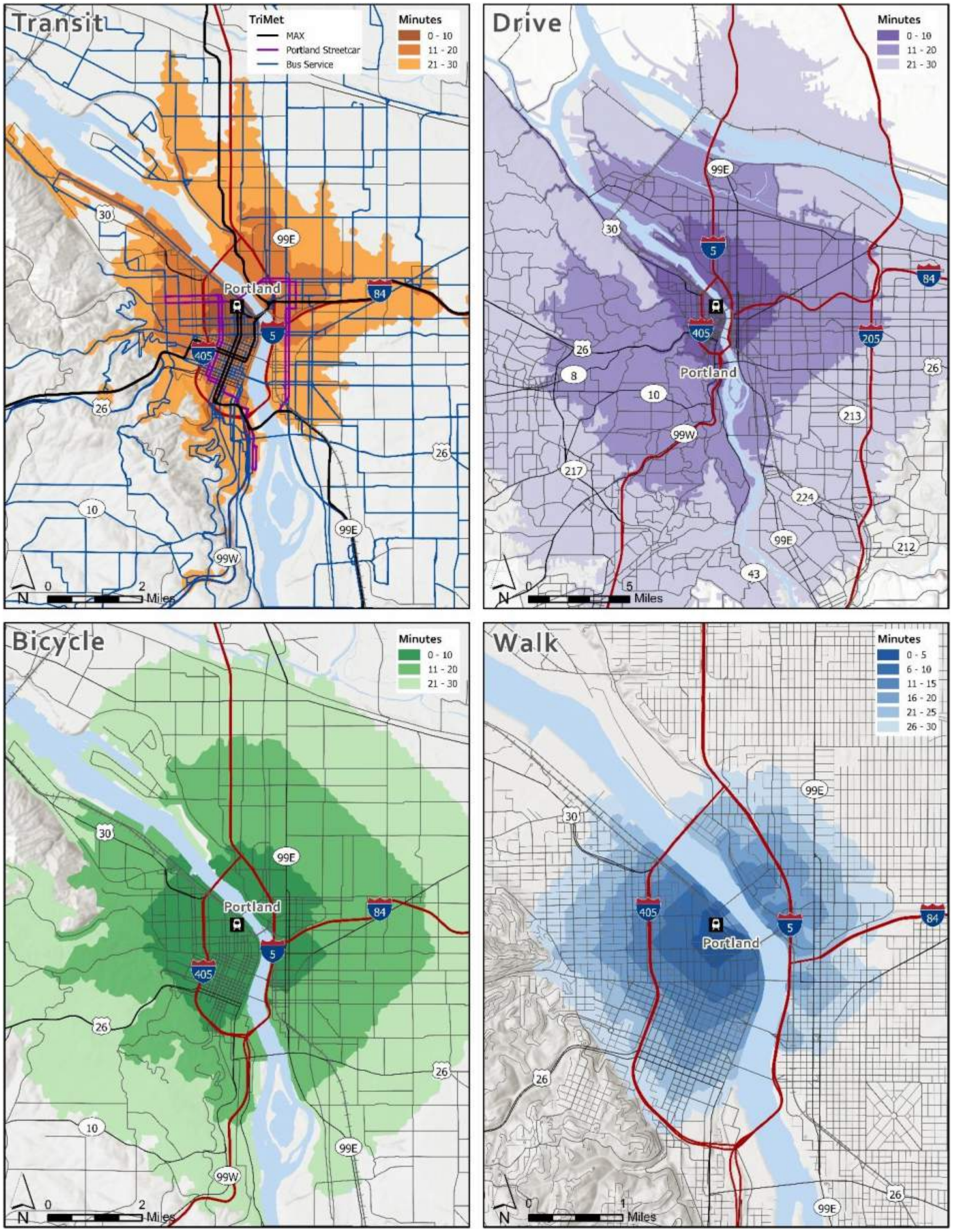
Figure C-7. Portland Station Mode of Access



C.1.4 Multimodal Interconnectivity

Figure C-8 maps the Union Station interconnectivity, illustrating separate travel sheds for walking and bicycle, transit and auto access. The transit and bicycle travel sheds are similar in Portland. Access (pedestrian) and dwell times (bus/rail stop times to alight and board passengers) are included in the transit travelshed calculation. Within 30 minutes, Amtrak Cascades riders can travel from or reach destinations by transit throughout central city and eastside Portland including the Greyhound Station (Cascades POINT service). Though it may vary throughout the day, Amtrak Cascades riders who arrive/depart Union Station as a vehicle passenger can travel from or reach destinations throughout the city of Portland, including the Portland International Airport.

Figure C-8. Portland Station Travel sheds



C.2 Oregon City

C.2.1 Site Suitability

Oregon City is within the southern area of the Portland Metro Urban Growth Boundary and is the county seat of Clackamas County. The existing station is a mostly uncovered platform with an adjacent small lot that has free short-term and overnight parking. The station area is near, but not immediately adjacent to, the existing historic downtown and central business district of Oregon City. Figure C-9 illustrates the existing Oregon City station. The existing surrounding built environment is mostly single-story industrial and commercial warehouse structures along Washington Street with some single-family residences interspersed. The surrounding area is designated as mixed-use residential, as shown in Figure C-10. The station area offers redevelopment potential at both infill and underutilized industrial sites. Oregon City's downtown has a revitalization program to generate economic development, including attracting new businesses, restaurants, and housing development projects while preserving the city's unique historic and cultural landmarks and history.

Figure C-9. Oregon City Station Aerial

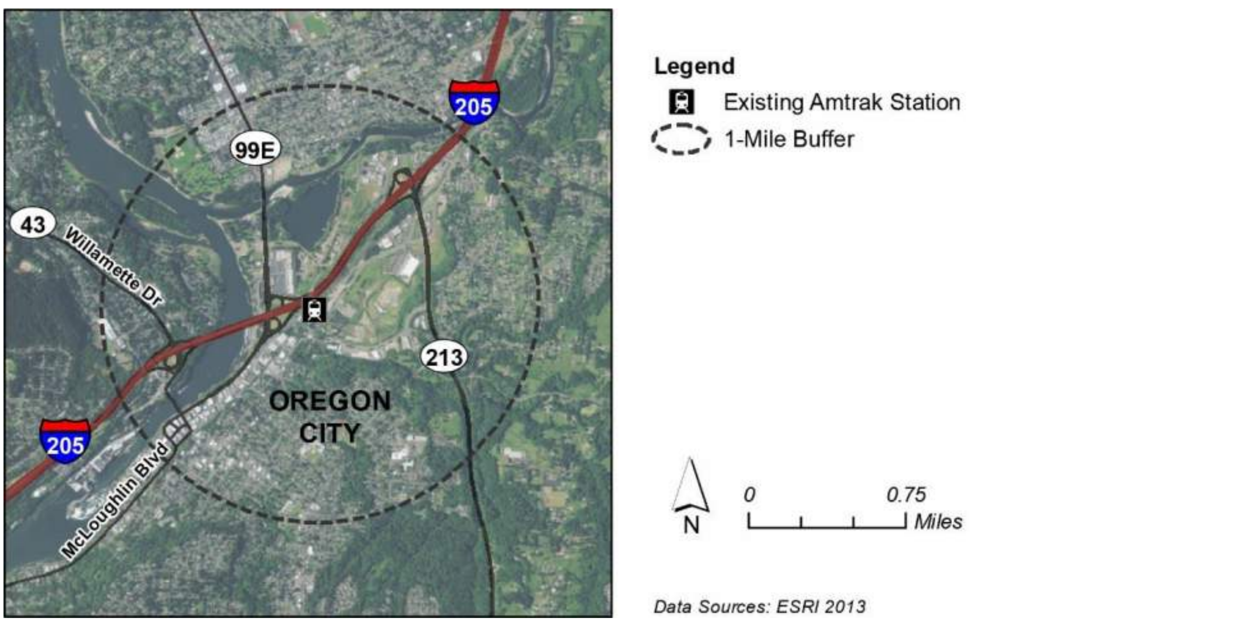
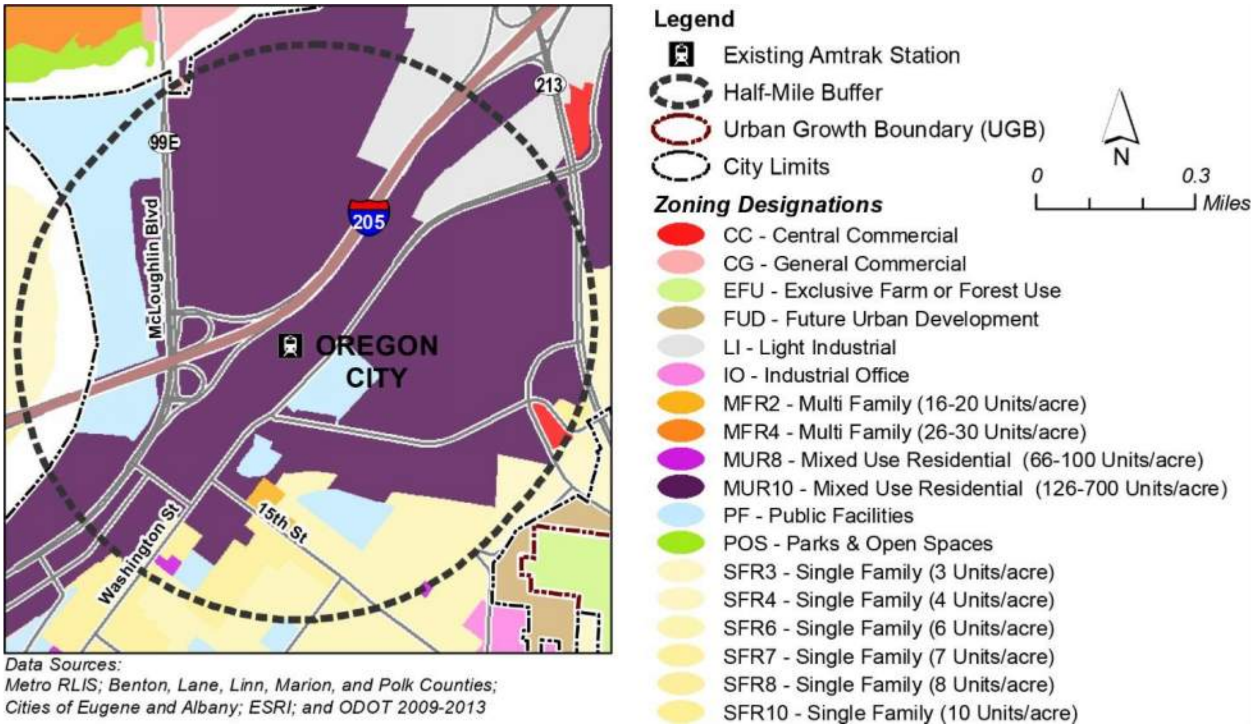


Figure C-10. Oregon City Station Zoning



Data Sources:
Metro RLIS; Benton, Lane, Linn, Marion, and Polk Counties;
Cities of Eugene and Albany; ESRI; and ODOT 2009-2013

C.2.2 Station Area Demographics

Oregon City has some smaller cultural attractions related to its historic location at the end of the Oregon Trail. Figure C-11 and Figure C-12 show the population and employment density within the Oregon City station area, respectively. The largest employers within a five-mile radius are public services, Clackamas County, Clackamas Community College, the municipality of Oregon City, and Providence Willamette Hospital. Complete details about population and employment can be found in Table C-2. Most major single employers and employment areas are to the north, in Portland. Oregon City's proximity to Portland is reflected in the significant increase in population within a 10-mile radius. However, the density is offset by the rural areas to the east.

Table C-2. Oregon City Station Population and Employment

	1-Mile Radius	5-Mile Radius	10-Mile Radius
Population	7,478	140,645	553,364
Population Density (people per sq. mile)	2,381	1,791	1,761
Total Employees	5,418	63,211	230,371
Employee Density (employees per sq. mile)	1,725	805	734

Figure C-11. Oregon City Station Population

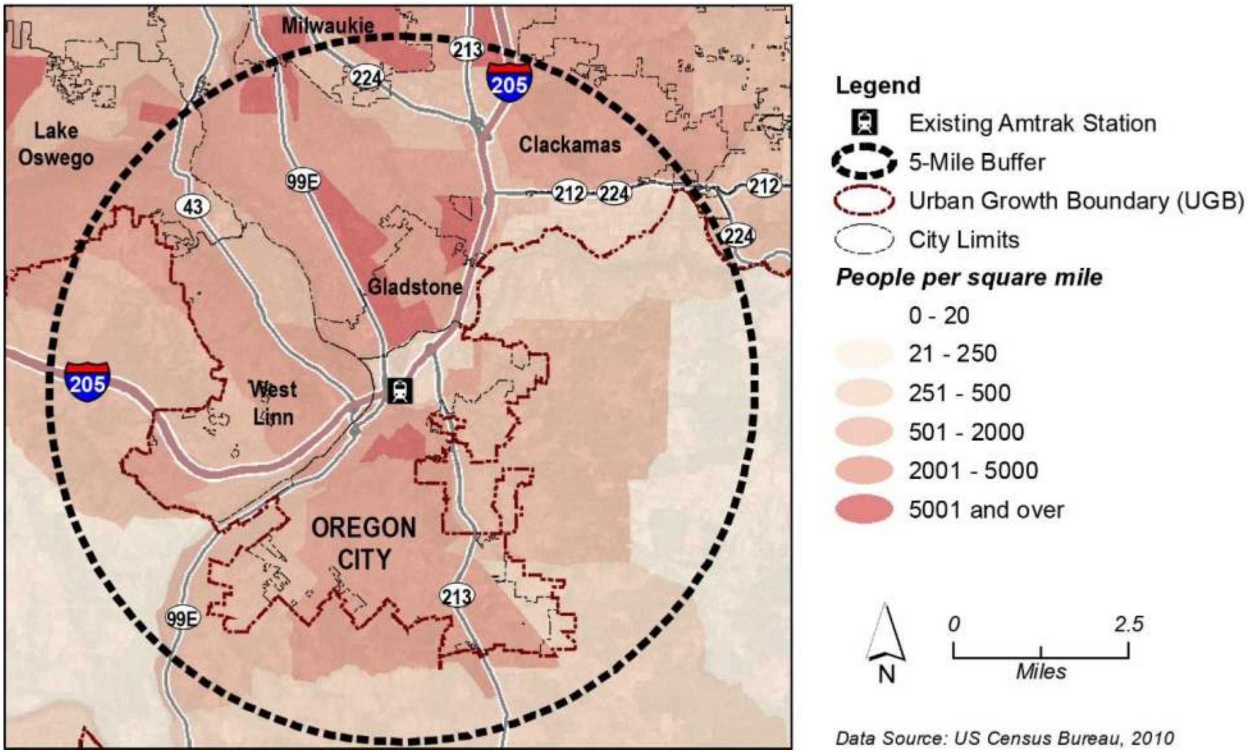


Figure C-12. Oregon City Station Employment

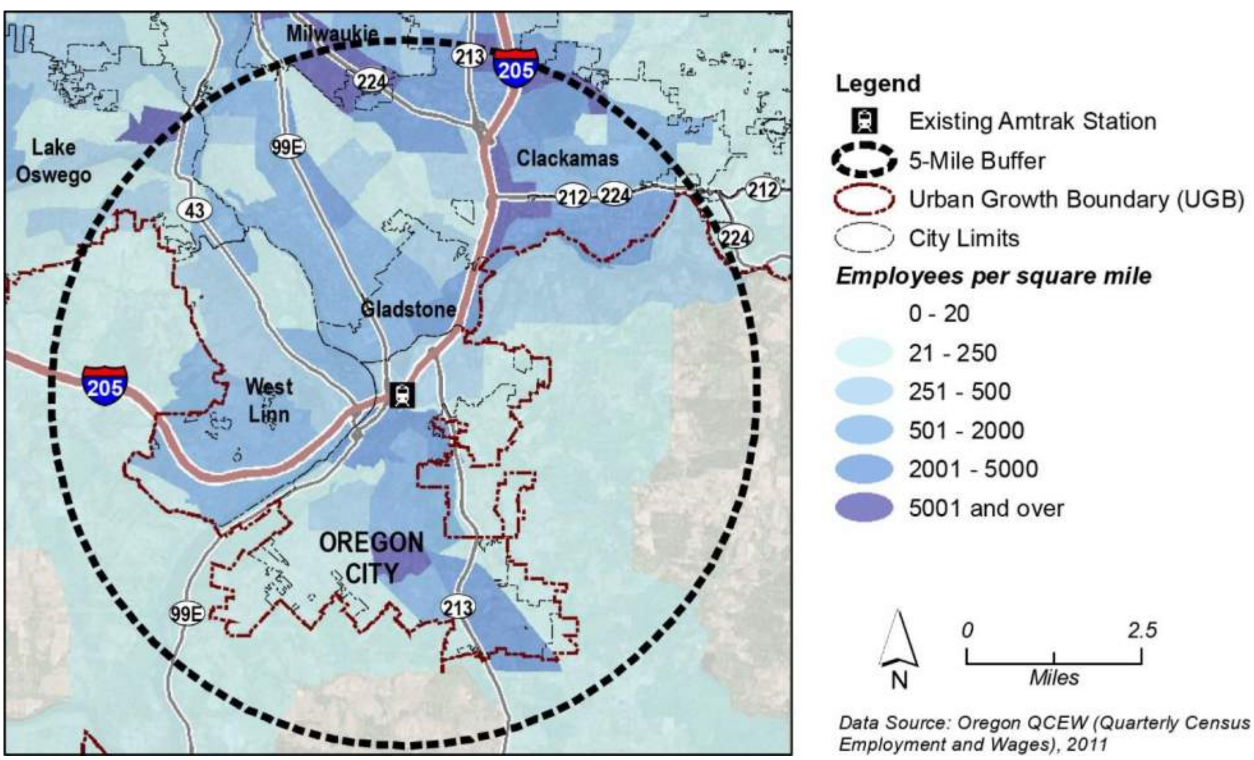
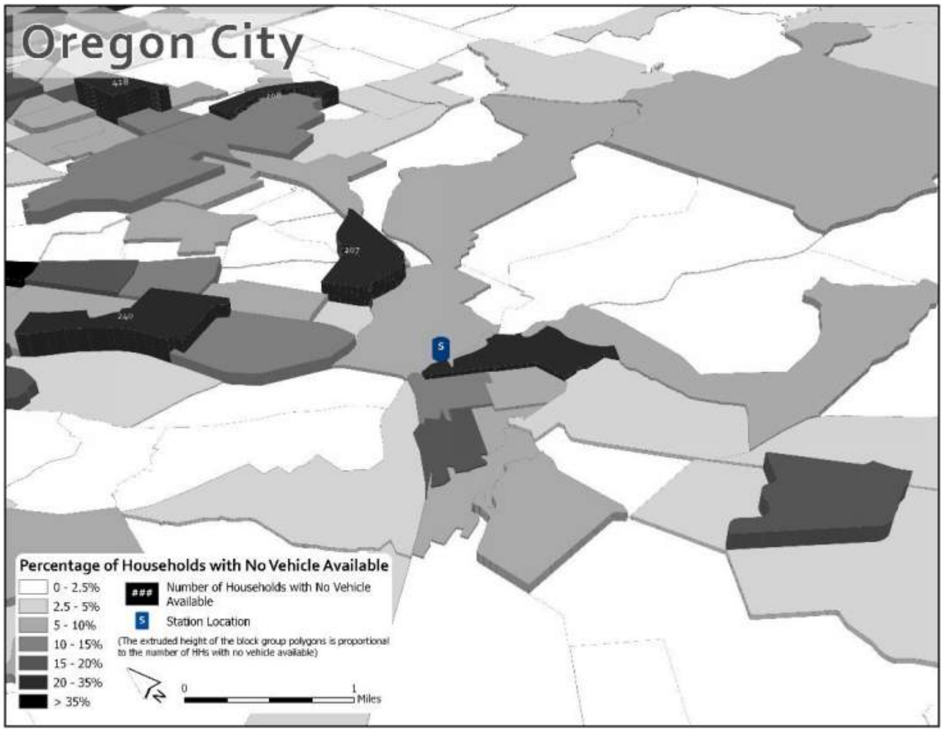


Figure C-13 summarizes the relative density and number of zero-auto households within the Oregon City station areas. Within a one-mile radius of Oregon City station, there are very few zero-auto households, mostly in low-density neighborhoods immediately east of the station.

Figure C-13. Oregon City Zero-Auto Households

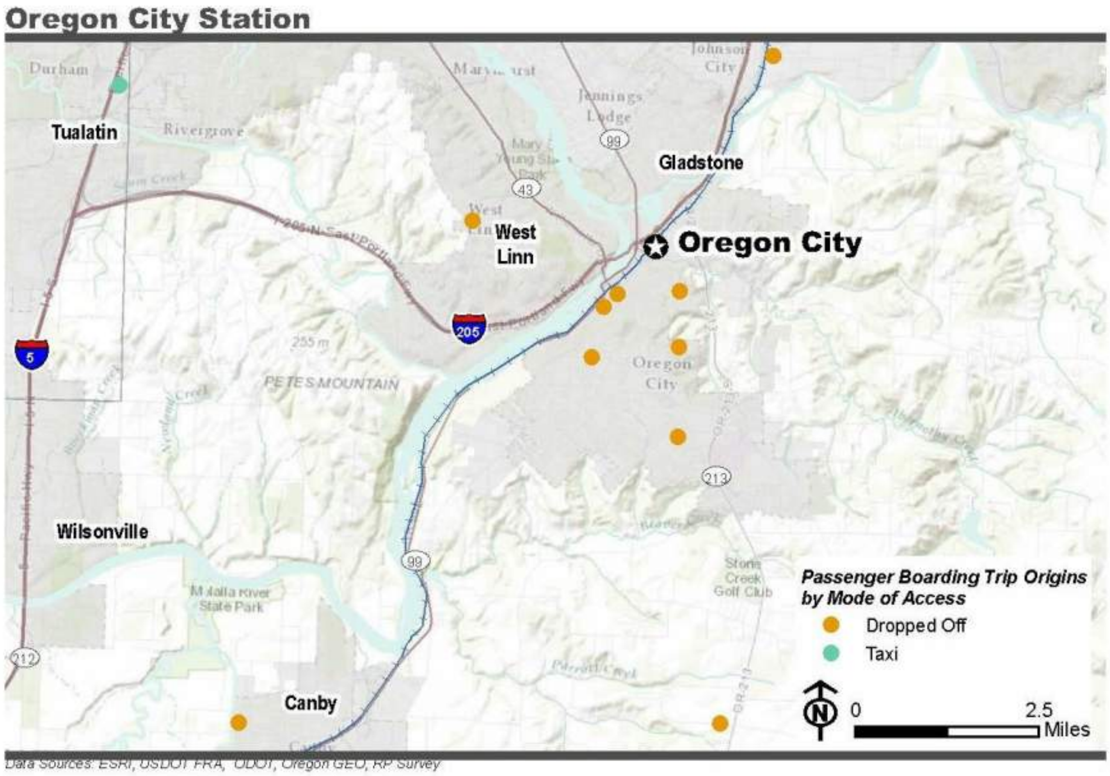


Data Source: U.S. Census Bureau. (2017). *2017 American Community Survey 5-Year Estimates, Table B25044 (Tenure by Vehicles Available).*

C.2.3 Mode of Access

The passenger survey respondents indicated that they are most likely to be dropped off and come from a number of surrounding communities in addition to Oregon City: Canby, West Linn, Gladstone and Tualatin. Figure C-14 maps the mode of access by passenger rail riders as identified in the 2014 Revealed Preference Survey. The predominant mode of access is *Dropped Off*. Zero respondents indicated that they take public transit or bike to the station. Given the low number of respondents at Oregon City station during this survey, the survey data may not accurately represent the station's mode of access profile.

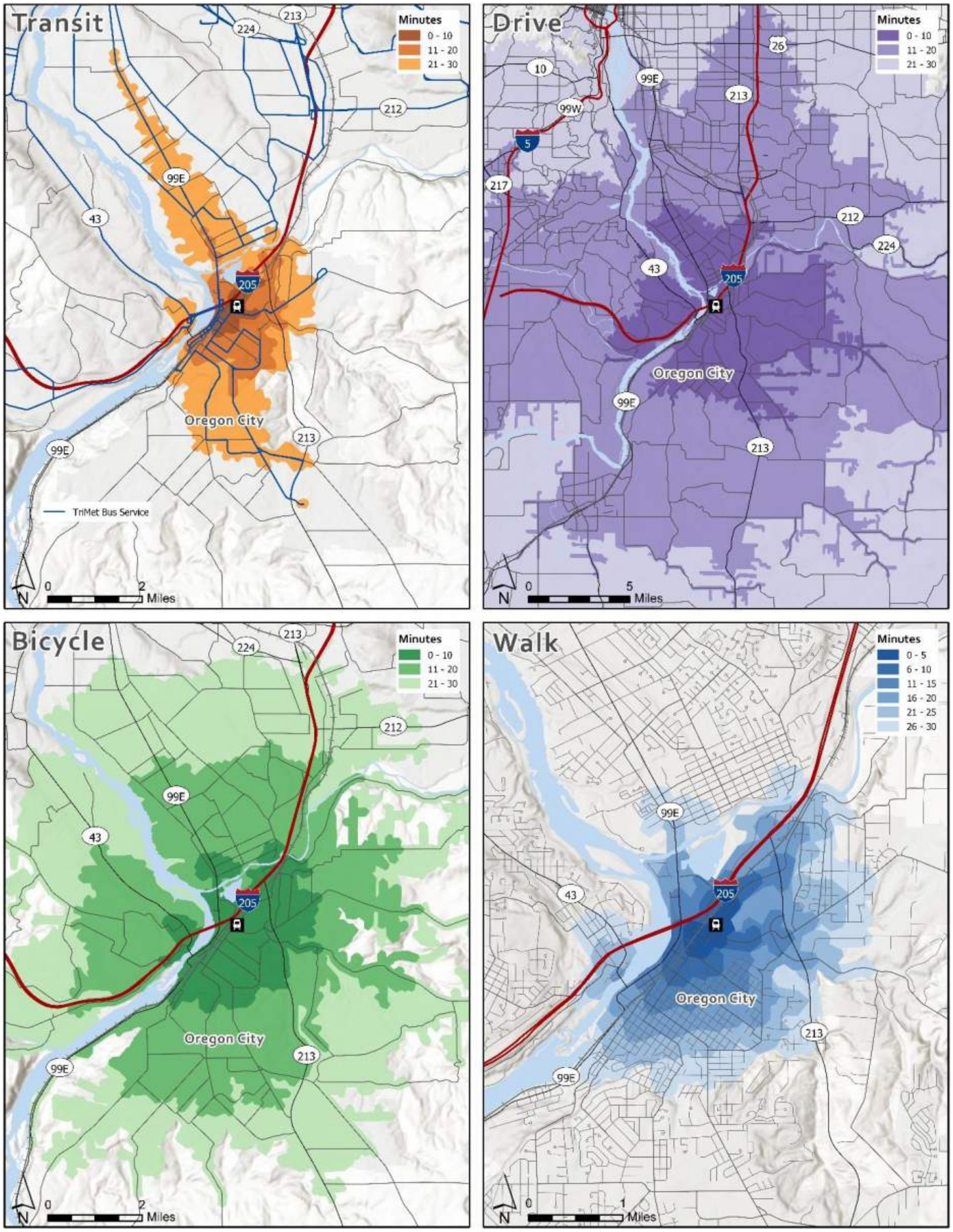
Figure C-14. Oregon City Station Mode of Access



C.2.4 Multimodal Interconnectivity

Figure C-15 maps the Oregon City station interconnectivity, illustrating separate travel sheds for walk and bicycle, transit and auto access. The transit travelshed is significantly smaller than the bicycle travelshed in Oregon City, primarily due to the limited number and frequency of local bus routes proximate to the Oregon City station. Though it may vary throughout the day, Amtrak Cascades riders who arrive/depart the Oregon City station as a vehicle driver or passenger can travel from or reach destinations throughout Oregon City and neighboring West Linn, Milwaukie and Gladstone neighborhoods within 30 minutes.

Figure C-15. Oregon City Station Travel sheds



C.3 Salem

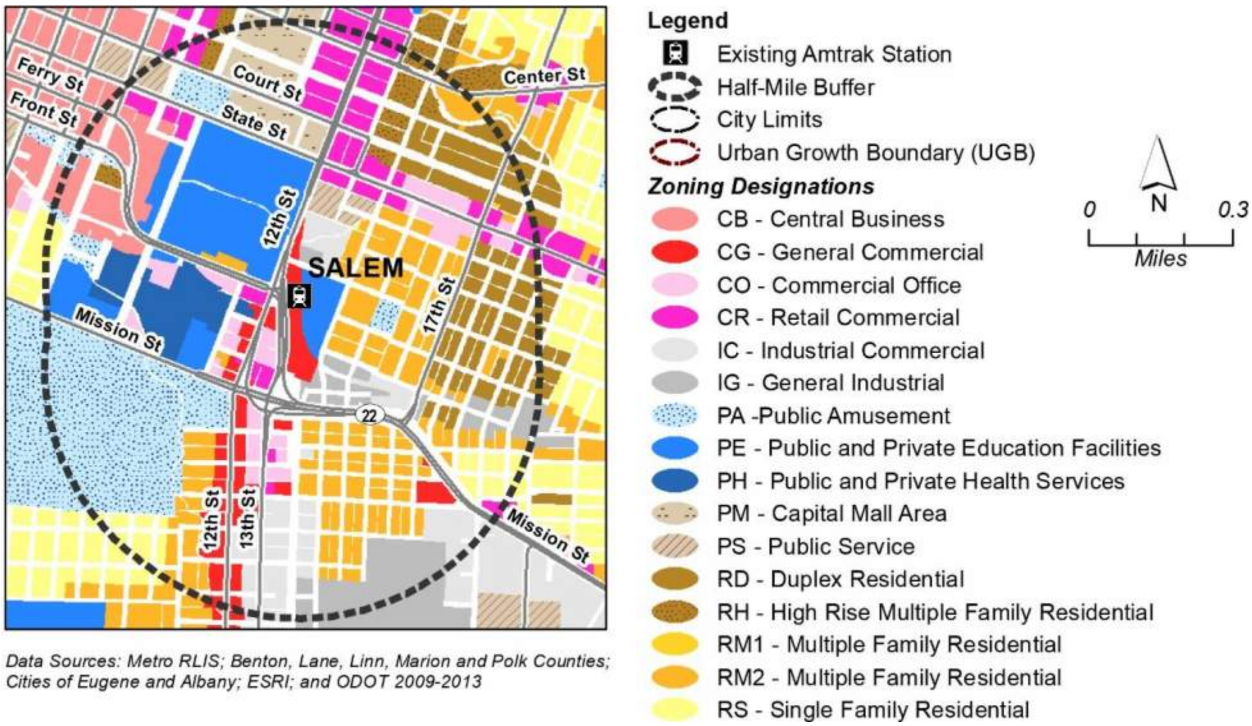
C.3.1 Site Suitability

The existing Amtrak station operates as the passenger depot, with an auxiliary building next door serving Greyhound bus operations. Figure C-16 illustrates the existing Amtrak station. The station is a Beaux-Arts-style structure listed on the NRHP. The Oregon Department of Transportation (ODOT), which completed a renovation of the station in 2000, leases the station to Amtrak. Willamette University and Salem Hospital are adjacent to the station on the west. The State of Oregon government offices and the central business district are located 0.5 mile north-northwest of the station. Willamette Heritage Center and the historic Thomas Kay woolen mill are located adjacent to the station on the north. Single-family and multifamily residences are concentrated in nearby areas east and northeast of the station. Redevelopment of properties surrounding the station would primarily be infill. Land zoning in the Salem Station area is shown in Figure C-17.

Figure C-16. Salem Station Aerial

The Railway Express Agency (REA) freight depot and baggage shed building (also listed on the NRHP) is located next to the existing Amtrak station building on the south side. This building had been out of use since the mid-1970s (City of Salem, 2009). In 2013, ODOT secured funds to restore the building with the intent of creating, in three phases, a multimodal transportation hub and recently completed renovations. Greyhound bus services are now located here.

Figure C-17. Salem Station Zoning



Data Sources: Metro RLIS; Benton, Lane, Linn, Marion and Polk Counties; Cities of Eugene and Albany; ESRI; and ODOT 2009-2013

C.3.2 Station Area Demographics

Salem is the state capital of Oregon and the county seat of Marion County. The Salem Metropolitan Statistical Area (MSA) includes Salem, Keizer, and Marion and Polk Counties, and is the state's second largest MSA with a population estimated at 396,103 (Portland State University, Population Research Center, 2008). The Amtrak station is located in proximity to the largest concentration of employment in the Salem-Keizer area. According to the Oregon Employment Department, there are more than 44,000 employees working within one mile of the station (Oregon Employment Department, 2011). Large employers and key generators near the Amtrak station include State of Oregon government offices, city of Salem offices, Willamette University, and Salem Hospital. Table C-3 shows the population and employment details for this station. Figure C-18 and Figure C-19 show the population and employment density within the Salem station area, respectively.

Table C-3. Salem Station Population and Employment

	1-Mile Radius	5-Mile Radius	10-Mile Radius
Population	13,033	206,480	261,155
Population Density (people per sq. mile)	4,150	2,630	832
Total Employees	44,262	110,556	121,842
Employee Density (employees per sq. mile)	14,094	1,408	388

Figure C-18. Salem Station Population

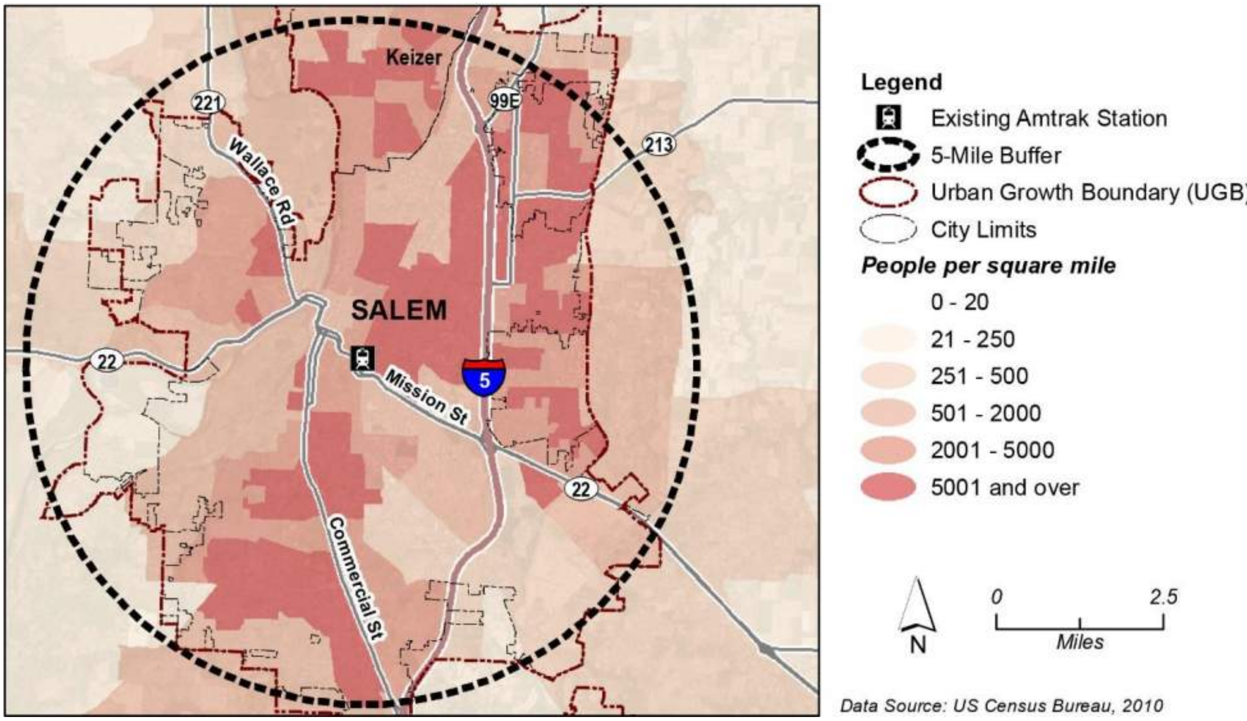


Figure C-19. Salem Station Employment

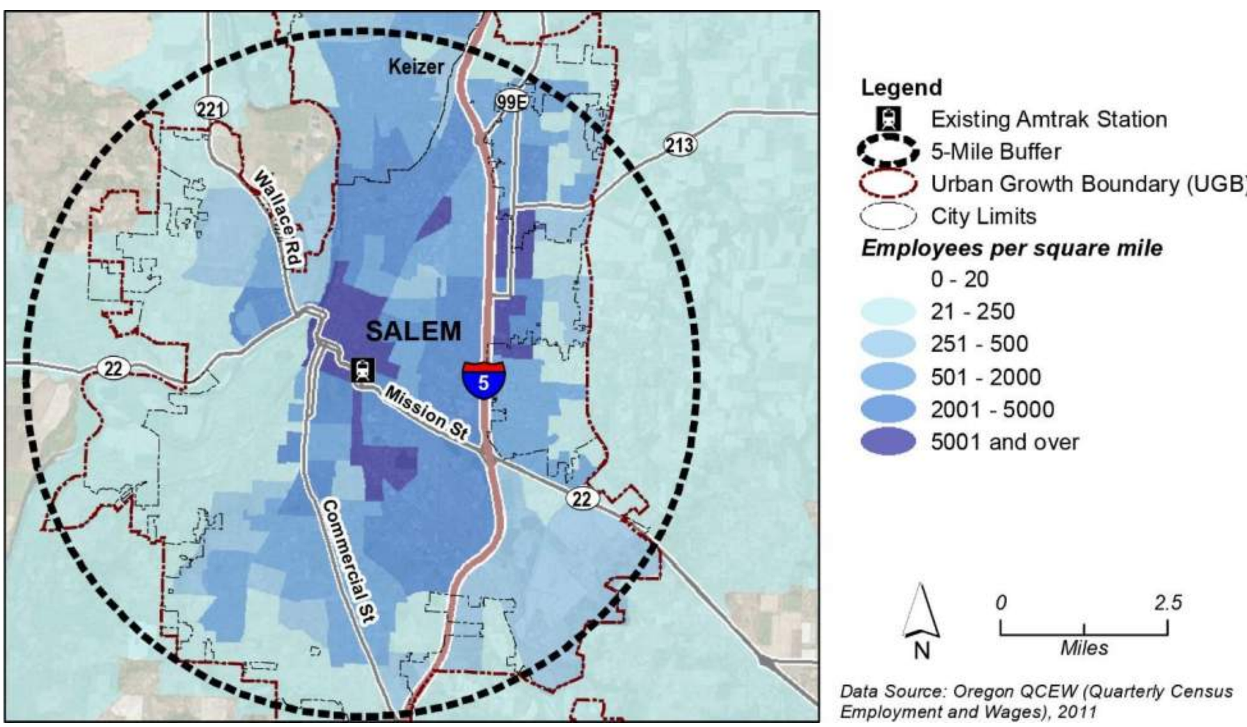


Figure C-20 summarizes the relative density and number of zero-auto households in Salem station area. Within a one-mile radius of Salem station, there is a modest level of zero-auto households, mostly in mid-density neighborhoods surrounding the city center and State Capitol.

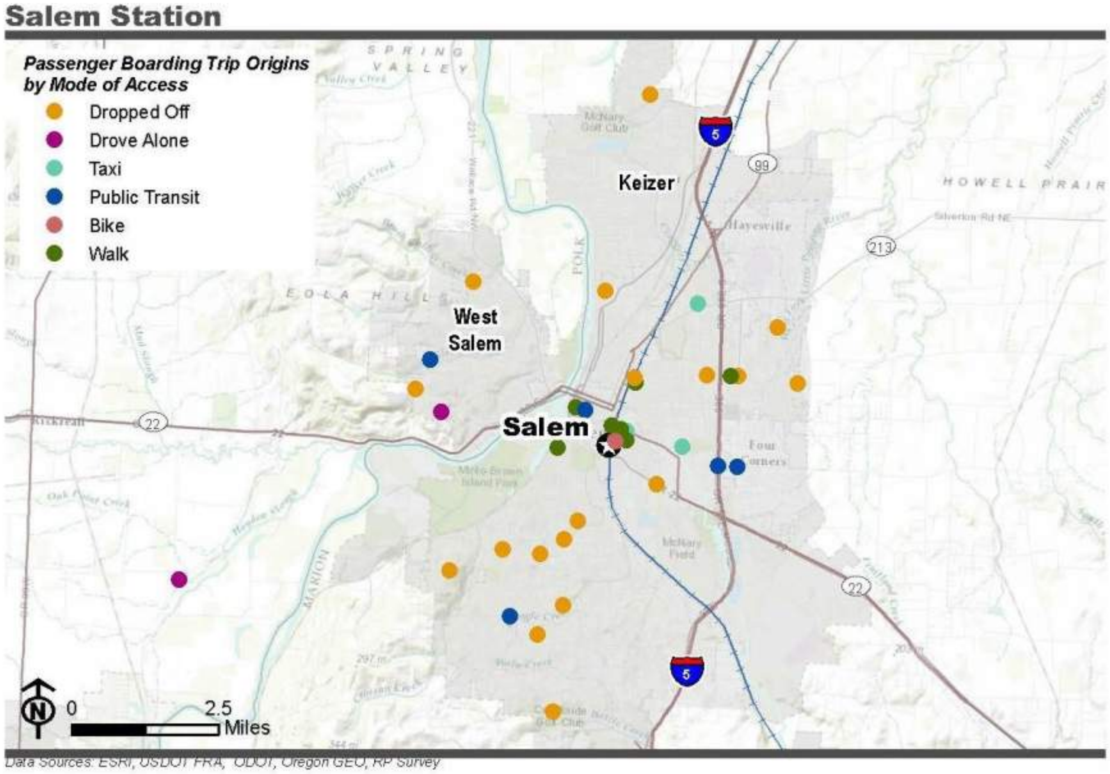
Figure C-20. Salem Station Zero-Auto Households

Data Source: U.S. Census Bureau. (2017). *2017 American Community Survey 5-Year Estimates, Table B25044 (Tenure by Vehicles Available).*

C.3.3 Mode of Access

The passenger survey respondents indicated that they walk to the station if they are located relatively close and are likely to be dropped off if they come from further away. Figure C-21 maps the mode of access by passenger rail riders as identified in the 2014 Revealed Preference Survey. Very few respondents indicated that they drive alone to the station. A small group of respondents also indicated that they take transit, bike and use a taxi.

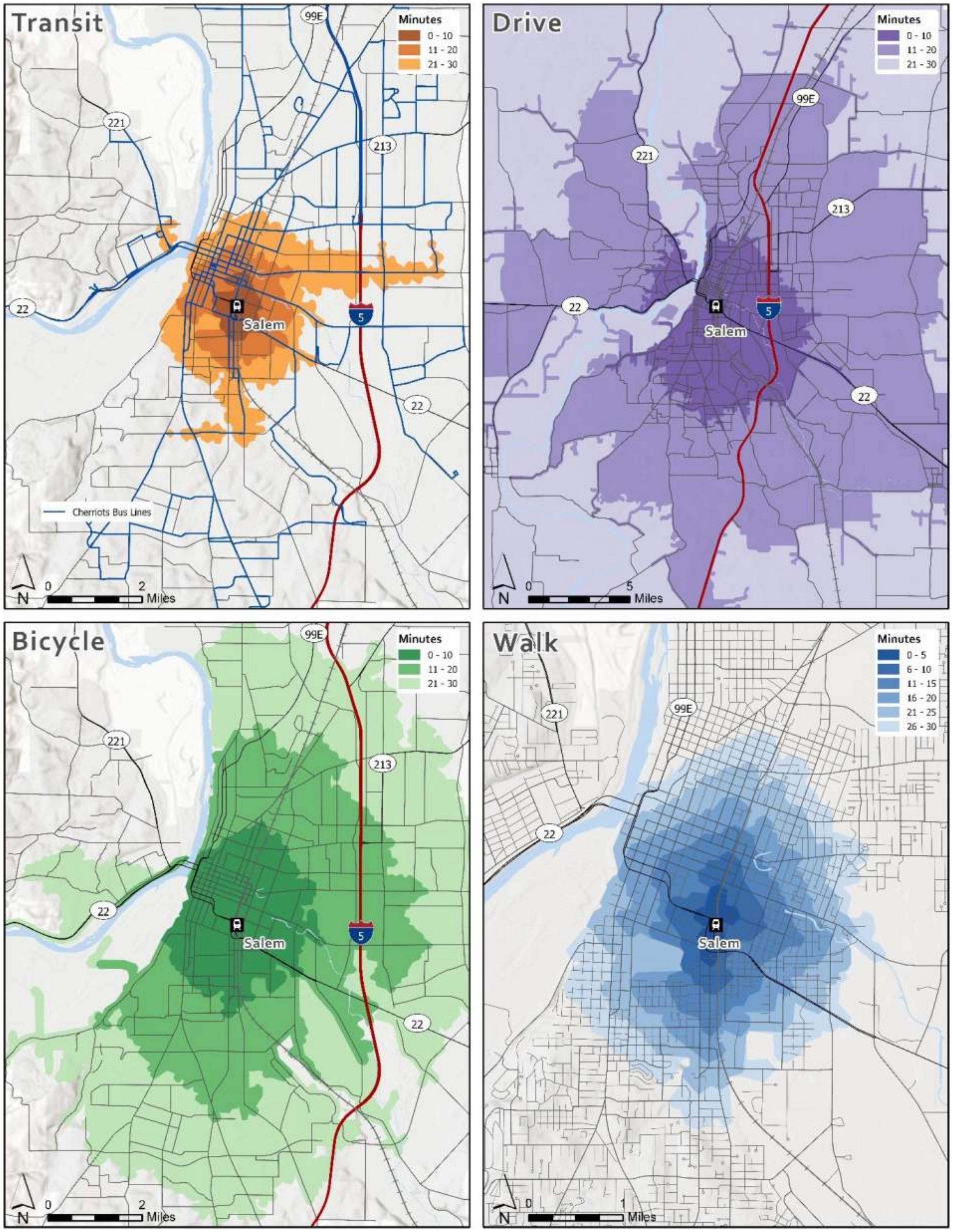
Figure C-21. Salem Station Mode of Access



C.3.4 Multimodal Interconnectivity

Figure C-22 maps the Salem station interconnectivity, illustrating separate travel sheds for walk and bicycle, transit and auto access. The transit travelshed is significantly smaller than the bicycle travelshed in Salem, due to the limited number and frequency of local bus routes proximate to the Salem station. Though it may vary throughout the day, Amtrak Cascades riders who arrive/depart the Salem station as a vehicle driver or passenger can travel from or reach destinations throughout the Salem-Keizer urban area within 30 minutes.

Figure C-22. Salem Station Travel sheds



C.4 Albany

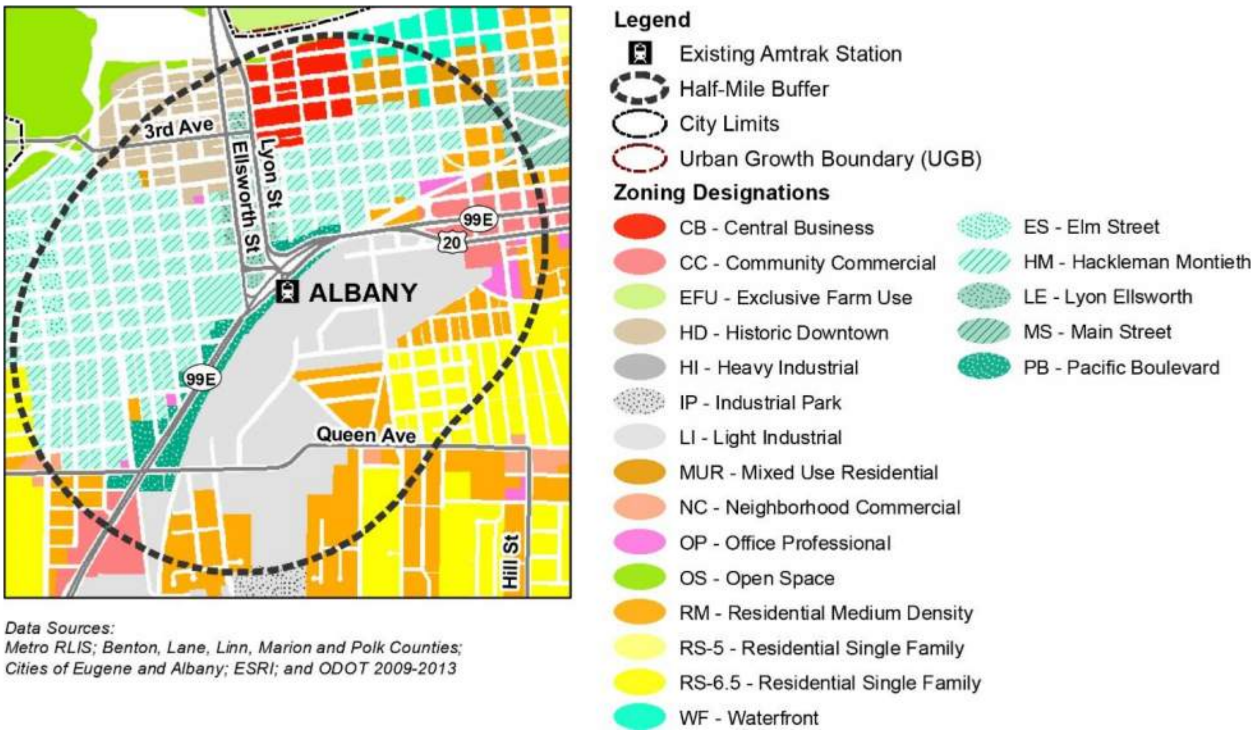
C.4.1 Site Suitability

The Albany rail depot, which has undergone a historic renovation, is part of a recently completed Albany Multimodal Transportation Center on a seven-acre site. Figure C-23 illustrates the existing Albany train depot. The project included redevelopment of underutilized properties with deteriorated buildings. The depot is on the southern end of the downtown, which is intersected by OR 99E and the railroad tracks. Most of downtown Albany, including the area adjacent to the station, is part of an historic district. Any new development in the historic district must respect the variety of architecture and time periods reflected; this can include size and scale, as outlined in the City of Albany Development Code. Zoning for mixed-use development is in place in much of downtown Albany, see Figure C-24. Undeveloped and underdeveloped properties in downtown provide an opportunity for infill near the station, including redevelopment of potential parking lots.

Figure C-23. Albany Station Aerial

Adjacent to and east of the station, there is a rail yard. East of the rail yard are mostly industrial and public uses, such as the sheriff's office, the Albany-Lebanon Sanitization Station, a school bus depot, and the Linn County Jail. Farther west of the station, there are underutilized larger commercial and mixed-use lots along the Willamette River that have redevelopment potential. Smaller residential lots are located to the south and north.

Figure C-24. Albany Station Zoning



C.4.2 Station Area Demographics

Albany is the county seat of Linn County. It is largely surrounded by agricultural areas, as is demonstrated by the significant decrease in population density that occurs between five and 10 miles from the station. Figure C-25 and Figure C-26 show the population and employment density within the Albany station area, respectively. The main employers in proximity to the station are Linn County offices, Albany General Hospital, and city of Albany offices, all of which have less than 800 employees. Corvallis is approximately 10 miles from Albany and has two large employers: Oregon State University and Good Samaritan Hospital. Albany's main attraction is its historic downtown, which has four historic districts that are listed in the National Register of Historic Places by the United States Department of the Interior. There are limited lodging options in downtown Albany. Table C-4 shows the population and employment surrounding Albany.

Table C-4. Albany Station Population and Employment

	1-Mile Radius	5-Mile Radius	10-Mile Radius
Population	12,216	55,256	113,200
Population Density (people per sq. mile)	3,890	704	360
Total Employees	9,020	23,425	52,095
Employee Density (employees per sq. mile)	2,872	298	166

The passenger survey reveals that most of the respondents came from Albany, with a handful from Corvallis and three from Jefferson and Lebanon combined. Figure C-28 maps the mode of access by passenger rail riders as identified in the 2014 On-Board Ridership Survey. The most common mode of access to the station is getting dropped off, especially when the respondent originates in Albany. Driving alone and transit are also popular modes of access for this station.

Figure C-25. Albany Station Population

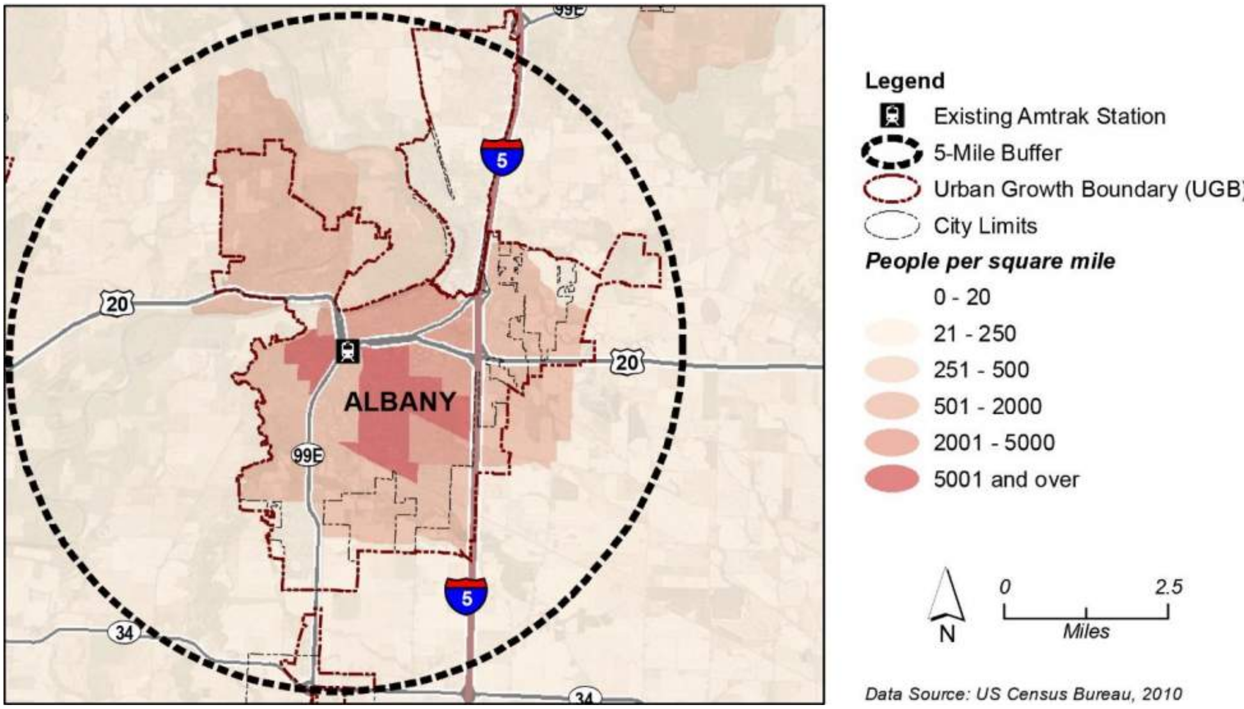


Figure C-26. Albany Station Employment

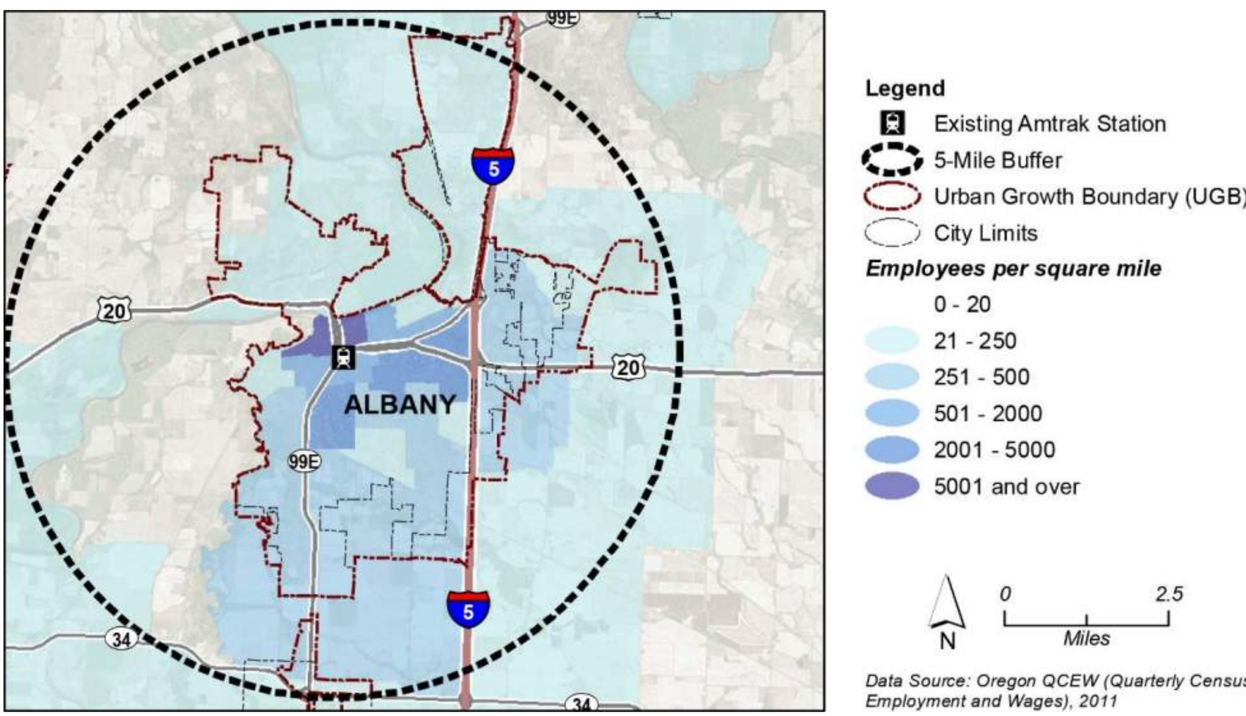
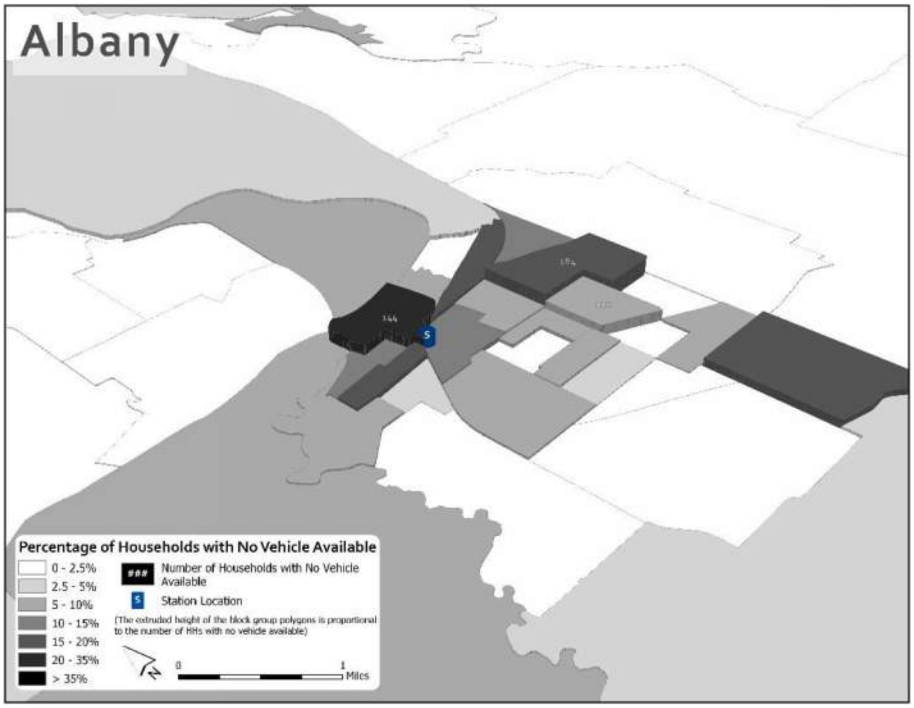


Figure C-27 summarizes the relative density and number of zero-auto households in Albany Station area. Within a one-mile radius of Albany station, there is a modest level of zero-auto households, mostly in mid-density neighborhoods in the Albany city center.

Figure C-27. Albany Station Zero-Auto Households

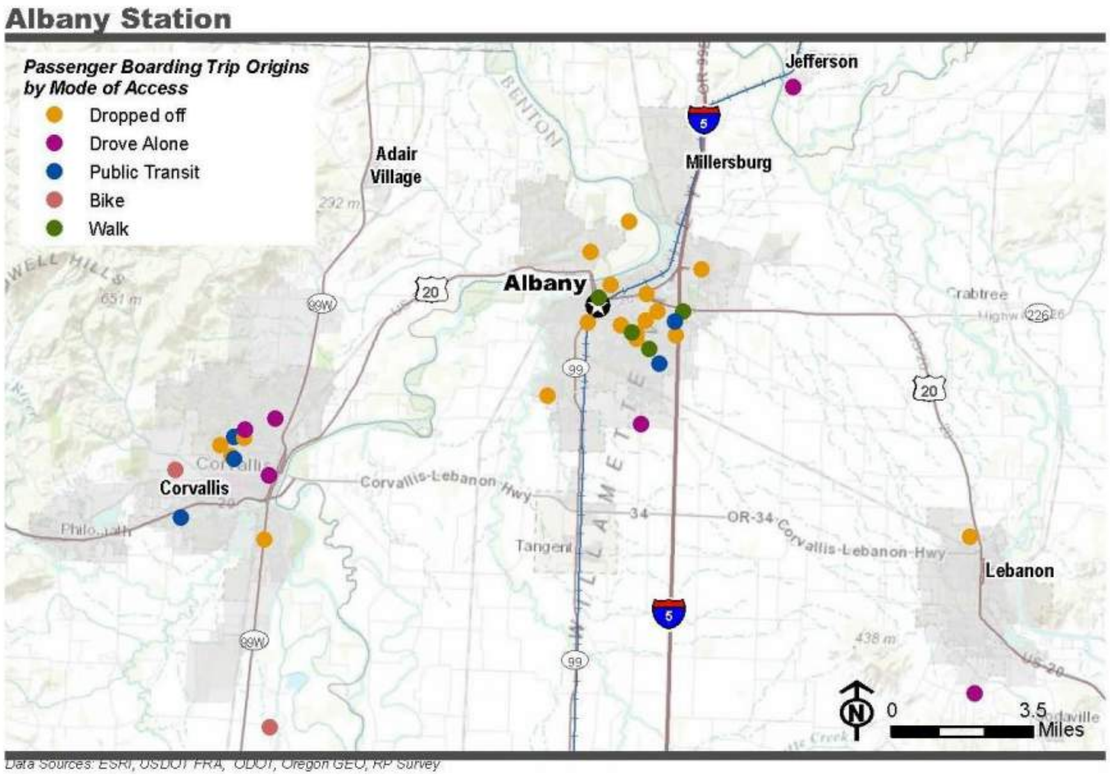


Data Source: U.S. Census Bureau. (2017). *2017 American Community Survey 5-Year Estimates, Table B25044 (Tenure by Vehicles Available).*

C.4.3 Mode of Access

The passenger survey respondents indicated that they walk to the station if they are located relatively close and are likely to be dropped off if they come from further away. Figure C-28 maps the mode of access by passenger rail riders as identified in the 2014 Revealed Preference Survey. Very few respondents indicated that they drive alone to the station. A small group of respondents also indicated that they take transit, bike and use a taxi.

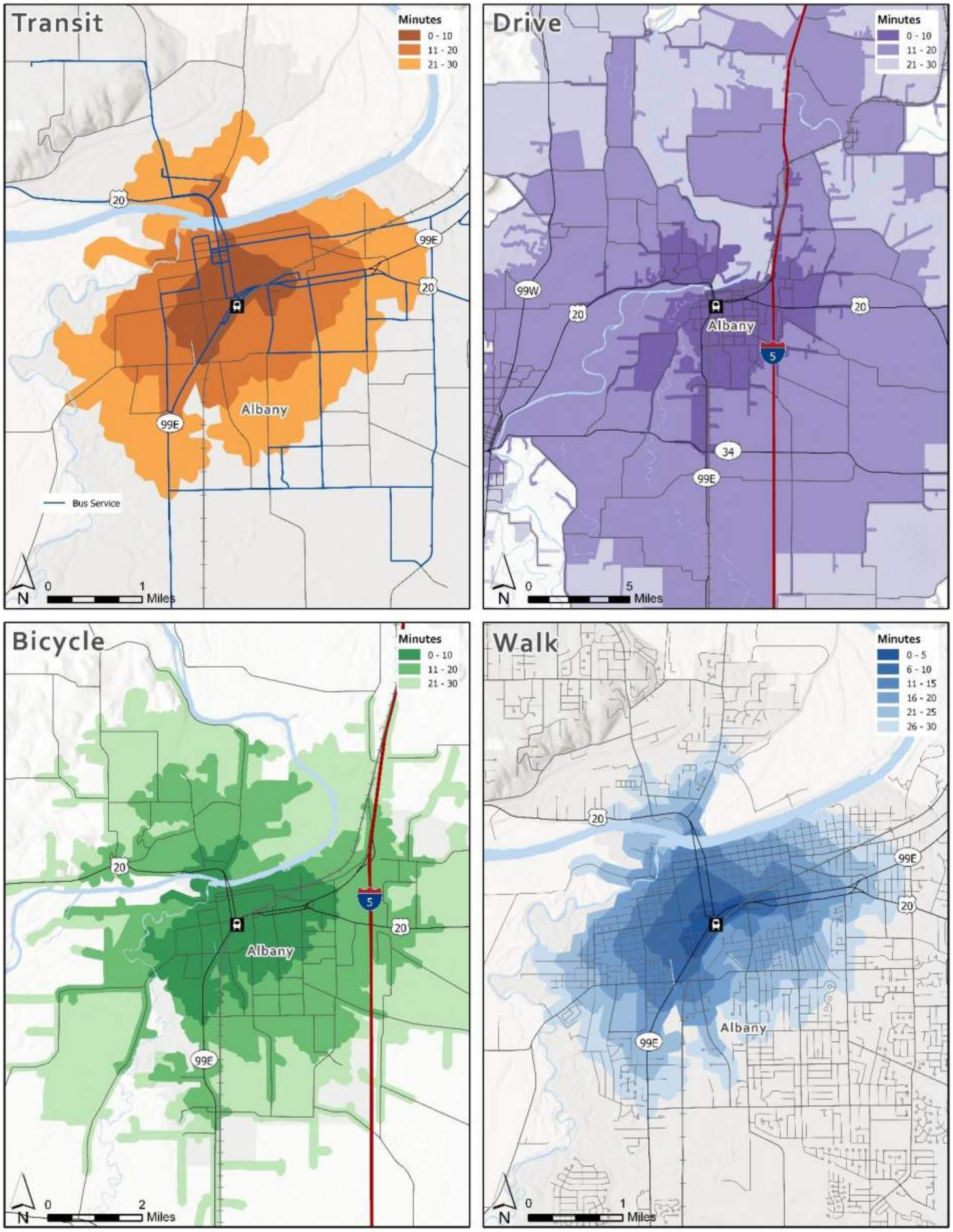
Figure C-28. Albany Station Mode of Access



C.4.4 Multimodal Interconnectivity

Figure C-29 maps the Albany station interconnectivity, illustrating separate travel sheds for walk and bicycle, transit and auto access. The travel sheds for transit and bicycle travel are roughly similar in Albany. Though it may vary throughout the day, Amtrak Cascades riders who arrive/depart the Albany station as a vehicle driver or passenger can travel from or reach destinations throughout the Albany area and much of neighboring Corvallis within 30 minutes.

Figure C-29. Albany Station Travel sheds



C.5 Eugene

C.5.1 Site Suitability

Downtown Eugene is the regional commercial and cultural center in the Lane County metro area. The downtown is surrounded by residential neighborhoods, major activity centers and the University of Oregon. The downtown has undergone concerted urban revitalization efforts and significant investments in recent years, including the addition of the Lane Community College downtown campus and the 13th Avenue and Olive Street housing project.

The Eugene Downtown Plan (adopted in 2004) supports development and increased density in the downtown for an active urban environment. The plan includes policies to pursue public/private development opportunities and facilitate downtown development of the many surface parking lots. In addition, the plan identifies 12 key development opportunity areas in the downtown area. They include the train station area, and blocks both directly south and northeast of the train station.

The existing train depot has been in operation since 1908 and is on the NRHP; it was refurbished in 2004. Figure C-30 illustrates the existing train depot. Much of the train depot area is designated and zoned for industrial uses, see Figure C-31. This area is anticipated to be redesignated and rezoned to allow commercial development compatible with the adjacent downtown area. Except for the station area itself, zoning in the proximity of the station is largely commercial (offices, hotels and restaurants), public land (government offices and county jail), and industrial. Most of downtown has a Transit Oriented Development Overlay Zone to promote the creation and retention of mixed land uses, and enhanced transit and pedestrian activity.

Figure C-30. Eugene Station Aerial

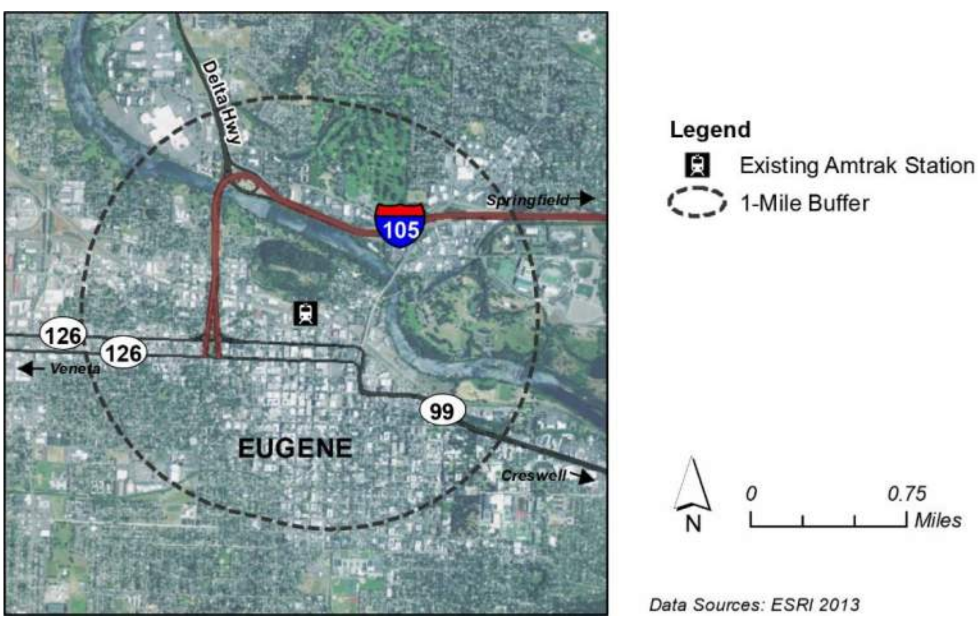
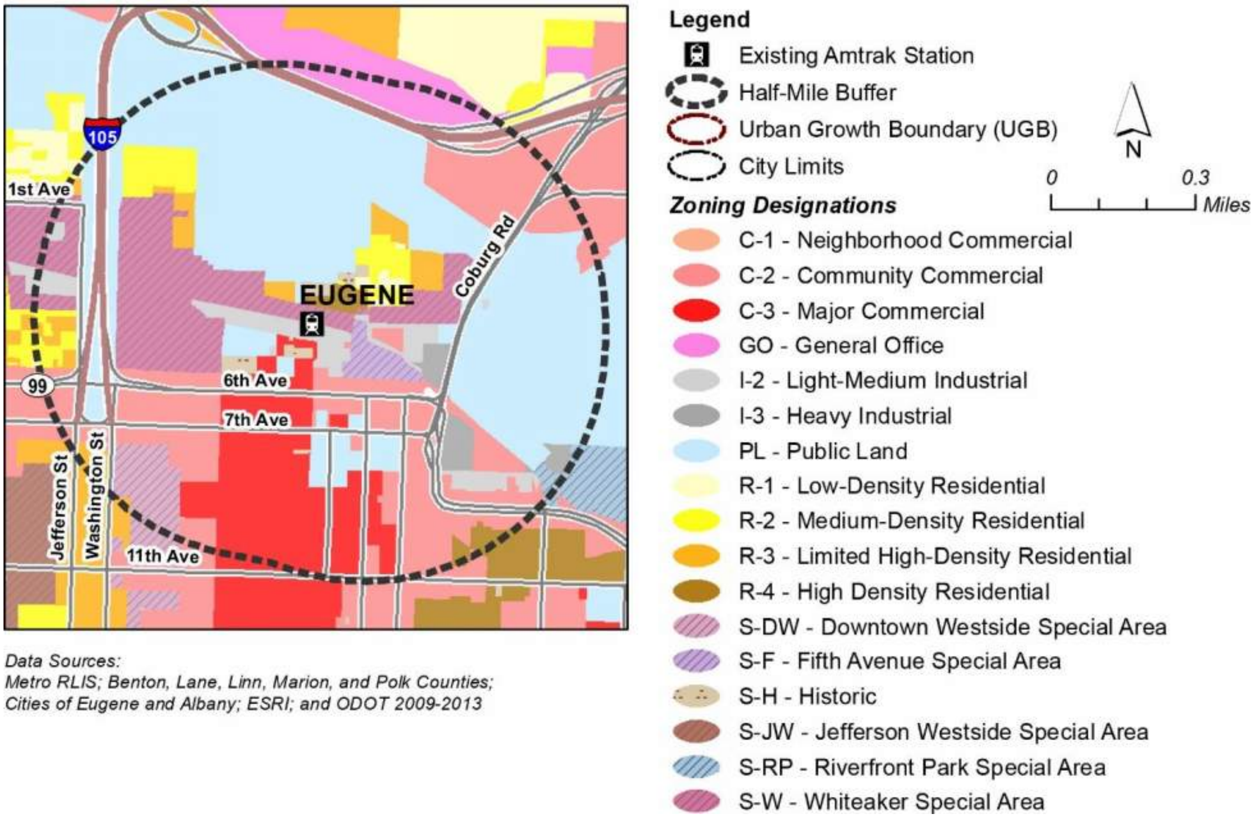


Figure C-31. Eugene Station Zoning



C.5.2 Station Area Demographics

Eugene is the second-largest city in the state of Oregon and is the county seat of Lane County. As shown in Table C-5, the farther you get from the station, population and employment densities significantly decrease. Figure C-32 and Figure C-33 show the population and employment density within the Eugene station area, respectively. This is indicative of the downtown urbanized concentration represented in the one-mile radius, more suburban areas captured in the five-mile radius, and rural areas captured in the 10-mile radius.

Table C-5. Eugene Station Population and Employment

	1-Mile Radius	5-Mile Radius	10-Mile Radius
Population	17,301	196,711	261,428
Population Density (people per sq. mile)	5,509	2,505	832
Total Employees	28,634	104,006	118,586
Employee Density (employees per sq. mile)	9,118	1,325	378

Although the densities decrease as the distance increases from the station, respondents from the passenger survey indicated that they arrive at the station with a mix of driving alone and transit. Figure C-35 maps the mode of access by passenger rail riders as identified in the 2014 On-Board Ridership Survey.Generally speaking, those riding transit to the station were closer to the station. A small group of respondents biked to access the station.

Figure C-32. Eugene Station Population

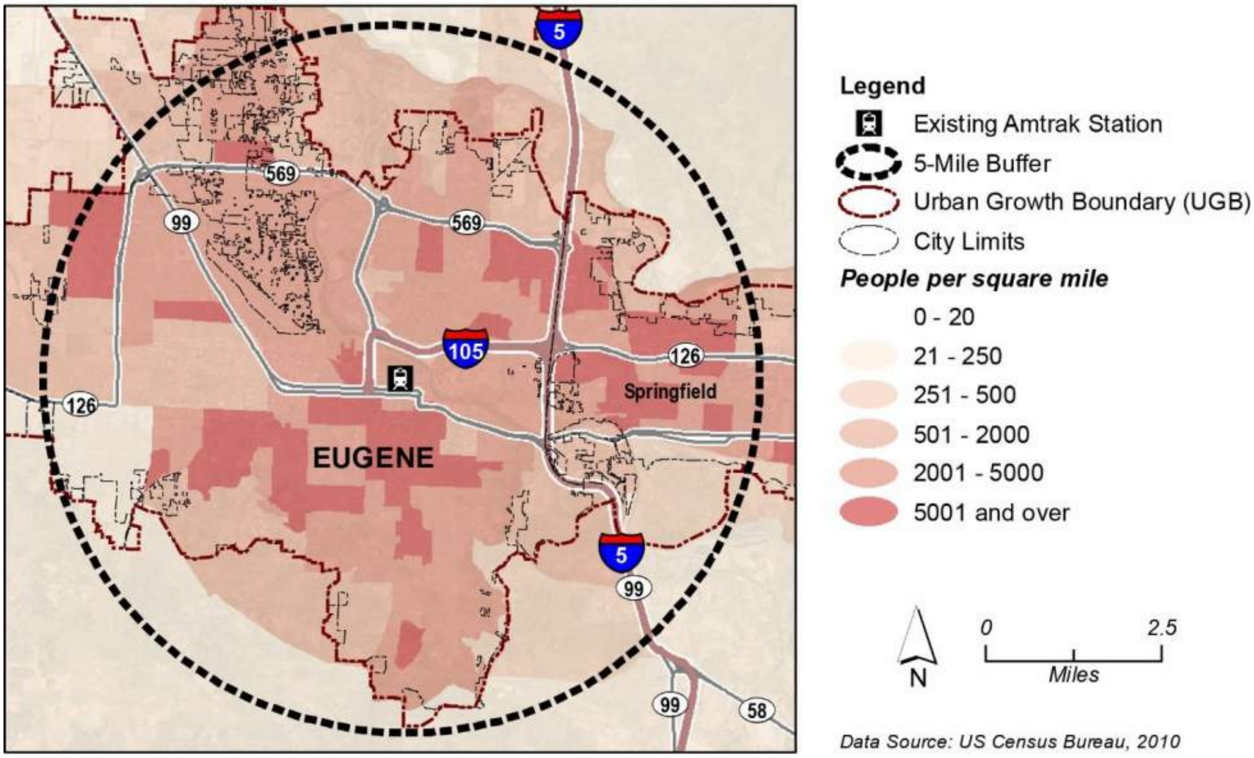


Figure C-33. Eugene Station Employment

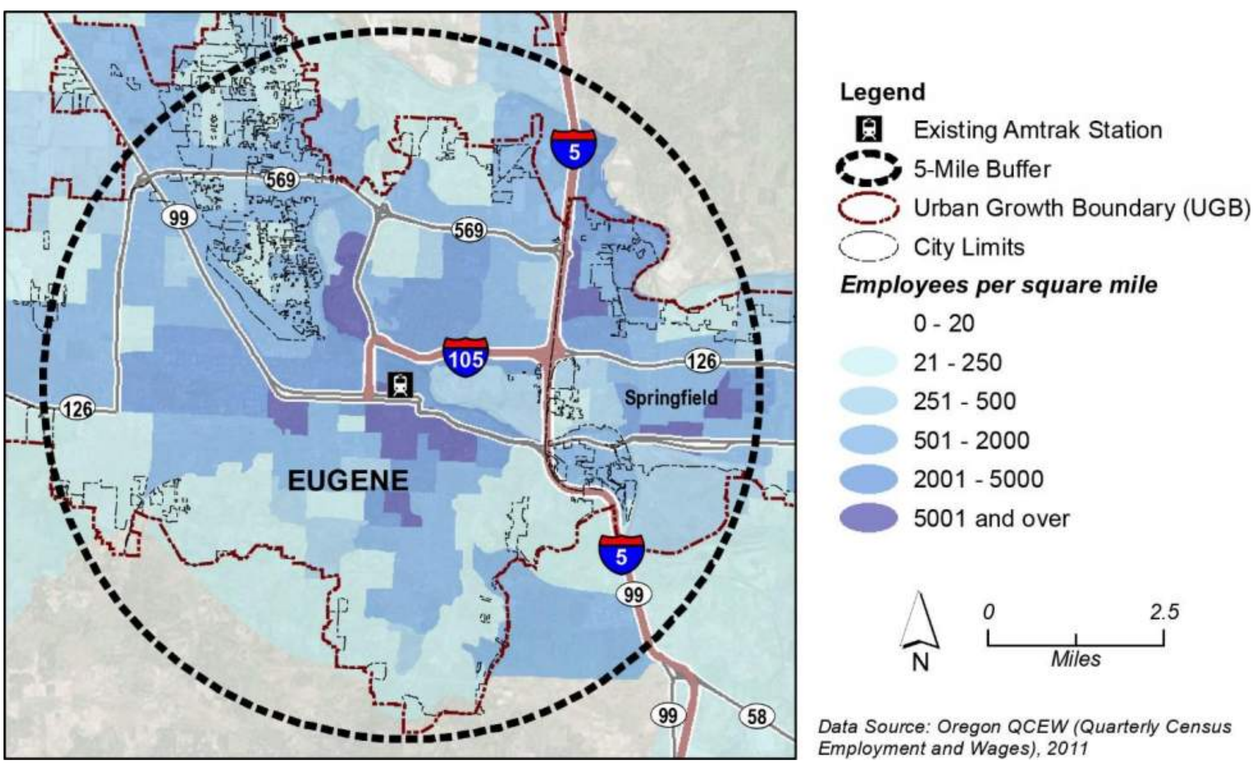
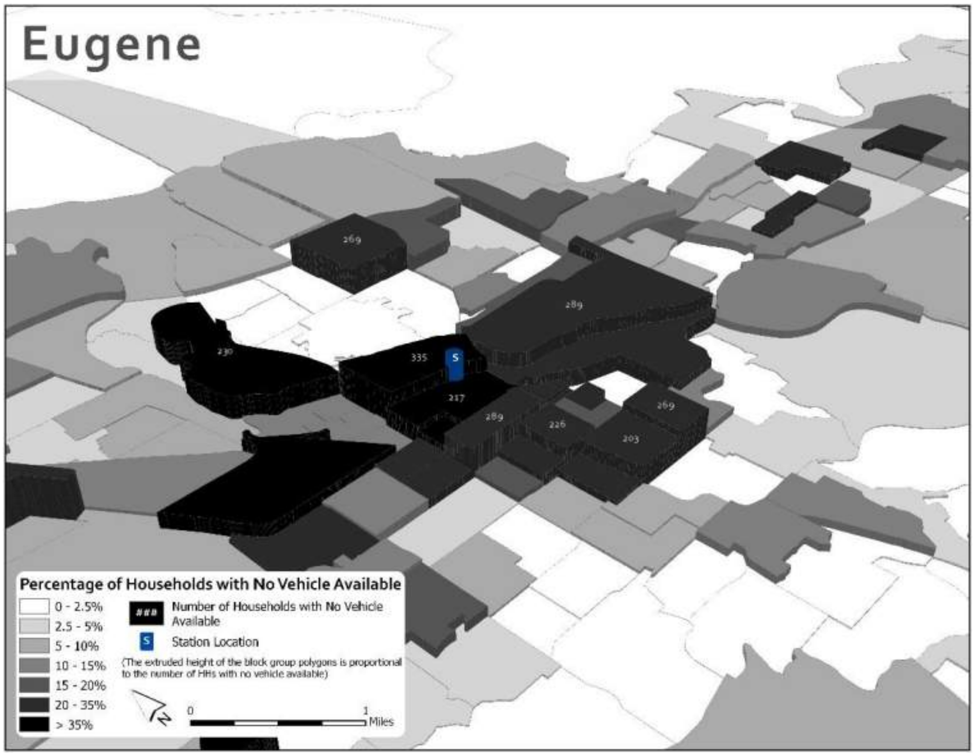


Figure C-34 summarizes the relative density and number of zero-auto households within the Eugene Station area. Within a one-mile radius of Eugene Station, there are a significant number of zero-auto households. These areas include the central city, University of Oregon, and high-densify residential areas west and north downtown Eugene.

Figure C-34. Eugene Station Zero-Auto Households

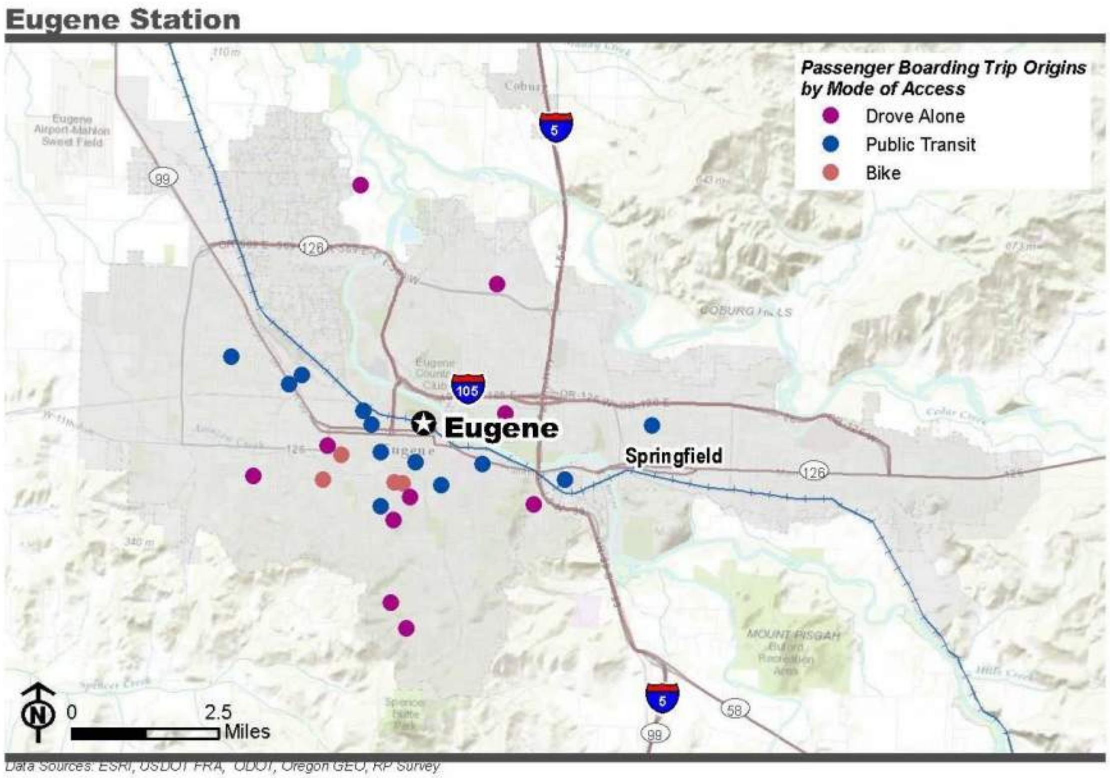


Data Source: U.S. Census Bureau. (2017). *2017 American Community Survey 5-Year Estimates, Table B25044 (Tenure by Vehicles Available).*

C.5.3 Mode of Access

The passenger survey respondents indicated that they walk to the station if they are located relatively close and are likely to be dropped off as they come from further away. Figure C-35 maps the mode of access by passenger rail riders as identified in the 2014 Revealed Preference Survey. Very few respondents indicated that they drive alone to the station. A small group of respondents also indicated that they take transit, bike and use a taxi.

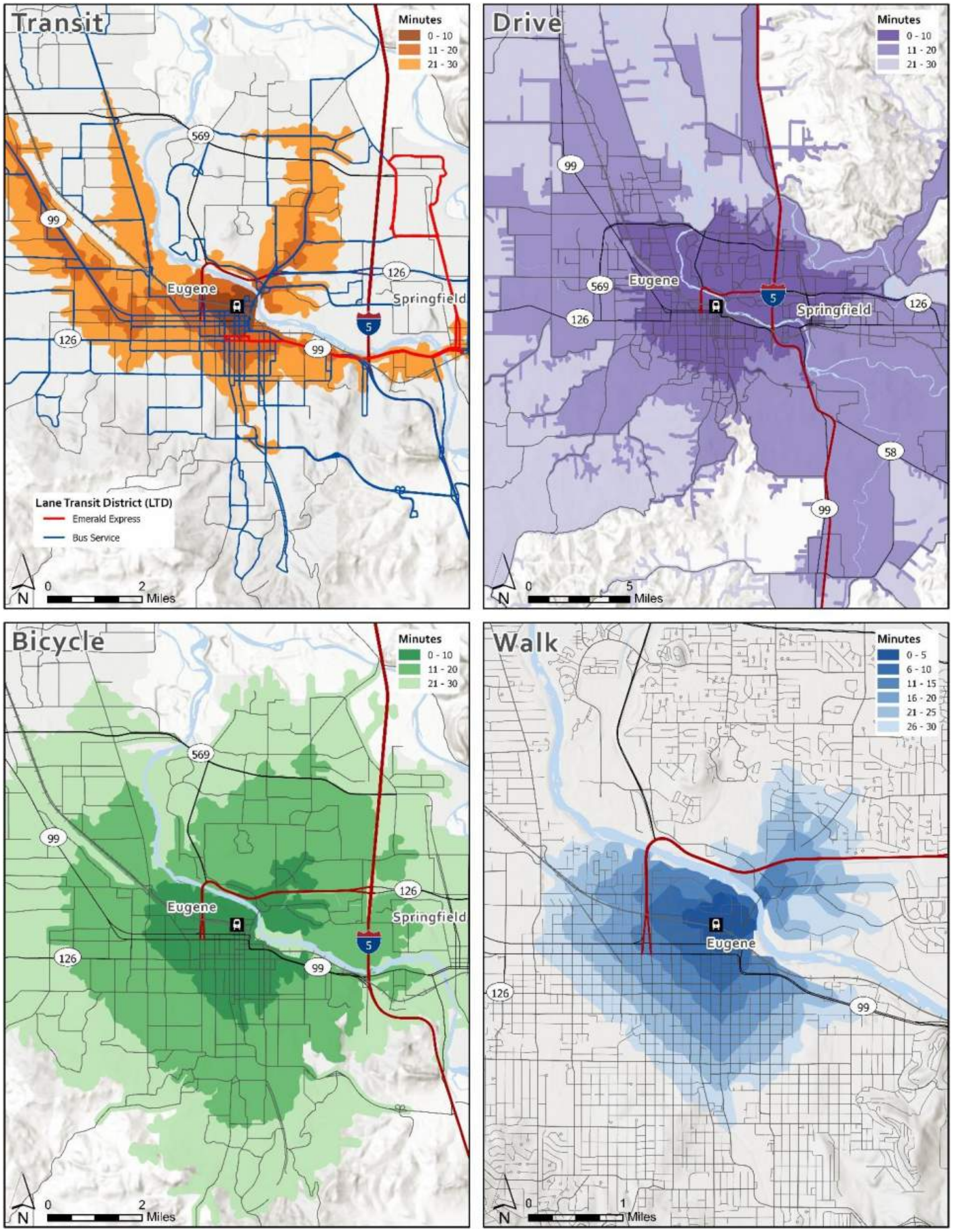
Figure C-35. Eugene Station Mode of Access



C.5.4 Multimodal Interconnectivity

Figure C-36 maps the Eugene station interconnectivity, illustrating separate travel sheds for walking and bicycle, transit and auto access. The transit travelshed is significantly smaller than the bicycle travelshed in Eugene, due in part to the distance separating Eugene station and the central city transit center. Though it may vary throughout the day, Amtrak Cascades riders who arrive/depart the Eugene station as a vehicle driver or passenger can travel from or reach destinations throughout the Eugene-Springfield urban area within 30 minutes.

Figure C-36. Eugene Station Travel sheds



Oregon Passenger Rail
Eugene - Portland
CHOOSING A PATH FORWARD

Appendix D

PRIIA

March 31, 2014

Oregon Department of Transportation

U.S. Department of Transportation
Federal Railroad Administration

AMTRAK

Cascades FY2014 PRIIA 209 State Payment Forecast

March 31, 2014

Summary
Amtrak Financial Analysis/Business Line Planning & Strategy through Amtrak's State Supported Business Line/State Partnerships is presenting a forecast of the state payment for FY2015 for the *Cascades*.

A summary of this forecast is displayed in the table below:

Comparison of FY2014 and FY2015 Route Forecast
PRIIA 209 Pricing Policy
(all numbers in FY2014 and FY2015 dollars as noted)

Cascades	Route Forecast		
	FY2014	FY2015	Change
Total Passenger & Other Revenue	**$36,126,000**	**$33,547,000**	**($2,579,000)**
Third Party Costs	$11,853,000	$10,997,000	($856,000)
Route Costs	37,465,000	40,224,000	2,759,000
Additives	8,207,000	8,601,139	394,139
Total PRIIA 209 Operating Costs	**$57,525,000**	**$59,822,139**	**$2,297,139**
State Operating Payment (Credit), Passenger Mile Split Option	**$21,399,000**	**$26,275,139**	**$4,876,139**
Equipment Capital Charge	$1,806,063	$3,761,052	$1,954,989
Fixed Asset Charge (not applied through FY2015)	$0	$0	$0
Total Capital Charges	**$1,806,063**	**$3,761,052**	**$1,954,989**
Total 209 State Payment	**$23,205,063**	**$30,036,191**	**$6,831,128**

Overall, the FY2015 PRIIA 209 State Forecast for the *Cascades* is $6.831 million higher than the FY2014 agreement, an increase of 14.54 percent. The primary cause is due to the continued forecast decrease in passenger revenue, down by $4.057 million over the FY2013 actuals, and $2.579 million from the FY2014 agreement forecast. While overall operating costs increase four percent over the FY2014 forecast, the increase over the inflated FY2013 actuals is $603,000, or one percent, primarily driven by forecast increases in station costs.

The FY2015 forecast state payment for the *Cascades* is split between Oregon and Washington based on the passenger mile derived shares of revenues and train mile derived shares of costs. These are summarized in the following table, with details on page 13.

Cascades FY 2015 PRIIA 209 Forecast, Split by State

(all numbers in $000s)

	FY2015 FORECAST	Oregon Share	Washington Share
Total Passenger & Other Revenue	**$33,547,000**	**$3,229,502**	**$30,317,498**
Third Party Costs	10,997,000	1,570,151	9,426,849
Route Costs	40,224,000	7,632,404	32,591,596
Additives	8,601,139	1,632,045	6,969,094
Total PRIIA 209 Costs	**$59,822,139**	**$10,834,599**	**$48,987,540**
PRIIA 209 State Operating Payment	**$26,275,139**	**$7,605,098**	**$18,670,041**
Equipment Capital Charge	3,761,052	713,650	3,047,402
Fixed Asset Capital Charge	n/a	n/a	0
Total Capital Charges	**$3,761,052**	**$713,650**	**$3,047,402**
Total 209 State Payment	**$30,036,191**	**$8,318,748**	**$21,717,443**

Revenues are split based on each state's share of passenger miles as split at Portland, OR, from FY2013, being 9.63 percent for Oregon and 90.37 percent for Washington. The host railroad portion of Third Party costs are based on the FY2013 share of Union Pacific costs going to Oregon, and the remainder going to Washington, resulting in 11.88 percent for Oregon, and 88.12 percent for Washington. All other costs are split based on the scheduled as split at Portland, OR, with 18.97 percent for Oregon and 81.03 percent for Washington.

Assumptions

This FY2015 forecast for the *Cascades* is based on FY2013 actuals as adjusted to account for any one-time FY2013 expenses or APT allocations. The FY2015 forecast assumes no change in the *Cascades* from the schedules, frequencies, consists or services as reflected in the schedules effective January 6, 2014. Additionally, no special holiday or peak services are included in this forecast.

Contract Type

Under the PRIIA 209 Methodology, states have the option of agreeing to either fixed or actual revenues and costs. The FY2015 agreement with the States of Oregon and Washington are anticipated to include the following:

Revenues:	Actual
Third Party Costs:	Actual
Route Costs:	Fixed
Additives:	Fixed

Schedule

This forecast includes the incremental impact of specific changes to the Portland-Eugene segment of the train schedules effective January 6, 2014, as shown on page 4.

Consist

There are no proposed changes to the current consists for FY2015 *Cascades*. The scheduled consists are provided in the following table:

Equipment Type/Description	Number of Units per Train	Notes
Core Consist		
Diesel Locomotive - F59 Diesel Loco	1	May operate with either locomotive type.
Diesel Locomotive - P42-8 Loco 1/3/97		
Talgo End Power Car	1	
Talgo Business Class	1	
Talgo ADA Business Class	1	
Talgo Table Car	1	
Talgo Bistro Car	1	
Talgo ADA Coach	1	
Talgo Coach	6	
Talgo Bike/Baggage Car	1	
F40 Cab/Baggage Car	1	Does not operate with 2 Oregon-owned Talgo Series 8 trainsets
Maximum Train Revenue Seating Capacity	280	

The *Cascades* requires a total of seven sets of equipment. Of this equipment, all of the locomotives are owned by Amtrak. Amtrak also owns two of the seven Talgo trainsets.

Washington State owns three of the Talgo trainsets, and Oregon owns two of the Talgo trainsets. Note that the two Oregon-owned Talgo sets include Talgo cab-control cars, and therefore do not include an additional F40 Cab/Baggage Car.
Overall, costs are inflated by 5.39 percent from the FY2013 base to the FY2015 forecast year. For costs primarily based on agreement labor, the inflation rate from the FY2013 base to the FY2015 forecast is 5.99 percent. For non-labor costs except for fuel, which is based on a separate forecast of the price per gallon, electric traction power and commissions, the inflation rate from the FY2013 base to the FY2015 forecast is 3.48 percent. These rates are consistent with those provided in the *Methodology for Determining Inflation Rates for Amtrak's Route Forecast Model and State Pricing Forecasts from FY2013 Base Actual Costs* of December 11, 2013.

The *Cascades* operated 3,963 train trips and 933,783 train miles in FY2013. This compares to a base schedule of 4,015 train trips and 954,110 train miles for FY2015. Therefore, in addition to inflating the FY2013 actuals for FY2015, applicable revenue and expenses have also been adjusted to reflect the scheduled service for FY2015 versus the actual operation of FY2013. In FY2013 there were a number of events that closed portions of the railroad right of way used by the *Cascades* which forced the cancellation of some service. These impacts are also seen in similar changes in the number of locomotive and car unit trips and miles, and train and engine crew and on-board service labor hours. A summary of the changes in select operating statistics is presented in the table below.

STATISTICS & PERFORMANCE MEASURES

FY2015 PRIIA 209 Forecast

Cascades	ACTUALS from 2013.Total	Actuals (Inflated for year above)	Incr. BASE (Scheduled) - Actuals	BASE (Scheduled)
STATISTICS (all but Frequency, Unit Trips , Units Used and Labor Hours in 000s)				
Total Riders	811,692	811,692	(2,392)	809,300
Total Operated Passenger Miles	125,497,488	125,497,488	(1,857,488)	123,640,000
Total Seat and Berth Miles	239,273,035	239,273,035	27,877,765	267,150,800
Frequency of Train Trips	3,963	3,963	52	4,015
Locomotive and Car Unit Trips	54,532	54,532	4,233	58,765
Total Operated Train Miles	933,783	933,783	20,327	954,110
Locomotive and Car Unit Miles	13,232,925	13,232,925	694,052	13,926,977
Average Locos and Cars Used per Day (Units Used) Financial Route	69	69	34	103
Diesel-Hauled Total Train Miles	933,783	933,783	20,327	954,110
Electric-Hauled Total Train Miles	-	-	-	-
Diesel Fuel Allocated Gallons	1,231,763	1,231,763	(65,188)	1,166,575
Total OBS Labor Hours	34,298	34,298	(238)	34,061
OBS Full Time Equivalent (FTE) positions	16.5	16.5	(0.1)	16.4
Conductor and Engineer Labor Hours	146,273	146,273	971	147,244
Conductor and Engineer Full Time Equivalent (FTE) positions	70.3	70.3	0.5	70.8
Scheduled Train Hours	N/A	N/A	N/A	21,596
PERFORMANCE MEASURES				
Load Factor (PM/SM)	52.45%	52.45%	(6.17%)	46.28%
Yield (Fare Revenue/PM)	$0.27	$0.27	($0.03)	$0.24
Cost/Seat Mile	$0.25	$0.25	($0.03)	$0.22
Revenue/Seat Mile	$0.16	$0.16	($0.03)	$0.13
Contribution (Loss)/Seat Mile	($0.09)	($0.09)	($0.01)	($0.10)
Revenue/Passenger Mile	$0.27	$0.27	($0.03)	$0.24
Contribution (Loss)/Passenger Mile	($0.18)	($0.17)	($0.03)	($0.21)
Cost/Passenger Mile	$0.48	$0.47	$0.01	$0.48
Cost Recovery (Revenue/Operating Cost)	62.4%	63.5%	(6.7%)	56.8%
Passenger Mile/Train Mile	134.4	134.4	(4.8)	129.6
Operating Ratio (Operating Cost/Passenger Revenue)	160.4%	157.5%	18.7%	176.2%
Passenger miles / Average Units Used	1,823,166	1,823,166	(622,778)	1,200,388
Unit Miles / Average Units Used	192,241	192,241	(57,028)	135,213
On-Time Performance	79.50%	79.50%	0.00%	79.50%
Average Minutes of Delay	45.87	45.87	0.00	45.87

Cascades FY2015 PRIIA 209 State Forecast
Southbound

Train Name ►				Cascades	Cascades	Cascades	Cascades	Cascades	Cascades	Cascades
Train Number ►				503	505	501	513	507	509	517
Normal Days of Operation ►				Mo-Fr xHo	SaSuHo	Daily	Daily	Daily	Daily	Daily
On Board Service ►				R B C Ba W	R B C Ba W	R B C Ba W	R B C Ba W	R B C Ba W	R B C Ba W	R B C Ba W
Station	Mile									
Vancouver, BC	0.0	PT	Dp				6:40 AM			**5:45 PM**
Bellingham, WA	62.3	PT					8:45 AM			**7:49 PM**
Mount Vernon, WA	87.8	PT					9:15 AM			**8:19 PM**
Stanwood, WA	99.1	PT					9:29 AM			**8:36 PM**
Everett, WA	122.7	PT					10:02 AM			**9:09 PM**
Edmonds, WA	139.3	PT					10:27 AM			**9:34 PM**
Seattle, WA	156.9	PT				7:30 AM	11:25 AM	**2:00 PM**	**5:30 PM**	**10:10 PM**
Tukwila, WA	167.7	PT				7:44 AM	11:39 AM	**2:14 PM**	**5:44 PM**	
Tacoma, WA	196.2	PT				8:13 AM	**12:08 PM**	**2:43 PM**	**6:13 PM**	
Olympia-Lacey, WA	231.9	PT				8:50 AM	**12:45 PM**	**3:20 PM**	**6:50 PM**	
Centralia, WA	251.0	PT				9:11 AM	**1:06 PM**	**3:41 PM**	**7:11 PM**	
Kelso-Longview, WA	294.3	PT				9:52 AM	**1:47 PM**	**4:22 PM**	**7:52 PM**	
Vancouver, WA	333.5	PT				10:30 AM	**2:25 PM**	**5:00 PM**	**8:30 PM**	
Portland, OR	343.4	PT		6:00 AM	8:30 AM	11:20 AM	**3:15 PM**	**6:05 PM**	**9:20 PM**	
Oregon City, OR	358.8	PT		6:21 AM	8:51 AM			**6:26 PM**		
Salem, OR	395.4	PT		7:07 AM	9:37 AM			**7:12 PM**		
Albany, OR	423.4	PT		7:36 AM	10:06 AM			**7:41 PM**		
Eugene, OR	467.0	PT		8:35 AM	11:05 AM			**8:40 PM**		

On Board Service Reference Marks:

B - Business Class, **Ba** - Checked Baggage, **Bi** - Bicycles, **C** - Café/Lounge, **Ca** - Cart Service, **D** - Dining Car, **F** - First Class, **R** - Reserved Coach, **S** - Sleeping Car, **U** - Unreserved Coach, **W** - WiFi

Cascades FY2015 PRIIA 209 State Forecast
Northbound

Train Name ►				Cascades	Cascades	Cascades	Cascades	Cascades
Train Number ►				510	500	506	516	508
Normal Days of Operation ►				Daily	Daily	Daily	Daily	Daily
On Board Service ►				R B C Ba W	R B C Ba W	R B C Ba W	R B C Ba W	R B C Ba W
Station	Mile							
Eugene, OR	0.0	PT	Dp		5:30 AM			**4:00 PM**
Albany, OR	43.6	PT			6:13 AM			**4:43 PM**
Salem, OR	71.6	PT			6:42 AM			**5:12 PM**
Oregon City, OR	108.2	PT			7:24 AM			**5:54 PM**
Portland, OR	123.6	PT			8:20 AM	**12:15 PM**	**2:45 PM**	**6:50 PM**
Vancouver, WA	133.5	PT			8:35 AM	**12:30 PM**	**3:00 PM**	**7:05 PM**
Kelso-Longview, WA	172.7	PT			9:10 AM	**1:05 PM**	**3:35 PM**	**7:40 PM**
Centralia, WA	216.0	PT			9:51 AM	**1:46 PM**	**4:16 PM**	**8:21 PM**
Olympia-Lacey, WA	235.1	PT			10:12 AM	**2:07 PM**	**4:37 PM**	**8:42 PM**
Tacoma, WA	270.8	PT			10:54 AM	**2:49 PM**	**5:19 PM**	**9:24 PM**
Tukwila, WA	299.3	PT			11:22 AM	**3:17 PM**	**5:47 PM**	**9:52 PM**
Seattle, WA	310.1	PT		7:40 AM	**12:10 PM**	**4:05 PM**	**6:50 PM**	**10:30 PM**
Edmonds, WA	327.7	PT		8:07 AM			**7:17 PM**	
Everett, WA	344.3	PT		8:31 AM			**7:42 PM**	
Stanwood, WA	367.9	PT		9:03 AM			**8:14 PM**	
Mount Vernon, WA	379.2	PT		9:21 AM			**8:27 PM**	
Bellingham, WA	404.7	PT		9:52 AM			**9:00 PM**	
Vancouver, BC	467.0	PT		11:40 AM			**10:50 PM**	

On Board Service Reference Marks:

B - Business Class, **Ba** - Checked Baggage, **Bi** - Bicycles, **C** - Café/Lounge, **Ca** - Cart Service, **D** - Dining Car, **F** - First Class, **R** - Reserved Coach, **S** - Sleeping Car, **U** - Unreserved Coach, **W** - WiFi

Operating Forecast

The PRIIA 209 operating forecast for the *Cascades* is presented on pages 11-12, with a comparison to the FY2014 forecast on page 14. Below is a description of the impact on specific revenue and cost categories.

Ridership and Revenue

Amtrak Market Research & Analysis, through SDG, forecast ridership, passenger miles and ticket revenue for FY2015. For the *Cascades*, the FY2015 demand is forecast to include $29,772,000 ticket revenue, 809,300 passengers, and 123,640,000 passenger miles. Forecast ticket revenue decreases from FY2013 actuals by $3,764,000 while passengers decrease by 2,392 and passenger miles decrease by 1,857,488. The passenger and passenger mile forecasts include an adjustment to reflect the shift in Amtrak's methodology for counting the ridership from multi-ride ticketholders to use e-Ticketing scanned counts. As this change does not impact the number of multi-ride tickets sold, ticket revenue is not affected.

Planning & Strategy forecast a decrease of $72,000 in food and beverage revenue due to the overall forecast decrease in passenger miles.

Operating Costs

Third Party Costs

Host Railroad
Host Railroad costs are based on the FY2013 host railroad costs as reported in the Amtrak Performance Tracking system, inflated to FY2015 dollars, and adjusted for the scheduled train miles. If the service continues to operate with its FY2013 on-time performance rate of 79.5 percent, these costs are forecast to be $7.275 million in FY2015. Further improvements in host railroad operating performance on this route could increase host railroad costs, perhaps to $7.314 million if on-time performance reaches 90 percent as calculated per the individual host railroad agreements.

Fuel
Fuel and power costs are forecast on the FY2013 APT experience using the fuel model, as the consists are changed in January 2014 with the operation of the two new Oregon Talgo trainsets that include a cab control car, eliminating the need for an Amtrak-provided unit. Amtrak forecasts the FY2015 average price per gallon of diesel fuel at Seattle and Portland to be $3.19 in FY2015. This forecast rate is down considerably from the $3.48 per gallon assumed in the FY2014 forecast.

Route Costs

Train & Engine Crews
Train and engine (T&E) crew costs are forecast to increase in FY2015 by $68,000 from the inflated actuals due to the full year of scheduled operation over the FY2013 operation where some service was cancelled due to special occurrences that closed the rail line, net of the slight savings generated by the January 6, 2014, Portland-Eugene schedule change and increase due to the longer Seattle-Portland schedule time to accommodate BNSF track work. The assumed T&E crew includes one engineer, one conductor, and one assistant conductor on board all scheduled frequencies.

A total of approximately 71 train and engine crew full-time equivalents (conductors and engineers) are included in this forecast.

Car & Locomotive Maintenance and Turnaround
The $124,000 increase in car and locomotive maintenance and turnaround costs over the FY2013 inflated actuals is due to several factors. One is the need to operate additional locomotives to support the two additional Talgo trainsets Oregon has acquired, which increases the total number of trainsets from five to seven. However, these two new trainsets will require less miles to be operated in daily service by the separate F40 cab-baggage (NPCU) cars, reducing some forecast maintenance expenses for this equipment.

The FY2013 base cost for car and locomotive maintenance and turnaround were reduced by $62,000 due to an adjustment for credits related to labor activity that did not include the necessary information to apply to the functions included in the PRIIA 209 Methodology.

The table below provides an additional breakdown of the maintenance of equipment cost forecast by turnaround servicing, locomotive maintenance, and car maintenance costs.

Car & Locomotive Maintenance and Turnaround
(all numbers in FY2015 dollars except where noted)

	Adjusted Actuals (Inflated to FY2015)	Incr.Base (Scheduled - Adusted Actuals)	FY2015 Base (Scheduled)
Turnaround Servicing	$7,320,991	$78,395	$7,399,417
Loco Maintenance	$1,658,155	$48,322	$1,706,420
Car Maintenance	$766,854	($2,717)	$764,163
Total: Car & Loco Maintenance and Turnaround	**$9,746,000**	**$124,000**	**$9,870,000**

The majority of *Cascades* costs in this area are within turnaround servicing, which includes those costs from Amtrak's Seattle maintenance facility as well as turnaround costs at Portland and Eugene related to the *Cascades*. Turnaround also includes costs Amtrak incurs with its contract with Talgo to maintain the Amtrak-owned Talgo trainsets. Locomotive maintenance is for preventative maintenance and repairs for the *Cascades'* share of diesel locomotives that operate on the service, primarily based on the number of units used and unit miles. These include both Amtrak F59 and P42 locomotives. Car maintenance is for preventative maintenance and repairs for the *Cascades'* share of train cars that operate on the service, primarily based on the number of units used and unit miles. For this forecast, these are related to the F40 cab-baggage NPCU cars that operate on five of the seven trainsets.

The FY2015 forecast cost of $9.87 million is $1.531 million higher than the FY2014 forecast, due to the reasons presented above and due to higher reported actual expenses in FY2013 over the FY2012 actuals that formed the basis of the FY2014 forecast. Of this difference, $235,000 is due to the exclusion of Amtrak's costs to GE for the maintenance support of the share of P42 diesel locomotives used in *Cascades* service. The remainder is primarily due to the increase in turnaround costs in the FY2013 actual experience over FY2012, the basis of the FY2014 forecast.

On Board Service Crew
OBS labor costs are forecast to decrease by $21,000 in FY2015 compared to the inflated actuals due to the scheduled operation versus the FY2013 actual service, net of the savings generated by the January 6, 2014 schedule change for the Portland-Eugene segment and increases due to the longer Seattle-Portland schedule time to accommodate BNSF track work. This forecast is $59,000, or 1.98 percent, higher than the FY2014 forecast. All frequencies include one lead service attendant (LSA) to support the bistro food service. In addition, frequencies serving Vancouver, BC include an operations supervisor.

A total of approximately 16 full-time equivalents, excluding the operations supervisors and extra board positions, are included in this forecast.

OBS Commissary Provisions
OBS commissary provision costs are forecast to decrease from the adjusted actuals by $26,000 to $2.079 million in FY2015 due to the forecast decrease in food and beverage revenue resulting from overall decrease in forecast passenger demand. This forecast is $87,000, or 4.02 percent, lower than the FY2014 forecast cost.

The FY2013 actuals are adjusted by $783,000 to include costs related to Amtrak's contract with Aramark to supply and load commissary items on the train for sale. These costs were excluded in the APT actuals that form the basis of the commissary provisions route costs included in the PRIIA 209 Methodology.

Route Advertising
There are no route advertising costs included for the *Cascades*.

Sales Distribution
Sales distribution costs are driven by changes in the number of passengers. Sales distribution costs are adjusted with a $225,000 increase from the inflated FY2013 actuals to $681,000 to capture the costs of offering AmtrakConnect on-board Wi-Fi service on the *Cascades*. This forecast is $140,000 higher than the FY2014 forecast primarily due to the capture of all Wi-Fi related costs for the seven Talgo trainsets for FY2015.

Reservations & Call Centers
Reservations and call center costs are forecast to decrease by $98,000 to $2.302 million from the adjusted base due to a forecast reduction in talk time due to the forecast decrease in ridership versus the forecast increase in overall Amtrak system passenger demand.

In FY2013, the average reservations sales office talk time per *Cascades* passenger was 8.9 minutes. This rate is not anticipated to change significantly in FY2015.

Stations
Route station costs are forecast to increase by $50,000 from the inflated actuals due to increases in station security costs at Vancouver, BC.

Shared station costs are forecast to increase by $637,000 from the adjusted actuals due to the *Cascades'* share of the forecast incremental increase in station rent and facility costs of $900,000 at the renovated Seattle King Street Station. This increase more than offsets the overall decrease of $110,000 in shared station costs due to the overall forecast decrease in passenger demand compared to the forecast growth on other Amtrak services sharing these stations.

Commissions
Credit card and travel agent commissions are forecast to decrease by $92,000 from the adjusted FY2013 actuals to $763,000 for FY2015 due to the forecast decrease in revenue. These costs are not inflated as they are directly tied to changes in revenue.

The FY2013 actual commissions costs are adjusted with a $492,000 decrease due to two reasons. Commissions paid to VIA Rail Canada for interline sales of Amtrak tickets for the *Cascades* in FY2013 are adjusted to replace a reconciliation payment made in FY2013 with an annualized figure. In addition, the adjustment includes the change in the travel agency sales allocations in APT beginning in June 2013 that more accurately reflect the generation of these costs by Amtrak-defined leisure trains.

Customer Concession
Customer concession costs are forecast to be $56,000, with no changes from the FY2013 actuals except for an inflationary increase.

Connecting Motor Coach
All connecting motor coach costs are removed from the forecast consistent with the state agreements. Also note that the forecast only includes the connecting *Cascades* train portion of any ticket revenue generated by connecting services.

Regional/Local Police
Regional and local police costs change in relation to changes in the total car and locomotive trips. The *Cascades'* share of regional/local police costs are forecast to increase by $13,000 from the adjusted actuals due to the forecast increase in locomotive and car trips resulting from the full FY2015 scheduled operation against a slight decrease due to the reduced number of trips operating with an F40 cab-baggage car.

The FY2013 actuals are adjusted with a $41,000 decrease due to costs for cost center 3042 Police-Mid-Atlantic Division North moved out of the route costs to the national police costs for work performed that is national in nature and not directly related to the *Cascades*.

The FY2015 forecast regional/local police cost is higher than the FY2014 forecast by $25,000 due to the actual FY2013 costs being higher than those in FY2012. The FY2013 actuals are the basis of the FY2015 forecast as the FY2012 actuals were the basis of the prior FY2014 forecast.

Terminal Yard Operations
Terminal yard operation costs are forecast to increase by $78,000 from the adjusted actuals due to the combination of supporting two additional trainsets and the full operation of the schedule in FY2015, resulting in the forecast increase in car and locomotive trips.

The FY2013 actuals are adjusted with a $27,000 decrease due to the removal of those terminal yard operations costs within APT related to the movement of cars and locomotives for mechanical work and not directly related to train make up. Overall, the FY2015 forecast is $99,000 below the FY2014 forecast for terminal yard operations.

Terminal Maintenance of Way
There is no terminal maintenance of way cost forecast for the *Cascades*.

Insurance
Insurance costs are forecast to increase on the *Cascades* for FY2015 by $653,000 from the FY2013 actuals to $1.644 million. Of this increase, $372,000 are due to Amtrak's claims

history in 2013, which results in costs more in line with the overall railroad industry due to the overall high risk of claims.

In addition, the FY2013 actuals and the FY2014 forecast excluded the cost of the premium for the deductible buy down for the Oregon and Washington State owned equipment. This premium, estimated to be $267,000 in FY2015, is included in this forecast.

Another $10,000 from the adjusted actuals is included in the forecast primarily due to the incremental forecast increase in station costs and $4,000 due to the difference in costs between the FY2013 actuals and those related to the FY2015 scheduled base service, as these purchased insurance costs are allocated on their relationship with the corporation's overall cost activity.

PRIIA 209 Methodology Additives

All additive rates presented in this forecast are consistent with those published in the PRIIA Section 209 Cost Methodology Policy.

The Marketing additive is forecast to decrease by $77,083 over the adjusted actuals and by $48,063 over the FY2014 forecast due to the projected decrease in total revenue.

The T&E additive is forecast to increase by $22,032 over the adjusted actuals and by $4,696 over the FY2014 forecast due to the increase in train and engine crew costs.

The MoE additive is forecast to increase by $33,604 over the adjusted actuals and by $414,770 over the FY2014 forecast due to the increase in car & locomotive maintenance and turnaround costs.

The OBS additive is forecast to decrease by $4,700 over the adjusted actuals and by $3,400 over the FY2014 forecast due to the increase in OBS crew and OBS commissary provisions costs.

The Police additive is forecast to decrease by $9,288 over the adjusted actuals and by $28,800 over the FY2014 forecast due to the projected decrease in passenger miles.

The G&A additive is forecast to increase by $22,580 over the adjusted actuals and by $55,480 over the FY2014 forecast due to the projected increase in route station and shared station costs offset somewhat by the overall decrease in other route costs from the inflated actuals.

All Other Operating Costs
No other operating costs are forecast to be impacted by the proposed changes. However, future route profit (loss) statements may show changes to other expense lines due to cost allocations in APT (Amtrak Performance Tracking) due to associated changes in revenue, passenger statistics, and/or operating statistics.

Associated Capital Charges

Equipment Capital
For FY2015, the equipment capital use charge is forecast to be $3.761 million for the *Cascades* for the use of four Amtrak-owned P42 Diesel Locomotives, three F59PH Diesel Locomotives, five NPCU (F40 cab-baggage cars), and the seven (two owned by Amtrak) Talgo trainsets. The number of units is factored down slightly to reflect the calculated

average units used in APT. Equipment within these fleet types is forecast to undergo capital overhaul during FY2015. The table on page 15 details the forecast equipment capital use charge per equipment type. This charge is assumed to be split on the basis of train miles between Oregon and Washington as provided in the summary table on page 1.

As Oregon and Washington took the "lower" equipment capital use option that pre-dated the FY2014 PRIIA 209 forecast for the *Cascades,* the FY2015 forecast charge is $1.955 million higher than the FY2014 contract estimated amount, but just $477,000 higher than the FY2014 forecast. The FY2015 forecast is based on data currently under review by the Next Generation Equipment Committee (NGEC) Section 209 Equipment Capital Work Group. It includes the units used pro-rata share of Positive Train Control (PTC) installation in the P42 locomotives and NPCU cab-baggage cars. It also includes the units used pro-rata share of F59 locomotive overhauls.

Fixed Asset Capital
The methodology for this charge is still under development and will not be included in the FY2015 PRIIA 209 state operating agreements.

Cascades FY2015 PRIIA 209 State Forecast
PRIIA 209 Pricing Policy
(all numbers in FY2015 dollars except where noted)

		Impact of Change in Service	
	FY2015 Base (Scheduled)	Increment	Base + Increment
REVENUES[1]			
Ticket Revenue	$29,722,000	$0	$29,722,000
Food & Beverage	3,064,000	-	3,064,000
Other Revenue	761,000	-	761,000
Total Revenue	**$33,547,000**	$0	**$33,547,000**
EXPENSES[2]			
Third Party Costs			
Host Railroad (Maintenance of Way and Performance Incentives)	$7,275,000	$0	$7,275,000
Synthetic Host Railroad Charge	-	-	-
Fuel and Power	3,722,000	-	3,722,000
Subtotal: Third Party Costs	**$10,997,000**	$0	**$10,997,000**
Route Costs			
Train & Engine Crew Labor	$10,354,000	$0	$10,354,000
Car & Locomotive Maintenance and Turnaround	9,870,000	-	9,870,000
OBS - Crew	3,037,000	-	3,037,000
Commissary Provisions	2,079,000	-	2,079,000
Route Advertising	-	-	-
Sales Distribution	681,000	-	681,000
Reservations & Call Centers	2,302,000	-	2,302,000
Stations - Route	846,000	50,000	896,000
Stations - Shared	6,645,000	637,000	7,282,000
Commissions	763,000	-	763,000
Customer Concession	56,000	-	56,000
Connecting Motor Coach	-	-	-
Regional/Local Police	178,000	-	178,000
Block & Tower Operations	-	-	-
Terminal Yard Operations	1,082,000	-	1,082,000
Terminal MoW	-	-	-
Insurance	1,634,000	10,000	1,644,000
Subtotal: Route Costs	**$39,527,000**	**$697,000**	**$40,224,000**
Additives			
Marketing	$637,393	$0	$637,393
T&E	3,354,696	-	3,354,696
MoE	2,674,770	-	2,674,770
OBS	511,600	-	511,600
Police	618,200	-	618,200
G&A	790,540	13,940	804,480
Total: Additives	**$8,587,199**	**$13,940**	**$8,601,139**
Total Expenses	**$59,111,199**	**$710,940**	**$59,822,139**
Estimated State Payment or (Credit)	**$25,564,199**	**$710,940**	**$26,275,139**

Notes
1. 'Actuals' are revenues per APT (FY2013). 'BASE' are revenues as forecast by Amtrak for FY2015.
2. Expenses per APT (FY2013) inflated to FY2015.

Please see page 12 for the calculation of the FY2015 Base (Scheduled) figures.

Calculation of the FY2015 Base (Scheduled) for the Cascades from FY2013 Actuals

Cascades FY2015 PRIIA 209 State Forecast
PRIIA 209 Pricing Policy
(all numbers in FY2015 dollars except where noted)

	PRIIA 209 Based on APT Actuals from FY2013	Adjustments to FY2013 Actuals	Adjusted FY2013 Actuals	Adjusted Actuals (Inflated to FY2015)	Incr.Base (Scheduled - Adjusted Actuals)	FY2015 Base (Scheduled)
REVENUES[1]						
Ticket Revenue	$33,707,000	$0	$33,707,000	$33,707,000	($3,985,000)	$29,722,000
Food & Beverage	3,136,000		3,136,000	3,136,000	(72,000)	3,064,000
Other Revenue	761,000		761,000	761,000		761,000
Total Revenue	**$37,604,000**	$0	**$37,604,000**	**$37,604,000**	**($4,057,000)**	**$33,547,000**
EXPENSES[2]						
Third Party Costs						
Host Railroad (Maintenance of Way and Performance Incentives)	$6,755,000	$0	$6,755,000	$7,120,000	$155,000	$7,275,000
Synthetic Host Railroad Charge						
Fuel and Power	4,102,000		4,102,000	4,390,000	(668,000)	3,722,000
Subtotal: Third Party Costs	**$10,857,000**	$0	**$10,857,000**	**$11,510,000**	**($513,000)**	**$10,997,000**
Route Costs						
Train & Engine Crew Labor	$9,705,000	$0	$9,705,000	$10,286,000	$68,000	$10,354,000
Car & Locomotive Maintenance and Turnaround	9,309,000	(62,000)	9,247,000	9,746,000	124,000	9,870,000
OBS - Crew	2,885,000		2,885,000	3,058,000	(21,000)	3,037,000
Commissary Provisions	1,251,000	783,000	2,034,000	2,105,000	(26,000)	2,079,000
Route Advertising						
Sales Distribution	433,000		433,000	456,000	225,000	681,000
Reservations & Call Centers	2,278,000		2,278,000	2,400,000	(98,000)	2,302,000
Stations - Route	803,000		803,000	846,000		846,000
Stations - Shared	6,410,000		6,410,000	6,755,000	(110,000)	6,645,000
Commissions	1,346,000	(492,000)	854,000	855,000	(92,000)	763,000
Customer Concession	54,000		54,000	56,000		56,000
Connecting Motor Coach	4,558,000	(4,558,000)				
Regional/Local Police	196,000	(41,000)	155,000	165,000	13,000	178,000
Block & Tower Operations						
Terminal Yard Operations	974,000	(27,000)	947,000	1,004,000	78,000	1,082,000
Terminal MoW	2,000	(5,000)	(3,000)			
Insurance	991,000		991,000	1,363,000	271,000	1,634,000
Subtotal: Route Costs	**$41,195,000**	**($4,402,000)**	**$36,793,000**	**$39,095,000**	**$432,000**	**$39,527,000**
Additives						
Marketing	$714,476	$0	$714,476	$714,476	($77,083)	$637,393
T&E	3,144,420		3,144,420	3,332,664	22,032	3,354,696
MoE	2,522,739	(16,802)	2,505,937	2,641,166	33,604	2,674,770
OBS	413,600	78,300	491,900	516,300	(4,700)	511,600
Police	627,488		627,488	627,488	(9,288)	618,200
G&A	823,900	(88,040)	735,860	781,900	8,640	790,540
Total: Additives	**$8,246,623**	**($26,542)**	**$8,220,081**	**$8,613,994**	**($26,795)**	**$8,587,199**
Total Expenses	**$60,298,623**	**($4,428,542)**	**$55,870,081**	**$59,218,994**	**($107,795)**	**$59,111,199**
Estimated State Payment or (Credit)	**$22,694,623**	**($4,428,542)**	**$18,266,081**	**$21,614,994**	**$3,949,206**	**$25,564,199**

Notes
1. 'Actuals' are revenues per APT (FY2013). 'BASE' are revenues as forecast by Amtrak for FY2015.
2. Expenses per APT (FY2013) inflated to FY2015.

FY 2015 Cascades PRIIA 209 Base Forecast, Split by State
FY2015 (all numbers in $000s)

Cascades	FY 2015 Total Route	Oregon Share	Washington Share
REVENUES[1]			
Ticket Revenue	$29,722,000	$2,861,277	$26,860,723
Food & Beverage	3,064,000	294,965	2,769,035
Other Revenue	761,000	73,260	687,740
Total Revenue	**$33,547,000**	**$3,229,502**	**$30,317,498**
EXPENSES[2]			
Third Party Costs			
Host Railroad (Maintenance of Way and Performance Incentives)	$7,275,000	$863,910	$6,411,090
Host Railroad Maintenance of Way	$4,434,000	$526,540	$3,907,460
Host Railroad Performance Incentives	2,841,000	337,370	2,503,630
Synthetic Host Railroad Charge	-	-	-
Fuel and Power	3,722,000	706,240	3,015,760
Route Costs			
Train & Engine Crew Labor	10,354,000	1,964,646	8,389,354
Car & Locomotive Maintenance and Turnaround	9,870,000	1,872,808	7,997,192
OBS - Crew	3,037,000	576,263	2,460,737
Commissary Provisions	2,079,000	394,485	1,684,515
Route Advertising	-	-	-
Sales Distribution	681,000	129,218	551,782
Reservations & Call Centers	2,302,000	436,799	1,865,201
Stations - Route	896,000	170,014	725,986
Stations - Shared	7,282,000	1,381,741	5,900,259
Commissions	763,000	144,777	618,223
Customer Concession	56,000	10,626	45,374
Connecting Motor Coach	-	-	-
Regional/Local Police	178,000	33,775	144,225
Block & Tower Operations	-	-	-
Terminal Yard Operations	1,082,000	205,307	876,693
Terminal MoW	-	-	-
Insurance	1,644,000	311,945	1,332,055
Additives			
Marketing	637,393	120,944	516,449
T&E	3,354,696	636,545	2,718,151
MoE	2,674,770	507,531	2,167,239
OBS	511,600	97,075	414,525
Police	618,200	117,302	500,898
G&A	804,480	152,648	651,832
Total Expenses	**$59,822,139**	**$10,834,599**	**$48,987,540**
Estimated State Payment or (Credit)	**$26,275,139**	**$7,605,098**	**$18,670,041**

Notes
1. 'Actuals' are revenues per APT (FY2013). 'BASE' are revenues as forecast by Amtrak for FY2015.
2. Expenses per APT (FY2013) adjusted and inflated to FY2015.

Route & Service Financial Evaluation
Financial Analysis, Business Line Planning & Strategy

AMTRAK

Comparison of FY2014 and FY2015 Route Forecast
PRIIA 209 Pricing Policy
(all numbers in FY2014 and FY2015 dollars as noted)

Cascades	Route Forecast			
	FY2014	FY2015	Change	% Change
REVENUES[1]				
Ticket Revenue	$32,188,000	$29,722,000	($2,466,000)	(7.66%)
Food & Beverage	3,330,000	3,064,000	(266,000)	(7.99%)
Other Revenue	608,000	761,000	153,000	25.16%
Total Revenue	**$36,126,000**	**$33,547,000**	**($2,579,000)**	**(7.14%)**
EXPENSES[2]				
Third Party Costs				
Host Railroad (Maintenance of Way and Performance Incentives)	$7,790,000	$7,275,000	($515,000)	(6.61%)
Synthetic Host Railroad Charge	-	-	-	NA
Fuel and Power	4,063,000	3,722,000	(341,000)	(8.39%)
Subtotal: Third Party Costs	**$11,853,000**	**$10,997,000**	**($856,000)**	**(7.22%)**
Route Costs				
Train & Engine Crew Labor	$10,338,000	$10,354,000	$16,000	0.15%
Car & Locomotive Maintenance and Turnaround	8,339,000	9,870,000	1,531,000	18.36%
OBS - Crew	2,978,000	3,037,000	59,000	1.98%
Commissary Provisions	2,166,000	2,079,000	(87,000)	(4.02%)
Route Advertising	-	-	-	NA
Sales Distribution	541,000	681,000	140,000	25.88%
Reservations & Call Centers	2,523,000	2,302,000	(221,000)	(8.76%)
Stations - Route	941,000	896,000	(45,000)	(4.78%)
Stations - Shared	6,573,000	7,282,000	709,000	10.79%
Commissions	775,000	763,000	(12,000)	(1.55%)
Customer Concession	63,000	56,000	(7,000)	(11.11%)
Connecting Motor Coach	-	-	-	NA
Regional/Local Police	153,000	178,000	25,000	16.34%
Block & Tower Operations	-	-	-	NA
Terminal Yard Operations	1,181,000	1,082,000	(99,000)	(8.38%)
Terminal MoW	7,000	-	(7,000)	(100.00%)
Insurance	887,000	1,644,000	757,000	85.34%
Subtotal: Route Costs	**$37,465,000**	**$40,224,000**	**$2,759,000**	**7.36%**
Additives				
Marketing	$686,000	$637,393	($48,607)	(7.09%)
T&E	3,350,000	3,354,696	4,696	0.14%
MoE	2,260,000	2,674,770	414,770	18.35%
OBS	515,000	511,600	(3,400)	(0.66%)
Police	647,000	618,200	(28,800)	(4.45%)
G&A	749,000	804,480	55,480	7.41%
Total: Additives	**$8,207,000**	**$8,601,139**	**$394,139**	**4.80%**
Total Expenses	**$57,525,000**	**$59,822,139**	**$2,297,139**	**3.99%**
State Operating Payment (Credit)	**$21,399,000**	**$26,275,139**	**$4,876,139**	**22.79%**

Notes
1. *'Actuals' are revenues per APT (FY2013). 'BASE' are revenues as forecast by Amtrak for FY2015.*
2. *Expenses per APT (FY2013) inflated and forecast for FY2015.*

Cascades APT_RT_36
Forecast Equipment Capital Use Charge
FY 2015 $s in Thousands (000s)

Mechanical Capital Overhaul Projects	FY2015 Total Cost	APT Stat Qualifier/Equipment Type		Daily Units Used	Units Used Percentage	FY 2015 Forecast Equipment Charge
NPCU Overhaul	$1,479,000	SQ_EQ_CBBC	Cab Car - Bge Cab/Ccm 2/7/96	4.00	28.57%	$422,571
		SQ_EQ_EXEH	Electric Loco- Hhp-8 Elect Loco	0.00	0.00%	$0
		SQ_EQ_EXAE	Electric Loco - Aem - 7	0.00	0.00%	$0
ACS 64 Acquisition (RRIF)	$27,200,000	SQ_EQ_EXAC	Electric Loco - ACS - 64	0.00	0.00%	$0
P-42 LCPM	$20,060,449	SQ_EQ_DXB	Diesel Locomotive - P42-8 Loco 1/3/97	4.00	2.52%	$505,619
P-32DM LCPM	$2,288,042	SQ_EQ_DXDM	Diesel Loco - P32-Ac-Dm	0.00	0.00%	$0
LCPM Paint	$1,092,000	SQ_EQ_DXB	Diesel Locomotive - P42-8 Loco 1/3/97	4.00	2.52%	$27,524
F-59 Overhaul	$6,978,000	SQ_EQ_DXGM	Diesel Locomotive - F59 Diesel Loco	3.00	27.27%	$1,903,091
P-32-8 ED Overhaul	$5,480,000	SQ_EQ_DXBH	Diesel Locomotive - P32-8	0.00	0.00%	$0
		-	-			
LOCOMOTIVES	**$64,577,491**					**$2,858,805**
Talgo Equipment Modifications	$500,000	SQ_EQ_TTTU	Talgo Train Prim Equip - Coach	12.00	100.00%	$500,000
TALGO	**$500,000**					**$500,000**
Positive Train Control (PTC)	$8,774,000	SQ_EQ_PTC	PTC	8.00	4.58%	$402,246
PTC	**$8,774,000**					**$402,246**
Total Forecast Equipment Capital Use Charge for			**Cascades**			**$3,761,052**

Oregon Passenger Rail
Eugene - Portland
CHOOSING A PATH FORWARD

Appendix E

Economic Assessment

October 6, 2020

Oregon Department of Transportation

U.S. Department of Transportation
Federal Railroad Administration

Economic Assessment

1. Introduction

In support of the Oregon Department of Transportation's (ODOT) Oregon Passenger Rail (OPR) Project, an economic assessment of the project was conducted using two approaches: 1. Benefit-Cost Analysis (BCA) and 2. Economic Impact Analysis (EIA).

The two approaches measure the economic viability of projects differently. Fundamentally, EIA and BCA address different questions:

- BCA - addresses whether society is better off by performing a certain action (such as investing in improved rail service) versus doing nothing. BCA describes the viability of a project in terms of the ratio of benefits to costs, and net value (benefits less costs).

- EIA - addresses how an economy is likely to change in response to an action. EIA describes the impacts of a project in terms of its impacts on a region's employment, wages, Gross Regional or State Product, and taxes.

The focus of this study is on the BCA, particularly the benefit-cost ratio and net present value of the project, which are often criteria in the selection of a project for federal grant funding. The EIA compliments the BCA, but the results describe broader regional impacts and are not additive to the BCA results.

The BCA and EIA in this chapter build upon the information presented in Chapter 5, which presents the Demand Revenue Forecast, and Chapter 6, which presents the Operating Plan. These two chapters and the analyses used to develop them provide the basis for operating costs, ridership, and passenger miles for the alternative deployment scenarios.

This chapter is organized as follows:

- Section 2 contains the Project description.

- Section 3 documents the benefit-cost analysis methodology, including key methodological components, assumptions, and the study scenarios.

- Section 4 provides traffic projections for the Project area and the underlying assumptions.

- Section 5 contains a detailed explanation and calculation of the Project benefits.

- Section 6 contains a detailed explanation and calculation of the Project costs.

- Section 7 contains the detailed results of the benefit-cost analysis and the results of a BCA sensitivity analysis.
- Section 8 presents the Economic Impact Analysis and regional impacts of the Project.
- Section 9presents the economic assessment conclusions.

2. Project Description

The Oregon Department of Transportation published a Tier 1 Draft Environmental Impact Statement (DEIS) in 2018 for its Oregon Passenger Rail Project to evaluate service alternatives on the Amtrak Cascades route between Eugene and Portland. The DEIS forecasts, which were performed in 2015, included three project alternatives: No Action Alternative, Phase 1 of the Preferred Alternative with two new daily round trips in Oregon for a total of four (4+1), and Phase 2 of the Preferred Alternative with four new daily round trips in Oregon for a total of six (6+1).

Subsequently, ODOT intends to complete the Final Environmental Impact Statement (FEIS) with two project alternatives: the “No Action” Alternative and the Preferred Alternative, which includes six Amtrak Cascades daily trains operating between Eugene and Portland, as well as the daily long-haul *Coast Starlight* train. Alternative 1 is described below:

Preferred Alternative – (2029-2034) 4+1

The Preferred Alternative would expand service on the existing Amtrak Cascades route between Eugene and Vancouver, Washington, with capital improvements constructed adjacent to the existing Union Pacific Railroad track in specific locations, as shown in Chapter 6, Figure 6-2. Planned infrastructure improvements consist of new main line track, sidings, crossovers and industry connections constructed or reconfigured as needed to optimize freight and passenger rail operations throughout the Amtrak Cascades route. Under this phase of the Preferred Alternative, passenger trains would continue to share track with freight trains, and five passenger rail round trips per day—four Amtrak Cascades and one *Coast Starlight* (a “4+1” schedule) would serve the corridor.

Preferred Alternative – (2035-2058+) 6+1

Under this phase of the Preferred Alternative, passenger trains would continue to share track with freight trains as in Phase 1, and seven daily passenger rail round trips—six Amtrak Cascades and one *Coast Starlight* (a “6+1” schedule) would serve the corridor.

This BCA examines the benefits and costs of the proposed preferred alternative vis-à-vis the “No Action” scenario. Basic cost and operating assumptions used for the BCA were updated since the DEIS was published to reflect the current existing conditions of late 2019. These changes are presented in Sections 5 and 6.

3. Benefit-Cost Analysis Framework

A BCA is an evaluation framework to assess the economic advantages (benefits) and disadvantages (costs) of an investment alternative. Benefits and costs are broadly defined and are quantified in monetary terms to the extent possible. The overall goal of a BCA is to assess whether the expected benefits of a project justify the costs. A BCA framework attempts to capture the net welfare change created by a project, including cost savings and increases in welfare (benefits), as well as disbenefits where costs can be identified (e.g., project capital costs).

The BCA framework involves defining a Base or "No Action" scenario, which is compared to the "Build" scenario. The BCA assesses the incremental difference between the "Build" scenario and the "No Action" scenario, which represents the net change in welfare. BCAs are forward-looking exercises which seek to assess the incremental change in welfare over a project life cycle. The importance of future welfare changes is determined through discounting, which is meant to reflect both the opportunity cost of capital as well as the societal preference for the present.

3.1 Key Methodological Components

The BCA was conducted in accordance with the benefit-cost methodology recommended by the U.S. DOT.[1] The methodology includes the following key components:

- Defining existing and future conditions under the "No Action" (Base) scenario as well as under the "Build" scenario;
- Estimating benefits and costs during Project construction and operation, including 30 years of operations beyond the Project completion when benefits accrue;
- Using U.S. DOT recommended values to monetize changes in vehicle operating costs, emissions and traffic crashes by severity while relying on best practices for monetization of other benefits or disbenefits;
- Presenting dollar values in real 2015 dollars.[2] In instances where cost estimates and benefits valuations are expressed in historical dollar years, using an appropriate Consumer Price Index (CPI) to adjust the values; and
- Discounting future benefits and costs with a real discount rate of 7% consistent with U.S. DOT guidance.

[1] U.S. Department of Transportation. Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2020.

[2] 2015 was used as the base year for the analysis, so all monetary values were discounted to 2015 dollars.

3.2 Key Assumptions

The assessment of the benefits and costs associated with the OPR Project involve the following key assumptions:

- The evaluation period includes the construction during which capital expenditures are undertaken, plus 30 years of operations beyond the Project completion within which to evaluate ongoing benefits and costs.

- The Project implementation is phased, therefore benefits do start to accrue in 2029 with introduction of 4+1 service. This is considered year 1 of benefits in the 30-year benefit horizon (ending in 2058).

- Initial capital expenditures begin 2026 and continue into 2029. This moves service from "No Action" 2+1 service to 4+1 service.

- Capital expenditures resume 2032 into 2035 at which time 6+1 service begins.

- All benefits and costs are conservatively assumed to occur at the end of each calendar year for purposes of present value discounting.

- Monetary values of Project costs and benefits are expressed in constant, year-end 2015 dollars.

- Ridership, passenger miles traveled (PMT), and travel time savings for the alternatives were previously modelled and presented in Section 4.

- The travel demand model, not being multimodal, resulted in travel time savings being developed only for ridership levels from the "No Action" scenario. This is done to account for travel time savings to riders, as a result of the improved rail service, who are already or projected to use the rail service and not diverted from other modes.

3.4. "Build" and "No Action" Scenarios

The analysis of the OPR Project considered how the balance of costs and benefits resulting from capital investments supporting improved rail service would result in long-term benefits to its users and general society. This is accomplished by comparing the "Build" scenario relative to the "No Action" scenario.

- The "No Action" (Base) 2+1 scenario would consist of maintaining existing infrastructure without improvement.

- The "Build" scenario (Preferred Alternative) would entail significant infrastructure improvements and addition of new rolling stock. This scenario would entail the capital costs associated with the construction until the Project has been completed, and then routine operational costs once the

Project is in use over the 30-year evaluation period. A residual value of the assets is calculated based on remaining useful life, using straight line depreciation of the assets.

4. Ridership and Passenger Miles Traveled Projections

Ridership, revenue, and passenger miles were modelled and presented in Chapter 5.

Table 1 shows the forecast ridership to 2058. Assumed growth rates are 2.94% per year for the "No Action" alternative and 3.96% per year for 4+1 service (2029-2035) and 4.97% per year for 6+1 service.

Table 2 presents the forecast Passenger Miles Traveled (PMT) to 2058.

Table 3 presents the forecasted diversion of increased ridership and PMT of the Build versus No Action.

Table 1: Oregon Passenger Rail Project - Forecast Ridership to 2058

	Scenario				
	2+1	**4+1**	**6+1**	**Preferred**	**Build v. No Action**
Year	**No Action**	**Project**	**Project**	**Total**	**Difference**
2015	656,800			656,800	0
2016	676,133			676,133	0
2017	696,034			696,034	0
2018	716,522			716,522	0
2019	737,613			737,613	0
2020	759,324			759,324	0
2021	781,674			781,674	0
2022	804,683			804,683	0
2023	828,368			828,368	0
2024	852,751			852,751	0
2025	877,852			877,852	0
2026	903,691			903,691	0
2027	930,291			930,291	0
2028	957,674			957,674	0
2029	985,862	1,131,000		1,131,000	145,137
2030	1,014,881	1,175,768		1,175,768	160,887
2031	1,044,754	1,222,309		1,222,309	177,555
2032	1,075,506	1,270,692		1,270,692	195,186
2033	1,107,163	1,320,990		1,320,990	213,827
2034	1,139,752	1,373,279		1,373,279	233,527
2035	1,173,300		1,733,800	1,733,800	560,500
2036	1,207,836		1,820,025	1,820,025	612,189
2037	1,243,388		1,910,538	1,910,538	667,150
2038	1,279,987		2,005,552	2,005,552	725,565

	Scenario				
	2+1	4+1	6+1	Preferred	Build v. No Action
Year	No Action	Project	Project	Total	Difference
2039	1,317,663		2,105,291	2,105,291	787,628
2040	1,356,448		2,209,991	2,209,991	853,543
2041	1,396,374		2,319,897	2,319,897	923,523
2042	1,437,476		2,435,270	2,435,270	997,793
2043	1,479,788		2,556,380	2,556,380	1,076,592
2044	1,523,345		2,683,513	2,683,513	1,160,168
2045	1,568,184		2,816,968	2,816,968	1,248,784
2046	1,614,343		2,957,061	2,957,061	1,342,718
2047	1,661,861		3,104,120	3,104,120	1,442,259
2048	1,710,777		3,258,493	3,258,493	1,547,716
2049	1,761,133		3,420,543	3,420,543	1,659,410
2050	1,812,972		3,590,653	3,590,653	1,777,681
2051	1,866,336		3,769,222	3,769,222	1,902,886
2052	1,921,271		3,956,671	3,956,671	2,035,400
2053	1,977,823		4,153,443	4,153,443	2,175,620
2054	2,036,040		4,360,001	4,360,001	2,323,961
2055	2,095,970		4,576,831	4,576,831	2,480,861
2056	2,157,664		4,804,444	4,804,444	2,646,780
2057	2,221,174		5,043,377	5,043,377	2,822,203
2058	2,286,554		5,294,193	5,294,193	3,007,639

Source: Cambridge Systematics, Inc.

Table 2: Oregon Passenger Rail Project - Forecast Passenger Miles of Travel to 2058

	Scenario				
	2+1	4+1	6+1	Preferred	Build v. No Action
Year	No Action	Project	Project	Total	Difference
2015	156,050,495			156,050,495	0
2016	158,887,885			158,887,885	0
2017	161,776,865			161,776,865	0
2018	164,718,374			164,718,374	0
2019	167,713,368			167,713,368	0
2020	170,762,817			170,762,817	0
2021	173,867,714			173,867,714	0
2022	177,029,065			177,029,065	0
2023	180,247,898			180,247,898	0
2024	183,525,257			183,525,257	0
2025	186,862,207			186,862,207	0
2026	190,259,830			190,259,830	0
2027	193,719,231			193,719,231	0
2028	197,241,533			197,241,533	0
2029	200,827,879	229,899,282		229,899,282	29,071,402
2030	204,479,434	236,350,800		236,350,800	31,871,366
2031	208,197,383	242,983,362		242,983,362	34,785,979
2032	211,982,934	249,802,051		249,802,051	37,819,117
2033	215,837,315	256,812,087		256,812,087	40,974,772
2034	219,761,779	264,018,842		264,018,842	44,257,063
2035	223,757,600		328,646,300	328,646,300	104,888,700
2036	227,826,075		341,115,872	341,115,872	113,289,797
2037	231,968,524		354,058,567	354,058,567	122,090,042
2038	236,186,294		367,492,336	367,492,336	131,306,042
2039	240,480,754		381,435,813	381,435,813	140,955,059
2040	244,853,297		395,908,336	395,908,336	151,055,039
2041	249,305,344		410,929,979	410,929,979	161,624,635
2042	253,838,341		426,521,577	426,521,577	172,683,236
2043	258,453,759		442,704,754	442,704,754	184,250,995
2044	263,153,097		459,501,957	459,501,957	196,348,861
2045	267,937,880		476,936,484	476,936,484	208,998,603
2046	272,809,663		495,032,515	495,032,515	222,222,852
2047	277,770,028		513,815,150	513,815,150	236,045,122
2048	282,820,584		533,310,439	533,310,439	250,489,856
2049	287,962,971		553,545,424	553,545,424	265,582,452
2050	293,198,861		574,548,169	574,548,169	281,349,308
2051	298,529,952		596,347,804	596,347,804	297,817,852

Year	Scenario				
	2+1 No Action	4+1 Project	6+1 Project	Preferred Total	Build v. No Action Difference
2052	303,957,975		618,974,567	618,974,567	315,016,591
2053	309,484,694		642,459,838	642,459,838	332,975,144
2054	315,111,902		666,836,194	666,836,194	351,724,292
2055	320,841,427		692,137,442	692,137,442	371,296,015
2056	326,675,130		718,398,677	718,398,677	391,723,547
2057	332,614,903		745,656,321	745,656,321	413,041,417
2058	338,662,677		773,948,180	773,948,180	435,285,503

Source: Cambridge Systematics, Inc.

Table 3: Oregon Passenger Rail Project - Forecast Ridership and PMT Diverted to Rail

Year	Ridership Diverted to Rail			PMT Diverted to Rail		
	Auto	Airplane	Bus	Auto	Airplane	Bus
2029	120,443	4,594	20,100	24,482,642	933,869	4,085,678
2030	133,514	5,093	22,281	26,838,685	1,023,739	4,478,856
2031	147,346	5,620	24,589	29,290,930	1,117,277	4,888,089
2032	161,977	6,178	27,031	31,842,620	1,214,609	5,313,916
2033	177,446	6,769	29,612	34,497,096	1,315,862	5,756,897
2034	193,794	7,392	32,341	37,257,805	1,421,167	6,217,606
2035	465,136	17,742	77,622	88,167,677	3,363,080	14,713,476
2036	508,030	19,378	84,780	95,216,937	3,631,968	15,889,861
2037	553,640	21,118	92,392	102,599,864	3,913,584	17,121,928
2038	602,116	22,967	100,482	110,330,301	4,208,455	18,411,989
2039	653,620	24,932	109,077	118,422,637	4,517,130	19,762,443
2040	708,320	27,018	118,205	126,891,831	4,840,180	21,175,787
2041	766,393	29,233	127,896	135,753,428	5,178,198	22,654,616
2042	828,027	31,584	138,182	145,023,587	5,531,800	24,201,626
2043	893,419	34,079	149,094	154,719,103	5,901,627	25,819,619
2044	962,775	36,724	160,668	164,857,431	6,288,345	27,511,510
2045	1,036,314	39,529	172,941	175,456,711	6,692,645	29,280,324
2046	1,114,265	42,503	185,949	186,535,797	7,115,248	31,129,209
2047	1,196,871	45,654	199,735	198,114,281	7,556,899	33,061,433
2048	1,284,385	48,992	214,339	210,212,524	8,018,376	35,080,395
2049	1,377,076	52,527	229,807	222,851,684	8,500,486	37,189,626
2050	1,475,224	56,271	246,186	236,053,749	9,004,067	39,392,795
2051	1,579,126	60,234	263,526	249,841,567	9,529,992	41,693,715
2052	1,689,094	64,429	281,877	264,238,878	10,079,165	44,096,347

Year	Ridership Diverted to Rail			PMT Diverted to Rail		
	Auto	Airplane	Bus	Auto	Airplane	Bus
2053	1,805,457	68,868	301,296	279,270,351	10,652,528	46,604,808
2054	1,928,559	73,563	321,839	294,961,619	11,251,058	49,223,377
2055	2,058,764	78,530	343,568	311,339,315	11,875,771	51,956,497
2056	2,196,453	83,782	366,545	328,431,111	12,527,723	54,808,786
2057	2,342,029	89,335	390,839	346,265,758	13,208,010	57,785,043
2058	2,495,915	95,205	416,520	364,873,129	13,917,772	60,890,253

Source: Cambridge Systematics, Inc.

5. Project Benefits

5.1 Economic Competitiveness

This Project would contribute to increasing the economic competitiveness of the state and nation through improvements in the mobility of people and goods in the study area. The project would improve transportation accessibility and reduce congestion on roadways by diverting travelers from road to rail. A measured benefit is the reduction in vehicle operating costs for autos, buses and airplanes. Another benefit, travel time savings from the rail improvements, were also calculated.

Vehicle Operating Cost Savings

Vehicle operating costs were obtained via a literature search and values per passenger mile were developed using the published costs and passenger load rates. The values were deflated to 2015 dollars. Table 4 presents per PMT costs used in the analysis.

Table 4: Vehicle Operating Cost Factors

Vehicle Type	Value	Unit	Source Name	Source Link (if available online)
Passenger Cars	**$0.42** - Published Cost per vehicle mile of $0.62 Divided by FHWA factor of 1.48 persons per auto	2015$ / PMT	AAA Cost of Driving 2019-deflated to 2015. U.S. Department of Transportation, Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2020	https://exchange.aaa.com/wp-content/uploads/2019/09/AAA-Your-Driving-Costs-2019.pdf; https://www.transportation.gov/sites/dot.gov/files/2020-01/benefit-cost-analysis-guidance-2020_0.pdf
Bus	**$0.96**	2015$ / PMT	National Transit Database	https://www.transit.dot.gov/ntd

Vehicle Type	Value	Unit	Source Name	Source Link (if available online)
Airplane	**$0.11**	2015$ / available seat mile (PMT)	Statistic: Airlines in the U.S.: domestic cost per available seat mile Q3 2018	https://www.statista.com/statistics/527881/us-domestic-cost-per-available-seat-mile-by-airline/
Rail (Amtrak)				

Source: Cambridge Systematics, Inc.

These values were multiplied by the PMT diverted from roadway and air travel to the improved rail service. Table 5 presents the annual vehicle operating cost savings by travelers (autos) and by operators of buses and airplanes as a result of travelers moving to rail from the other passenger modes. The vehicle operating cost savings increase over time as ridership and passenger diversion from other modes increases, from $13 million non-discounted ($5 million discounted at 7%) in 2029 to $195 million non-discounted ($11 million discounted at 7%) in 2058. Overall, the Project's lifecycle's operating cost benefits are expected to realize nearly $2.7 billion in 2015 undiscounted dollars and $318 million in 2015 dollars at a discounted rate of 7%.

Table 5: Oregon Passenger Rail Project - Vehicle Operating Cost Savings by Mode ($2015 Dollars)

Year	Annual Vehicle Operating Cost Savings				
	Auto	Airplane	Bus	Total	Discounted @7%
2029	$9,071,772	$102,726	$3,922,251	$13,096,749	$5,079,145
2030	$9,944,778	$112,611	$4,299,702	$14,357,091	$5,203,670
2031	$10,853,430	$122,901	$4,692,565	$15,668,895	$5,307,597
2032	$11,798,930	$133,607	$5,101,359	$17,033,896	$5,392,495
2033	$12,782,517	$144,745	$5,526,621	$18,453,882	$5,459,838
2034	$13,805,467	$156,328	$5,968,901	$19,930,697	$5,511,004
2035	$32,669,556	$369,939	$14,124,937	$47,164,432	$12,188,185
2036	$35,281,581	$399,517	$15,254,267	$50,935,364	$12,301,557
2037	$38,017,243	$430,494	$16,437,051	$54,884,788	$12,388,219
2038	$40,881,671	$462,930	$17,675,509	$59,020,110	$12,450,108
2039	$43,880,196	$496,884	$18,971,945	$63,349,026	$12,489,046
2040	$47,018,362	$532,420	$20,328,755	$67,879,537	$12,506,749
2041	$50,301,929	$569,602	$21,748,431	$72,619,962	$12,504,830
2042	$53,736,884	$608,498	$23,233,561	$77,578,942	$12,484,808
2043	$57,329,450	$649,179	$24,786,834	$82,765,463	$12,448,109
2044	$61,086,095	$691,718	$26,411,049	$88,188,862	$12,396,075
2045	$65,013,541	$736,191	$28,109,111	$93,858,843	$12,329,966

Year	Annual Vehicle Operating Cost Savings				
	Auto	Airplane	Bus	Total	Discounted @7%
2046	$69,118,773	$782,677	$29,884,040	$99,785,491	$12,250,965
2047	$73,409,052	$831,259	$31,738,976	$105,979,287	$12,160,183
2048	$77,891,922	$882,021	$33,677,180	$112,451,123	$12,058,662
2049	$82,575,223	$935,053	$35,702,041	$119,212,318	$11,947,380
2050	$87,467,102	$990,447	$37,817,083	$126,274,633	$11,827,253
2051	$92,576,025	$1,048,299	$40,025,966	$133,650,290	$11,699,139
2052	$97,910,789	$1,108,708	$42,332,493	$141,351,990	$11,563,842
2053	$103,480,535	$1,171,778	$44,740,616	$149,392,929	$11,422,114
2054	$109,294,760	$1,237,616	$47,254,442	$157,786,818	$11,274,658
2055	$115,363,334	$1,306,335	$49,878,237	$166,547,906	$11,122,133
2056	$121,696,510	$1,378,049	$52,616,435	$175,690,994	$10,965,151
2057	$128,304,941	$1,452,881	$55,473,641	$185,231,463	$10,804,287
2058	$135,199,696	$1,530,955	$58,454,642	$195,185,293	$10,640,074
Total	**$1,887,762,061**	**$21,376,369**	**$816,188,643**	**$2,725,327,073**	**$318,177,243**

Source: Cambridge Systematics, Inc.

Travel Time Cost Savings

The travel time savings resulting from the rail improvements were only calculated for rail passengers that are already riding the train or would be riding the train under the “No Action” scenario. This analysis did not model the travel time savings to be realized by new riders diverting from other modes. This analysis only modeled the travel time savings to be realized by existing rail users and therefore, the savings present here are conservative estimates. The current rail users would realize travel time savings because the new trains would travel faster and operate under improved scheduling as a result of the rail system improvements. To calculate the travel time savings, the ridership values for the “No Action” scenario in Table 1 were multiplied by a weighted average trip savings of 12.9 minutes per trip for trips originating/ending at or between Portland and Eugene. This was done for each year 2029 through 2058. The time savings were multiplied by the U.S. DOT recommended value of time for all travelers (2018) and deflated to 2015 dollars using the Bureau of Economic Analysis, National Income and Product Accounts, Table 1.1.9, “Implicit Price Deflators for Gross Domestic Product” (November 2019). This travel time value is $15.74 per traveler per hour.

Table 6 presents the calculated travel time savings. Over the study horizon, the rail improvements will reduce travel time by nearly 10 million hours resulting in a time cost savings to the passengers of $157 million in 2015 dollars.

Table 6: Oregon Passenger Rail Project – Travel Time Cost Savings

Year	Travel Time Savings			
	Rail Riders "No Action"	Travel Time Saved (Hours)	Value of Travel Time Savings	Discounted @7%
2029	985,862	211,888	$3,335,547	$1,293,583
2030	1,014,881	218,124	$3,433,728	$1,244,541
2031	1,044,754	224,545	$3,534,799	$1,197,359
2032	1,075,506	231,154	$3,638,844	$1,151,965
2033	1,107,163	237,958	$3,745,952	$1,108,292
2034	1,139,752	244,962	$3,856,213	$1,066,275
2035	1,173,300	252,173	$3,969,720	$1,025,851
2036	1,207,836	259,595	$4,086,567	$986,959
2037	1,243,388	267,237	$4,206,854	$949,542
2038	1,279,987	275,103	$4,330,681	$913,544
2039	1,317,663	283,200	$4,458,154	$878,910
2040	1,356,448	291,536	$4,589,378	$845,589
2041	1,396,374	300,117	$4,724,465	$813,532
2042	1,437,476	308,951	$4,863,528	$782,689
2043	1,479,788	318,045	$5,006,684	$753,016
2044	1,523,345	327,407	$5,154,055	$724,468
2045	1,568,184	337,044	$5,305,763	$697,003
2046	1,614,343	346,965	$5,461,936	$670,578
2047	1,661,861	357,177	$5,622,706	$645,156
2048	1,710,777	367,691	$5,788,209	$620,697
2049	1,761,133	378,514	$5,958,583	$597,165
2050	1,812,972	389,655	$6,133,972	$574,526
2051	1,866,336	401,124	$6,314,524	$552,745
2052	1,921,271	412,931	$6,500,390	$531,789
2053	1,977,823	425,086	$6,691,727	$511,628
2054	2,036,040	437,598	$6,888,695	$492,232
2055	2,095,970	450,479	$7,091,462	$473,571
2056	2,157,664	463,738	$7,300,197	$455,617
2057	2,221,174	477,388	$7,515,076	$438,344
2058	2,286,554	491,440	$7,736,280	$421,725
Total	**46,475,621**	**9,988,827**	**$157,244,690**	**$23,418,891**

5.2 Safety Benefits

The safety benefits assessed in this analysis are reductions in costs associated with crash-related fatalities and injuries resulting from a diversion of passengers to rail from other modes. Offsetting reductions in crash costs for roadway and air travel are increases in fatality and injury costs associated with increased rail travelers.

Safety benefits result from the reduction in the number of predicted annual crashes from the "Build" scenario relative to the "No Action" scenario. These are summarized in Table 7. The estimation of the safety impacts involves the following:

- Automobile fatality and injury historical data was obtained from the Oregon Traffic Crash Summary published by ODOT Transportation Data Section Crash Analysis and Reporting Unit.[3] Average numbers of fatalities and injuries per PMT were calculated by dividing the number of fatalities and injuries (2015-2018) by average Oregon annual miles of travel (2015-2018)[4] and then dividing that value by the average passenger loading of 1.48 persons per car[5]. The injury and fatality rates for automobiles are estimated at 75.51 injuries and 0.83 fatalities per 100 million passenger miles. These values were multiplied by the PMT diverted from automobile to rail to calculate the automobile safety consequences.

- Bus (motor coach) crash impacts were obtained from the Analysis Division, Federal Motor Carrier Safety Administration, "Large Truck and Bus Crash Facts 2017" published May 2019.[6] Table 22, Bus Fatal Crash Statistics, 1975-2017 and Table 23, Bus Injury Crash Statistics, 1997-2017 were used to obtain an average fatalities and injuries per 100 million miles for 2008-2017. A vehicle load rate from the American Bus Association of 36 passengers per motor coach[7] is used. Estimated fatalities and injuries per 100 million passenger miles of travel are 4.80 and 0.05, respectively. These values were multiplied by the PMT diverted from bus to rail to calculate the bus safety consequences.

- Air travel safety impacts were developed from crash data obtained from the National Transportation Safety Board.[8] Data on fatalities, injuries, and number of passengers for U.S. commercial carriers showed nine fatalities and 104 serious injuries over 2008-2017. In the same

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3 https://www.oregon.gov/odot/Data/Documents/Crash_Summary_2018.pdf Last accessed July 15, 2020.
4 https://www.fhwa.dot.gov/policyinformation/statistics.cfm/hpms/fieldmanual/pubs/presentations/hpms/fieldmanual/pubs/hss/guide/index.cfm Last accessed July 27, 2020
5 https://www.transportation.gov/sites/dot.gov/files/2020-01/benefit-cost-analysis-guidance-2020_0.pdf Last accessed July 20, 2020
6 https://www.fmcsa.dot.gov/safety/data-and-statistics/large-truck-and-bus-crash-facts-2017#A7 Last accessed July 15, 2020
7 https://www.buses.org/assets/images/uploads/general/2019%20UPDATE%20Comparative%20Fuel%20CO2%20FINAL-July%202019.pdf?_zs=dep0a&_zl=UWgk1 Last accessed July 15, 2020
8 https://www.ntsb.gov/investigations/data/Pages/AviationDataStats2017.aspx# Last accessed July 21, 2020

period approximately 4.7 billion flew on these carriers. The few casualties and large number of passengers result in very low rates, but this notwithstanding, were multiplied by the air travelers diverted to rail to calculate the air safety consequences.

- With the increase in rail passengers diverted from other modes, the occurrence of negative safety impacts was estimated using incident data from the FRA for Amtrak operations in Oregon (2015-2019).[9] The data showed zero fatalities and 82 serious injuries. The number of passengers in the same period was approximately 3.5 million. This yields a zero-fatality rate and an injury rate of 0.00002354 per passenger. This value was multiplied by the number of passengers diverted from other modes to calculate the negative rail safety consequences.

Table 7: Oregon Passenger Rail Project - Safety Cost Savings

Mode	Fatalities	Injuries	Unit
Auto	75.51	0.83	Per 100 million PMT
Airplane	0.000000001902	0.0001156	Per Passenger
Bus	4.80	0.05	Per 100 million PMT
Rail (Amtrak)	0	0.0000235	Per Passenger

Source: Cambridge Systematics, Inc.

The safety consequences (avoided in automobile, bus and air) and incurred (rail) were multiplied by dollar values for fatalities and injuries recommended by U.S. Department of Transportation in their Benefit-Cost Guidance.[10] The published values were in 2018 dollars which were deflated to 2015 dollars for this analysis. In 2015 dollars, a fatality costs $9,091,200 and an injury (unknown severity) $164,778. The estimated impacts on safety in dollar amounts in presented in Table 8. The Project's safety benefits are expected to total $790 million in 2015 undiscounted dollars and $93 million in 2015 dollars at a 7% discounted rate.

[9] https://railroads.dot.gov/accident-and-incident-reporting/casualty-reporting/408-casualty-summary-tables Last accessed July 25, 2020

[10] https://www.transportation.gov/sites/dot.gov/files/2020-01/benefit-cost-analysis-guidance-2020_0.pdf Last accessed July 1, 2020

Table 8: Oregon Passenger Rail Project - Safety-Related Costs Savings by Mode ($2015 Dollars)

Year	Safety Cost Savings by Mode					
	Rail	Auto	Airplane	Bus	Net Safety Cost Savings	Discounted @7%
2029	($563,023)	$4,339,755	$87,558	$53,417	$3,917,707	$1,519,354
2030	($624,121)	$4,757,383	$97,060	$58,557	$4,288,879	$1,554,487
2031	($688,780)	$5,192,065	$107,115	$63,908	$4,674,307	$1,583,350
2032	($757,174)	$5,644,373	$117,751	$69,475	$5,074,425	$1,606,433
2033	($829,487)	$6,114,901	$128,997	$75,267	$5,489,678	$1,624,198
2034	($905,908)	$6,604,260	$140,881	$81,290	$5,920,524	$1,637,074
2035	($2,174,315)	$15,628,465	$338,136	$192,367	$13,984,652	$3,613,900
2036	($2,374,830)	$16,878,006	$369,319	$207,747	$15,080,242	$3,642,076
2037	($2,588,035)	$18,186,692	$402,476	$223,855	$16,224,987	$3,662,193
2038	($2,814,643)	$19,556,977	$437,716	$240,722	$17,420,772	$3,674,858
2039	($3,055,402)	$20,991,412	$475,158	$258,378	$18,669,545	$3,680,638
2040	($3,311,101)	$22,492,648	$514,922	$276,856	$19,973,326	$3,680,069
2041	($3,582,569)	$24,063,441	$557,139	$296,190	$21,334,201	$3,673,653
2042	($3,870,683)	$25,706,655	$601,945	$316,416	$22,754,333	$3,661,863
2043	($4,176,360)	$27,425,267	$649,482	$337,570	$24,235,959	$3,645,142
2044	($4,500,572)	$29,222,371	$699,902	$359,690	$25,781,391	$3,623,905
2045	($4,844,336)	$31,101,183	$753,362	$382,816	$27,393,025	$3,598,543
2046	($5,208,727)	$33,065,044	$810,030	$406,989	$29,073,336	$3,569,421
2047	($5,594,874)	$35,117,428	$870,081	$432,251	$30,824,887	$3,536,882
2048	($6,003,966)	$37,261,944	$933,700	$458,647	$32,650,326	$3,501,248
2049	($6,437,254)	$39,502,342	$1,001,083	$486,224	$34,552,394	$3,462,818
2050	($6,896,055)	$41,842,519	$1,072,433	$515,028	$36,533,925	$3,421,875
2051	($7,381,755)	$44,286,526	$1,147,966	$545,111	$38,597,848	$3,378,680
2052	($7,895,812)	$46,838,571	$1,227,909	$576,523	$40,747,192	$3,333,480
2053	($8,439,758)	$49,503,027	$1,312,500	$609,319	$42,985,088	$3,286,505
2054	($9,015,209)	$52,284,436	$1,401,991	$643,555	$45,314,773	$3,237,967
2055	($9,623,861)	$55,187,521	$1,496,645	$679,288	$47,739,593	$3,188,068
2056	($10,267,502)	$58,217,186	$1,596,740	$716,580	$50,263,004	$3,136,993
2057	($10,948,010)	$61,378,528	$1,702,568	$755,492	$52,888,578	$3,084,915
2058	($11,667,360)	$64,676,842	$1,814,437	$796,090	$55,620,008	$3,031,996
Total	**($147,041,480)**	**$903,067,770**	**$22,866,999**	**$11,115,617**	**$790,008,907**	**$92,852,584**

Source: Cambridge Systematics, Inc.

5.3 Environmental Sustainability Benefits

This analysis focuses on environmental sustainability as measured by reduction in vehicle emissions. Net change in environmental costs is estimated based on the changes in vehicle emissions in the "Build" scenario relative to the "No Action" scenario. Emission damage costs are a function of vehicle type and PMT.

This analysis applies the emission rates pertaining to Nitrogen Oxides (NOx), Particulate Matter (PM2.5), Carbon Dioxide (CO2) for passenger cars, motor coaches/buses, aircraft, and rail. Running emissions rates in grams per PMT were developed from the literature and presented in Table 9.[11,12]

Table 9: Emission Rates per Passenger Mile of Travel

Mode	NOx (g / PMT)	$PM_{2.5}$ (g / PMT)	CO2 (g / PMT)
Automobile	0.24	0.01	266.75
Bus - Diesel	0.25	0.01	36.70
Rail (Amtrak)	0.08	0.00	127.53
Airplane	0.63	0.04	181.50

The environmental cost per PMT for each pollutant was calculated by multiplying the pollutant emission rate by the corresponding pollutant unit emission cost recommended by U.S. DOT and shown in Table 10.[13] This estimation involves deflating the 2018 dollar values recommended by U.S. DOT to 2015, and converting grams to short tons for the non-carbon emissions (NOx, $PM_{2.5}$) and grams to metric tons for carbon dioxide (CO2) emissions. The summation of the environmental cost per mile for each of these pollutants represents the emission cost per PMT. These steps are shown in the formulas below.

Environmental Costs (Rail, Automobile, Bus, Airplane)

- Environmental Cost per PMT = ∑ Running Emission Rate (gr/PMT) x Emission Cost ($/short ton) / conversion factor
- Conversion factor = 907,185 to convert grams to short tons and 1,000,000 to convert grams to metric tons
- Carbon Environmental Cost = ∑ VHT_t x Environmental Cost per Mile, where $2029 \leq t \leq 2058$

[11] https://www.buses.org/assets/images/uploads/general/2019%20UPDATE%20Comparative%20Fuel%20CO2%20FINAL-July%202019.pdf Last accessed July 26, 2020

[12] https://www.railwayage.com/passenger/intercity/amtrak-begins-power-renewal-orders-75-siemens-chargers-for-long-distance-trains/ Last accessed July 26, 2020

[13] U.S. Department of Transportation, Benefit-Cost Analysis Guidance for Discretionary Grant Programs, (January 2020)

The emission costs per PMT were calculated for each mode and presented in Table 11.

Table 10: Unit Emission Cost used in the Monetization of the Environmental Sustainability Benefits

Pollutant	Unit	US DOT Value	2015 Cost per Gram
NOx	2018$ per short ton	$8,600	$0.0090
PM2.5	2018$ per short ton	$387,300	$0.4049
CO_2	2018$ per short ton	$1.0 (2029-2034); $2.0 (2035-2058)	$0.00000000103 (2029-2034) $0.00000000206 (2035-2058)

Table 11: Per PMT Emission Costs by Mode ($2015 Dollars)

Mode	NOx	PM2.5	CO2 (2029-2034) / (2035-2058)	Total
Automobile	$0.0022	$0.0023	$0.00000027 / $0.00000055	$0.0045
Bus - Diesel	$0.0023	$0.0045	$0.00000004/ $0.00000008	$0.0067
Rail (Amtrak)	$0.0007	$0.0019	$0.00000013 / $0.00000026	$0.0026
Airplane	$0.0057	$0.0152	$0.00000019 / $0.00000037	$0.0209

Source: Cambridge Systematics, Inc.

The emissions costs per PMT were multiplied by the PMT by mode diverted from highway (auto and bus) and air to rail and represent the environmental cost savings associated with the diverted passenger miles. The per PMT environmental cost factors were also multiplied by the increased rail PMT ("Build" minus "No Action" PMT) and represent an increase in environmental costs. The increased rail environmental costs were subtracted from the environmental cost savings from travel diverted from other modes to yield a net environmental benefit. The annual environmental sustainability benefits are presented in Table 12. Overall, the Project's lifecycle's environmental sustainability benefits are expected to realize $7.4 million in 2015 undiscounted dollars and $0.9 million in 2015 dollars at a discounted rate of 7%.

Table 12: Oregon Passenger Rail Project - Environmental Cost Savings by Mode ($2015 Dollars)

Year	Environmental Cost Savings by Mode					
	Rail	Auto	Airplane	Bus	Net Safety Cost Savings	Discounted @7%
2029	($76,418)	$110,094	$19,474	$27,525	$80,675	$31,287
2030	($83,772)	$120,689	$21,348	$30,174	$88,438	$32,054
2031	($91,427)	$131,716	$23,299	$32,931	$96,519	$32,694
2032	($99,391)	$143,190	$25,328	$35,800	$104,927	$33,217
2033	($107,677)	$155,127	$27,440	$38,784	$113,674	$33,632
2034	($116,294)	$167,542	$29,636	$41,888	$122,771	$33,947
2035	($275,215)	$228,389	$70,132	$99,124	$122,431	$31,638
2036	($297,219)	$246,650	$75,739	$107,050	$132,219	$31,933
2037	($320,264)	$265,774	$81,611	$115,350	$142,471	$32,158
2038	($344,395)	$285,799	$87,761	$124,041	$153,206	$32,318
2039	($369,655)	$306,761	$94,197	$133,139	$164,443	$32,419
2040	($396,092)	$328,700	$100,934	$142,661	$176,203	$32,465
2041	($423,753)	$351,655	$107,983	$152,624	$188,509	$32,460
2042	($452,690)	$375,668	$115,357	$163,046	$201,381	$32,408
2043	($482,954)	$400,784	$123,069	$173,946	$214,845	$32,313
2044	($514,601)	$427,046	$131,133	$185,344	$228,923	$32,178
2045	($547,686)	$454,502	$139,564	$197,261	$243,641	$32,006
2046	($582,270)	$483,201	$148,377	$209,717	$259,026	$31,801
2047	($618,412)	$513,194	$157,587	$222,734	$275,104	$31,566
2048	($656,176)	$544,534	$167,210	$236,336	$291,903	$31,302
2049	($695,629)	$577,274	$177,264	$250,546	$309,454	$31,013
2050	($736,840)	$611,473	$187,765	$265,388	$327,787	$30,701
2051	($779,878)	$647,188	$198,733	$280,890	$346,933	$30,369
2052	($824,819)	$684,483	$210,185	$297,076	$366,925	$30,018
2053	($871,740)	$723,421	$222,141	$313,976	$387,798	$29,650
2054	($920,720)	$764,067	$234,623	$331,617	$409,587	$29,267
2055	($971,843)	$806,492	$247,650	$350,030	$432,329	$28,871
2056	($1,025,195)	$850,766	$261,245	$369,246	$456,063	$28,464
2057	($1,080,865)	$896,965	$275,432	$389,297	$480,828	$28,046
2058	($1,138,948)	$945,166	$290,233	$410,216	$506,667	$27,620
Total	**($15,902,838)**	**$13,548,311**	**$4,052,450**	**$5,727,756**	**$7,425,678**	**$939,818**

Source: Cambridge Systematics, Inc.

5.4 State of Good Repair Benefits

The State of Good Repair benefits accrue as a result of the Project by enabling passengers who would be traveling by roadway via automobile, or bus and diverting them to rail, thus reducing wear and tear on the region's road system. This analysis focuses on only the passenger travel diverted to rail.

This analysis determined the average Oregon spends on roadway maintenance and services (known as O&M) per VMT, based on data from the FHWA Highway Statistic series for 2017 and 2018.[14] The average O&M cost per VMT was deflated to 2015 dollars using the Consumer Price Index (CPI). The state O&M cost per VMT is $0.0152. This value is multiplied by the annual diverted automobile and bus VMT (PMT divided by occupancy load factors of 1.48 and 36 for cars and buses, respectively) to derive an annual O&M reduction assuming the reduced VMT results in a reduction in O&M. This reduction in O&M costs is the State of Good Repair benefit for this project. The annual State of Good Repair benefits are presented in Table 13.

The Project's lifecycle's State of Good Repair benefits are expected to total $52.6 million in 2015 undiscounted dollars and $6.1 million in 2015 dollars at a 7% discounted rate.

[14] https://www.fhwa.dot.gov/policyinformation/statistics Last accessed July 22, 2020

Table 13: Oregon Passenger Rail Project - State of Good Repair Benefits ($2015 Dollars)

Year	State of Good Repair Benefits			
	Auto	**Bus**	**Total**	**Discounted @7%**
2029	$250,874	$1,721	$252,596	$97,961
2030	$275,017	$1,887	$276,904	$100,363
2031	$300,145	$2,059	$302,204	$102,367
2032	$326,292	$2,239	$328,531	$104,004
2033	$353,493	$2,425	$355,918	$105,303
2034	$381,782	$2,619	$384,401	$106,290
2035	$903,457	$6,198	$909,655	$235,072
2036	$975,691	$6,694	$982,385	$237,259
2037	$1,051,344	$7,213	$1,058,557	$238,930
2038	$1,130,558	$7,756	$1,138,314	$240,124
2039	$1,213,480	$8,325	$1,221,805	$240,875
2040	$1,300,264	$8,921	$1,309,185	$241,216
2041	$1,391,069	$9,544	$1,400,613	$241,179
2042	$1,486,061	$10,195	$1,496,256	$240,793
2043	$1,585,411	$10,877	$1,596,288	$240,085
2044	$1,689,299	$11,590	$1,700,889	$239,082
2045	$1,797,910	$12,335	$1,810,245	$237,807
2046	$1,911,438	$13,114	$1,924,551	$236,283
2047	$2,030,083	$13,928	$2,044,010	$234,532
2048	$2,154,054	$14,778	$2,168,832	$232,574
2049	$2,283,568	$15,667	$2,299,234	$230,428
2050	$2,418,850	$16,595	$2,435,444	$228,111
2051	$2,560,134	$17,564	$2,577,698	$225,640
2052	$2,707,663	$18,576	$2,726,240	$223,031
2053	$2,861,691	$19,633	$2,881,324	$220,297
2054	$3,022,480	$20,736	$3,043,216	$217,453
2055	$3,190,303	$21,888	$3,212,190	$214,511
2056	$3,365,443	$23,089	$3,388,532	$211,484
2057	$3,548,195	$24,343	$3,572,538	$208,381
2058	$3,738,865	$25,651	$3,764,516	$205,214
Total	**$52,204,913**	**$358,160**	**$52,563,072**	**$6,136,648**

Source: Cambridge Systematics, Inc.

5.5 Project Benefits Summary

The benefits of the Project can be described as user benefits, including vehicle operating costs, and social benefits, including emissions reductions and the reduction in damage to humans resulting from crash incidents. The analysis covers the following benefit categories:

- Vehicle Operating Cost Savings
- Travel Time savings
- Safety Benefits
- Reduced Emissions and Environmental Cost Savings
- State of Good Repair Benefits

The analysis uses standardized factors provided by governmental and industry sources to efficiently determine the monetized value of user and social benefits resulting from the Project improvements. These benefits include the reduction of existing costs or the prevention of future costs related to the operation and use of the existing road facility. Table 14 shows the Project long-term benefits aligning the benefit categories - with the merit criteria of federal grants programs.

Table 14: Oregon Passenger Rail Project - Benefits by Long-Term Outcome Category,

Long-Term Outcome	Benefit (Disbenefit) Category	Benefit (Disbenefit) Description	7% Discount (Millions of $2015)
Economic Competitiveness	Vehicle Operating Costs	Reduced vehicle operating costs	$318.2
	Travel Time Savings	Value of time saved traveling by rail	$23.4
Safety	Reduced Crash Incidents	Reduction in fatalities and injuries	$92.9
Environmental Sustainability	Reduced Emissions	Enhancement of the natural environment	$1.1
State of Good Repair	Reduced roadway O&M costs	Reduced VMT on roads resulting in reduced maintenance costs	$6.1
Total			**$441.7**

Source: Cambridge Systematics, Inc.

6. Project Costs

6.1 Capital Costs

The capital costs associated with this Project are for trainsets, maintenance yard and rail infrastructure beginning in 2026 and ending in 2035. Table 15 presents these costs which total $831 million (undiscounted $2015) and $286 million when discounted at 7%.

Table 15: Oregon Passenger Rail Project - Capital Costs, Millions of 2015 Dollars

Year	Capital Costs in Millions of 2015 Dollars				
	Trainsets	Layover/Light Maintenance Facility	Rail Infrastructure	Total Capital	Total Capital Costs Discounted @7%
2026	$0.0	$12.6	$70.6	$83.2	$39.6
2027	$0.0	$12.6	$70.6	$83.2	$37.0
2028	$16.5	$13.0	$72.8	$102.3	$42.4
2029	$16.5	$0.0	$0.0	$16.5	$6.4
2030	$0.0	$0.0	$0.0	$0.0	$0.0
2031	$0.0	$0.0	$0.0	$0.0	$0.0
2032	$0.0	$0.0	$169.3	$169.3	$53.6
2033	$0.0	$0.0	$169.3	$169.3	$50.1
2034	$16.5	$0.0	$174.4	$190.9	$52.8
2035	$16.5	$0.0	$0.0	$16.5	$4.3
Total	**$66.0**	**$38.2**	**$727.0**	**$831.2**	**$286.2**

6.2 Operations and Maintenance Costs

The difference between Operations and Maintenance costs (O&M) for the “No Action” and the “Build” scenarios represents the ongoing costs to maintain and operate the enhanced service levels. Annual O&M costs are $14 million (undiscounted $2015) for the years 2029-2034. From 2035 through 2058, annual O&M costs are $30 million (undiscounted $2015). Over 30 years of enhanced service (2029-2058), the increase in O&M costs is $812.4 million (undiscounted $2015) and $124.2 million discounted at 7%.

6.3 Life Cycle Project Costs

Total Capital and O&M life cycle costs are presented in Table 16.

Table 16: Oregon Passenger Rail Project - Life Cycle Project Costs ($2015 dollars)

Year	Capital Costs		Operating and Maintenance Cost	
	$2015 Undiscounted	Discounted	$2015 Undiscounted	Discounted
2026	$83.2	$39.6	$0.0	$0.0
2027	$83.2	$37.0	$0.0	$0.0
2028	$102.3	$42.4	$0.0	$0.0
2029	$16.5	$6.4	$14.2	$5.5
2030	$0.0	$0.0	$14.2	$5.1
2031	$0.0	$0.0	$14.2	$4.8
2032	$169.3	$53.6	$14.2	$4.5
2033	$169.3	$50.1	$14.2	$4.2
2034	$190.9	$52.8	$14.2	$3.9
2035	$16.5	$4.3	$30.3	$7.8
2036	$0	$0	$30.3	$7.3
2037	$0	$0	$30.3	$6.8
2038	$0	$0	$30.3	$6.4
2039	$0	$0	$30.3	$6.0
2040	$0	$0	$30.3	$5.6
2041	$0	$0	$30.3	$5.2
2042	$0	$0	$30.3	$4.9
2043	$0	$0	$30.3	$4.6
2044	$0	$0	$30.3	$4.3
2045	$0	$0	$30.3	$4.0
2046	$0	$0	$30.3	$3.7
2047	$0	$0	$30.3	$3.5
2048	$0	$0	$30.3	$3.2
2049	$0	$0	$30.3	$3.0
2050	$0	$0	$30.3	$2.8
2051	$0	$0	$30.3	$2.7
2052	$0	$0	$30.3	$2.5
2053	$0	$0	$30.3	$2.3
2054	$0	$0	$30.3	$2.2
2055	$0	$0	$30.3	$2.0
2056	$0	$0	$30.3	$1.9
2057	$0	$0	$30.3	$1.8
2058	$0	$0	$30.3	$1.7
NET TOTAL	**$831.2**	**$286.2**	**$812.4**	**$124.2**

Source: Cambridge Systematics, Inc.

6.4 Residual Value on Capital Assets

The capital assets acquired under this project will have a useful life exceeding the 30-year Benefit-Cost study time horizon. Therefore, per U.S. DOT guidance[15], assets with useful lives beyond 30 years were valued for the remaining useful lifetime (using straight-line depreciation) and discounted at the year 30 (2058) discount value. The residual value of the assets is a Project benefit. The trainsets are assumed to have a useful life of 30 years. Other capital assets are assumed to have a useful life of 50 years, so the trainsets have a zero value and the other assets retain 40% of their initial value in 2058. The calculated residual value of the assets is $352.5 million (undiscounted $2015) and $19.2 million when discounted at 7%.

[15] U.S. Department of Transportation. Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2020.

7. Benefit – Cost Analysis

7.1 Evaluation Measures

The Benefit-Cost Analysis converts potential gains (benefits) and losses (costs) from the Project into monetary units and compares them. The following common benefit-cost evaluation measures are included in this BCA:

- Net Present Value (NPV): NPV compares the net benefits (benefits minus costs) after being discounted to present values using the real discount rate assumption. The NPV provides a perspective on the overall dollar magnitude of cash flows over time in today's dollar terms.

- Benefit-Cost Ratio (BCR): The present value of incremental benefits is divided by the present value of incremental costs to yield the BCR. The BCR expresses the relation of discounted benefits to discounted costs as a measure of the extent to which a project's benefits either exceed or fall short of the costs.

7.2 BCA Results

Table 17 presents the evaluation results for the Project. Results are presented in undiscounted and discounted at 7%. All benefits and costs were estimated in constant 2015 dollars over an evaluation period extending 30 years beyond system completion in 2029.

Table 17: Oregon Passenger Rail Project – Evaluation Measures

BCA Metric	Project Lifecycle	
	Undiscounted (Millions of $2015)	7% Discount (Millions of $2015)
Benefits =B	$3,732	$442
O&M Increased Costs = OMCS	$812	$124
Net Project Benefits = B - OMCS = PB	$2,920	$318
Residual Asset Value = RAV	$353	$19
Total Project Benefits = B - OMCS + RAV = PB	$3,273	$337
Total Project Costs = PC	$831	$286
Net Present Value = PB - PC = NPV	$2,442	$51
Benefit-Cost Ratio = BCR = PB / PC	3.9:1	1.2:1

Source: Cambridge Systematics, Inc.

The total net benefits from the Project improvements within the analysis period are $337 million in 2015 dollars (including the O&M cost increases and asset residual value) when discounted at 7%. In accordance with U.S.DOT BCA guidance, O&M cost increases are treated as "negative" benefits and subtracted from the total benefits.

The total costs are calculated to be $286 million in 2015 dollars when discounted at 7%. The difference of the discounted benefits and costs equal an NPV of $51 million in 2015 dollars, resulting in a BCR of 1.2:1. Table 18 summarizes the results of the BCA by year.

Table 18: Oregon Passenger Rail Project-Life Cycle Benefit-Cost Analysis ($2015 Millions)

	Undiscounted Costs and Benefits		Discounted Costs and Benefits	
Year	Undiscounted Costs ($2015 Millions)	Undiscounted Benefits ($2015 Millions)	Costs (7% Discount) ($2015 Millions)	Benefits (7% Discount) ($2015 Millions)
2026	$83	$0	$40	$0
2027	$83	$0	$37	$0
2028	$102	$0	$42	$0
2029	$17	$6	$6	$3
2030	$0	$8	$0	$3
2031	$0	$10	$0	$3
2032	$169	$12	$54	$4
2033	$169	$14	$50	$4
2034	$191	$16	$53	$4
2035	$17	$36	$4	$9
2036	$0	$41	$0	$10
2037	$0	$46	$0	$10
2038	$0	$52	$0	$11
2039	$0	$58	$0	$11
2040	$0	$64	$0	$12
2041	$0	$70	$0	$12
2042	$0	$77	$0	$12
2043	$0	$84	$0	$13
2044	$0	$91	$0	$13
2045	$0	$98	$0	$13
2046	$0	$106	$0	$13
2047	$0	$114	$0	$13
2048	$0	$123	$0	$13
2049	$0	$132	$0	$13
2050	$0	$141	$0	$13
2051	$0	$151	$0	$13
2052	$0	$161	$0	$13
2053	$0	$172	$0	$13
2054	$0	$183	$0	$13
2055	$0	$195	$0	$13
2056	$0	$207	$0	$13

	Undiscounted Costs and Benefits		Discounted Costs and Benefits	
Year	Undiscounted Costs ($2015 Millions)	Undiscounted Benefits ($2015 Millions)	Costs (7% Discount) ($2015 Millions)	Benefits (7% Discount) ($2015 Millions)
2057	$0	$219	$0	$13
2058	$0	$232	$0	$13
Residual Asset Value	$0	$353	$0	$19
TOTAL	$831	$3,273	$286	$337

Source: Cambridge Systematics, Inc.

7.3. Benefit-Cost Sensitivity Testing

A sensitivity analysis is used to help identify which variables have the greatest impact on the BCA results. This analysis can be used to estimate how changes to key variables from their preferred value affect the results and how sensitive the results are to these changes. This allows for the assessment of the strength of the BCA, including whether the results reached using the preferred set of input variables are significantly different by reasonable departures from those values. Table 18 summarizes the key variables which have been tested for sensitivity and the results of this analysis. The sensitivity scenarios are described below:

- Increasing capital expenditures by 10%.
- Decreasing capital expenditures by 10%.
- Increasing the rate of passenger growth (and benefits) by 10%.
- Decreasing the rate of passenger growth (and benefits) by 10%.
- Decrease capital expenditures by 10% and Increasing the rate of passenger growth (and benefits) by 10%.
- Discounting at 3% percent rather than 7%.
- Discounting at 4% rather than 7%.

Of the variables examined, the discount rate used has the greatest impact on the fiscal viability of the project. As discussed in Section 3.1, the U.S. DOT-recommended 7% discount rate may be excessive in evaluating true return on investment given relatively low U.S. Treasury yields and inflation for the foreseeable future.

Table 19: Benefit Cost Analysis-Sensitivity Analysis

Sensitivity Variable	Sensitivity Value	BCR (Discounted 7%)	NPV (Millions of $2015)
Base Case	NA	1.2 : 1	$51
Capital Expenditures	Increased by 10%	1.1 : 1	$24
Capital Expenditures	Decreased by 10%	1.30 : 1	$77
Passenger Growth	Increased by 10%	1.3 : 1	$95
Passenger Growth	Decreased by 10%	1.0 : 1	$6
Capital Expenditures & Passenger Growth	Expenditures -10% Passengers +10%	1.2 : 1	$68
3 Percent Discount Rate	Discount Rate Reduced from 7% to 3%	2.5 : 1	$798
4 Percent Discount Rate	Discount Rate Reduced from 7% to 4%	2.1 : 1	$508
5 Percent Discount Rate	Discount Rate Reduced from 7% to 5%	1.8 : 1	$313

Source: Cambridge Systematics, Inc.

8. Economic Impact Analysis

The purpose of Economic Impact Analysis (EIA) is typically to forecast personal income, employment, and business impacts for a defined project, program, or policy. Using the 2018 Economic Impact Analysis for Planning (IMPLAN) model for the state of Oregon, the economic impacts of the Cascades Rail Project are estimated in terms of employment (number of job-years supported), labor income (compensation of employees), Gross State Product (economic output less intermediate inputs, accounting for the additional output created at that stage of production), and tax revenues.

IMPLAN is an Input-Output (I-O) model used to estimate the economy-wide effects on the state economy of direct impacts of the capital and operating expenses associated with the Project versus the "No Action" scenario.

As these direct impacts ripple through the state economy, jobs and economic activity are generated through multiplier effects. The analyses conducted for this Project calculated three types of impact: direct, indirect, and induced. These terms are also commonly referred to as initial, secondary, and tertiary impacts that ripple throughout the economy when a change is made to a given input level. These are described as:

- The direct impact of an economic disturbance is an initial change in the economy such as the direct outlays for the rail project - spending on materials, equipment, labor, and other inputs.
- The indirect, or secondary, impact due to the suppliers of the inputs purchasing their inputs for production and hiring workers to meet demand.
- The induced, or tertiary, impact resulting from the workers of suppliers purchasing more goods and services.

The total economic impacts on Oregon's economy is the sum of direct, secondary, and tertiary effects.

It should be noted that IMPLAN, being an I-O model, is based on current relationships between industries and is best applied to relatively short, three- to five- year planning horizons. In reality, it would be expected that the makeup of the Oregon economy in the future will be different than it is today, but in using IMPLAN, the assumption is that the economy of the future will react to the inputs as it would currently.

As mentioned in Section 1, the EIA is meant to compliment the BCA, to provide additional important information for policymakers. The results should be considered along with the BCA but are not additive to the BCA results. Table 19 presents the results of the economic impacts of the rail Project over the 32-year period.

Table 20: Total Economic Impact of Cascades Rail Project

Year	Employment (Job-Years)	Millions of $					
		Wages	Gross State Product	County & Sub-County Tax	State Tax	Federal Tax	Total Tax
2026	1,550	$103	$93	$3	$5	$19	$28
2027	1,550	$103	$93	$3	$5	$19	$28
2028	1,690	$113	$106	$4	$6	$21	$31
2029	250	$17	$25	$1	$1	$3	$6
2030	150	$10	$14	$1	$1	$2	$3
2031	150	$10	$14	$1	$1	$2	$3
2032	3,870	$257	$238	$9	$13	$48	$70
2033	3,870	$257	$238	$9	$13	$48	$70
2034	4,080	$271	$255	$9	$14	$51	$75
2035	420	$28	$41	$2	$2	$6	$9
2036	320	$21	$31	$1	$1	$4	$7
2037	320	$21	$31	$1	$1	$4	$7
2038	320	$21	$31	$1	$1	$4	$7
2039	320	$21	$31	$1	$1	$4	$7
2040	320	$21	$31	$1	$1	$4	$7
2041	320	$21	$31	$1	$1	$4	$7
2042	320	$21	$31	$1	$1	$4	$7
2043	320	$21	$31	$1	$1	$4	$7
2044	320	$21	$31	$1	$1	$4	$7
2045	320	$21	$31	$1	$1	$4	$7
2046	320	$21	$31	$1	$1	$4	$7
2047	320	$21	$31	$1	$1	$4	$7
2048	320	$21	$31	$1	$1	$4	$7
2049	320	$21	$31	$1	$1	$4	$7
2050	320	$21	$31	$1	$1	$4	$7
2051	320	$21	$31	$1	$1	$4	$7
2052	320	$21	$31	$1	$1	$4	$7
2053	320	$21	$31	$1	$1	$4	$7
2054	320	$21	$31	$1	$1	$4	$7
2055	320	$21	$31	$1	$1	$4	$7
2056	320	$21	$31	$1	$1	$4	$7
2057	320	$21	$31	$1	$1	$4	$7
2058	320	$21	$31	$1	$1	$4	$7
Total	**24,940**	**$1,644**	**$1,821**	**$68**	**$91**	**$317**	**$475**

To summarize, the Oregon Passenger Rail Project and its ongoing operations (2026-2058) versus the "No Action" scenario would create 25 thousand job-years of employment. These jobs are worth nearly $1.6 billion in wages. The value added to the state's economy (Gross State Product) is $1.8 billion. In terms of tax generation, it is estimated that the Project would result in increased tax revenues of $68 million at the sub-county and county level; $91 million in state taxes; and $317 million in federal taxes. In total, tax revenues over the study period would increase $475 million.

9. Conclusions

This Benefit-Cost Analysis focused on quantifiable benefits related to modelled passenger travel by mode. These include the costs/avoided costs of travel of rail versus automobile, bus/motor coach and air travel. These travel-related factors include transportation costs paid by users of the different modes, travel time costs, crash occurrence and its human and cost consequences, mobile-source emissions costs, and impacts on roadway infrastructure.

The study showed significant benefits over a 30-year period (2029-2058) following completion of initial construction to improve service from 2+1 to 4+1 in 2029. Benefits also increased substantially following additional investment to bring service to 6+1 starting in 2035.

Over the study period, the Project is expected to generate a Benefit-Cost Ratio of 1.2 : 1 and a Net Present Value of $51 million in 2015 dollars at a 7% discount rate.

Sensitivity Analysis showed in terms of 2015 discounted dollars (7% discount rate):

- 10% increase/decrease in capital expenditures equates to $27 million decrease/increase in NPV.
- 10% increase/decrease in ridership equates to $44 million increase/decrease in NPV.
- The discount rate chosen for the BCA has the greatest impact on NPV of the factors examined. At the U.S. DOT recommended discount rate of 7%, the project breaks even within the study period (in year 2053). The project would see significantly shorter financial breakeven periods with lower discount rates. For example, at 3%, 4% and 5% discount rates, financial breakeven would occur in the years 2047, 2048 and 2050, respectively.

The regional economic impacts of construction, operation, and maintenance of the improved rail service are substantial. For every $1 billion in project expenditures on the Project, 15.5 thousand job-years, worth $1 billion in wages are created. Additionally, for each $1 billion in Project spending, GSP and tax revenues are estimated to increase by 1.1 billion and $300 million, respectively. Not included in these analyses are factors such as impacts on congestion and travel time reliability; accessibility to employment, health and human services, education, shopping, and entertainment; and other quality of life considerations.