Washington State
Department of Transportation

Service Development Plan

for the

Pacific Northwest Rail Corridor Program

FINAL UPDATE

Service Development Plan

For the

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September 2017

Washington State Department of Transportation
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Revision History

Revision No.	Status	Date	Notes
Rev. 00	Initial Draft	August 2009	2009 HSIPR Track 2 application
Rev. 01	Draft Program Deliverable	July 2011	Revised per FRA
Rev. 02	Final Program Deliverable	September 2017	Revised per FRA

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Chapter 1: Introduction

The Service Development Plan (SDP) is a detailed plan for infrastructure and capital investments needed to improve intercity passenger rail service on the Pacific Northwest Rail Corridor (PNWRC). The SDP defines the purpose and need for service improvements, analyzes alternatives, defines the recommended improvements, and evaluates the operational, network and financial impacts of the service changes and infrastructure investment.

Information presented in this SDP is based on work completed as part of the 2009 High Speed Intercity Passenger Rail (HSIPR) Track 2 grant application materials, including conceptual engineering and a Tier 1, service-level environmental assessment. The SDP was updated in July 2011 to reflect the elements of the PNWRC Program (Program) funded through the 2011 Grant/Cooperative Agreement between the Washington State Department of Transportation (WSDOT) and the Federal Railroad Administration (FRA). As required by the Agreement, WSDOT updated and finalized the SDP in 2017 to reflect decisions and refinements made during the project-level preliminary engineering and environmental review phases for the funded PNWRC Program, particularly changes in scope based on additional operations analysis and modeling.

The Final SDP is outlined as follows:

> **Chapter 1 (Introduction) –** provides the requirements of the Program, a review of existing conditions, the rationale (purpose and need) established at the onset of the plan, and an overview of alternatives development.
>
> **Chapter 2 (Qualifications) –** describes WSDOT's qualifications to implement and operate the Program.
>
> **Chapter 3 (Station Evaluation) –** addresses the stations to be served by the Program, including discussion of proposed improvements.
>
> **Chapter 4 (Service Operation Plan) –** provides the technical basis for establishing and improving the existing service, including route selection, operations analysis, and the infrastructure and equipment required to support the Program.
>
> **Chapter 5 (Ridership and Revenue Projections) –** reviews the methodology used and the projections developed for ridership and revenue for the funded Program.
>
> **Chapter 6 (Public Benefits of the Service) –** presents the public benefits of the funded Program; including results of a cost benefit analysis and an economic impact analysis.
>
> **Chapter 7 (Program Delivery) –** provides an overview of the process used to deliver the Program, including stakeholder coordination and applicable agreements, the phases of the Program and the required Program documents.

Background

Over the past several decades, cities located in western Washington state have experienced a steady population growth, which has resulted in increases in highway traffic and airport congestion. The Washington State Legislature recognized the need to develop more transportation options between major population centers and directed the Washington State Department of Transportation (WSDOT) to launch the Intercity Passenger Rail Program in 1993. The purpose of the program is to provide safe, efficient, environmentally responsible alternatives to highway congestion through the development of a regional intercity passenger rail program. The rail passenger service is to complement and enhance other transportation systems, accommodate future travel demand, ensure state economic viability, save energy, and protect quality of life.

WSDOT completed long-range and mid-range plans for high-speed passenger rail in 2006 and 2008, respectively, that document the need for passenger rail improvements through a progressive and well-planned approach. The long-term vision is a dedicated high-speed intercity passenger service where trains will operate at higher speeds, with 13 daily round trips between Seattle, Wash. and Portland, or and four daily round trips between Seattle, Wash. and Vancouver, British Columbia. The region takes a cost-effective, systematic approach towards achieving this vision, by focusing investments on projects that have immediate benefits, but also lay the groundwork for the future.

The American Recovery and Reinvestment Act of 2009 (ARRA), enacted February 17, 2009, appropriated $8 billion to the Federal Railroad Administration (FRA) to fund high-speed and intercity passenger rail projects. The purpose of the funding was to reinvigorate intercity passenger rail in the United States and usher in a new era of rail transportation, reduce airplane and automotive pollution, spur economic growth and job recovery, and revitalize American manufacturing.

Service Development Plan Purpose

This Service Development Plan (SDP) outlines the basis and implementation approach for improving and expanding Amtrak Cascades intercity passenger rail service in the Pacific Northwest. The SDP covers three general topics: (i) rationale for the improved service (including purpose and need), (ii) service/operating plan and prioritized capital plan, and (iii) implementation plan (including project management approach, stakeholder agreements and financial plan.

FRA Service Development Plan Requirements

This plan fulfills the requirements for the SDP set forth by the FRA under the ARRA High-Speed Intercity Passenger Rail (HSIPR) Program. FRA published the interim guidance for the ARRA HSIPR Program in the Federal Register on June 23, 2009, (Vol. 74, No. 119, page 29900). Sections 2.2, 4.3.3.2, and Appendix 2.2 of the interim guidance describe the requirements of a Service Development Plan.

ARRA Interim Guidance

On June 23, 2009, the FRA published a Notice of Funding Availability and Interim Program Guidance for the High-Speed Intercity Passenger Rail (HSIPR) Program. This notice described multiple funding opportunities for projects at different stages of development, while also providing details on how applicants were expected to comply with the multiple requirements of HSIPR.

In order to accommodate the variety of potential applicant goals and stages of project development while meeting the statutory and program constraints, the Interim Guidance provided four funding "tracks" in which applications may be submitted. FRA has adopted this four-track approach to aid in near-term economic recovery efforts and to establish the path to realize a fully developed national High-Speed Rail Intercity Passenger Rail network.

Award Announcement for Washington State

In response to the funding availability, WSDOT submitted an application in October 2009 for a grant under the Track 2 – High-Speed Rail/Intercity Passenger Rail Service Development Program. WSDOT would use the funding to improve and expand Amtrak Cascades intercity passenger rail service on the PNWRC. Completion of an SDP and a Tier 1, service-level, NEPA[1] document were pre-requisites for eligibility. The application included an initial draft SDP and a NEPA Environmental Assessment (EA) that outlined WSDOT's incremental approach toward expanding service on the PNWRC. Identified as "Service Blocks", this stepwise approach allows for implementation of service improvements as funding and travel demand allows.

FRA selected WSDOT for an award of $590 million to fund the PNWRC Program (Program) and, in February 2011, the two entities entered into a Grant/Cooperative Agreement (FR-HSR-0017-11-01-00) to implement a selected number of projects (eleven) identified in the 2009 initial draft SDP. These projects (listed as Tasks in the Agreement) will accomplish a series of passenger rail service improvements between the Columbia River and the U.S./Canada border in Washington state. The improvements will reduce the current delays encountered by the Amtrak Cascades passenger trains attributable to freight train interference/congestion, track conditions and signaling, and will improve ride quality and passenger comfort, trip reliability, and on-time performance for the Amtrak Cascades and other intercity passenger services, while adding rail capacity to the overall route. Additional funding ($161,575,100) was made available to the Program as a result of redistribution of ARRA funding originally obligated to other states. The funding would provide for additional improvements (five more projects) within the PNWRC to reduce further the incidence of delays caused by freight train interference, temporary speed restrictions, and service disruption due to landslide events and reliability of motive power. The Agreement was amended in April 2011 (Amendment #1) and in September 2011 (Amendment #2) to include the scope and budget of the additional projects. Amendment #2 reflected the total number of projects (16) funded under the Agreement[2].

Because of the change in the scope and budget of the Program, FRA required WSDOT to update the 2009 initial draft SDP to reflect the scope of the funded Program (as described in the Agreement) and the specific quantifiable benefits of the projects. WSDOT submitted an updated draft in July 2011, which included results of Rail Traffic Controller (RTC) Modeling as well as an updated cost benefit analysis and economic impact assessment.

The Agreement also stipulated that WSDOT prepare and submit a Final SDP for FRA approval upon completion of the preliminary engineering and environmental review phases for all Program components.

[1] National Environmental Policy Act

[2] The Cascades High Speed Rail Program is comprised of twenty federally funded projects. The four other projects are funded and administered by separate, individual grant agreements: http://www.wsdot.wa.gov/Rail/highspeedrail.htm

Existing Amtrak Cascades Service

The Amtrak Cascades service connects communities from Vancouver, British Columbia to Eugene, Oregon via Seattle and Portland on a 467-mile rail corridor. Listed as one of 11 federally designated, high-speed rail corridors in the nation[3], the PNWRC primarily parallels Interstate 5 (I-5) and is a critical north-south line for local, regional and statewide passenger and freight rail operations.

Amtrak Cascades is a state-supported service jointly administered by the Washington State Department of Transportation and Oregon Department of Transportation in contractual collaboration with Amtrak, host railroads, and equipment manufacturers. WSDOT's intercity passenger rail program sponsors the service between Portland, Seattle, and Vancouver, British Columbia, and the Oregon Department of Transportation's (ODOT) intercity passenger rail program sponsors the service between Portland and Eugene.

To ensure on-time performance, train designers and operators have worked to safely, maximize speeds along the corridor's many curves and varied topography. State supported passenger rail service was first introduced in the Pacific Northwest in 1994, when Amtrak and WSDOT began offering a second daily round trip between Seattle and Portland, and has become increasingly popular for both business travelers and tourists, with service connecting major metropolitan and urban centers throughout the Northwest. Currently, the Amtrak Cascades service runs 4,000 trains per year with stops in 18 cities. The service runs on track owned primarily by the BNSF Railway Company (BNSF) and the Union Pacific Railroad (UP).

WSDOT's role and responsibility in Amtrak Cascades service development include:

- Planning and project identification
- Budget development
- Construction project management and reporting
- Operations oversight and reporting
- Local, regional, state, national and international program coordination
- Public education, public involvement and marketing activities

Since 1994, WSDOT has invested over $627 million in public funds for track and signal improvements, new train equipment, station construction and renovations, and train operations. Passengers and the

[3] FRA designated the PNWRC as a high-speed rail corridor in 1992: https://www.fra.dot.gov/Page/P0140

states of Washington and Oregon fund the operation of Amtrak Cascades[4]. Washington has been focusing its rail improvement efforts on the PNWRC between Portland, or and Vancouver, British Columbia, but it has made investments throughout the state to benefit both freight and passenger services. Funding from the state of Washington comes from taxes collected from the sale of new and used motor vehicles, car rentals and vehicle weight fees. The governor and the state legislature direct these funds to WSDOT's intercity passenger rail program.

WSDOT also receives other federal grants for rail projects. State and some federal funds go toward rail construction projects that allow Amtrak Cascades trains to run safely, reliably, more frequently and with reduced travel times between cities. State funds are also used for day-to-day operation of the trains.

WSDOT's capital investments in equipment, stations, and improvements to BNSF's main line corridor between the U.S./Canada border and the Columbia River have led to additional daily passenger rail service between the region's major cities in 1994, 1995, 1998, 1999, 2006, and 2009. The current Amtrak Cascades service operates 11 daily trains between Eugene, or and Vancouver, British Columbia, providing four daily round-trips between Seattle and Portland; two daily round-trips between Eugene and Portland; and two daily round-trips between Seattle and Vancouver, British Columbia, with intermediate stops in between.

WSDOT and the Oregon Department of Transportation (ODOT) work together with Amtrak to deliver the Amtrak Cascades as one service; however, the contractual frameworks are split between these three core partners. Amtrak has separate operating agreements with WSDOT and ODOT covering their respective responsibilities on the PNWRC. WSDOT's intercity passenger rail program provides direct support for the service between Portland, Seattle, and Vancouver, British Columbia, and ODOT's intercity passenger rail program provides direct support for the service between Portland and Eugene. Table 1-1 provides a summary of the 11 Amtrak Cascades trains operating on the PNWRC in 2011.

Table 1-1: 2011 Amtrak Cascades Service – Train Numbers by Route Section

Route Section	***Between Seattle and Portland***	***Between Vancouver, British Columbia and Portland***	***Between Seattle and Eugene***	***Between Vancouver, British Columbia and Seattle***	***Between Eugene and Portland***
Train Numbers and Direction	501 (S)	513 (S)	507 (S)	517 (S)	504 (N)
	506 (N)	516 (N)	509 (S)	510 (N)	
	508 (N)		500 (N)		

Figures 1-1 and 1-2 are copies of the published schedules that were in effect on July 1, 2011, for the Amtrak Cascades service. The figures also show Amtrak's long-distance service, the Coast Starlight, and Thruway buses, which provide connections to other cities along the PNWRC. This schedule was used as a baseline for the operational modelling conducted by BNSF for the July 2011 Draft SDP.

[4] Funding for Amtrak Cascades service changed dramatically with implementation of the Passenger Rail Investment and Improvement Act (PRIIA) of 2008, which eliminated federal funding via Amtrak starting October 1, 2013.

This service level attracts an increasing number of travelers each year, but is not attracting large segments of business travelers. This is due to schedules that are not at optimal times for early morning and late evening travel, nor travel times that are as reliable as most business travelers desire.

Figure 1-1: Amtrak Cascades Schedule – Southbound (Effective July 1, 2011)

AMTRAK CASCADES-Southbound

Train Name ▸				Amtrak Cascades	Coast Starlight	Amtrak Cascades	Thruway	Amtrak Cascades	Thruway	Thruway	Amtrak Cascades	Thruway	Amtrak Cascades
Train Number ▸				501	11	513	Bus	507	Bus	Bus	509	Bus	517
Normal Days of Operation ▸				Daily	Daily	Daily	Daily	Daily	FrSu [13]	Daily	Daily	Daily	Daily
On Board Service ▸				R B	R	R B	R	R B	R	R	R B	R	R B
	Mile	Symbol											
Vancouver, BC (PT) –Pacific Central Station	0	●	Dp		*5 30A	6 40A		*8 00A		*11 30A		*5 00P	5 45P
Richmond, BC –Sandman Signature Hotel	12	○			R5 50A			R8 30A		R12 00N		R5 30P	
Surrey, BC–Pacific Inn	29	○			R6 20A			R9 00A		R12 30P		R6 00P	
Bellingham, WA (Alaska Marine Highway)	62	●			↓	8 45A		↓		↓	2 50P	↓	7 49P
Mount Vernon, WA	88	○				9 15A					3 25P		8 19P
Stanwood, WA	103	○				9 29A							8 36P
Everett, WA	123	●				10 02A					4 10P		9 09P
Edmonds, WA	139	●				10 27A							9 34P
Seattle, WA	157	●	Ar		9 00A	11 05A		12 00N		3 30P	5 00P	8 30P	10 10P
(Victoria, BC —see below; Port Angeles—see back	0		Dp	7 30A	9 45A	11 25A		2 20P			5 30P		
Tukwila, WA (SeaTac Airport)	11	○		7 44A		11 39A		2 34P			5 44P		
Tacoma, WA	39	●		8 13A	10 31A	12 08P		3 03P			6 13P		
Olympia-Lacey, WA	75	○		8 50A	11 21A	12 45P		3 40P			6 50P		
Centralia, WA	94	●		9 11A	11 45A	1 06P		4 01P			7 11P		
Kelso-Longview, WA	137	○		9 52A	12 29P	1 47P		4 42P			7 52P		
Vancouver, WA	177	●		10 30A	1 08P	2 25P		5 20P			8 30P		
Portland, OR Boise, Seaside, Astoria—see back	187	●	Ar	11 00A	1 50P	2 55P		5 50P			9 00P		
			Dp	11 30A	2 25P	3 35P	5 45P	6 15P	7 30P		9 10P		
Oregon City, OR	202	○						6 36P			9 31P		
Salem, OR	239	●		12 30P	3 37P	4 35P	6 45P	7 22P	D8 30P		10 17P		
Albany, OR Corvallis, Newport—see back	267	●		1 10P	4 10P	D5 10P	D7 20P	7 51P	D9 05P		10 46P		
Eugene-Springfield, OR Florence, Coos Bay—see back	310	●		1 55P	5 03P	6 00P	8 10P	8 50P	D9 55P		11 45P		
University of Oregon-Eugene, OR (PT)	310	○	Ar	2 10P		6 15P	8 25P		10 10P				

Service on Amtrak Cascades® Trains

- R **Coaches: Reservations required.**
- B **Cascades Business class service.**
- **Wi-Fi available on board.**
- Airport connection.
- **Sleeping cars:**
  - Superliner sleeping accommodations on Trains 11 and 14, the Coast Starlight
  - Amtrak Metropolitan Lounge available in Portland for Sleeping car service passengers.
- **Dining cars:** Complete meal service on Trains 11 and 14.
- **Lounge/Bistro cars:** Sandwiches, snacks and beverages on all trains.
- **Bicycles:** Trains 500 through 517 are equipped with a limited number of bike racks for carrying unboxed bicycles.
  - Reservation required; service charge applies.
  - The passenger brings the bicycle to and picks it up from the baggage car.
  - Certain connecting Thruway buses also carry bicycles. Consult agent.
- Visit clippervacations.com or call 1-800-888-2535 for schedules to Victoria, BC.
- [12] Time is available at Eugene to ticket University of Oregon passengers.
- [13] Bus will not operate 7/3 and 9/4. Bus will also operate 7/4 and 9/5.
- * Cantrail Coach Lines accepts two free suitcases and one carry-on bag. Additional bags for a fee. Bicycles must be in a box. Call 604-294-5541.

Smoking is prohibited.

Note: Proper documentation is required to cross U.S./Canadian border. See General Information at Amtrak.com for important customs and immigration information.

Operation of Trains 500 through 517 and Thruway bus service between Portland and Eugene is financed primarily through funds made available by the Oregon Department of Transportation, and between Vancouver–Seattle–Portland by the Washington State Department of Transportation.

Multi-ride Tickets on Thruway Bus Services

Passengers holding multi-ride tickets should be aware that reserved and ticketed passengers have priority seating on Amtrak Thruway buses.

Wi-Fi NOW AVAILABLE ON AMTRAK CASCADES

Wi-Fi is now available on board to passengers traveling on all Amtrak Cascades trains. For more information, see AmtrakCascades.com.

Connecting Local Services

Vancouver, BC—
TransLink Skytrain, bus and ferry service: (604) 953-3333; translink.ca
West Coast Express commuter rail: (604) 488-8906 or 1-800-570-7245; westcoastexpress.com

Mount Vernon—
Skagit Transit bus service in Mount Vernon and "Island Connector" service to Anacortes and Oak Harbor: (360) 757-4433; skagittransit.org

Seattle—
Seattle Metro light rail and bus: (206) 553-3000 or 1-800-542-7876; metro.kingcounty.gov
Sound Transit Sounder commuter rail and Tacoma and Central Rail Service: (206) 398-5000 or 1-800-201-4900; soundtransit.org

Portland—
Tri-Met light rail, bus and streetcar system: (503) 238-7433; trimet.org

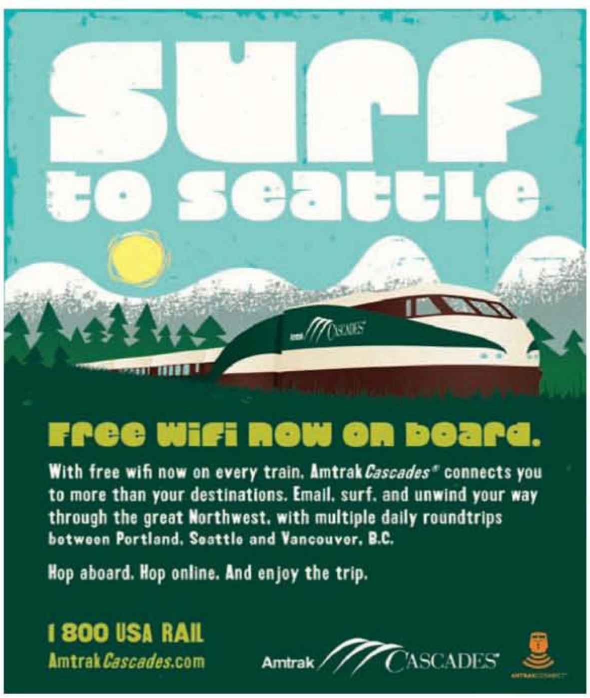
Seattle-Tacoma International Airport

Sound Transit Link Light Rail offers an easy, direct connection from Seattle Amtrak Station to SEA-TAC Airport. Walk out King St. exit, turn left to the Weller Street Pedestrian Overpass and follow it directly two blocks to the International District Station. Trains run every 8-15 minutes 5:00 a.m. - 2:00 a.m. Travel time is 36 minutes. Tickets are $2.50, sold by machine at the entrance. Sound Transit Information: 1-888-889-6368 or www.soundtransit.org.

Figure 1-2: Amtrak Cascades Schedule – Northbound (Effective July 1, 2011

AMTRAK CASCADES-Northbound

Train Name ▸				Amtrak Cascades	Thruway	Amtrak Cascades	Thruway	Amtrak Cascades	Amtrak Cascades	Amtrak Cascades	Thruway	Coast Starlight	Thruway	Amtrak Cascades
Train Number ▸				510	Bus	500	Bus	504	506	516	Bus	14	Bus	508
Normal Days of Operation ▸				Daily	Daily	Daily	Daily	Daily	Daily	Daily	Daily	Daily	FrSu 13	Daily
On Board Service ▸				R B	R	R B	R	R B	R B	R B	R	R	R	R B
	Mile	Symbol												
University of Oregon-Eugene, OR (PT)	0	○	Dp							11 10A	12 50P		3 10P	2 25P
Eugene-Springfield, OR — Florence, Coos Bay—see back	0	● QT				5 30A		9 00A		11 35A	1 15P	12 44P	3 35P	2 50P
Albany, OR — Corvallis, Newport—see back	44	●				6 13A		9 43A		12 30P	2 05P	1 30P	↓	3 40P
Salem, OR	72	● QT				6 42A		10 12A		1 00P	2 40P	2 03P		4 15P
Oregon City, OR	108	○				7 24A		10 54A						
Portland, OR — Boise, Seaside, Astoria—see back	124	● QT	Ar			8 05A		11 35A		2 10P	3 45P	3 40P	5 25P	5 25P
			Dp			8 30A		→	12 15P	2 50P		4 20P		6 15P
Vancouver, WA	134	● QT				8 45A			12 30P	3 05P		4 36P		6 30P
Kelso-Longview, WA	173	○ QT				9 20A			1 05P	3 40P		5 14P		7 05P
Centralia, WA	216	● QT				10 02A			1 47P	4 22P		5 57P		7 47P
Olympia-Lacey, WA	235	○ QT				10 23A			2 08P	4 43P		6 22P		8 08P
Tacoma, WA	271	● QT				11 05A			2 50P	5 25P		7 11P		8 50P
Tukwila, WA (SeaTac Airport)	299	○				11 33A			3 18P	5 53P				9 17P
Seattle, WA	310	● QT	Ar			12 00N			3 45P	6 20P		8 45P		9 45P
(Victoria, BC—see below) Port Angeles—see back	0		Dp	7 40A	10 45A	12 20P	1 00P		4 45P	6 50P		9 15P		
Edmonds, WA	18	● QT	Ar	8 07A	↓		↓		↓	7 17P		↓		
Everett, WA	34	● QT		8 31A		1 05P				7 42P				
Stanwood, WA	54	○		9 03A						8 14P				
Mount Vernon, WA	69	○ QT		9 21A		1 50P				8 27P				
Bellingham, WA (Alaska Marine Highway)	95	● QT		9 52A		2 20P				9 00P				
Surrey, BC–Pacific Inn	115	○			D1 15P		D3 30P		D7 00P			D11 20P		
Richmond, BC –Sandman Signature Hotel	132	○			D1 45P		D4 00P		D7 30P			D11 50P		
Vancouver, BC –Pacific Central Station (PT)	157	●	Ar	11 40A	2 15P		5 00P		8 00P	10 50P		12 20A		



Shading Key

Shading Key	
Reserved long-distance train	Thruway and connecting services
Reserved Corridor service train	

AMTRAK CASCADES ROUTE MAP and SYMBOLS

- A Time Symbol for A.M.
- N Time Symbol for Noon.
- P Time Symbol for P.M.
- D Stops only to discharge passengers; train may leave before time shown.
- R Stops only to receive passengers.
- MT Mountain time
- PT Pacific time
- Bus stop
- Checked baggage
- Airport connection
- Ferry connection
- QT Quik-Trak self-serve ticketing kiosk
- ○ Unstaffed station
- ● Staffed ticket office; may or may not be open for all train departures
- Station wheelchair accessible; no barriers between station and train
- Station wheelchair accessible; not all station facilities accessible

The average annual on-time performance (OTP) for Amtrak Cascades service ranges between 62 percent and 73 percent, based on historical data, with 73 percent being achieved in 2010. A train is considered on time if it arrives at its final destination within 10-15 minutes of the scheduled arrival time[5]. Delays can be caused by freight or passenger train interference, track conditions, signal troubles, third parties (e.g., trespassers or at-grade crossing incidents), weather related incidents, or by equipment failure.

WSDOT and ODOT, along with Amtrak and the host railroads (BNSF and UP), monitor and measure the train performance and causes of delay on the Amtrak Cascades service. The key performance metrics are used to measure the corridor's passenger rail performance and are used to demonstrate to decision-makers and taxpayers the return on their investment. The metrics also assist WSDOT in identifying performance trends that may require corrective policy actions.

On board service accommodations for Amtrak Cascades include both coach and business classes. Coach class is a reserved seating arrangement and includes amenities such as reclining seats, baggage racks, reading lights, Wi-Fi service, and laptop power outlets. In addition to the amenities provided in coach class, business class amenities include priority boarding and detraining, wider seats with additional legroom, fewer passengers in each car, and a menu item coupon.

WSDOT, ODOT and Amtrak work together to update marketing campaigns, offer more promotional fares during off-peak months, and to position the Amtrak Cascades service as a transportation option for U.S. and international visitors for special events.

Locomotives and Rolling Stock

Seven trainsets serve the Amtrak Cascades corridor[6], each of which typically consists of a baggage car, two business-class coaches, one lounge/dining car, one cafe car (also known as a Bistro car), six standard coaches and one substitute power/service car.

WSDOT, ODOT, and Amtrak together operate the Amtrak Cascades equipment as one intercity passenger rail service that serves the entire Amtrak Cascades corridor. Each entity has an ownership stake in the equipment, which encourages the most efficient use of the equipment without favoring any one partner or its direct stake in the fleet. All three partners operationally pool and use the equipment as required. Consequently, irrespective of who owns a particular piece of equipment, Amtrak can operate that equipment anywhere on the corridor to optimize the service and best serve customers. Of the seven trainsets currently in use on the corridor, ownership is as follows:

- Amtrak: Two Talgo Series 6 trainsets.
- WSDOT: Three Talgo Series 6 trainsets.
- ODOT: Two Talgo Series 8 trainsets.

In addition to business and coach class accommodations, each trainset includes a Bistro car that offers food and beverage and a lounge car with table seating for a casual dining experience. Baggage cars allow passengers to check baggage and other specialty items such as bicycles and sporting equipment. All of the Amtrak Cascades trains meet accessibility requirements for disabled passengers. Each train

[5] The OTP threshold depends on the route segment the train is serving.

[6] There were five trainsets in service in 2011. The state of Oregon purchased two trainsets in 2012, which were placed into service in 2013.

has designated space for passengers who use wheeled mobility devices and accommodations are in place to assist these passengers when boarding and de-boarding trains.

A locomotive fleet made up of six Amtrak-owned F59PHI locomotives and six additional Amtrak-owned P42 locomotives powers the trainsets. The six F59PHI locomotives are permanently assigned to the Amtrak Cascades service and are maintained at Amtrak's Maintenance Facility in Seattle. Amtrak integrates six P42 locomotives within their fleet to support the Amtrak Cascades corridor and its long-distance services in the region. The Amtrak locomotives are multifunctional and can push or pull Amtrak Cascades trains. This allows the crews to turn passenger seats around, without having to turn the train set around when trains reach the end of their route. Hidden beneath the 7-foot-tall tail fins at both ends of the train are baggage and service cars (that supply electricity and lights). Amtrak Cascades trains are designed for high-speed service (up to 125 mph), but current track and safety systems limit the trains to a top speed of 79 mph.

Maintenance Facility

The locomotives and train sets are maintained at Amtrak's Seattle Maintenance Facility. The facility supports Amtrak equipment operations and maintenance for the PNWRC trains including the Amtrak Cascades, *Empire Builder, Coast Starlight,* as well as Sound Transit's *Sounder* commuter trains.

In 2010, Amtrak began a four-phase program to modernize and expand the Seattle Maintenance Facility. Phases I and II were completed in 2012. Phase I provided a new fully enclosed structure over two tracks that is large enough to allow an entire train to be serviced indoors. It will be primarily used by Talgo to maintain the Amtrak Cascades train sets. Phase II provided a three-story building that includes a new materials warehouse for parts storage, administrative offices, and facilities for the approximately 133 mechanical personnel and over 200 transportation personnel who work at the site.

Phases III and IV include (1) construction of a new service and inspection building for Amtrak long-distance trains and Sound Transit commuter trains; and (2) construction of a new locomotive servicing and repair building.

Existing Stations

The existing Amtrak Cascades service operates on the PNWRC and connects cities and towns in western Oregon, western Washington, and the lower mainland of British Columbia, Canada. There are 18 station stops on the PNWRC: one in British Columbia, twelve in Washington, and five in Oregon.

The stations vary greatly in terms of ownership, age, architecture, staffing and operation. The facilities range from simple bus stop type shelters to historic restored depots to relatively modern buildings and offer varying amenities, such as waiting rooms, restrooms, parking, ticketing and baggage services, self-serve ticket machines, and ADA accommodations. Some of the station stops in Washington State share platforms with Sound Transit's Sounder Commuter Rail.

All of the station stops provide some level of multimodal connections to other forms of transportation including domestic and international air travel, ferries, intercity passenger bus, transit light rail and/or bus, rental cars, and taxis. See Chapter 3 – Station Evaluation, for analysis of the stations that serve the Amtrak Cascades and Appendix 2 for detailed description of each of these station stops.

Service Development Plan Rationale

The principal transportation challenges along the PNWRC are centered upon congestion in the airport and highway systems; the high cost of adding transportation capacity to those systems and at the same time maintaining the connectivity, travel times, and travel efficiency upon which users of this transportation corridor and intersecting corridors depend.

Purpose and Need

The purpose of the PNWRC Program is to improve intercity passenger rail service by reducing travel times and achieving greater schedule reliability in order to accommodate growing intercity travel demand along the Washington state segment of the PNWRC.

The need for the Program was first identified in 1993, when the Washington State Legislature acknowledged that major intercity transportation corridors in the state were becoming increasingly congested and directed WSDOT to launch an intercity passenger rail program. Population and employment were projected to increase 40 percent, and almost 50 percent, respectively by 2013. This results in a 75 percent increase of the intercity travel demand forecast. Air travel, with heightened airport security, has become more challenging on the corridor since September 11, 2001. Highway congestion on Interstate 5 (I-5), which roughly parallels the entire PNWRC, is no longer limited to traditional morning and evening peak times around major cities. The need for intercity passenger rail service in the Pacific Northwest has grown in urgency as rail travel has become a more desirable and convenient mode of transportation compared to air or highway travel.

Business and leisure travelers are searching for travel options that are affordable and reliable. It is crucial to the economy of the state of Washington and the Pacific Northwest region that development of an alternative form of effective and efficient travel continues to move forward.

Additionally, intercity passenger rail service is recognized by state and federal policy makers as a means to address 21st century public policy goals, which include reducing the nation’s dependency on foreign sources of energy, reducing greenhouse gas emissions that contribute to climate change, increasing public safety, and strengthening transportation system redundancies in the event of natural and manmade disasters.

In order to expand service, reduce running times, and improve reliability, capacity constraints on the corridor must be addressed. As a point of reference, in 2007, the combined number of freight and passenger trains averaged 49 per day between Vancouver, Wash. and Tacoma, Wash.; 60 trains per day between Tacoma and Seattle, Wash.; 41 trains per day between Seattle and Everett, Wash.; and as many as 28 trains per day between Everett and Blaine, Wash. These numbers are expected to only increase. There are a number of bottlenecks on the PNWRC, where freight train traffic is heavy, especially near port terminals in Vancouver, Kalama, Longview, and Tacoma, Washington. The heavy rail traffic in these areas limits the number of passenger trains that can be operated on the rail line. Further, scheduled running times are extended to allow for anticipated delays in these areas, but unanticipated delays at these locations still result in poor reliability.

To address the need for expanded passenger rail service, WSDOT has worked with BNSF, Amtrak, and Sound Transit, to define and develop railroad infrastructure improvements between the Portland, or and the U.S./Canada border, a portion of the PNWRC that is approximately 297 miles long and located on the BNSF north-south main line. The railroad infrastructure improvements will address network congestion and capacity constraints on the Washington State segment of the PNWRC.

The PNWRC is one of the nation's established intercity passenger rail routes, serving as a popular option for travelers within the region and demonstrating consistent ridership growth. Benefits of the investment in the PNWRC Program include:

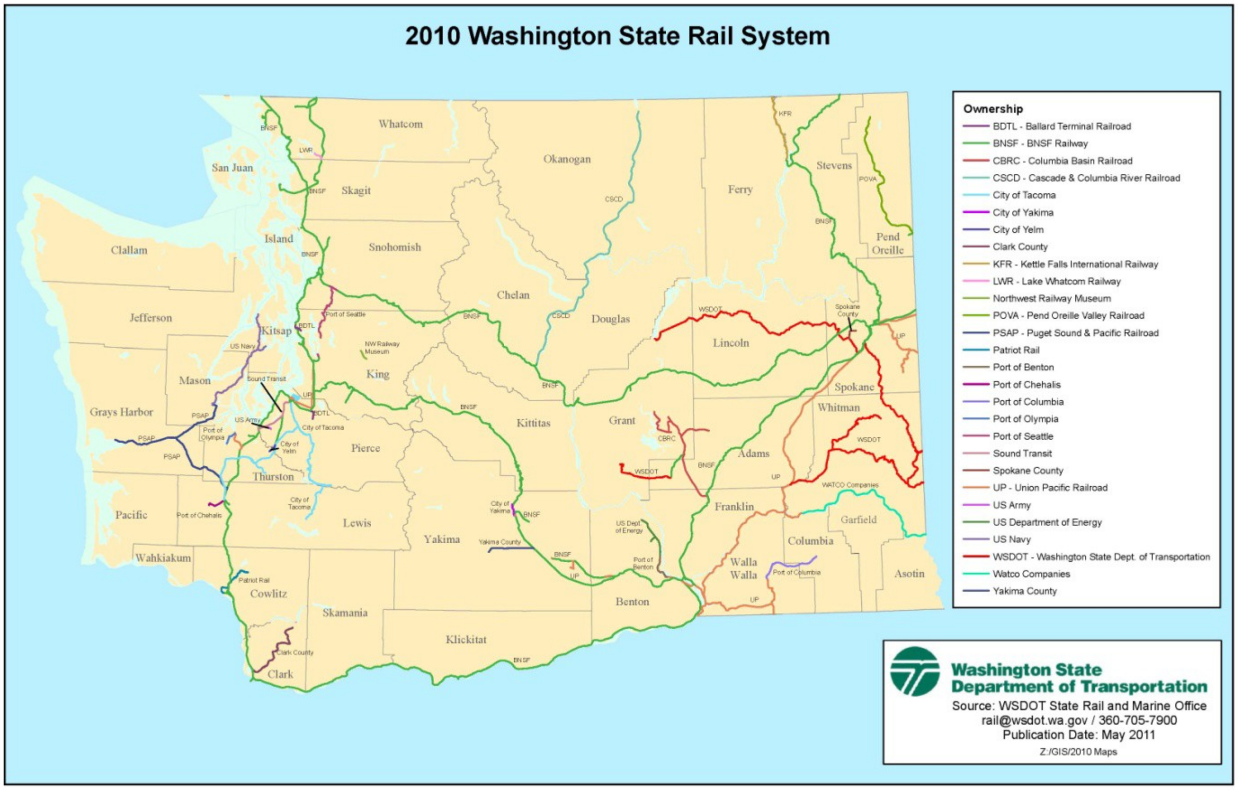
- Creating short- and long-term job opportunities.
- Providing improved reliability and convenience for rail passengers.
- Reducing travel times.
- Increasing daily frequencies.
- Increasing safety through improved infrastructure and signaling.
- Providing an enhanced travel alternative in a critically important economic region of the country.
- Reducing highway and airport congestion.
- Reducing vehicle air emissions as travelers choose rail.
- Contributing to economic growth and strengthening manufacturing, service, and tourism in Washington, Oregon, and British Columbia.
- Providing an affordable transportation option between communities in Washington, Oregon, and British Columbia, especially for segments of the population that have proportionately lower access to air travel, including students, the elderly, tourists, and low income families.
- Serving as the impetus for significant public/private development opportunities near stations.
- Promoting connectivity with other transportation modes, including municipal transit and commuter rail agencies, other intercity and long-distance Amtrak rail services, intercity bus services, major airports, ferries, and cruise lines.

Geography and Population of the Service Area

The Pacific Northwest is a geographic region in western North America bounded by the Pacific Ocean to the west and (loosely) by the Rocky Mountains on the east. The states of Washington, Oregon, and Idaho, together with the coastal areas of British Columbia, Canada, make up this region. The economy is driven by major industries including: agriculture, aerospace, finance and banking, high technology and e-commerce, hydroelectric power, mass retail, forestry, fishing, mining, and outdoor tourism.

Railroads are large part of the transportation network in Washington State for moving people and goods. The economic vitality of the state requires a strong rail system capable of providing its businesses, ports, and farms with competitive access to North American and international markets. Figure 1-3 provides an illustration of the railroad infrastructure in the state of Washington.

Figure 1-3: 2010 Washington State Rail Map (published May 2011)



Source: http://www.wsdot.wa.gov/Freight/Rail/default.htm

Geography

The Pacific Northwest is a diverse geographic region, dominated by several mountain ranges including the Cascade Range, which divides eastern and western Washington/Oregon, the Coastal Mountains in western Oregon, the Olympic Mountains in northwest Washington, and the Rocky Mountains in British Columbia, Canada and Idaho. The Columbia River is the largest river in the region and is considered the largest river (by volume) in the United States. It flows south from the Rocky Mountains of British Columbia, through Washington State, then turns west to form most of the border between Washington and Oregon before emptying into the Pacific Ocean. Four U.S. National Parks are located in the region: Crater Lake in Oregon and Olympic, Mount Rainier, and North Cascades in Washington. Other natural features and attractions include the Oregon Coast, Columbia River Gorge, and Mount St. Helens. The region is highly geologically active with both volcanoes and geologic faults.

The major cities along the PNWRC (Portland, or, Tacoma and Seattle, Wash., and Vancouver, British Columbia) began as seaports supporting logging, mining, and farming industries in the region. Today, these cities have developed into major technological and industrial centers.

Population Growth

Population in the Pacific Northwest is more than 15 million and growing[7]. The 2010 U.S. Census reports the population for Washington State as 6,724,540 and Oregon State as 3,831,074[8]. The population of the Pacific Northwest is concentrated in the Portland – Seattle – British Columbia corridor along I-5 in Oregon and Washington States and Highway 99 in British Columbia. Seattle/Tacoma, Portland, and British Columbia are the region's largest metropolitan areas. A large proportion of the world's high technology companies are headquartered in Seattle, Portland, and Vancouver, British Columbia The 2010 U.S. Census indicates populations for these major cities (exclusive of their surrounding metropolitan areas) are:

Table 1-2: Population 2010 U.S. Census Bureau Statistics

City	***Population***
Portland	583,776
Seattle	608,660
Vancouver, British Columbia9	578,041

Population in Washington state is expected to grow 20 percent between 2010 and 2025[10]. Over the past several decades, the cities of western Washington State have experienced a steadily growing population and economy resulting in highway and airport congestion. This growth pattern has also occurred in organ's Willamette Valley and in the lower mainland of British Columbia. Amtrak Cascades service provides downtown-to-downtown connections to twelve cities in Washington State, five in Oregon, and one in British Columbia. Improved service reliability and frequency fosters acceptance by the business community of considering intercity passenger rail as a transportation choice.

Existing Corridor Transportation Options and Corridor Multimodal Connections

Overall, Washington State's economy depends on a strong transportation system. Valuable asset improvements have been made and the benefits are recognized; however, revenues do not keep up with the transportation system's growing needs. Future economic competitiveness could be jeopardized by increased highway congestion and deteriorating roadways.

Washington State's economy needs to maintain and enhance the existing rail network. The network must provide a reliable, accessible and cost-effective service to residents and customers in Western Washington along with connecting to the national network. At the same time, the freight rail system must co-exist with a high quality, fast, frequent, and reliable intercity passenger rail service between major cities across the state that is competitive with air and automobile travel times. The PNWRC Program focuses on the intercity passenger rail aspect of the state's rail network. However, it is recognized that both systems are interconnected and must be planned accordingly to meet both passenger and freight rail needs as an integrated network.

[7] Go Northwest, www.gonorthwest.com/Visitor/about/population.htm.
[8] U.S. Census Bureau, 2010 Census, http://2010.census.gove/2010census/popmap/.
[9] Vancouver, British Columbia, 2006 Census Data, http://vancouver.ca/commsvcs/planning/census/2006/index.htm.
[10] State of Transportation Moving Washington Forward 2011, http://www.wsdot.wa.gov/publications/.

Highway Travel

Washington State's highways carry 86 million vehicle miles per day on 18,500 highway lane miles. There are more than 3,600 bridges and structures on the state's highway network. Interstate 5 (I-5), which roughly parallels the PNWRC is the main north/south highway in western Wash. Vehicle registrations are anticipated to increase 26 percent between 2010 and 2025, and the number of licensed drivers is expected to increase by 16 percent during the same period[11].

Air Travel

There are 17 WSDOT-managed airports and 138 public use airports within the state of Washington. Major airports that serve the PNWRC include Portland International Airport in Oregon, Sea-Tac International Airport in Washington, and Vancouver International Airport in Canada.

Table 1-3: 2010 Airline Passenger Statistics[12],[13]

Airport	*Domestic Flights*	*International Flights*	*Total*
Portland International Airport (PDX)	6,339,668	236,589	6,576,257
Sea-Tac International Airport (SEA)	14,007,067	1,360,747	15,367,814
Vancouver International Airport (YVR)	Data not available	Data not available	16,779,709

Although Amtrak Cascades does not provide direct service to these three major airports, convenient bus or light rail service provides connectors between the nearby rail stations and their corresponding airports. Portland Union Station is approximately 12 miles from Portland International Airport and MAX light rail service connects this facility; Tukwila station is approximately 5 miles from SeaTac International Airport; and Vancouver Pacific Central Station is approximately 9 miles from Vancouver International Airport.

Transit/Commuter Travel

Public transit along the PNWRC ranges from city agencies to regional authorities. The Central Puget Sound Regional Authority, aka Sound Transit, provides the majority of the transit and commuter services in the Seattle/Tacoma region. Sound Transit services include express buses, light rail and commuter rail. Sound Transit's Sounder commuter rail service operates on the same rail line as Amtrak Cascades and offers morning and evening service between Seattle and Tacoma[14] and between Seattle and Everett, with intermediate stops in between (some of these stops are shared with Amtrak Cascades). Commuter rail compliments, rather than competes with, intercity passenger rail.

[11] State of Transportation Moving Washington Forward 2011, http://www.wsdot.wa.gov/publications/.
[12] 2010 U.S. Airline Passenger Statistics, Research & Innovative Technology Administration, Bureau of Statistics, http://222.transtats.bts.gov/Data_Elements.aspx?Data=1.
[13] 2010 Canada Airport Statistics, Wikipedia, http://en.wikipedia.org/wiki/List_of_the_busiest_airports_in_Canada#Canada.27s_15_busiest_airports_by_passenger_traffic
[14] Sound Transit extended their service to Lakewood in 2012.

Marine Ferries

WSDOT owns and operates the Washington State Ferry System. The system is the largest fleet of passenger and automobile ferries in the U.S. In 2010, the ferry system carried 23 million passengers annually with a fleet of 21 ferry vessels, 20 terminals, and 505 daily sailings[15]. The ferries provide an east-west connection between the larger cities on the PNWRC and communities on Puget Sound and the San Juan Islands.

Intercity Bus Lines[16]

Greyhound Lines offers intercity bus services to more than 3,100 North America destinations, which includes the Pacific Northwest. Greyhound Lines services between Portland and Vancouver, British Columbia similar to the Amtrak Cascades include the following:

Table 1-4: 2010 Greyhound Lines Services[17]

To / From	*Daily Round Trips*	*Travel time*	*Fares*
Portland to Vancouver, British Columbia	4	8 hours, 45 minutes to 8 hours, 55 minutes	$56-$71
Seattle to Portland	4	4 hours, 5 minutes to 4 hours, 20 minutes	$28-$38
Seattle Amtrak Station to Portland (layover at Greyhound Seattle station)	2	7 hours, 30 minutes to 8 hours, 45 minutes	$45-$56
Seattle to Vancouver, British Columbia	5	3 hours, 55 minutes to 4 hours 10 minutes	$29-$38
Seattle Amtrak Station to Vancouver, British Columbia (layover at Greyhound Seattle station)	2	9 hours to 9 hours, 50 minutes	$36-$46

Amtrak passengers can use Greyhound to make connections to cities not served by rail on Amtrak Thruway service by purchasing a ticket for the bus connection from Amtrak in conjunction with the purchase of their rail ticket. Passengers may also buy a bus ticket directly from Greyhound.

The Travel Washington Intercity Bus Program is WSDOT's innovative way to provide intercity bus service and more options for east/west travel to connect smaller towns and rural communities with major transportation hubs and urban centers. Travel Washington transit buses make scheduled connections with other intercity carriers to make traveling accessible, reliable and convenient. The program fills gaps in our statewide transit system by bringing new bus routes to rural communities and other parts of the state that once were underserved.

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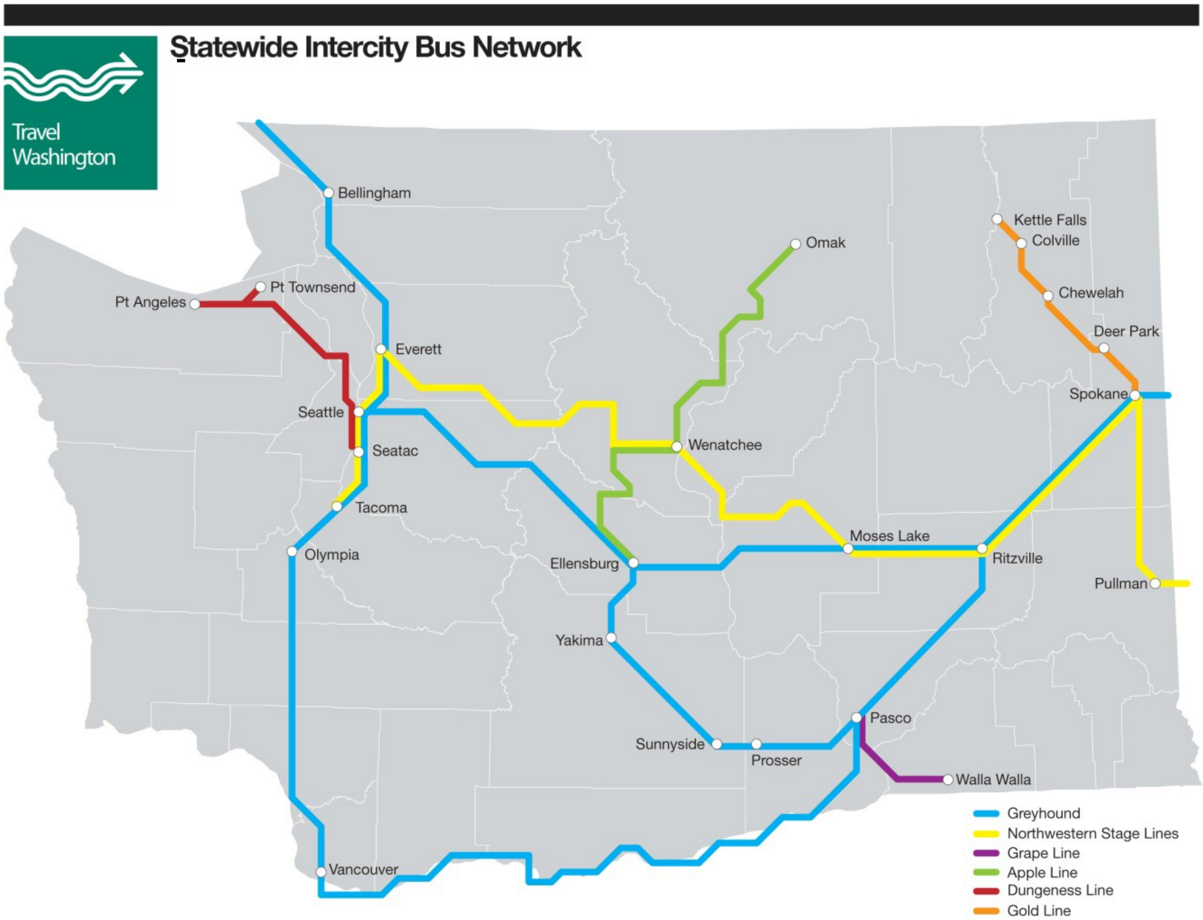
[15] State of Transportation 2011, http://www.wsdot.wa.gov/publications/

[16] WSDOT Travel Washington Program for Intercity Bus Service, http://www.wsdot.wa.gov/transit/intercity.

[17] Greyhound Lines, http://www.greyhound.com/

Figure 1-4: Travel Washington Program Statewide Intercity Bus Network



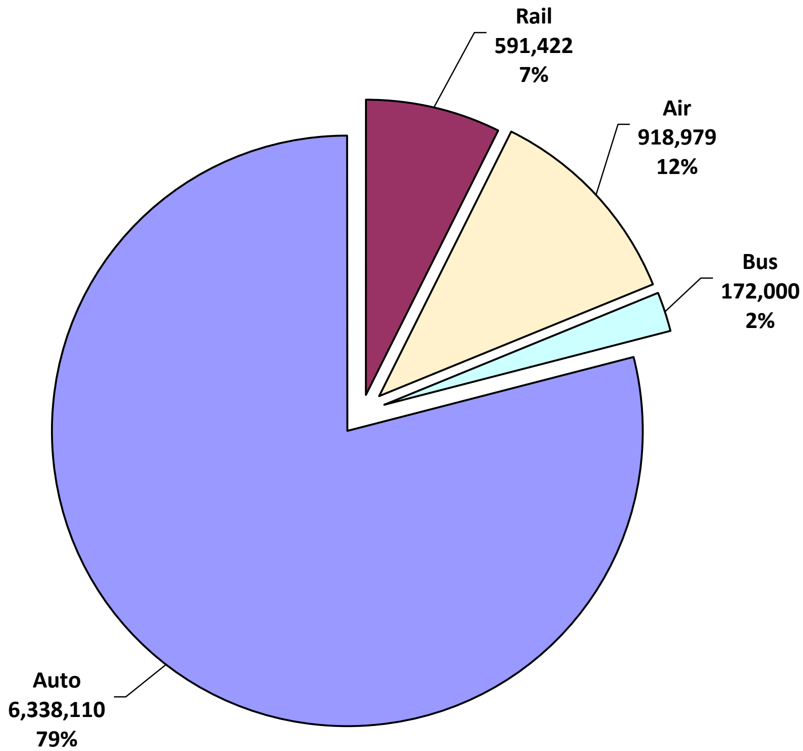
The Federal Transit Administration (FTA) provides 50 percent of the funds for the program and Greyhound Bus Lines provides local matching funds that pay for the rest. The funding structure streamlines a coordinated approach to bringing transit options to portions of the state that are underserved. Currently, there are four intercity bus lines across the state. Schedules are coordinated, for timely connections to other transportation providers, with larger networks such as Amtrak Cascades, Northwestern Trailways, and Greyhound.

Transportation Demand Analysis

As part of the PNWRC service planning process, WSDOT completed a transportation demand and use analysis for travel between Seattle and Portland for 2010. Transportation modes included in the analysis are air, rail, bus, and automobile.

Air trips reflect scheduled intercity non-stop flights between Seattle and Portland; bus trips are based on the capacity of scheduled buses; and auto trips are based upon the Long-Range Plan market size estimate in 2002 and updated to 2010 based upon actual I-5 traffic volumes comparisons between 2002 and 2010.

Figure 1-4: 2010 Intercity Travel Market Shares – Seattle to Portland



Sources: *Data derived from WSDOT Amtrak Cascades Ridership Database; Amtrak Cascades Long Range Plan, Statewide Travel & Collision Data Office, WSDOT; USDOT T-100 Domestic Segment (U.S. Carriers), On-Flight Market Passengers Enplaned by origin for 2010; WSDOT VMT 2010 forecast; Greyhound Bus Schedules.*

Amtrak Cascades Travel Demand

Amtrak Cascades ridership on the Portland to Vancouver, British Columbia corridor has been increasing since the mid-1990s. Based on the travel demand through the years, WSDOT, ODOT, Amtrak, and other stakeholders have partnered to enhance intercity passenger rail services on the PNWRC by increasing frequencies and upgrading amenities on-board and at stations. Table 1-5 highlights service expansion over the years.

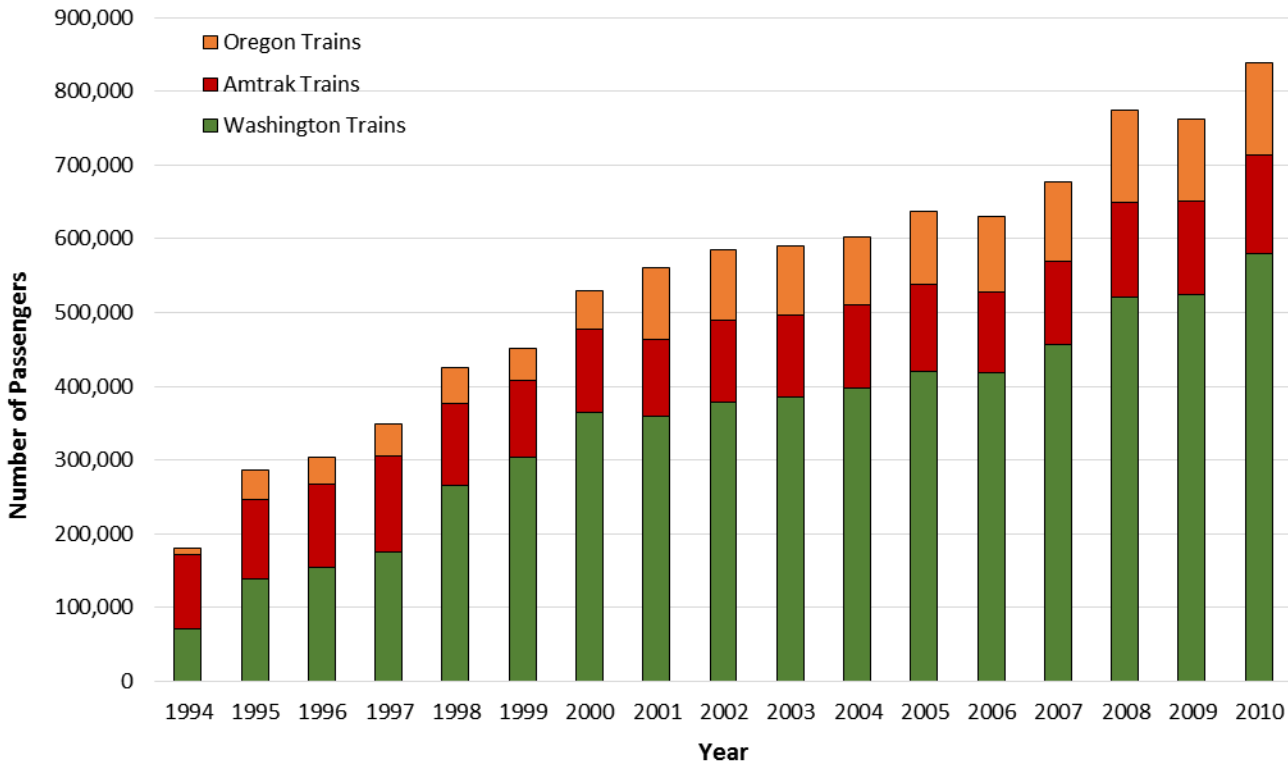
Table 1-5: Amtrak Cascades Historical Expansion 1992-2009

Year	***Activity***
1992	The U.S. Department of Transportation designated the Pacific Northwest Rail Corridor (Vancouver, British Columbia to Eugene, or) as one of five high-speed rail corridors in the country.
1994	WSDOT contracts with Amtrak to sponsor a second daily Seattle-Portland round trip and begins leasing one train set from Talgo.
1995	WSDOT and Amtrak introduce service between Seattle and Vancouver, British Columbia, and offer one daily round-trip between the two cities. ODOT sponsors a daily round-trip between Portland and Eugene, with stops in Salem and Albany.

Year	*Activity*
1996	WSDOT leased a second Talgo train set.
1998	WSDOT sponsors a third daily round trip between Seattle and Portland.
1999	WSDOT offers a new daily Seattle-Bellingham service. The Amtrak Cascades brand is debuted. WSDOT replaces the leased equipment with custom-built trainsets purchased from Talgo.
2000	ODOT sponsors a second Portland-Eugene round trip with the extension of a second daily Seattle-Portland train.
2001	Amtrak Cascades begins stopping at the Tukwila commuter rail station.
2002	A new Amtrak station opens in Everett.
2003	The City of Seattle begins major renovation on King Street Station.
2004	Amtrak Cascades begins stopping at Mount Vernon's new Skagit Transit Station in Wash, as well as the new station in Oregon City, Oregon.
2006	A fourth daily Amtrak Cascades round trip between Seattle and Portland is added to the service.
2009	Amtrak Cascades service between Portland, or and Bellingham, Wash. is extended to Vancouver, British Columbia Amtrak Cascades begins stopping at the new Stanwood Station in Wash.

Since 1994, ridership has risen steadily on the Amtrak Cascades service in the Pacific Northwest between Eugene and Vancouver, British Columbia. In 1994, ridership was less than 200,000 annually; in 2010, total annual ridership was over 838,000.

Figure 1-5: 1994 to 2010 Amtrak Cascades Annual Ridership by Funding Organization



The main factors in travel mode selection by the public include schedule time, reliability, frequencies, and amenities. The PNWRC Program addresses these travel mode factors for Amtrak Cascades by:

- Reducing the travel times by 10 minutes between Seattle and Portland.
- Adding two daily round trips between Seattle and Portland.
- Improving service schedule reliability to 88 percent.

Approximately 80 percent of passengers use Amtrak Cascades service for leisure purposes. Ridership peaks during Friday, Saturday, and Sunday seasonally in the summer months and during the winter holidays. Multi-ride tickets are offered for frequent travelers on the Amtrak Cascades where seats are usually available in Washington from Seattle, Edmonds, or Everett to Bellingham and/or Mount Vernon and in Oregon between Eugene and Portland. Multi-ride ticket types include: 1) *10 Trips in 45 Days*, or 2) *Unlimited Monthly Pass*.

Passengers are sensitive to ticket pricing. Similar to airlines, ticket prices for intercity passenger rail service rise as trains reach capacity. Higher costs for competing transportation modes also increase growth in intercity passenger rail usage. A contributing factor to increased intercity passenger rail ridership in recent years has been driven by higher gasoline prices.

WSDOT recognizes that providing frequent and reliable service is important to attract business customers. Business travelers, in most instances, are willing to pay a higher fare to travel at peak times and for premium services.

Projected ridership forecast results for Amtrak Cascades are expected to continue to grow based on intercity passenger rail being a transportation mode of choice. With the implementation of the improvements and new equipment that are part of the PNWRC Program, increasing ridership growth is anticipated over the next 20 years.

Table 1-6: Projected Amtrak Cascades Ridership

Ridership Year	*Ridership - Actual*	*Ridership - Projected*	*Percent Increase*
2010	838,251		
2015		889,427	6%
2017 (2 daily round trips added)		1,194,082	26%
2020		1,254,956	5%
2025		1,353,024	8%
2030		1,446,764	7%

More detail on ridership and revenue and travel demand is provided in Chapter 5 – Ridership and Revenue Projections.

Identification of Alternatives

To support the SDP for the funded Program and satisfy National Environmental Policy Act (NEPA) requirements, WSDOT completed a Tier 1 (programmatic/service-level) NEPA environmental assessment (EA) in 2009. Service-level NEPA addresses broader issues and likely environmental effects for the entire corridor relating to the type of service(s) being proposed, including cities and stations served, route alternatives, service levels, types of operations (speed, electric, or diesel powered), ridership projections, major infrastructure components, and identification of major terminal area or facility capacity constraints. The Tier 1 EA evaluated two alternatives: 1) No-Build, and 2) Corridor Service Expansion (CSE) Alternative. The No-Build Alternative is the “do nothing” alternative, which illustrates existing service and is used as a baseline. The CSE Alternative included groups of service blocks that will provide distinct improvements to daily service levels (between Seattle and Portland), scheduled running time, and on-time performance. Table 1-7 summarizes the service alternatives.

Table 1-7: PNWRC Program Service Alternatives

Service Alternative	*Alternative Elements*	*Total Round Trips*	*Scheduled Run Time*	*On-Time Performance*
No-Build	Do nothing	4	3h 30min	62%-73%
CSE – Service Block 1	Implement 11 projects	5	3h 24min	88%
CSE – Service Block 2	Implement 17 projects	6	3h 20min	88%
CSE – Service Block 3	Implement 25 projects	8	3h 12min	88%

No-Build Alternative

The No-Build Alternative examined what would happen with the intercity passenger rail service if the proposed action were not implemented. The No-Build Alternative included improvement projects in the vicinity of the rail corridor that would still be constructed as well as planned maintenance on the rail corridor to support freight and passenger operations regardless of any improvement projects.

If no further improvements are made to the PNWRC, then the rail capacity will remain as it exists today for Amtrak Cascades service with four round trips per day between Seattle and Portland, with one of those trips continuing on to Vancouver, British Columbia, and an individual round trip between Seattle and Vancouver, British Columbia As a result, the Amtrak Cascades schedules will remain the same and on-time performance will likely continue to fluctuate between 62 percent and 73 percent based on historical data, and may degrade over time due to the increase in freight traffic operated over the shared corridor. The service capacity cannot be increased on the Amtrak Cascades trains to handle the projected growth in ridership.

Other anticipated benefits that will not be achieved include: reduced use of fuel consumed by automobiles and commercial aircraft transporting intercity travelers; anticipated reductions in greenhouse gas emissions generated by intercity auto and air travel; and reduced congestion on the I-5 corridor. Mobility in the PNWRC will continue to be constrained, thus making the region a less attractive location for businesses that may wish to relocate to areas with improved intercity passenger rail systems. The No-Build Alternative did not meet the Program's purpose and need; therefore, it was not selected as a viable alternative.

Corridor Service Expansion Alternative

The Corridor Service Expansion (CSE) Alternative improves service on the existing PNWRC and includes infrastructure and capital investment projects that, when completed, will result in increased daily service levels, reduced scheduled run-time, and improved on-time performance and schedule reliability. The projects were grouped into three service blocks that would allow for incremental increases in service to be implemented as funding allowed. Service Block 1 included a core set of projects (11). Service Block 2 included all of the projects listed in Service Block 1 plus six additional projects, for a total of 17. Service Block 3 adds seven more projects, for a total of 25.

These projects will also keep the freight operations on the rail system whole such that the increase in passenger service will not negatively impact freight service and operations. The resulting reduction in congestion on the rail network will allow an increase in passenger train frequencies and reliability. In addition, the reduction in congestion will also improve the efficiency of the intercity passenger and freight operations on the network. For example, at specific improvement locations, reduction in localized congestion for the benefit of the intercity passenger rail service may also improve the efficiency of terminal freight switching operations.

The CSE Alternative was selected as the preferred alternative and the FRA issued a Finding of No Significant Impact (FONSI) in November 2010 for the proposed service improvements at the Tier 1 level of review. The SDP for the funded Program includes all but two of the projects identified under the CSE – Service Block 2 Alternative in the Tier 1 NEPA EA. These projects (listed as Tasks in the 2011 FRA-WSDOT Grant/Cooperative Agreement FR-HSR-017-011-00 and subsequent amendments) are described further below. Note: The Service Block 2 projects not funded under this Program were selected and funded under separate, individual federal grants.

- D to M Street Construction (Task 1): Funds construction of 1.4 miles of new passenger rail track between D Street and M Street in downtown Tacoma. The new track, when combined with the Point Defiance Bypass project, will provide a bypass route to reroute Amtrak Cascades passenger trains from the congested BNSF main line tracks along Puget Sound to the new, shorter inland route that will reduce passenger train delays, reduce trip times, and create the capacity for two additional Seattle to Portland Amtrak Cascades service round trips.
- Point Defiance Bypass (Task 2): Construct infrastructure improvements on a 19.5-mile inland bypass route between Tacoma and Nisqually. Project elements include the construction of a 3.5-mile second main line track through Lakeview Junction, the rehabilitation of approximately 10.5 miles of the rail line between Nisqually Junction and Lakewood, as well as station improvements at or near Sound Transit's existing Tacoma Dome Station for relocating the Tacoma Amtrak station to the bypass alignment.
- Vancouver Rail Yard Bypass (Task 3): Construct a bypass track and yard improvements that will separate freight and passenger services, thereby improving the reliability of the intercity rail passenger service. The project scope includes track and signal construction on an existing subgrade.
- Kelso Martins Bluff – Toteff Siding (Task 4): Construct improvements to extend a signaled sidetrack approximately one mile long near the south end of the Port of Kalama on the BNSF's Seattle Subdivision. Increased speeds through turnouts and improved track conditions on the new siding track will result in reduced freight traffic occupancy on the main line, thereby reducing delays to intercity passenger trains.
- Kelso Martins Bluff – New Siding (Task 5): Construct a new signaled siding track near the Port of Kalama on the BNSF Seattle Subdivision. Increased speeds through turnouts will result in reduced freight traffic occupancy on the main line, thereby reducing delays to intercity passenger trains.
- Infrastructure Improvements – Kelso Martins Bluff – Kelso to Longview Junction (Task 6): Construct a new signaled main track near the rail yard serving the Port of Longview on the BNSF Seattle Subdivision. The new main track will reduce the delays to Amtrak Cascades passenger trains by allowing passenger and through freight traffic to move around freight movements entering or leaving the Port of Longview yard facilities.
- Everett Storage Tracks (Task 7): Construct two new departure/receiving tracks and associated signal improvements on an alignment parallel to the existing Delta Yard tracks in Everett. This project will eliminate a substantial rail yard bottleneck by allowing freight trains to move into the Delta Yard and out of the way of oncoming passenger trains, thereby eliminating existing passenger train delays and improving on- time performance.
- Corridor Reliability Upgrades – South (Task 8): Construct infrastructure upgrades from Nisqually Junction (approximately M.P. 24.5) to the Columbia River Bridge at Vancouver, Wash. (approximately M.P. 136.5) on the BNSF Seattle Subdivision. Infrastructure improvements will include, but not be limited to, tie replacement, rail renewal, undercutting, drainage improvements, surfacing and lining, and other work as may be necessary to restore or

upgrade the existing main track. Project work is intended to upgrade the main tracks to a condition that will eliminate the occurrence of temporary slow orders that have adversely affected the reliability of Amtrak Cascades train operations.

- Advanced Wayside Signal System (Task 9): Construct signal system improvements to upgrade the current analog signal system to an advanced wayside signal system with state-of-the-art digital circuitry at control points, sidings, turnouts, and other locations of the existing signal system on the BNSF main line tracks between the U.S./Canada border and the Columbia River. This will improve rail safety, line capacity, and reliability, and will support the potential for future higher passenger train speeds.
- Seattle – King Street Station Tracks (Task 10): Construct track, signal and platform improvements at King Street Station in Seattle on the BNSF's Seattle Subdivision. Elements include turnout and lead track construction, signalization, and extension and construction of station platforms and canopies. These improvements will add track capacity, signalize lead tracks, and modify station platforms and canopies so that the station can accommodate a growing number of daily intercity passenger trains, allowing trains arriving and departing the station to operate at higher speeds, as well as improving track connections between the station and the new Seattle Maintenance Facility.
- New Train Set or Passenger Rail Cars (Task 11): Procure one new trainset or passenger rail cars. The equipment shall be in compliance with the specifications developed by the Passenger Rail Investment and Improvement Act (PRIIA) Section 305 Committee. Proceeding with equipment procurement is dependent upon an evaluation of risks and opportunities. Note: This project was removed from the funded project list after preliminary engineering determined an additional trainset was not required to implement the new service.
- Corridor Reliability Upgrades – North (Task 13): Construct infrastructure upgrades from Everett at PA Junction (approximately M.P. 0.0) to the U.S./Canada border at Blaine (approximately M.P. 119.6) on the BNSF Bellingham Subdivision. Upgrades will occur on approximately 85 miles of track (milepost numbers on some segments of the BNSF Bellingham Subdivision are not consecutive). Infrastructure improvements will include, but not be limited to, tie replacement, rail renewal, undercutting and drainage improvements, surfacing and lining, and other work as may be necessary to restore or upgrade the existing main track. Project work is intended to upgrade the main track to a condition that will eliminate the occurrence of temporary slow orders that have adversely affected the reliability of Amtrak Cascades train operations.
- Vancouver – New Middle Lead (Task 14): Construct a second connecting or lead track, located in the Vancouver, Washington, rail yard, joining BNSF's Seattle Subdivision and connecting to BNSF's Fallbridge Subdivision. The project scope includes track and signal construction on an existing subgrade. This lead track will improve the efficiency of freight movements on and off the north-south main line, thereby improving the reliability of Amtrak Cascades rail passenger service by decreasing interference from freight trains.
- Blaine – Swift Custom Facility (Task 15): Construct a new main track and convert the existing main track to a second siding track near the U.S./Canada border on BNSF's Bellingham Subdivision. The project scope includes new subgrade, track, and signal construction. This new construction will allow freight train inspections to occur clear of the main line, thereby reducing

freight train interference and improving the reliability of the Amtrak Cascades rail passenger service.

- New Locomotives (Task 16): Procure eight new locomotives to be used for Amtrak Cascades passenger service. The new locomotives will replace existing locomotives that are owned by others. The equipment shall be in compliance with the specifications developed by the Passenger Rail Investment and Improvement Act (PRIIA) Section 305 Committee. The new locomotives will be capable of being equipped with positive train control (PTC) technology once the system is approved by the FRA.
- Corridor Reliability Supplemental Work (Task 17): Construct improvements to prevent slope failure incidents and to mitigate the impacts that disrupt the service along the BNSF mainline from Blaine, Wash. on the BNSF Bellingham and Scenic Subdivisions to the Columbia River Bridge at Vancouver, Wash. on the BNSF Seattle Subdivision. The improvements will increase service reliability on the PNWRC by reducing the number of closures of the rail line due to slope failure incidents.

The CSE Alternative selected for the funded PNWRC Program leverages the existing capacity of rail infrastructure and the ability to add capacity to the existing infrastructure in comparison to more costly highway and airport infrastructure, and to reduce congestion on air and highway transportation systems and maintain capacity on those systems for users who cannot readily or economically substitute rail transportation.

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Chapter 2: Qualifications of the State of Washington to Implement and Maintain the Service

In 1991, the Washington State Legislature directed WSDOT to develop a comprehensive assessment of the feasibility of developing a high-speed ground transportation system in the state of Washington. The *High Speed Ground Transportation Study* was delivered to the Governor and the legislature in October 1992. This study confirmed the feasibility of developing high-speed rail in the region. In October 1992, the Federal Railroad Administration (FRA) designated the Pacific Northwest Rail Corridor (PNWRC) as one of five high-speed rail corridors in the United States (U.S.).

Eligibility

The Washington State Department of Transportation (WSDOT) is an experienced and highly successful partner in administering a broad array of federally-funded programs across all transportation modes. WSDOT has the necessary financial management capacity and capability to receive and administer funding for the High-Speed Intercity Passenger Rail (HSIPR) program.

Under the Revised Code of Washington (RCW)[18] Chapter 47.79 – High-Speed Ground Transportation, WSDOT is expressly directed to administer the program:

- ***RCW 47.79.020-Program established – Goals***: The legislature finds that there is substantial public benefit to establishing a high-speed ground transportation program in this state. The program shall implement the recommendations of the high-speed ground transportation steering committee report dated October 15, 1992. The program shall be administered by the department of transportation in close cooperation with the utilities and transportation commission and affected cities and counties.

WSDOT is eligible for the 2009 American Recovery and Reinvestment Act (ARRA) HSIPR funding under the following federal legislation:

- Intercity Passenger Rail Corridor Capital Assistance, Passenger Rail Investment and Improvement Act (PRIIA) Section 301
- High Speed Rail Corridor Development, PRIIA Section 501

Agreements between the States and Enabling Legislation

Amtrak Cascades services traverse through Oregon (Ore.), Washington (Wash.), and into British Columbia. Currently, WSDOT partners with Amtrak under its 403-B[19] to supplement the passenger railroad's national service network through state investments. There are individual state agreements with Amtrak for operations of Amtrak Cascades intercity passenger rail service. There are no bi-state or cross border agreements between the states of Washington and Oregon or between Washington State and British Columbia, however, WSDOT and ODOT signed a Memorandum of Understanding in March

[18] http://app.leg.wa.gov/rcw/

[19] Section 403-B is from the Rail Passenger Service Act of 1970, the Amtrak enabling legislation that established conditions under which local jurisdictions desiring to operate passenger trains could require Amtrak to operate such on their behalf.

2012 to establish a workplan that will define how the two agencies will jointly manage the service. In January 2013, a Corridor Management Workplan was developed and was the first step towards achieving a coordinated, efficient and effective intercity passenger rail service in the PNWRC.

State Enabling Legislation

Legislation that defines Washington State's permanent laws for WSDOT is contained in Title 47 Revised Code of Washington (RCW). This title describes the powers and responsibilities of WSDOT relative to all transportation modes in the state. Similarly, Chapters **47.79 – High-Speed Ground Transportation**, and **47.82 – Amtrak**, describes the organizational structure of WSDOT and the passenger rail-related articles in the statutes, which include the following subsections:

47.79 RCW High Speed Ground Transportation

- 47.79.010 Legislative declaration.
- 47.79.020 Program established – Goals.
- 47.79.030 Project priority – Funding sources.
- 47.79.040 Rail passenger plan.
- 47.79.050 Facility acquisition and management.
- 47.79.060 Gifts.
- 47.79.070 Adjacent real property.
- 47.79.110 King Street station – Findings.
- 47.79.120 King Street station – Acquisition.
- 47.79.130 King Street station – Department's powers and duties.
- 47.79.140 King Street station – Leases and contracts for multimodal terminal.
- 47.79.150 King Street railroad station facility account.
- 47.79.900 Effective date – 1993.

47.82 RCW Amtrak

- 47.82.010 Service improvement program.
- 47.82.020 Depot upgrading.
- 47.82.030 Service extension.
- 47.82.040 Coordination with other rail systems and common carriers.
- 47.82.900 Construction – Severability – Headings – 1990

Legislative Directives and Plans

The Washington State Legislature directed WSDOT to develop plans for passenger and freight rail services in support of state objectives. In addition to the legislation, the legislature has commissioned several studies of rail transportation issues and funding. The underlying theme in the findings and recommendations is that the state faces challenges in population and economic growth for the near future. Rail transportation represents another link in a multimodal solution to address these challenges. Creative funding opportunities are to be considered for transportation initiatives. Plans prepared for the legislature and WSDOT focusing on rail transportation include the following documents listed in Table 2-1.

Table 2-1: WSDOT Passenger Rail Planning and Planning Related Documents 2010-1984

Year	*Title*	*Summary*
2010	Pacific Northwest Rail Corridor Program - Finding of No Significant Impact (FONSI)	This decision document, issued by the FRA, concluded the Corridor Service Expansion alternative would not have a significant impact on the environment.
2009	Pacific Northwest Rail Corridor Program – Service Level Environmental Assessment	Completed to evaluate the impacts of proposed service improvements.
	Washington State 2010-2030 Freight Rail Plan	Provides guidance for initiatives and investments in the Wash. rail system.
	Marine Cargo Forecast: Rail System Capacity	Rail Chapter: Analysis and impacts of passenger rail projects on rail system capacity.
	Amtrak Cascades Market Analysis and Ridership Forecast – 2009-2030	Market analysis and ridership forecasts for incremental service options.
	Cost Benefit Analysis & Economic Impact	Cost benefit analysis for service development options.
	Economic Impact Assessment	Economic impact assessment for service development options.
2008	Amtrak Cascades Mid-Range Plan	Eight-year service development plan with detailed investment analysis and options for achieving incremental Amtrak Cascades services.
2006	Long-Range Plan for Amtrak Cascades	Updated, detailed plan for implementing intercity passenger rail service on the PNWRC.
	Statewide Rail Capacity and Needs Study	Analysis of capacity and needs for both passenger rail and freight rail in Wash..
2004	Amtrak Cascades and Economic Development: A Look Ahead	Discussion of economic development opportunities near Amtrak Cascades stations.
2001	East-West Passenger Rail Feasibility Study	A preliminary analysis of passenger rail and service between Seattle, Pasco, and Spokane.
2000	Update – Amtrak Cascades Plan for Washington State – 1998-2020	Updated summary 20-year program plan for passenger rail service between Portland, Seattle, and Vancouver, British Columbia
1998	Environmental Overview for the Intercity Passenger Rail Plan for Washington State – 1998-2018	Overview of environmental conditions on the Washington segment of the PNWRC.
	Economic Analysis for the Intercity Passenger Rail Service Program for Washington State – 1998-2020	Cross-modal cost comparison of air, auto, and intercity rail service between Portland, Seattle, and Vancouver, British Columbia

Year	Title	Summary
1997	Amtrak Cascades Plan for Washington State – 1998-2020	Summary 20-year program plan for passenger rail service between Portland, Seattle, and Vancouver, British Columbia
	Pacific Northwest Rail Corridor Operating Plan	Establishes service goals for passenger operations on the PNWRC.
	Pacific Northwest Rail Corridor Environmental Impact Statement: Final Management Plan	Environmental documentation for internal use.
1995	Options for Passenger Rail in the Pacific Northwest Rail Corridor: A Planning Report	Describes alternative alignment options for intercity passenger rail service between Eugene, Oregon, and Vancouver, British Columbia
1994	Washington Rail Capacity Analysis	Investigates current and future capacity requirements for the state's rail system.
	The Impact of Intercity Passenger Rail on Operations at Sea-Tac Airport	Analyzes the high-speed rail option to determine its feasibility, considering the likely extent of its impact on future operations at SeaTac International Airport.
1992	Restoration of Passenger Rail Service between Seattle and Vancouver, British Columbia	Summarizes infrastructure improvements required to re-establish passenger rail service between Seattle and Vancouver, British Columbia
	High-Speed Ground Transportation Study	Explores potential high-speed rail corridors throughout the state of Washington.
	Passenger Rail Speed Increase Working Papers 1-3	Investigates steps that need to be taken to provide passenger rail service above 79 mph.
	Statewide Rail Passenger Program: Summary and Technical Reports	Describes potential passenger rail program development.
1984	High-Speed Rail Passenger Service Economic Feasibility Study	First investigation of high-speed rail service for western Washington State.

Operating Subsidy

Fifteen states contract with Amtrak for the operation of trains that supplement the national Amtrak network by extending the reach of passenger rail services or provide additional frequencies on Amtrak routes. State and regional agencies subsidize most of the operating costs of the services not covered by farebox revenues. Continued operation of these state- supported routes is subject to annual contracts and state legislative appropriations, along with Amtrak financial participation[20].

In 2009, WSDOT provided the operating subsidy for operations of four of the five daily round trips for Amtrak Cascades service within Washington State (Amtrak subsidized one round trip). The operating and financial results for Amtrak Cascades intercity passenger rail service are based on one daily round trip that operates between Vancouver, British Columbia to Portland via Seattle and three daily round trips that operate between Seattle and Portland, Ore. The cost allocation methodology changed in October 2013 with the implementation of the requirements set forth by the 2009 Passenger Rail

[20] Inside Amtrak - National Facts: http://www.amtrak.com/servlet/ContentServer?c=Page&pagename=am%2FLayout&cid=1246041980246

Improvement and Investment Act (PRIIA). PRIIA Section 209 placed all of the funding responsibilities to state-supported service on routes less than 750 miles in length. As such, WSDOT and ODOT began providing 100% of the funding to operate the service on October 1, 2013.

The state of Washington began direct support for Amtrak Cascades service in 1994. Based on trending over the previous five years, the state of Washington subsidized approximately 50 percent of the net operating costs. Expenses that Amtrak includes in the calculation of the operating costs include: host railroad; fuel; train and engine labor; yard operations, transportation management, and training; mechanical; stations; and remaining direct and shared costs.

Funding for the operating subsidy is provided in specific WSDOT appropriations every two years through the state's biennial budget act, which requires approval by the State Legislature and signature by the Governor. As with all appropriations, WSDOT requests funding for its intercity passenger rail service appropriations based on estimates of operating costs over the next two years.

Washington State operates on a two-year (biennial) basis – July 1 of each odd numbered year through June 30 of the next odd-numbered year. The following is an outline of the state budget process:

- By early fall of each even-numbered year, state agencies are required to submit their budget request for the upcoming biennium to the Governor's Office of Financial Management (OFM). OFM staff evaluates the agency requests during the fall and provides analysis and recommendations to the Governor.
- As required by law, the Governor poses a biennial budget in December of even- numbered years. Based on the analysis and recommendations of OFM, the Governor develops a proposed spending and taxation plan for the biennium and submits the proposed budget to the legislature for consideration during session.
- The legislature reviews the Governor's budget and formulates its own version during the legislative session. By tradition, each biennium the House and Senate alternate being the first to publish a proposed budget.
- The chairs of the fiscal committees (House Appropriations, House Capital Budget, House Transportation, Senate Ways and Means, and Senate Transportation) work with their respective members and staff to analyze the Governor's proposed budget. Alternative recommendations or proposals usually result from this effort.
- After each chamber has passed a version of the budget, the differences are worked out in the budget conference process. Generally, fiscal leaders from both chambers and both political parties meet to negotiate and draft a final budget that is submitted to the full legislature. Once the identical budget is passed by both chambers, it is delivered to the Governor for signature.
- The Governor may veto all or part of the budget. The Governor may eliminate funding or requirements for certain activities, but may not add money for an activity for which the legislature did not fund. The budget for the biennium is established when the Governor signs the budget bill.
- In even-numbered years, the legislature will consider changes to the biennial budget. These modifications, known as the supplemental budget, are generally corrections to the 2-year spending plan to account for changes in conditions faced by the state.

Financial Responsibility

WSDOT delivers a sizable transportation program that spans all modes of travel and has successfully delivered multiple large-scale projects over the past ten years. The program in the approved 2011 to 2013 State transportation budget was $5.6 billion[21]. WSDOT analyzes and bonds a sizeable portion of the highway-related budget, and works closely with the State's financing community and Office of the State Treasurer to assure that the state maintains sound financial standing.

If WSDOT's transportation funding were to remain static between 2011 and 2017 (over three biennia), the cumulative budget would be approximately $16.8 billion. When compared to the PNWRC Program funded at $760.1 million[22], the PNWRC Program would comprise approximately 4.5 percent of WSDOT's total budgeted workload.

At this time, the PNWRC Program is funded from three sources:

1) $751.5 million FRA High Speed Intercity Passenger Rail (HSIPR) grant appropriated by the American Recovery and Reinvestment Act (ARRA)
2) $24.6 million in local funding from Sound Transit.
3) $4.0 million[23] in state Multi-Modal Transportation Account (MMA) funding to cover federally ineligible costs.

The PNWRC Program will use the FRA and Sound Transit funding directly and will not solicit any financing for construction of the individual projects. The state MMA funding comes from programmatically bonded revenues and is not individually financed. The PNWRC Program is not responsible for any financing costs or debt service.

Current authorized funding can be verified on the Washington State legislatively-approved transportation project list (LEAP list) at the following link: http://leap.leg.wa.gov/index.html.

Cost Sharing and Matching Funds Agreements

The FRA has authorized $751,575,100 in 2009 ARRA funding for the PNWRC Program under Grant/Cooperative Agreement FR-HSR-0017-11-01-00 and Amendments 1 and 2 as follows:

Table 2-2: Funding Summary

	FRA Funded	***Grantee Funded***
Grant/Cooperative Agreement FR-HSR-0017-11-01-00	$590,000,000	$24,612,590
Amendment 1	$145,458,912	$0
Amendment 2	$16,116,188	$0
Funding Source Obligation	$751,575,100	$24,612,590
Funding Source % Contribution	96.8290%	3.1710%

[21] Engrossed Substitute House Bill (ESHB) 1175, Chapter 367, Laws of 2011 (referred to as 11LEGFIN)

[22] The funded Program increased to $776.2 million in September 2011 when additional funding was made available as a result of redistribution of Recovery Act funds originally obligated to other states.

[23] Rounded from $3.990 million

Total Program	***$776,187,690***

Grantee funding is for Task 1: Tacoma - D to M Connection project and is through a local Sound Transit commuter rail agency contribution. The funding that comprises the $24.6 million Sound Transit contribution uses five different funding sources:

- FTA-Section 5307 (29%)
- FRA FY 2008 State Assistance Grant (24%)
- WSDOT Regional Mobility (18%)
- Federal Surface Transportation Program (STP) (17%)
- FY 2011 Congestion Mitigation and Air Quality Program (CMAQ) (12%)

The WSDOT and Sound Transit Memorandum of Understanding, executed June 8, 2010, describes cost split obligations between agencies and funding risk for federal reimbursement for Task 1; Tacoma – D to M Connection. As part of the PNWRC Program, WSDOT and Sound Transit will negotiate, and with FRA concurrence, execute agreements for the following: 1) Service Outcomes Agreement; 2) Stakeholder/Construction Agreement; and 3) Maintenance Agreement. The Stakeholder/Construction Agreement will specifically include the cost sharing along with the responsibility for handling cost overruns for Task 1.

Prior Experience with Large Transportation Projects and Rail Projects

WSDOT is an experienced and highly successful partner in administering a broad array of federally-funded programs across all transportation modes. Washington State has a sizeable transportation program that spans all modes. The approved 2011 to 2013 budget included a $5.6 billion transportation program. Mega transportation projects within Washington State include:

- SR 520 Bridge Replacement and High Occupancy Vehicle Project ($4.65 billion).
- Alaskan Way Viaduct and Land Seawall Replacement Project ($3.1 billion).
- Tacoma Narrows Toll Bridge and High Occupancy Vehicle Project ($849 million).
- U.S. 395 North Spokane Corridor Project ($612 million).

WSDOT's Gray Notebook is a quarterly performance and accountability report that provides summary expenditure and budget information for all of WSDOT's projects, including information on WSDOT's financial health, and tracks how well WSDOT is delivering on its projects. The most recent financial assessment report that includes WSDOT's rail program can be found by searching the subject index at the following link: http://www.wsdot.wa.gov/Accountability/GrayNotebook/navigateGNB.htm

WSDOT is familiar with the reimbursement nature of federal funding, receiving approximately $846 million in federal highway (FHWA) funding, $45 million in federal railroad funding (FRA), $25 million in federal transit funding (FTA), and $1 million in federal aviation funding (FAA). Thus, WSDOT has all the necessary accounting and financial management processes in place and has established the necessary processes needed for the PNWRC Program.

Passengers and the states of Washington and Oregon fund the operation of the Amtrak Cascades. Washington has been focusing its rail improvement efforts on the Interstate 5 (I-5) corridor between the Columbia River and the U.S./Canada Border, but it has made investments throughout the state to benefit both passenger and freight operations. Funding from the state of Washington comes from a portion of the taxes collected from the sale of new and used motor vehicles, car rentals, and vehicle weight fees. The Governor and the state Legislature direct these funds to WSDOT's intercity passenger rail program.

WSDOT has also received federal grants for specific rail projects through the years. Some of the state and federal funds go toward rail construction projects that allow Amtrak Cascades trains to operate safely, reliably, more frequently, and with reduced travel times. Representative projects completed or in progress include:

State Fiscal Year(1)	***Improvement***	***Project Location***	***Cost*** ***(in millions)***
2007-Current	Amtrak Cascades Train Set Overhaul	N/A	$9.0
2005-Current	Vancouver-Rail Bypass and West 39th Street Bridge	Vancouver, Wash.	$120.0
2006-2010	New Stanwood Station	Stanwood, Wash.	$5.0
2005-2007	Talgo Train Set Purchase	N/A	$7.5
2003-2007	King Street Station Improvements	Seattle, Wash.	$9.0
TOTAL			***$155.5***

(1) Washington State Fiscal Years start on July 1 and end on June 30

Understanding the Commitment

Since 1994 WSDOT has partnered with the FRA, the state of Oregon, the province of British Columbia, Amtrak, host railroads (BNSF Railway, Sound Transit), and others to provide fast, reliable and more frequent intercity passenger rail service along the I-5 corridor. The service, known as Amtrak Cascades, provides travelers transportation options for intercity trips. WSDOT's role and responsibility in Amtrak Cascades service development includes:

- Planning and project identification.
- Environmental documentation.
- Preliminary engineering/final design.
- Budget development.
- Construction project management and reporting.
- Operations oversight and reporting.
- Local, regional, state, national, and international program coordination.
- Public education, public involvement, and marketing activities.

State and federal funds are committed to rail construction projects that allow Amtrak Cascades trains to run safely, reliably, more frequently, and with reduced travel times between cities. State funds are also used for the day-to-day operation of the trains.

In anticipation of capital funding programs for high-speed intercity passenger rail service development, WSDOT prepared an updated Long-Range Plan for Amtrak Cascades in 2006 and an Amtrak Cascades Mid-Range Plan in 2008. Both transportation plans were developed in close coordination with BNSF, Amtrak, and other stakeholders. The plans present, in detail, how a series of strategic capital investments in the shared rail corridor will create sufficient rail line capacity to accommodate incrementally faster, more reliable, and more frequent Amtrak Cascades service without degrading existing and future operations of BNSF, Union Pacific, and Sound Transit. These planning documents provided the basis for WSDOT's HSIPR grant applications between 2009 and 2011.

With the 2009 ARRA HSIPR grant, totaling over $751 million, Washington State is now implementing the PNWRC Program, which includes infrastructure improvements and equipment acquisition that, when completed in 2017, will allow for reduced travel times and increased frequencies (two daily round trips) between Seattle and Portland, as well as improving on-time performance.

Public Support and Public Involvement

The National Environmental Policy Act (NEPA) Tier I, Service Level Environmental Assessment (EA), completed in September 2009, evaluated the PNWRC Program of improvements including a: 1) no-build alternative; and a 2) corridor service expansion alternative. WSDOT posted the EA on its Web site on October 2, 2009 and requested that all written comments be received via e-mail or by mail by October 19, 2009 (17-day comment period). Additionally, notice of the EA was posted on the Washington State Environmental Policy Act (SEPA) Register on October 5, 2009; due to agency requests, the comment period was extended until October 23, 2009 (extended comment period to 21 days). The EA was also sent via mail to federal, state, and local agencies; military bases; ports; tribes; and city and county governments located along the rail corridor.

Thirteen agencies submitted written comments on the EA. No individual written comments on the EA were received. Agency concerns included:

- Future site-specific analysis.
- Deadline for the comment period.
- Future train stop locations.
- Potential grade-separated crossing locations.
- Wildlife/train collisions.

WSDOT responded to each of the comments in writing. The written responses are included in an appendix to the EA. FRA issued a Finding of No Significant Impact (FONSI) for the PNWRC service expansion alternative in November 2010. Project level (i.e., site-specific) environmental evaluation will be prepared for the individual projects within the program which include public outreach and involvement components. Public involvement activities for the individual projects include outreach to communities through scoping letters and meetings, public notices, community open houses, and agency and tribal meetings.

To facilitate public access, each project will have a communication plan to address three main audiences: 1) media relations; 2) government relations; and 3) community relations. The communication tools WSDOT may use include e-mails, press releases, newsletters, and in some cases, open houses to keep media, government officials, and the community informed of the improvements being planned and their progress. The choice of communication tools and the extent that they are used vary with the size and potential impacts of each improvement and the amount of interest by each of the audiences. At a minimum for each project, WSDOT will develop individual project Web pages that include a project description and location map, contact information, and all public outreach materials and environmental documents. Monthly updates are posted on each Web page. The individual project web pages are located at http://www.wsdot.wa.gov/projects/.

Native American tribes have determined their areas of interest on WSDOT projects. When a project is proposed, WSDOT consults with the affected tribes on a government-to-government basis. This consultation occurs either as a National Historic Preservation Act Section 106 consultation or as a Governor's Executive order 05-05 consultation (which is similar to a Section 106 consultation and is required for all state-funded, capital construction projects).

In August 2010, FRA initiated formal government-to-government consultation for the PNWRC Program in a letter sent to potentially interested tribes. FRA and WSDOT will continue to meet their government-to-government consultation responsibilities during the project-level environmental process and at the request of the individual tribes. In general, tribes are concerned about any affects to their usual and accustomed fishing, hunting, or sacred places, as well as any known archaeological sites or the potential of encountering unknown cultural resources. A cultural resources report/survey is completed for every project, and an inadvertent discovery plan is required for all project construction.

Chapter 3: Station Evaluation

This chapter addresses the stations to be served by the improved intercity passenger rail service and the how stations will accommodate the proposed new service. The PNWRC Program SDP reflects improvement of existing service; therefor, evaluation is centered on the existing stations within the Washington Segment of the PNWRC and their ability to meet the goals and objectives of the improved intercity passenger rail service, which are:

- Two additional Seattle-Portland round-trips, for a total of six;
- A 10-minute reduction in scheduled run-time between Seattle-Portland; and
- Increase overall on-time performance to 88%.

The first section provides and overview of the existing stations and the second section describes the station improvements needed to support the improved service.

Overview of Existing Stations

The existing Amtrak Cascades service operates on the PNWRC and connects cities and towns in western Oregon, western Washington, and the lower mainland of British Columbia, Canada. There are 18 station stops on the PNWRC: one in British Columbia, twelve in Washington, and five in Oregon. The distance between the station stops ranges roughly between 10 to 60 miles. The location of and distance between the station stops is a function of population and demand, in that stops are closer together in the densely populated, urban areas and farther apart in the rural areas.

The stations vary greatly in terms of ownership, age, architecture, staffing and operation (WSDOT currently owns only one station: Stanwood Station). Roles and responsibilities regarding maintenance and operation of the station vary as well and are facilitated through agreements with the various parties. The station facilities range from simple bus stop type shelters to historic restored depots to relatively modern buildings and offer varying amenities, such as waiting rooms, restrooms, parking, ticketing and baggage services, and self-serve ticket machines. All of the stations meet, or will meet, the Americans with Disabilities Act (ADA) compliance requirements[24].

Some of the station stops in Washington State share platforms with Sound Transit's (ST) Sounder Commuter Rail. All of the station stops provide some level of multimodal connections to other forms of transportation including

[24] Amtrak is currently implementing the Accessible Stations Development Program, which will identify needed improvements to ensure accessible features and pathways at all of their stations

domestic and international air travel, ferries, intercity passenger bus, transit light rail and/or bus, rental cars, and taxis.

There are several commuter rail stations on the PNWRC that are used exclusively by ST and do not host Amtrak long-distance or Amtrak Cascades service. These commuter rail stations are located in Mukilteo (between Everett and Seattle), Auburn, Kent, Sumner, and Puyallup (between Tukwila and Tacoma). In addition, there are two commuter rail only stations on the Point Defiance Bypass route (which will become part of the PNWRC as a result of the Program): one in South Tacoma and one in Lakewood.

Appendix A of this SDP presents information for each of the 18 Amtrak Cascades station stops on the PNWRC, starting at the northern terminus in Vancouver, British Columbia to the southern terminus in Eugene, or Each station stop is described in terms of its physical location, as well as a reference route mile on the PNWRC, history, ownership, features and services, access, and multimodal connectivity.

The information was collected from various sources, including Amtrak's Great American Stations website (http://www.greatamericanstations.com/), WSDOT Rail Division and local jurisdiction websites. WSDOT used this information to evaluate the sufficiency of each station and identify needed improvements.

Station Improvements

The evaluation of the existing station stops found they provided adequate access to the proposed expanded service, as such the PNWRC Program does not propose to remove or add any new station stops at this time; however, there is a need to implement improvements at two existing station stops: King Street Station in Seattle and the station stop in Tukwila. In addition, due to rerouting passenger trains onto the Point Defiance Bypass route, the Tacoma station stop would need to be relocated.

The PNWRC Program, as funded by the 2011 Grant/Cooperative Agreement between WSDOT and the Federal Railroad Administration (FRA) includes improvements to the tracks and platforms at the Seattle station stop (listed as Task 10: Seattle – King Street Station Tracks) and the relocation of the Tacoma station stop (identified within Task 2: Point Defiance Bypass). Although not included in the funded Program, additional improvements at King Street Station as well as the improvements at Tukwila Station are included in this discussion because they support the overall Cascades High-Speed Rail Program[25].

King Street Station - Seattle

King Street Station is a major hub for rail passengers, and is the busiest passenger station on the PNWRC. The station serves 26 ST Sounder commuter, 10 Amtrak Cascades and four Amtrak long-distance (the Coast Starlight and the Empire Builder) trains each day, in addition to the attendant movements to and from the maintenance facility. Ownership of the King Street Station is invested in several entities. The city of Seattle owns the station building itself, while BNSF owns the main tracks and station tracks. However, Amtrak leases the station tracks and platforms from BNSF, and is responsible for operation and maintenance in these areas. ST, while not an owner, has exclusive use of station tracks 1 and 2 and the platform and elevators between them, all of which Amtrak maintains.

[25] The Cascades High Speed Rail Program is comprised of twenty federally funded projects. The projects are funded and administered by several grant/cooperative agreements: http://www.wsdot.wa.gov/Rail/highspeedrail.htm

The improvements identified at King Street Station involve major upgrades to the tracks and platforms to increase train and passenger capacity as well as renovation to the building to strengthen the structural integrity and accommodate higher volumes of rail travelers.

Track and Platform Improvements

Discussed further in Chapter 4 – Operations Analysis, this work includes new track and switches and a new platform. These upgrades are needed to allow the station to handle the projected growth in train traffic.

Seismic Retrofit and Renovation

Upgrades to the station were identified in the 2009 draft SDP as well as prior service planning documents. This work is part of the multi-phase major restoration of King Street Station, which began in 2004. In late 2010, the Federal Rail Administration (FRA) awarded an ARRA HSIPR grant (approximately $16 million) to fund a portion of the expanded passenger facilities and seismic retrofit. The work includes construction of a seismic support system to greatly enhance public safety and keep the station functional after earthquakes. Additional project benefits include better access to the main hall ticketing and waiting area, as well as more efficient heating and cooling systems.

Tacoma Station

The Point Defiance Bypass project, described in more detail in Chapter 4 – Operations Analysis, will re-route Amtrak long-distance and Amtrak Cascades trains off the BNSF main line between Nisqually and TR Jct. As a result, trains will no longer have access to the current Amtrak station located on Puyallup Avenue in Tacoma. Instead, Amtrak long-distance and Amtrak Cascades trains will stop at the ST Sounder commuter station a few blocks away. Informally known as “Freight house Square,” the Tacoma Dome Station location is ideally situated at a main gateway to the city, with easy access to Interstates 5 and 705, State Routes 7, 16, 167, and 509, local and regional bus service, free Link streetcar service to downtown, and a parking garage with spaces for park-and-ride.

The existing commuter rail station is comprised chiefly of an 800-foot long platform, between the Freighthouse Square building and the tracks. Passenger access is either directly from East D Street onto the platform or through the breezeway in the middle of the Freighthouse square development. The breezeway provides direct access between the platform and East 25th Street, where passengers can board the free Link streetcar for downtown Tacoma, which operates on 10-minute headway between 7AM and 7PM. The breezeway also provides access to the multi-level parking garage between East 25th Street and Puyallup Avenue.

In conjunction with the Point Defiance Bypass project, a new station facility would be located inside the Freighthouse building. This development has historically had ample vacancy space to accommodate such a facility, and Amtrak participated in an initial scoping discussion in 2007. At that time, it was confirmed that adequate lease space was available and that there are opportunities to include a ticketing area, waiting area (approximately 1,600 square feet), and baggage handling areas within the Freighthouse building. The proposed facility would include all of the features of the Puyallup Avenue station.

Tukwila Station

Upgrades to the station were identified in the 2009 draft SDP as well as prior service planning documents. In late 2010, the Federal Rail Administration (FRA) awarded a $9 million ARRA HSIPR grant to fund a portion of the construction of the new Tukwila station. At the time of this evaluation, Sound Transit was finalizing plans to replace the existing shelter with a permanent station that will be shared with Amtrak Cascades. The future station would include passenger platforms and shelters, security and safety features, ADA accessible station access, approximately 350 parking spaces (40 of which would be dedicated for Amtrak Cascades customers), bicycle storage, landscaping, and public art.

Chapter 4: Operations Analysis

This chapter describes the technical basis for improving Amtrak Cascades intercity passenger-rail service under the FRA-funded Pacific Northwest Rail Corridor (PNWRC) Program. This chapter translates the purpose and need for the Program, described in Chapter 1 of this Service Development Plan, into the technical parameters of a passenger rail service that will fulfill the Program's requirement in a cost effective and feasible manner. Elements of this process included the following:

- Route selection, in conjunction with the 2009 Tier 1, Service-Level National Environmental Policy Act (NEPA) process, as defined by the High-Speed Intercity Passenger Rail (HSIPR) Program guidance.
- A review and understanding of the past and present-day function, geometry, and operating and engineering feasibility for high-speed passenger rail on the selected route.
- A review and understanding of the past and present-day freight and passenger rail uses of the route, in order to best-fit the needs of the Program with the needs of other users of the route.
- Rail Traffic Controller (RTC) models of the corridor to validate conceptual infrastructure planning, proposed schedules, and proposed operating plans.
- Identification of the infrastructure requirements to meet the proposed schedule and operating plan.
- Development of a final operating plan, which involved detailed validation through additional modeling and coordination with the host railroads (BNSF, UP, ST) and Amtrak.
- Development of cost estimates for infrastructure improvements, equipment purchases, and operation and maintenance of the new service.

Route Selection

The 2009 Tier 1 NEPA process, as well as prior service planning efforts, assisted in identifying the route for the improved service. The NEPA process involved input from rail operations and engineering experts, host railroads, Amtrak, the cities that would be served by the PNWRC Program, and the public. The process was informed by initial conceptual-level passenger train schedules, assessments of existing infrastructure, discussions with freight and passenger rail users to determine existing and likely future uses of the proposed routes, and initial cost estimates. The route selection process concluded with the selection of the Corridor Service Expansion (CSE) Alternative as the preferred alternative (See Chapter 1.4). The CSE Alternative identifies the existing PNWRC (Eugene, or to Vancouver, British Columbia) as the selected route. This route consists of mainline track owned primarily by BNSF Railway (BNSF) and Union Pacific Railway (UP). The only exception is approximately 21 miles of rail line owned by Sound Transit (ST) between Nisqually and TR Junction in Washington State, where trains will be rerouted inland on the new Point Defiance Bypass route. Table 4-1 provides a summary of the route (Note: mileposts are approximate and indicate a sequence for a train traveling from Eugene, or northward to Vancouver, British Columbia).

Table 4-1: PNWRC Route Summary (as of 2017)

Track Owner	*RR Subdivision*	*Begin MP*	*End MP*	*Total Dist. (miles)*	*Method(s) of Operation*[26]	*Operating Direction*	*Passenger/ Freight Operators/ Sponsors*
Union Pacific (UP)	Brooklyn	647.1	770.0	122.9	Centralized Traffic Control (CTC)	North-South	UP, Amtrak, Oregon Department of Transportation (ODOT)
UP	Portland	n/a	n/a	<1.0	CTC	n/a	UP, Portland & Western Railway (P&W), Amtrak, ODOT
City of Portland	Station Tracks	0.0	0.3	<1.0	CTC/Other Than Main Track	n/a	Amtrak, WSDOT, ODOT
BNSF Railway (BNSF)	Fallbridge	0.3	9.9	9.6	CTC	West-East	BNSF, P&W, Amtrak, WSDOT
BNSF	Seattle (Line Segment 52)	136.5	24.5	112.0	CTC	North-South	BNSF, UP, ST, Amtrak, WSDOT
Sound Transit (ST) (formally owned by BNSF)	Lakewood	21.5	0.0	21.5	CTC (dispatched by BNSF)	North-South	BNSF, Tacoma Rail Mountain Division (TRMD), Amtrak, ST, WSDOT
BNSF	Seattle (Line Segment 51)	38.2	0.0	38.2	CTC	North/South	BNSF, UP, ST, Amtrak, WSDOT
BNSF	Station and Yard tracks	n/a	n/a	1.5	CTC (dispatched by BNSF), Yard Limits	n/a	BNSF, Amtrak, WSDOT
BNSF	Scenic (Line Segment 50)	0.0	33.0	33.0	CTC	East/West	BNSF, UP, ST, Amtrak, WSDOT
BNSF	Bellingham (Line Segment 50)	0.0	119.6	84.0	CTC	North/South	BNSF, UP WSDOT
BNSF	New Westminster	119.6	141.3	35.4	CTC	South/North	BNSF, UP, WSDOT
Via Rail	None			<0.5			WSDOT, Via Rail

The following sections describe the historic and present-day operating environment and infrastructure.

[26] The Rail Safety Improvement Act of 2008 requires all Class I railroad carriers to install positive train control (PTC) on main lines over which intercity passenger rail or commuter rail service is regularly provided by December 31, 2018.

UP Portion of the Route

The UP portion of the PNWRC route extends from Eugene to Portland, or and crosses several subdivisions.

UP Route Background

The UP Brooklyn Subdivision, which links Eugene to Portland via the Willamette Valley, consists of former Southern Pacific (SP) routes. The Central Pacific (CP), as well as several predecessor short line companies completed the SP line between California and Portland in 1887. The line extends through the broad and generally flat Willamette Valley, which allowed the SP to connect major towns with a line with few curves and gentle grades. The CP, seeking entrance to northwest markets for overland traffic as well as the market for coastwise trade, connected and upgraded these short lines into a coherent system. In 1996 SP was merged into UP, the line's current owner.

A short segment of UP's Portland Subdivision, from East Portland Jct., across the Steel Bridge, and into Portland Union Station, was originally constructed by the UP. The original structure, known as the Steel Bridge, was completed in 1888; the franchise agreement that granted UP rights into Portland required that the railroad bridge include a roadway. The current steel bridge, designed by W.A.J. Waddell, was completed in 1912 to replace the earlier structure.

Trackage at Portland Union Station was originally part of the Portland Terminal Railroad, a joint facility between the UP; Northern Pacific (NP); Spokane, Portland, and Seattle Railway (SP&S); and SP, each of which used the station. Connection between SP, UP, and NP main lines was effected at this joint facility. UP ownership also started at the station and extended across the Steel Bridge, where UP and SP effected connection. NP ownership started at the station. The current station building was completed in 1896.

UP also accesses the major ports at Longview, Kelso/Kalama, Grays Harbor, Olympia, Tacoma, Seattle, Everett, and Vancouver British Columbia, via a complex series of trackage rights agreements. The historical basis for these agreements is described below; this historical background is helpful in understanding modern-day operations and ownership, described later.

UP gained access to the NP line between Portland Union Station and Tacoma as part of a deal arranged by E.H. Harriman. At the time, there was insufficient traffic to justify the capital investment for two separate railroads between these points. Harriman convinced NP that he was serious about constructing a separate line, and eventually the two companies struck an agreement to share main line infrastructure between Portland and Tacoma.

Between Reservation (now called TR Junction) in Tacoma and Black River (north of Tukwila), UP trains operate on UP's own line, formerly shared with the Chicago, Milwaukee, St. Paul, and Pacific Railroad (Milwaukee), until the latter carrier's retreat from the Pacific Northwest in1980, at which time UP became the sole owner. The UP-Milwaukee line is located to the west of the NP line between TR Junction and Black River. At TR Junction, the Milwaukee crossed over the NP to access the Milwaukee's former Tacoma Eastern route to Chehalis and Morton. The joint facility arrangement between the UP and Milwaukee explains the complex configuration of trackage in the Tacoma and Seattle areas: the first company to survey through the area NP was afforded the best location, while the second railroad (Milwaukee) was forced to weave back and forth across the tracks of the first to access customers and facilities.

Between Black River and Argo (Seattle), UP and Milwaukee operated (and continues to operate) on the east side of the NP main line, necessitating a crossing at Black River. This was to access the Milwaukee's transcontinental line over Snoqualmie Pass, and to access trackage of the Pacific Coast Railway, a coal hauling short line, over which Milwaukee and UP had struck a deal for access to Seattle.

UP Present Day Operations

The UP Brooklyn Subdivision handles primarily intermodal and forest products, and serves as UP's link between the Pacific Northwest and California. It is single track, relatively flat and straight railroad that extends roughly down the middle of the Willamette Valley. Most of UP's transcontinental traffic (manifest, unit bulk, and intermodal) from the Pacific Northwest is funneled eastward, up the Columbia River Gorge, via the Portland Subdivision. The remaining traffic (manifest and intermodal) heads south to California destinations. With a substantial online customer base, there is heavy switching along this line. There is an average of 15 to 25 through trains per day on this segment, and one to two roadswitchers each day on any section of the territory. There are currently six passenger trains per day (Amtrak Coast Starlight 11 and 14, and Amtrak Cascades 500, 504, 507, and 509) running on this subdivision.

A short segment of UP's Portland Subdivision links East Portland Jct. on the Brooklyn Subdivision to Portland Union Station and the BNSF connection, via the Steel Bridge, a vertical lift span. This section, if two main tracks, is CTC controlled. Trains headed for the BNSF connection are generally staged at Albina or Brooklyn yards and thus do not block the UP main line in this area. There is an average of 10 to 20 freight movements per day over this section of the Portland Subdivision.

The main line tracks adjacent to Portland Union Station are owned by UP and BNSF; this is where the west end of the UP Portland Subdivision meets the east end of the BNSF Fallbridge Subdivision. The city of Portland owns and maintains the platform tracks at Union Station, which are between ¼ and ½ mile long. BNSF dispatches trains at the north end of the station, while UP dispatches trains from the south end of the station. Amtrak has operating rights at the station. The station leads are within CTC limits.

Currently, access to the BNSF main line between Portland and Tacoma is dispatched on a first- come, first-served basis by a BNSF dispatcher. As mentioned above, northbound UP trains enter the BNSF Fallbridge Subdivision at North Portland Junction and leave the BNSF Seattle Subdivision at TR Junction, or vice versa for southbound trains.

Table 4-2: 2010 UP Brooklyn Subdivision Crossover Locations and Characteristics

Location	*MP*	*Type of Operation*	*Turnout Size*	*Speed Through Turnout (MPH)*	*Notes*
UP Brooklyn Subdivision - Maximum Authorized Passenger Train Speed MP 765.2 to MP 770.0 = 70 MPH					
Willsburg Jct.	765.2	2MT CTC	No. 14	15	
Reed	766.6		No. 20	40	
Haig	768.3		No. 14	15	
East Portland	770.0		No. 14	15	Connection to Portland Union Station

Table 4-3: 2010 UP Brooklyn Subdivision Siding Locations and Characteristics

Location	*South MP*	*North MP*	*Siding Length (Feet)*	*Turnout Size*	*Siding Speed (MPH)*	*Notes*
UP Brooklyn Subdivision - Maximum Authorized Passenger Train Speed MP 647.1 to 765.2 = 79 MPH						
Eugene	647.1	647.6	1,986	No. 12 S, No. 10 N	10	
Swain	659.1	660.6	7,342	No. 14	25	
Alford	666.1	667.6	7,301	No. 14	25	
Shedd	677.7	679.2	7,326	No. 14	25	
Hallawell	687.2	688.8	7,430	No. 14	25	
Millersburg	694.5	696.0	7,278	No. 14	25	Speed 25 MPH per ETT, 20 MPH per track chart
Marion	704.2	705.8	7,708	No. 14	25	Speed 25 MPH per ETT, 20 MPH per track chart
Renard	713.9	715.5	7,373	No. 14	25	Speed 25 MPH per ETT, 30 MPH per track chart
Labish	720.4	721.8	7,352	No. 14	25	Speed not listed in ETT, 25 MPH per track chart
Gervais	732.3	733.8	7,280	No. 14	25	Speed 25 MPH per ETT, 20 MPH per track chart
Hito	740.9	742.6	8,011	No. 14	25	Speed 25 MPH per ETT, 30 MPH per track chart
Coalca	750.4	751.9	7,316	No. 14	10	Turnout and speed per track chart
Clackamas	759.3	760.8	7,335	No. 14	10	Turnout and speed per track chart

BNSF Portion of the Route

The BNSF portion of the PNWRC route extends from Portland or to Vancouver, British Columbia and crosses several subdivisions.

BNSF Route Background

Early on in its corporate history, NP embarked on a program to connect their then-planned transcontinental line, which would terminate at Tacoma, with Portland. In the 1870s, NP commenced construction of an otherwise isolated segment extending from Tacoma southward through South Tacoma, Lakeview, Yelm, Tenino, and onward to the Kalama (a Columbia River port north of Portland) ferry connection. Construction on this segment was completed in 1873.

The portions of the NP route between Tacoma and Auburn, Washington (Wash.) was part of NP’s original transcontinental main line between Chicago and Tacoma, which was completed in 1887 (well after completion of the segment between Tacoma and Portland).

The bridges across the Columbia River and the lesser span across the Willamette River, providing direct connection between Vancouver, Wash. and Portland (and the UP) were not completed until 1909 by the Spokane, SP&S. The SP&S was owned by GN interests and was constructed specifically to provide James J. Hill’s transcontinental line with a direct link to Portland via the north bank of the Columbia River.

In 1914 NP, finding the steep grade from Tacoma to South Tacoma operationally objectionable completed a water-level route around Point Defiance, via Ruston, Steilacoom, and Nisqually Junction, which joined the previously constructed main line at Tenino. The line between Portland and Tacoma, around Point Defiance, became the Third Subdivision of NP's Tacoma Division; NP also built a branch line between Lakeview (just south of South Tacoma on the original main line to Portland) and Olympia via American Lake and Nisqually Junction, which became the Fourth Subdivision. The portion of the PNWRC Pt. Defiance Bypass between Tacoma and Lakeview was part of NP's Fourth Subdivision (later the BNSF Lakeview Subdivision), while the portion between Lakeview and Nisqually Junction was part of NP's American Lake Branch (later the BNSF Lakeview Spur).

The GN completed the line between Seattle and the Fraser River (outside of Vancouver, British Columbia) in late 1891. The portion between Seattle and Everett (now on BNSF's Scenic Subdivision) became part of GN's original transcontinental line between Seattle and Minneapolis, which was completed in 1893.

BNSF Route Present Day Operations

Current operations on the BNSF portions of the route are complex, since there are multiple subdivisions and multiple railroads feeding into the main stem along the BNSF Seattle, Scenic, Bellingham and New Westminster Subdivisions, which form the backbone of the majority of the corridor.

The entire length of the BNSF portion of the PNWRC has been upgraded over the past ten years to accommodate growing freight and passenger traffic, which have both grown significantly. Freight traffic has grown as a result of the increased demand for imports (mostly intermodal traffic) and exports (mostly bulk commodities). Manifest traffic has been relatively stable, though domestic forest products continue to decline. Both Amtrak Cascades and Sound Transit (ST) *Sounder* passenger traffic have grown over this same time period. Both WSDOT and ST have made significant investments in the corridor to accommodate extra train frequencies and improved schedule reliability.

Currently, most main line crossovers are Number 20 or larger, rated for 35 mph through the diverging route, except where track speeds make Number 15 crossovers appropriate. BNSF has endeavored to replace small angle turnouts with larger angle turnouts for sidings and diverging tracks to allow trains to enter and exit the main line more rapidly. In the PNWRC, the high speed tilt train sets are allowed to operate at five inches of underbalance (as opposed to the conventional Amtrak equipment, which is limited to three inches of underbalance), and speed limits are posted to the nearest mile-per-hour, rather than nearest 5 mph, in order to accommodate the quickest travel times possible.

BNSF Fallbridge Subdivision

The BNSF Fallbridge Subdivision begins at Portland Union Station, where it connects with the UP Brooklyn Subdivision. The Fallbridge Subdivision extends across the Willamette liftspan and Columbia Rivers on swing spans, then, at the wye at the Vancouver passenger rail station, turns eastward to follow the Columbia River Gorge towards Spokane. The Fallbridge Subdivision was the former SP&S entrance to Portland. The short section between Portland and Vancouver, Wash., hosts the Amtrak Cascades and Amtrak long-distance trains. This section of the Fallbridge Subdivision handles a mix of manifest, bulk, and intermodal traffic. Though owned and dispatched by BNSF, UP, P&W/Willamette and Pacific, and Amtrak have operating rights over this segment of track.

Currently, there are approximately 20 freight movements per day and 12 passenger movements per day across this route. Because traffic across the Columbia River drawspan is offered in an uncoordinated manner from five different directions - the BNSF Fallbridge Subdivision (both eastbound and westbound directions), UP Portland, BNSF Seattle Subdivision, and the Port of Vancouver - and four different railroads (BNSF, UP, P&W, and Amtrak), this portion of the Fallbridge Subdivision is a frequent congestion point. Note that this section of the Fallbridge Subdivision is UP's primary access to the BNSF Seattle Subdivision and to the Port of Vancouver, Wash. BNSF and UP trains entering the Fallbridge Subdivision are supposed to be handled on a first-come, first-served basis.

Table 4-4: 2010 BNSF Fallbridge Subdivision Crossover Locations and Characteristics

Location	*MP*	*Type of Operation*	*Turnout Size*	*Speed Through Turnout (MPH)*	*Notes*
BNSF Fallbridge Subdivision - Maximum Authorized Passenger Train Speed MP 0.0 to MP 9.9 = 70 MPH					
Control Point 0.5	0.5	2MT CTC	No. 15	30	Connection to Portland Union Station; turnout size assumed
Willbridge	4.3		No. 11	10	
West St. Johns	5.8				Not in timetable, need current GO
N Portland Jct.	8.1		No. 11	10	

BNSF Seattle Subdivision

The BNSF Seattle Subdivision begins at the wye at the Vancouver, Wash. passenger station and extends all the way north to King Street Station in Seattle. The Seattle Subdivision is two main tracks for its entire length, with the exception of the approximately 1.4-mile single-track section through the Ruston and Nelson Bennett Tunnels, just south of Tacoma, and two sections of three main tracks between King Street and South Seattle, and another section of three main tracks at Tacoma. The Seattle Subdivision is relatively straight, with the maximum curves being about 3 degrees, and mostly flat, with Napavine Hill, at about 1 percent each direction, being the major grade. The Seattle Subdivision currently sees about 50 to 60 freight trains per day between Vancouver, Wash., and the bulk terminals near Longview and Kalama, and about 45 to 55 freight trains per day between Longview and Seattle.

Like the Fallbridge Subdivision, UP and BNSF trains are supposed to be handled on a first-come, first-served basis. Freight traffic patterns are complex, since only a few freight trains operate the entire length of the Seattle Subdivision. Rather, most freight trains operate from their point of entry on the Seattle Subdivision to the intermediate point where they leave the Subdivision. Because of its complexity, the subdivision is described by section from south to north.

Vancouver, Wash. To Longview Section

From the south, freight trains entering the Seattle Subdivision from the Fallbridge Subdivision are generally heavy unit bulk or manifest trains. The Seattle Subdivision is a low-grade route, well-suited to these heavy trains. UP intermodal, manifest, and bulk trains enter at Vancouver, as well. Many bulk trains, both UP and BNSF are destined only as far as the Columbia River port facilities at Longview and Kalama. Together, these two ports can handle approximately ten inbound trains per day and originate a similar number of empty outbound trains.

The portion between Kalama and Kelso has several large export facilities receiving bulk trains, which require frequent switching. These switching operations periodically effect main line operations.

There are ten daily passenger trains on this section of the Seattle Subdivision, two Amtrak long-distance trains and eight Amtrak Cascades.

Longview to Tacoma Section

BNSF traffic between Longview and Tacoma is mostly comprised of manifest and bulk traffic headed for the ports of Tacoma, Seattle, and Roberts Bank (south of Vancouver, British Columbia). This amounts to approximately 45 to 55 trains per day. (Note that many of BNSF's loaded bulk trains operate via the Fallbridge and Seattle Subdivisions, while their empty counterparts operate via the Seattle and Stampede Subdivisions). A smaller number of bulk and manifest trains, currently about two per day, operates as far as Centralia, where they leave the main line for the Port of Grays Harbor on the Puget Sound and Pacific Railroad (PSAP). As Grays Harbor expands its port capacity with new loop tracks and auto unloading facilities, the number of trains for this destination is expected to grow to approximately three to four trains per day.

There are ten daily passenger trains on this section of the Seattle Subdivision, eight Amtrak Cascades trains and two Amtrak long-distance trains.

Tacoma to Seattle Section

Between Tacoma and Seattle, BNSF traffic is comprised of intermodal, manifest, and bulk traffic. Intermodal traffic in this segment typically flows between the Scenic Subdivision and the Ports of Seattle and Tacoma, since that is the shortest transcontinental route that will clear loads over Plate C. Most manifest traffic, generally 10 to 20 trains per day, moves to or from the Scenic or Fallbridge Subdivisions. About 10 to 20 loaded bulk trains from the Fallbridge Subdivision move northward to the Ports of Tacoma and Seattle, while approximately four bulk trains per day continue to or from the Scenic and Bellingham Subdivisions, and onward to Roberts Bank. Approximately eight empty bulk trains typically return over the Seattle Subdivision to Auburn, where they enter the Stampede Subdivision at Auburn to head east over Stampede Pass. BNSF uses the yard at Auburn to stage trains coming from or going to the Stampede Subdivision, as well as to stage trains for Seattle and Tacoma, since the yards (manifest, bulk, and intermodal) have limited capacity to arrive or depart full-length trains.

Given the intensity of passenger operations on this segment, BNSF endeavors to avoid holding trains on the main track, which might ultimately result in passenger train delays, and Auburn Yard provides a place to hold trains until the yards are ready for them.

There are heavy intermodal operations between Seattle and Tacoma. Most westbound intermodal traffic for the ports at Tacoma and Seattle comes via the Scenic Subdivision, through Everett, and to the ports. The Scenic Subdivision, while steeply graded over Stevens Pass, is the fastest route from Spokane, which favors this time-sensitive traffic. The intermodal traffic to and from the Port of Seattle amounts to 10 to 14 trains per day, with a similar number to/from the Port of Tacoma. The total number of through freight movements on the rail lines between Seattle and Tacoma is 45 to 55 trains per day, excluding transfer moves, road, and local switchers.

There are heavy passenger operations on this section of the Seattle Subdivision. Amtrak operates two long-distance trains and eight Amtrak Cascades trains over the Seattle Subdivision. Between Tacoma and Seattle, BNSF also operates 18 Sounder commuter trains on behalf of ST. This will increase to as many as 26 Sounder trains in 2017.

UP Operations on BNSF Seattle Subdivision

As noted, UP has a trackage rights agreement with BNSF for operations over the BNSF Seattle Subdivision between Vancouver, Wash. and TR Junction, and between Argo and Seattle. UP owns their own line for the short distance between TR Junction and Argo, about 28 miles. Very little UP traffic moves north of Argo on trackage rights; most UP traffic north of Argo is to Terminal 86, between North Portal and Interbay.

UP traffic between Longview and Tacoma is mostly intermodal, bound for the Ports of Seattle and Tacoma, and manifest. UP operates only a limited amount of bulk traffic on this corridor because of the destinations available and the track ownership and operating rights. UP operates about 10 to 15 trains per day over this segment. Note: UP traffic leaves the Seattle Subdivision at TR Junction, in Tacoma, and operates over their own line between Tacoma and Seattle.

Between Tacoma and Seattle, most UP operations occur on UP's own railroad, located west of the BNSF main, starting at TR Junction (BNSF MP 38.4X) and heading north to Black River (BNSF MP 20.0X). At Black River, UP trains cross over the BNSF main line to access UP's own tracks on the east side of the BNSF main and at Argo, UP trains cross over the BNSF main lines again to access UP's Argo Yard and the Port of Seattle. There are approximately 10-12 UP trains, mostly intermodal with a few manifest trains, per day between Black River Jct. and Argo. On occasion, UP operates bulk trains to Terminal 86 in Seattle, or northward to Roberts Bank. Recently, this bulk traffic has been only a few trains per week.

Table 4-5: 2010 BNSF Seattle Subdivision Crossover Locations and Characteristics

Location	*MP*	*Type of Operation*	*Turnout Size*	*Speed Through Turnout (MPH)*	*Notes*
BNSF Seattle Subdivision - Maximum Authorized Passenger Train Speed MP 136.5 to MP 0.0X = 79 MPH					
Vancouver Center	136.5	2MT CTC	No. 11	10	MP 136.5 Seattle Sub = MP 9.9 Fallbridge Sub
39th Street	135.1		No. 24	50	
Fruit Valley	133.5		No. 24	50	
Vancouver Jct. North	132.5		No. 20	35	
Felida	130.7		No. 24	50	
Ridgefield South	123.6		No. 20	35	
Woodland	118.3		No. 24	50	
MP 111	110.9		No. 20	35	
Longview Jct. South	102.6		No. 20	35	
Kelso South	98.9		No. 20	35	
Ostrander	93.4		No. 20	35	
MP 85	85.0		No. 20	35	

Location	***MP***	***Type of Operation***	***Turnout Size***	***Speed Through Turnout (MPH)***	***Notes***
Vader	77.0		No. 20	35	
CP 72	72.0		No. 24	50	
Napavine South	66.2		No. 20	35	
Chehalis Jct.	58.7		No. 20	35	
Centralia South	55.8		No. 20	35	
Centralia Center	54.0		No. 11	10	Speed not in timetable, estimated based on turnout size
Wabash	49.5		No. 20	35	
Tenino	43.2		No. 24	50	
Plumb	37.5		No. 20	35	
CP 32	32.4		No. 24	50	
CP 31	31.9		No. 24	50	
Nisqually Junction	24.5		No. 20	35	
Pioneer	13.5		No. 20	35	
Titlow	10.0		No. 20	35	
Nelson Bennett	6.7	CTC	No. 20	40	Single track through Nelson Bennett & Ruston Tunnels
Ruston	5.1	2MT CTC	No. 24	40	
Harbor	3.2		No. 24	50	
Davis	1.4	3MT CTC	No. 24	45	
21st Street	0.0		No. 15	30	MP 0.0 = MP 40.1X
Bay Street	38.6X		No. 15	30	
TR Junction	38.2X	2MT CTC	No. 15	30	
Clear Creek	37.8X		No. 24	50	
Stewart	34.0X		No. 24	50	
CP Sumner	29.7X		No. 24	50	
Pacific	24.0X		No. 24	50	
Auburn North	21.0X		No. 24	50	
Willis	16.9X		No. 24	50	
Glacier Park	11.3X		No. 24	50	
CP Tukwila	10.3X		No. 24	50	
Black River	10.0X	3MT CTC	No. 24	50	
Boeing	6.6X		No. 24	50	
Rhodes	6.3X		No. 24	50	
Bailey	3.6X	2MT CTC	No. 24 & No. 15	50/30	
Argo	3.3X		No. 15	30	
Lucile	3.2X	3MT CTC	No. 15	30	
Spokane Street	2.1X		No. 20	40	
Stadium	0.6X		No. 20	40	
King Street	0.3X	2MT CTC	No. 15	30	

Table 4-6: 2010 BNSF Seattle Subdivision Siding Locations and Characteristics

Location	*South MP*	*North MP*	*Siding Length (Feet)*	*Turnout Size*	*Siding Speed (MPH)*	*Notes*
BNSF Seattle Subdivision - Maximum Authorized Passenger Train Speed MP 136.5 to 0.0X = 79 MPH						
Amtrak Lead	39.6X	39.0X	3,960	No. 15	20	Tacoma Amtrak station siding
Ellingston	23.8X	21.8X	9,240	No. 20	35	
Glacier Park	13.3X	11.3X	9,170	No. 24	25	Track chart lists No. 24 Turnouts
Van Asselt	5.4X	3.6X	7,760			Speed and turnouts not shown in timetable or track chart

BNSF Scenic Subdivision

The BNSF Scenic Subdivision is an east-west rail line that begins in Wenatchee Wash. (MP 1650.2) and ends in Seattle Wash. (MP 0.00), via PA Jct. in Everett, Wash.. The section between Seattle and Everett is a component of the PNWRC. Between Seattle and Everett, BNSF operates approximately 10 to 15 manifest and bulk trains per day and 15 to 20 intermodal trains per day. This portion of the route is mostly two main tracks, with short sections single track between MP 16 and Edmonds, between Edmonds and Mukilteo, and between Everett Junction through the tunnel to Everett, where the passenger station is located (just west of PA Junction, where the Scenic Subdivision meets the Bellingham Subdivision). A significant amount of local freight switching occurs on the Bayside Lead, a freight bypass that loops around Everett, starting at Everett Jct. and joining the Bellingham Subdivision at Delta Jct., near the bridge over the Snohomish River.

This portion of the rail line is built along the shore of Puget Sound, at the base of a long stretch of bluffs ranging between 80 and 100 feet high and has a long history of landslides. The landslides generally occur during a wetter than usual winter season and are influenced primarily by the combination of glacial soils, steep slopes, and changing drainage patterns due to upland development.

This section of the Scenic Subdivision currently has two Amtrak long-distance trains (the *Empire Builder*), eight *Sounder* commuter trains, and four Amtrak Cascades trains. At Everett, the PNWRC route continues north toward the Canadian border via the Bellingham Subdivision and the Empire Builder continues on the Scenic Subdivision heading east toward Chicago, Illinois.

Table 4-7: 2010 BNSF Scenic Subdivision Crossover Locations and Characteristics

Location	*MP*	*Type of Operation*	*Turnout Size*	*Speed Through Turnout (MPH)*	*Notes*
BNSF Scenic Subdivision - Maximum Authorized Passenger Train Speed MP 0.0 to 1782.5 = 63 MPH					
South Portal	0.1	2MT CTC	No. 15	30P 25F	
Gale Street	3.4		No. 20	35	
Magnolia	4.1		No. 20	40	Turnout size based on speed
23rd Avenue	5.1	2MT CTC	No. 20	35	
Blue Ridge	9.1		No. 24	50	
MP 16	15.9	CTC	No. 20	35	

Location	MP	Type of Operation	Turnout Size	Speed Through Turnout (MPH)	Notes
MP 18	17.8	2MT CTC	No. 20	35	
MP 27	27.1	CTC	No. 20	35	
MP 28	27.8	2MT CTC	No. 20	35	
CP Mukilteo	28.9		No. 24	50	
Howarth Park	31.4		No. 20	35	
Everett Jct.	32.2		No. 15	25	MP 32.3 = MP 1784.7
PA Jct.	1782.5		No. 15	30	Junction Bellingham Subdivision

Table 4-8: 2010 BNSF Scenic Subdivision Siding Locations and Characteristics

Location	West MP	East MP	Siding Length (Feet)	Turnout Size	Siding Speed (MPH)	Notes
BNSF Scenic Subdivision - Maximum Authorized Passenger Train Speed MP 0.0 to 1782.5 = 63 MPH						
Broadway/Lowell	1782.9	1780.9	10,700	No. 15	25	Crossover at PA Jct. through siding to Bellingham Subdivision located at MP 1782.5

BNSF Bellingham Subdivision

The BNSF Bellingham Subdivision is between the United States (U.S.)/Canada border at Blaine, Wash., (MP 119.6) to PA Jct. at Everett, Wash. (MP 0.00). It is a single-track rail line with sidings spaced at approximately 8 to 10 mile intervals. Freight traffic on this line consists mostly of manifest traffic and forest products from Canada.

Currently, there are approximately 16 freight trains per day on this Subdivision. An industrial developer plans a major bulk port facility on this line at Cherry Point, which could dramatically increase freight traffic on this Subdivision. Most of the loaded bulk trains would likely operate via the low-grade Fallbridge, Seattle, and Scenic Subdivisions to reach the Bellingham Subdivision at Everett. Empty trains would likely operate eastward via the Scenic or Stampede Subdivisions. If the latter, the empty trains would also traverse the Scenic and Seattle Subdivisions to access the Stampede Subdivision.

The Bellingham Subdivision ends at the international border crossing separating the U.S. from Canada. Northbound Amtrak Cascades trains are generally allowed to proceed across the international border into Canada without stopping for inspection. Northbound freight trains stop just north of the border, where the Canada Border Service Agency (CBSA) performs an inspection of the freight trains. This occurs in an area with no sidings, which has the possibility of creating delays for following passenger trains.

Southbound Amtrak Cascades passengers receive an initial “screening” to ensure they have the proper immigration documents prior to boarding the train at Pacific Central Station in Vancouver, British Columbia Southbound Amtrak Cascades trains stop at the international border for inspection by U.S. Customs and Border Protection (CBP) agents and K-9 units. The inspection typically requires the train to stop for 10 to 15 minutes. Southbound freight trains are fully scanned by an in-motion x-ray inspection at the Swift siding. Trains roll through the scanner at approximately 5 mph. No prolonged stops occur unless CBP agents find something out of the ordinary. CBP personnel have the discretion to stop trains on the main line or move them to an adjacent inspection track for further screening. Currently, the Bellingham Subdivision hosts four Amtrak Cascades trains per day.

Table 4-9: 2010 BNSF Bellingham Subdivision Crossover Locations and Characteristics

Location	*MP*	*Type of Operation*	*Turnout Size*	*Speed Through Turnout (MPH)*	*Notes*
BNSF Bellingham Subdivision - Maximum Authorized Passenger Train Speed MP 0.0 to 119.6 = 79 MPH					
Logen	57.6	CTC	No. 20	30	Crossover in Stanwood Siding provides north pocket for Amtrak train meets

Table 4-10: 2010 BNSF Bellingham Subdivision Siding Locations and Characteristics

Location	*South MP*	*North MP*	*Siding Length (Feet)*	*Turnout Size*	*Siding Speed (MPH)*	*Notes*
BNSF Bellingham Subdivision - Maximum Authorized Passenger Train Speed MP 0.0 to 119.6 = 79 MPH						
Sea Line Jct.						MP 0.8 = MP 7.9
Delta Jct.						MP 10.9 = MP 37.0
English	44.1	46.2	10,680	No. 20	30	
Stanwood	55.2	58.0	13,100	No. 20	35	Crossover Logen at MP 57.6 provides north pocket for Amtrak train meets
Mt. Vernon	66.2	67.4	6,075	No. 20	20	
Bow	79.1	80.9	8,884	No. 20	30	
South Bellingham	92.2	93.5	6,347	No. 20	10	Turnout size per track chart
Ferndale	106.4	108.3	8,478	No. 20	30	
Swift	115.0	116.7	8,588	No. 20	30	Customs scanner for freight trains
						Non-signaled sidings at Burlington & Custer not listed

BNSF New Westminster Subdivision

The New Westminster Subdivision extends from the U.S./Canadian border (MP 119.6) to Pacific Central Station near downtown Vancouver, British Columbia (MP 141.3). Most train movements on the subdivision are manifest or bulk commodities. Bulk trains typically serve Westshore Terminals at Delta Port; they leave the New Westminster Subdivision for the British Columbia Rail Port Subdivision at Colebrook. Traffic north of Colebrook is mostly manifest traffic, largely comprised of forest products.

The New Westminster Subdivision is mostly single main track between the border and the Fraser River Bridge, and two main tracks from the bridge to Still Creek (a distance of approximately 9.5 miles). BNSF dispatches as far north as the Fraser River Bridge, a swing span type bridge.

Trackage north of the bridge, though owned by BNSF, is controlled by Canadian National Railway's (CN) Rail Traffic Controllers. (An "RTC" is the Canadian analogue to a U.S. dispatcher). Amtrak retains rights over the New Westminster Subdivision and into Pacific Central Station.

The Fraser River Bridge is a congestion point; it is shared by the Cascades, BNSF, CN, Canadian Pacific Railway (CPR), Via Rail Canada, and the Southern Railway of British Columbia (SRY). The bridge's draw span opens several times each day to allow water traffic to pass. Since major yards and industries for both CPR and CN are located on each side of the bridge, there are several transfer jobs each day that cross the span, in addition to through freights and local switchers.

Table 4-11: 2010 BNSF New Westminster Subdivision Crossover Locations and Characteristics

Location	*MP*	*Type of Operation*	*Turnout Size*	*Speed Through Turnout (MPH)*	*Notes* *(Spruce to C.N. Jct. not in timetable, items listed from track chart)*
BNSF New Westminster Subdivision - Maximum Authorized Passenger Train Speed MP 141.3 to 155.3 = 50 MPH					
Spruce	144.5	2MT CTC	No. 20	20	Begin 2MT
Brunette	145.4		No. 11	20	
North Road	146.1		No. 11	20	
Lake City	146.4		No. 20	35	
Piper	148.0		No. 20	35	
Sperling	149.8		No. 20	35	
Willingdon Jct.	151.8	2MT ABS	No. 20	35	
Still Creek	153.8	CTC	No. 20	35	
C.N. Jct.	155.3		N/A	20	Junction Canadian National; 1.4 miles to Vancouver Pacific Central Station

Table 4-12: 2010 BNSF New Westminster Subdivision Siding Locations and Characteristics

Location	*South MP*	*North MP*	*Siding Length (Feet)*	*Turnout Size*	*Siding Speed (MPH)*	*Notes*
BNSF New Westminster Subdivision - Maximum Authorized Passenger Train Speed MP 119.6 to 155.3 = 60 MPH						
Oliver	131.5	133.5	10,539	No. 20	35	
Brownsville (West)	139.0	140.2	5,800	No. 11	10	
Brownsville (East)	139.1	140.2	6,063	No. 20	25	

Via Rail Canada Pacific Central Station

The last ½ mile of track into Pacific Central Station, including the station itself, is owned and maintained by Via Rail Canada, the Canadian analogue to Amtrak. Trains arriving from the U.S. enter a fenced area that is secured after the train stops, whereupon the CBSA agents perform a customs and immigration inspection of all passengers. The operations are handled under an agreement between Amtrak and Via Rail. Amtrak Cascades trains layover inside the "fence" until their scheduled departure for the U.S.

Tacoma Rail/ST Portion of the Route

Amtrak Cascades service will be rerouted inland off BNSF's Seattle Subdivision between Nisqually Junction and TR Junction. This new section of the PNWRC is known as the Point Defiance Bypass (PDB) Route.

Tacoma Rail/ST Route Background

A short section of the PDB Route extends along Tacoma Rail (TR) trackage, between TR Junction and East D Street. This was originally part of the Tacoma Eastern Railway, which was purchased by the Milwaukee Road in an attempt to link Milwaukee's transcontinental line with Portland.

Subsequent to the bankruptcy and cessation of operations of the Milwaukee Road on the Pacific Coast Extension, Weyerhaeuser purchased the rail line and began operating it as the Chehalis Western. Subsequent to that, the line was sold to TR, a division of the Tacoma Public Utilities, which operates the line today as the Tacoma Rail Mountain Division.

TR operates over the Lakeview Subdivision and the Lakeview Spur originally part of the NP Fourth Subdivision and American Lake Branch, respectively (please refer to the previous section on the BNSF Route Background). The city of Lakewood is a formerly unincorporated area known as Lakeview, which gave its name to both the Lakeview Subdivision and the Lakeview Spur. In geographic terms, Lakeview and Lakewood refer to the same area. Until purchased by ST in 2005 and 2006, these lines were owned by BNSF, which used TR as a contract operator. The southern portion of the Lakeview Subdivision (the original through route between Portland and Tacoma), between Yelm and the connection to the Seattle Subdivision at Tenino, was abandoned in the 1980s, and service was cut back to Roy, with access provided from the north. TR operates this as part of their Tacoma Rail Capital Division.

With abandonment of the southern portion of the Lakeview Subdivision, the American Lake Spur, originally an "afterthought," became part of the connection for a through route (albeit a little-used one) between Tacoma and Nisqually Junction, while the Lakeview Subdivision south of Lakeview Junction became a spur. It is notable that the north-end of this line connected with the former NP main line at Half Moon Yard in Tacoma, but the connection was configured such that northward trains on the Seattle Subdivision would encounter a facing-point connection at Half Moon Yard. originally, this connection provided access over a long since demolished swing span across the Thea Foss Waterway, which accounted for the "backwards" connection to the original NP main line.

The Lakeview Subdivision was severed in downtown Tacoma in the early 2000s when construction of the Link streetcar would have necessitated a crossing at grade between the Lakeview Subdivision and the Link route. To avoid the at-grade crossing between light rail and freight trains, the entire Subdivision was sold to ST who subsequently removed the freight tracks. Once the connection was severed, the only access to industries in South Tacoma, Lakewood, and to the military bases at Ft. Lewis and McChord Air Force Base (now Joint Base Lewis McChord – JBLM) was via Nisqually Junction and the Lakeview Spur.

As part of their commuter rail service expansion south, ST constructed a new section of track between the Tacoma Dome Station and Chandler Street in South Tacoma. This new alignment will allow a direct connection for southbound trains between the BNSF main line TR Junction and Nisqually Junction. This alignment is commonly referred to as the "D Street to M Street" connection (which, in reality, connects D Street to Chandler Street in South Tacoma); this project is the recipient of American Recovery and Reinvestment Act (ARRA) High-Speed Intercity Passenger Rail (HSIPR) funding.

ST has already completed improvements to the line between Chandler Street and Bridgeport Way (just south of Lakewood Station), in conjunction with the proposed PNWRC upgrades to the rail line between Lakewood and Nisqually Junction. This route is known as the Point Defiance Bypass, and has been designed to allow 79 mph operation for train sets capable of operating on five inches of underbalance between Chandler and Nisqually Junction.

Tacoma Rail/ST Route Present Day and Future Operations

The section of track between TR Junction and Lakewood Station is currently used by ST's Sounder commuter rail (service to Lakewood began in October 2012. ST also has a layover facility between L Street and Portland Avenue for its commuter trains. This section is within CTC limits, and is dispatched by BNSF.

Currently, TR operates approximately two trains per day on their Mountain Division, which, between Portland Avenue and G Street, is the same trackage used by ST. TR currently operates approximately three to four round trips (six to eight trains) per week on their Capital Division line (aka Lakeview Spur) from Nisqually Junction to Chandler Street. BNSF operates approximately two to three round trips (four to six trains) per week to serve customers on the Yelm line, and interchanges cars with TR on a daily basis at DuPont. Since these lines are spurs, each operation is comprised of two trains.

Although the Capital Division is operated under the General Code of Operating Rules (GCOR) 6.28, Other Than Main Track, TR has ultimate responsibility for operations, as a condition of the sale agreement between BNSF and ST. BNSF maintains rights to serve customers along the line. Track and signal maintenance is ST's responsibility; currently ST contracts with TR for these functions.

Operational control of the entire route between TR Junction and Lakewood Station is handled by BNSF, under an agreement with ST. The CTC system is connected to BNSF's communications system and the Network Operations center in Fort Worth, Texas. ST is responsible for maintaining the track, signals, and bridges.

Upon completion of the Point Defiance Bypass track and signal upgrades between Lakewood Station and Nisqually Junction, BNSF will also begin dispatching that segment of line, while ST's maintenance contractor will assume responsibility for track, signal, and bridge maintenance on this section of the line.

From an operational perspective, BNSF has dispatching control over the entire railroad from Portland to the Fraser River Bridge in Canada, including the Point Defiance Bypass route. The unified dispatching will help ensure that daily operations are conducted in an integrated manner.

Table 4-13: 2010 TR Mountain Division Siding Locations and Characteristics

Location	*South MP*	*North MP*	*Siding Length (Feet)*	*Turnout Size*	*Siding Speed (MPH)*	*Notes*
TR Mountain Division - Maximum Authorized Speed MP 0.7 to 2.0 = 30 MPH						
L Street	1.4	1.1	1,320	No. 9	10	Speed and length assumed

Rail Traffic Controller Analysis

Rail Traffic Controller (RTC) is a simulation software tool that models the performance of trains on track, both individually and as part of a dispatched network. RTC is the North American rail industry's accepted rail operations simulation tool. RTC analysis was conducted between Portland, or and Vancouver, British Columbia, in order to design and validate the program's transportation delivery plan, i.e., the passenger train schedules, frequency, station stops, speed, and reliability.

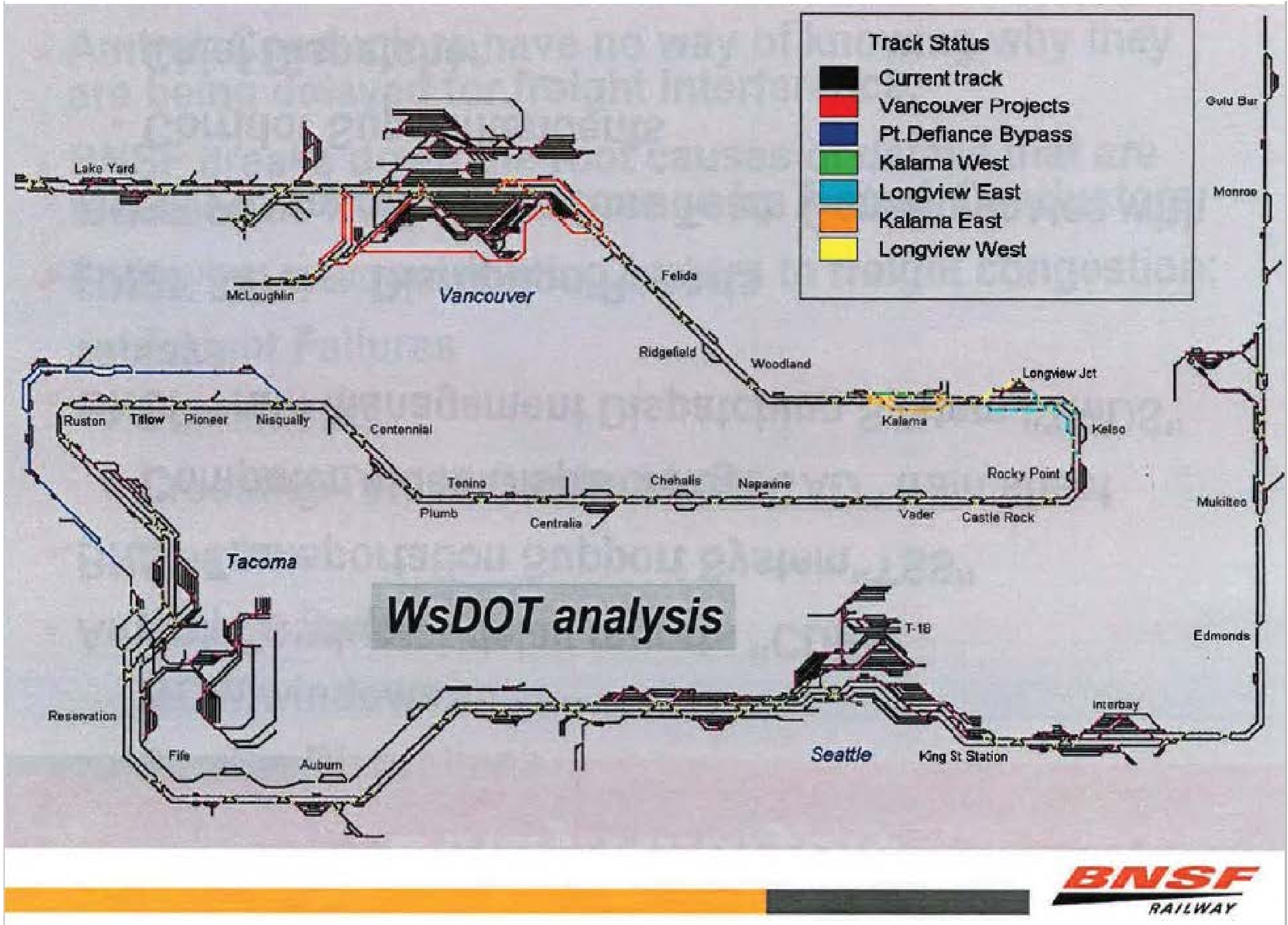
- The principal goals of the RTC model for the Amtrak Cascades corridor were:
- To develop and validate the efficiency of the operating plan for the program's passenger trains, both existing and proposed trains.
- To develop a timetable for the proposed new trains in conjunction with existing program, Amtrak long-distance, and commuter passenger trains, as well as freight service commitments and reliability, and to eliminate to the greatest degree possible conflicts between passenger trains that would potentially reduce reliability, on-time performance, overall end-to-end speed, and convenient times for station stops.
- To understand fleet cycling and crew assignments, and develop information for the Fleet Management Plan.
- To validate the Program's proposed infrastructure projects for their necessity, sufficiency, location, configuration, and characteristics.
- To measure the overall capacity of the corridor and verify that the operating plan, when implemented, does not have negative effects upon existing and likely future freight capacity, service delivery, reliability, and efficiency, and that existing commuter, long- distance, and existing program passenger trains are likewise able to maintain or receive improved reliability, service delivery, and efficiency.

RTC Analysis – Methodology and Output

RTC analysis was performed by BNSF and reviewed by WSDOT and its consultant, HDR Engineering, Inc. BNSF's methodology for RTC modeling is described in this section.

BSNF followed its standard procedures and assumptions to create and run the WSDOT RTC model. Existing infrastructure was input into the model using information from track charts, and new infrastructure was input based on conceptual schematics, or in some cases preliminary engineering. BNSF established a regional basis for the model in order to capture network effects of trains operating on rail lines that connect to the PNWRC. BNSF subdivisions or portions of subdivisions included in the WSDOT model are the Bellingham, Columbia River, Fallbridge, New Westminster, Scenic, Seattle, Stampede, Sumas, Yakima Valley, Lakeview, and a portion of UP Railroad's main line between Seattle and Tacoma, between Clear Creek and Black River, Wash.. This network is shown in Figure 4.1. Note that this figure also shows the proposed infrastructure that would be constructed under this Program.

Figure 4-1: Rail Traffic Controller Model: Network Map



BNSF approached the modeling informed by actual results of trains within the Program area, including reliability, known bottleneck points, and on-time performance (both passenger and freight). BNSF collected delay information from its dispatching computer records, as well as written records, discussions with Amtrak, ST, WSDOT, and UP. Key metrics about on-time performance were aggregated and visually displayed in order to identify bottlenecks, track conditions, and operating conflicts that would need to be addressed in order to increase corridor capacity, speed, on-time performance, schedule recovery performance, and reliability of passenger and freight train service. Figures 4-2 through 4-8 illustrate these key metrics.

Figures 4-2 and 4-3 capture “freight on freight” interference delays and Figures 4-4 and 4-5 capture “passenger on passenger” interference delays in minutes and number of delays. These are delays where network operating plans, network capacity, or a combination of the two, result in more trains attempting to operate through the same area of the network simultaneously than the network has capacity to offer.

Figure 4-2: 2010 Portland-Seattle Freight Train Interference Delays, in minutes and number of incidents

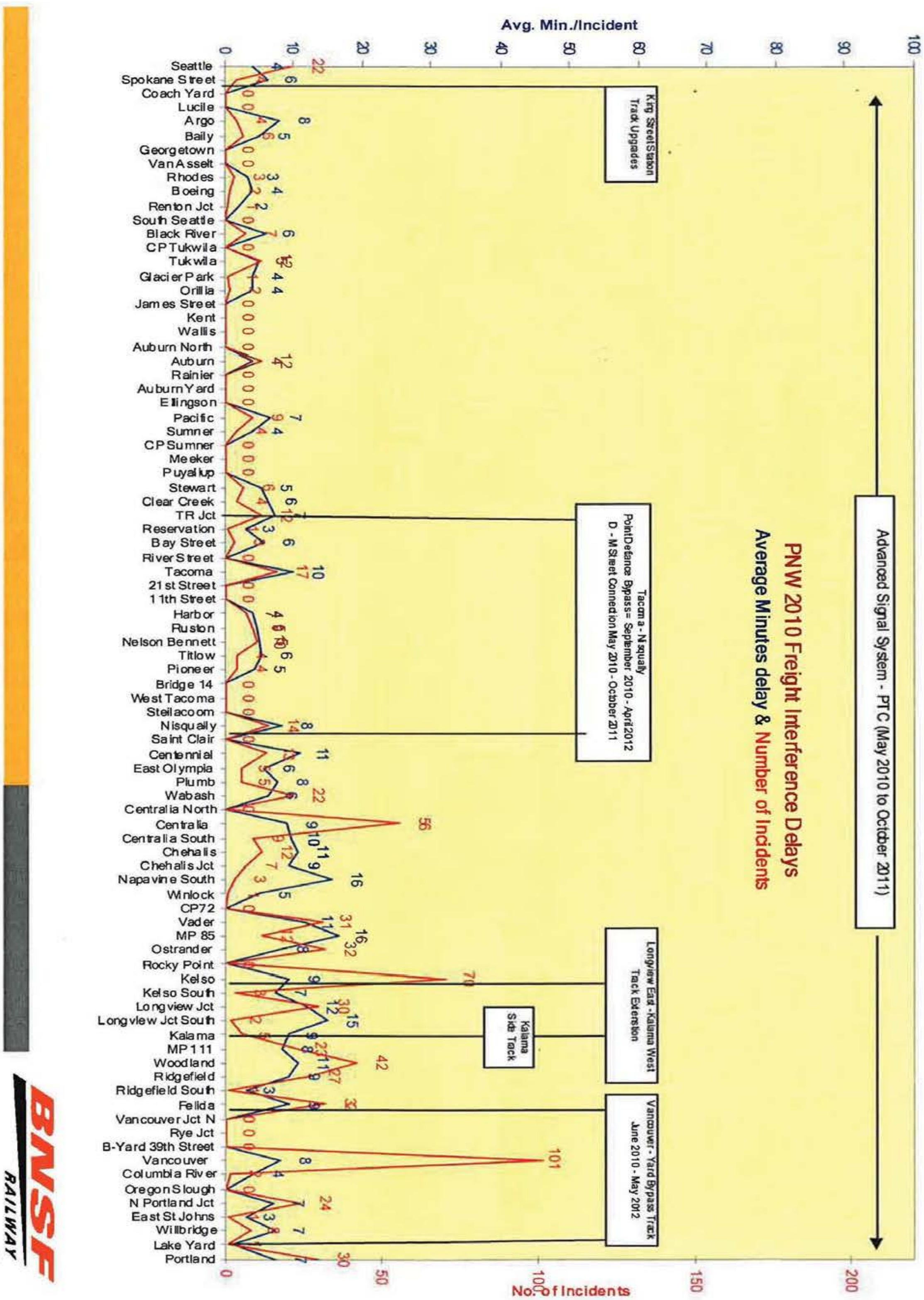


Figure 4-3: 2010 Seattle-Vancouver, B.C., Freight Train Interference Delays, in minutes and number of incidents

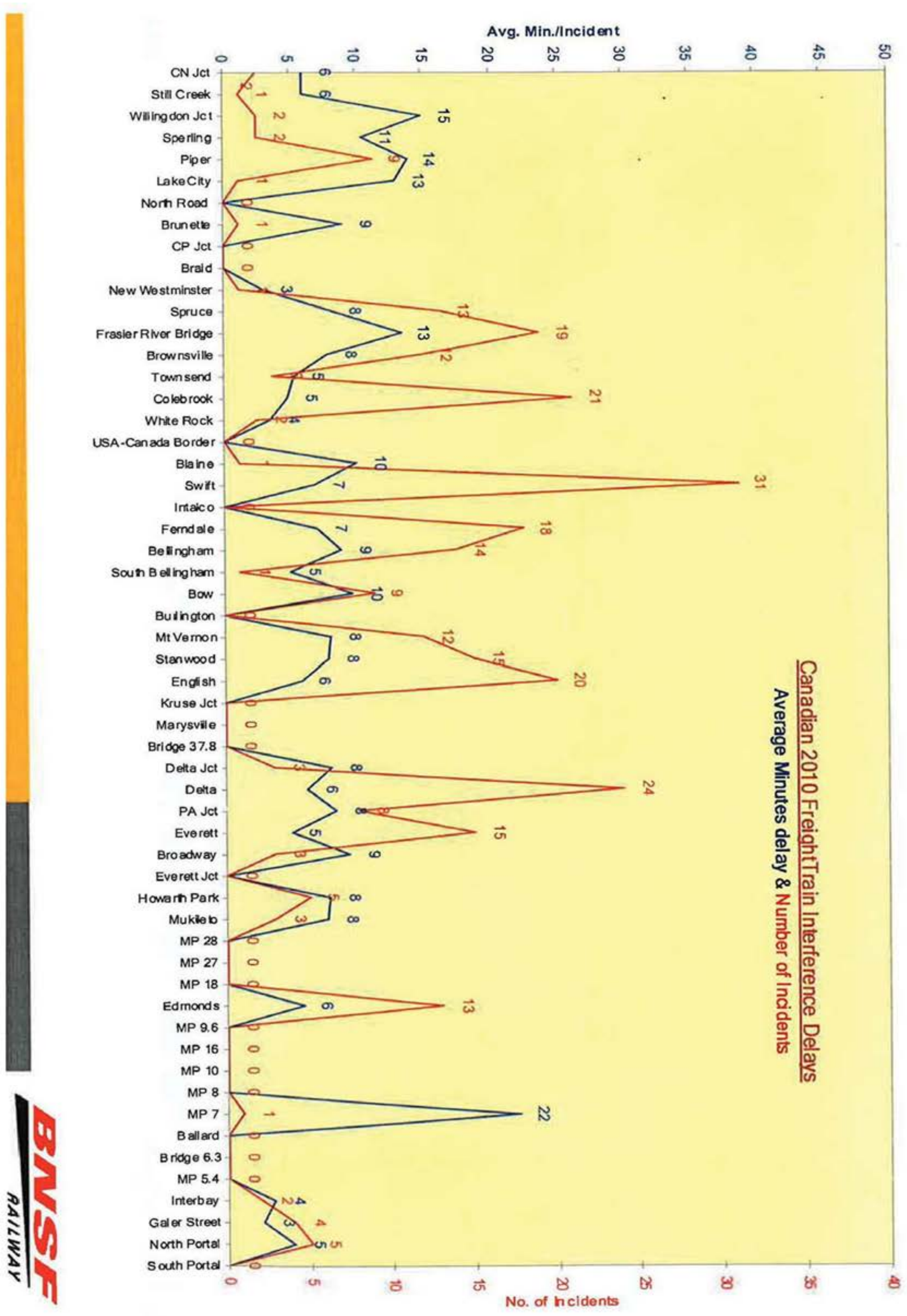


Figure 4-4: Portland-Seattle Passenger Train Interference Delays

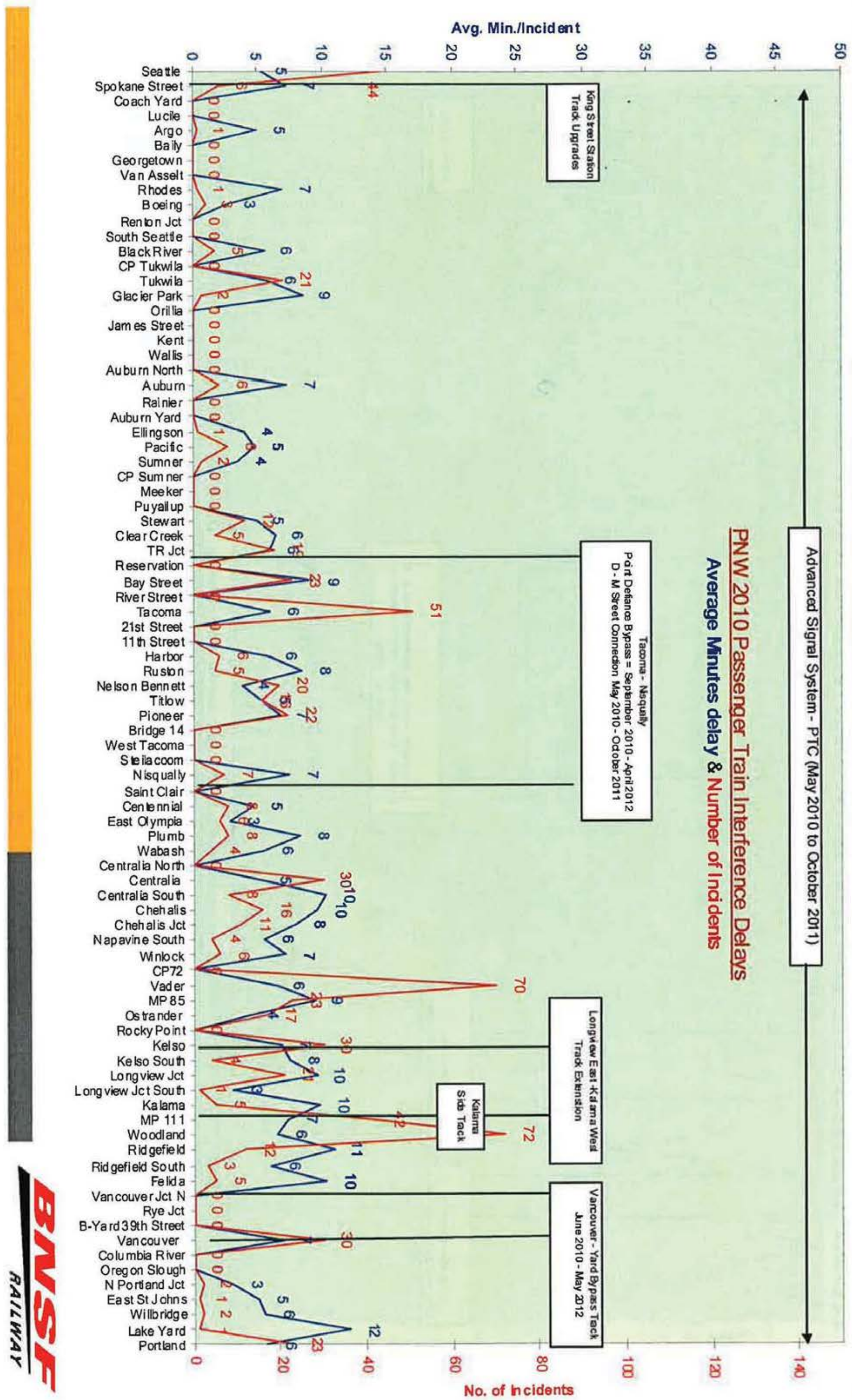


Figure 4-5: Seattle-Vancouver, B.C., Passenger Train Interference Delays

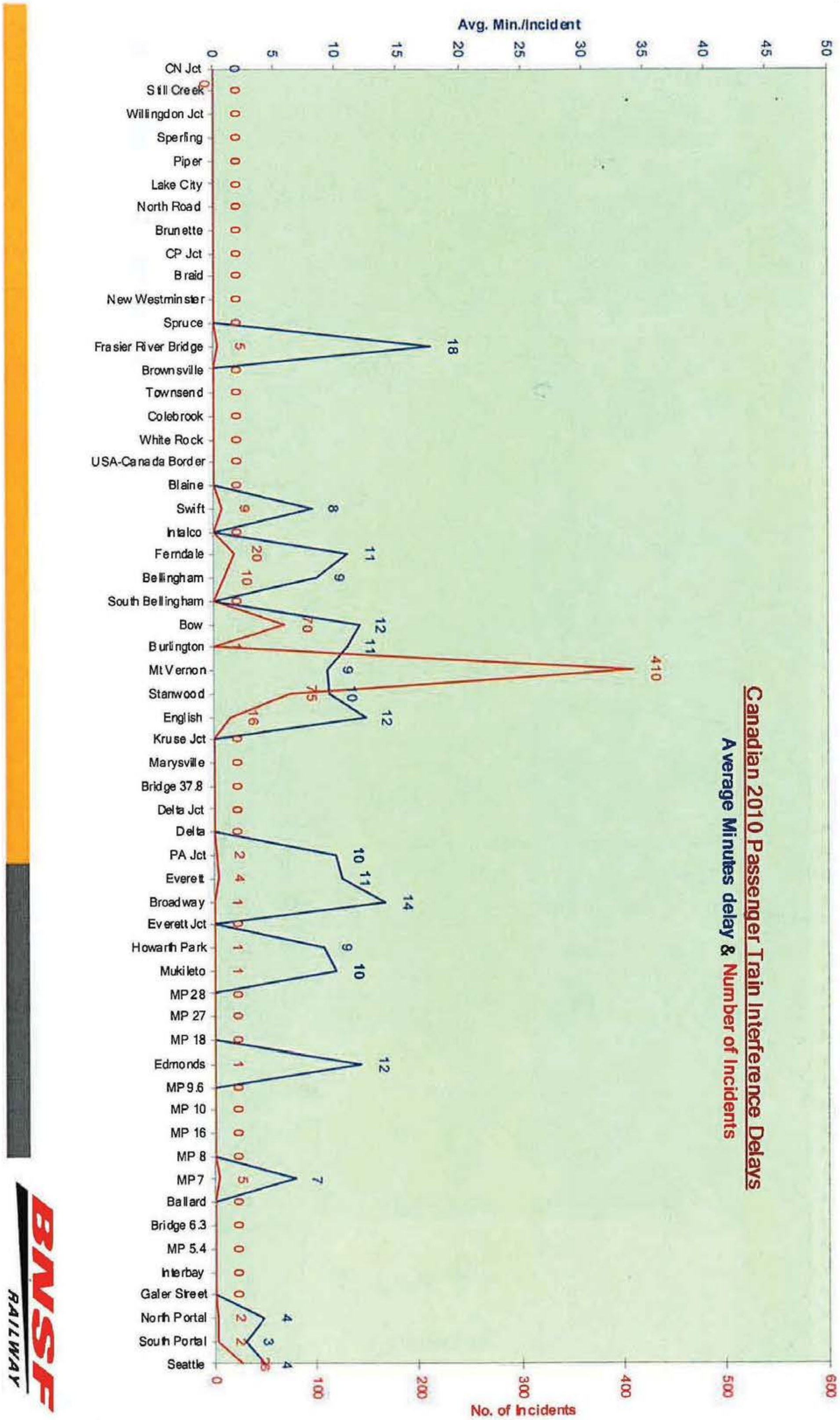


Figure 4-6 shows crossover delays. These are delays where, for example, trains must slow to cross from one main track to the other due to slow trains being overtaken by fast trains, or main track occupancy by a local train switching at an industry track, or unit trains entering or leaving a port. In general, crossover moves on a high-traffic, two-track main line, such as the Portland- Seattle corridor, result in severe capacity loss as it effectively "one-ways" the railroad for 15 to 30 miles in front of the train that is crossing over. Either trains moving in the direction opposing the train that is crossing over must wait until the crossing-over train returns at the next crossover to its original main track, or they must cross over.

Train-on-train interference delays and crossover delays are reduced or resolved through a combination of additional infrastructure or changes in operating plans that serve to spread-out train movements from congested periods of the day to light periods, or both. These maps show locations where interference and crossover delays peak. Note that the delays cluster between Tacoma and Nisqually Junction, Longview-Kelso, and Vancouver Yard.

Figures 4-7 and 4-8 illustrate delays caused by track and signal defects or maintenance requirements, and the work gangs that are occupying main tracks in order to repair and maintain the track and signal systems. These figures graph the weekly total average delay minutes for Amtrak trains in the Portland-Seattle and Seattle-Vancouver, British Columbia, corridors, respectively, and show weeks when delay-minutes exceed built-in schedule recovery time and in some cases also built-in schedule tolerance time. A train that exceeds its recovery time arrives late at intermediate or final destination stations beyond published timetable times; a train that also exceeds its tolerance time is late beyond timetable by greater than the nominal five-minute "tolerable lateness" limit. Key maintenance events, and known maintenance problems, that cause average weekly delay to exceed these thresholds, are noted in these figures.

The track and signal conditions that cause these delays were not modeled in the RTC model, but served to identify key locations in the corridor where current track and signal conditions repeatedly cause delay. These conditions were not captured in the model as while they are recurring, their exact frequency, duration, and effect are erratic and not predictable. These delays ripple into a loss of overall corridor capacity. For example, delayed trains result in overall loss of corridor speed and fluidity, which in turn overloads the infrastructure compared to a non-delayed scenario. In other words, a corridor with persistent train delays caused by track and signal quality insufficiencies needs more infrastructure to make up for this deficiency. Thus, in the RTC modeling process, the modeler and the operations analysts wish to account for track conditions in a holistic sense, to ensure that the RTC model doesn't over-idealize actual conditions, and thus indicate a corridor capacity that in actuality cannot be realized.

Figure 4-6: 2010 Portland-Seattle Crossover Delays

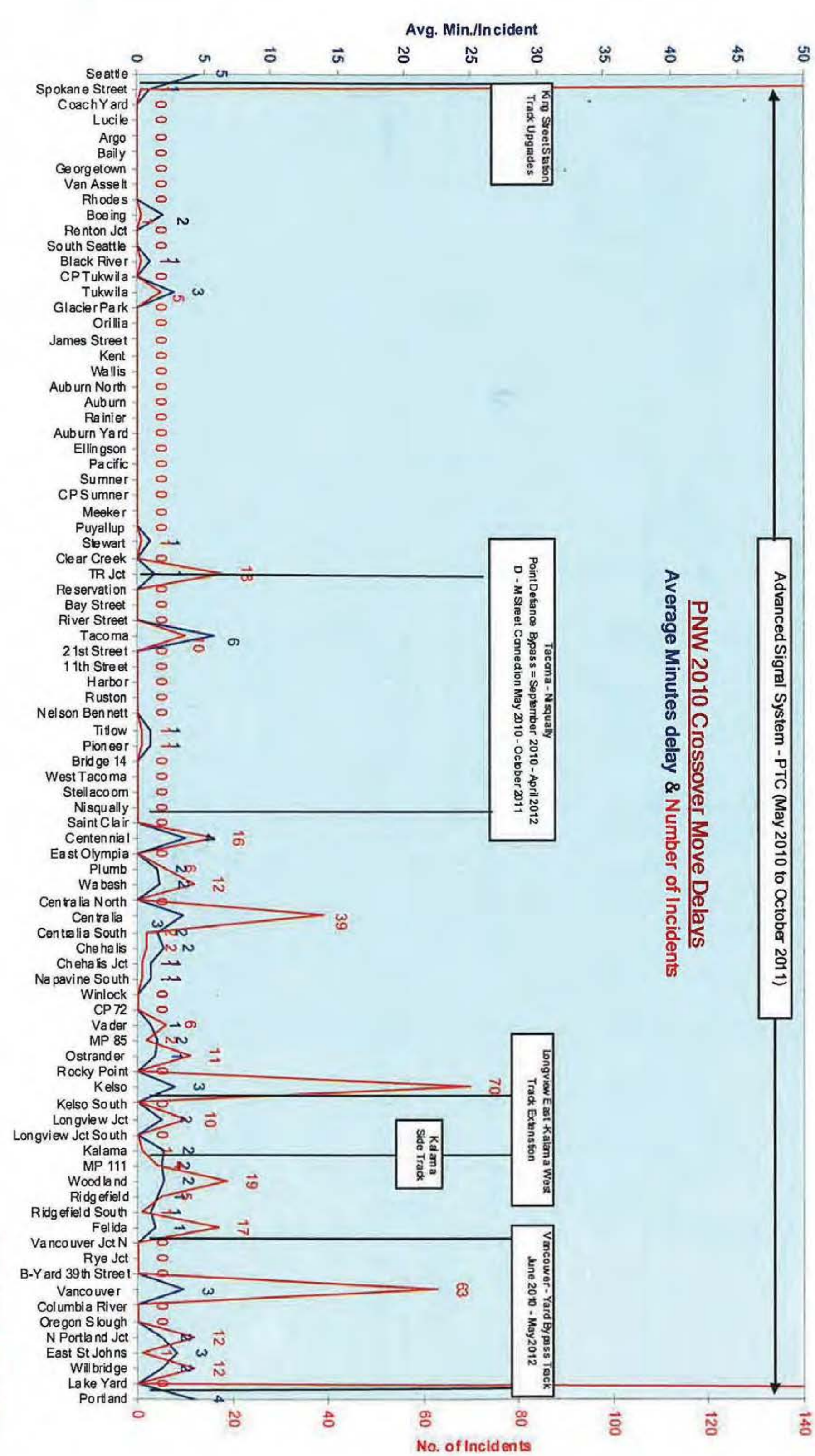


Figure 4-7: 2010 Portland-Seattle Weekly Average Speed Restrictions

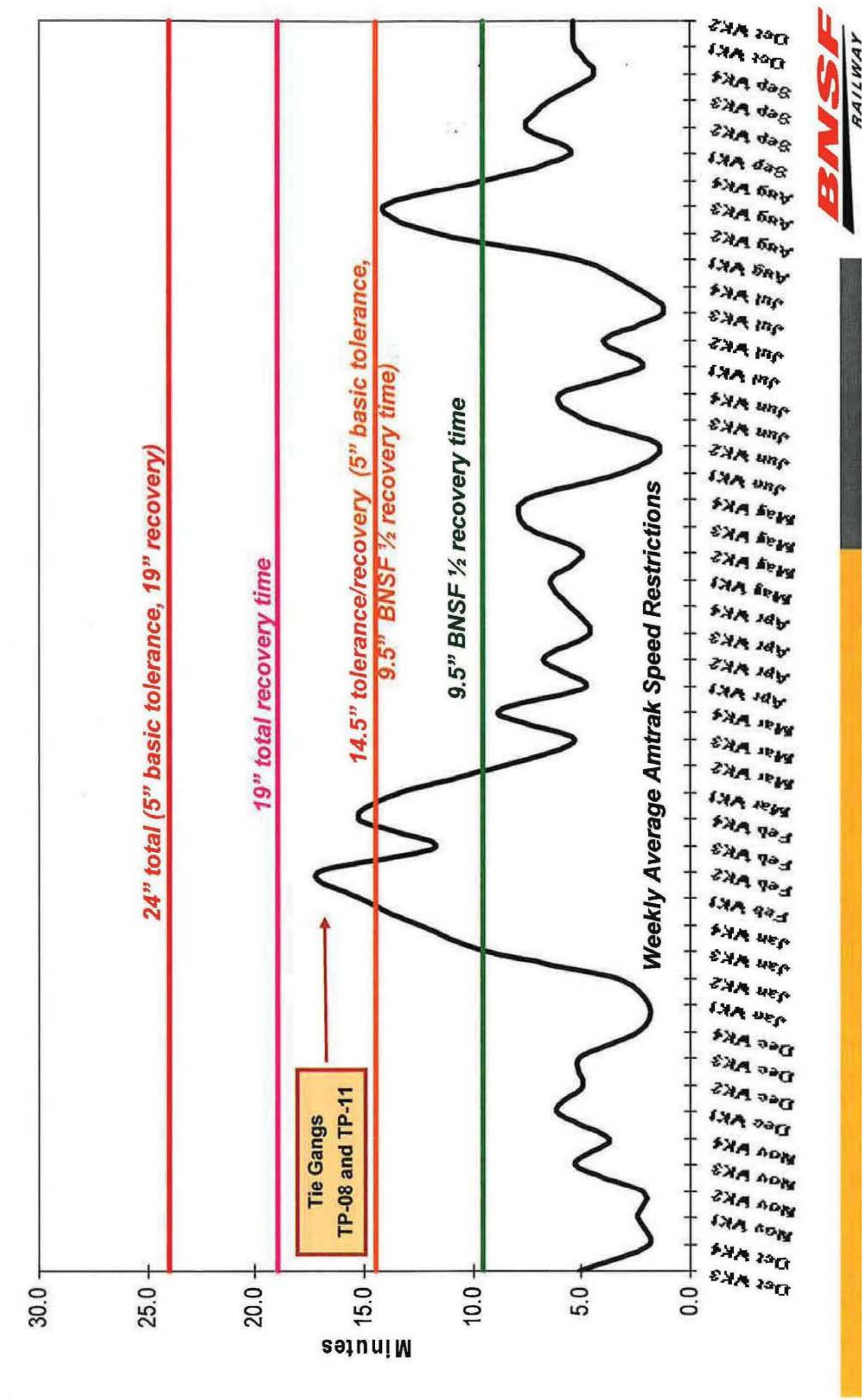
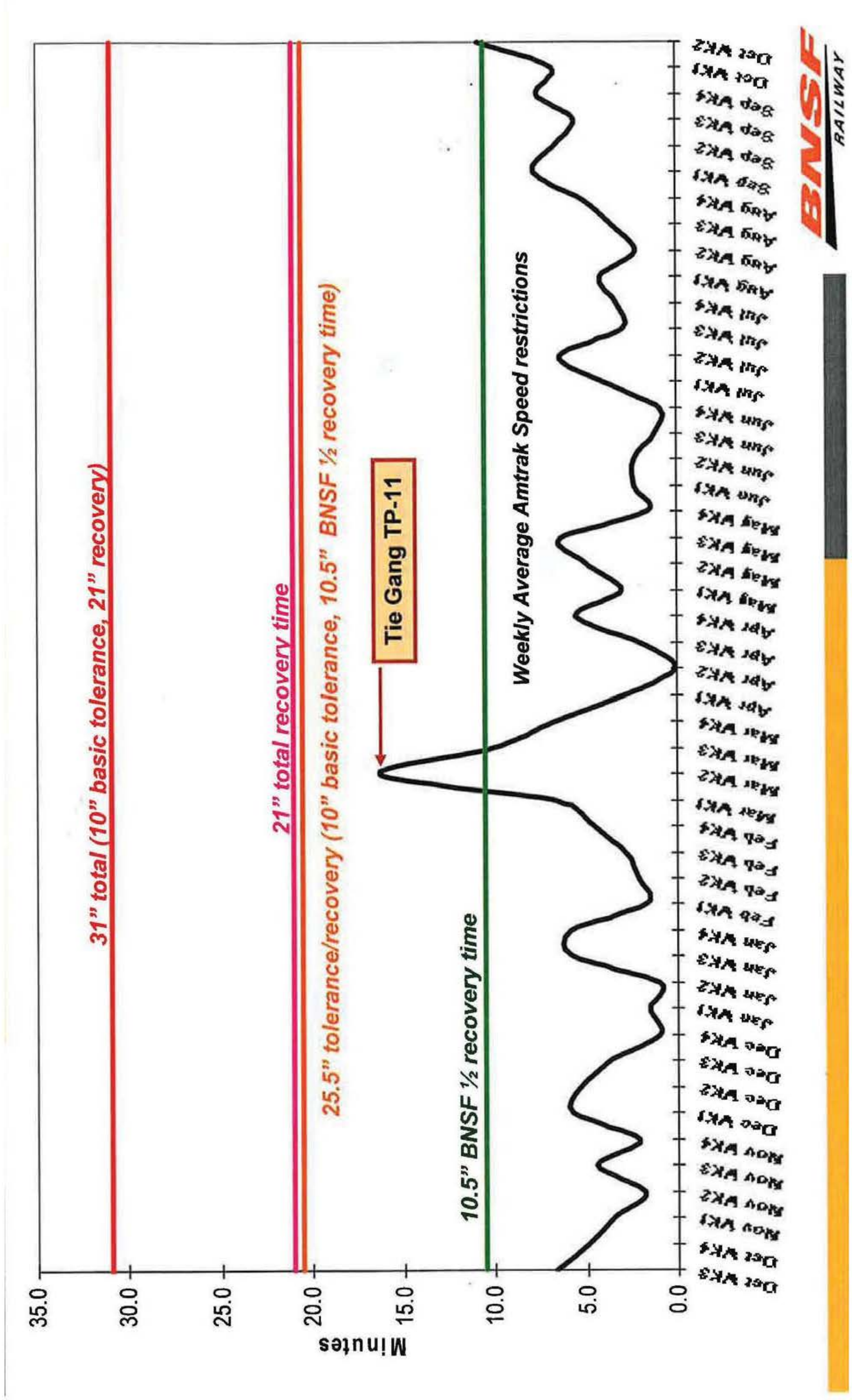


Figure 4-8: 2010 Seattle-Vancouver, B.C., Seattle Weekly Average Speed Restrictions



BNSF uses the following standards when creating infrastructure in the RTC model:

- Track infrastructure features are added to the model from track charts based on mileposts.
- Features incorporated in the model include basic track geometry such as the number of main tracks, turnouts located on main tracks, controlled and non-controlled sidings, crossovers, industrial leads, yard leads and yard receiving and departure tracks tributary to main tracks, at-grade road crossings, fouling limits, industrial spurs leading from main tracks or sidings, station platforms, and industrial trackage that affects main track operations.
- The model is constructed in a link and node format: a node is a point such as the intersection of two tracks, or the point where a tangent track begins to curve. When links exceed 2.8 miles, intermediate nodes are added to simulate signal blocks.
- Elevation data is assigned to all of the geometry nodes and additional data is added for high points, low points, and significant grade changes.
- Speed limits are applied to the model per restrictions outlined in timetables.
- Turnout and crossover nodes are assigned frog numbers and fouling distances per track chart designation and speeds based on the hierarchy of current subdivision timetable and FRA guidelines (see Table 4-14).
- Horizontal curves are not included in BNSF RTC models; instead, any speed limitations around curves are controlled through permanent speed restrictions derived from timetables, special instructions, or general orders. Speed limits are coded into the model according to train type (e.g., conventional passenger, Talgo passenger, freight).
- Track maintenance activities, weather outages and temporary speed restrictions were not incorporated in the model.

Table 4-14: FRA Guidelines for Turnout and Crossover Nodes for RTC Model

Frog #	*BNSF Allowed Maximum Speed (mph)*	*Switch Foul (ft.)*	*Crossover Length (14 foot track centers)*
7	10	89.9	127.024
9	10	107.4	156.029
11	20	124.6	185.035
14	20	170.0	246.046
15	20	177.3	265.050
20	40	227.5	338.064
24	50	264.3	399.075

BNSF used current operating plans to arrive at the proper number of train counts in the model. BNSF then tested the model to determine the existing latent freight train capacity in the corridor, by adding freight trains to the model until the average delay-minutes per train exceeded BNSF's tolerance threshold. This latent capacity is the number of trains that BNSF could run in the corridor, beyond existing trains, and while maintaining existing passenger train performance, without exceeding BNSF tolerances for freight train delay. BNSF has determined this tolerance to be 15 minutes per 100 train-miles. Beyond this point, train delay becomes too costly to be economically tolerated by rail shippers, i.e., delays in freight delivery, and rail network operating costs that would be ultimately absorbed by rail shippers, would cumulatively become too high.

BNSF found in the base case model that the existing latent train capacity is 22 trains per day between Portland and Seattle. BNSF operating plans and forecasts project that traffic growth in this corridor will primarily consist of unit trains carrying bulk commodities; accordingly, the 22 trains added to the Base Case RTC model consist of unit trains, and are operated with the consist, speed, and plan that is appropriate for unit trains.

Figure 4-9 shows the types and number of trains used in the model, and Figure 4-10 illustrates the train-delay growth that was used to determine the latent capacity of the corridor.

Figure 4-9: July 2010 Seattle-Portland RTC Train Counts

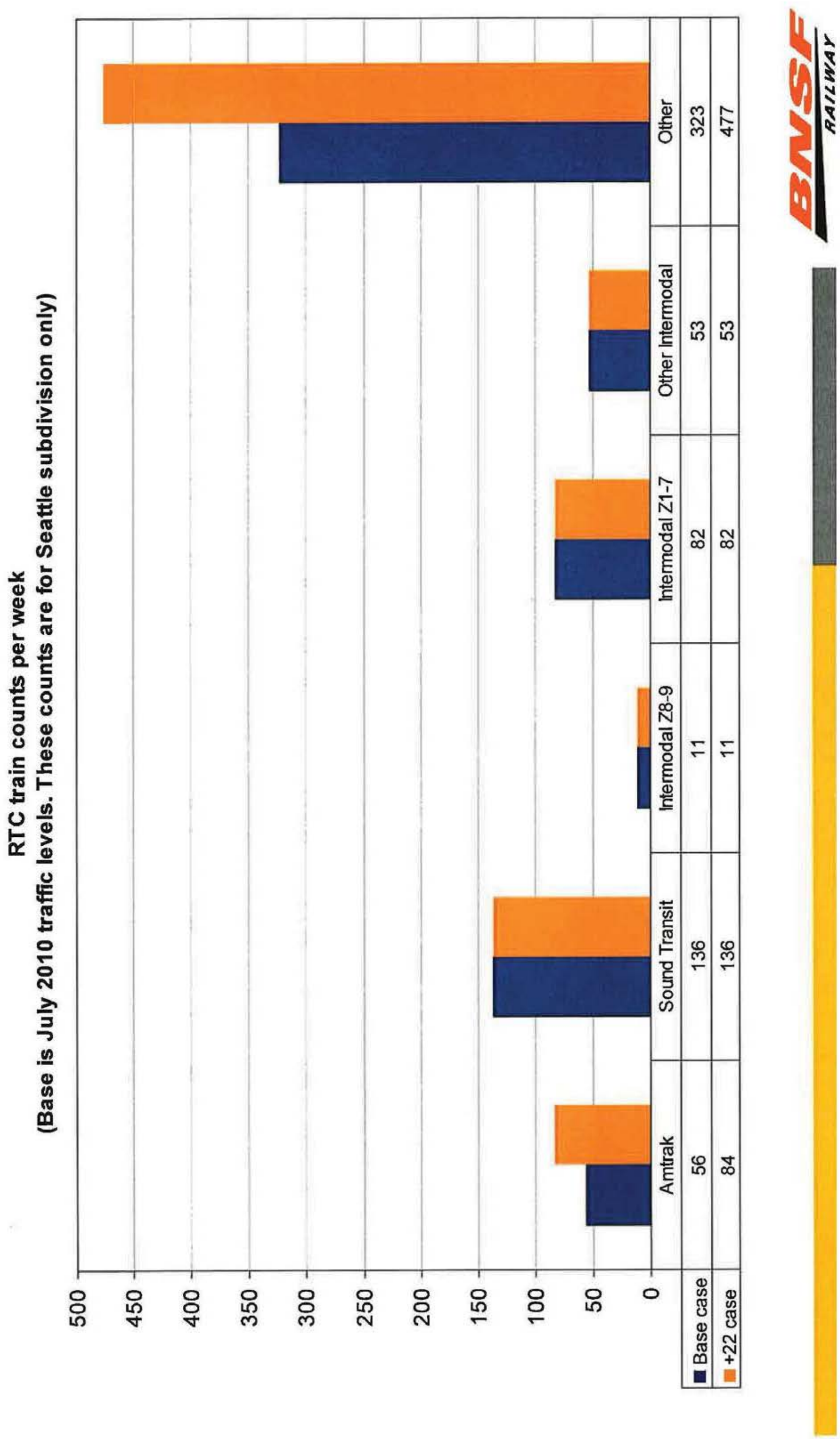
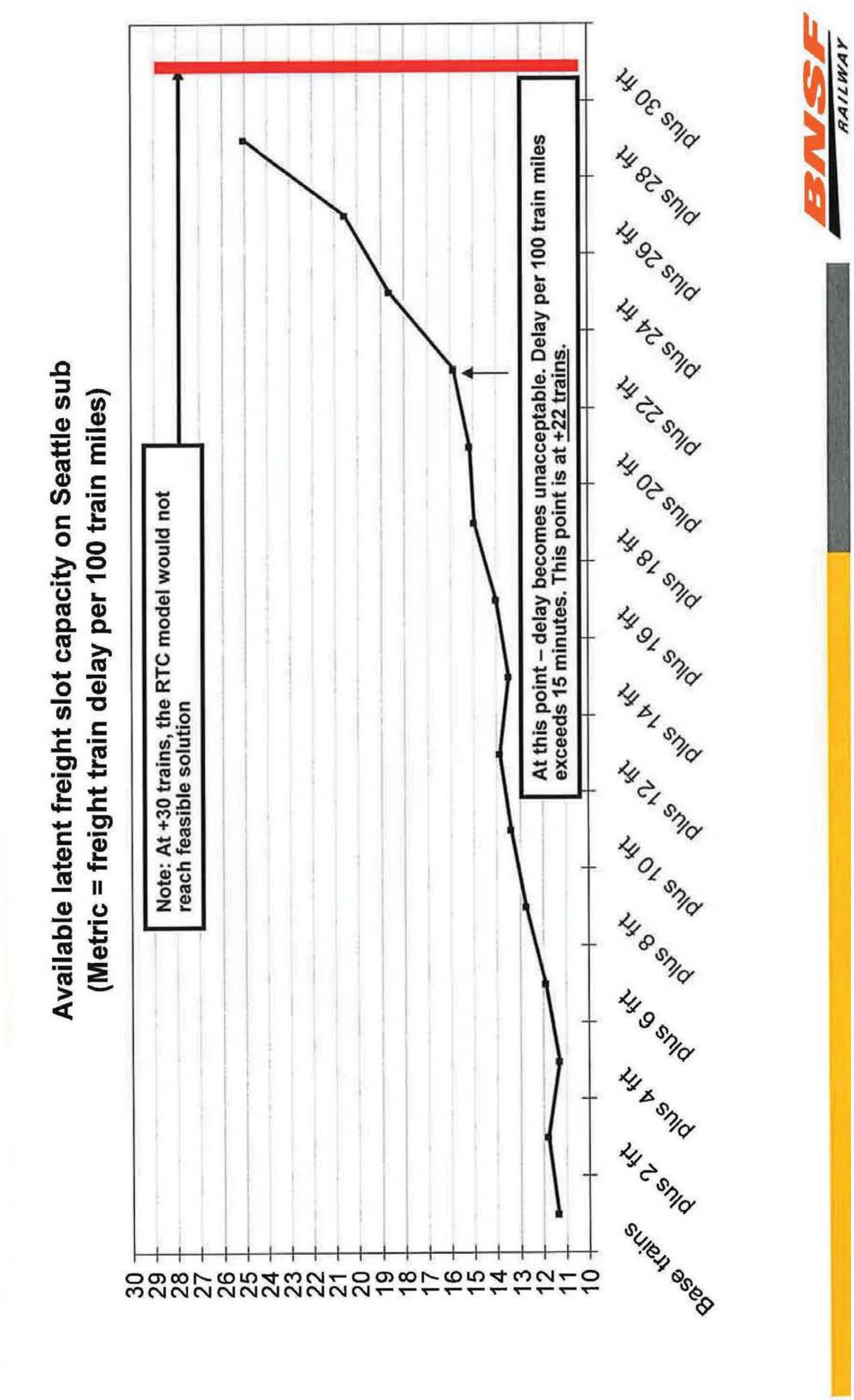


Figure 4-10: Seattle-Portland Existing Latent Freight Train Capacity



BNSF inputs freight trains into its RTC models based on network operating plans, and not through actual train reports (also known as OS data). BNSF then randomizes freight trains in the model based on network maximums, as discussed below. BNSF inputs local train schedules based on actual work event plans which are based on discussions with its local operating officials. Existing Amtrak Cascades, Amtrak long-distance, and ST Sounder train schedules were taken from public sources. BNSF used the supplied schedules as a starting point for the Amtrak Cascades and refined the schedules to include the program's proposed two additional round trips per day with input from WSDOT.

To better simulate real world train operations, the RTC model includes parameters for train priority and randomization inherent in freight train operations over extensive networks. Train priorities are used to determine which class of train takes priority over another. Priorities are based on a range of values that vary depending on whether the train is early or late relative to its schedule. A crew approaching its 12-hour hours-of-service limits significantly improves that train's priority, regardless of its nominal priority. General train class priorities are shown in the following table. Randomizing departure times is a feature supported by RTC that is used to apply variability and test how the system responds.

BNSF runs all of the scenarios in a modeling exercise eight times each, with different randomization patterns each time. The randomization in each run is created through a random number generation engine that generates random late or early times, and assigns one to each train. For each train type, the RTC software permits the modeler to define and quantify if the train is allowed to leave early, late, or have different dwell times at stations or intermediate points. BNSF does not perform randomization on the passenger trains because it intends that passenger trains are run on time, have highest priority, and are unlikely to run late except under unpredictable occurrences. BNSF does not permit intermodal or guaranteed trains to leave early, but they can leave up to 30 minutes late. All other freight trains are permitted to leave up to 30 minutes early and as late as 1.5 hours. Refer to the Table 4-15 for the assigned train priorities for the RTC modeling.

Table 4-15: General Train Class Priorities

Priority	***Train Type***
1	Amtrak and ST (equal priority)
2	Intermodal Z8-9 ("hot" day intermodal LTL trains)
3	Intermodal Z1-7 trains
4	Other Intermodal (domestic stack, international stack, vehicle)
5	All other freight (unit, general merchandise, local)
Foreign trains will be folded into these 5 dispatching categories (based on foreign train type)	

RTC Scenarios

BNSF modeled four different scenarios for this study. The different scenarios are briefly described thus:

- Scenario One: Base infrastructure and trains (the trains and infrastructure existing as of July 2010). The model was built and tested for errors. Known infrastructure under construction, such as the BNSF-funded Longview Yard bypass track, was included. The base model includes new ST trains that will commence operation before this program reaches completion.
- Scenario Two: Base infrastructure and trains, plus 22 freight trains (the latent capacity of the existing infrastructure in the Portland-Seattle corridor).
- Scenario Three: Base infrastructure and trains, plus 22 freight and two additional Amtrak Cascades round trips proposed in this Program. Two additional round trip passenger trains were added, and the RTC model was run again using different random seed times for the freight trains coming on and off the network to reflect the real world variability in the freight trains slots. With the new passenger trains and latent freight slots added, infrastructure projects were added to reduce the delay.
- Scenario Four: Base infrastructure and trains, plus 22 freight and two additional Amtrak Cascades round trips, plus the infrastructure improvement projects between Portland and Seattle proposed in this Program:
    - Vancouver Yard Bypass
    - Kelso-Martin’s Bluff-Longview area: additional main track, siding improvements, turnout improvements, crossover improvements, and yard lead improvements
    - Point Defiance Bypass
    - D to M Street Connection, Tacoma

BNSF ran a fifth scenario that consisted of Scenario Four and the addition of center platforms at Kelso and Centralia stations. Because these projects are not part of the Program at this time, they are not discussed further in this SDP.

Figures 4-11 and 4-12 on the following pages show the average run times and delay minutes for each of the four scenarios.

Figure 4-11 illustrates the results of the RTC model showing the average run times for passenger trains for selected sections on the Corridor. Note that average run times do not vary significantly between the scenarios, which would be expected given that BNSF instructs the RTC model to prioritize passenger trains, and hold freight trains in order that passenger train on-time performance is maintained. This point requires special attention: BNSF constructs its RTC models to add passenger trains and then add infrastructure to return the freight fluidity (including latent capacity) to the status quo ante bellum. This ensures in the RTC model that (1) passenger trains in all scenarios receive the best possible performance offered by the characteristics of the network and (2) the passenger schedule then ensures that freight train fluidity and capacity is made whole. This methodology avoids confounding effects that can occur when the model is used to attempt to solve for passenger train velocity and freight train fluidity and capacity simultaneously. Note that Figure 4-11 also shows the time savings that occurs through the inclusion of the Point Defiance Bypass project (in Scenario Four), approximately 10-minutes of run time.

Figure 4-12 shows the average delay minutes for passenger trains in the Portland-Seattle segment of the route for each RTC modelled scenario. Most of this delay is accounted for by passenger-train on passenger-train delay, where trains attempt to use the same platform track simultaneously, or occupy the single track D Street to M Street and Freighthouse Square portion of the route in Tacoma simultaneously. These conflicts are inherent to the schedule and the infrastructure and are not easily resolved without invoking unfavorable schedules, connections, or crew and equipment cycles, or constructing new infrastructure. Note that passenger train delay does not significantly drop with the construction of the new infrastructure. This is expected given the prioritization for passenger trains selected in the RTC model scenarios. The addition of infrastructure between Nisqually Junction and Portland thus creates the necessary capacity for freight trains that is consumed by the additional two round trips for passenger trains, while the new infrastructure between Nisqually Junction and Tacoma creates a time savings for passenger trains, as well as resolving lack of capacity for freight, via the existing Point Defiance route.

Figure 4-11: RTC Scenarios - Passenger Train Average Run Times

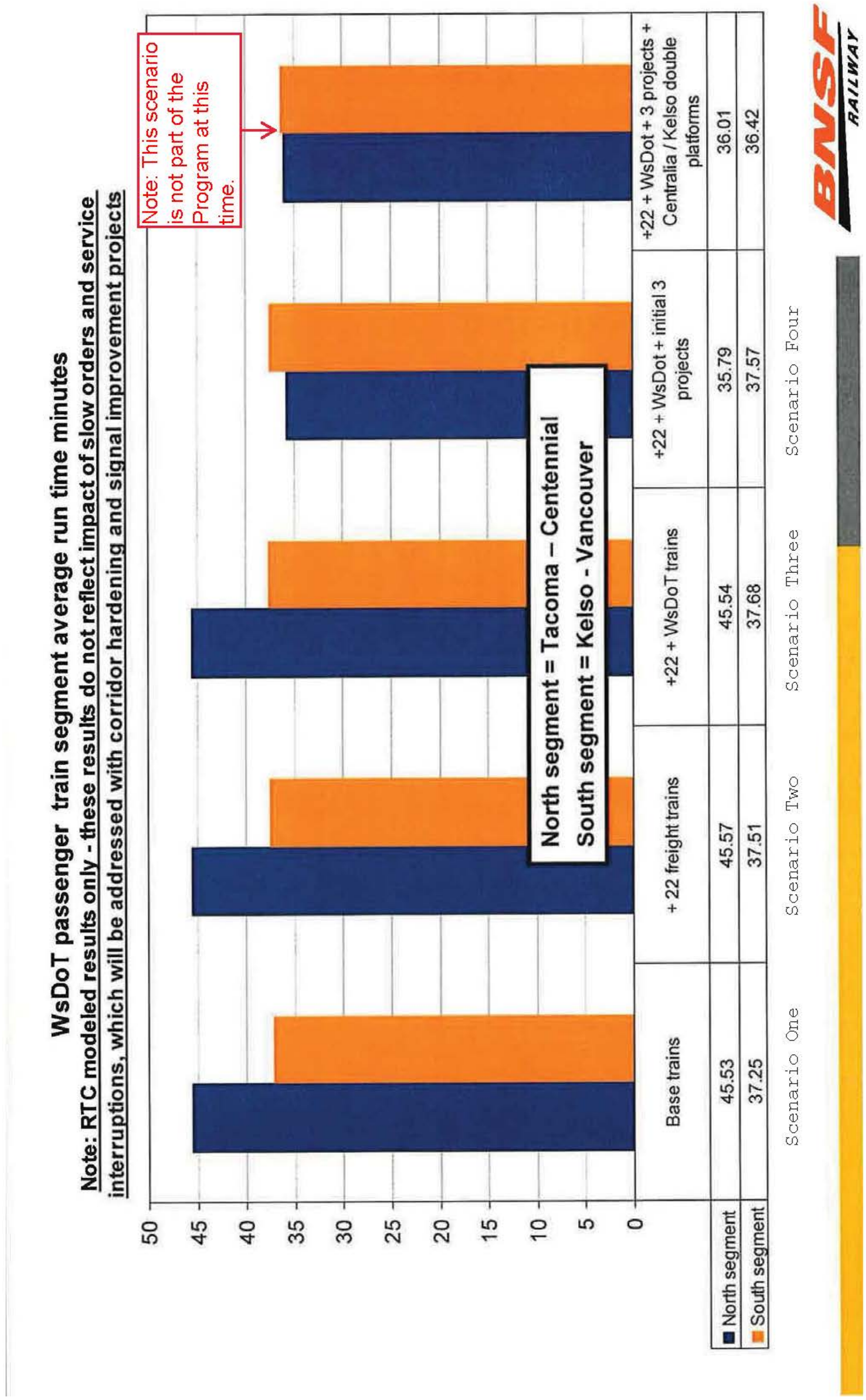
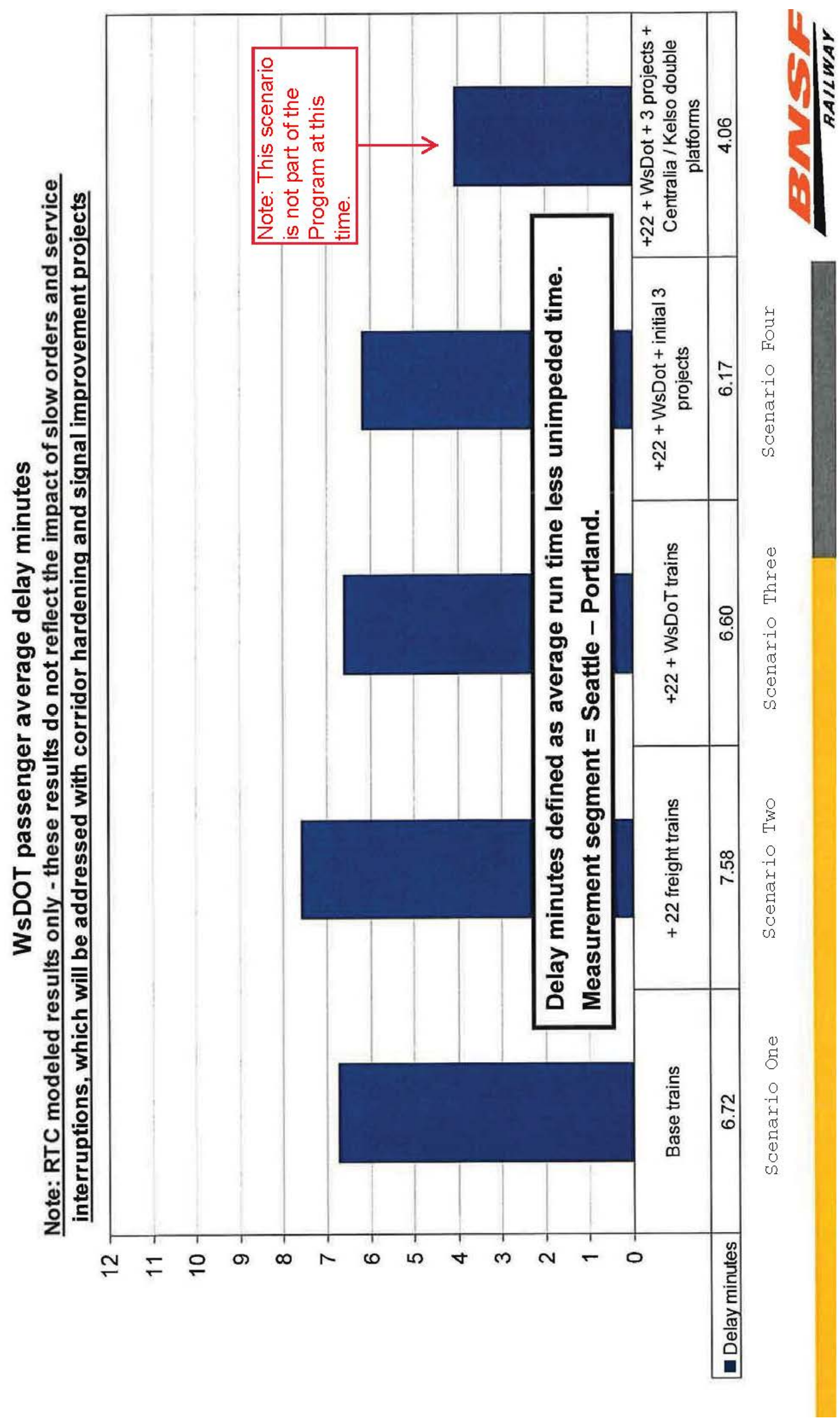


Figure 4-12: RTC Scenarios - Passenger Train Average Run Delay Minutes



The initial RTC output is the Train Performance Calculator (TPC) Graph. The TPC graphs display elevations, speed, throttle, brake settings, cumulative distance and run time. TPC graphs were developed using a typical Amtrak Cascades consist for each of the four RTC scenarios and are illustrated in Figures 13A through 13D in Appendix C. The most notable result is the significant difference in cumulative run time showing a 10-minute time savings under Scenario Four as a result of the inclusion of the Point Defiance Bypass project.

It is instructive to note the performance of the standard train set as speed exceeds 50 mph. At that point, acceleration slows dramatically. The acceleration curves illustrated in the TPC graphs demonstrate the unfavorable results of passenger trains crossing over for freight train overtakes or to skirt local trains and unit trains entering, exiting, or switching industries. The loss of train speed through crossovers, rated at 50 mph maximum in this corridor, is slow to be made up. Accordingly, the infrastructure, which is designed to separate freight and passenger trains (at Vancouver Yard Bypass, Kelso-Longview, and Point Defiance), has a knock-on effect by reducing requirements for crossover moves.

The other output of the RTC model is a series of stringlines. Stringlines are the basic tool used to view overall capacity and performance of a corridor, by showing trains that are delayed excessively (illustrated by a horizontal dotted line), by showing congestion points, and by showing overtake events that negatively impact overall corridor fluidity and train velocity. RTC model stringlines were developed for the four RTC scenarios and are illustrated in Figures 14A through 14D in Appendix C. These stringlines were examined by BNSF and WSDOT's consultant, HDR Engineering, to identify key times of the week, and locations in the corridor, in terms of infrastructure sufficiency and schedule design. In particular, the Kelso-Longview area and Vancouver Yard area were singled out for close attention to model animations to ensure that infrastructure proposed in this program was correctly configured, and of sufficient quantity, to reliably deliver the program goals of improved schedule reliability and the additional two Amtrak Cascades round trips desired by WSDOT.

Selected screenshots of RTC animations are shown in Figures 4-15 through 4-20 on the following pages. These screenshots illustrate how the new infrastructure in the Longview-Kalama area substantially reduces passenger train on passenger train conflict by advancing freight trains out of the way in order to create free paths (in most cases without crossover moves) for passenger trains. The animations also show how it returns freight train fluidity to the status quo with the addition of the two WSDOT round trips desired in this program. Freight trains shown with a "clear arrow" are freight trains that are late beyond their design tolerance, e.g., 1.5 hours for unit and manifest trains. Amtrak trains are shown in white, manifest trains in red, unit trains in blue, local train in brown, and UP trains in yellow.

Figure 4-15: RTC Animation - Passenger Train on Passenger Train Conflict

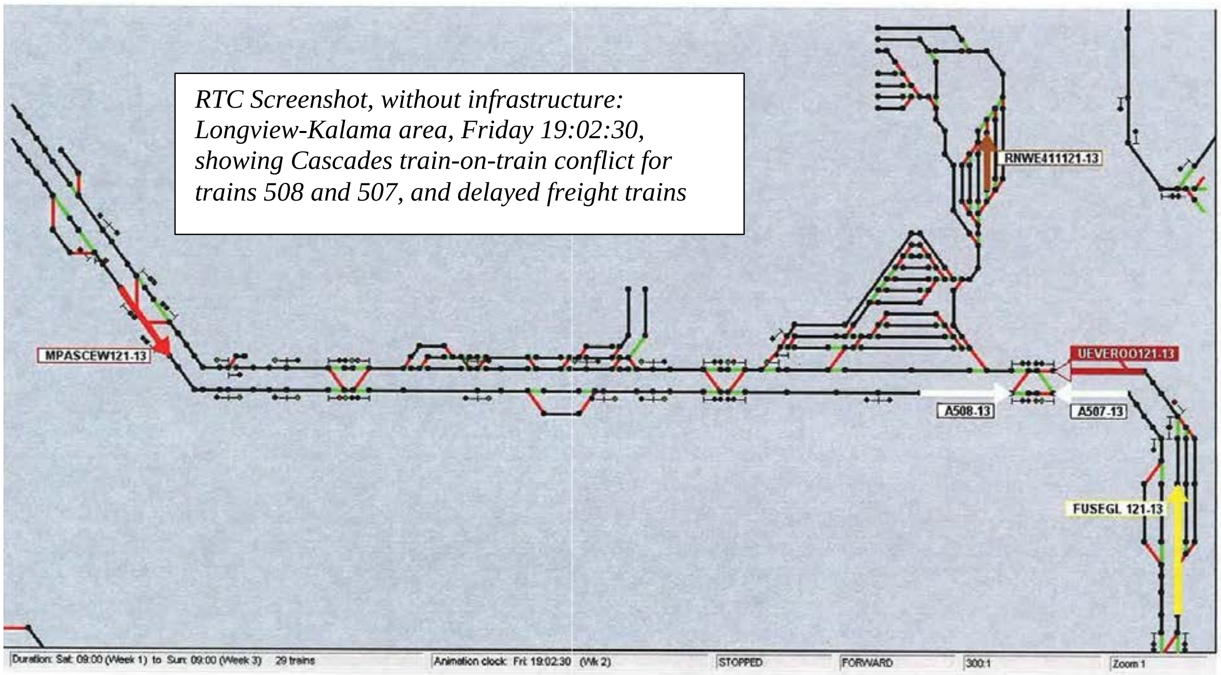


Figure 4-16: RTC Animation – Passenger and Freight Train Delays

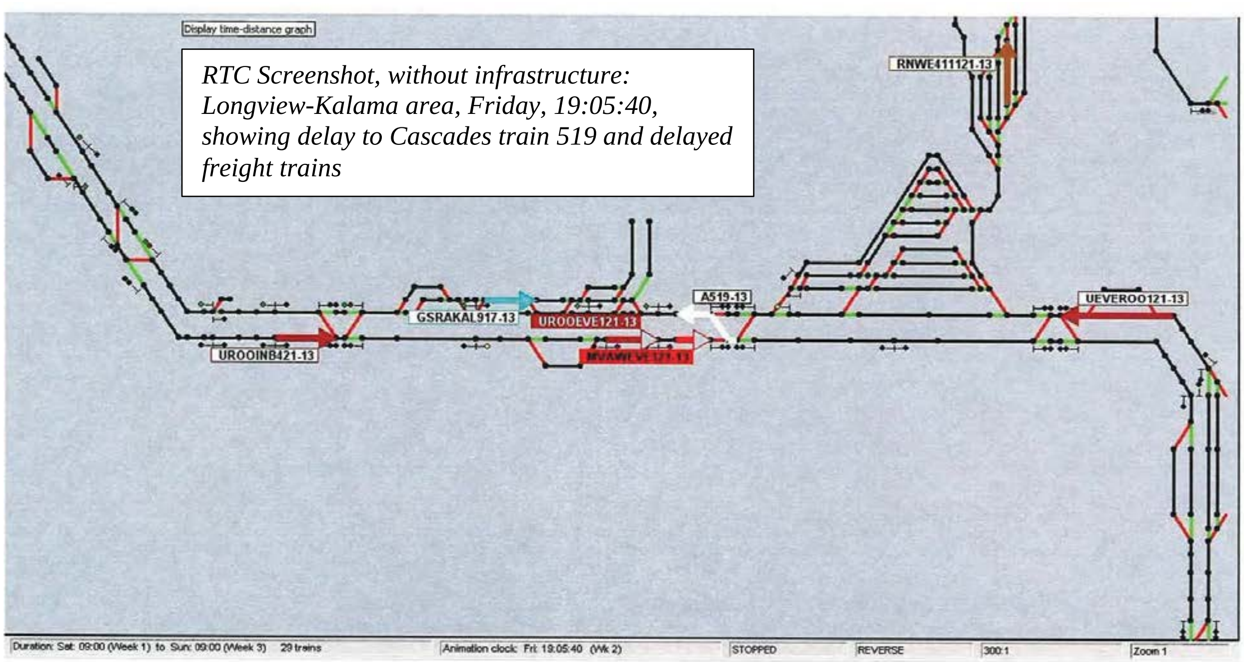


Figure 4-17: RTC Animation – Freight Train Delay

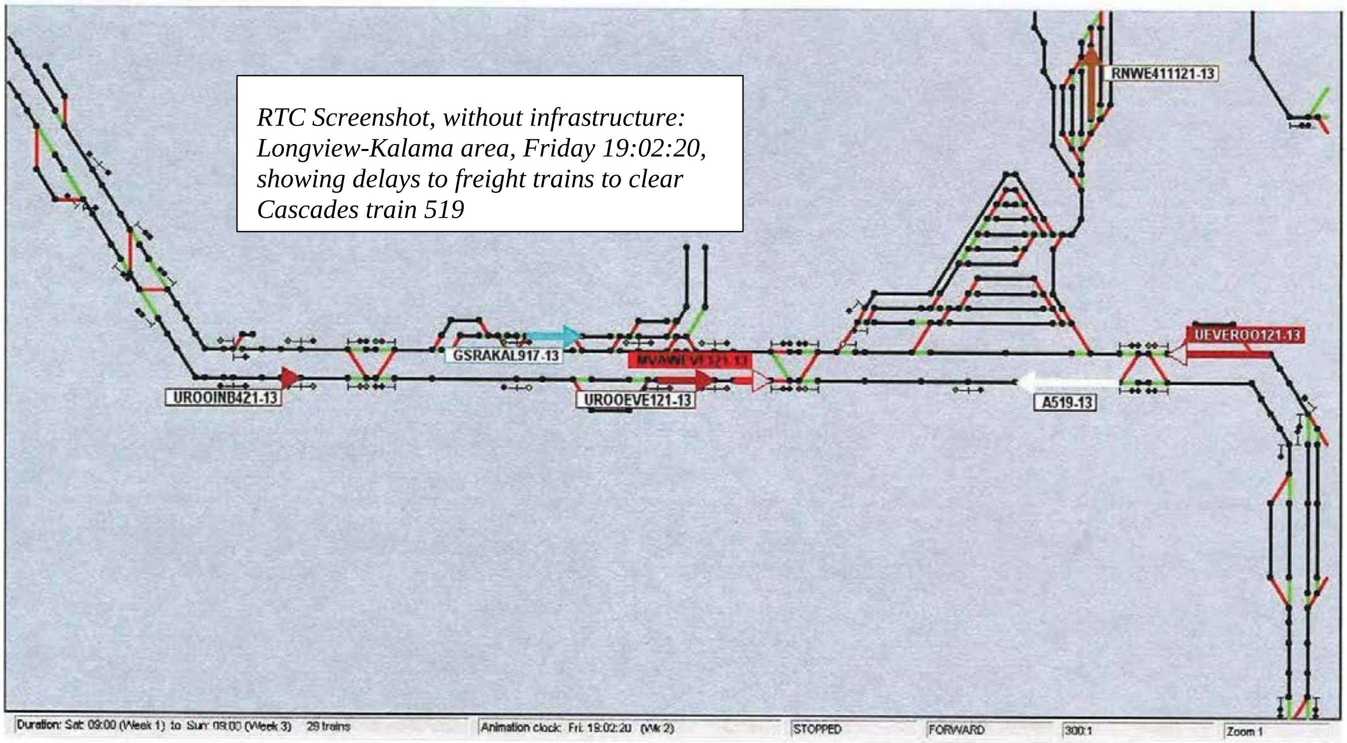


Figure 4-18: RTC Animation – Freight Train Delays

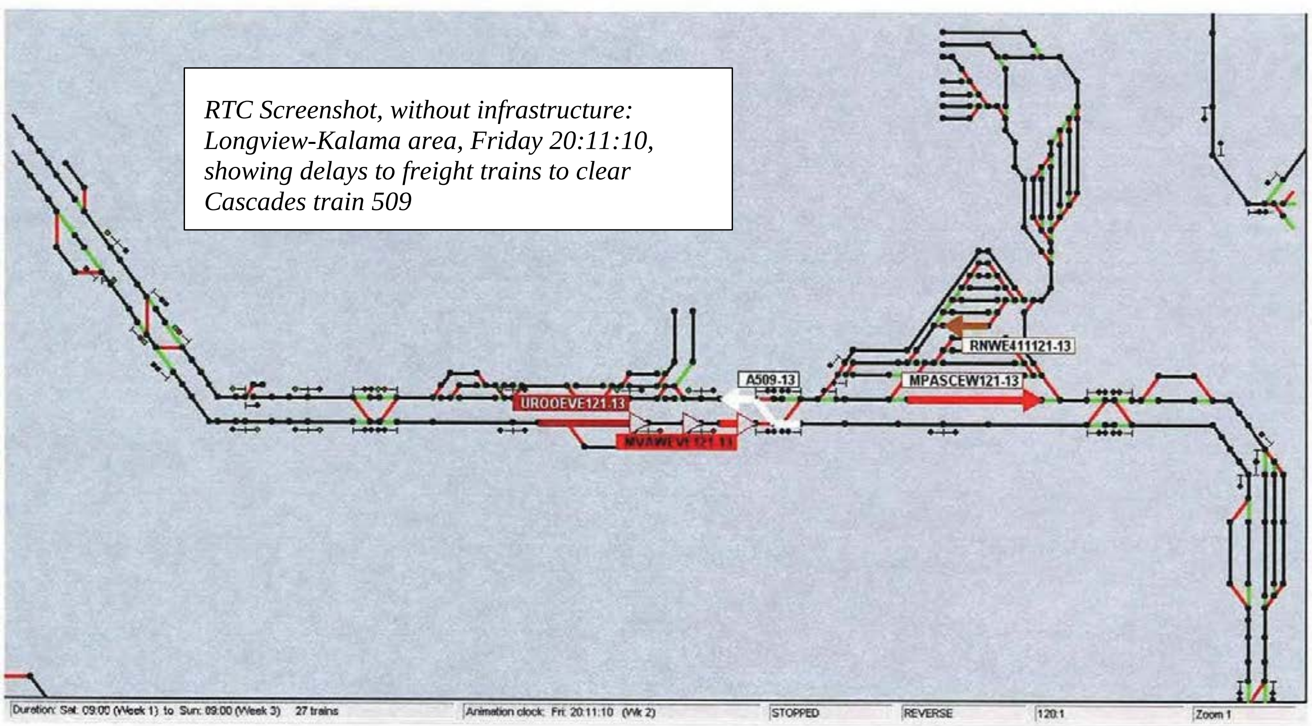


Figure 4-19: RTC Animation With New Infrastructure – No Passenger Train Conflicts

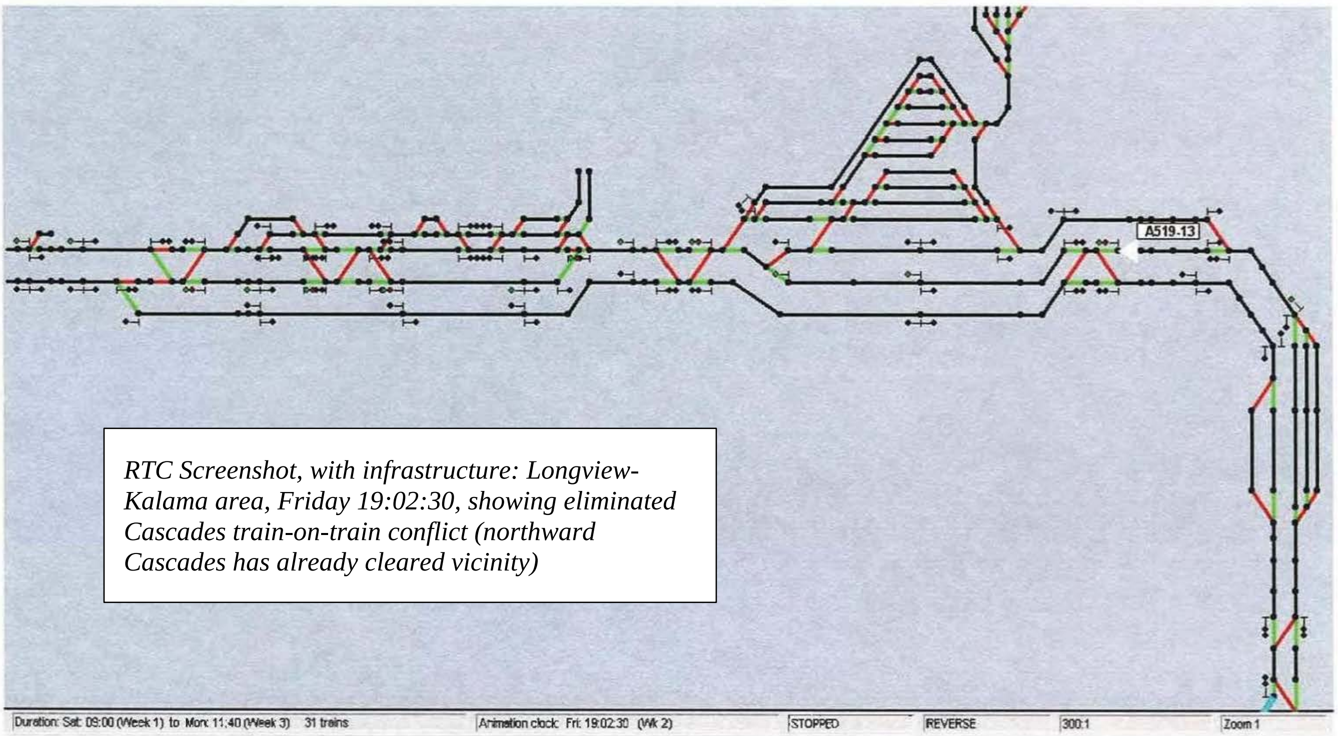
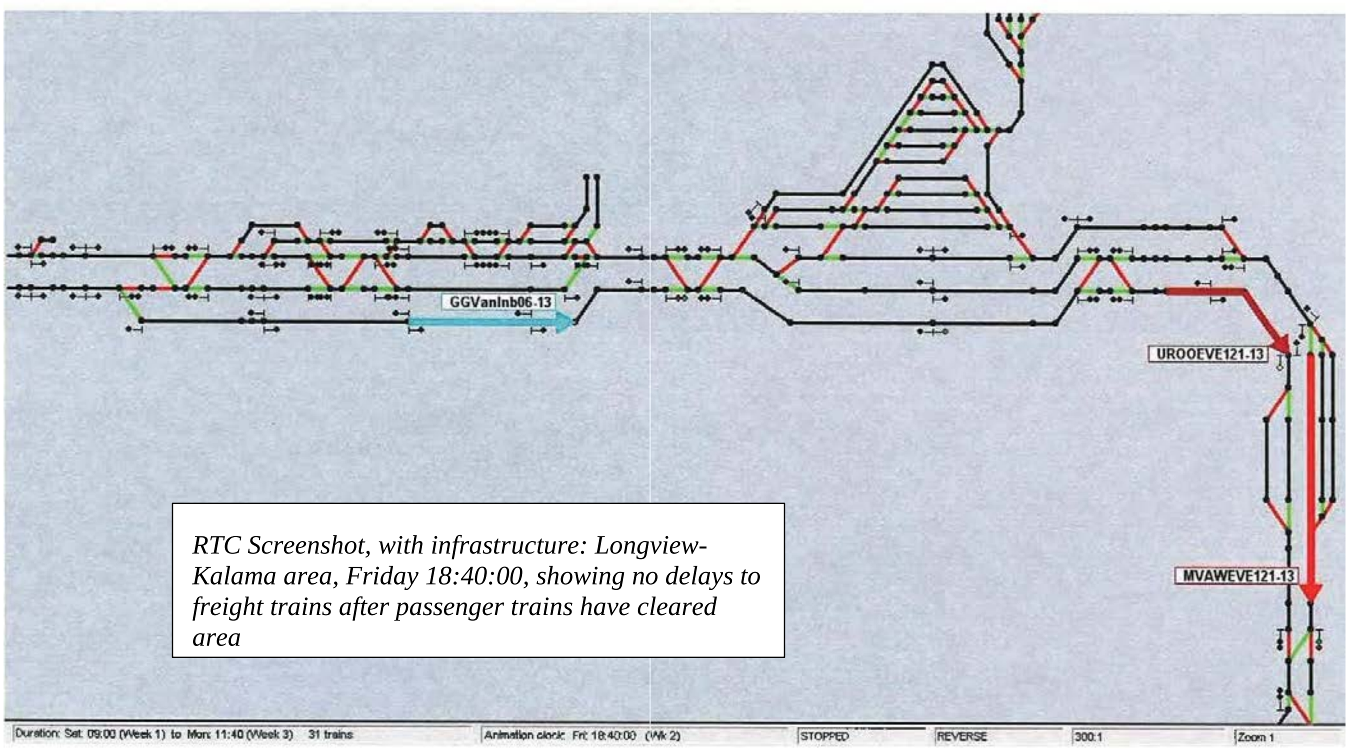


Figure 4-20: RTC Animation With New Infrastructure – No Freight Train Delays



Passenger Stations

The existing Amtrak Cascades service stops at 18 stations. Because the goal is to reduce scheduled run-time and increase on-time performance, the PNWRC Program does not propose adding any new station stops at this time; however, based on the operational modeling, one passenger station will be relocated and one passenger station will be modified.

The Point Defiance Bypass project will re-route Amtrak long-distance and Amtrak Cascades trains off of the BNSF main line between Nisqually Junction and TR Junction. As a result, the station stop in Tacoma will be relocated from its current location, adjacent to BNSF's rail yard, to the Sound Transit commuter rail station, a few blocks southwest.

Modifications will be made to the tracks and platforms at King Street Station in Seattle. The modifications are needed in order to increase train capacity and operational reliability. Descriptions of the changes at these two locations can be found in Chapter 3 – Station Analysis.

Infrastructure Improvements Required to Support the New Service

Overview

Train operations and scheduling are a function of rail line capacity. Physical characteristics of the existing route was examined for their influence on train schedules, train service benchmarks, costs, and suitability for a passenger rail corridor that must also continue to host freight and passenger trains of other railroads without significant negative effects on their capacity, speed, reliability, costs of operation, or operational flexibility. These characteristics were used to develop Conceptual Engineering documents that describe, illustrate, and quantify new track, train-control, and communications infrastructure that will be required to deliver the proposed service reliably, at reasonable cost, and for the 20-year time horizon required by the FRA. These Conceptual Engineering documents were attached separately to the 2009 HSIPR, Track 2, grant application and consisted of track plans and narrative descriptions. Stakeholders involved in the development of these documents included BNSF, WSDOT, and ST.

2010 Existing Conditions

The existing route and track mileage for the host railroads and Amtrak, as well as approximate volumes and speed information (i.e., prior to the Program improvements) of the proposed route from Eugene to Vancouver, British Columbia is as follows:

BNSF

The BNSF portion of the PNWRC is comprised of four subdivisions: Fallbridge, Seattle, Scenic, Bellingham, and New Westminster.

- 387 route miles, overall
- 695 track miles

286,000 pounds maximum gross weight on rail for the Seattle, Bellingham, and New Westminster Subdivisions; 315,000 pounds maximum gross weight on rail for the Scenic Subdivision

Subdivision	Number of Trains	Train Speeds
Fallbridge Subdivision (Portland, Ore. to Vancouver, Wash.):	• Eight Amtrak Cascades trains • Four Amtrak long-distance trains • 10 to 20 freight trains per day	• Freight speeds 30 to 50 mph • Passenger speeds 30 to 70 mph
Seattle Subdivision (Vancouver, Wash. to Seattle, Wash.):	• 18 ST Sounder trains per day between Tacoma, Wash. and Seattle, Wash. • Eight Amtrak Cascades trains per day • Two Amtrak long-distance trains per day • 45 to 60 freight trains per day	• Freight speeds 30 to 60 mph • Passenger speeds 40 to79 mph
Scenic Subdivision (Seattle, Wash. to Everett, Wash.):	• Eight ST Sounder trains per day • Four Amtrak Cascades trains per day • Two Amtrak long-distance trains • 30 to 40 freight trains per day	• Freight speeds 25 to 50 mph • Passenger speeds 30 to 70 mph
Bellingham Subdivision (Everett, Wash. to U.S./Canada Border):	• Four Amtrak Cascades trains per day • 10 to 20 freight trains per day	• Freight speeds 30 to 60 mph • Passenger speeds 45 to 79 mph
New Westminster Subdivision (U.S./Canada Border to Vancouver, B.C.):	• Four Amtrak Cascades trains • 10 to 20 freight trains per day	• Freight speeds 25 to 35 mph • Passenger speeds 30 to 50 mph

UP

The UP portion of the PNWRC is comprised of two subdivisions: Brooklyn and Portland

- 123 route miles, overall
- 124 track miles (includes 2 MT)

315,000 pounds maximum gross weight on rail

Class I freight railroad per Surface Transportation Board rules

Subdivision	Number of Trains	Train Speeds
Brooklyn Subdivision	• Four Amtrak Cascades trains per day • Two Amtrak long-distance trains per day • 15 to 25 freight trains per day Eugene to East Portland Jct.	• Passenger speeds 45 to 79 mph

Portland Subdivision	• Four Amtrak Cascades train per day • Two Amtrak long-distance trains • 8 to 16 freight trains per day between East Portland Jct. and VC Tower (Union Station)	• Freight speeds 6 mph • Passenger speeds 10 mph

Sound Transit

Characteristics of the Sound Transit portion of the PNWRC (aka: Point Defiance Bypass route) are described as existing in 2013.

- 21 Route miles overall(existing)
- 25 track miles (proposed)

Subdivision	Number of Trains	Train Speeds
Between TR Junction and Lakewood Station (MP 0.0 – MP 10.0):	• 26 Sounder trains per day • Two freight trains per day • 12 Amtrak Cascades trains per day (proposed) • Two Amtrak long-distance trains per day (proposed)	• Freight speeds 10 mph • Passenger speeds 30 mph (existing) 30 to 79 mph (proposed)
Between Lakewood Station and Nisqually Junction (MP 10.0 – MP 21.0):	• 12 Amtrak Cascades trains per day (proposed) • Two Amtrak long-distance trains per day (proposed)	• Freight speeds 10 mph (existing) 40 mph (proposed) • Passenger speeds 60 to 79 mph (proposed)

Amtrak

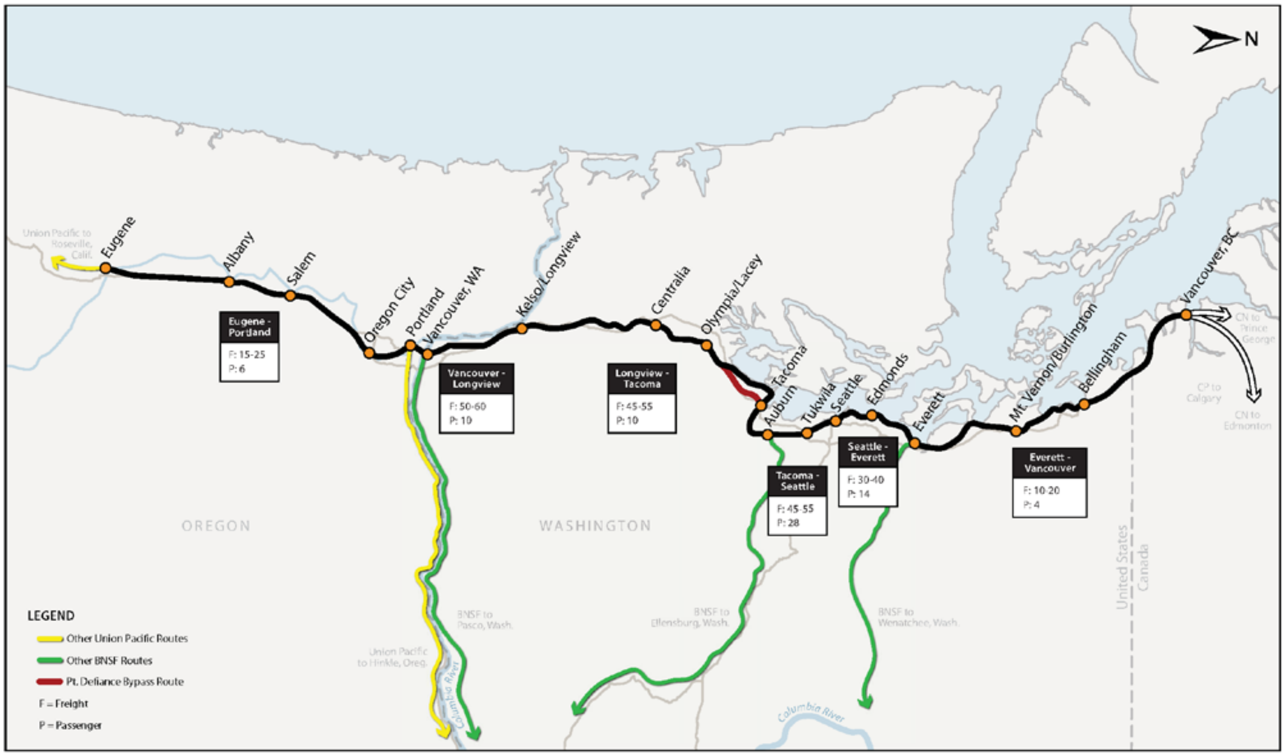
The Amtrak portion of the PNWRC is comprised of tracks surrounding the King Street Station. Amtrak leases the tracks, which are owned by BNSF.

- 0.5 route miles (King Street Station)
- 1.5 track miles

Subdivision	Number of Trains	Train Speeds
Station Tracks	• 10 Amtrak Cascades trains per day • 26 ST Sounder trains per day • Four Amtrak long-distance trains per day	• 10 to 30 mph maximum speed in station and yard throat, depending upon track assignment

Figure 4-21 shows the approximate weekday volumes of passenger and freight trains on the PNWRC in 2011 and Figure 4-23 illustrates the projected flow patterns for freight trains in 2015.

Figure 4-21: Weekday Train Volumes



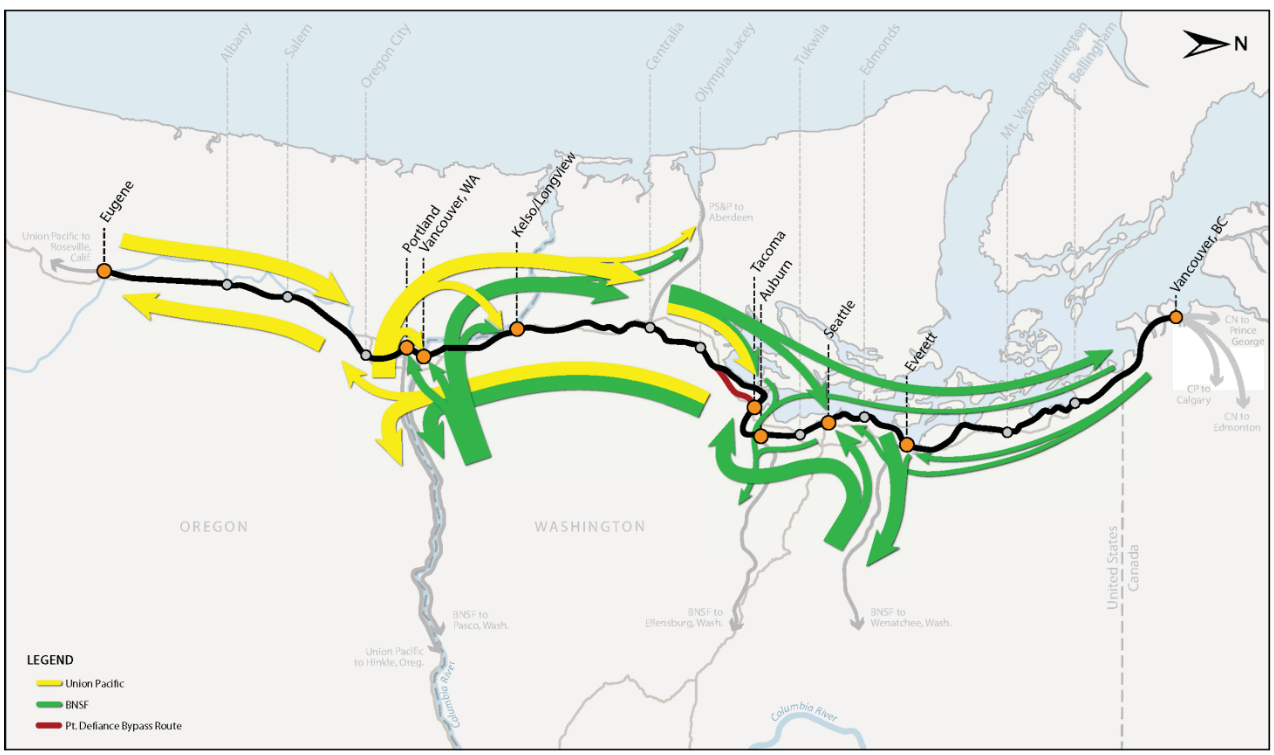


Figure 4-22: 2015 Projected Major Freight Flow Patterns

In general, the existing FRA track classification for the section between Eugene and Portland (primarily on UP) is Class 4. The section between Portland and Vancouver, British Columbia (primarily on BNSF) is FRA Class 4. Rail weight varies, with mostly 6-inch base sections south of Everett, and a mixture of 6-inch base and 5½-inch base sections north of Everett. Most main line track is constructed with wood ties, though recent construction (within the last 10 years and especially within the last 5 years) has been with concrete ties.

The approximate amount of curvature sharper than 2-degrees from Portland, or to Vancouver, British Columbia is as follows:

- Fallbridge Subdivision and Seattle Subdivision, curves 2-degrees or sharper: approximately 20 miles
- Scenic Subdivision, curves 2-degrees and sharper: approximately 9 miles
- Bellingham Subdivision, curves 2-degrees and sharper: approximately 10 miles
- New Westminster Subdivision, curves 2-degrees and sharper: approximately eight miles
- Brooklyn Subdivision, curves 2-degrees and sharper: approximately XX miles
- Portland Subdivision, curves 2-degrees and sharper: approximately 0.5 miles

A 2-degree curve was picked as the threshold, since either a significant speed reduction would be required for the high-speed train sets (running at five inches underbalance) on sharper curves, or superelevation would have to be increased over three inches to avoid significant speed reductions.

The existing corridor from Eugene to Vancouver, British Columbia has limited right-of-way fencing, located primarily in urban areas to discourage trespassers. No additional right-of-way fencing is proposed.

There is believed to be no third-party ownership (i.e., other than the track owners) of air-rights along the corridor from Eugene to Vancouver, British Columbia, with the exception of property above tunnels. Air rights and utility rights-of-way will be verified during final design as necessary.

There are multiple overhead structures, especially grade separations, which have been granted easements or licenses.

There are multiple utility licenses along the route, including fiber optic, pipeline, and electric power. While most of these are perpendicular to the right of way, some, like the fiber optic lines, do run parallel to the right of way.

Proposed Infrastructure Improvements

Based on results from the operational analysis and evaluation of the existing conditions, infrastructure along the PNWRC requires significant improvements on both the BNSF and ST portions, as well as at King Street Station. These improvements are needed in order to support the proposed passenger-train schedule and obtain sufficient track capacity on each railroad. The proposed improvements to the physical plant of the route will allow BNSF to provide cost-effective and satisfactory service to their freight customers. Absent these improvements, rail-served shippers could incur higher transportation costs due to slower transit times, higher inventory volumes, and unreliable shipping schedules. The goal is to develop a rail network that provides for on-time performance for both the existing freight service as well as the proposed passenger service.

As part of this Program, portions of the BNSF main line will be upgraded and locations noted as consistent trouble spots for passenger train timekeeping will be addressed by replacing worn components and subgrade materials with new ties, rail, or undercutting. Surfacing, ballast dressing, tamping, and aligning, to improve track geometry and reduce track maintenance frequency needs, will also be addressed as part of the proposed improvements.

In addition, existing turnouts and crossovers will be upgraded. Where appropriate, existing #15 or #20 turnouts will be replaced with #20 or #24 turnouts. In some locations, where it is important for trains to enter and depart the main track quickly, #11 turnouts may be upgraded to a larger size in speed-critical areas.

All improvements are assumed to occur on right-of-way currently owned by BNSF or ST. As conceptual engineering progresses on several projects, particularly on the Kelso Martin's Bluff projects, the extent of right of way acquisitions, if any are necessary, will be determined.

The one major exception is development of the relocated Amtrak station stop. The proposed location is in the vicinity of the Freighthouse Square building and ST's Tacoma Dome Station. Build-out of this space will likely require leasing space for the ticket counter, waiting room, and baggage handling area. Since this station currently only serves commuter, none of these facilities exist.

In addition to these general improvements, several key infrastructure projects were identified along the route and are described in the following sections. These infrastructure improvement projects are included in the BNSF/WSDOT/Amtrak Service Outcomes Agreement executed on February 25, 2011 and amended on July 12, and September 7, 2012.

Vancouver Yard Improvements

The Vancouver Yard is at the junction of the BNSF Fallbridge Subdivision and Seattle Subdivision. This is a major yard for freight traffic, and also serves as the entrance to the Port of Vancouver, a major bulk port. The improvements at Vancouver Yard will streamline switching operations, reduce main track occupancy, and allow for trains headed to or from the Fallbridge Subdivision to avoid the busy junction near the Columbia River Bridge and to circumvent the yard, joining the Seattle Subdivision north of the yard. New crossovers will also allow parallel moves where tracks diverge from the main line.

Corridor Reliability Upgrades

The Corridor Reliability Upgrades will replace components identified as weak links. By accomplishing this work, the amount of slow orders should be reduced and the reliability of operations would improve.

For example, replacing #20 turnouts with #24 turnouts will allow increased speeds. Thus, saving time when trains have to cross from one track to another.

Kelso Martin's Bluff Improvements

On the BNSF Seattle Subdivision, between approximately MP 97 and MP 111, there is an area where heavy local freight and unit bulk traffic enter and leave the main line. Alongside the main line, there are two major grain export facilities, United Harvest and Kalama Export, and several smaller industries adjacent to the Columbia River. Both of these facilities export a significant amount of grain, which translates to a significant volume of rail traffic. As trains work the export facilities, they often occupy the main line, thus reducing main line capacity. The improvements are intended to: 1) allow passenger trains to bypass these switching operations; and 2) allow freight trains to enter or exit the main line more rapidly via higher speed turnouts.

At Longview, the work will include additional tracks to minimize interference with local switching and access to the Port of Longview, which is home to several bulk and breakbulk importers and exporters. In addition to the bulk traffic, which moves mostly in unit trains, there is a significant amount of carload business at the Port of Longview. Much of the carload business for the Ports and Kalama is marshaled in the yard at Longview Junction. Bulk equipment can also be staged, in cuts, at Longview Junction.

Generally, the improvements between Kelso and Martin's Bluff consist of adding sections of third main track south of Kelso to bypass the areas of local switching, replace mainline turnouts with larger angle turnouts to allow higher speeds, add or reconfigure crossovers to allow for parallel movements, and extend lead tracks to provide headroom for switching without fouling main lines. Major elements of the Kelso Martin's Bluff suite of projects include:

- Extension of lead track along Main 1 near Toteff Road to provide additional headroom for switching.
- New third main track between the Kalama River and MP 110.5.
- Reconfigured leads and control points to export facilities at Kalama to increase speed of trains entering and departing the main track.
- New third main track between Kelso and Longview.
- Reconfigured yard lead at Longview Jct. to provide additional headroom for switching to reduce main track occupancy.

Although not all this work is on the main line, some of the primary benefits from this work are obtained by improving speeds for freight traffic. For example, a mile-long train exiting the main track over a #11 turnout will require six minutes to traverse the turnout (exclusive of deceleration time). If that turnout were upgraded to a #15, the main track occupancy required to traverse the turnout would be reduced to below three minutes (and with even less concomitant deceleration time).

Everett Storage Tracks

Two storage tracks between PA Jct. and Delta Jct., at Delta Yard in Everett, will be constructed in order to create a place to arrive and depart full-length trains without breaking or "doubling" trains into the yard. Currently, trains perform these maneuvers while occupying main tracks or displacing switching operations at adjacent Delta Yard onto main tracks.

Advanced Wayside Signal System

The Advanced Wayside Signal System will upgrade wayside signal equipment along the Fallbridge, Seattle, Scenic, and Bellingham Subdivisions in order to improve safety, rail capacity, and reliability. The Advanced Wayside Signal System lays groundwork for potential higher speeds in the future. The system includes upgrades to all wayside equipment locations. This system covers nearly the entire corridor from Vancouver, Wash. to the U.S./Canada border at Blaine, Wash.

D to M Street Connection

This project constructs a connection between the existing ST Tacoma Dome Station and MP 3.4 (just north of Chandler Street) on the recently reconstructed Lakewood Subdivision. The connection includes three grade separations, multiple roadway relocations (both vertically and horizontally), one new public grade crossing, two rehabilitated public grade crossings, and substantial quantities of retaining wall. The resulting grade will be approximately 2.9 percent, and the maximum speed will be 35 mph. Track construction will be 136-pound rail on concrete ties. The D to M Street Connection project has been configured to allow the addition of a second main track.

The project will also install CTC equipment and fiber optic communications links between the control point at G Street (near Tacoma Dome Station) and the Lakewood commuter station. Upon completion and commissioning, this system will be used to dispatch trains over the line. Although ST owns the railroad, ST intends to enter into an agreement with BNSF for BNSF to provide dispatching. This should eliminate delays often caused by dispatcher hand-offs between different railroads. The CTC system has been configured for eventual inclusion of Positive Train Control (PTC) equipment.

Point Defiance Bypass

The Point Defiance Bypass project consists of two major components. The first component will construct second main track between MP 6.9 (just south of the existing South 66th Street grade separation in Tacoma) and MP 10.7 (just north of the Clover Creek Bridge in Lakewood). The second component will reconstruct the railroad from Lakewood to Nisqually Junction.

ST constructed the existing track between MP 3.4 (Chandler Street in Tacoma) and MP 10.5 (in Lakewood) as part of the improvements for the extension of commuter rail from the Tacoma Dome Station to Lakewood. The approximately 3.8 miles of second main track will allow trains to meet, and is long enough to enable rolling meets. (Note that the D to M project will connect with the existing track at MP 3.4).

The ST commuter trains end their journeys at Lakewood Station at MP 10, whereupon they return to the Lakewood Layover Yard at approximately MP 9. The second track in this area will allow through trains to pass the commuter trains. The curve for the second track has been designed with high superelevation in order to allow for high-speed operations, and will take full advantage of the underbalance capabilities of high-speed trainsets. The turnouts at each end of the second track will be #24 spring frogs on concrete ties. Currently, BNSF operates on these at 50 mph, but the geometry is suitable for 60 mph operations and is the maximum speed of the Sounder trains, which will utilize the diverging route through the turnout.

The existing track, just completed by ST, is 136-pound rail, with high strength rail in curves, laid on concrete ties, and with concrete tie turnouts with spring-rail frogs. The railroad has been completely re-graded to provide for a full-width subgrade and full-depth sub-ballast layer, to promote good ride quality and low maintenance. All grade crossings were completely reconstructed to improve previous roadway and railroad drainage issues, while also improving the roadway ride quality.

The first component of the project, addition of the second track, was designed with the future improvements in mind:

- The grading and sub ballast has been built to be wide enough for the second track.
- Short sections of the second track have been installed at grade crossings so that no roadway re-work (and thus no disruption to the public) is required.
- Grade crossing controls are installed for the second track, and grade crossing advanced preemption added.

The second component of the Point Defiance Bypass project will reconstruct the existing rail between MP 10.7 (Lakewood, where the ST construction work ended) and MP 21 (Nisqually Junction). The existing line consists of 85-pound rail on wood ties, and has received minimal maintenance over the years. The line is currently used only for freight service, operated approximately daily by TR and approximately three times weekly by BNSF. Track conditions are generally FRA Class 1.

Reconstruction will be from the subgrade-up, including:

- Reconstructed full width subgrade and re-established track drainage between MP 10.7 and MP 20.0.
- New full width, full depth sub-ballast between MP 10.7 and MP 20.0.
- Concrete tie track with 136-pound rail between MP 10.7 and MP 20.0.
- Approximately 50-percent new wood ties, undercut, and ditching between MP 20.0 and MP 21.0, where sharp curves and narrow embankment prevent full reconstruction.
- Reconstructed grade crossings, including revised railroad drainage, roadway drainage, ADA pedestrian access, and improved roadway profiles.
- New grade crossing warning devices, including revised traffic signal preemption adjacent to the grade crossings.
- New retaining walls to provide full-width roadbed section and drainage at Mounts Road (approximately MP 19.6).
- A new track configuration at the junction with the BNSF at Nisqually Junction, MP 21, to allow parallel movements through the control point at Nisqually Junction while trains are moving on or off the Point Defiance Bypass.
- New CTC (or PTC, if applicable), linking to ST's CTC/PTC system between Tacoma and Lakewood.

King Street Station Tracks

King Street Station is located at MP 0.0X and MP 0.0, the dividing point between the BNSF Seattle and Scenic Subdivisions, respectively. The station is in downtown Seattle, and provides connectivity to dozens of bus routes from three operators (ST, King County Metro, and Community Transit) and the Link light rail system. The Amtrak Thruway Bus System also provides direct connectivity from northbound Amtrak Cascades trains terminating at the station and Vancouver, British Columbia (and intermediate destinations).

This project will revise train operations and the existing track and platform configuration at King Street Station. The station has seven station tracks and three platforms (the platforms are situated between and serve station tracks 1 & 2, 3 & 4, and 5 & 6). Currently, 26 Sounder trains per weekday operate in and out of King Street Station; Sounder trains use station tracks 1 and 2, the two tracks nearest the BNSF main lines (which connect to the main lines at both the north and south ends of the station), exclusively. Each of these trains (except a reverse commuter train) must also traverse the leads to the coach yard, located just south of the station. To access the coach yard, Sounder trains on station tracks 1 and 2 must cross over the leads to all other station tracks. In addition, only the south ends of station tracks 1 and 2 are configured to allow parallel moves to and from the BNSF main lines.

Amtrak long-distance trains, the Coast Starlight and the Empire Builder, use station track 3, which is a through track, with access to the BNSF main line at both the north and south ends of the station. This is the only track long enough for the Coast Starlight, while it is the only track – other than the two tracks reserved for the Sounder trains – that has a connection to the BNSF main lines at the north end of the station.

The project will lengthen station track 6 and station track 7 about 150 feet, providing more options for Cascades and the longer Coast Starlight to board and alight passengers and baggage. The platform adjacent to station track 6 is of sufficient length to accommodate the lengthened track; however, as there is no platform adjacent to station track 7, one will be constructed as part of this project. The platform will be ADA compliant and be equipped with canopies for all-weather use.

The project will also install CTC (or PTC as appropriate) in the station yard throat. Currently, most turnouts are thrown by hand by train crews or switchmen (Sounder trains operate over power-operated turnouts to the main line, but, like other movements, rely on hand-thrown turnouts for access to the coach yard). However, this forces many movements to proceed at restricted speed, and forces verbal coordination with dispatchers. CTC will allow dispatchers to know where trains are at all times and to avoid reliance on verbal authorization, which will save time and reduce dispatcher workload.

Other Infrastructure Improvements

The following projects were identified to support the improved service; however, they were not included in the list of projects funded by the PNWRC Program. These projects were funded by the American Recovery and Reinvestment Act of 2009 (ARRA) and facilitated by individual grant/cooperative agreements between the FRA and WSDOT.

Vancouver Port Access Improvements

This project will reduce delays and improve reliability and safety of passenger rail service within the PNWRC, particularly through the Portland Oregon/Vancouver Washington segment by constructing a grade-separated rail access to the Port of Vancouver to significantly reduce freight and passenger rail conflicts. The existing railroad crossing located adjacent to the Port is currently responsible for delays of passenger and freight trains within the PNWRC as unit trains intended for or leaving the Port must cross the BNSF north/south mainlines.

Mount Vernon Siding Extension

This project improves Amtrak Cascades reliability by reducing congestion with slower moving freight trains on the tracks by extending an existing 4,600-foot siding track another 4,700 feet, creating space for slower freight trains to pull aside for faster passenger trains. This addition provides sufficient space for 8,000-foot freight trains that are now common.

Signaling, Train Control, and Positive Train Control

The proposed route from Eugene to Vancouver, British Columbia, consists of two types of train control systems. The vast majority of the route is equipped with centralized traffic control (CTC). Automatic Block Signals (ABS) within yard limits are in effect over short sections of UP's Brooklyn Subdivision, while ABS and Occupancy Control System (OCS) are used over portions of the New Westminster Subdivision in Canada. CTC, ABS, and OCS are considered "Methods of Operation," which describe the mechanism by which trains are granted authority to occupy a track. CTC, by comparison, when used as the Method of Operation, is allowed speeds of 79 mph by the FRA for both passenger and freight trains, whereas ABS is limited to 59 mph for passenger trains. CTC enables a much higher degree of train dispatcher capacity and flexibility compared to track warrant control. CTC commands can be issued by the dispatcher in as little as 1 to 2 seconds in normal practice, and many CTC commands can be pre-selected by a dispatcher and "stacked" for transmission to trains as trains execute planned operational events. Accordingly for the Program, CTC is necessary for the following reasons:

1) to permit the 79 mph track speeds required to meet the Program's ridership goals and public service goals;
2) to reduce train dispatcher workload and avoid overloading the train dispatcher;
3) to ensure rapid train dispatcher reaction times necessary to insure high reliability for passenger trains when unanticipated train performance events occur; and
4) to enable BNSF to continue to efficiently meet the needs of its existing and future shippers.

OCS is a common Method of Operation in Canada for line-haul railroads of moderate train traffic density and moderate speeds, as it has a low cost of implementation and execution. OCS is inefficient for high-density or complex rail operations because of the high "time per instruction" workload it requires of the dispatcher, and long latency time for the passage of instructions from the dispatcher to the train, and acknowledgement of compliance with instructions from the train to the dispatcher. Execution of a single instruction typically requires three to five minutes in normal practice, and in some cases requires the train that is receiving the instruction to stop and stay stopped during the instruction process. During the time an instruction is being issued or acknowledged, the train dispatcher cannot engage in other tasks.

Positive Train Control

Positive train control (PTC) is an advanced safety system capable of automatically controlling train speeds and movements should a train operator fail to take appropriate action for the conditions at hand. For example, PTC can enforce a train to a stop before it passes a signal displaying a stop indication, or before diverging on a switch improperly lined, thereby averting a potential collision. PTC systems must also provide for interoperability in a manner that allows for equipped locomotives traversing other railroad's PTC-equipped territories to communicate with and respond to that railroad's PTC system, including uninterrupted movements over property boundaries. The Rail Safety Improvement Act of 2008 (RSIA), as codified in 49 CFR 236, Subpart I, requires railroads to install PTC systems on tracks that carry passengers or poisonous-inhalation-hazard materials. The mandated deadline for implementing PTC was originally set for December 31, 2015; however, the United States Congress extended the deadline another three years to December 31, 2018, with the possibility for two additional years if certain requirements are met.

The host railroad is responsible for implementing PTC on their rail lines. Work required to implement PTC includes:

- Development of the system requirements, systems management strategy and implementation strategy, including a PTC Implementation Plan, a Positive Train Control Safety Plan (PTCSP) and PTC System Certification.
- Construction of sufficient communications bandwidth of high reliability to assure system robustness and minimization of train delay or dispatching delay.
- Construction of wayside interface units to tie the wayside signal system to the PTC system.
- Installation of PTC equipment on freight and passenger locomotives.
- Installation of a PTC-compatible CTC dispatching equipment and computer hardware and software.
- Testing, commissioning, and implementation of a management and configuration method for long-term operation.

BNSF already has a system-wide PTC program underway and the Program will be the beneficiary of the substantial work BNSF has already completed and will complete in order to be fully compliant with the FRA mandate. ST is currently developing a PTC program for implementation between TR Junction and their Lakewood Station; the Point Defiance Bypass CTC system will be designed to include the PTC overlay.

Passenger Train Schedule Development

One of the key benefits of the Corridor Service Expansion Alternative is not only the addition of a fifth and sixth daily round trip between Seattle and Portland, but the time when the new trains will operate each day. The improved service proposes a schedule that adds earlier in the morning and later in the evening departures, which has been one of the most requested service improvements made by Amtrak Cascades customers, particularly business travelers from both Portland and Seattle.

In mid-2015, WSDOT began the development of the final 2017 schedules for Amtrak Cascades service. The schedule development effort used findings from the earlier operational analysis efforts described previously in this plan, but for the first time, incorporated schedules for service on Union Pacific territory between Portland and Eugene, Oregon, as well as more recent modifications to the Sound Transit commuter train schedules between Lakewood and Seattle, Washington.

The final 2017 schedules were developed using a modelling program that incorporated all new railroad infrastructure constructed under WSDOT ARRA program, and a detailed analysis of the entire Cascades corridor between Eugene, Oregon and Vancouver, British Columbia, Canada.

This analysis included track grades, speeds, curvatures, control point and signal locations, acceleration and deceleration rates for the various types of passenger rail equipment operating on the corridor, equipment rotations and maintenance cycles, and the application of industry standard recovery times. Schedule development also included adjusting each train's timetable so that all trains can operate on-time simultaneously with no built-in conflicts for the use of any segment of track by any train. These schedules were then shared with Amtrak, Union Pacific, BNSF, and Sound Transit for further analysis, verification, and final acceptance by all parties. See Appendix B for the joint operating plan and draft final schedule for the 2017 Amtrak Cascades service.

Equipment Plan

This section provides a brief summary of the equipment (both existing and proposed) that will be used to support the Program. more detailed information is found in the PNWRC Program Fleet Management Plan that was completed as part of the FRA funded Program. The FMP is listed in the reference section of this SDP.

Equipment Plan – Passenger Cars

TPC runs were conducted to compare the performance of the typical consist against the schedule requirements and proposed infrastructure, with all station stops included. The typical consist currently used on the Corridor is as follows:

- One locomotive
- One end power car
- One bike/baggage car
- One bistro car
- One business class coach
- One business class coach with ADA seating
- One lounge/dining car
- One coach with ADA seating
- Five or six standard coaches

TPC runs showed that the typical consist running on the proposed infrastructure could meet or exceed the proposed run time of 3 hrs., 20 mins., using appropriate station dwell times (see Figure 13D in Appendix C).

The 2010 RTC modeling effort identified the need for additional train equipment to supplement the existing fleet of five trainsets. This additional equipment would allow WSDOT to implement the two additional round-trips in conjunction with the identified infrastructure improvements.

The draft SDP proposed to purchase one new trainset for the PNWRC Program. The purchase was funded under the 2011 WSDOT/FRA Cooperative Grant Agreement (described in Chapter 1 as Task 11 – Equipment Acquisition). Under the requirements of the Agreement, the new trainset would need to be compliant with the specifications developed by the Passenger Rail Investment and Improvement Act (PRIIA) Section 305, Next Generation Equipment Committee (NGEC) and be capable of operating up to 125 mph. However, during the preliminary engineering phase of the project, WSDOT found, through a Request for Information (RFI) process, they would not be able to acquire a trainset in accordance with the NGEC specifications and other Agreement requirements within the timeframe required by the Agreement.

Subsequent to the execution of the Agreement, the state of Oregon purchased two train sets - which were placed into service in 2013 - bringing the total number of trainsets to seven. Following the results of the RFI, WSDOT commissioned an equipment rotation optimization analysis to identify the optimal rotation of equipment and crews on the Amtrak Cascades corridor. The analysis revealed that it would be possible to serve the proposed 2017 timetable using seven trainsets. As such, the Program will not be purchasing an additional trainset at this time.

Equipment Plan - Locomotives

The current service utilizes locomotives leased from Amtrak. Six F59PHI locomotives are permanently assigned to the Amtrak Cascades service and are maintained at Amtrak's Maintenance facility in Seattle. Amtrak integrates six P42 locomotives within their fleet to support the Amtrak Cascades corridor and its long-distance services in the region[27]. The six F59PHI locomotives will be nearly 20 years old when the new service is implemented in late 2017 and are reaching the end of their equipment life as defined in Amtrak's Fleet Strategy Plan. Recently, the F59PHIs have experienced higher levels of unreliability and failure, which have led to lengthy service disruptions.

The PNWRC Program proposed to acquire up to 8 new locomotives to replace the aging F59PHIs which will alleviate the reliability issue and provide enhanced operational performance. The 2011 WSDOT/FRA Cooperative Grant Agreement provided funding for acquisition of 8 locomotives (listed as Task 16 – Equipment Acquisition in the Agreement). WSDOT joined other Departments of Transportation in a multi-state procurement to design, build and deliver the locomotives. The new locomotives will serve all the existing scheduled trains and the two additional round trips between Seattle and Portland, which will be added in 2017.

Capital Cost Estimates

Initial cost estimates were developed for the acquisition of new motive power and train sets for the service as part of the draft SDP. order of magnitude estimates were made after review of orders (including purchases by Metrolink, Amtrak California service, MTA Metro-North, and MBTA), discussions with manufacturers, and cost escalations that are likely.

[27] Coast Starlight and Empire Builder

The equipment cost data (described above), was used as a basis for determining the makeup of and the initial estimated cost of the standard consist designated for the Program, as well as the estimated cost for the new locomotives. Table 4-16 lists the 2009 estimated costs to purchase new equipment. Note, because the cost of the new equipment would be influenced by the equipment specifications developed by the PRIIA Section 305 Committee (anticipated to be approved after execution of the Agreement), these preliminary estimates are shown for illustrative purposes only. The NGEC Committee is tasked with designing and developing specifications for a standardized next generation rail passenger equipment pool for intercity services across the country. Updated costs are listed in the Grant Agreement.

Table 4-16: PNWRC Program Initial Estimated Equipment Cost

Equipment Type	*Estimated cost in millions*
Locomotives (8)	$24 Million
Train set (1)	$16 Million
Subtotal	$40 Million
Project Management @ 4 percent	$2 Million
Total	$42 Million

Locomotives Capital Renewal

During the 20-year event horizon of this Service Development Plan, it is not anticipated that the new locomotives will require a mid-life rebuild program. However, it is anticipated they will require an overhaul every 8 years. The estimated cost of locomotive overhaul is outlined in the Fleet Management Plan.

Operating Costs

Service improvements include two additional round-trips (four more trains) between Seattle, Wash. and Portland, or Operating costs are subject to agreements with Amtrak and are further defined by Amtrak's agreements with the host railroads (BNSF, ST, UP), equipment manufacturers, and station owners, as such, costs are illustrated by the estimated increase in costs as a result of the two additional roundtrips. Table 4-17 provides the estimated increase in some, but not all, annual operating costs. Note: WSDOT and ODOT share these costs based on calculation/allocation methodology that changed on October 1, 2013 per the requirements of PRIIA Section 209.

Table 4-17 New Service Operating Costs – Per Year

Operating Expense Category	*Estimated Annual Increase*[28]	*Assumptions/Basis*
Train and Engine Crew (T&E) Labor	$726,000	Each train consists of a crew of one engineer, one conductor, and one assistant conductor.

[28] Inflated to FY2018 dollars

Operating Expense Category	***Estimated Annual Increase***[28]	***Assumptions/Basis***
On Board Service (OBS) Labor	$576,000	Each train has on-board service labor consisting of one Lead Service Agent (LSA) to staff the bistro car.
Fuel and Power	$670,000	Includes DEF (diesel emission fluid) costs for the new locomotives.
Commissary Provisions and Management	$330,000	Based on the forecast changes in food and beverage revenue.
Car and Locomotive Maintenance and Turnaround	$134,000	Based on the increase in unit trips and miles of the existing seven trainsets.
Stations (shared)	$2,294,000	Based on forecasted increase in ridership.
Host Railroad	$1,870,000	Additional round trips & forecasted improved on-time performance.
Total:	**$6,600,000**	

Chapter 5: Ridership and Revenue Projections

The Amtrak Cascades service connects communities from Vancouver, British Columbia to Eugene, Oregon via Seattle and Portland on a 467-mile rail corridor. Listed as one of 11 federally designated, high-speed rail corridors in the nation, the Pacific Northwest Rail Corridor (PNWRC) primarily parallels Interstate 5 (I-5) and is a critical north-south line for local, regional and statewide passenger and freight rail operations. Amtrak Cascades is a state-supported service jointly administered by the Washington State Department of Transportation and Oregon Department of Transportation in contractual collaboration with Amtrak, host railroads, and equipment manufacturers. WSDOT's intercity passenger rail program sponsors the service between Portland, Seattle, and Vancouver, British Columbia, and the Oregon Department of Transportation's (ODOT) intercity passenger rail program sponsors the service between Portland and Eugene.

Ridership Historical Trends

Ridership for Amtrak Cascades on the PNWRC has steadily increased in conjunction with service expansion. In 1993, Amtrak offered only one daily round trip between Seattle and Portland. Washington State saw the need and demand for more passenger rail service on the PNWRC, and in 1994 expanded service by introducing passenger trains sponsored by Washington State. This new Washington-sponsored train service first leased a train set from Renfe Talgo of America (Talgo) to provide a second daily regional round trip between Seattle and Portland. In 1995, after a 14- year absence, service was restored between Seattle and Vancouver, British Columbia. Also in 1995, the state of Oregon sponsored a state-funded train and one of the two existing Seattle to Portland daily round trips was extended to Eugene, Oregon (Ore.).

The Amtrak Cascades brand debuted in 1999 and WSDOT expanded Seattle to Portland service by offering a third daily round trip. In 2000, a second daily Seattle to Portland train was extended to Eugene, also sponsored by Oregon. A fourth daily Seattle to Portland regional round trip started in July 2006, which completed the extent of current Amtrak Cascades regional service between Seattle and Portland. In August 2009, a second daily round trip was extended from Bellingham to Vancouver, British Columbia

Washington State initiated a new phase for Amtrak Cascades in 1999 by replacing leased equipment with custom-built trains purchased from Talgo. In late 2003, WSDOT purchased the train set that the state of Oregon had been leasing from Amtrak. By 2010, there were five train sets in the Amtrak Cascades service. Washington State owns three of the train sets and Amtrak owns two. In late 2010, the state of Oregon purchased two train sets to incorporate into the existing Amtrak Cascades service, these train sets were placed into service in 2013, bringing the total of train sets to seven.

As highlighted in Chapter 1, ridership has increased steadily on the PNWRC between Eugene, Ore. and Vancouver, British Columbia, from less than 200,000 annual passengers in 1994 to 838,251 passengers in 2010. Since 1994, when Washington began actively supporting Amtrak service, consumers have responded to the increased frequency of daily train service. In every case, when or where the supply of passenger train capacity increased, higher ridership has quickly followed. Ridership increases are most pronounced in the Seattle to Portland corridor, now that it has four daily Amtrak Cascades regional round trips.

Ridership Distribution

Station on-offs provide a good measurement of the distribution of ridership along the rail corridor. Amtrak Cascades currently has 18 station stops. originally, Amtrak Cascades had 15 stations in operation in 1995, including Vancouver, British Columbia Three station stops have been added over the years: Tukwila, Wash. opened in 2001, followed by Oregon City, Ore. in 2004, and Stanwood, Wash. in 2009. Station stops with 2010 total on-offs are listed from north to south in Table 5-1. Nearly six out of every ten passengers begin or end their train travel at either the Seattle or Portland stations. These two cities serve as hubs for north and south traffic from each station and as beginning or end points for the four daily Seattle to Portland round trips.

Table 5-1: Amtrak Cascades Station On-Offs: 2010

Stations	***Number***	***Percentage***
Vancouver, British Columbia	138,578	8.27%
Washington Stations		
Bellingham	62,562	3.73%
Mt. Vernon	18,662	1.11%
Stanwood	4,638	0.28%
Everett	24,108	1.44%
Edmonds	23,114	1.38%
Seattle	481,192	28.70%
Tukwila	24,892	1.48%
Tacoma	94,437	5.63%
Olympia/Lacey	48,141	2.87%
Centralia	18,472	1.10%
Kelso/Longview	23,962	1.43%
Vancouver	75,303	4.49%
ST Transfer Passengers	1,382	4.15%
Sub-total	***900,865***	***53.73%***
Oregon Stations		
Portland	471,163	28.10%
Oregon City	8,975	0.54%
Salem	39,976	2.38%
Albany	23,417	1.40%
Eugene	60,232	3.59%
Sub-total	***603,763***	***36.01%***
Unidentified	33,296	1.99%
Grand Total	***1,676,502***	***100.00%***
Source: *WSDOT State Rail and Marine Office*		

Ridership Profile

Passenger demographics are important in determining characteristics of current passengers and potential growth of additional passengers. Surveys, periodically conducted by Amtrak, collect national and regional data to provide updated information on Amtrak Cascades. Current demographics of riders have been identified for targeting marketing campaigns:

- Adults 25 to 54.
- Household income $50,000+.
- Slightly skewed female (60 percent).
- Employed (52 percent full time, 12 percent part time).
- Educated (54 percent college graduate, 31 percent some college).
- Travels an average of seven one-way trips along the I-5 corridor per year, for business or leisure.

Based on Amtrak surveys, approximately 81 percent of passengers are riding Amtrak Cascades for leisure. Ridership peaks during Friday, Saturday, and Sunday; and seasonally in the summer months and during the winter holidays. The percentage of business travelers is significantly less due to current schedules that are not at optimal times for early morning and late evening travel, nor travel times that are as reliable as most business travelers desire.

Ridership and Revenue Growth for the PNWRC High-Speed Rail (HSIPR) Program

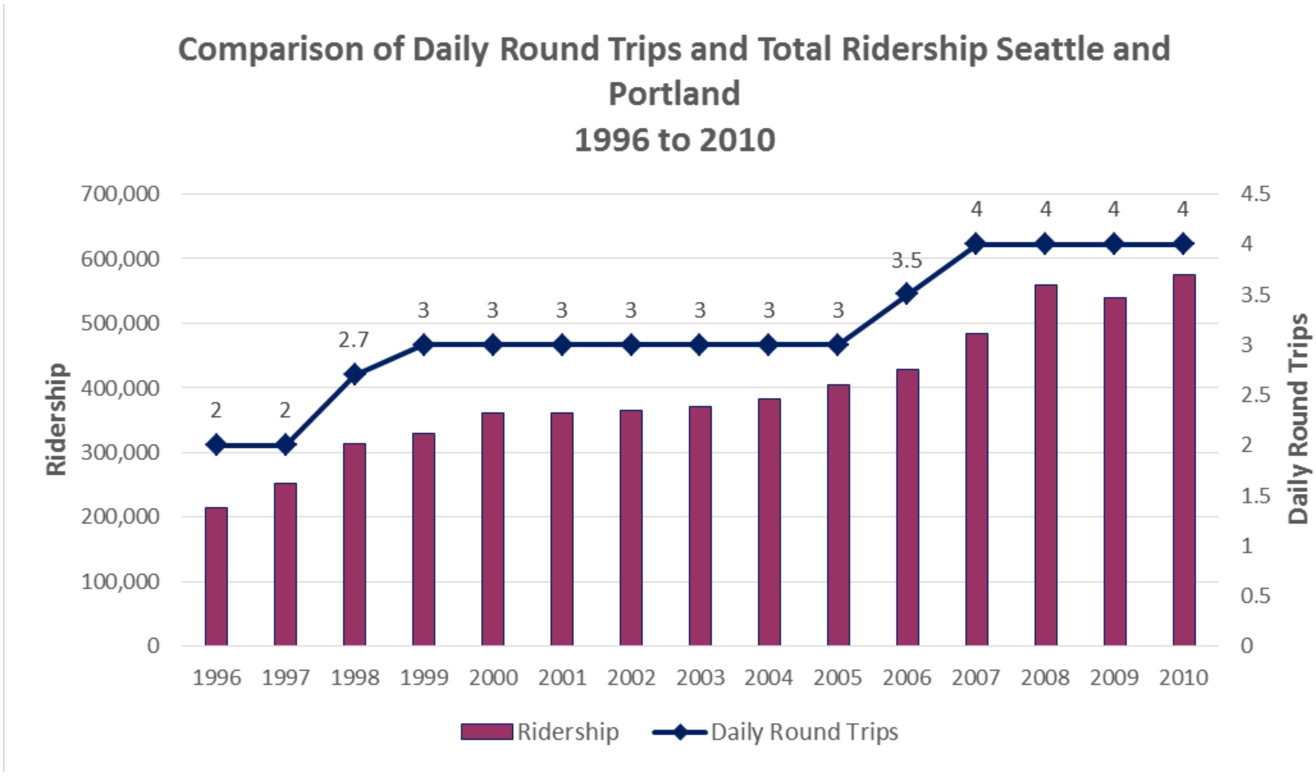
The American Recovery and Reinvestment Act (ARRA) provided new opportunities for Amtrak Cascades to implement such incremental “service block” strategies envisioned by the PNWRC policymakers and planners. The Federal Railroad Administration (FRA) published guidance detailing the application requirements and procedures for obtaining funding for High-Speed Intercity Passenger Rail (HSIPR) projects.

The service outcomes of the PNWRC HSIPR Program described in this SDP are:

- 10-minute reduction in the run time shown in the public schedule for the Amtrak Cascades service operating between Seattle, Wash. and Portland, Ore.
- Two additional daily round-trip Amtrak Cascades corridor service intercity passenger trains operating between Seattle, Wash. and Portland, Ore.
- Improvement in Amtrak Cascades service reliability to 88 percent.

The service outcomes of the PNWRC HSIPR Program will directly affect the ridership and revenue growth based on historical trends of adding capacity. The history of annual capacity of trains and trips travelling between Seattle and Portland was compiled from historical records and shows that ridership is strongly correlated to capacity change (Figure 5-1).

Figure 5-1: Effect of Adding Capacity – Seattle to Portland



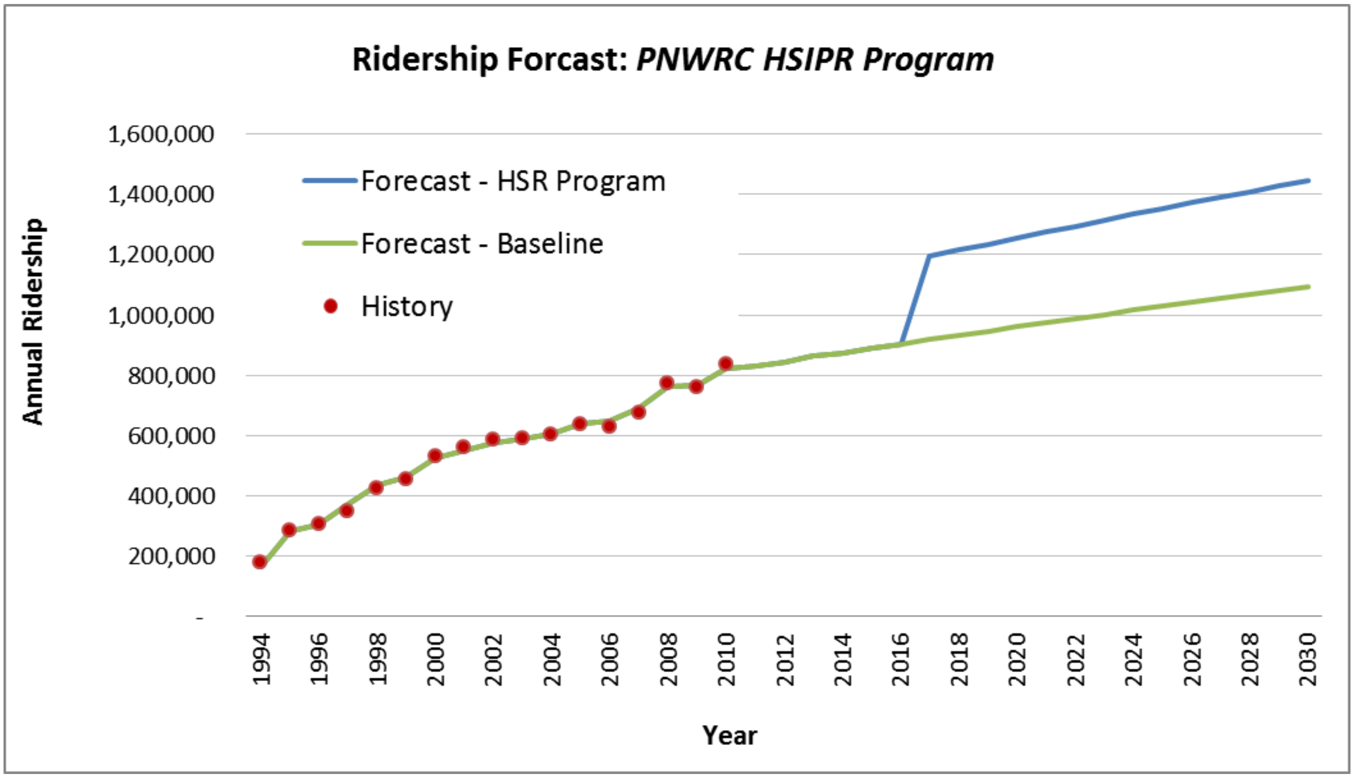
Scheduled time is one of the main factors that drive people's transportation choices. Economists show that when travel time decreases, the use of a specific travel mode will increase. This demand elasticity of time saving is a major driver of ridership growth. High- speed rail will gain more market shares over airplanes, automobiles, and intercity buses, when scheduled time of travel is reduced.

Reliability, or on-time performance, is an important driver of ridership. When reliability improves, more people are willing to take passenger rail. This leads to an increase in ridership. Both reliability improvement projects and capacity enhancement projects lead to reduction in delay. Attracting business travelers, especially those willing to pay higher fare tickets, is essential for increasing demand for current capacity and proposed capacity expansion. Providing frequent and reliable service with flexible timetables is important in attracting business customers.

Amtrak helped WSDOT estimate incremental ridership as a result of ARRA investment during the ARRA application process. Amtrak used elasticities for frequency, reliability, and scheduled time saving to forecast ridership growth. WSDOT developed its Amtrak Cascades Model to estimate ridership based on historical data. This model is used in operations to estimate the ridership growth resulting from change in investment policy and service levels. It estimates ridership growth using five growth driving factors—driving time population, capacity or frequency of operation, utilization, scheduled time saving, and reliability improvement. Both the Amtrak method and the WSDOT method were used to estimate ridership and revenue.

Figure 5-2 shows the ridership growth results from ARRA investment in the PNWRC HSIPR program. Detailed ridership information is provided in Appendix D: Amtrak Cascades Market Analysis and Ridership Forecast.

Figure 5-2: Estimates for Amtrak Cascades Ridership Growth Resulting from Implementation of PNWRC HSIPR Program



In 2010, three partners funded Amtrak Cascades service: the states of Washington and Oregon, and Amtrak. Figure 5-3 shows the forecasted ridership distribution between WSDOT and these funding partners.

Figure 5-3: Estimated Amtrak Cascades Ridership Growth by Funding Partners

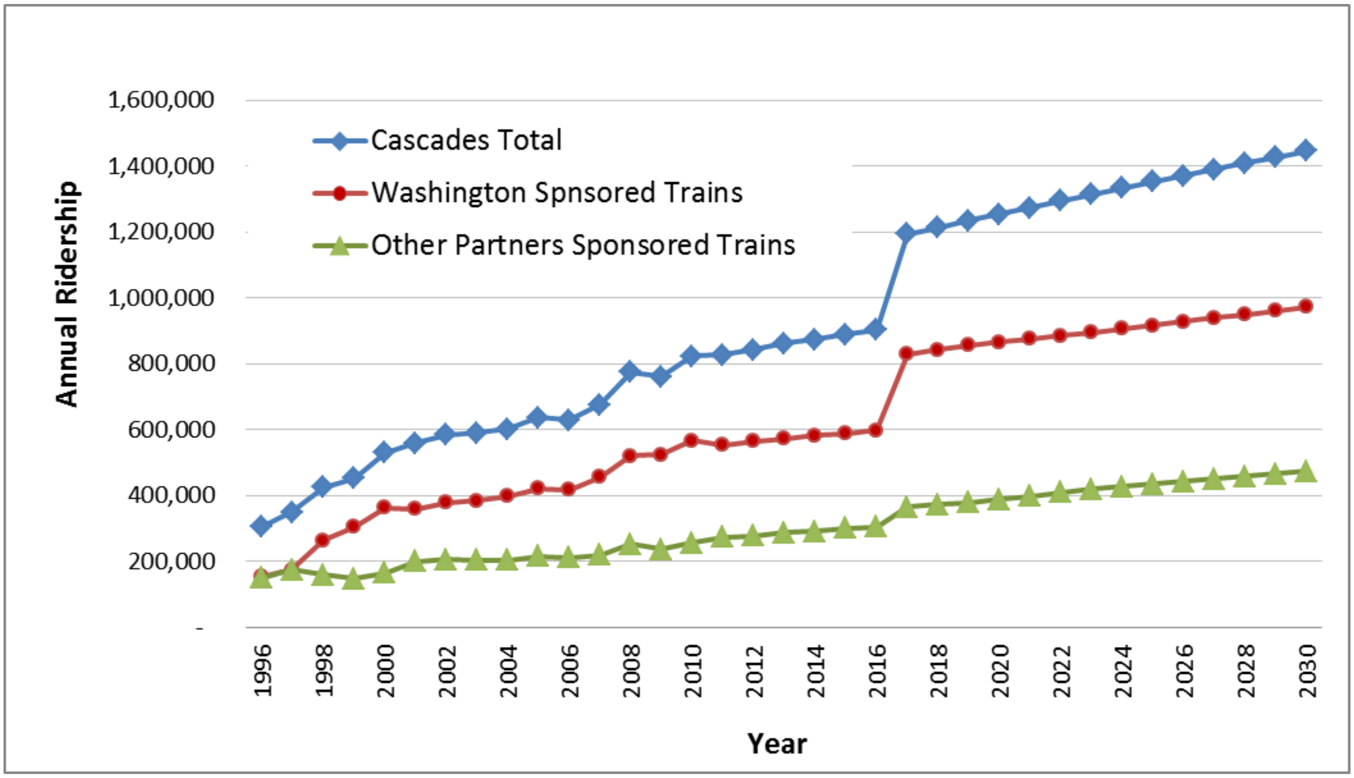


Table 5-2 illustrates the estimated revenue and expense performance of the Washington State sponsored trains for 2018 (one year after program completion) and 2030. The average fares were based on observed average yields per passenger in existing Amtrak Cascades markets within the Northwest. Food and Beverage Revenue were forecasted based on the per rider average. Implicit price deflator for personal consumption forecasted by Global Insight is used for inflation factor for the estimates.

Table 5-2: Amtrak Cascades Ridership and Revenue Projections for the PNWRC Program

Amtrak Cascades Washington State Sponsored Trains			
Estimated Revenue & Expense Performance			
	2009 Actual	**PNWRC HSR Program 2018 Projected**	**PNWRC HSR Program 2030 Projected**
			(In Millions of Dollars)
Passenger Revenue			
Expense	$31.98	$53.78	$68.88
Fare Box Recovery	56.85%	65.32%	75.44%
Total Projected Ridership	523,808	842,543	973,055
Passenger Miles	82,384,760	132,515,489	171,673,665
Average Revenue per Rider	$34.72	$40.14	$62.16

This projection does not include Amtrak or state of Oregon sponsored trains.

Ridership Forecast

Forecast is based on historical data and reflects effect of capacity expansion, reliability improvement, scheduled time saving, and general population increase.

Revenue

Growth based on ridership growth and inflation rate. General inflation rate based on the implicit price deflator for personal consumption forecasted by Global Insight (November 2010).

Operating Cost

Growth based on ridership growth and inflation rate. General inflation rate based on the implicit price deflator for personal consumption forecasted by Global Inside (November 2010).

Talgo maintenance expenses are included.

Operation costs from 2016 to 2030 include estimated maintenance expenses associated with use of the Point Defiance Bypass Route. These estimates are preliminary and subject to verification and negotiation.

Operation costs also include preliminary estimates for capitalized and operational maintenance expenses associated with use of BNSF tracks for high-speed passenger rail services, assuming the payment will start after the program is completed in 2017.

The impact of Passenger Rail Investment and Improvement Act (PRIIA) Section 209 (which goes into effect in October 2013) on WSDOT operation costs was not included, given the policy and cost methodology were still in process at the time of this evaluation.

The impact of second train to Vancouver, British Columbia on operation costs and revenues were not included in the estimate, given the fact both the U.S. and Canada were still working on an agreement at the time these estimates were calculated.

Ridership and Revenue Estimate Methodology

Baseline ridership trend is estimated by a model the WSDOT State Rail and Marine Office has developed for a ridership forecast model using 18 years' actual operation data. This model can reflect current investment policy and operation results by holding constant at current operation levels. It uses drive time population as a demand base to forecast future ridership based on historic trends. It also uses capacity and utilization variables to explain the variation in historical ridership growth. It predicts ridership growth assuming we continue current operations and investments. The model results are used as a baseline for calculating the outcome of PNWRC HSPIR Program funded by FRA. Appendix D describes this econometric model in detail.

The incremental ridership resulting from the PNWRC HSIPR Program implementation is estimated using Amtrak's method, combined with baseline ridership estimates. As developer of the ridership and revenue estimate, Amtrak has provided the following description of its methodology to the states. Ridership forecasts for proposed intercity rail passenger services are prepared using a "National Corridor Model" developed by AECOM for Amtrak and various states for corridor passenger rail forecasting throughout the U.S. This "best practices" model was derived from several detailed models, surveys, and data, including:

- Northeast Corridor Model (Amtrak – NEC area)
- Amtrak/Caltrans Model (Amtrak and Caltrans)
- Chicago-Milwaukee Corridor Model (Wisconsin and Illinois)
- Southeast Corridor Model (North Carolina, Virginia, South Carolina, Georgia, and Florida)

For purposes of ridership projections, the model evaluates proposed new passenger rail services based upon a number of variables including the following key inputs:

- Total Market Size – Population, employment, and income of each market served.
- Station Locations – Size of potential local/regional market(s) to be served.
- Mode Share – Modal distribution of the existing transportation market.
- Service Characteristics of Competing Modes – Auto, Air, and Bus.
- Passenger Rail Timetable, Providing Departure/Arrival Times by Train and Station, Thus Defining:
    - Travel Time (duration of proposed trip)
    - Frequency (proposed number of daily round trips, i.e., travel options available to a potential traveler)
    - Schedule/Scheduling Attractiveness – Proposed scheduled departure and arrival times and time-of-day slots
- Average Fares, Based on Observed Average Yields per Mile in Existing Amtrak Markets within the Midwest.

When applicable, pertinent state and/or regional information may also be supplemented by national sources, such as Moody's Economy, in order to permit consideration of anticipated national trends in population, employment, and income. Table 5-3 shows the elasticities Amtrak used to estimate ridership growth for Amtrak Cascades.

Table 5-3: Ridership Elasticities Used by Amtrak

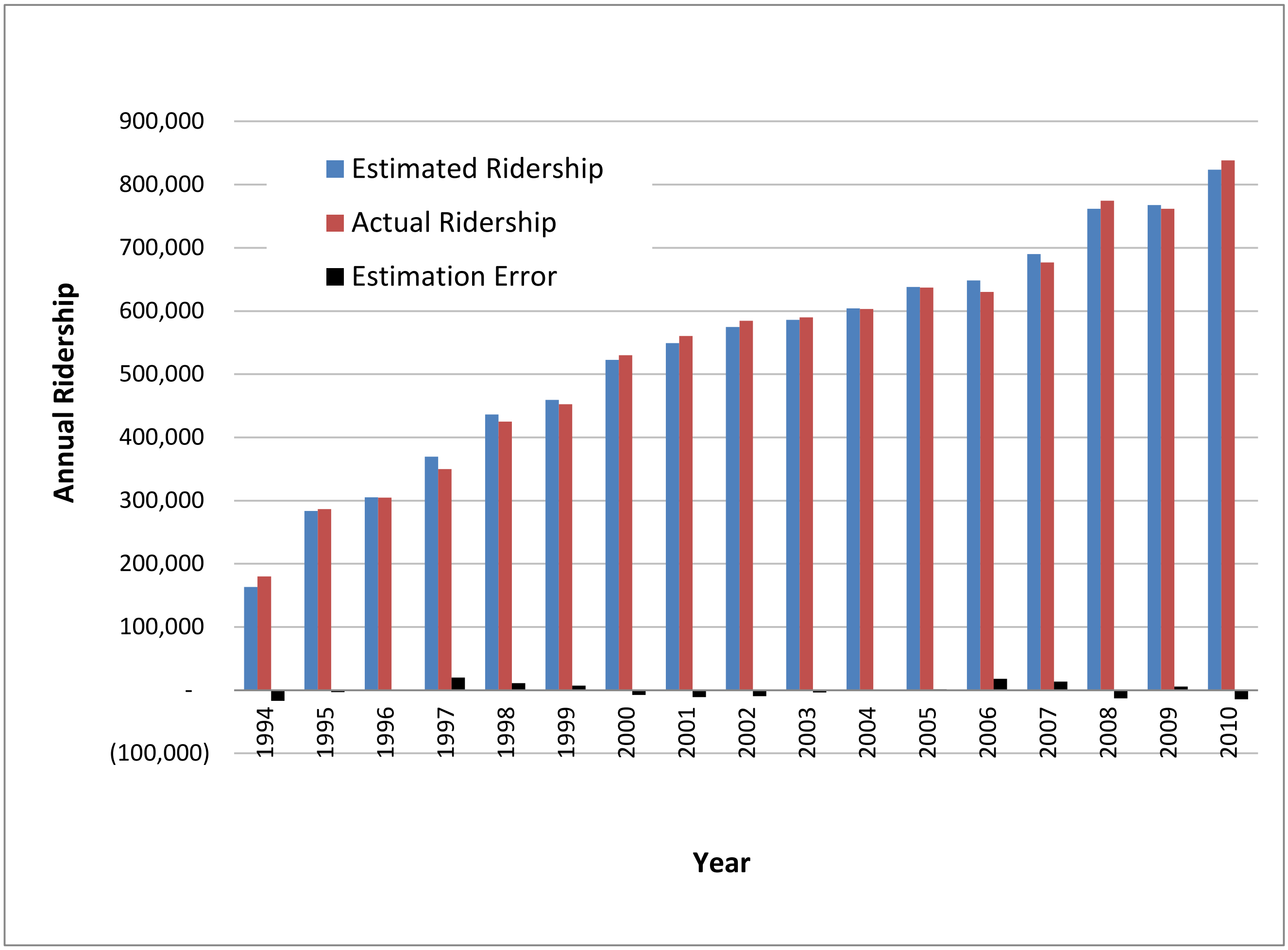
Amtrak Ridership Growth Parameters for WSDOT ARRA Applications	
Train Frequency	
Vancouver - Seattle	+5.9% per 10% freq. increase
Seattle - Portland	
Portland - Eugene	
Travel Times	
Vancouver - Seattle	+10% per 10% trip time improvement
Seattle - Portland	
Portland - Eugene	
On-Time Performance	
Amtrak Cascades	+1.1% per 5 point OTP improvement
Source: Amtrak	

The incremental ridership resulting from PNWRC HSIPR Program implementation is also estimated using WSDOT's Amtrak Cascades Growth Model. This model is developed to estimate the ridership growth resulting from change in investment policy and service levels. It estimates ridership growth using five growth driving factors—driving time population, capacity or frequency of operation, utilization, scheduled time saving, and reliability improvement. The detailed method is in Appendix D: Amtrak Cascades Market Analysis and Ridership Forecast.

Ridership Estimate Validation

Ridership estimated by the baseline model was compared with 18 years' actual operation data. Figure 5-4 provides information about fitness of model into historical data. In other words, actual historical data is used to validate the accuracy of the model estimates.

Figure 5-4: Amtrak Cascades Base Model Validation – Estimated vs. Actual Ridership



Incremental ridership growth estimated by the Amtrak model is validated by the WSDOT model that was built based on historical data. A 3-year average of ridership statistics before and after adding a round trip in 1998 and in 2006 between Seattle and Portland were used for comparison. The estimated ridership was compared with actual historical data. The results indicated the model estimates are within narrow band of the actual ridership data. Table 5-4 shows the estimates were validated by historical data.

Table 5-4: Validation of Estimated Ridership Growth (SEA-PDX Leg)

Ridership Forecast Validation				
	Adding a Round Trip Between Seattle and Portland in 1998			
	Historical Data (SEA-PDX Leg)	Average Estimates (SEA-PDX Leg)	Estimated by Amtrak Elasticity Method (SEA-PDX Leg)	Estimated by WSDOT Model (SEA-PDX Leg)

Ridership Forecast Validation				
Base: Average 1996 to 1998 Historical Ridership	257,851	257,851	257,851	257,851
Average 1999 to 2001 Ridership	367,085	363,392	361,855	364,928
Incremental Ridership Due to Increased Frequency	109,234	105,541	104,004	107,077
	Adding a Round Trip Between Seattle and Portland in 2006			
	Historical Data	Average Estimates	Estimated by Amtrak Elasticity Method	Estimated by WSDOT Model
Baseline: Average 1996 to 1998 Ridership	420,648	420,648	420,648	420,648
Average 1999 to 2001 Ridership	543,074	558,373	576,903	539,844
Incremental Ridership Due to Increased Frequency	122,427	137,726	156,255	119,196

Revenue Methodology and Validation

Forecasted revenues were based on the Amtrak Ticket Lift Database and financial billing data. The average fares were based on observed average yields per rider in existing Amtrak markets within the Northwest. The revenue was inflated based on the implicit price deflator for personal consumption forecasted by Global Insight.

Chapter 6: Public Benefits of the Service

The Pacific Northwest Rail Corridor (PNWRC) Program includes infrastructure and capital investment projects that support improvement of the Amtrak Cascades intercity passenger rail service. The projects will increase overall train capacity on the corridor, improve travel time reliability and allow for implementation of additional travel options for Amtrak Cascades passengers. The objectives of the Program are to:

- Increase the number of round-trips between Seattle, Wash. and Portland, Ore. from four to six;
- Reduce the travel time between Seattle, Wash. and Portland, Ore. by 10 minutes; and
- Improve on-time performance to 88%.

Public benefits can be categorized in terms of cost benefit analyses and economic impact analyses. Each of these benefit categories are described in the following sections.

Cost Benefit Analysis (CBA) for the Service

The Cost Benefit Analysis (CBA) framework is a comparison of values – the cost to build and operate the Program represents the forgone value that could alternatively be invested elsewhere and the benefits represent the improvement in social welfare delivered by the Program. Benefits are estimated for current and future users, including remaining highway users, on an incremental basis – as the change in welfare that consumers and, more generally, society derive from the access to the new passenger rail service in comparison with an estimated no-build situation.

In general, benefits primarily represent the creation of economic value from changes in the quantity of final uses and the quality (time spent and reliability, among other factors) of the services provided to affected travelers. For example, the total transportation costs for current travelers between Portland and Seattle includes the value of the total time spent traveling, plus the expenses associated with operating the vehicles used for the travel, plus other externalities, such as the costs of pollution and accidents generated by the specific level and composition of traffic. The benefits of the passenger rail service could therefore be evaluated by considering the travel costs savings accruing to travelers switching from other modes, based on the consumer surplus methodology. This is accomplished by comparing transportation costs per trip between the base case and the implementation case. The social cost of a trip on a congested road includes travel time, vehicle operating costs, safety costs, and emission costs.

The following principles guide the estimation of benefits and costs for this study:

- Only incremental benefits and costs are measured.
    - The incremental benefits of the project include the transportation cost savings for the users of the service as a result of the implementation of the transportation improvements.
    - The incremental costs of implementation of the project include initial and recurring costs. Initial costs refer to the capital costs incurred for design and construction of a list of enhancements designed to support the goals of the Program.. Recurring costs include incremental operating costs, and administration and marketing expenses.

Only additions in cost to the current operations and planned investments are considered as costs of the project.

- Incremental in this situation means that only net additions in costs to the current situation will be considered. Any investments or operating costs required for the operation of the existing track structure are not considered costs associated with this project.
- Benefits and costs are valued at their opportunity costs: The benefits stemming from the implementation of the transportation improvement are those above and beyond the benefits that could be obtained from the best existing transportation alternative. For instance, the transportation costs savings for users are measured relative to the best existing alternative, which may be the highway or the existing bus service, depending on the type of user. The benefit is the net cost saving in transportation costs relative to the best alternative.

CBA Results

The benefits of the rail service are evaluated in this analysis based on the HSIPR funding evaluation criteria published in CFR Vol. 74 No. 119 Docket No. FRA-2009-0045. The full CBA Report can be found in Appendix D. Annual costs and benefits are computed over a long-run planning horizon and summarized over the lifecycle of the project. The project is assumed to have a useful life of at least 30 years; that is the time horizon of the analysis. Construction is expected to be completed in 2017; but operating costs begin in the opening year and continue through the whole horizon of the project. Benefits also accrue during the full operation of the project.

Table 6-1 below summarizes the CBA results. Given all monetized benefits, the estimated rate of return is 1.88 percent. At a 7 percent discount rate, a $663.8 million investment results in over $492.5 million net benefits and a benefit to cost ratio approximately 0.74. At a 3 percent discount rate, a $855.2 million investment results in over $795.3 million in net benefits and a benefit to cost ratio approximately 0.93.

Table 6-1: Overall Results of the Cost Benefit Analysis

Variable	***Results***		
	7% Discount Rate	***3% Discount Rate***	***0% Discount Rate***
Total Discounted Benefits ($ millions)	$492.5	$795.3	$1,232.6
Total Discounted Costs ($ millions)	$663.8	$855.2	$1,081.7
Capital Costs ($ millions)	$563.2	$666.1	$760.7
O & M Costs ($ millions)	$100.5	$189.1	$321.1
Benefit - Cost Ratio	0.74	0.93	1.14
Net Present Value ($ millions)	($171.3)	($59.97)	$150.9
Internal Rate of Return	1.88%	1.88%	1.88%

Note: Values for benefits and costs represent cumulative totals at the specified discount rate for a 30-year timeframe of analysis.

Table 6-2: Detailed Results of the Benefit by Category

Benefit Category	*Results*		
Transportation Benefits	***7% Discount Rate***	***3% Discount Rate***	***0% Discount Rate***
Benefits to High Speed Rail Users			
Total Increased Ridership	7.4 M	7.4 M	7.4 M
Average Annual Increased Ridership	352,510	352,510	352,510
Average Annual Reduction in Vehicle Miles Traveled	40.6 M	40.6 M	40.6 M
Monetized Benefits			
Benefits to High-Speed Rail Users			
Transportation Cost Savings to Diverted Users ($ millions)	$140.4	$274.4	$480.2
Transportation Cost Savings to Existing Users ($ millions)	$48.1	$92.3	$159.1
Induced Demand Benefits ($ millions)	$1.8	$3.6	$6.5
System Revenues ($ millions	$71.2	$137.3	$237.6
Economic Recovery Benefits			
Short-Term Employment Benefits for EDAs	$214.7	$256.2	$294.7
Benefits to Traffic			
Congestion Cost Savings ($ millions)	$15.3	$29.5	$51.1
Accident Cost Savings ($ millions)	$6.9	$13.3	$23.1
Pavement Maintenance Savings ($ millions)	$0.8	$1.5	$2.5
Noise Emission Savings ($ millions)	$0.3	$0.5	$0.9
Environmental Benefits ($ millions)	$2.6	$5.3	$9.5
NOx	-$0.3	-$0.6	-$0.9
PM	$0.0	$0.0	$0.0
VOC	$0.1	$0.3	$0.5
CO2	$2.9	$5.6	$9.7
SO2	$0.0	$0.1	$0.1

Note: Monetary values of benefits represent cumulative totals at the specified discount rate for a 30-year timeframe of analysis.

Jobs Creation and Economic Impact of the Service

Economic impacts for the program were estimated using both the Washington Input-Output Model developed by the Office of Financial Management (OFM) as well as the IMPLAN system. OFM provided state job multipliers for the different activities (pre-engineering, right-of-way acquisition, and construction) occurring during the development phase (through 2017). The IMPLAN system was used to obtain United States (U.S.) multipliers for all activities occurring during the development phase and the operational phase. It was also used to derive state multipliers associated with operations and maintenance (O&M) expenditures. A complete discussion of the Economic Impact Assessment (EIA) methodology is included in Appendix F.

The EIA analyzed both short-term economic impacts that stem from the engineering, right-of- way acquisition, and construction spending associated with the program, as well as the long- term economic impacts that stem from the additional rail service provided by the program.

Therefore, economic impacts are calculated for both the costs associated with the construction of the program, as well as the additional annual O&M expenditure associated with the program. Capital costs, shown in Table 6-3, are non-escalated as the EIA modeling methodology used current relationships between investment and economic outcomes and using escalated cost data would distort the results.

Table 6-3: Capital Costs by Task, Millions of 2009 Dollars

Task	*Capital Cost (Millions of 2009 Dollars)*
Task 1: Infrastructure Improvements (D to M Street Connection)	$45.9
Task 2: Infrastructure Improvements (Point Defiance Bypass)	$89.1
Task 3: Infrastructure Improvements (Vancouver Rail Yard Bypass)	$28.5
Task 4: Infrastructure Improvements (Kelso Martins Bluff - Toteff Siding)	$36.5
Task 5: Infrastructure Improvements (Kelso Martins Bluff - New Siding)	$34.7
Task 6: Infrastructure Improvements (Kelso Martins Bluff - Kelso to Longview Jct.)	$123.0
Task 7: Infrastructure Improvements (Everett Storage Tracks)	$3.5
Task 8: Infrastructure Improvements (Corridor Reliability Upgrades - South)	$91.7
Task 9: Infrastructure Improvements (Advanced Wayside Signal System)	$60.7
Task 10: Infrastructure Improvements (King Street Station Tracks)	$50.4
Task 11: Equipment Acquisition - New Train Set	$23.5
Task 12: Program Management	$30.0
Task 13: Infrastructure Improvements (Corridor Reliability Upgrades - North)	$57.3
Task 14: Infrastructure Improvements (Vancouver New Middle Lead)	$10.0
Task 15: Infrastructure Improvements (Blaine-Swift Customs Facility)	$5.0
Task 16: Equipment Acquisition - New Locomotives	$46.7
Unallocated Contingency	$23.4
Total	***$760.1***

Note: Costs modeled in EIA represent non-escalated total project costs

Based on information provided by the project team, it is estimated that 75 percent of the new train set costs will be domestically incurred, and therefor 75 percent of these costs are accounted for in the EIA. The remaining costs are assumed to be expended internationally and therefor are not included in our analysis. While these items will be domestically sourced, they may not be entirely sourced within the state of Washington. Therefore, the analysis looks at both impacts at the state level and at the national level.

Impacts were examined in terms of the type of impact. These effects are defined as:

- The **direct effect** represents the initial expenditures (construction expenditures, for instance) that are received by businesses located in the study area.
- The **indirect effect** represents the impact of the additional business spending that is generated as these businesses sell more output and in turn purchase additional inputs from their suppliers (machinery manufacturers, for instance).
- The **induced effect** represents the increase in economic activity – over and above the direct and indirect effects – associated with increased labor income that accrue to workers and is spent on household goods and services purchased from businesses in the area.

Short-Term Economic Impacts

The short-term impacts associated with engineering, right-of-way acquisition, and construction expenditures were estimated at the state level using job-multipliers derived from the Washington Input-Output Model and provided by OFM. Note that the impacts associated with equipment acquisition are not estimated at the state level since design and construction will most likely be out-of-state. In summary, the short-term employment impacts of the program will generate 8,309 job-years over the construction period (2009-2017), with nearly 40 percent of the job creation occurring by the end of 2012. These values are based on spending expected to take place within the state of Washington, and represent engineering, right-of-way acquisition, and construction activities. Also, three Economically Distressed Areas (EDAs) will be directly impacted by the construction of the Washington State High-Speed Rail Program: Clark County, Cowlitz County, and Lewis County, with nearly 3,800 job-years generated, with construction accounting for more than 88 percent of the total.

At the national level, the Washington State High-Speed Rail Program produces economic impacts that differ in breadth and magnitude from those at the state level. Included in the analysis are impacts resulting from engineering, right-of-way acquisition, and construction, as well as railroad rolling stock. The analysis at the national level is necessary as a portion of the costs (equipment acquisition) is expected to be spent on domestically produced items; however, these may not necessary all come from within the state of Washington. Spending on engineering, right-of-way acquisition, and construction is expected to generate nearly 11,500 job-years in the U.S. from 2009 to 2017, with nearly half of the job growth (5,323) occurring in 2012 and 2013.

Equipment acquisition will also stimulate the U.S. economy. These additional short-term economic impacts total 463 job-years created. Moreover, $59.8 million will be generated in value added, of which over 48 percent is attributed to labor income. Over 62 percent of the employment impact will be generated in 2014 and 2015.

Long-Term Economic Impacts

Additional expenditures on rail O&M will spur economic activity as new levels of rail service are achieved after completion of the project in 2017. At the state level, the additional spending on O&M is expected to generate 1,067 job-years through 2030. At peak (2017), those additional costs will create 87 job-years. At any given time over this period, on average, the gain in value added will be $9.0 million and that in labor income will be $5.2 million; the growth pattern is the same as that for O&M employment impacts. The indirect employment impact accounts for about 20 percent of the program’s total impact, or about 210 job-years. Maintenance and repair construction of nonresidential structures has the largest set of impacts, generating 62 job- years, $4.2 million in value added and $3.6 million in labor income over the 2017 to 2030 period.

At the national level, the additional spending on O&M is expected to generate a total of 1,642 job-years through 2030. At peak (2017), those additional costs will create 134 job-years. On average, the gain in value added will be $12.8 million per year and that in labor income will be $7.5 million per year.

Chapter 7: Program Delivery

The Washington State Department of Transportation (WSDOT) is the steward of a large and robust transportation system and is responsible for ensuring that people and goods move safely and efficiently. In addition to building, maintaining, and operating the state highway system, WSDOT is responsible for the state ferry system and works in partnership with other stakeholders to maintain and improve local roads, railroads, airports, and multi-modal alternatives to driving. The Program Management Plan, developed as part of the funded program, will provide the detail on the means and methods for WSDOT to deliver the Pacific Northwest Rail Corridor (PNWRC) Program. WSDOT project management procedures also require that individual project management plans be completed for each task in the overall Program. This chapter highlights the overall approach to deliver the Program. Detailed information is incorporated by reference.

WSDOT tracks, reports, and manages its transportation programs and projects according to the six transportation policy goals adopted by the legislature in RCW 47.04.280. The six policy goals are:

- Economic Vitality
- Preservation
- Safety
- Mobility
- Environment
- Stewardship

These goals are independent and support the overall vision for all transportation agencies (like WSDOT) in the state.

In 2011, WSDOT was in the midst of delivering the largest capital construction program in history – more than $15.5 billion in projects. Over 7,000 full-time employees, including engineers, environmental specialists, planners, maintenance technicians, and many others, support WSDOT's diverse programs and projects.

WSDOT's Mission Statement

The mission of the Washington State Department of Transportation is to keep people and business moving by operating and improving the state's transportation systems vital to our taxpayers and communities.

WSDOT's Management Principles

Safety:

Concern for the health and safety of the people who use and work on our transportation facilities will be a paramount value in every area of our business.

Project Delivery:

We will improve our effectiveness by delivering projects and programs of the highest quality and in a timely and fiscally responsible manner. We will manage the resources taxpayers and the Legislature entrust to us for the highest possible return of value.

Accountability and Management:

We will be accountable to the public for all of our challenges and achievements by providing clear and concise information to the people of Washington, elected officials, and our many other transportation partners. To preserve and enhance our resources, we will manage the WSDOT organization efficiently through the use of performance information and strategic investments.

Communication:

We will continue to break down communication barriers by delivering comprehensible, credible, and timely information, and by listening and attending to the concerns of the public, the Governor, Legislature and our employees. We will strive to make these communication standards an agency-wide practice. We will stress the importance of sharing clear, concise, and timely information with WSDOT employees, elected officials, community leaders, businesses, citizens and taxpayers, others in the transportation community, and the press and other media.

Innovation, Best Business Practices, Efficiency, and Effectiveness:

We will drive innovation within WSDOT by applying progressive technology and business management practices to the delivery of cost effective and efficient transportation programs. Accordingly, we will remain at the forefront as a national and international leader in transportation technology and practices. We will preserve and enhance the resources taxpayers and the Legislature have entrusted to us by being disciplined in our use of time and money.

Strategic Long-Term Investment Programs:

We will provide strategic vision and leadership for Washington's transportation needs. We will balance the quest for short-term cost savings and business process improvements with the long-term need to preserve and improve the state's transportation systems. We will accomplish this through sound fiscal planning, asset management, and the development of strategic investment programs.

OneDOT and Partnership:

We will manage WSDOT as a unified organization with a strong work ethic and a focus on coalition building. We will build and maintain strong partnerships with other governments, tribes, and citizens to align priorities and resources.

Environmental Responsibility:

Our work will incorporate environmental protection and improvements into the day-to- day operations of the department as well as the ongoing development of the state's transportation plans and facilities.

Excellence and Integrity:

Our employees will work in a culture of workplace excellence and diversity that encourages creativity and personal responsibility, values teamwork, and always respects the contributions of one another and of those with whom we do business. We will adhere to the highest standards of courtesy, integrity and ethical conduct. We will encourage and recognize our employees' professionalism and their career growth. We will strive for the effectiveness of all our employees in meeting WSDOT's communications standards.

Rail Division

WSDOT Executive Management has restructured the Rail Division (formally known as the State Rail and Marine Office) to align it with the office structures used by the state's largest capital programs that receive large federal grant funds. Now recognized as the Rail, Freight and Ports Division, the goal is to make the Rail Division more strategically oriented, accountable, and efficient in its use of resources. The group within the Rail, Freight, and Ports Division responsible for delivering the PNWRC Program is the Cascades High-Speed Rail Capital Delivery Program team. In addition to the WSDOT resources, rail engineering consultants support the Program.

Partners and Stakeholders

Partnerships are critical to the success of the high-speed rail program in Washington state. WSDOT Rail, Freight and Ports Division has developed strong relationships with our passenger rail partners and stakeholders over the past 24 years. The focus is on the partnerships and stakeholders needed to advance the awarded Cascades HSR Program projects. The Stakeholders listed below are engaged in and supportive of the Program:

- BNSF Railway (BNSF)
- Central Puget Sound Regional Transit Authority (Sound Transit)
- Amtrak
- State of Oregon
- Province of British Columbia
- City of Seattle
- City of Vancouver (WA)
- Port of Vancouver (WA)
- City of Everett
- City of Kelso
- City of Centralia
- Port of Longview
- Port of Kalama
- City of Tacoma
- City of Lakewood
- Tacoma Rail
- Port of Bellingham
- City of Mount Vernon

The Cascades High-Speed Rail Program is committed to its long-term vision and developing more effective partnerships. Our goals are being accomplished with dedication and the support of our partners: FRA, BNSF, Sound Transit, Amtrak, city of Seattle and additional partners to complete the Cascades High-Speed Rail Program.

Program Phases

Distinct phases have been identified as part of the Grant/Cooperative Agreement executed by FRA and WSDOT for the PNWRC Program. Each of the phases will be implemented with the involvement of WSDOT and the key stakeholders for each task.

Preliminary Engineering/Final Design

The WSDOT project leads are responsible for performing design reviews and commenting on design deliverables. Design documents include all design deliverables including design criteria, calculations, drawings, technical reports, specifications, and bid documents. All projects are designed and constructed in accordance with the American Railway Engineering and Maintenance-of-Way Association (AREMA) manual. All BNSF projects are designed and constructed in accordance with the BNSF “Design Guidelines for Industrial Track Projects.”

NEPA

WSDOT will adhere to the environmental policies and procedures contained in WSDOT’s Environmental Procedures Manual.

WSDOT will also comply with all federal and state permit requirements. In addition, WSDOT will follow the consultation requirements for Endangered Species Act; Magnuson-Stevens Fishery Conservation and Management Act, including Essential Fish Habitat; Bald and Golden Eagle Protection Act; Section 106 of the Historical Preservation Act; and Environmental Justice Executive orders.

Construction

Construction will be the responsibility of host railroad. Dependent on governing labor agreements, either railroad forces or contractors will be used to perform construction/installation activities for the individual tasks.

Equipment Acquisition

The PRIIA Section 305 Committee guidelines will govern the acquisition of the equipment. The Fleet Management Plan provides more detail related to the equipment acquisitions.

PNWRC Program Schedule and Phasing

The Grant/Cooperative Agreement FR-HSR-0017-11-01-00 for the Pacific Northwest Rail Corridor Program (PNWRC) was executed in February 2011 in the amount of $590 million, amended to $735 million in April 2011, and then amended to $751 million in September 2011. Amendments 3 through 6 were executed in March 2013 and 2014, May 2015 and September 2015 respectively to adjust baseline schedules and budgets. Since the execution of Amendment 6, FRA approved 18 GARFs (Grant Agreement Request Forms) to further adjust line item budgets.

Projects funded by this grant will help grow Amtrak Cascades service and improve on-time performance and reliability. The projects (listed as Tasks in the Award to WSDOT and in the Grant/Cooperative Agreement) must be completed by September 30, 2017. The following is a summary of the funded tasks and associated phases. The budgets and schedules for each task are detailed in the executed Agreement and the PNWRC Program Management Plan.

- Task 1: Tacoma – D to M Street Connection
  - Project includes 1.4 miles of new passenger rail track between D Street and M Street in downtown Tacoma, Wash.
  - Phase – Construction
  - Delivery Method – Design-Bid-Build
- Task 2: Tacoma – Point Defiance Bypass
  - Project includes infrastructure improvements on a 19.5-mile inland bypass route between Tacoma and Nisqually.
  - Phases – PE/NEPA, Right of Way, Final Design, Construction.
  - Delivery Method
    - Tract A – BNSF – Design-Bid-Build
    - Tract B – Sound Transit – Design-Bid-Build
    - Tract C – WSDOT – Design-Bid-Build
    - Tract D – Sound Transit – Design-Bid-Build
    - Tract E – Sound Transit – Change order
- Task 3: Vancouver Rail Yard Bypass
  - Project includes a freight bypass track on the eastern side of BNSF's Vancouver Yard, located approximately between milepost (MP) 133.4 on BNSF's Seattle Subdivision, and extending to about 15,000 ft. to approximately MP 10.2 on the BNSF's Fallbridge Subdivision.
  - Phases – PE, Final Design, Construction
  - Delivery Method – Design-Bid-Build
- Task 4: Kelso Martins Bluff – Toteff Siding Extension
  - Project includes improvements to extend a signaled siding track approximately 1 mile near the south end of the Port of Kalama (approximately MP 105.7 to MP 110.0 on the BNSF's Seattle Subdivision).
  - Phases – PE/NEPA, Right of Way, Final Design, Construction
  - Delivery Method – Design-Bid-Build
- Task 5: Kelso Martins Bluff – New Siding
  - Project includes a new signaled siding track near the Port of Kalama (approximately MP 105.9 to MP 109.9 on the BNSF Seattle Subdivision).
  - Phases – PE/NEPA, Right of Way, Final Design, Construction
  - Delivery Method – Design-Bid-Build

- Task 6: Kelso Martins Bluff – Kelso to Longview Jct.
    - Project includes 5.3 miles of new signaled main track near the rail yard serving the Port of Longview, extending from approximately MP 97.2 to MP 102.7 on the BNSF Seattle Subdivision.
    - Phases – PE/NEPA, Right of Way, Final Design, Construction
    - Delivery Method – Design-Bid-Build
- Task 7: Everett Storage Tracks
    - Project includes two new departure/receiving tracks (approximately 6,700 feet each) and associated signal improvements on an alignment parallel to the existing Delta Yard tracks in Everett.
    - Phases –Construction
    - Delivery Method – Design-Bid-Build
- Task 8: Corridor Reliability Upgrades – South
    - Project includes infrastructure upgrades from Nisqually Jct. (approximately MP 24.7) to the Columbia River Bridge at Vancouver, Wash. (approximately MP 136.5) on the BNSF Seattle Subdivision.
    - Phases – PE, Final Design, Construction
    - Delivery Method – Design-Bid-Build
- Task 9: Advanced Wayside Signal System
    - Project includes signal system improvements to upgrade the current analog signal system to an Advanced Wayside Signal System with state-of-the-art digital circuitry at control points, sidings, turnouts, and other locations of the existing signal system on the BNSF's main line tracks between the U.S./Canada border and the Columbia River.
    - Phases – PE, Final Design, Construction
    - Delivery Method – Design-Bid-Build
- Task 10: Seattle King Street Station Track Upgrades
    - Project includes track, signal, and station improvements at King Street Station in Seattle, Wash. on the BNSF's Seattle Subdivision, approximately between MP 0.7 and MP 0.0.
    - Phases – PE/NEPA, Final Design, Construction
    - Delivery Method – Design-Bid-Build
- Task 11: Reserved
- Task 12: Program and Task Management
    - Project includes all programmatic activities for the Pacific Northwest Rail Corridor (PNWRC) necessary for the completion of the Program or otherwise associated with rail

corridor infrastructure improvements, stations, property purchases, and new train set acquisitions.

- Task 13: Corridor Reliability Upgrades – North
    - Project includes infrastructure upgrades from Everett – PA Junction (approximately MP 0) to the Canadian border at Blaine, Wash. (MP 119.9) on the BNSF Bellingham Subdivision.
    - Phases – PE/NEPA, Final Design, Construction
    - Delivery Method – Design-Bid-Build
- Task 14 – Vancouver New Middle Lead
    - Project includes constructing a second connecting or "lead" track located approximately between MP 135.9 on BNSF's Seattle Subdivision, and extending to about 1,300 feet to approximately MP 10.2 on BNSF's Fallbridge Subdivision
    - Phases – PE/NEPA, Final Design, Construction
    - Delivery Method – Design-Bid-Build
- Task 15 – Blaine-Swift Customs Facility
    - Project includes constructing a new main track and converting the existing main track to a second siding track located approximately between MP 114.9 and MP 116.9 on BNSF's Bellingham Subdivision.
    - Phases –Construction
    - Delivery Method – Design-Bid-Build
- Task 16 – Equipment Acquisition – New Locomotives
    - Project includes environmental clearance, design, and procurement of eight new locomotives to be used for Amtrak Cascades passenger service between Portland and Vancouver, British Columbia
    - Delivery Method – Performance Based Procurement
- Task 17 – Corridor Reliability Supplement Work
    - Project includes constructing improvements to prevent landslides and mitigating the impacts that disrupt the service along the BNSF main line from Blaine, Wash. on the BNSF Bellingham Subdivision to the Columbia River Bridge at Vancouver, Wash. on the BNSF Seattle Subdivision.
    - Phases – PE/NEPA, Final Design, Construction
    - Delivery Method – Design-Bid-Build

Program Documents

As required by the FRA for American Recovery and Reinvestment Act (ARRA), High-Speed Intercity Passenger Rail (HSIPR) and PRIIA funding, WSDOT has created the documents necessary to support the PNWRC Program. In accordance with the Grant/Cooperative Agreement and subsequent amendments, the documents will be updated and submitted to the FRA for approval or acceptance annually in January of each calendar year until completion of the Program in 2017.

Program Management Plan

A Program Management Plan (PMP) is a formal integrated document that serves as an overview of the approach toward planning, monitoring, and implementation of the Program. This documentation establishes the "who, what, when, where, why, and how" of the Program. While elements of the PMP may draw information from outputs of the Program development process (such as scope and design specifications, cost estimates, and project schedules), the PMP serves as FRA's primary source of information related to the plan for implementing the Program.

Financial Plan

The Financial Plan provides the best cost estimates known to date to complete the Program and the estimates of financial resources to be utilized to fully fund the Program. The cost data in the Initial Financial Plan provides an accurate accounting of costs incurred to date and include a realistic estimate of future costs based on engineers' estimates, currently planned activities, and expected construction cost escalation factors. The Financial Plan documents the legal and necessary authority to accept and spend Federal and non-federal funds; financial stability of the project sponsors and key contributors; program funding commitments and budgets; operating forecasts; cash flows; and risk identification and mitigation.

Fleet Management Plan

The Fleet Management Plan documents the existing intercity passenger rail services including equipment; train crew scheduling; and terminal, yard, and support operations. The plan includes the addition of new equipment along with the associated increased frequencies and maintenance requirements.

Safety and Security System Plan

A System Safety and Security Plan demonstrates that the Service Development Program's design, implementation, and operation will comply with all applicable FRA safety requirements and will be performed in a manner that places safety as the highest priority. The security portion of the plan must comply with any federal regulations, laws, policy, and other guidance that FRA, United States Department of Transportation (USDOT), or the Department of Homeland Security (DHS) may issue pertaining to security oversight.

FRA Program Specific Requirements

The Grant/Cooperative Agreement includes the Terms and Conditions for the PNWRC Program. There are specific requirements related to the execution of the federally-funded HSIPR Program that include:

Disadvantaged Business Enterprise Requirements

WSDOT complies with federal Disadvantaged Business Enterprise (DBE) requirements in accordance with CFR 49 Part 26 in order to receive federal funds. The ARRA HSIPR Program encourages WSDOT to utilize small business concerns owned and controlled by socially and economically disadvantaged individuals.

The State's DBE program fosters non-discrimination in the award and administration of federally-funded transportation programs; creates a level playing field on which DBEs can compete fairly for federal contracts; helps in removing barriers to the participation in federal-financially assisted contracts; and assists in the development of DBE firms to complete successfully outside the DBE program. DBE participation for individual projects is readily available information including the disparity study; DBE directory and Census Bureau date; past DBE participation data; bidders list; and upcoming projects.

Davis-Bacon Requirement

The Davis-Bacon Act (Act) is a federal mandate assuring that payments for trades performed on federally-funded construction projects shall meet or exceed prevailing wages for a given locality. These prevailing wage determinations are categorized by construction type, e.g. civil/heavy highway, and further defined per county. The construction contracts will be administered in accordance with Davis-Bacon provisions. Prevailing wage payment compliance will be part of the regular review of certified payroll reports submitted by prime and subcontractors. For verification purposes, these reports will contain employee information and appropriate prevailing wage rate.

Prevailing wage determinations are updated by the Department of Labor with varying frequency, and as such, the terms of the Act require these wages are honored as payable minimum rates throughout the duration of the contract. If prevailing wages are not attained through previously contracted work due to an update to the regional determination, a Change order will be issued payable by the respective state to assure the difference in contract values is properly compensated in accordance with the Act.

Buy America Requirements

Buy America provisions are set forth in 49 U.S.C. 24405 (a) for the PNWRC Program with respect to the use of steel, iron, and manufactured goods produced in the United States of America (USA). In general, it is anticipated that very few items will require Buy America waivers and that the overall value of those items is comparatively low for the PNWRC Program. The prime contractor responsible for the task/phase of work performed will provide certification.

A major exception is rolling stock; while several manufacturers have expressed interest in establishing rolling stock manufacturing capabilities, no new passenger cars have been recently manufactured in the USA.

Where materials or equipment are either unavailable for purchase within the U.S. and/or demand a significant price premium, Buy America waivers will be submitted to and subsequently determined by the Secretary or FRA Administrator if one of the following conditions apply:

- The low domestic bid/proposal for the end product is 25 percent more than the low foreign bid/offer.
- The item(s) being procured are not available in the USA.

- There is a public interest in waiving the national policy embodied in the Buy America provisions.

Because the waiver solicitation process may be lengthy, if Buy America waivers are needed, WSDOT will work with key stakeholders to facilitate such waiver applications to the FRA to mitigate delay.

Agreements with Responsible Stakeholders

All agreements required to support the PNWRC Program will be executed as outlined in the Grant/Cooperative Agreement. Table 7-3 lists these agreements and the date of their execution.

Table 7-3: Agreements Supporting PNWRC Program

FRA Agreement	***Parties***	***Executed***
Grant/Cooperative Agreement	FRA and WSDOT	Original - 2/25/2011 Amendment No. 1 – 4/7/2011 Amendment No. 2 – 9/16/2011 Amendment No. 3 – 3/28/2013 Amendment No. 4 – 3/11/2014 Amendment No. 5 – 5/27/2015 Amendment No. 6 – 9/11/2015
Stakeholder Agreements	***Parties***	***Executed***
Maintenance Agreement: BNSF Corridor – North	WSDOT and BNSF	Original – 1/23/2013 Amendment No. 1 – 12/15/2015
Maintenance Agreement: BNSF Corridor – South	WSDOT and BNSF	4/20/2012
Construction and Maintenance Agreement: Sound Transit (ST)	WSDOT and ST	Original – 11/7/2014 Amendment No. 1 – 6/30/2016
Operating Agreement	WSDOT and Amtrak	11/21/2014 (2016-2018 in negotiations)
Service Outcomes Agreement – BNSF Corridor	WSDOT/Amtrak and BNSF	original – 2/25/2011 Amendment No. 1 – 7/12/2012 Amendment No. 2 – 9/7/2012
Service Outcomes Agreement: Point Defiance Bypass Route	WSDOT/Amtrak and Sound Transit	10/1/2014

Operating Subsidy

In 1993, the states of Washington and Oregon and the Province of British Columbia executed a Memorandum of Understanding (MOU) to initiate the PNWRC Program. The State of Washington agreed to take the lead role in the preparation of the study with informational and financial support from the other states. This MOU has been the foundation for all subsequent work that has been conducted in the corridor and has been supported by the FRA.

WSDOT has a contractual agreement with Amtrak to operate the Amtrak Cascades trains on behalf of the state of Washington. Under this agreement, WSDOT is responsible for covering the operating losses incurred in the operations of trains operating between Portland, Ore., Seattle, Wash., and Vancouver, British Columbia WSDOT makes estimated payments to Amtrak one month in advance, and quarterly adjustments are made to reflect actual revenues and operating costs. This agreement is renegotiated on a biennial basis with Amtrak.

As the two additional round trips begin in 2017 with the addition of the new equipment, the incremental costs associated with these round trips will be included in the 2017 supplemental budget request. Since direct support of passenger rail service began in 1994, sufficient funding has been made available to fund the operating subsidy. WSDOT anticipates that this funding will continue into the foreseeable future.

Program Communications and Reporting

Successful delivery of the PNWRC Program requires effective communications – both externally and internally. The Program cannot be realized without a communications plan that defines the protocol for the timely and accurate flow of information. Effective communications also demands effective listening and viewing the Program decisions from the stakeholders' perspectives. The following is an example of WSDOT's approach to communicating with our external and internal partners. A more refined approach is detailed in the Program Management Plan for the funded Program.

External Communications

Timely and meaningful exchange of information between FRA, WSDOT, and key stakeholders is critical.

Table 7-4: External Communications

What	*Who*	*How*	*When*
With Stakeholders			
Identify stakeholders	Project Lead	Identified in PMP and updated as needed	Beginning of the Program and as needed
Conduct local agency briefings	Rail Program Coordination Manager	Meetings, phone, e-mail	As needed
What future work is anticipated or planned by local agencies?	Rail Program Coordination Manager	Obtain information from WSDOT local programs and send letters to local agencies	Beginning of the Program
With the Public			
Program Web site	Communications Manager	Web sites will be established for each individual task (project) and can be found by searching for rail projects at: http:/wsdot.wa.gov/projects/	Ongoing
WSDOT contact with public	Communications Manager	Release media information through press releases and other means as appropriate	As appropriate

Internal Communications

Effective internal communication is open, honest, continuous, and efficient.

What	*Who*	*How*	*When*
Communicate project progress to senior management	Project Lead	Regional Confidence Report/Construction Status Report	Monthly
Communication Among all Teams			
Distribute and maintain schedule	Project Lead	Update schedule and distribute on a monthly basis	Monthly
Create an organizational chart that identifies team structure	Rail Program Coordination Manager	WSDOT ARRA Cascades High- Speed Rail Program (organization chart has been created)	Update as needed
Set Guidelines			
Clarify chain of command guidelines with other agencies and contractors	Project Team Members	Defined in PMP and modified as needed	Beginning of program and as needed
Set protocols	Project Team Members	Defined in PMP and modified as needed	Beginning of program and as needed
Team Member Communications			
How do program/project teams and resource agencies communicate?	Project Team Members	Meetings, phone, e-mail as appropriate	As needed
Communications Between Program Management Team and Production/Supervision Team			
Define internal communication roles and responsibilities	Rail Program coordination Manager	Defined in PMP and the organization chart	Beginning of the program and as needed
Facilitate distribution of information on other relevant agency projects to all production team members	Project Team Members	Meetings, phone, e-mail as needed	As needed
Communication Between Program Management Team and Consultant or Contractor			
At technical/ field level	Project Lead and Consultant or Contractor Personnel	Meetings, phone, e-mail as appropriate	As needed
At administration/regional level	Rail Program Coordination Manager	Meetings, phone, email as needed	As needed

Meetings

Meetings and conference calls are an important component to effectively manage and monitor the PNWRC Program along with the individual projects. Successful PNWRC Program delivery is dependent on a commitment by WSDOT and all key stakeholders to participate in meetings/conference calls and communicate effectively.

Table 7-6: Meetings and Conference Calls

Meetings/Conference Calls	***Parties***	***Remarks***
Monthly FRA, WSDOT and Stakeholder Meetings/Workshops	FRA, WSDOT, BNSF, ST, Amtrak, and Consultant Team (as needed)	Initially, meetings will be held monthly with a transition to quarterly as the Program progresses.
Weekly FRA, WSDOT, and Stakeholder Conference Calls	FRA, WSDOT, BNSF, ST, Amtrak, and Consultant Team (as needed)	Scheduled for every Wednesday
Bi-Weekly FRA and WSDOT Conference Calls	FRA, WSDOT, and Consultant Team (as needed)	Scheduled for every Monday and Thursday
Monthly WSDOT Executive Oversight Committee	WSDOT	WSDOT internal meeting. Monthly Program status report issued.
Bi-Weekly WSDOT Rail Program Meeting	WSDOT Cascades High-Speed Rail Program Team staff	WSDOT Team discusses project status, work completed, and work to be completed.
Task/Project Specific Meetings	WSDOT Cascades High-Speed Rail Program Team staff and task/project stakeholders	Individual Project Management Plans will identify the frequency of the scheduled meetings. Project specific meetings will also be conducted as needed to support the progress of the project to successful completion.

Appendix A

PNWRC Existing Stations

Appendix A: PNWRC Existing Stations

1.0 Overview

The existing Amtrak Cascades service operates on the PNWRC and connects cities and towns in western Oregon, western Washington, and the lower mainland of British Columbia, Canada. There are 18 station stops on the PNWRC: one in British Columbia, twelve in Washington, and five in Oregon. The following section presents information for each of the 18 Amtrak Cascades station stops, starting at the northern terminus, Vancouver, B.C. to the southern terminus at Eugene, Ore. Each station stop is described in terms of its physical location - as well as a reference route mile on the PNWRC, history, ownership, features and services, access, and multimodal connectivity. The information was collected from various sources, including Amtrak's Great American Stations website (http://www.greatamericanstations.com/), WSDOT Rail Division and local jurisdiction websites.

1.1 Vancouver, B.C. (VAC)

The Pacific Central Station is the most northern station on the PNWRC (route mile 0) and the northern terminus for the Amtrak Cascades service. . Pacific Central Station was completed in 1919 for the Canadian Northern Railway. In 1991, Pacific Central Station received the Canadian designation as a Heritage Railway Station (historic site). In 1993, the station was converted to a multimodal transportation facility that includes intercity bus services. It is situated across the street from Thornton Park and within walking distance to the Vancouver SkyTrain light rail service. In November 2010, the Canadian government announced the $5.1 million plan to refurbish the station including windows, masonry, and building roof.

Vancouver, B.C. – Station Stop Elements	
Address:	1150 Station Street, Vancouver, B.C., Canada V6A 4C7
Ownership – Station:	VIA Rail Canada
Ownership – Parking:	N/A
Ownership – Platform(s):	VIA Rail Canada
Ownership – Track(s):	Canadian National Railway/VIA Rail Canada
2012 Passenger Rail Service:	Amtrak Cascades (4 daily trains) Via Rail Canada (1 daily train)
2010 Amtrak Cascades Passenger Use (Station On-Offs):	138,578
Facilities:	Staffed Station building with waiting room
Station and Service Hours:	5:00 a.m. to 1:00 a.m.
Features and Services:	Ticket Office Restrooms Checked Baggage Service & Storage

Vancouver, B.C. – Station Stop Elements	
Parking and Access:	Pedestrian walkways Passenger drop off area On-street parking 20 Short-term Spaces No Long-term Parking Rental cars Taxi service
Multimodal Connections:	Transit/local Bus Service: • TransLink transit bus service • Aqua Bus transit service Intercity/Long Distance Bus Service: • Malaspina Bus • Amtrak Thruway and Connecting Bus • Pacific Coach Lines Other: • SkyTrain light rail service • BC Ferries • False Creek Ferries

1.2 Bellingham, WA (BEL)

The Bellingham station stop is located at PNWRC route mile 66. Known as Fairhaven Station, the current building is a vintage warehouse renovated in 1995. The facility sits across the tracks from the Bellingham Cruise Terminal, serving passenger ferry travelers to the San Juan Islands and Victoria, B.C., as well as the Alaska Marine Highway ferryliner service to Prince Rupert, B.C., and Skagway, Alaska.

Bellingham, WA – Station Stop Elements	
Address:	401 Harris Avenue, Bellingham, WA, 98225
Ownership – Station:	Port of Bellingham
Ownership – Parking:	Port of Bellingham
Ownership – Platform(s):	Port of Bellingham
Ownership – Track(s):	BNSF Railway
2012 Passenger Rail Service:	Amtrak Cascades (4 daily trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs):	62,562
Facilities:	Staffed by Amtrak Station building with waiting room
Station and Service Hours:	7:00 a.m. to 9:00 p.m.
Features and Services:	Ticket Office Restrooms Quik-Trak Self-Serve Ticketing Checked Baggage
Parking and Access:	Passenger drop off area 52 Short-term Spaces 117 Long-term Spaces Taxi service

Bellingham, WA – Station Stop Elements	
Multimodal Connections:	Transit/Local Bus Service • Whatcom Transportation Authority Intercity/Long Distance Bus Service • Greyhound Lines • Amtrak Connecting Bus Other • San Juan Islands Cruises • Alaska Marine Highway ferryliner service

1.3 Mount Vernon, WA (MVW)

The Mount Vernon station stop is at PNWRC route mile 88 and is located at the Skagit Station. The Skagit Station was built in 2004, replacing a small shelter on the platform at the BNSF offices about two miles north of the present station. The Skagit Station Community room offers 1,800 square feet of flexible and professional conference capabilities to accommodate up to 95 guests. The station provides commuter service to Everett Station.

Mount Vernon, WA – Station Stop Elements	
Address:	105 East Kincaid Street, Mount Vernon, WA 98273
Ownership – Station:	Skagit Transit
Ownership – Parking:	Skagit Transit
Ownership – Platform(s):	BNSF Railway
Ownership – Track(s):	BNSF Railway
2012 Passenger Rail Service:	Amtrak Cascades (4 daily trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs):	18,662
Facilities:	Unstaffed Station building with waiting room
Station and Service Hours:	8:30 a.m. to 9:15 p.m.
Features and Services:	Restrooms Quik-Trak Self-Serve Ticketing
Parking and Access:	Short-term Spaces 50 Long-term Spaces Taxi service and cueing area
Multimodal Connections:	Transit/Local Bus Service • Skagit Transit • Island Transit Intercity/Long Distance Bus Service • Amtrak Connecting Bus

1.4 Stanwood, WA (STW)

The Stanwood station stop is located at PNWRC route mile 103. Amtrak re-established service to Stanwood/Camano Island in 2009. The Washington State Legislature provided WSDOT with $5 million to construct a new train station platform in Stanwood. The new 600-foot platform is fully accessible and includes a canopy, covered ramps, railings, seating, lighting, and landscaping to blend in with downtown Stanwood. This project also involved creating stormwater detention ponds, street improvements, hazardous material abatements, and construction of a siding track to allow Amtrak trains to stop without affecting BNSF Railway freight movement.

Stanwood, WA – Station Stop Elements	
Address:	27111 Florence Way, Stanwood, WA 98292
Ownership – Station:	WSDOT
Ownership – Parking:	City of Stanwood
Ownership – Platform(s):	BNSF
Ownership – Track(s):	BNSF
2002 Passenger Rail Service:	Amtrak Cascades (4 daily trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs):	4,638
Facilities:	Unstaffed Platform with Shelter
Station and Service Hours:	N/A
Services and Features:	None
Parking and Access:	Passenger drop off area Parking lot adjacent to station
Multimodal Connections:	Island Transit

1.5 Everett, WA (EVR)

The Everett station stop is located at PNWRC route mile 123. The Everett intermodal facility, which opened in 2002, provides an array of transportation choices. In 2003, the station became the northernmost stop for Sound Transit's commuter rail service. The building houses transportation services and offices on the lower level. The upper levels house a career development center, two university centers, and various transportation agencies.

Everett, WA – Station Stop Elements	
Address:	3201 Smith Avenue, Everett, WA 98201
Ownership – Station:	City of Everett
Ownership – Parking:	City of Everett
Ownership – Platform(s):	BNSF Railway
Ownership – Track(s):	BNSF Railway
2012 Passenger Rail Service:	Amtrak Cascades (4 daily trains) Amtrak Empire Builder (2 daily trains) Sound Transit Sounder Commuter Rail (8 daily trains – 4 morning trains & 4 afternoon/evening trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs):	24,108
Facilities:	Staffed by Amtrak Station building with waiting room
Station and Service Hours:	6:00 a.m. to 10:00 p.m.
Features and Services:	Ticket Office Restrooms Checked Baggage Service & Storage Quik-Trak Self-Serve Ticketing

Everett, WA – Station Stop Elements	
Parking and Access:	Passenger drop off area 200 Short-term Spaces 25 Long-term Spaces Taxi service cueing area
Multimodal Connections:	Transit/Local Bus Service • Everett Transit • Community Transit Intercity/Long Distance Bus Service • Greyhound Lines • Northwestern Trailways • Amtrak Connecting Bus

1.6 Edmonds, WA (EDM)

The Edmonds station stop is located at PNWRC route mile 139.. Located on the eastern shore of Puget Sound, the Edmonds Amtrak station is one component of a larger multimodal complex that includes Sounder commuter rail, buses and ferry service. The Edmonds Station was constructed by the Great Northern Railway in 1956 and is located two blocks from the Washington State Ferry Terminal. This provides a convenient transportation option to ferry users.

Edmonds, WA – Station Stop Elements	
Address:	211 Railroad Avenue, Edmonds, WA 98020
Ownership – Station:	BNSF Railway
Ownership – Parking:	Central Puget Sound Regional Transit Authority (Sound Transit)
Ownership – Platform(s):	BNSF Railway
Ownership – Track(s):	BNSF Railway
2012 Passenger Rail Service:	Amtrak Cascades (4 daily trains) Empire Builder (2 daily trains) Sounder Commuter Rail (8 daily trains – 4 morning trains & 4 afternoon/evening trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs):	23,114
Facilities:	Staffed Station building with waiting room
Station and Service Hours:	7:15 a.m. to 12:30 p.m. 1:00 p.m. to 9:45 p.m.
Features and Services:	Ticket Office Restrooms Checked Baggage Service & Storage Quik-Trak Self-Serve Ticketing
Parking and Access:	Passenger drop off area No dedicated Amtrak Short or Long-term Parking (parking is for Sound Transit customers only) Taxi Service available

Edmonds, WA – Station Stop Elements	
Multimodal Connections:	Transit/Local Bus Service • Community Transit Intercity/Long Distance Bus Service • Greyhound Lines • Travel Washington: Dungeness Line Other • Washington State Ferries

1.7 Seattle, WA (SEA)

The Seattle station stop (King Street Station) is located at PNWRC route mile 157. The Great Northern Railway constructed Seattle's King Street Station in 1906. The station was part of a larger project that moved the rail main line away from the waterfront and into a tunnel under downtown. In the late 1960's, the interior was "modernized" to period tastes, which included fluorescent lighting and fabricated, lowered false ceilings. The station was placed on the National Register of Historic Places in 1973, which set the stage for a major restoration/rehabilitation project.

Restoration of the historic building began in 2003 and involved cosmetic renovations and modernization of services, while keeping the historic characteristics in mind, including new platform canopies, tracks, and a new entrance canopy. In 2008, the city of Seattle reached an agreement to purchase the station from the BNSF. The purchase freed up funds for further restoration, and the city devised a four-phase rehabilitation plan to return the station to its original grandeur. The city earmarked $10 million in city funds from a transportation levy to match federal and state monies to fund the improvements.

The city's intent is that the station will serve as one of three multimodal hubs in downtown Seattle, along with the Westlake hub and the Coleman Ferry Dock.

Seattle, WA – Station Stop Elements	
Address:	303 South Jackson Street, Seattle, WA 98104
Ownership – Station:	City of Seattle
Ownership – Parking:	City of Seattle
Ownership – Platform(s):	BNSF Railway
Ownership – Track(s):	BNSF Railway
2012 Passenger Rail Service:	Amtrak Cascades (10 daily trains) Coast Starlight (2 daily trains) Empire Builder (2 daily trains) Sound Transit Commuter Rail (26 daily trains – 13 morning trains & 13 afternoon/evening trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs):	481,192
Facilities:	Staffed by Amtrak Station building with waiting room
Station and Service Hours:	6:00 a.m. to 11:00 p.m.
Features and Services:	Ticket Office Restrooms Checked Baggage Service & Storage Quik-Trak Self-Serve Ticketing

Seattle, WA – Station Stop Elements	
Parking and Access:	Passenger drop off area Parking available adjacent to the station Rental cars Taxi service
Multimodal Connections:	Transit/local Bus Service • Seattle Metro bus • Sound Transit express bus • Community Transit Intercity Bus Service • Amtrak Thruway and Connecting Bus Service • Northwestern Trailways • Travel Washington Sound Transit's Central Link Light Rail is a five-minute walk east.

1.8 Tukwila, WA (TUK)

The Tukwila station stop is located at PNWRC route mile 168.. It is the closest station to Seattle-Tacoma International Airport and within walking distance to several major hotels. Opened in 2000, the unstaffed Tukwila Station consisted of a temporary platform with shelters shared with Sound Transit. At the time of this evaluation, Sound Transit was finalizing plans to replace the existing shelter with a permanent station that will be shared with Amtrak Cascades. The future station would include passenger platforms and shelters, security and safety features, ADA accessible station access, approximately 350 parking spaces (40 dedicated Amtrak Cascades spaces), bicycle storage, landscaping, and public art.

Tukwila, WA – Station Stop Elements	
Address:	7301 Longacres Way, Tukwila, WA 98188
Ownership – Station:	Sound Transit
Ownership – Parking:	Sound Transit
Ownership – Platform(s):	BNSF Railway
Ownership – Track(s):	BNSF Railway
2012 Passenger Rail Service:	Amtrak Cascades (8 daily trains) Sounder Commuter Rail (20 daily trains – 10 morning trains & 10 afternoon/evening trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs):	24,892
Facilities:	Unstaffed Platform with shelter
Station and Service Hours:	Midnight to 11:59 pm.
Features and Services:	None
Parking and Access:	Passenger drop off area 20 Short-term Parking 20 Long-term Parking Taxi service
Multimodal Connections:	Transit/Local Bus Service • King County Metro

1.9 Tacoma, WA (TAC)

The Tacoma station stop is located at PNWRC route mile 207. The Tacoma Station was opened in 1984 when service was moved from the old Tacoma Union Station. The PNWRC Program will re-route passenger service from the BNSF Railway mainline to the Point Defiance Bypass route, as such, the station stop will be moved a few blocks south to the Tacoma Dome Station. The station located at Puyallup Ave. will no longer be used when the new service begins in late 2017.

Tacoma, WA – Station Stop Elements	
Address:	1001 Puyallup Avenue, Tacoma, WA 98421
Ownership – Station:	BNSF Railway
Ownership – Parking:	BNSF Railway
Ownership – Platform(s):	BNSF Railway
Ownership – Track(s):	BNSF Railway
2012 Passenger Rail Service:	Amtrak Cascades (8 daily trains) Coast Starlight (2 daily trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs):	94,437
Facilities:	Staffed by Amtrak Station building with waiting room
Station and Service Hours	7:15 a.m. to 9:30 p.m.
Features and Services:	Ticket Office Restroom Checked Baggage with Storage Quik-Track Self-Serve Ticketing
Parking and Access:	Passenger drop off area Taxi cueing area Short-term Spaces 80 Long-term Spaces
Multimodal Connections:	Transit/Local Bus Service • Pierce Transit

1.10 Olympia-Lacey, WA (OLW)

The Olympia station stop is located at Centennial Station at PNWRC route mile 232. The station was opened in 1993 following a 6-year fundraising and lobbying effort by the citizens of Thurston County. Volunteers, under the direction of the Amtrak Depot Committee, staff the station.

Olympia-Lacey, WA – Station Stop Elements	
Address:	6600 Yelm Highway SE, Lacey, WA 98513
Ownership – Station:	Intercity Transit
Ownership – Parking:	Intercity Transit
Ownership – Platform(s):	BNSF Railway
Ownership – Track(s):	BNSF Railway
2012 Passenger Rail Service:	Amtrak Cascades (8 daily trains) Coast Starlight (2 daily trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs):	48,141

Olympia-Lacey, WA – Station Stop Elements	
Facilities:	Staffed by volunteers Station building with waiting room
Station and Service Hours:	8:15 a.m. to 8:30 p.m.
Features and Services:	Restrooms Quik-Track Self-Serve Ticketing
Parking and Access:	Passenger drop off area 98 Short and Long-term Spaces Taxi service available
Multimodal Connections:	Transit/Local Bus Service • Intercity Transit

1.11 Centralia, WA (CTL)

The Centralia station stop is located at the Centralia Union Depot at PNWRC route mile 251. The Northern Pacific Railroad constructed and opened it for use in 1912. In 1988, the station was placed on the National Register of Historic Places. In 1996, the city of Centralia purchased the depot. In April 2002, station renovations were completed, which included work on the deteriorated building, platform, and parking lot. The $4.4 million renovation was funded by the city of Centralia, WSDOT, Washington State Office of Archeology and Historic Preservation, Washington State Transportation Improvement Board, Federal Highway Administration (FHWA), and Amtrak.

Centralia, WA – Station Stop Elements	
Address:	210 Railroad Avenue, Centralia, WA 98531
Ownership – Station:	City of Centralia
Ownership – Parking:	City of Centralia
Ownership – Platform(s):	BNSF Railway
Ownership – Track(s):	BNSF Railway
Passenger Rail Service:	Amtrak Cascades (8 daily trains) Coast Starlight (2 daily trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs):	18,472
Facilities:	Staffed by Amtrak Station building with waiting room
Station and Service Hours:	9:00 a.m. to 4:30 p.m.
Features and Services:	Ticket Office Restrooms Checked Baggage and Storage Quik-Track Self-Serve Ticketing
Parking and Access:	Passenger drop off area 25 Short and Long-term Spaces
Multimodal Connections:	Transit/Local Bus Service • Twin Transit • Grays Harbor Transit

1.12 Kelso-Longview, WA (KEL)

The Kelso station stop is located at the Kelso Multimodal Transportation Center at PNWRC route mile 294. The original station was constructed for the Northern Pacific Railroad in 1912.

In 1994, the station underwent extensive renovations, with formal rededication in September 1995. It is the region's first multimodal center, as it includes commercial and intercity bus service.

Kelso-Longview, WA – Station Stop Elements	
Address:	501 South First Avenue, Kelso, WA 98626
Ownership – Station:	City of Kelso
Ownership – Parking:	BNSF Railway
Ownership – Platform(s):	BNSF Railway
Ownership – Track(s):	BNSF Railway
2012 Passenger Rail Service:	Amtrak Cascades (8 daily trains) Coast Starlight (2 daily trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs):	23,962
Facilities:	Staffed by volunteers Station building with waiting room
Station and Service Hours:	8:30 a.m. to 8:30 p.m.
Features and Services:	Restrooms Quik-Track Self-Serve Ticketing
Parking and Access:	Passenger drop off area 11 Short-term Spaces 14 Long-term Spaces Taxi service
Multimodal Connections:	Transit/Local Bus Service: • RiverCities Transit Intercity/Long Distance Bus Service: • Greyhound Lines • NW Connector: Columbia County Rider

1.13 Vancouver, WA (VAN)

The Vancouver station stop is located at PNWRC route mile 334. The Vancouver Station was built for the Spokane, Portland, and Seattle Railroad. In 1998, partial renovations of the facility were completed.

In 2008, the city of Vancouver initiated interior restorations to the building with the station reopening in 2009. A Federal Transportation Infrastructure Improvement Grant funded the $650,000 in interior restorations.

Vancouver, WA – Station Stop Elements	
Address:	1301 West 11th Street, Vancouver, WA 98660
Ownership – Station:	City of Vancouver
Ownership – Parking:	BNSF Railway
Ownership – Platform(s):	City of Vancouver/BNSF Railway
Ownership – Track(s):	BNSF Railway
2012 Passenger Rail Service:	Amtrak Cascades (8 daily trains) Coast Starlight (2 daily trains) Empire Builder (2 daily trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs):	75,303

Vancouver, WA – Station Stop Elements	
Facilities:	Staffed by Amtrak Station building with waiting room
Station and Service Hours:	8:15 a.m. to 9:00 p.m.
Features and Services:	Ticket Office Restrooms Checked Baggage and Storage Quik-Trak Self-Serve Ticketing
Parking and Access:	10 Short-term Spaces 45 Long-term Spaces Taxi service
Multimodal Connections:	Transit/Local Bus service: • C-TRAN public transit

1.14 Portland, OR (PDX)

Portland's Union Station is located at PNWRC route mile 344. The station has been in continuous operation since it was constructed in 1896. It was originally constructed as part of the Northwest Pacific Terminal Company, which was jointly owned by the Northern Pacific, Union Pacific, and Southern Pacific railroads. In 1975, Portland's Union Station was added to the National Register of Historic Places.

In 1987, the city of Portland, through its Development Commission (PDC), purchased Union Station (and 31 acres of former rail yards). Station rehabilitation occurred shortly after the acquisition. In 2003, the PDC improved access to the station by constructing a new street, a central plaza at the main entryway, and establishing a dedicated area for the Amtrak Thruway buses.

In 2008, ODOT's Enhancement Program awarded the city of Portland a $900,000 grant ($630,000 State Enhancement and $270,000 PDC funds) for the roof replacement at Portland Union Station.

Portland, OR – Station Stop Elements	
Station Address:	800 NW Sixth Avenue, Portland, OR 97209
Ownership – Station:	City of Portland
Ownership – Parking:	City of Portland
Ownership – Platform(s):	City of Portland
Ownership – Track(s):	City of Portland
2012 Passenger Rail Service:	Amtrak Cascades (12 daily trains) *Coast Starlight* (2 daily trains) *Empire Builder* (2 daily trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs):	471,163
Facilities:	Staffed by Amtrak Station building with waiting room
Station and Service Hours:	7:15 a.m. to 9:15 p.m.
Features and Services:	Ticket Office Restrooms Lounge Checked Baggage with Storage Quik-Trak Self-Serve Ticketing

Portland, OR – Station Stop Elements	
Parking and Access:	25 Short-term Spaces 100 Long-term Spaces Taxi service
Multimodal Connections:	Transit/Local Bus Service: • Tri-Met light rail and bus system • Metropolitan Area Express bus Intercity/Long Distance Bus Service: • Greyhound Lines • Oregon Point: Cascades Point & NorthWest Point • Northwest Connector: Columbia County Rider & Tillamook County Transportation District

1.15 Oregon City, OR (ORC)

The Oregon City station stop is located at PNWRC route mile 359. In 2008, the city of Oregon City provided $1.5 million for the relocation of the Amtrak station to the former Southern Pacific depot and to upgrade the parking lot.

Oregon City, OR – Station Stop Elements	
Address:	1757 Washington Street, Oregon City, OR 97045
Ownership – Station:	City of Oregon City
Ownership – Parking:	City of Oregon City
Ownership – Platform(s):	Union Pacific Railroad
Ownership – Track(s):	Union Pacific Railroad
2012 Passenger Rail Service:	Amtrak Cascades (4 daily trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs):	8,975
Facilities:	Unstaffed Platform with Shelter
Station and Service Hours:	No Station Hours
Features and Services:	None
Parking and Access:	Passenger drop off area 50 Long-term Spaces Taxi service cueing area
Multimodal Connections:	Intercity/Long Distance Bus Service: • Oregon Point: Cascades Point • TriMet Transit District

1.16 Salem, OR (SLM)

The Salem station is located at PNWRC route mile 396. The Salem station was built for the Southern Pacific Railroad and opened in 1918 as a replacement for the depot that burned in 1914. In 1999, ODOT managed the Salem Depot Renovation Project. In addition to renovation of the station facilities, modern features added included parking facility improvements, rail-side pedestrian shelters, lighting and landscaping for both rail systems and park-and-ride operations. Federal and state grants funded the $2.6 million renovation project.

Salem, OR – Station Stop Elements	
Address:	500 13th Street SE, Salem, OR 97301
Ownership – Station:	State of Oregon
Ownership – Parking:	State of Oregon
Ownership – Platform(s):	Union Pacific Railroad
Ownership – Track(s):	Union Pacific Railroad
2012 Passenger Rail Service:	Amtrak Cascades (4 daily trains) *Coast Starlight* (2 daily trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs):	39,976
Facilities:	Staffed Station building with waiting room
Station and Service Hours:	6:00 a.m. to 8:00 p.m.
Features and Services:	Ticket Office Restrooms Checked Baggage and Storage Quik-Trak Self-Serve Ticketing
Parking and Access:	25 Short and Long-term Spaces Taxi service
Multimodal Connections:	Transit/Local Bus Service: • Salem-Keizer Mass Transit Intercity/Long Distance Bus Service: • Oregon Point: Cascades Point • Tillamook County Transportation: Coastal Connector • Greyhound Lines

1.17 Albany, OR (ALY)

The Albany station is located at PNWRC route mile 424. The station was built in 1909 for the Southern Pacific Railroad. In 2003 the city of Albany purchased, restored, and expanded the station. From 2004 to 2006, vacant commercial buildings were removed from the site and enhancements including landscaping, a new parking lot, period lighting, a plaza, and a waiting area were added.

Albany, OR – Station Stop Elements	
Address:	110 10th Avenue, Albany, OR 97321
Ownership – Station:	City of Albany
Ownership – Parking:	City of Albany
Ownership – Platform(s):	Union Pacific Railroad
Ownership – Track(s):	Union Pacific Railroad

Albany, OR – Station Stop Elements	
2012 Passenger Rail Service:	Amtrak Cascades (4 daily trains) *Coast Starlight* (2 daily trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs)	23,417
Facilities:	Staffed Station building with waiting room
Station and Service Hours	8:00 a.m. to 6:30 p.m.
Features and Services	Ticket Office Restrooms Checked Baggage with Storage Quik-Trak Self-Serve Ticketing
Parking and Access	20 Short-term Spaces 50 Long-term Spaces Taxi service
Multimodal Connections	Transit/Local Bus Service Albany Transit System Intercity/Long Distance Bus Service Linn Shuttle Bus Linn-Benton Loop Bus Valley Retriever Bus Lines (*connecting Newport, Albany, Bend, Salem and Portland*) Oregon Point: Cascades Point

1.18 Eugene-Springfield, OR (EUG)

The Eugene station stop is located at PNWRC route mile 467 and is the southern terminus of the Corridor. The station was built in 1908 for the Southern Pacific Railroad. Southern Pacific sold the building to the Jenova Land Company in 1993 and in 2003 the city of Eugene purchased the depot and office/bunkhouse as part of a plan to develop a regional transportation center. The city oversaw the 2004 $4.5 million ($3.5 million in federal funding) restoration in 2004, which included exterior brickwork and renovation of the 5,346 sq. ft. interior. The station was listed on the National Register of Historic Places in 2008.

Eugene-Springfield, OR – Station Stop Elements	
Address:	433 Willamette Street, Eugene, OR 97401
Ownership – Station:	City of Eugene
Ownership – Parking:	City of Eugene
Ownership – Platform(s):	Union Pacific
Ownership – Track(s):	Union Pacific
2012 Passenger Rail Service:	Amtrak Cascades (4 daily trains) Coast Starlight (2 daily trains)
2010 Amtrak Cascades Passenger Use (Station On-Offs)	60,232
Facilities:	Staffed Station building with waiting room
Station and Service Hours	5:00 a.m. to 9:00 p.m.

Eugene-Springfield, OR – Station Stop Elements	
Features and Services	Ticket Office Restrooms Checked Baggage with Storage Quik-Trak Self-Serve Ticketing
Parking and Access	Passenger drop off area 20 Short-term Spaces 50 Long-term Spaces Taxi service and cueing area
Multimodal Connections	Transit/Local Bus Service: • Lane Transit District Intercity/Long Distance Bus Service: • Lane Transit District: Diamond Express • Oregon Point: Cascades Point • Pacific Crest Bus Lines

Appendix B

2017 Joint Operating Plan

PNWRC Joint Operating Plan

DRAFT 2017 Public Timetable - Weekday

NORTHBOUND

Legend

- ST Sounder Trains
- Amtrak Cascades Trains
- Amtrak Long Distance Trains
- *Station* Commuter Only Station

Train Number =>		1500	1502	1504	512	1506	1508	1510	1512	1514	1516	500	1518	502	516	1700	1702	8	1704	1706	504	1520	1522	1524	518	14	28	506	508
Station																													
VANCOUVER, BC	Ar														11:45										23:00				
BELLINGHAM, WA	↑														09:53										21:04				
MT VERNON, WA															09:23										20:34				
STANWOOD, WA															09:07										20:21				
EVERETT, WA	Dp														08:36			17:39							19:51				
EVERETT, WA	Ar															17:04	17:32		18:04	18:34									
MUKILTEO, WA	↑															16:47	17:15		17:47	18:17									
EDMONDS, WA															08:11	16:32	17:00	17:12	17:32	18:02					19:26				
SEATTLE, WA	Dp														07:45	16:05	16:33	16:40	17:05	17:35					19:00				
SEATTLE, WA	Ar	05:52	06:17	06:42		06:50	07:22	07:42	08:02	08:22	08:52	09:40	11:32	11:50							15:20	17:07	17:31	18:16	18:40	19:51		21:00	22:45
TUKWILA, WA	↑	05:32	05:57	06:22		06:30	07:02	07:22	07:42	08:02	08:32	09:22	11:12	11:32							15:02	16:47	17:11	17:56	18:23			20:43	22:27
KENT, WA		05:25	05:50	06:15		06:23	06:55	07:15	07:35	07:55	08:25		11:05									16:40	17:04	17:49					
AUBURN, WA		05:18	05:43	06:08		06:16	06:48	07:08	07:28	07:48	08:18		10:58									16:33	16:57	17:42					
SUMNER, WA		05:08	05:33	05:58		06:06	06:38	06:58	07:18	07:38	08:08		10:48									13:23	16:47	17:32					
PUYALLUP, WA		05:03	05:28	05:53		06:01	06:33	06:53	07:13	07:33	08:03		10:43									16:18	16:42	17:27					
TACOMA DOME, WA		04:50	05:15	05:40		05:48	06:20	06:40	07:02	07:20	07:50	08:52	10:30	11:02							14:32	16:06	16:30	17:15	17:51	18:43		20:13	21:57
SOUTH TACOMA, WA		04:41	05:06	05:31		05:39	06:11	06:31	06:54				10:21																
LAKEWOOD, WA	Dp	04:36	05:01	05:26		05:46	06:06	06:26	06:46				10:16																
OLYMPIA-LACEY, WA	↑											08:13		10:23							13:53				17:13	17:59		19:34	21:18
CENTRALIA, WA												07:52		10:02							13:32				16:52	17:36		19:12	20:57
KELSO , WA												07:11		09:21							12:51				16:11	16:51		18:31	20:16
VANCOUVER, WA												06:38		08:48							12:18				15:38	16:14	17:07	17:58	19:43
PORTLAND, OR	Dp											06:20		08:30							12:00				15:20	15:56	16:45	17:40	19:25
PORTLAND, OR	Ar				08:05																					15:32			19:05
OREGON CITY, OR	↑				07:21																								18:21
SALEM, OR					06:40																					13:49			17:40
ALBANY, OR					06:10																					13:18			17:10
EUGENE, OR	Dp				05:30																					12:36			16:30

PNWRC Joint Operating Plan

DRAFT 2017 Public Timetable - Weekday

SOUTHBOUND

Legend

- ST Sounder Trains
- Amtrak Cascades Trains
- Amtrak Long Distance Trains
- *Station* Commuter Only Station

Train Number =>		1701	501	511	27	1501	1703	1503	1705	1505	1707	503	11	7	517	505	1507	1509	1511	1513	1515	1517	1519	1521	1523	507	1525	509	519
Station																													
VANCOUVER, BC	Dp														06:45														18:00
BELLINGHAM, WA	↓														08:29														19:44
MT VERNON, WA															08:58														20:13
STANWOOD, WA															09:16														20:31
EVERETT, WA		05:45					06:15		06:45		07:15			08:38	09:48														21:03
MUKILTEO, WA		05:57					06:27		06:57		07:27																		
EDMONDS, WA		06:12					06:42		07:12		07:42			09:10	10:12														21:27
SEATTLE, WA	Ar	06:44					07:14		07:44		08:14				10:55														
SEATTLE, WA	Dp		06:00			06:05		06:35		07:55		08:40	09:45	10:25	11:30	14:15	14:35	15:15	15:35	15:55	16:15	16:35	16:55	17:20	17:45	18:10	18:30	19:45	22:10
TUKWILA, WA	↓		06:14			06:18		06:48		08:08		08:54			11:44	14:29	14:48	15:28	15:48	16:08	16:28	16:48	17:08	17:33	17:58	18:24	18:43	19:59	
KENT, WA						06:25		06:55		08:15							14:55	15:35	15:55	16:15	16:35	16:55	17:15	17:40	18:05		18:50		
AUBURN, WA						06:32		07:02		08:22							15:02	15:42	16:02	16:22	16:42	17:02	17:22	17:47	18:12		18:57		
SUMNER, WA						06:42		07:12		08:32							15:12	15:52	16:12	16:32	16:52	17:12	17:32	17:57	18:22		19:07		
PUYALLUP, WA						06:47		07:17		08:37							15:17	15:57	16:17	16:37	16:57	17:17	17:37	18:02	18:27		19:12		
TACOMA DOME, WA	Ar					07:06		07:36									15:37	16:17		16:57									
TACOMA DOME, WA	Dp		06:45							08:52		09:25	10:32		12:15	15:00			16:30		17:10	17:30	17:50	18:15	18:40	18:55	19:25	20:32	
SOUTH TACOMA, WA	↓									09:01									16:39		17:19	17:39	17:59	18:24	18:49		19:34		
LAKEWOOD, WA										09:11									16:51		17:31	17:51	18:11	18:36	19:01		19:46		
OLYMPIA-LACEY, WA			07:15									09:55	11:14		12:45	15:30										19:25		21:02	
CENTRALIA, WA			07:35									10:17	11:37		13:05	15:50										19:45		21:17	
KELSO , WA			08:16									10:58	12:23		13:46	16:31										20:30		22:03	
VANCOUVER, WA			08:53		09:18							11:33	13:01		14:21	17:06										21:05		22:38	
PORTLAND, OR	Ar												13:50			17:35													
PORTLAND, OR	Dp		09:20	09:45	10:10							12:00	14:25		14:50	18:05										21:30		23:05	
OREGON CITY, OR	↓			10:08												18:35													
SALEM, OR				10:51									15:37			19:17													
ALBANY, OR				11:21									16:10			19:47													
EUGENE, OR	Ar			12:20												20:40													
EUGENE, OR	Dp												17:10																

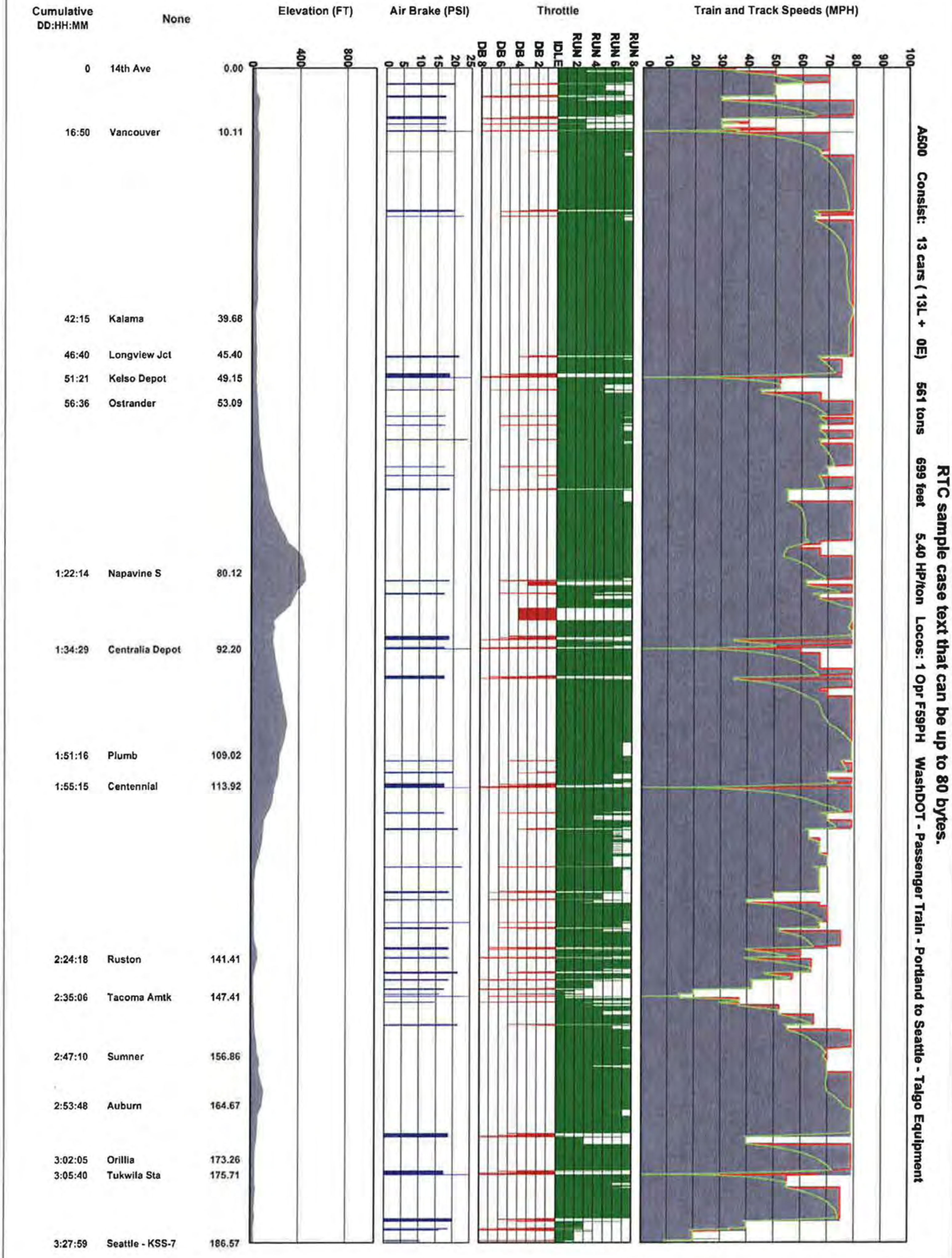
Appendix C

2011 RTC Modeling

Figure 13a

Train Performance Calculator Graphs for the PNWRC, Portland-Seattle Segment

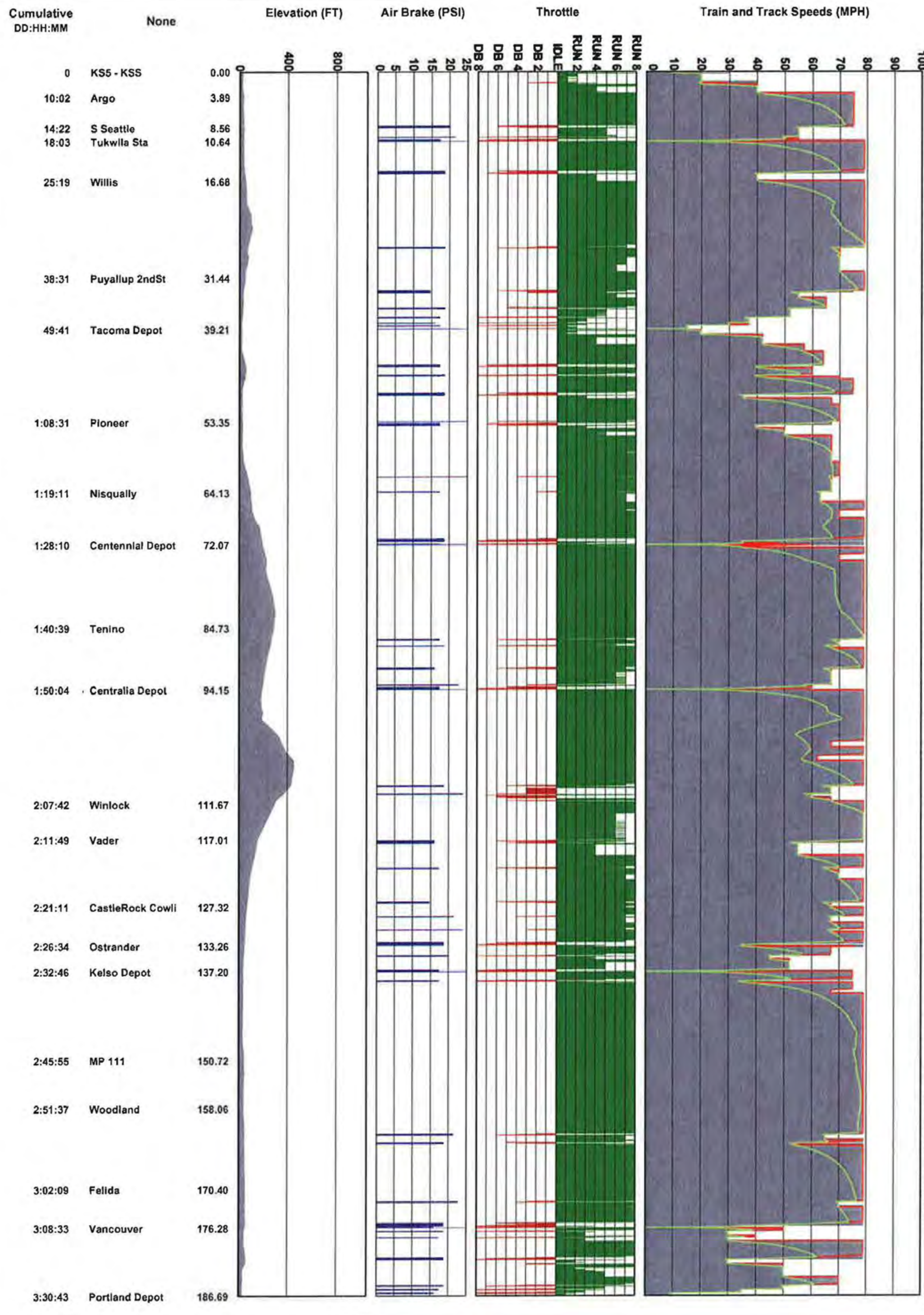
Scenario One: Base Case (June 2011 freight and passenger trains)



Case: 1WsDOT2_Base-R7 RTC run: 09 June 2011 16:31:49 User: Mick Parcel of BNSF Railway

RTC sample case text that can be up to 80 bytes.

A501 Consist: 13 cars (13L + 0E) 561 tons 699 feet 5.40 HP/ton Locos: 1 Opr F59PH WashDOT - Passenger Train - Seattle to Portland - Talgo Equipment

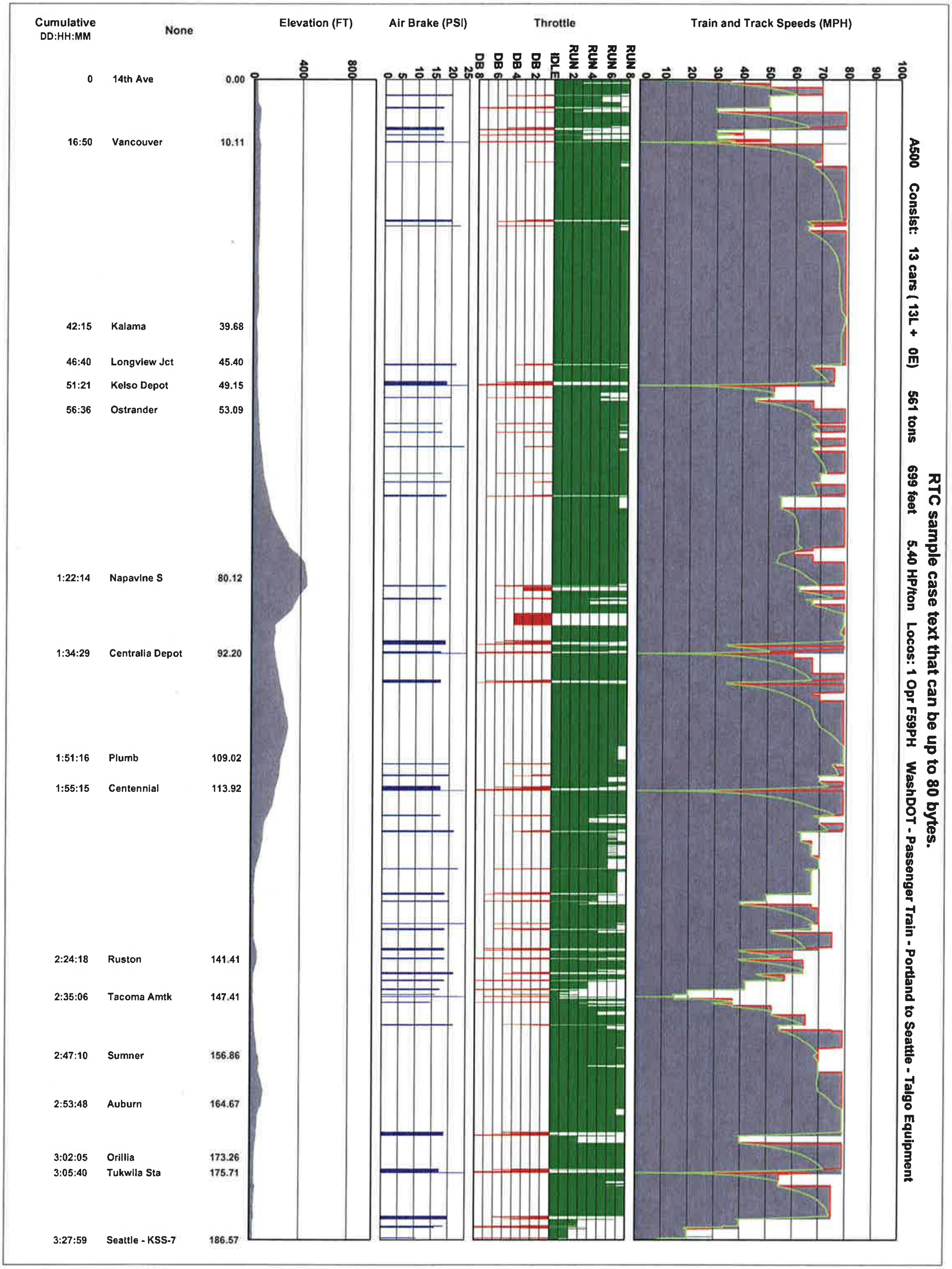


Case: 1WsDOT2_Base-R7 RTC run: 09 June 2011 16:32:13 User: Mick Parcel of BNSF Railway

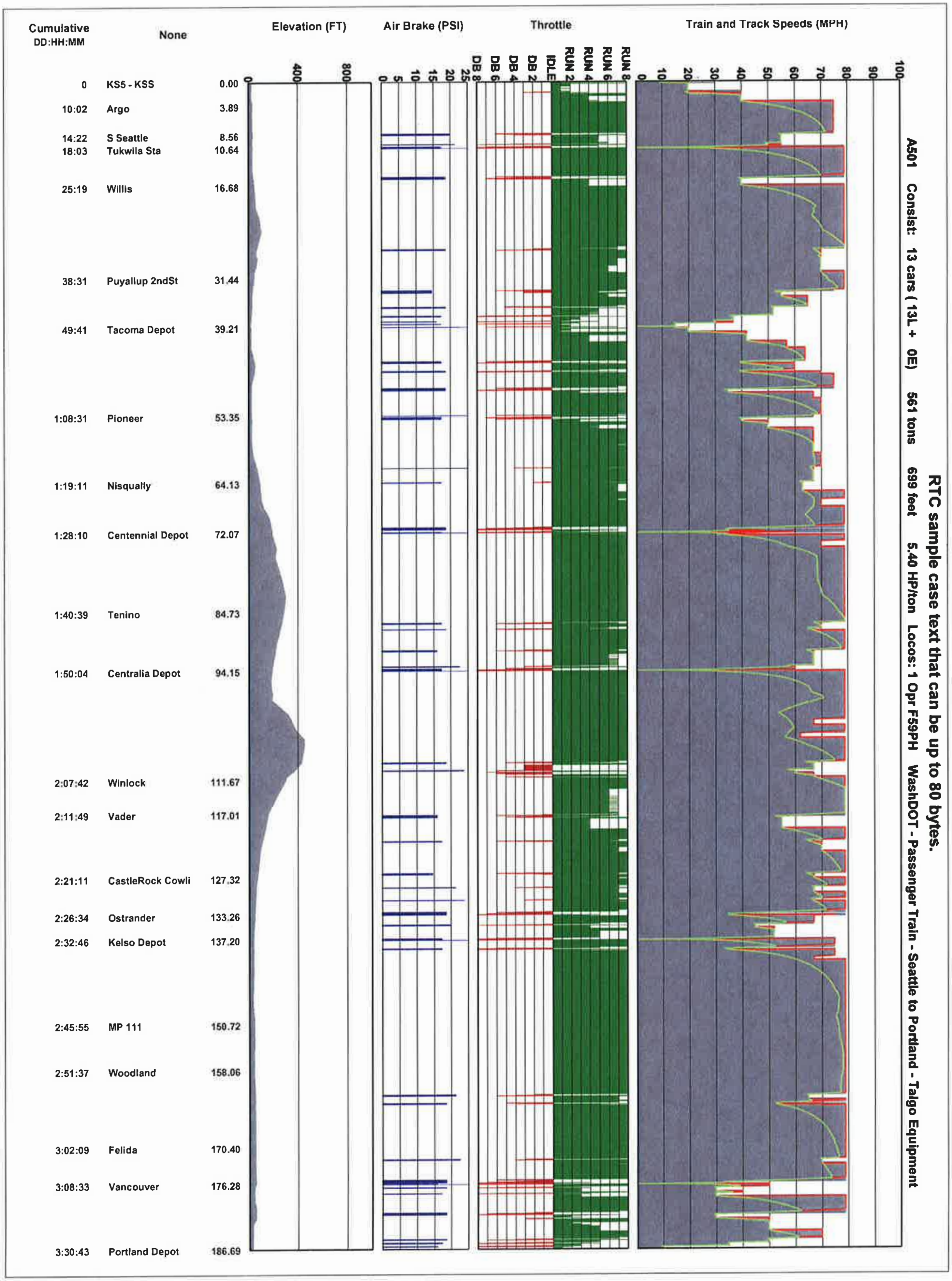
Figure 13b

Train Performance Calculator Graphs for the PNWRC, Portland-Seattle Segment

Scenario Two: Base Case + 22 Freight Trains (Latent Capacity of Portland-Seattle Corridor)



Case: 1WsDG11-R7 RTC run: 09 June 2011 16:26:23 User: Mick Parcel of BNSF Railway

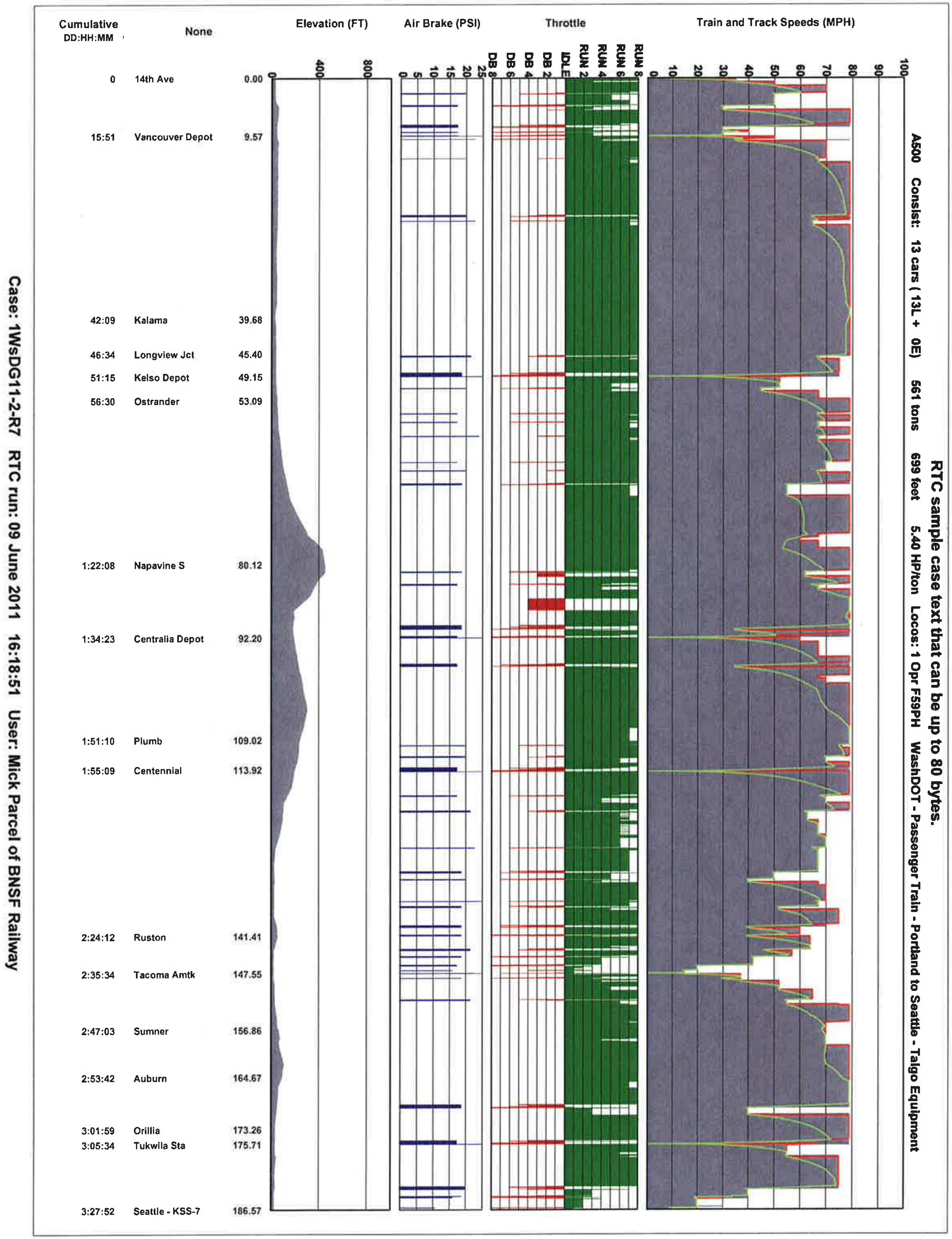


Case: 1WsDG11-R7 RTC run: 09 June 2011 16:27:11 User: Mick Parcel of BNSF Railway

Figure 13c

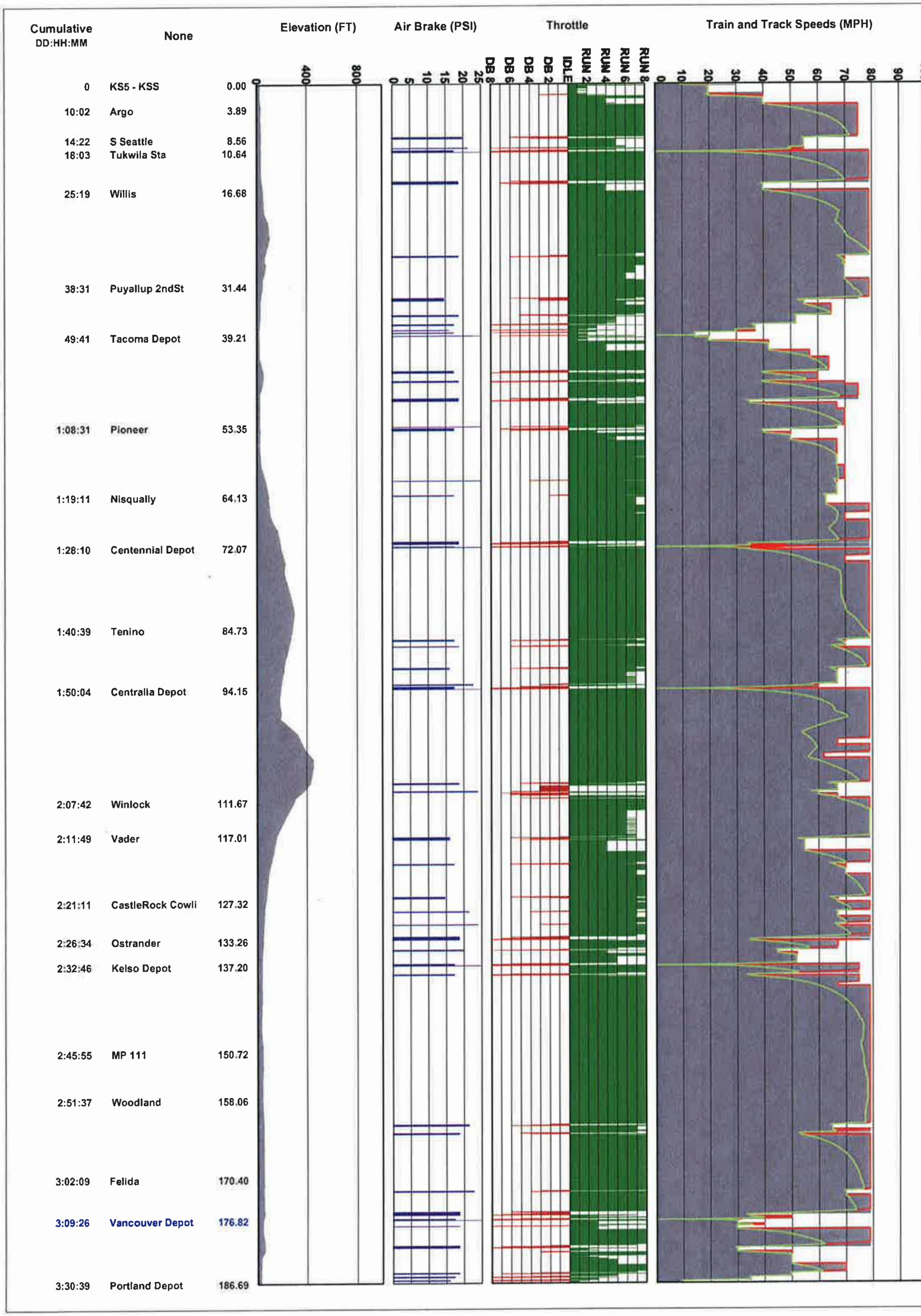
Train Performance Calculator Graphs for the PNWRC, Portland-Seattle Segment

Scenario Three: Base Case + 22 Freight Trains + 2 Additional Cascades Round Trips


RTC sample case text that can be up to 80 bytes.
A500 Consist: 13 cars (13L + 0E) 561 tons 699 feet 5.40 HP/ton Locos: 1 Opr F59PH WashDOT - Passenger Train - Portland to Seattle - Talgo Equipment
Cumulative DD:HH:MM
None
Elevation (FT)
Air Brake (PSI)
Throttle
Train and Track Speeds (MPH)
0 14th Ave 0.00
15:51 Vancouver Depot 9.57
42:09 Kalama 39.68
46:34 Longview Jct 45.40
51:15 Kelso Depot 49.15
56:30 Ostrander 53.09
1:22:08 Napavine S 80.12
1:34:23 Centralia Depot 92.20
1:51:10 Plumb 109.02
1:55:09 Centennial 113.92
2:24:12 Ruston 141.41
2:35:34 Tacoma Amtk 147.55
2:47:03 Sumner 156.86
2:53:42 Auburn 164.67
3:01:59 Orillia 173.26
3:05:34 Tukwila Sta 175.71
3:27:52 Seattle - KSS-7 186.57
0
400
800
0
5
10
15
20
25
DB 8
DB 6
DB 4
DB 2
IDLE
RUN 2
RUN 4
RUN 6
RUN 8
0
10
20
30
40
50
60
70
80
90
100
Case: 1WsDG11-2-R7 RTC run: 09 June 2011 16:18:51 User: Mick Parcel of BNSF Railway

RTC sample case text that can be up to 80 bytes.

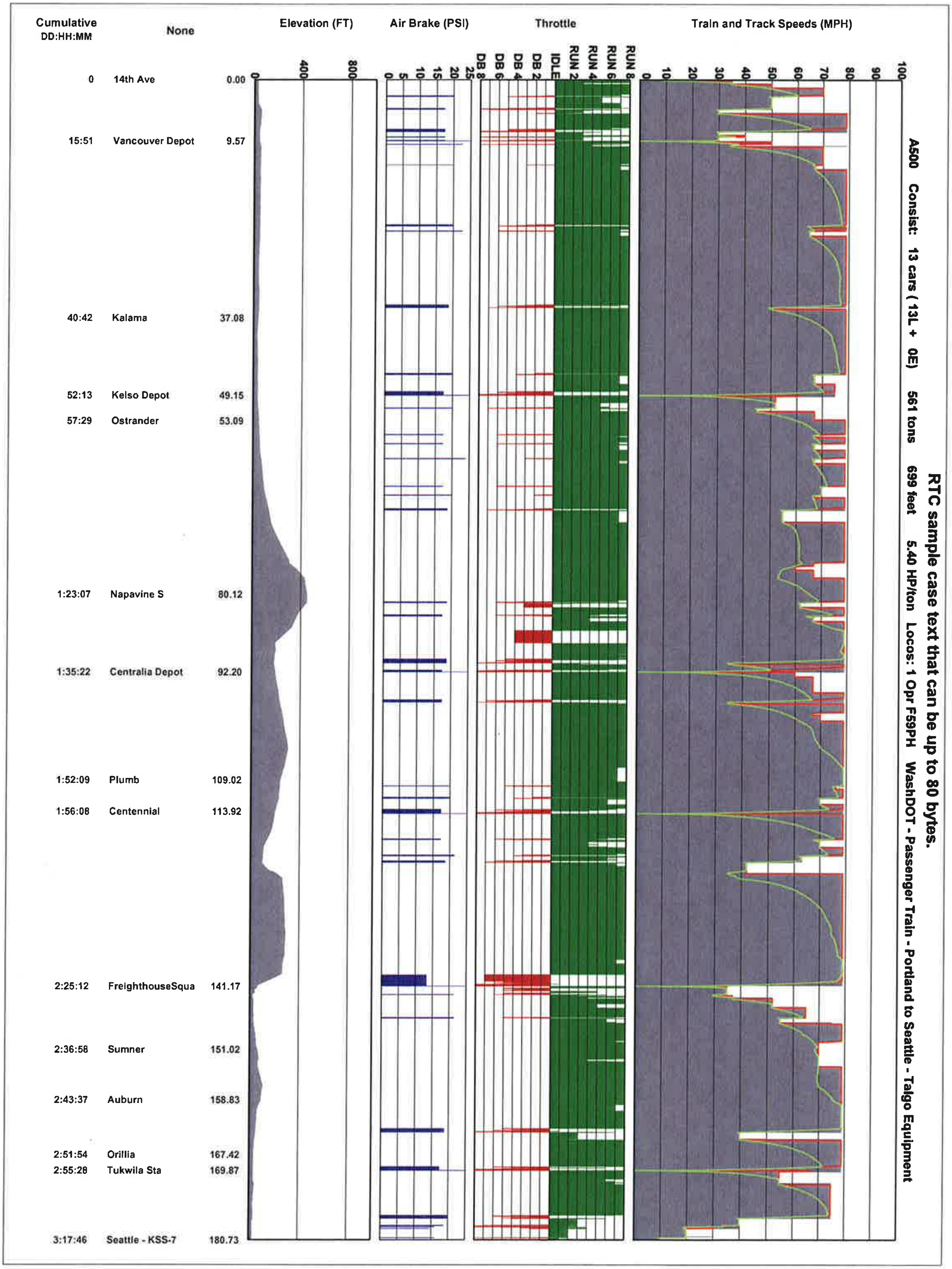
A501 Consist: 13 cars (13L + 0E) 561 tons 699 feet 5.40 HP/ton Locos: 1 Opr F59PH WashDOT - Passenger Train - Seattle to Portland - Talgo Equipment



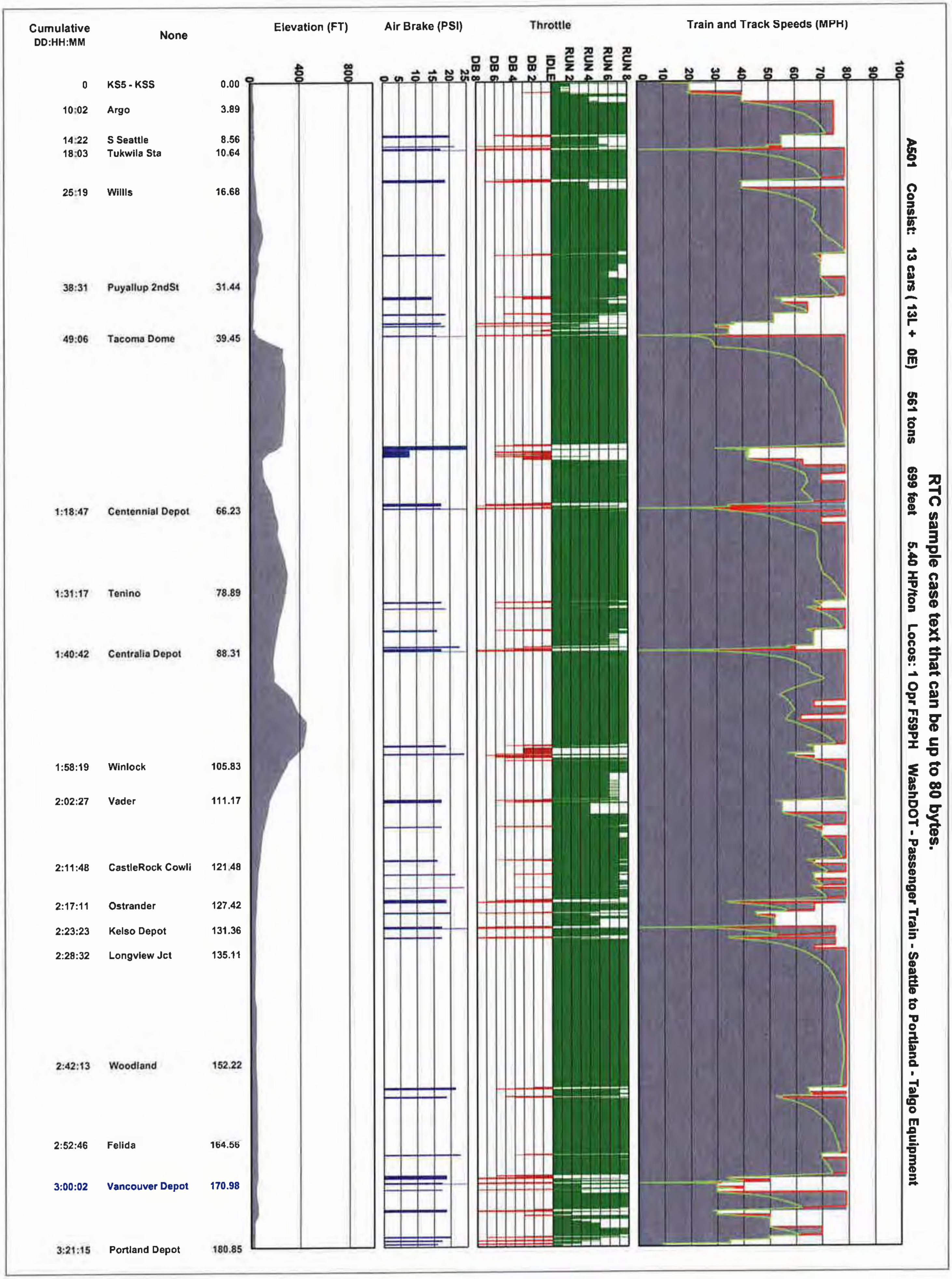
Case: 1WsDG11-2-R7 RTC run: 09 June 2011 16:21:35 User: Mick Parcel of BNSF Railway

Figure 13d

Train Performance Calculator Graphs for the PNWRC, Portland-Seattle Segment Scenario Four: Base Case + 22 Freight Trains + 2 Additional Cascades Round Trips + Proposed New Infrastructure Projects included in the RTC model (Vancouver Yard Bypass, Kelso-Martin’s Bluff, Point Defiance Bypass, D to M Street)



Case: 1WsDG11-7-R7 RTC run: 09 June 2011 16:16:59 User: Mick Parcel of BNSF Railway



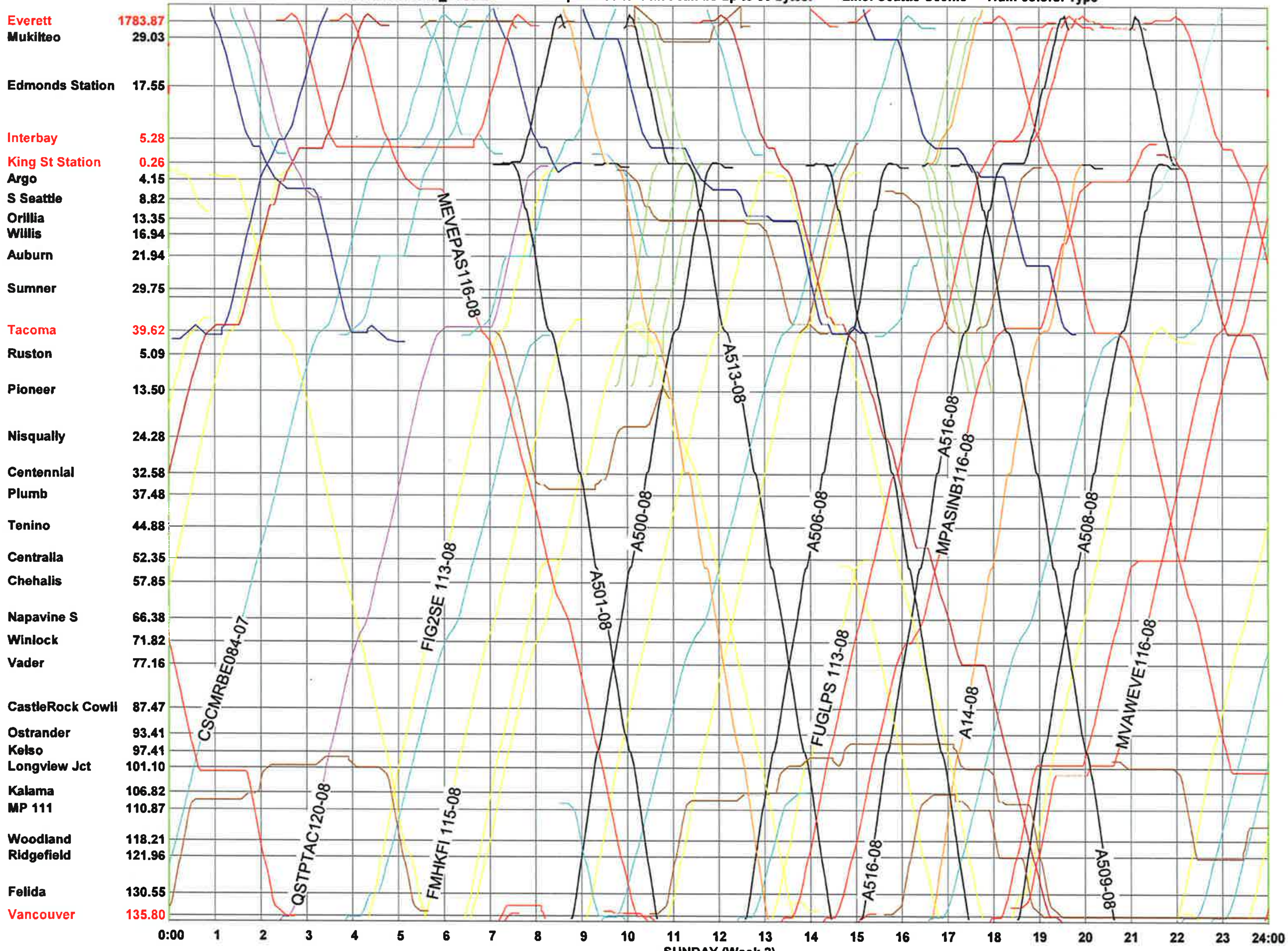
Case: 1WsDG11-7-R7 RTC run: 09 June 2011 16:17:30 User: Mick Parcel of BNSF Railway

Figure 14a

RTC Model Stringlines for BNSF Seattle and Scenic Subdivisions (Vancouver, Wash. - Seattle- Everett)

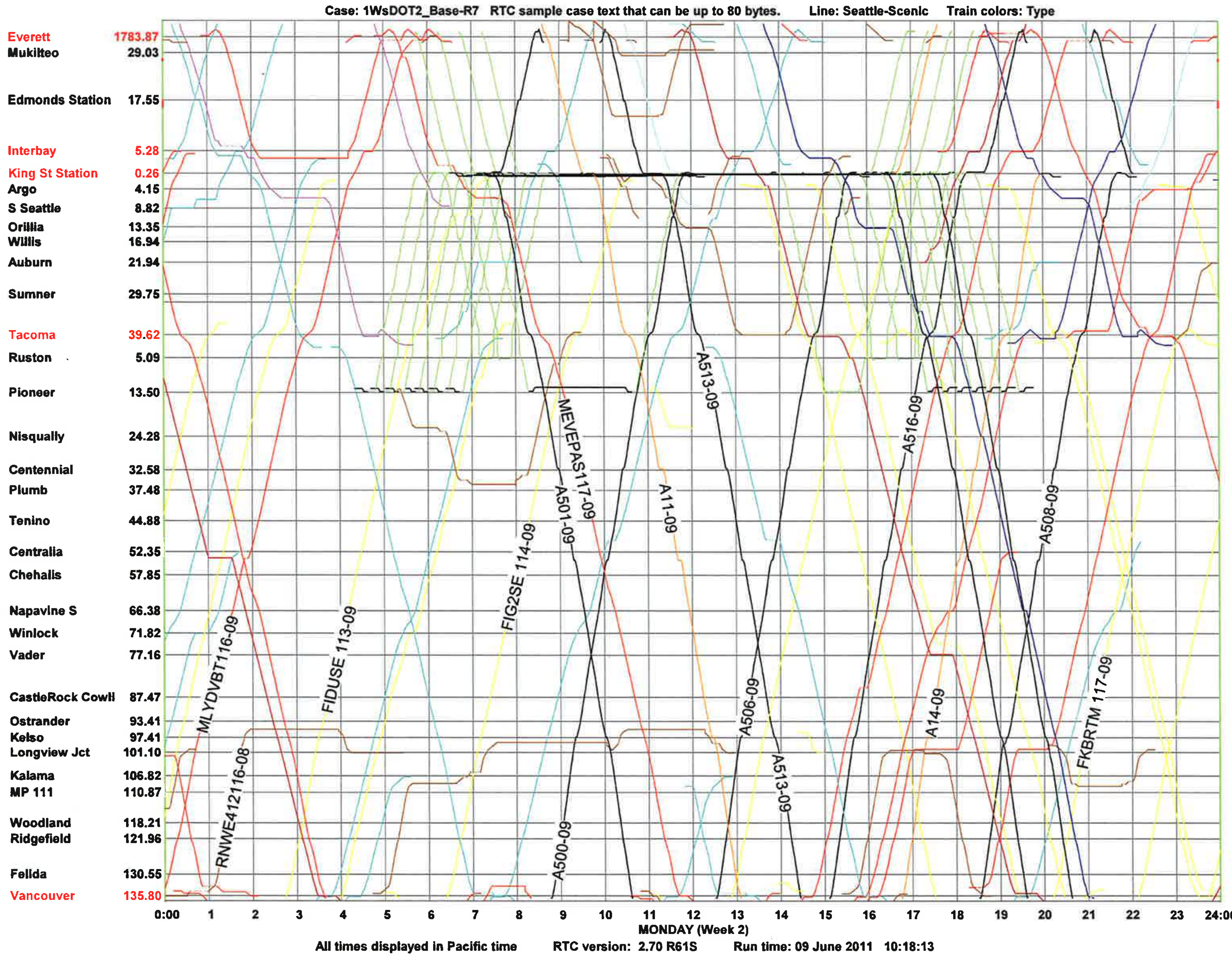
Scenario One: Base Case (June 2011 freight and passenger trains)

Case: 1WsDOT2_Base-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type

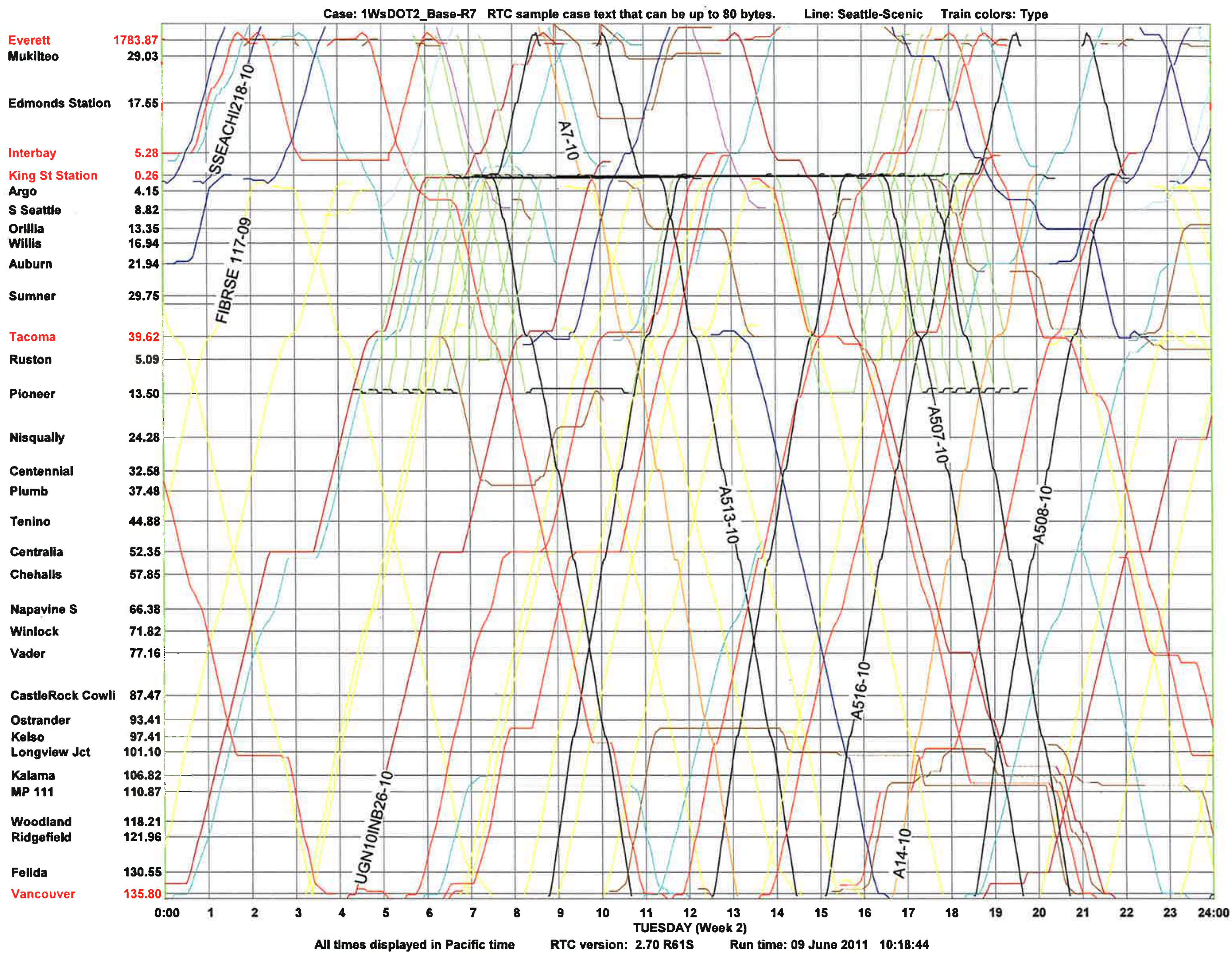


SUNDAY (Week 2)

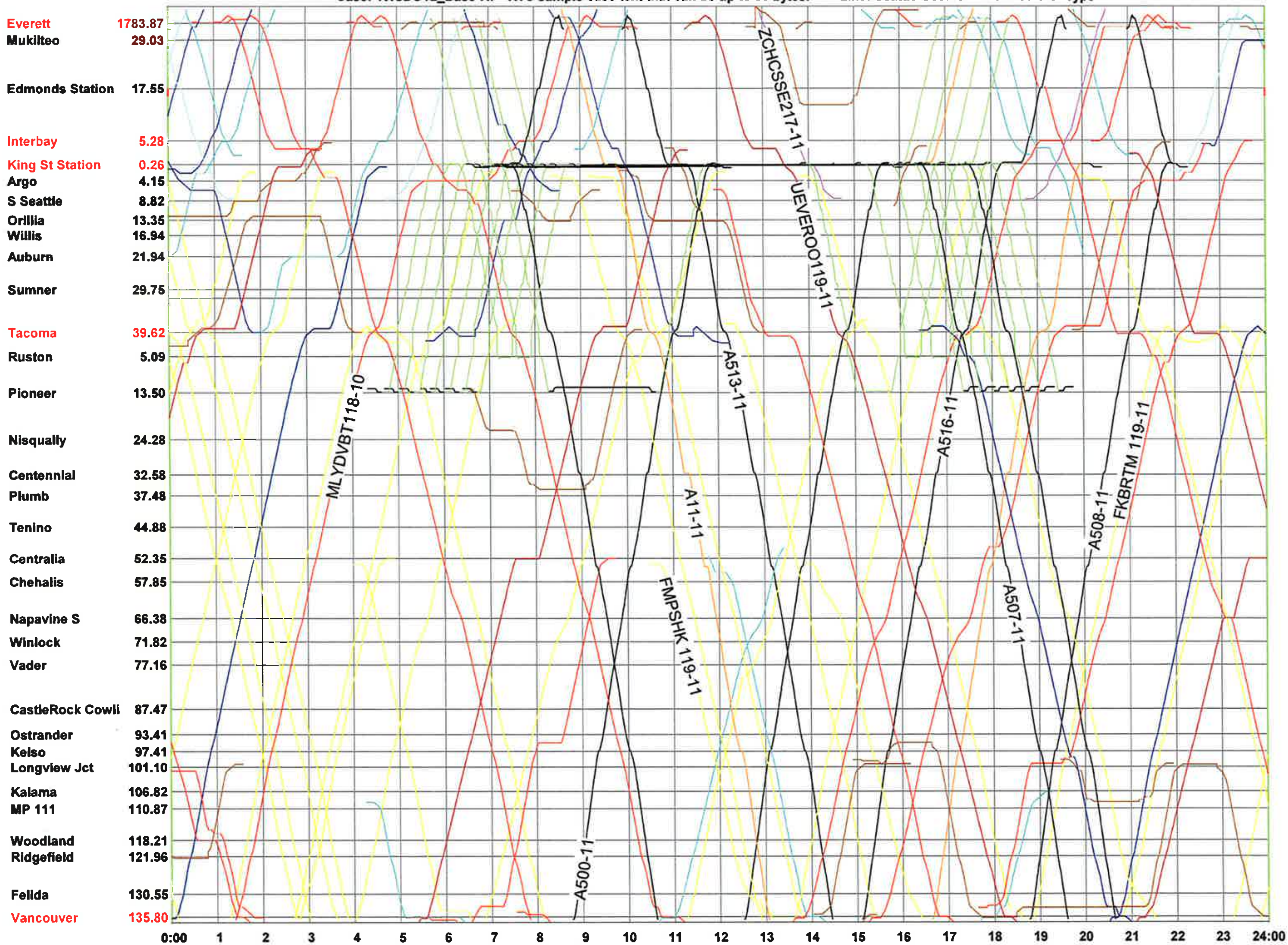
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 10:17:28



Case: 1WsDOT2_Base-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type
Everett 1783.87
Mukilteo 29.03
Edmonds Station 17.55
Interbay 5.28
King St Station 0.26
Argo 4.15
S Seattle 8.82
Orillia 13.35
Willis 16.94
Auburn 21.94
Sumner 29.75
Tacoma 39.62
Ruston 5.09
Pioneer 13.50
Nisqually 24.28
Centennial 32.58
Plumb 37.48
Tenino 44.88
Centralia 52.35
Chehalis 57.85
Napavine S 66.38
Winlock 71.82
Vader 77.16
CastleRock Cowll 87.47
Ostrander 93.41
Kelso 97.41
Longview Jct 101.10
Kalama 106.82
MP 111 110.87
Woodland 118.21
Ridgefield 121.96
Felida 130.55
Vancouver 135.80
MLYDVBT116-09
RNWE412116-08
FIDUSE 113-09
FIG2SE 114-09
MEVEPAS117-09
A501-09
A500-09
A11-09
A513-09
A506-09
A516-09
A14-09
A508-09
FKBRTM 117-09
0:00 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24:00
MONDAY (Week 2)
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 10:18:13


Case: 1WsDOT2_Base-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type
Everett 1783.87
Mukilteo 29.03
Edmonds Station 17.55
Interbay 5.28
King St Station 0.26
Argo 4.15
S Seattle 8.82
Orillia 13.35
Willis 16.94
Auburn 21.94
Sumner 29.75
Tacoma 39.62
Ruston 5.09
Pioneer 13.50
Nisqually 24.28
Centennial 32.58
Plumb 37.48
Tenino 44.88
Centralia 52.35
Chehalis 57.85
Napavine S 66.38
Winlock 71.82
Vader 77.16
CastleRock Cowli 87.47
Ostrander 93.41
Kelso 97.41
Longview Jct 101.10
Kalama 106.82
MP 111 110.87
Woodland 118.21
Ridgefield 121.96
Felida 130.55
Vancouver 135.80
SSEACHI218-10
FIBRSE 117-09
A7-10
A513-10
A507-10
A508-10
A516-10
UGN10INB26-10
A14-10
0:00 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24:00
TUESDAY (Week 2)
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 10:18:44

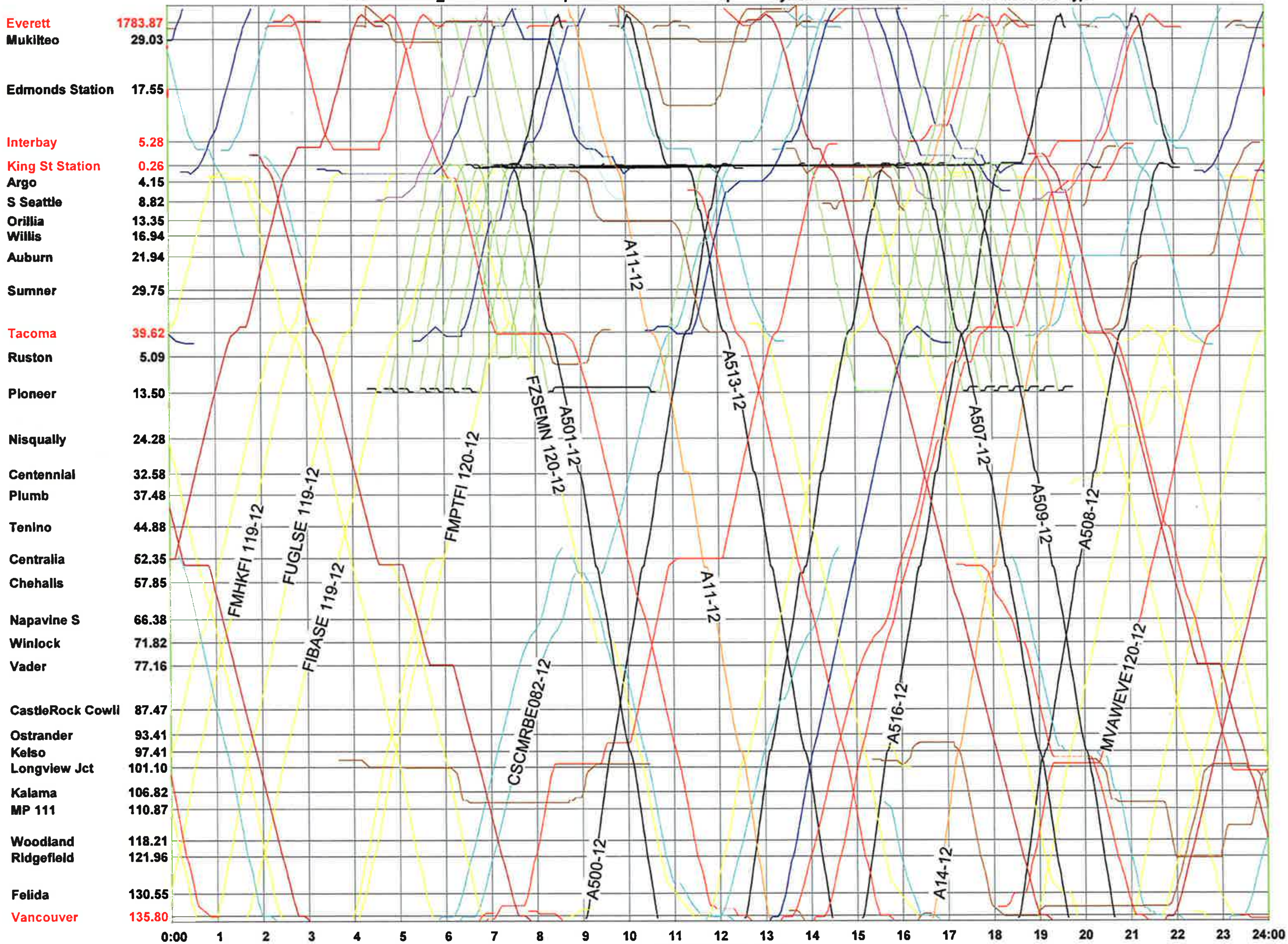
Case: 1WsDOT2_Base-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type



WEDNESDAY (Week 2)

All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 10:19:10

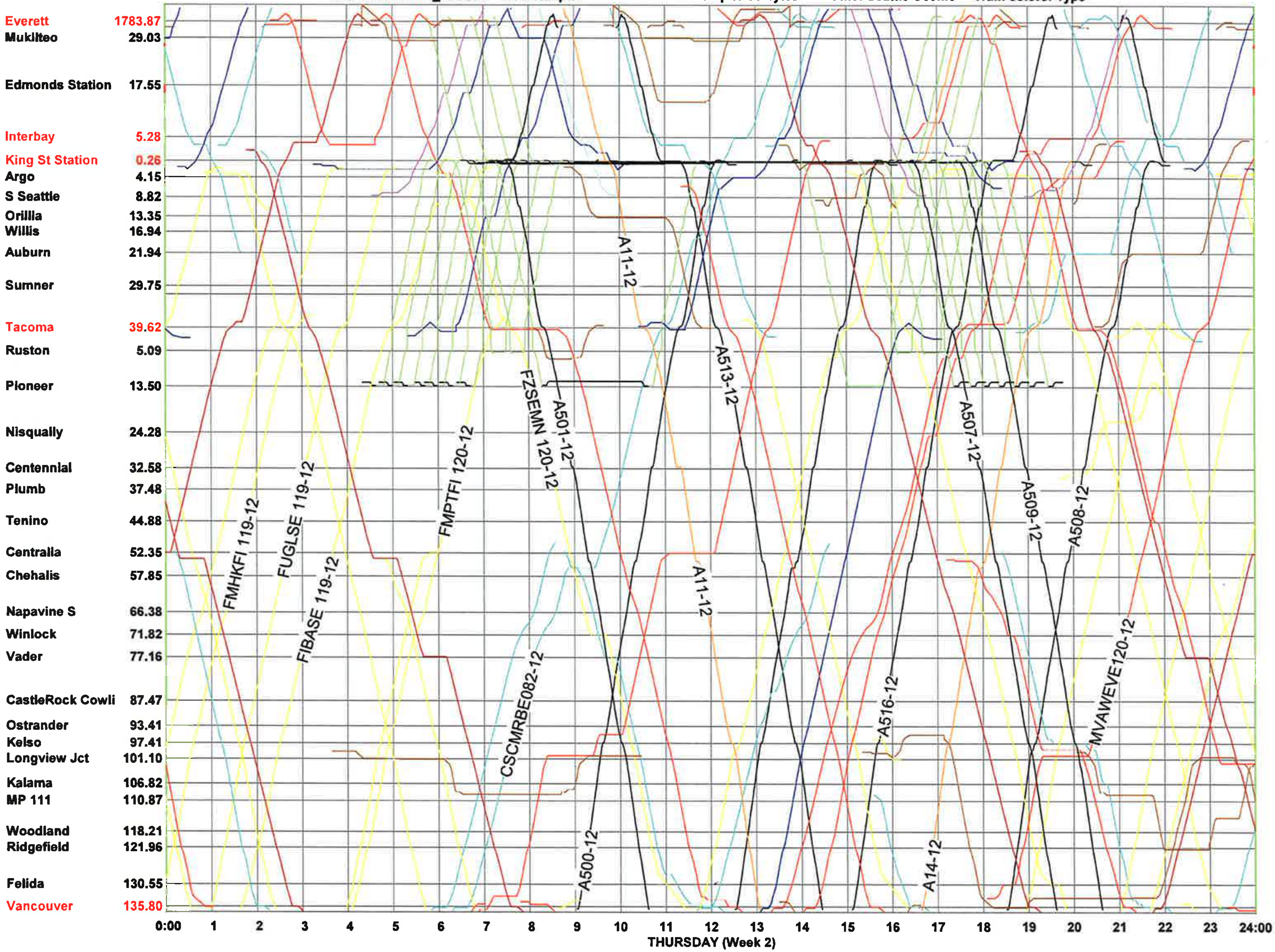
Case: 1WsDOT2_Base-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type



THURSDAY (Week 2)

All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 10:19:34

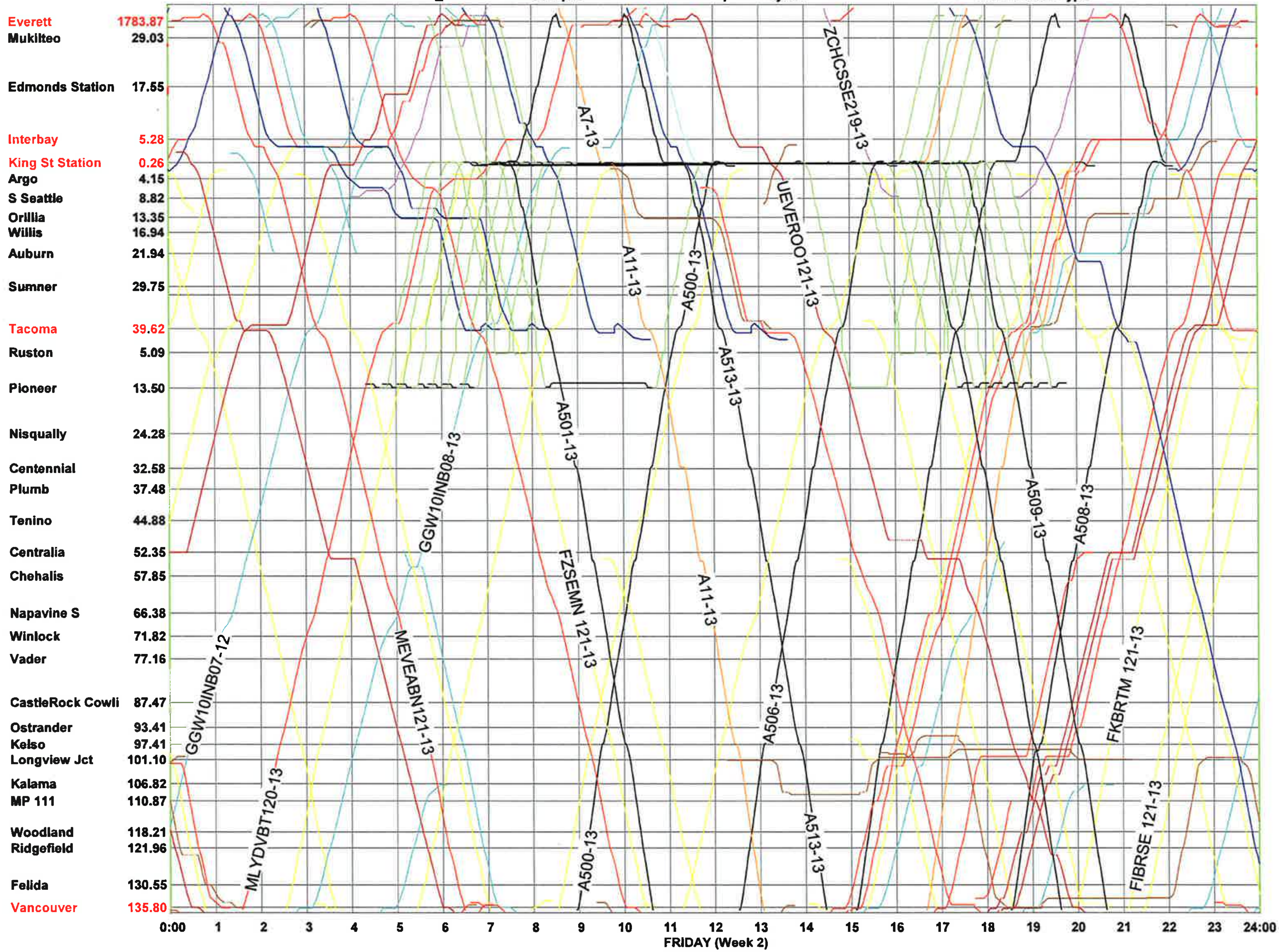
Case: 1WsDOT2_Base-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type



THURSDAY (Week 2)

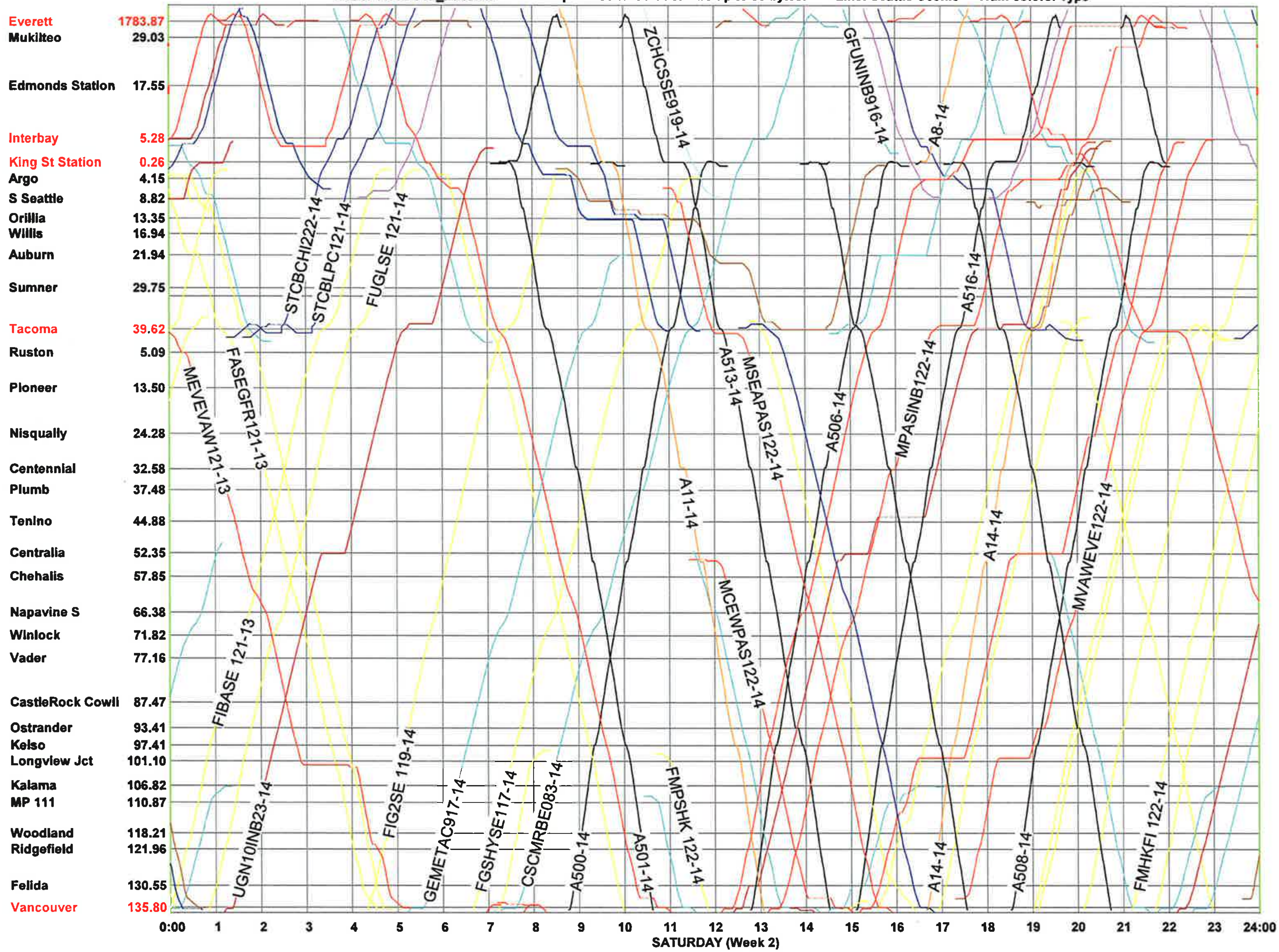
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 10:19:53

Case: 1WsDOT2_Base-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type



All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 10:20:13

Case: 1WsDOT2_Base-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type



SATURDAY (Week 2)

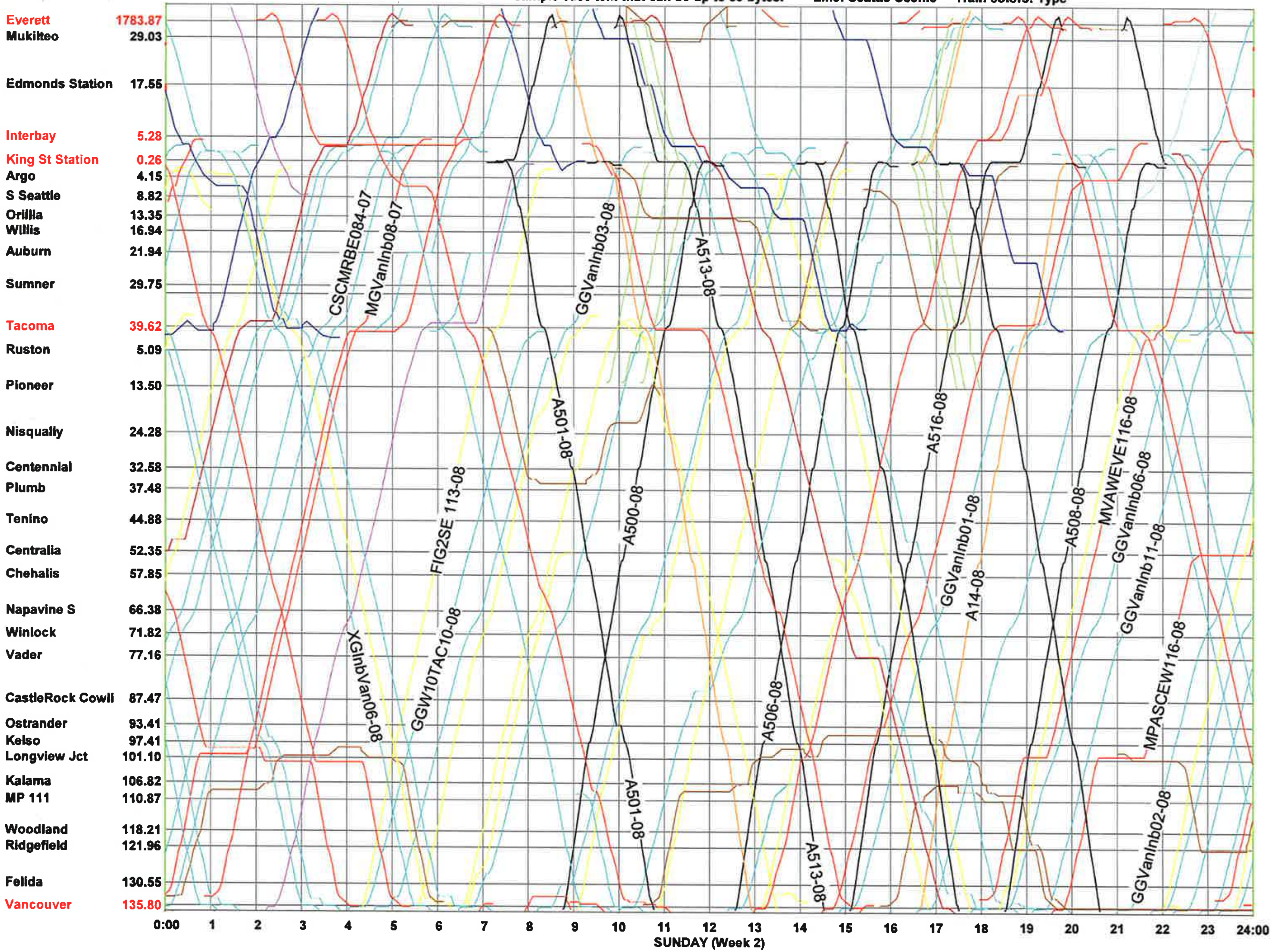
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 10:20:38

Figure 14b

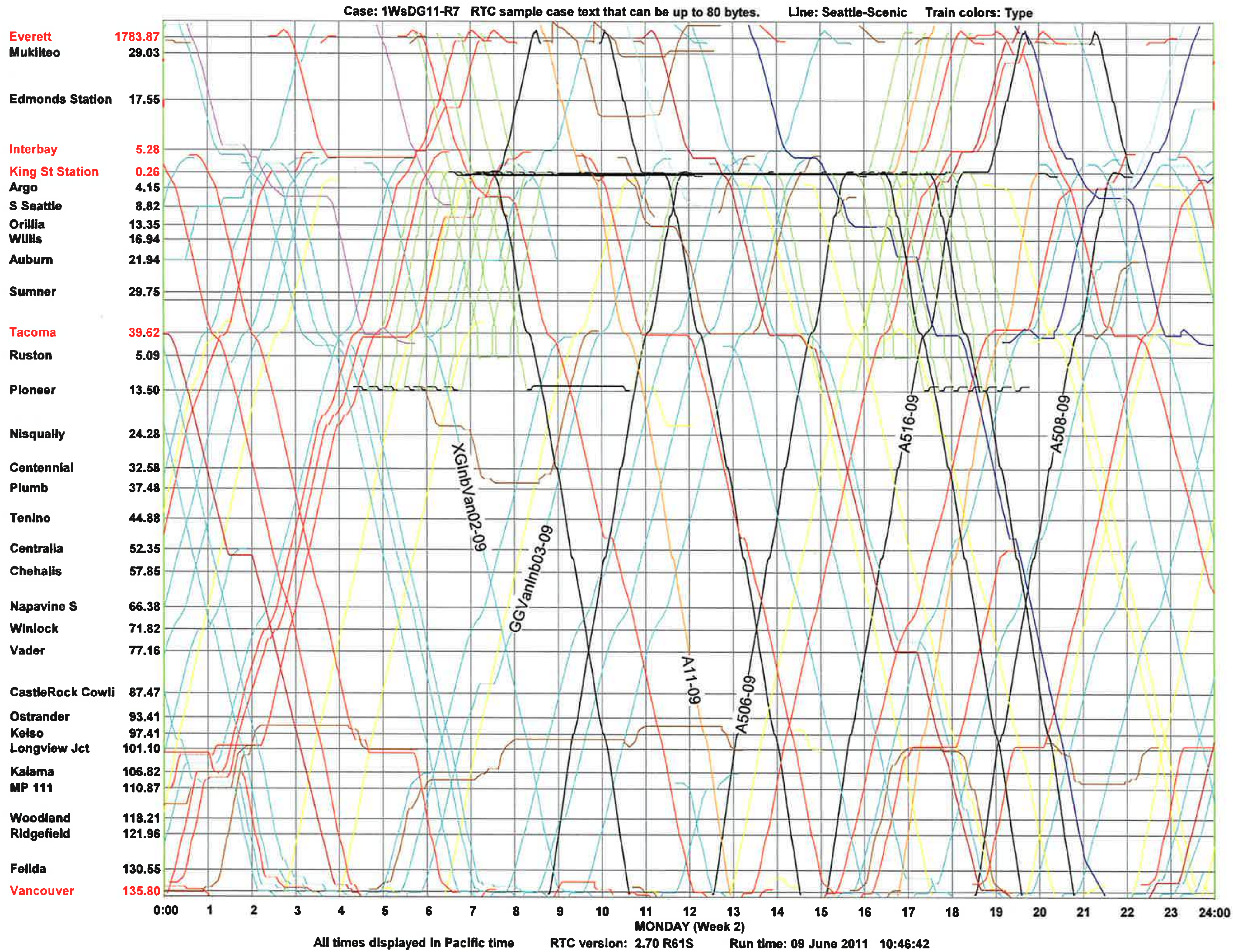
RTC Model Stringlines for BNSF Seattle and Scenic Subdivisions (Vancouver, Wash. - Seattle- Everett)

Scenario Two: Base Case + 22 Freight Trains (Latent Capacity of Portland-Seattle Corridor)

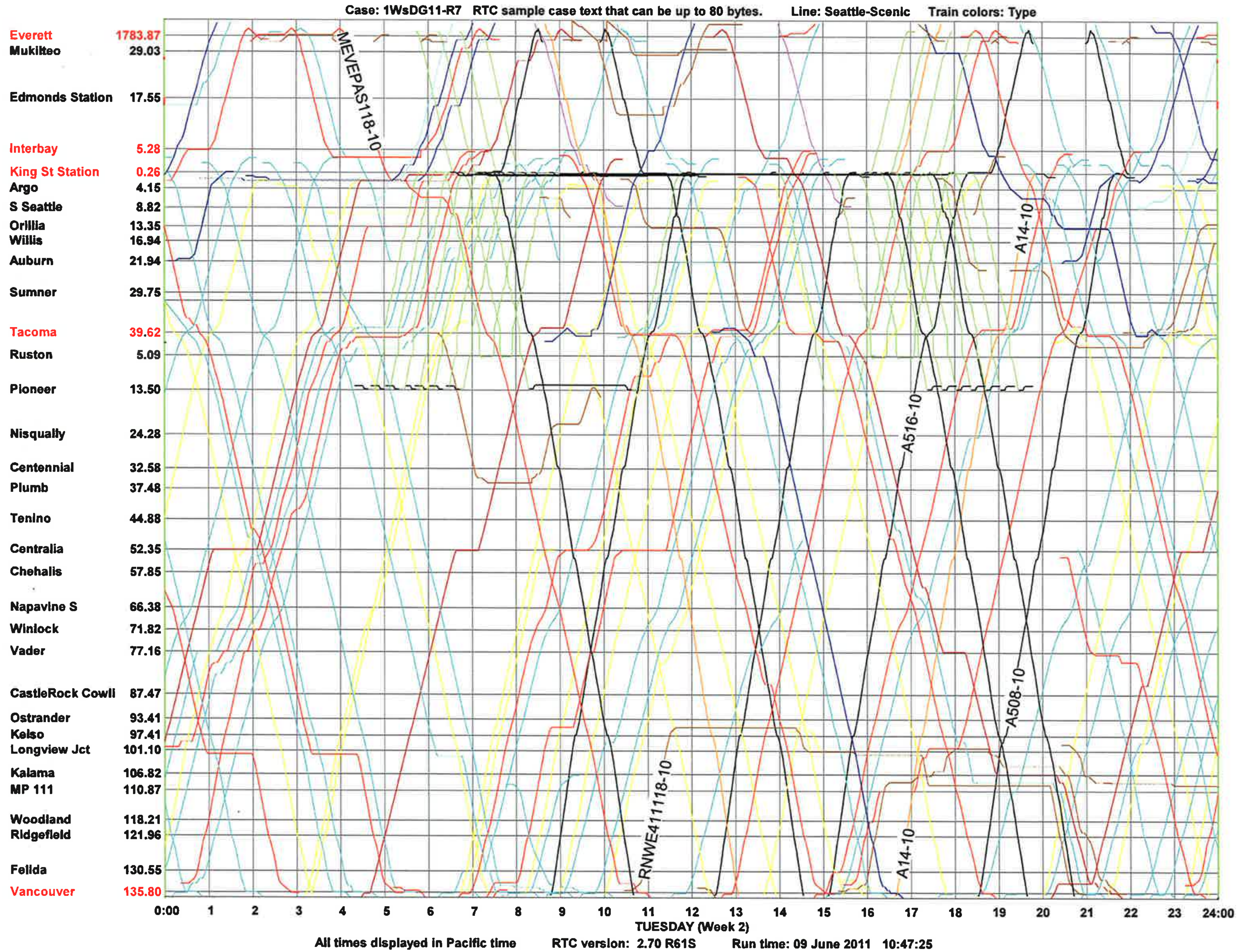
Case: 1WsDG11-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type



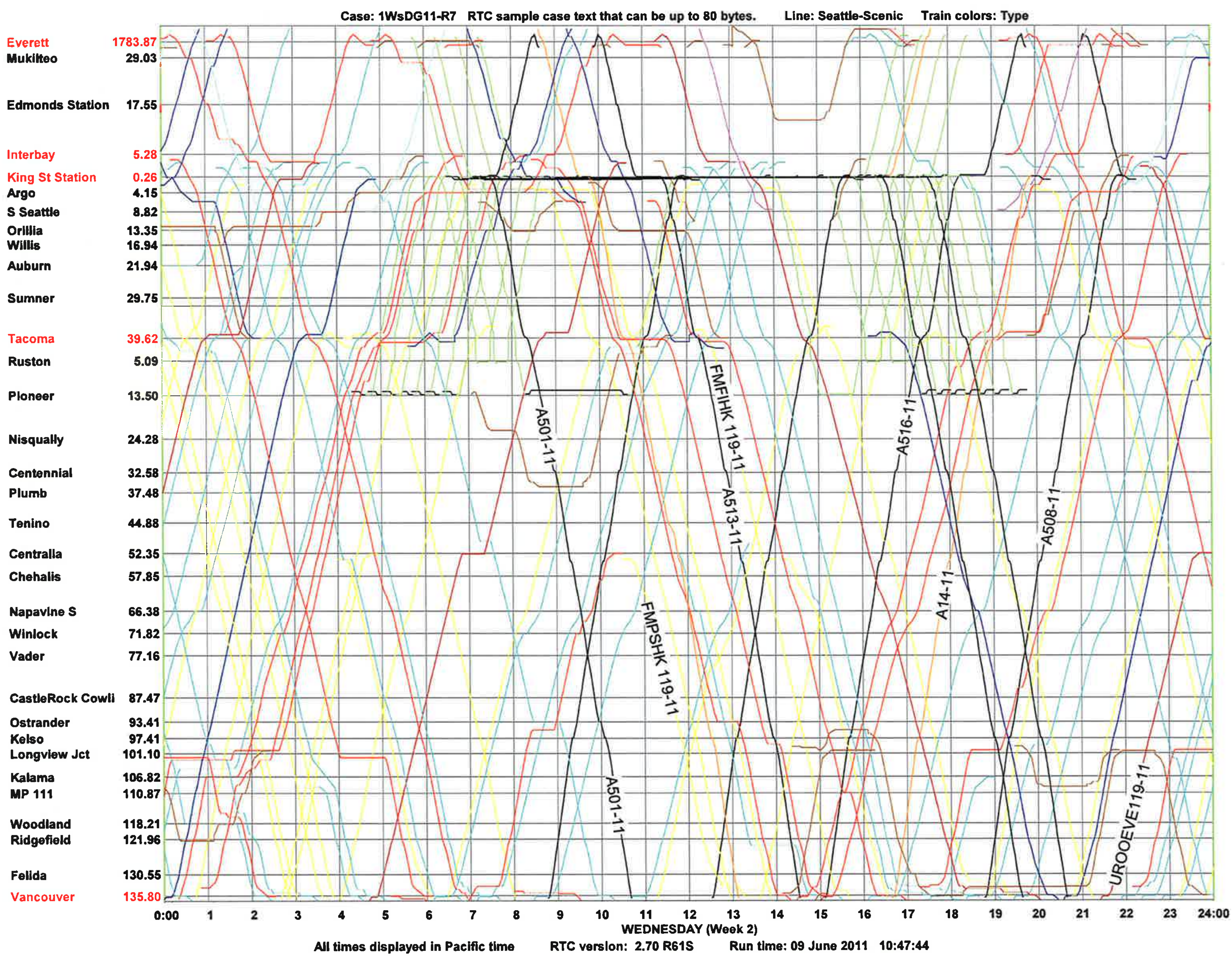
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 10:46:26



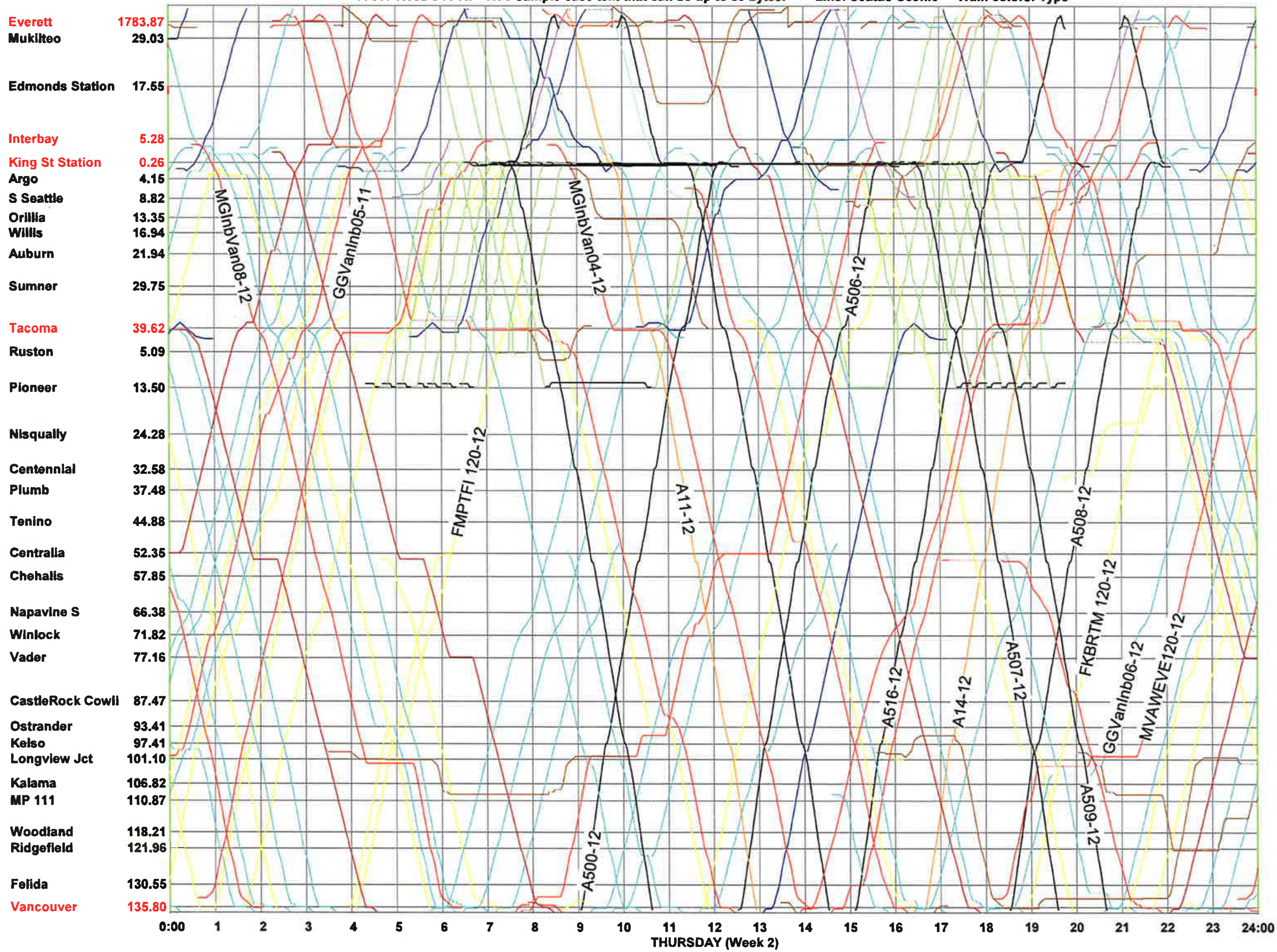
Case: 1WsDG11-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type
Everett 1783.87
Mukilteo 29.03
Edmonds Station 17.55
Interbay 5.28
King St Station 0.26
Argo 4.15
S Seattle 8.82
Orillia 13.35
Willis 16.94
Auburn 21.94
Sumner 29.75
Tacoma 39.62
Ruston 5.09
Pioneer 13.50
Nisqually 24.28
Centennial 32.58
Plumb 37.48
Tenino 44.88
Centralia 52.35
Chehalis 57.85
Napavine S 66.38
Winlock 71.82
Vader 77.16
CastleRock Cowli 87.47
Ostrander 93.41
Kelso 97.41
Longview Jct 101.10
Kalama 106.82
MP 111 110.87
Woodland 118.21
Ridgefield 121.96
Felida 130.55
Vancouver 135.80
XGlnbVan02-09
GGVanlnb03-09
A11-09
A506-09
A516-09
A508-09
0:00 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24:00
MONDAY (Week 2)
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 10:46:42



Case: 1WsDG11-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type
Everett 1783.87
Mukilteo 29.03
Edmonds Station 17.55
Interbay 5.28
King St Station 0.26
Argo 4.15
S Seattle 8.82
Orillia 13.35
Willis 16.94
Auburn 21.94
Sumner 29.75
Tacoma 39.62
Ruston 5.09
Pioneer 13.50
Nisqually 24.28
Centennial 32.58
Plumb 37.48
Tenino 44.88
Centralia 52.35
Chehalis 57.85
Napavine S 66.38
Winlock 71.82
Vader 77.16
CastleRock Cowli 87.47
Ostrander 93.41
Kelso 97.41
Longview Jct 101.10
Kalama 106.82
MP 111 110.87
Woodland 118.21
Ridgefield 121.96
Felida 130.55
Vancouver 135.80
MEVEPAS118-10
A14-10
A516-10
A508-10
RNWE411118-10
A14-10
0:00 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24:00
TUESDAY (Week 2)
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 10:47:25

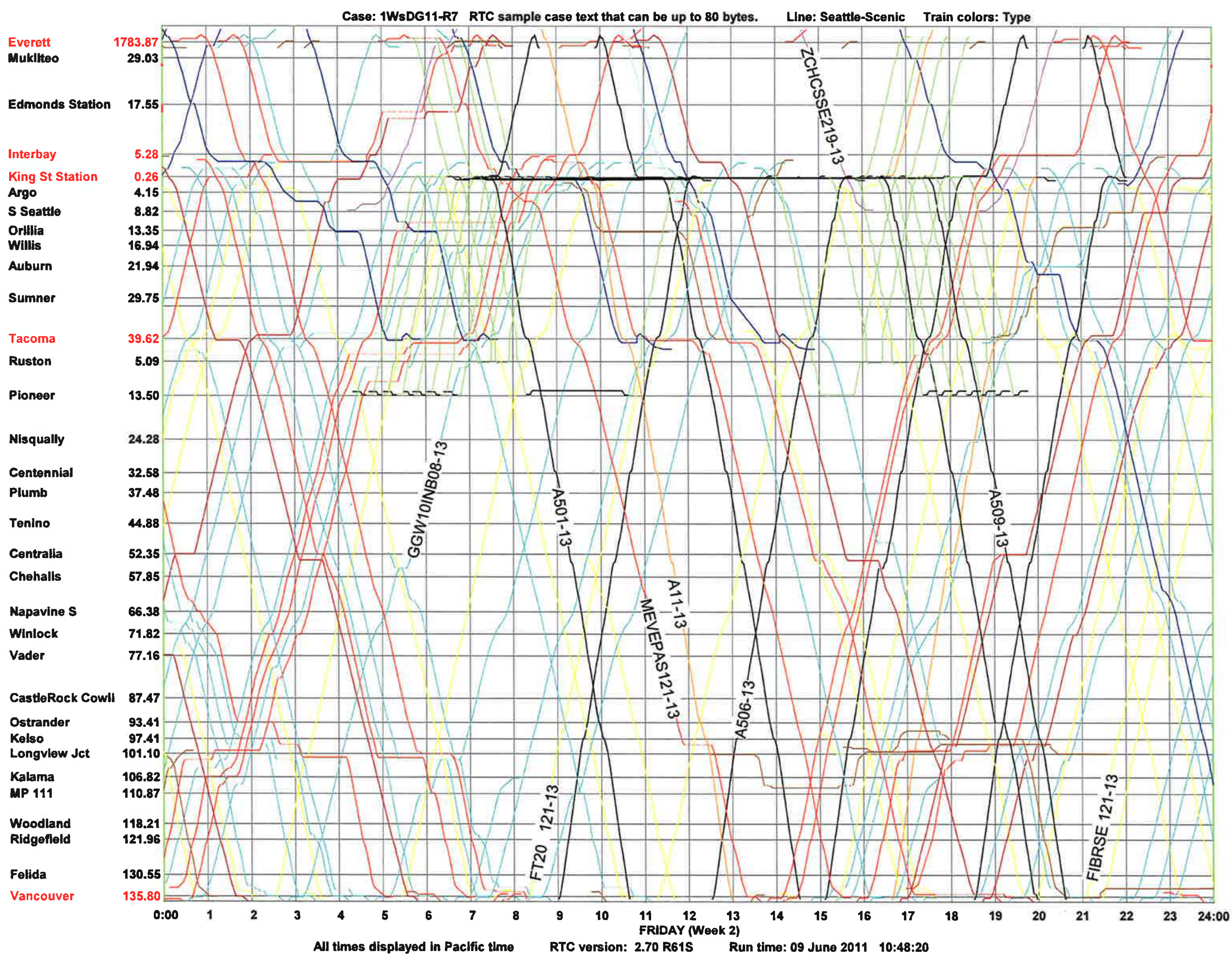

Case: 1WsDG11-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type
Everett 1783.87
Mukilteo 29.03
Edmonds Station 17.55
Interbay 5.28
King St Station 0.26
Argo 4.15
S Seattle 8.82
Orillia 13.35
Willis 16.94
Auburn 21.94
Sumner 29.75
Tacoma 39.62
Ruston 5.09
Pioneer 13.50
Nisqually 24.28
Centennial 32.58
Plumb 37.48
Tenino 44.88
Centralia 52.35
Chehalis 57.85
Napavine S 66.38
Winlock 71.82
Vader 77.16
CastleRock Cowli 87.47
Ostrander 93.41
Kelso 97.41
Longview Jct 101.10
Kalama 106.82
MP 111 110.87
Woodland 118.21
Ridgefield 121.96
Felida 130.55
Vancouver 135.80
A501-11
FMFIHK 119-11
A513-11
A516-11
A14-11
A508-11
FMPSHK 119-11
A501-11
UROOEVE119-11
0:00 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24:00
WEDNESDAY (Week 2)
All times displayed in Pacific time
RTC version: 2.70 R61S
Run time: 09 June 2011 10:47:44

Case: 1WsDG11-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type

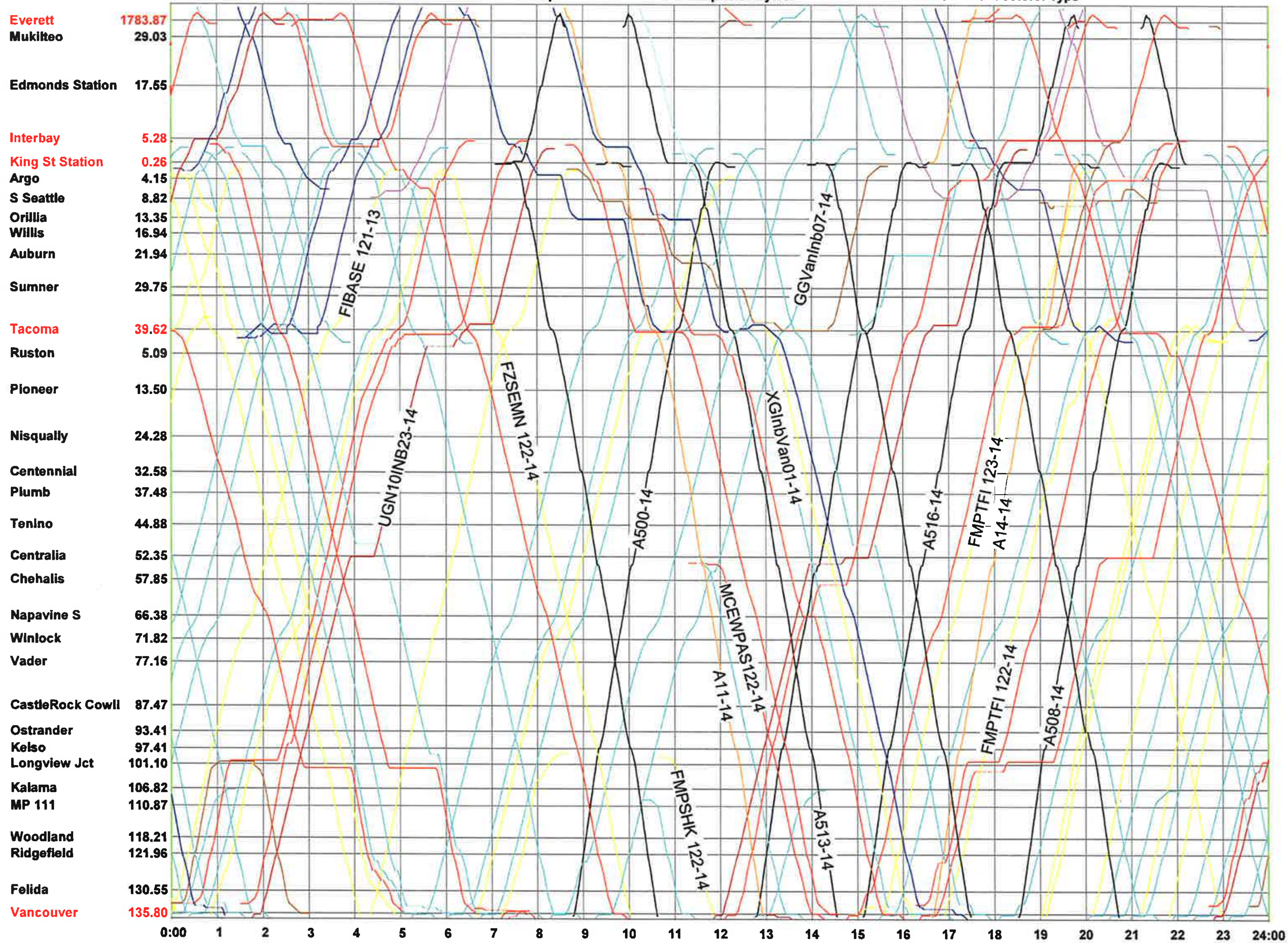


THURSDAY (Week 2)

All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 10:48:03


Case: 1WsDG11-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type
Everett 1783.87
Mukilteo 29.03
Edmonds Station 17.55
Interbay 5.28
King St Station 0.26
Argo 4.15
S Seattle 8.82
Orillia 13.35
Willis 16.94
Auburn 21.94
Sumner 29.75
Tacoma 39.62
Ruston 5.09
Pioneer 13.50
Nisqually 24.28
Centennial 32.58
Plumb 37.48
Tenino 44.88
Centralia 52.35
Chehalis 57.85
Napavine S 66.38
Winlock 71.82
Vader 77.16
CastleRock Cowli 87.47
Ostrander 93.41
Kelso 97.41
Longview Jct 101.10
Kalama 106.82
MP 111 110.87
Woodland 118.21
Ridgefield 121.96
Felida 130.55
Vancouver 135.80
ZCHCSSE219-13
GGW10INB08-13
A501-13
A509-13
A11-13
MEVEPAS121-13
A506-13
FT20 121-13
FIBRSE 121-13
0:00 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24:00
FRIDAY (Week 2)
All times displayed in Pacific time
RTC version: 2.70 R61S
Run time: 09 June 2011 10:48:20

Case: 1WsDG11-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type



SATURDAY (Week 2)

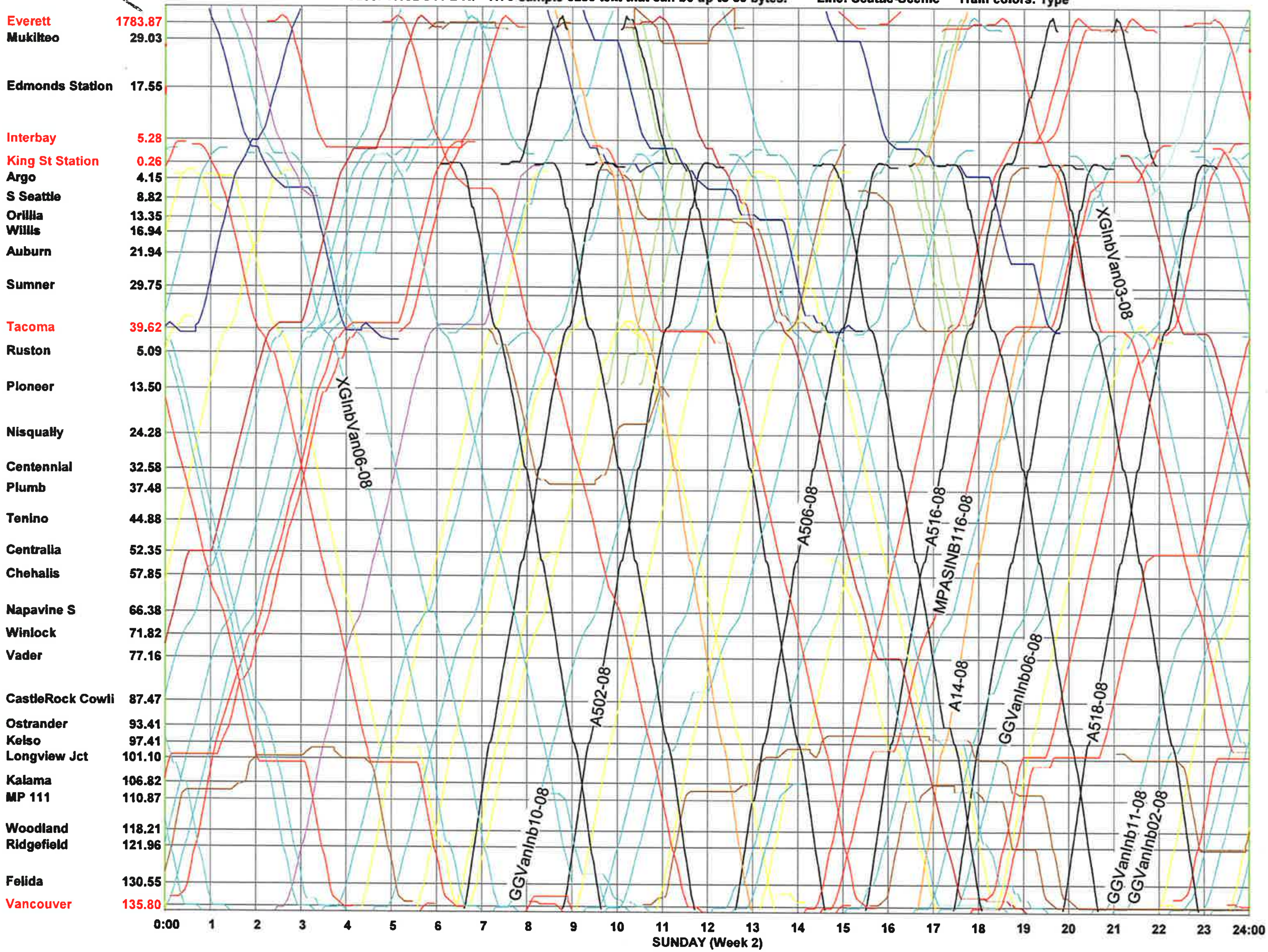
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 10:50:08

Figure 14c

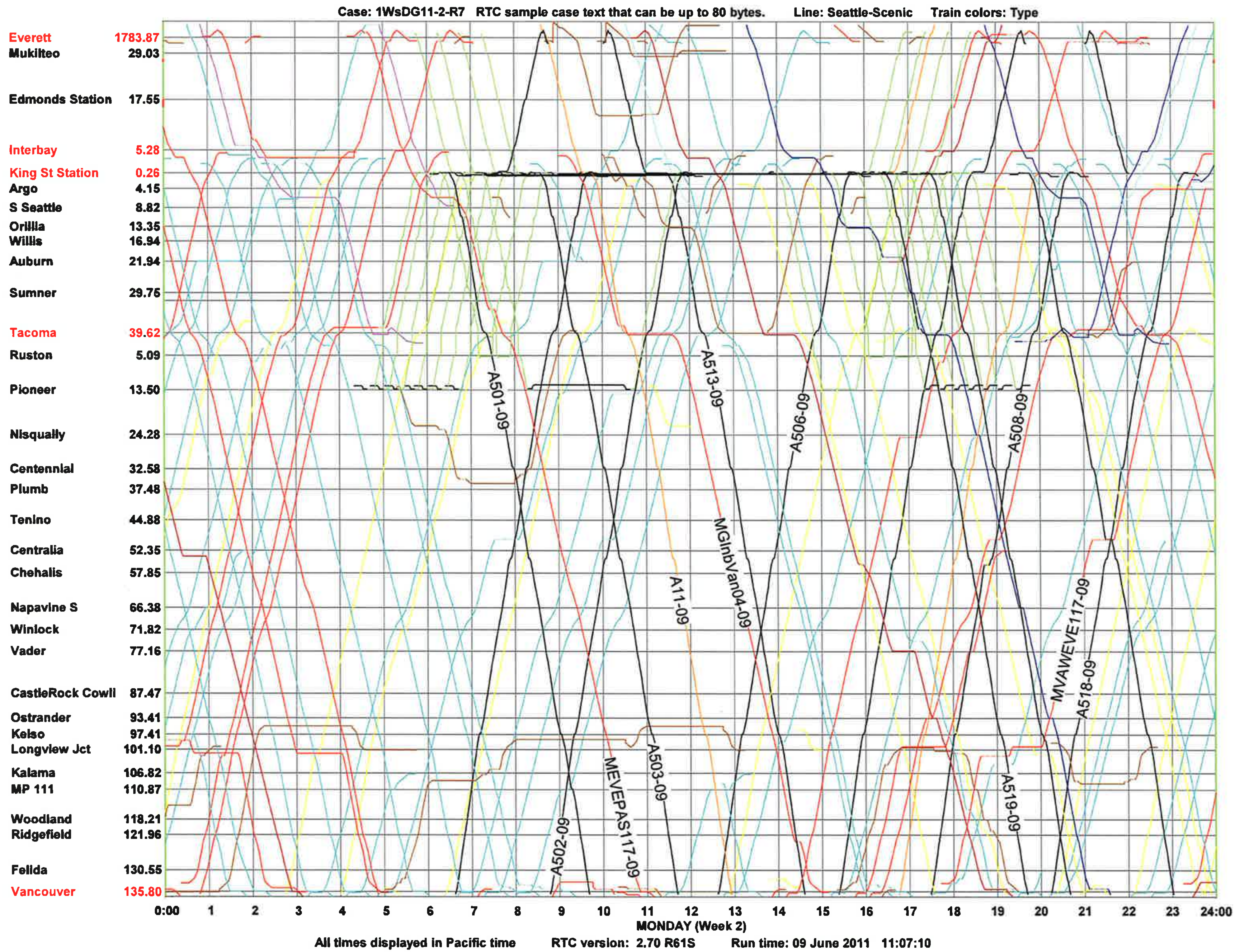
RTC Model Stringlines for BNSF Seattle and Scenic Subdivisions (Vancouver, Wash. - Seattle- Everett)

Scenario Three: Base Case + 22 Freight Trains + 2 Additional Amtrak *Cascades* Round Trips

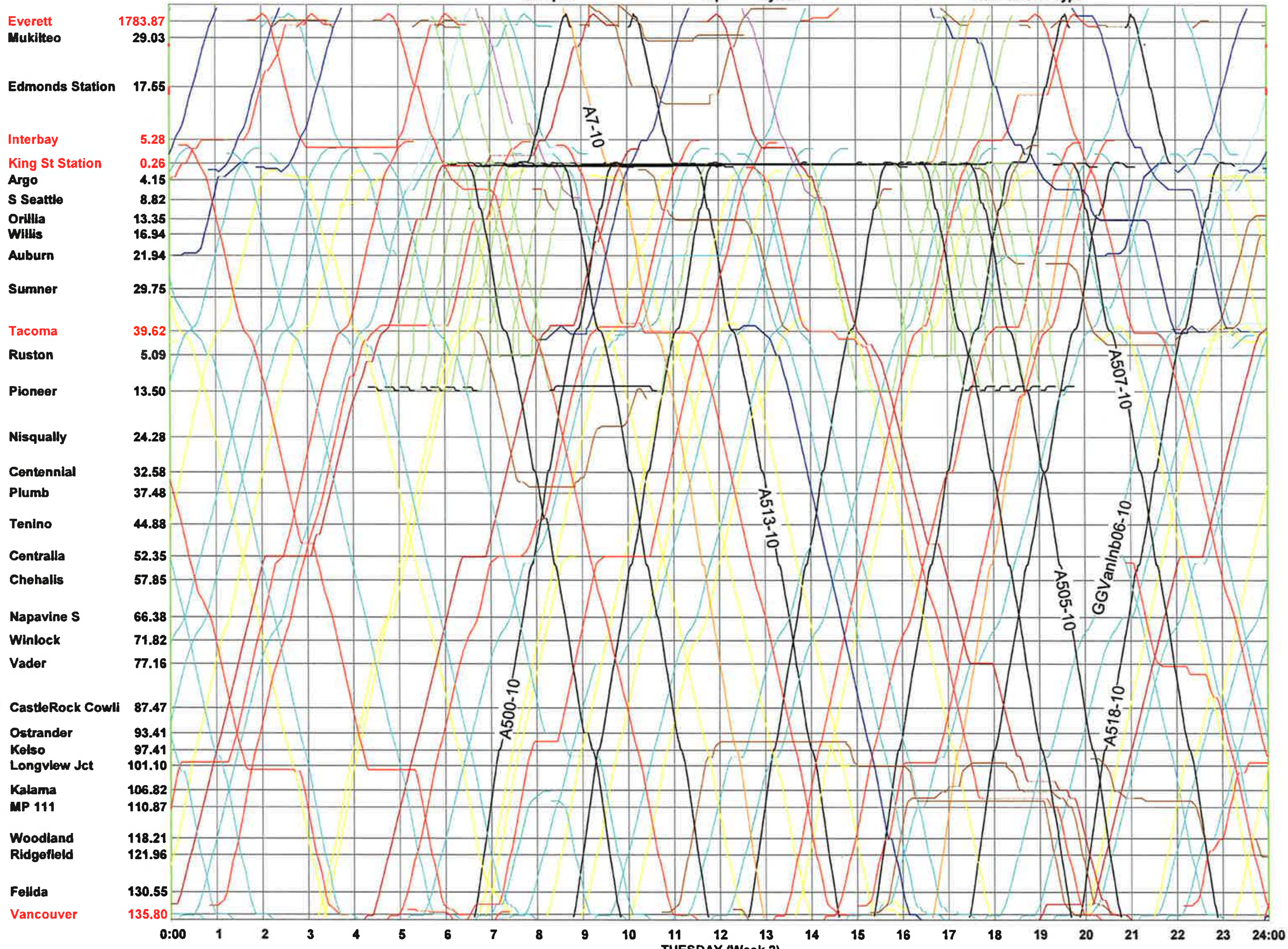
Case: 1WsDG11-2-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type



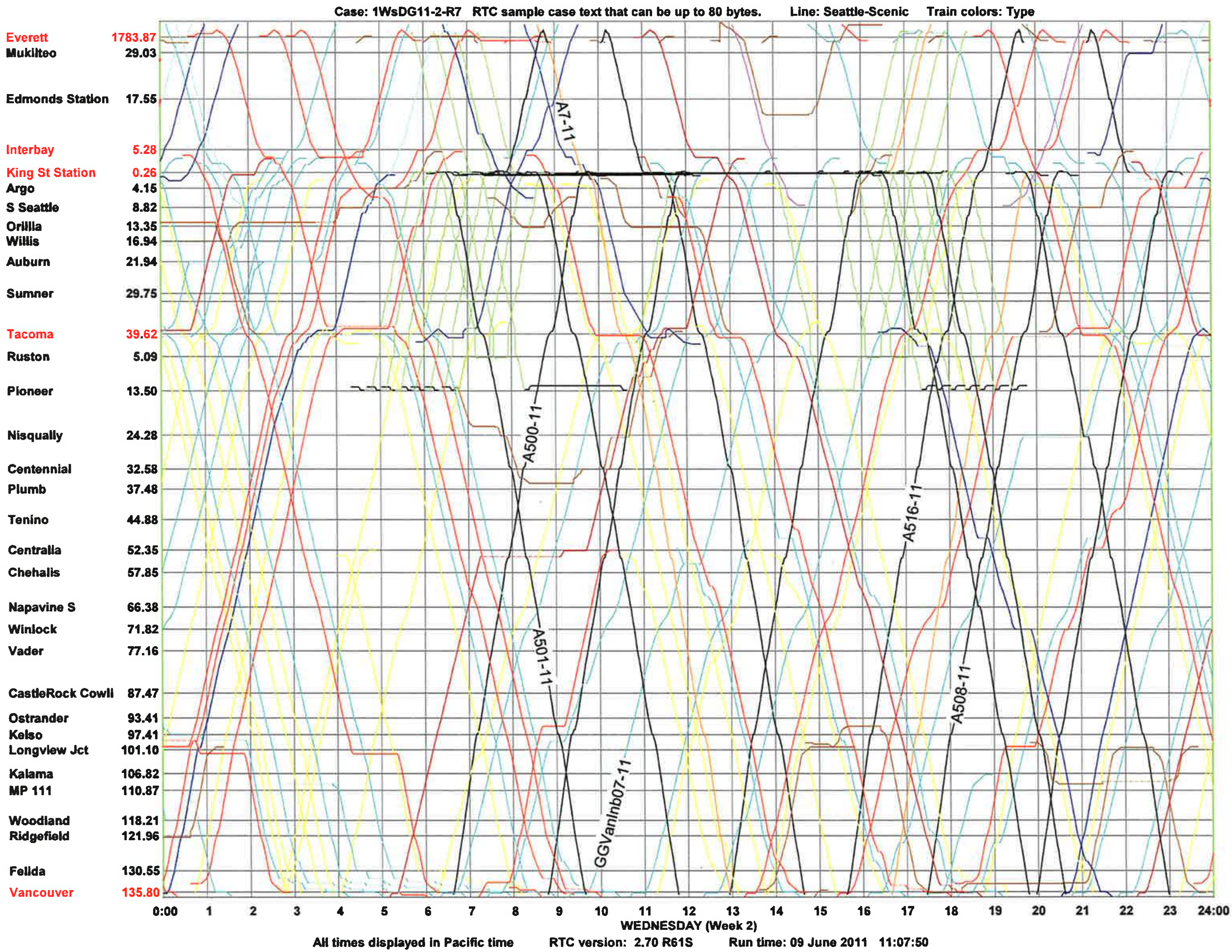
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 11:06:54


Case: 1WsDG11-2-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type
Everett 1783.87
Mukilteo 29.03
Edmonds Station 17.55
Interbay 5.28
King St Station 0.26
Argo 4.15
S Seattle 8.82
Orillia 13.35
Willis 16.94
Auburn 21.94
Sumner 29.75
Tacoma 39.62
Ruston 5.09
Pioneer 13.50
Nisqually 24.28
Centennial 32.58
Plumb 37.48
Tenino 44.88
Centralia 52.35
Chehalis 57.85
Napavine S 66.38
Winlock 71.82
Vader 77.16
CastleRock Cowll 87.47
Ostrander 93.41
Kelso 97.41
Longview Jct 101.10
Kalama 106.82
MP 111 110.87
Woodland 118.21
Ridgefield 121.96
Felida 130.55
Vancouver 135.80
A501-09
A502-09
MEVEPAS117-09
A503-09
A11-09
A513-09
MGlnbVan04-09
A506-09
A508-09
A519-09
MVAWEVE117-09
A518-09
0:00 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24:00
MONDAY (Week 2)
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 11:07:10

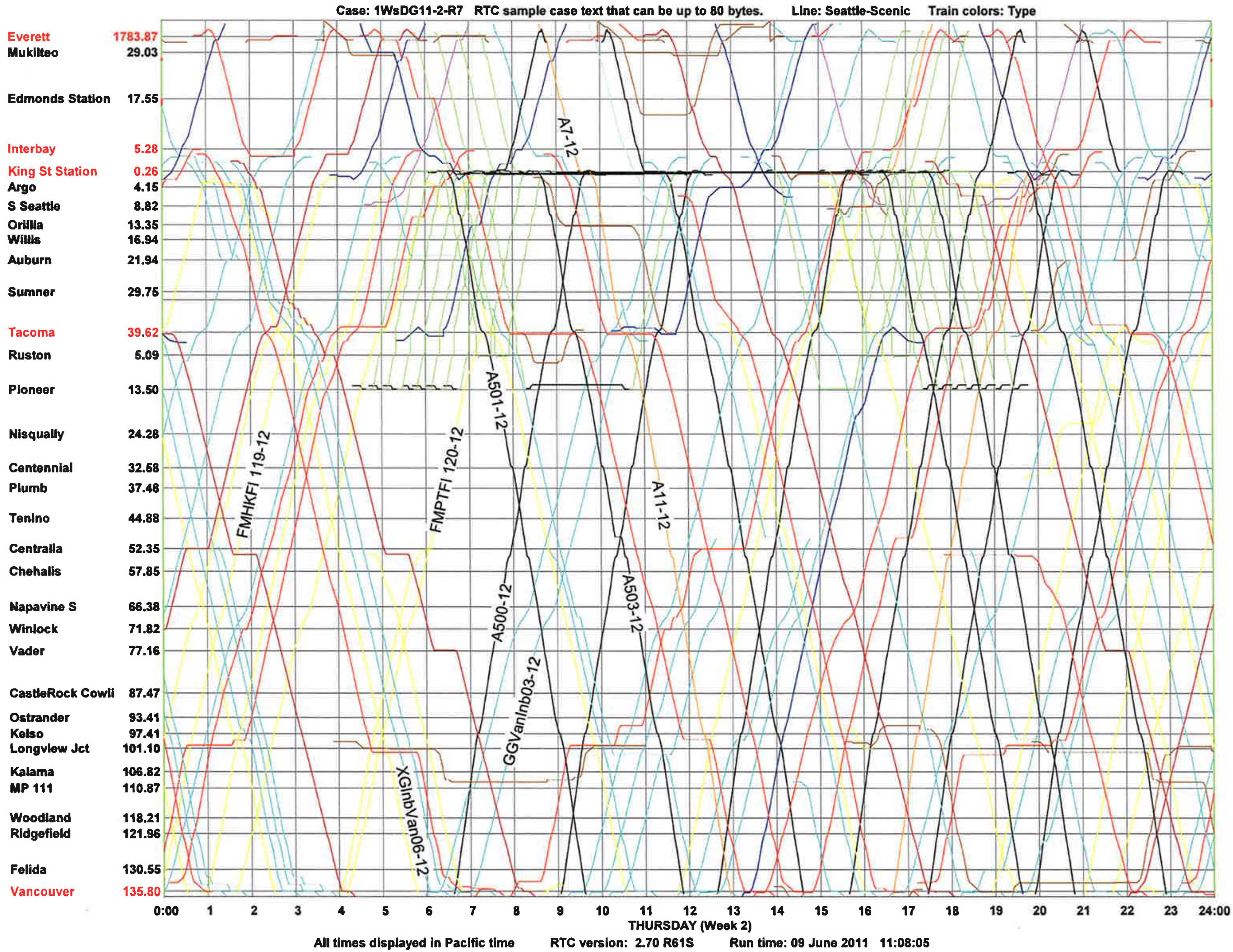
Case: 1WsDG11-2-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type



All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 11:07:29

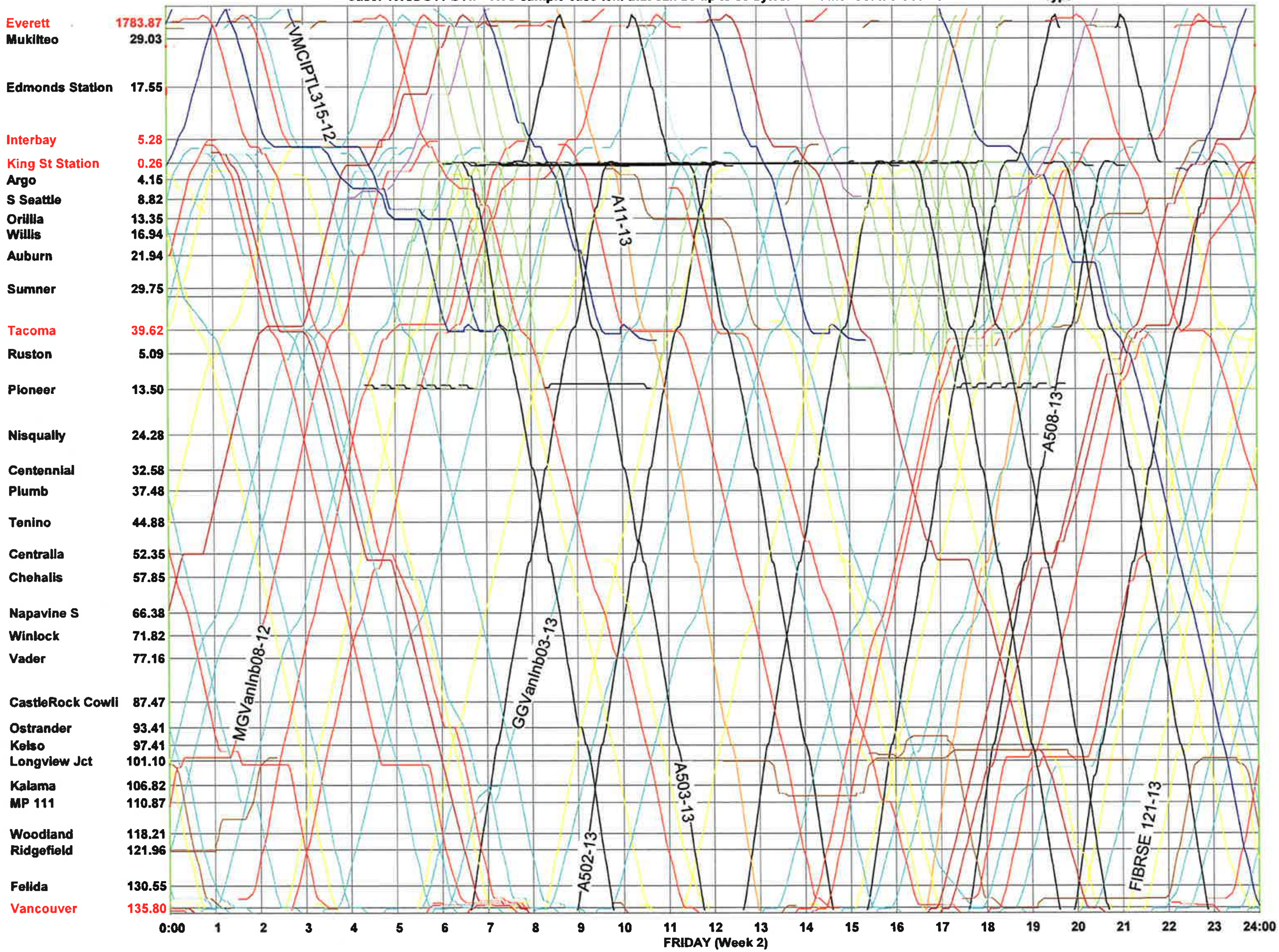


Case: 1WsDG11-2-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type
Everett 1783.87
Mukilteo 29.03
Edmonds Station 17.55
Interbay 5.28
King St Station 0.26
Argo 4.15
S Seattle 8.82
Orillia 13.35
Willis 16.94
Auburn 21.94
Sumner 29.75
Tacoma 39.62
Ruston 5.09
Pioneer 13.50
Nisqually 24.28
Centennial 32.58
Plumb 37.48
Tenino 44.88
Centralia 52.35
Chehalis 57.85
Napavine S 66.38
Winlock 71.82
Vader 77.16
CastleRock Cowll 87.47
Ostrander 93.41
Kelso 97.41
Longview Jct 101.10
Kalama 106.82
MP 111 110.87
Woodland 118.21
Ridgefield 121.96
Felida 130.55
Vancouver 135.80
A7-11
A500-11
A501-11
GGVanInb07-11
A516-11
A508-11
0:00 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24:00
WEDNESDAY (Week 2)
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 11:07:50



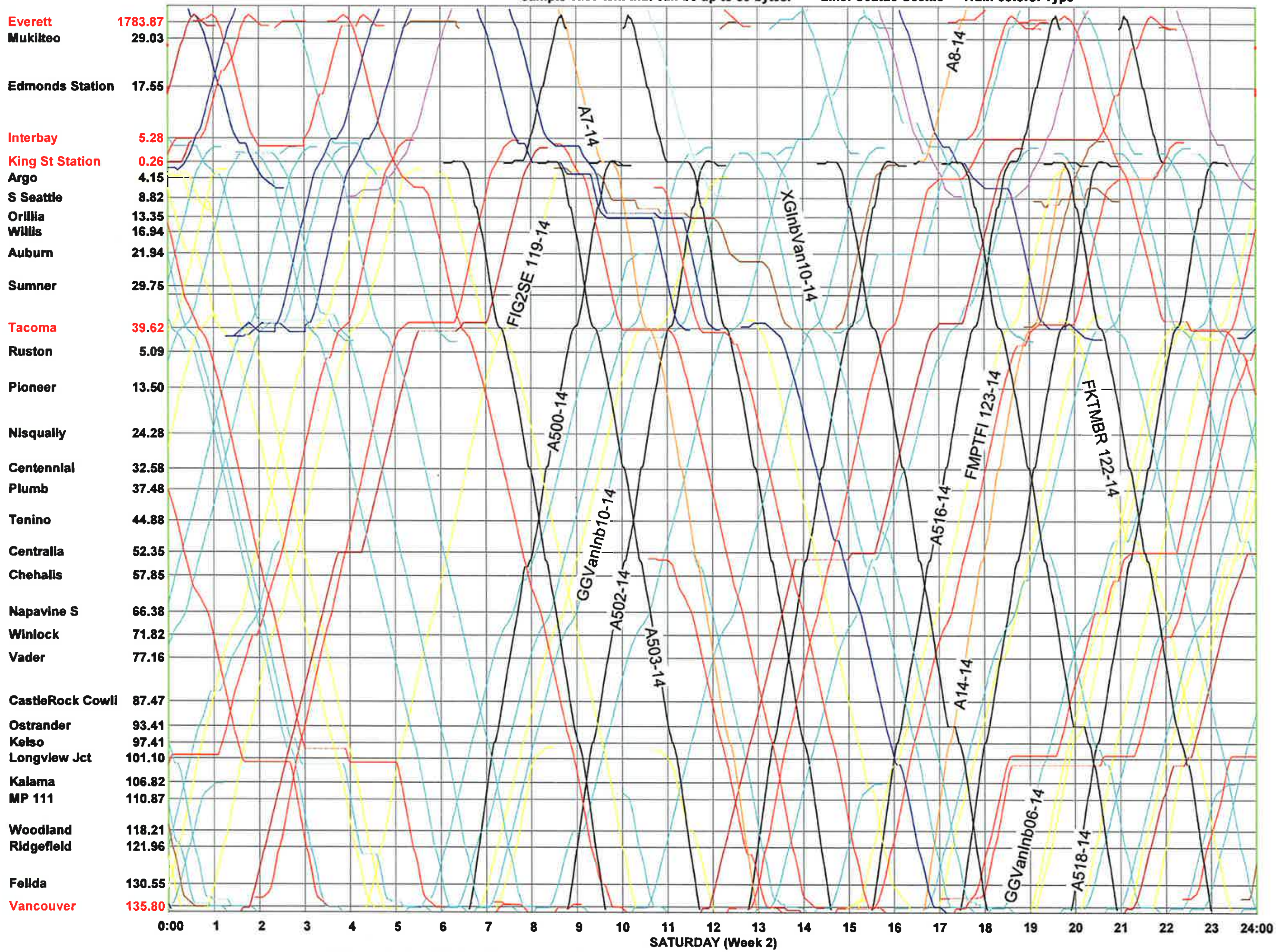
Case: 1WsDG11-2-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type
Everett 1783.87
Mukilteo 29.03
Edmonds Station 17.55
Interbay 5.28
King St Station 0.26
Argo 4.15
S Seattle 8.82
Orillia 13.35
Willis 16.94
Auburn 21.94
Sumner 29.75
Tacoma 39.62
Ruston 5.09
Pioneer 13.50
Nisqually 24.28
Centennial 32.58
Plumb 37.48
Tenino 44.88
Centralia 52.35
Chehalis 57.85
Napavine S 66.38
Winlock 71.82
Vader 77.16
CastleRock Cowli 87.47
Ostrander 93.41
Kelso 97.41
Longview Jct 101.10
Kalama 106.82
MP 111 110.87
Woodland 118.21
Ridgefield 121.96
Felida 130.55
Vancouver 135.80
A7-12
A501-12
FMHKFI 119-12
FMPTFI 120-12
A11-12
A500-12
A503-12
GGVanInb03-12
XGInbVan06-12
0:00
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24:00
THURSDAY (Week 2)
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 11:08:05

Case: 1WsDG11-2-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type



All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 11:08:26

Case: 1WsDG11-2-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type



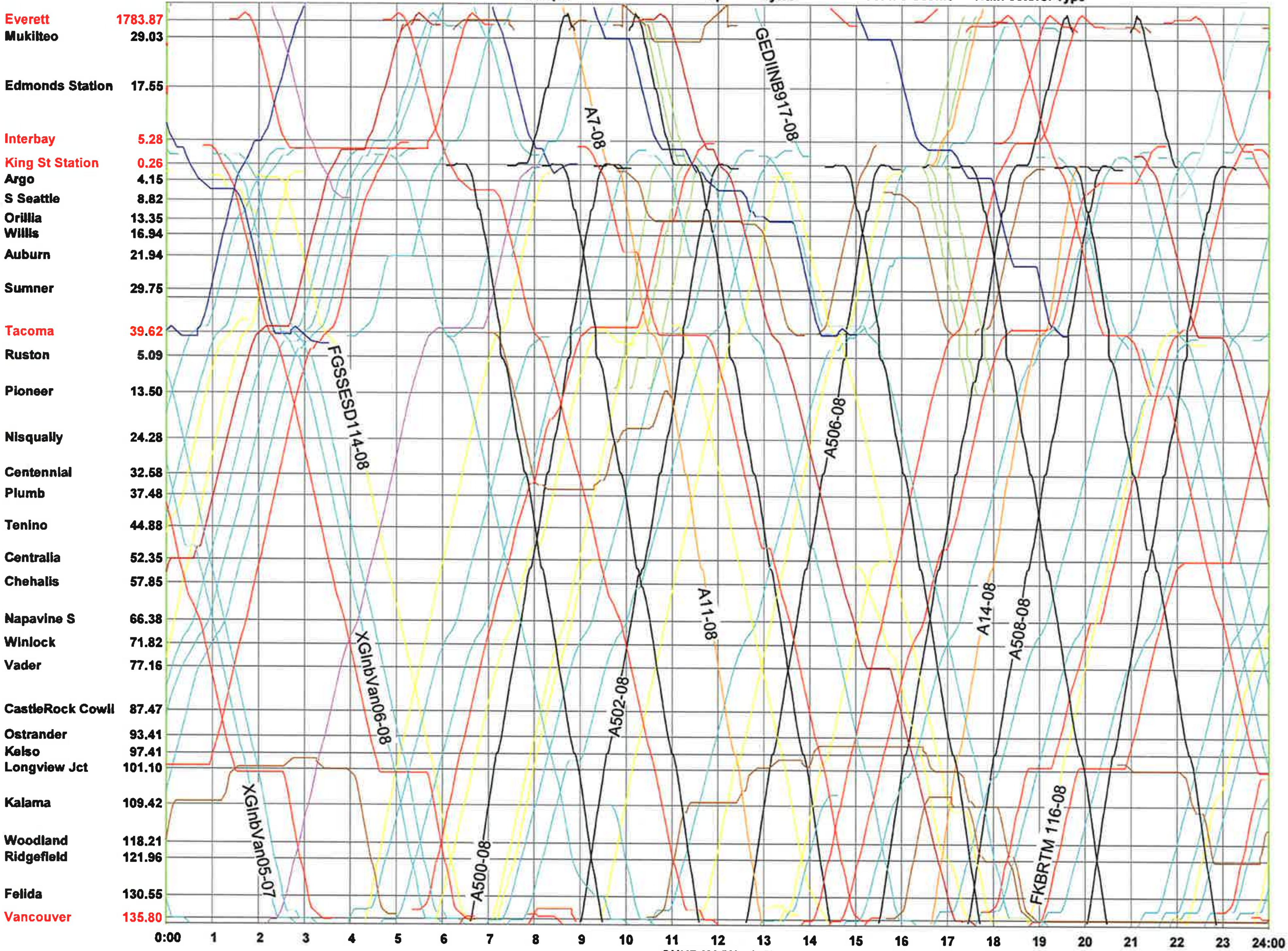
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 11:08:41

Figure 14d

RTC Model Stringlines for BNSF Seattle and Scenic Subdivisions (Vancouver, Wash. - Seattle- Everett)

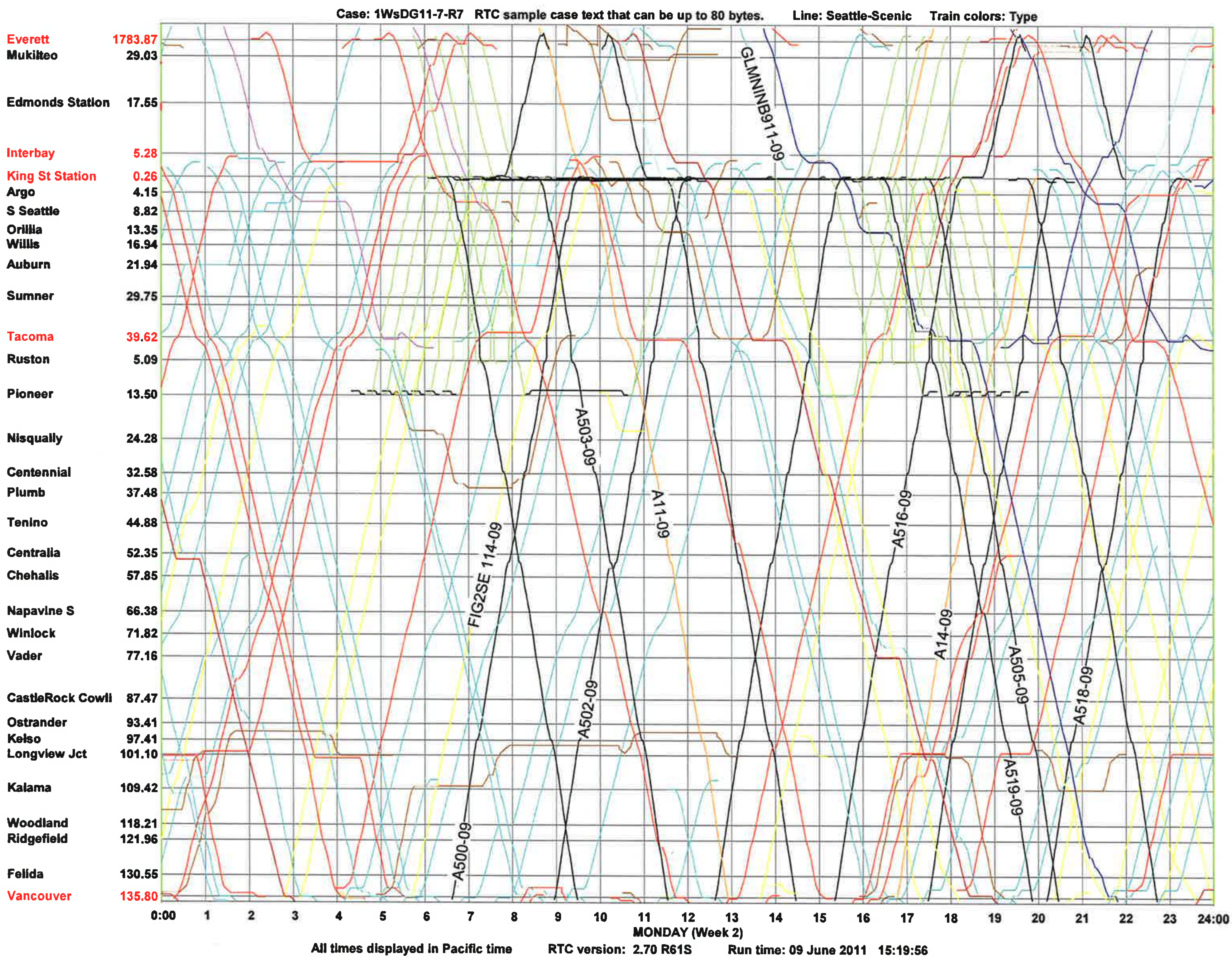
Scenario Four: Base Case + 22 Freight Trains + 2 Additional Amtrak *Cascades* Round Trips + Proposed New Infrastructure included in RTC model (Vancouver Yard Bypass, Kelso-Martin's Bluff, Point Defiance Bypass, D to M Street)

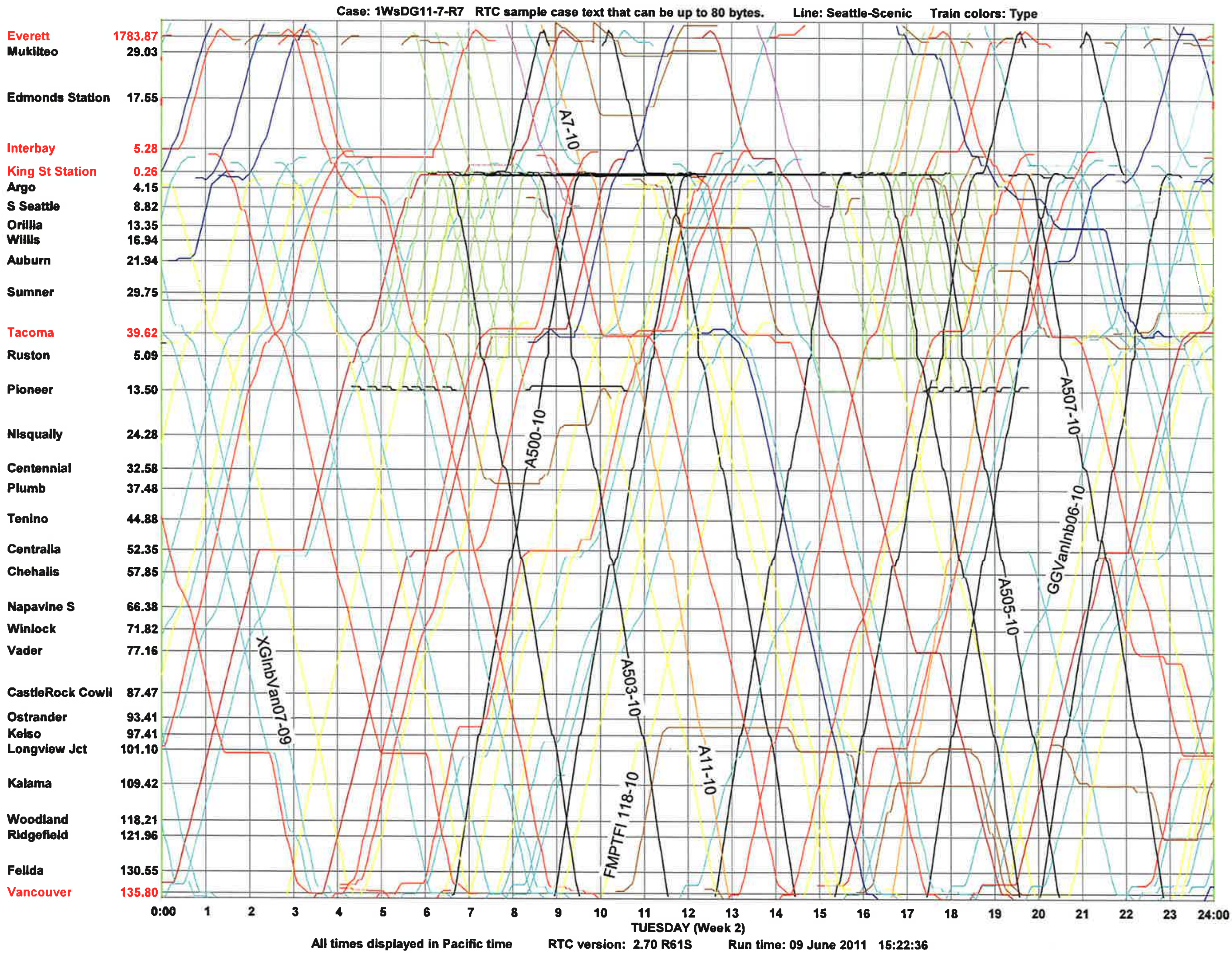
Case: 1WsDG11-7-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type



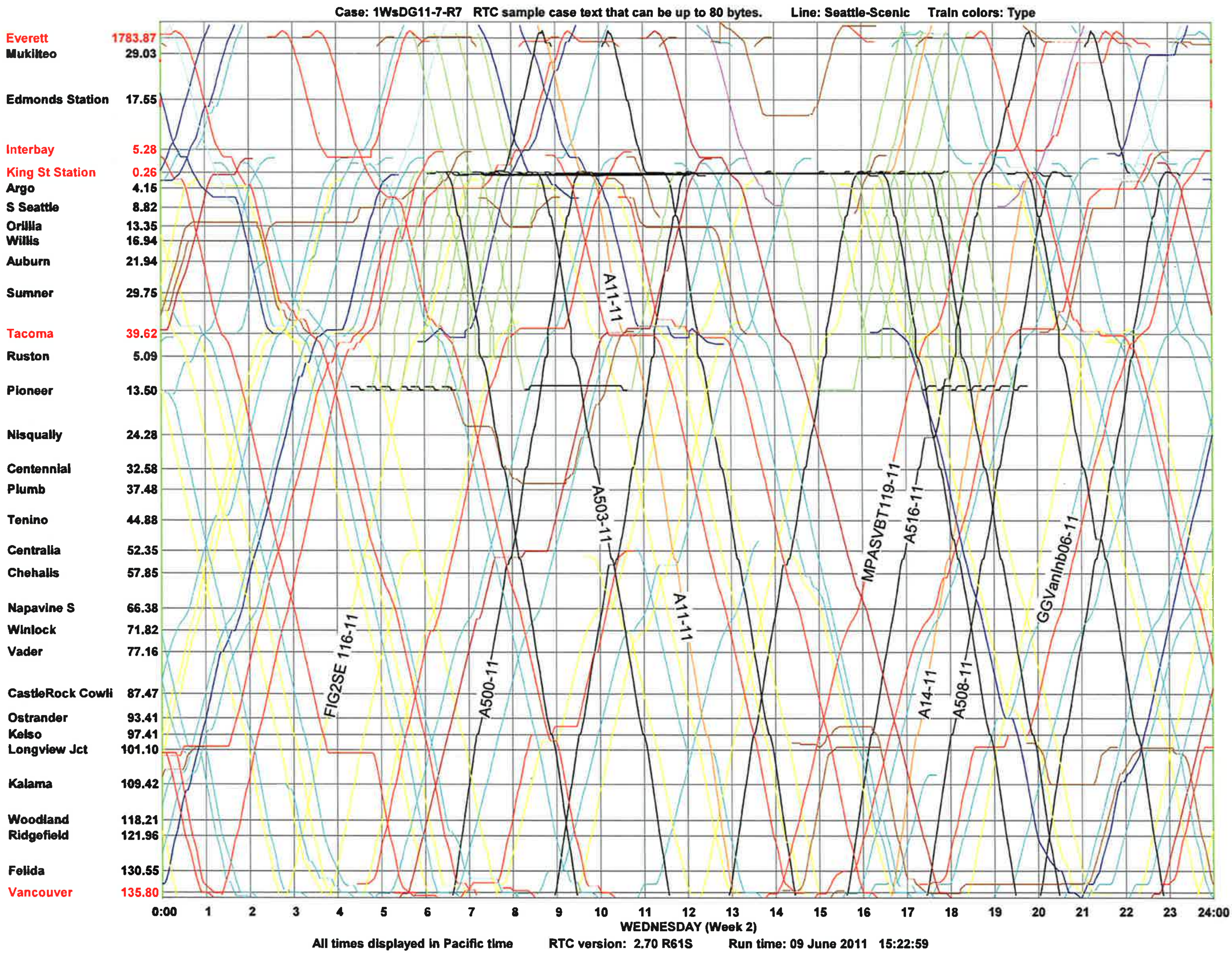
SUNDAY (Week 2)

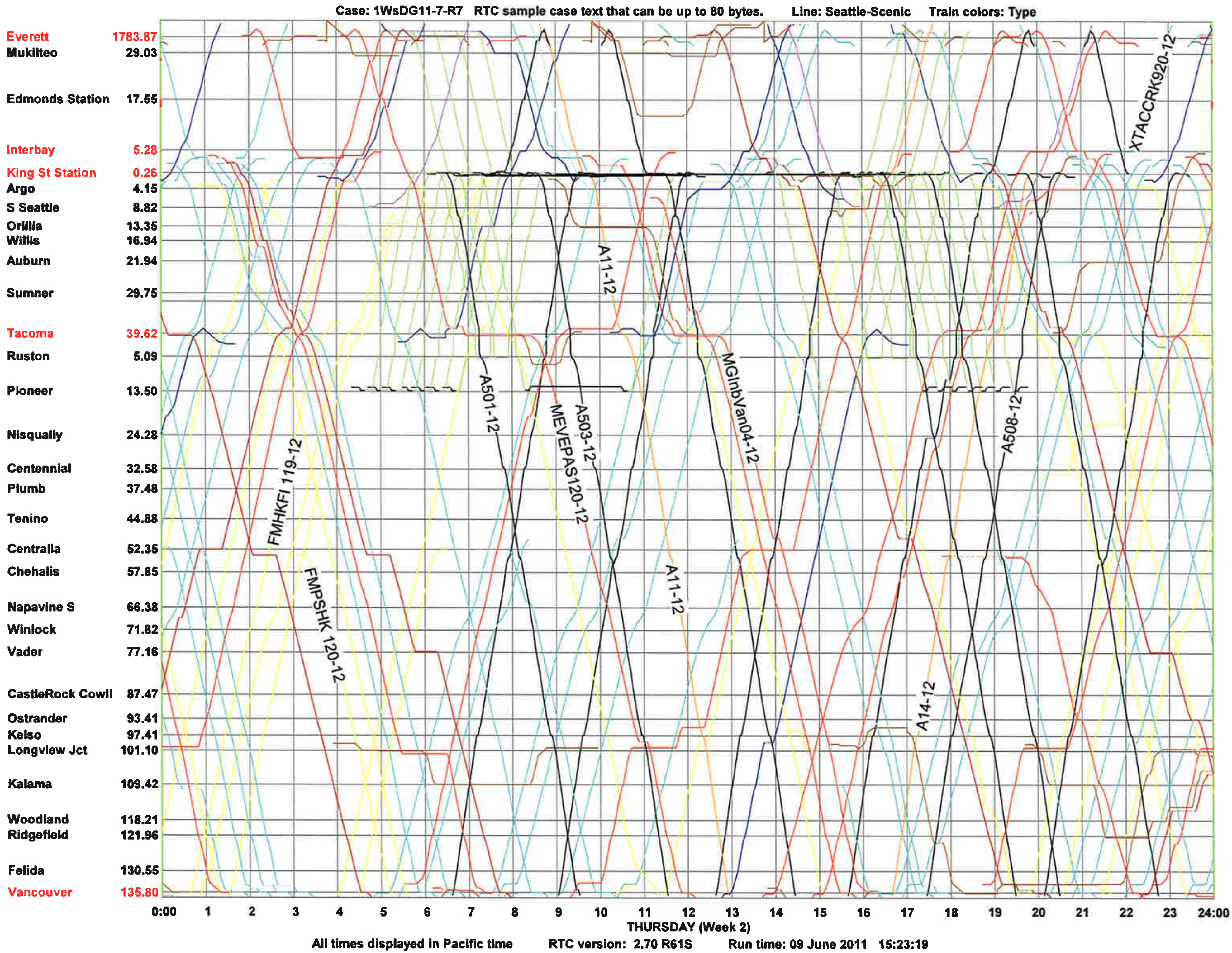
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 15:19:25

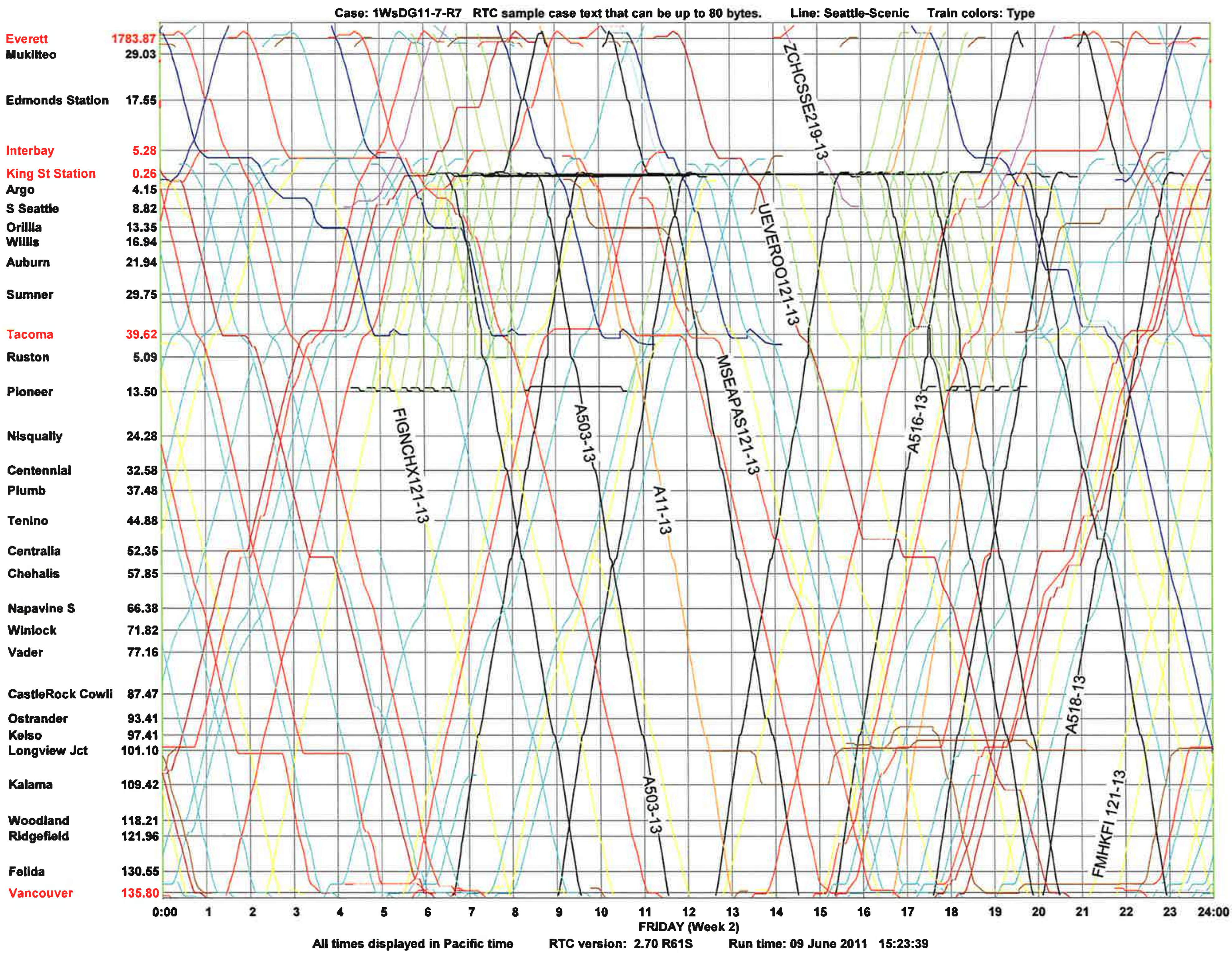

Case: 1WsDG11-7-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type
Everett 1783.87
Mukilteo 29.03
Edmonds Station 17.55
Interbay 5.28
King St Station 0.26
Argo 4.15
S Seattle 8.82
Orillia 13.35
Willis 16.94
Auburn 21.94
Sumner 29.75
Tacoma 39.62
Ruston 5.09
Pioneer 13.50
Nisqually 24.28
Centennial 32.58
Plumb 37.48
Tenino 44.88
Centralia 52.35
Chehalis 57.85
Napavine S 66.38
Winlock 71.82
Vader 77.16
CastleRock Cowli 87.47
Ostrander 93.41
Kelso 97.41
Longview Jct 101.10
Kalama 109.42
Woodland 118.21
Ridgefield 121.96
Felida 130.55
Vancouver 135.80
GLMNINB911-09
A503-09
A11-09
A516-09
FIG2SE 114-09
A14-09
A505-09
A518-09
A502-09
A519-09
A500-09
0:00 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24:00
MONDAY (Week 2)
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 15:19:56



Case: 1WsDG11-7-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type
Everett 1783.87
Mukilteo 29.03
Edmonds Station 17.55
Interbay 5.28
King St Station 0.26
Argo 4.15
S Seattle 8.82
Orillia 13.35
Willis 16.94
Auburn 21.94
Sumner 29.75
Tacoma 39.62
Ruston 5.09
Pioneer 13.50
Nisqually 24.28
Centennial 32.58
Plumb 37.48
Tenino 44.88
Centralia 52.35
Chehalis 57.85
Napavine S 66.38
Winlock 71.82
Vader 77.16
CastleRock Cowli 87.47
Ostrander 93.41
Kelso 97.41
Longview Jct 101.10
Kalama 109.42
Woodland 118.21
Ridgefield 121.96
Felida 130.55
Vancouver 135.80
A7-10
A500-10
A503-10
FMPTFI 118-10
A11-10
XGlnbVan07-09
A505-10
A507-10
GGVanInb06-10
0:00 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24:00
TUESDAY (Week 2)
All times displayed in Pacific time
RTC version: 2.70 R61S
Run time: 09 June 2011 15:22:36


Case: 1WsDG11-7-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type
Everett 1783.87
Mukilteo 29.03
Edmonds Station 17.55
Interbay 5.28
King St Station 0.26
Argo 4.15
S Seattle 8.82
Orillia 13.35
Willis 16.94
Auburn 21.94
Sumner 29.75
Tacoma 39.62
Ruston 5.09
Pioneer 13.50
Nisqually 24.28
Centennial 32.58
Plumb 37.48
Tenino 44.88
Centralia 52.35
Chehalis 57.85
Napavine S 66.38
Winlock 71.82
Vader 77.16
CastleRock Cowli 87.47
Ostrander 93.41
Kelso 97.41
Longview Jct 101.10
Kalama 109.42
Woodland 118.21
Ridgefield 121.96
Felida 130.55
Vancouver 135.80
FIG2SE 116-11
A500-11
A503-11
A11-11
A11-11
MPASVBT119-11
A516-11
A14-11
A508-11
GGVanInb06-11
0:00 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24:00
WEDNESDAY (Week 2)
All times displayed in Pacific time
RTC version: 2.70 R61S
Run time: 09 June 2011 15:22:59


Case: 1WsDG11-7-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type
Everett 1783.87
Mukilteo 29.03
Edmonds Station 17.55
Interbay 5.28
King St Station 0.26
Argo 4.15
S Seattle 8.82
Orillia 13.35
Willis 16.94
Auburn 21.94
Sumner 29.75
Tacoma 39.62
Ruston 5.09
Pioneer 13.50
Nisqually 24.28
Centennial 32.58
Plumb 37.48
Tenino 44.88
Centralia 52.35
Chehalis 57.85
Napavine S 66.38
Winlock 71.82
Vader 77.16
CastleRock Cowli 87.47
Ostrander 93.41
Kelso 97.41
Longview Jct 101.10
Kalama 109.42
Woodland 118.21
Ridgefield 121.96
Felida 130.55
Vancouver 135.80
FMHKFI 119-12
FMPSHK 120-12
A501-12
MEVEPAS120-12
A503-12
A11-12
A11-12
MGinbVan04-12
A14-12
A508-12
XTACCRK920-12
0:00 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24:00
THURSDAY (Week 2)
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 15:23:19


Case: 1WsDG11-7-R7 RTC sample case text that can be up to 80 bytes. Line: Seattle-Scenic Train colors: Type
Everett 1783.87
Mukilteo 29.03
Edmonds Station 17.55
Interbay 5.28
King St Station 0.26
Argo 4.15
S Seattle 8.82
Orillia 13.35
Willis 16.94
Auburn 21.94
Sumner 29.75
Tacoma 39.62
Ruston 5.09
Pioneer 13.50
Nisqually 24.28
Centennial 32.58
Plumb 37.48
Tenino 44.88
Centralia 52.35
Chehalis 57.85
Napavine S 66.38
Winlock 71.82
Vader 77.16
CastleRock Cowli 87.47
Ostrander 93.41
Kelso 97.41
Longview Jct 101.10
Kalama 109.42
Woodland 118.21
Ridgefield 121.96
Felida 130.55
Vancouver 135.80
ZCHCSSE219-13
UEVEROO121-13
MSEAPAS121-13
FIGNCHX121-13
A503-13
A11-13
A503-13
A516-13
A518-13
FMHKFI 121-13
0:00 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24:00
FRIDAY (Week 2)
All times displayed in Pacific time RTC version: 2.70 R61S Run time: 09 June 2011 15:23:39

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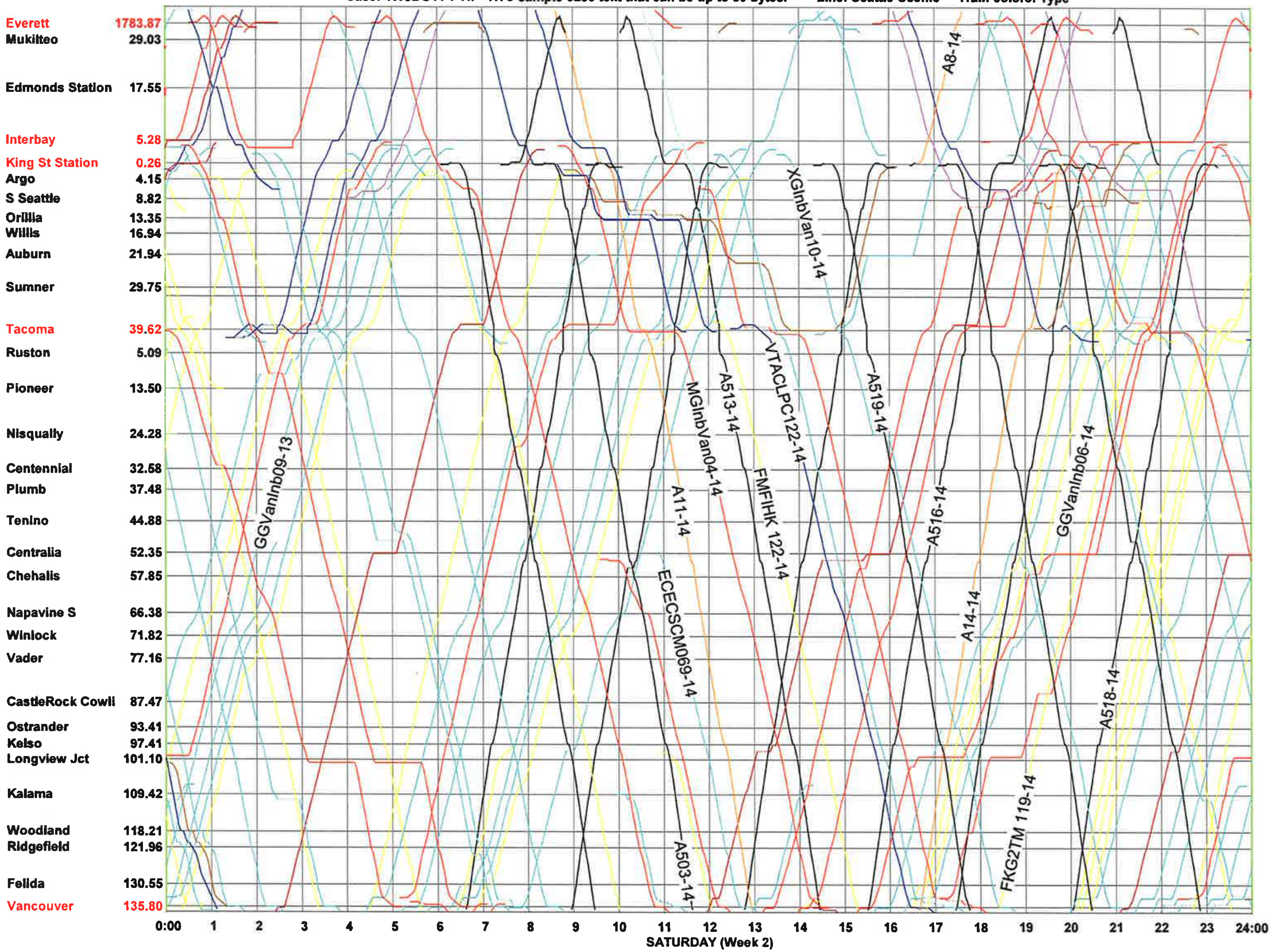

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Appendix D

Amtrak Cascades Market Analysis and Ridership Forecast

Amtrak Cascades Intercity Passenger Train Service

Since 1994 the Washington State Department of Transportation (WSDOT) has partnered with Amtrak, the state of Oregon, the province of British Columbia, the railroads, and others to provide fast, reliable, and more frequent intercity passenger rail service along the 466-mile Pacific Northwest Rail Corridor (PNWRC). As one of 11 federally designated corridors, the PNWRC extends from Eugene, Oregon to Vancouver, British Columbia (B.C.). The service, known as the Amtrak Cascades, provides travelers with a viable transportation alternative for their intercity trips.

Following the legislature's directive, WSDOT developed and published the *Long-Range Plan for Amtrak Cascades* (2006). The incremental approach, outlined in the plan, would allow the state of Washington to add faster, more frequent Amtrak Cascades service based on market demand, partnership investment, and legislative authorization. In order to ensure that public funds are expended in the most efficient manner, construction projects were designed and grouped as "service blocks" to deliver incremental services. This strategy allowed projects to be constructed in a logical sequence to meet system performance objectives while providing flexibility for funding. The Amtrak Cascades program is being implemented in stages, using a step-by-step approach for development. Service is added over time, based on available state and federal funding and market demand.

The *Amtrak Cascades Mid-Range Plan* (2008) fulfilled a legislative mandate. It identified and developed implementable options that outlined concrete steps to achieve incremental Amtrak Cascades services for the next eight years. The Mid-Range Plan conducted ridership forecasts, performed cost-benefit analyses, and assessed economic impacts of each of the proposed investment options that can be completed between 2009 and 2017. The Mid-Range Plan provided investment scalability for various funding possibilities in terms of engineering feasibility.

Pacific Northwest Rail Corridor Program

The American Recovery and Reinvestment Act (ARRA) provides new opportunities to Amtrak Cascades to implement such incremental "service block" strategies envisioned by the PNWRC policymakers and planners. The Federal Railroad Administration (FRA) published guidance detailing the application requirements and procedures for obtaining funding for High-Speed Intercity Passenger Rail (HSIPR) projects.

WSDOT submitted applications and was awarded $751 million.

The service outcomes of the PNWRC program described in WSDOT's application for funding under the HSIPR program are:

- Ten-minute reduction in the run time shown in the public schedule for the Amtrak Cascades service operating between Seattle, WA and Portland, OR.
- Two additional daily round-trip Amtrak Cascades corridor service intercity passenger trains operating between Seattle, WA and Portland, OR.
- Improvement in Amtrak Cascades service reliability to 88 percent.

Amtrak Cascades Passenger Rail Market

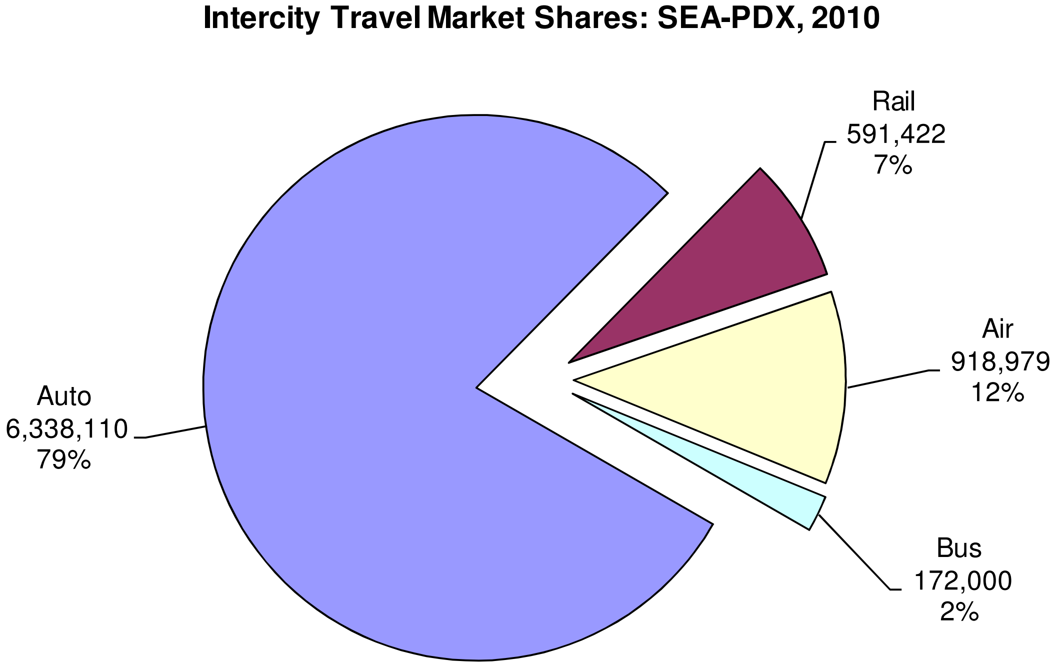
Amtrak intercity passenger service in the state of Washington is operated over the BNSF Railway Company (BNSF) main line. Amtrak intercity passenger service in the state of Oregon is operated over the Union Pacific Railroad Company (UP) main line. The alignment roughly parallels Interstate 5 (I-5) and runs through western Washington and western Oregon. A number of cities and towns are traversed by the rail line, including Vancouver (WA), Kelso/Longview, Centralia, Olympia/Lacey, Tacoma, Tukwila, Seattle, Edmonds, Everett, Stanwood, Mt. Vernon, and Bellingham. In Oregon, the alignment travels through Portland, Oregon City, Salem, Albany, and Eugene. The alignment also connects with Vancouver, B.C. in Canada.

The corridor is diversely populated and contains a mixture of farmlands, small communities, natural habitats, and large metropolitan areas. Corridor development is a cooperative effort between the states of Oregon and Washington, BNSF, UP, Amtrak, Sound Transit, the Province of British Columbia, ports, local communities, passengers, and the general public.

Intercity Transportation Demand Analysis

Transportation demand and transportation use by mode in the service corridor has been studied by WSDOT and documented in Washington's 2010 application for HSIPR Program funds. Figure 1 shows the latest intercity annual total trips in the Seattle to Portland corridor, for the year 2010. Air trips reflect scheduled non-stop flights between Seattle and Portland. Bus trips are based upon the capacity of scheduled buses. Auto figures are based upon the Long-Range Plan market size 2002 estimates updated to 2010 from I-5 traffic volumes comparisons between 2002 and 2010.

Figure 1: Total Trips in the Seattle-Portland Corridor, for Year 2010



Sources: *Data derived from WSDOT Amtrak Cascades Ridership Database; Amtrak Cascades Long Range Plan, Statewide Travel & Collision Data Office, WSDOT; USDOT T-100 Domestic Segment (U.S. Carriers), On-Flight Market Passengers Enplaned by Origin for 2010; WSDOT VMT 2010 forecast; Greyhound Bus Schedules.*

Ridership History

Ridership for Amtrak Cascades on the PNWRC has been increasing. The following paragraphs highlight the changes in ridership in the past, present, and future.

In 1993 Amtrak offered only one daily round trip between Seattle and Portland. Washington State saw the need and demand for more passenger rail service in the PNWRC, and in 1994 expanded service by introducing passenger trains sponsored by Washington State. This new Washington-sponsored train service first leased a train set from Renfe Talgo of America (Talgo) to provide a second daily regional round trip between Seattle and Portland. In 1995 Oregon sponsored a state-funded train and one of two existing Seattle to Portland daily round trips was extended to Eugene, Oregon. Also in 1995, after a 14-year absence, service was restored between Seattle and Vancouver, B.C. In 1996 Washington leased a second Talgo train to support service. The Amtrak Cascades brand debuted in 1999 and WSDOT expanded Seattle to Portland service by offering a third daily round trip.

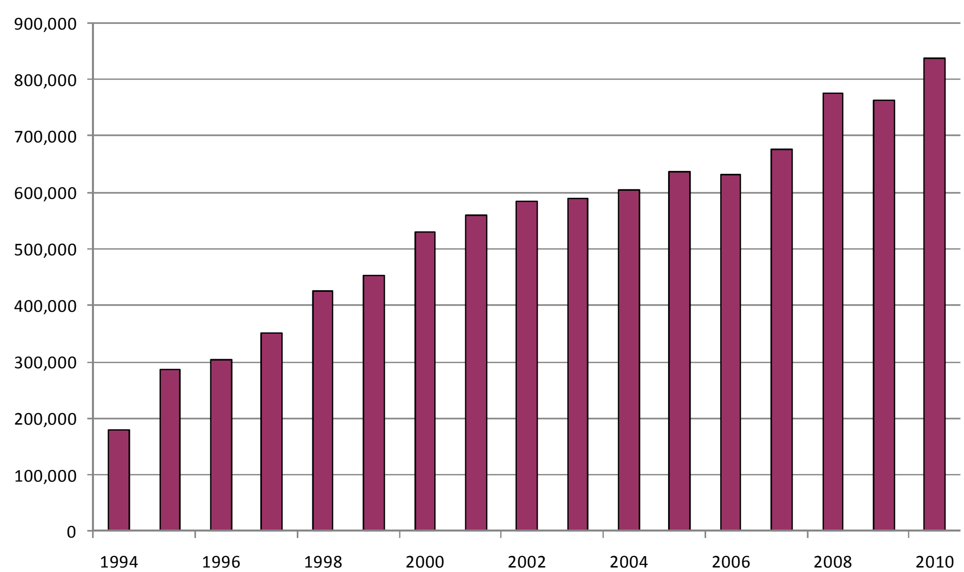
WSDOT signed a lease/purchase agreement for two train sets with Talgo in 1995, and took delivery in late 1998-early 1999. In late 2003, Washington State purchased the train set that the state of Oregon was leasing from Amtrak. In 2011, there were five train sets in the Amtrak Cascades service. Washington State owns three train sets and Amtrak owns two. The state of Oregon purchased two train sets in 2010. The train sets will be placed into service on the PNWRC in 2012.

In 2000, a second daily Seattle to Portland train was extended to Eugene, sponsored by Oregon. A fourth daily Seattle to Portland regional round trip started in July 2006, which completed the extent of current Amtrak Cascades regional service between Seattle and Portland. In August 2009, a second daily round trip was extended from Bellingham to Vancouver, B.C.

The original station stops for the Amtrak Cascades service were located in the following cities: Seattle, Tacoma, Olympia/Lacey, Centralia, Kelso/Longview, Vancouver (WA), Portland, Salem, Albany, and Eugene. As ridership increased, new stops were added over the years: Vancouver, B.C., Bellingham, Mount Vernon, Everett, Edmonds, in 1995; Tukwila, WA in 2001; Oregon City, OR in 2004; and Stanwood, WA in 2009.

Ridership has risen steadily on the PNWRC between Eugene, OR and Vancouver, B.C., from less than 200,000 annual passengers in 1994 to 838,251 passengers in 2010. The change over time of the Amtrak Cascades annual ridership is shown in Figure 2.

Figure 2: Amtrak *Cascades* Annual Ridership
1994 to 2010



Source: *WSDOT State Rail and Marine Office: Amtrak Cascades Ridership and Revenue*

Since 1994, when Washington began actively supporting Amtrak service, consumers have responded to the increased frequency of daily train service. In every case when or where the supply of passenger train capacity increased, higher ridership has quickly followed. Ridership increases are most pronounced in the Seattle to Portland corridor, now that it has four daily Amtrak Cascades regional round trips.

Ridership Distribution

Public use of Amtrak Cascades is also measured by station on-offs, which measures passenger volumes per station. This measurement is determined by counting the number of passengers who get on and off trains at each station along the PNWRC. Station volumes can assist planners and businesses in determining local train station activity. This knowledge can support greater connectivity with bus systems and other transportation modes. It can also be of help in land use planning for residential and business expansion.

Station on-offs provide a good measurement of the distribution of ridership along the rail corridor. Amtrak Cascades service currently has 18 station stops. In 1995, Amtrak Cascades stopped at 15 stations, including Vancouver, B.C. Three station stops have been added since then, Tukwila, WA opened in 2001, followed by Oregon City, OR in 2004, and Stanwood, WA in 2009. Restoration of older stations and building of new stations in more strategic locations led to greater volumes of passengers at stations. For passengers traveling between major cities (e.g., Seattle and Portland), having all trains stop at all stations increases travel time. Future consideration should be given to adding express trains between major cities. Total station on-offs for Amtrak Cascades in 2010 are listed from north to south in Figure 3. Nearly six out of every ten passengers begin or end their train travel at either the Seattle or Portland stations. These two cities serve as hubs for north and south traffic from each station and as beginning or end points for the four daily Seattle to Portland round trips.

Figure 3: Amtrak *Cascades* Station On-Offs: 2010

Stations	Number	Percentage
Vancouver, B.C.	***138,578***	***8.27%***
Washington Stations		
Bellingham	62,562	3.73%
Mt. Vernon	18,662	1.11%
Stanwood	4,638	0.28%
Everett	24,108	1.44%
Edmonds	23,114	1.38%
Seattle	481,192	28.70%
Tukwila	24,892	1.48%
Tacoma	94,437	5.63%
Olympia/Lacey	48,141	2.87%
Centralia	18,472	1.10%
Kelso/Longview	23,962	1.43%
Vancouver	75,303	4.49%
ST Transfer Passengers	1,382	4.15%
Sum	***900,865***	***53.73%***
Oregon Stations		
Portland	471,163	28.10%
Oregon City	8,975	0.54%
Salem	39,976	2.38%
Albany	23,417	1.40%
Eugene	60,232	3.59%
Sum	***603,763***	***36.01%***
Unidentified	33,296	1.99%
Grand Total	**1,676,502**	**100.00%**

Source: *WSDOT State Rail and Marine Office*

Ridership Profile

Passenger demographics are important in determining characteristics of current passengers and potential growth of additional passengers. Surveys, periodically conducted by Amtrak, collect national and regional data to provide updated information on Amtrak Cascades. Current demographics of riders have been identified for targeting advertising campaigns:

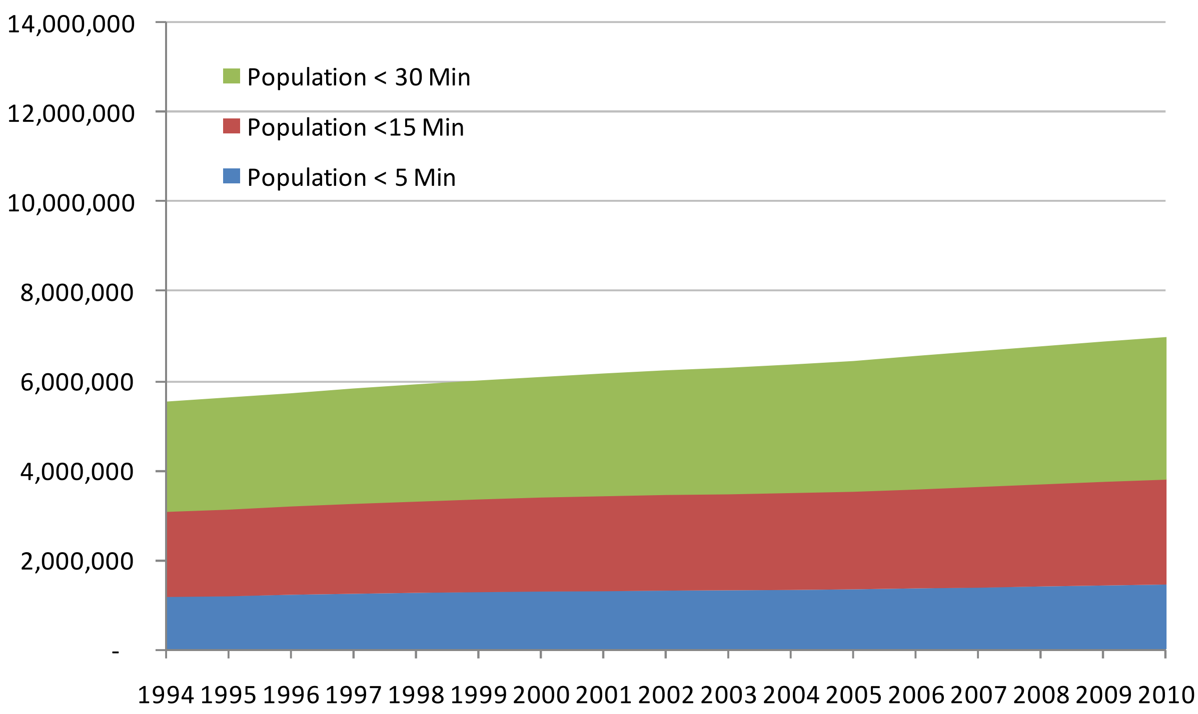
- Adults 25 to 54.
- Household income $50,000+.
- Slightly skewed female (60 percent).
- Employed (52 percent full time, 12 percent part time).
- Educated (54 percent college graduate, 31 percent some college).
- Travels an average of seven one-way trips along the I-5 corridor per year, for business or leisure.

Approximately 80 percent of passengers are riding Amtrak Cascades for leisure. Ridership peaks during Friday, Saturday, and Sunday; and seasonally in the summer months and during the winter holidays. Attracting business travelers, especially those willing to pay higher fare tickets, is essential for increasing demand for current capacity and proposed capacity expansion. Providing frequent and reliable service with flexible timetables is important in attracting business customers.

Ridership Growth

Ridership has grown over time, in part, because of underlying demographic characteristics of potential rail passengers. Population density and proximity to Amtrak stations is important in determining ridership growth. As of 2010, more than six million people reside within 30 minutes of Oregon and Washington Amtrak Cascades stations, (Figure 4). Employment opportunities and income levels of the same nearby populations are also important.

Figure 4: Population surrounding Amtrak *Cascades* Stations Defined by Round-Trip Driving Time

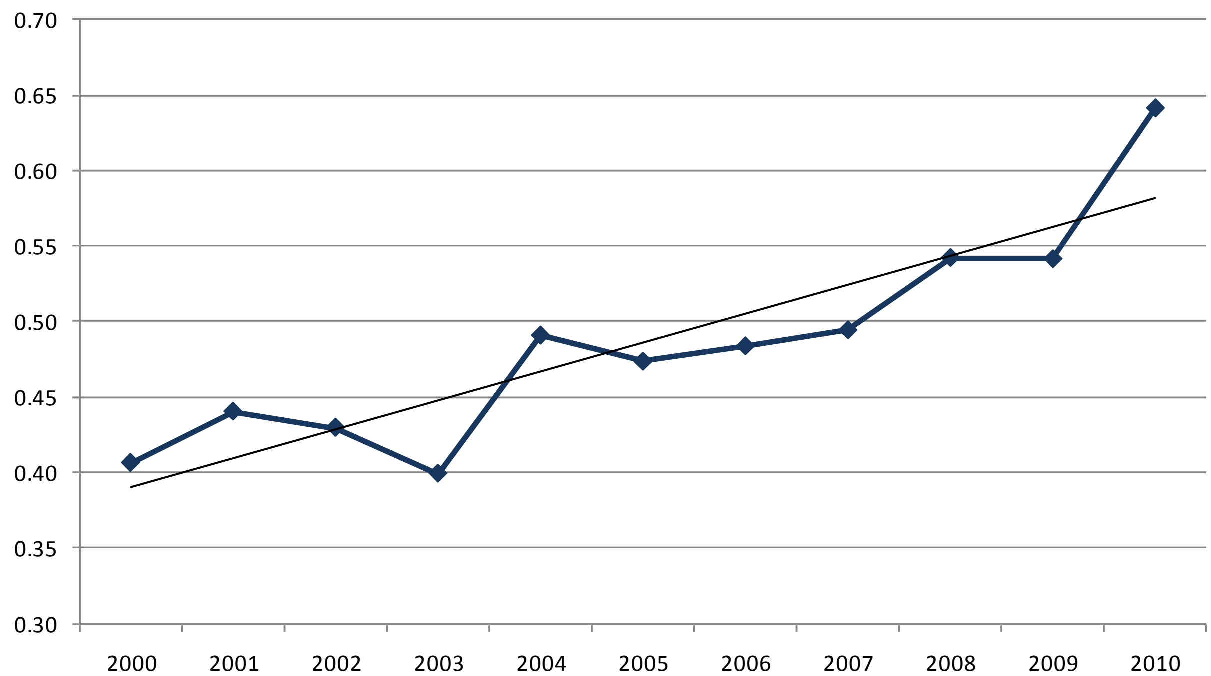


Source: *WSDOT State Rail and Marine Office*

Greater capacity in the number of daily trips between stations is instrumental in increasing demand for passenger rail service. More daily trips expand the daily timetable, attracting more customers who may find an earlier or later travel time more attractive, especially for taking day trips. Business travelers especially respond to more flexibility and choices.

Passengers are sensitive to ticket pricing. Amtrak offers four categories of ticket prices. Similar to airlines, prices rise as the trains fill up. Historically when additional trips were added to the Seattle to Portland segment, ridership responded quickly. More seats were available per day, which drove down ticket prices, as more seats were available at a lower price. Saving money can be a great incentive for switching to other travel times. In order to sustain Amtrak Cascades service, Washington State continues to subsidize the operation and make the price competitive. This strategy works: as more riders increase over time, the farebox recovery increases (Figure 5).

Figure 5: Amtrak *Cascades* Farebox Recovery: FFY2000 to FFY2010



Source: *WSDOT State Rail and Marine Office*

Higher costs for competing transportation modes also increase growth of ridership. Higher gasoline prices for automobile travel have been a big contributing factor for higher ridership, especially between 2007-2010. Nationwide, more highways and bridges are charging tolls, which add an additional cost to automobile travel. A new bridge, being planned for the I-5 crossing of the Columbia River between Washington and Oregon, is considering a toll for financing. This has the potential of furthering rail passenger growth between Portland and Seattle by increasing the cost of automobile travel.

Ridership Forecast

WSDOT has built a rail data modeling and forecast capacity. It has developed a system of databases and a research and development capability to carry out the functions of providing decision support information for its intercity passenger rail and freight rail programs. The WSDOT State Rail and Marine Office, Strategic Planning and Research Team conducted this ridership forecast and analysis for the Service Development Plan.

Amtrak has a market analysis group, which also conducts ridership forecasts through their contractor AECOM. The Amtrak ridership modeling group provided assistance for WSDOT ARRA applications by providing ridership estimates based on Amtrak forecast models and WSDOT application scenarios.

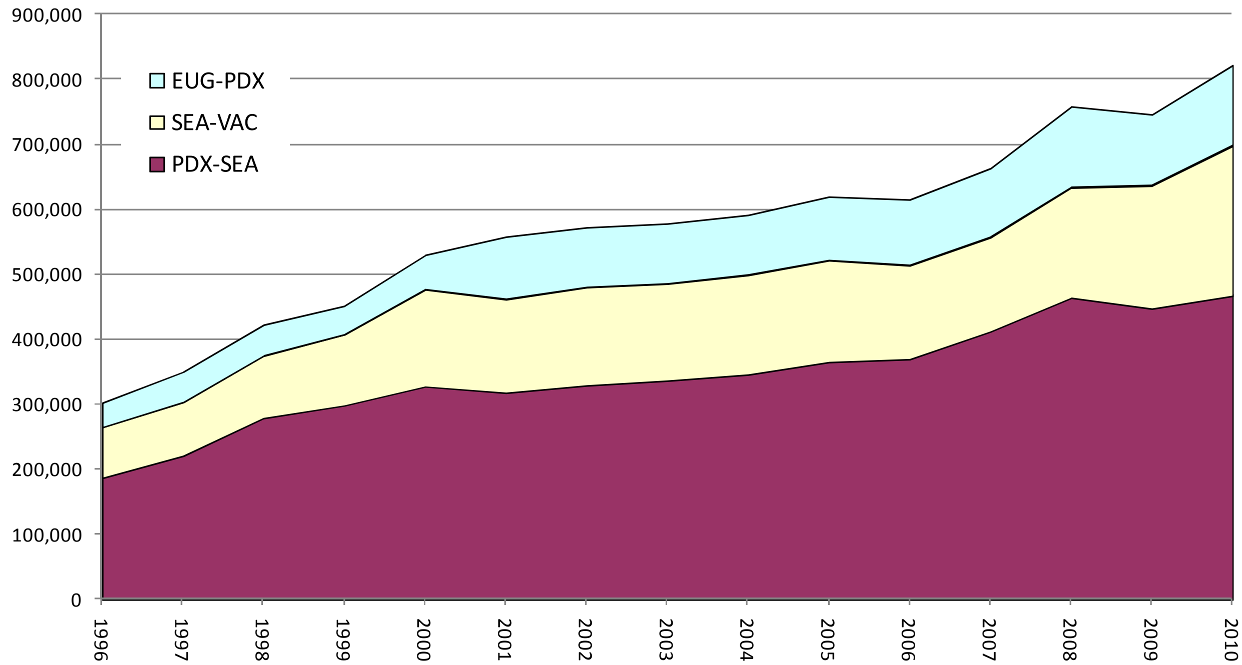
WSDOT and Amtrak forecasts were then integrated to produce a final data report.

Ridership Data

Public use of Amtrak Cascades is measured by daily, monthly, quarterly, and annual ridership and also by station on-offs, which measures passenger volumes per station. Station on-offs are a good indication of the geographical distribution of passenger use of stations, while ridership is a measurement of train usage for a given time period, whether by day, month, or year. In addition to ridership and station on-offs, a third method of measuring use is by train occupancy. Occupancy is a measurement of the number of passengers riding a train over a given travel segment. This measure is used in planning to identify bottleneck segments. The last measure-loading factor is a ratio of total passenger miles to total seating miles. It measures total route capacity utilization levels. All ridership measures are useful statistics for modeling and determining capacity needs for current and future levels of service.

WSDOT has developed and is maintaining the Amtrak Cascades Ridership and Revenue Database that contains detailed use information of Amtrak Cascades services. For this modeling, annual ridership data from 1996 to 2010 were used to forecast: Seattle to Portland (SEA-PDX including all crossing segment riders), Seattle to Vancouver, B.C. (SEA-VAC, riders traveling within the segment), and Portland to Eugene (PDX-EUG, riders traveling within the segment) (Figure 6).

Figure 6: Amtrak Cascades Ridership: 1996 to 2010



Source: *WSDOT State Rail and Marine Office*

Independent Variables

Independent predicting variables were evaluated based on historical values and availability of respected forecasts of independent variables. Variables considered included employment, income, population, energy pricing, scheduled time saving, utilization level, reliability improvement, and capacity (train frequency). Employment and income were considered, but dropped. Initial testing of annual employment and income variables regressed on annual historical ridership; population trends have explained a lot of variation that was captured by employment and income trends. While energy price is a driver for ridership, it was not used for this modeling, given its wild and sharp short-term fluctuation in recent years, driven by many factors that could not be reflected by ridership data. Ridership, in general, responds to capacity increase, utilization, reliability improvement, and travel time savings. Therefore, population, capacity (frequency), time savings, utilization, and reliability improvements were used to model Amtrak Cascades ridership for the Service Development Plan.

Population Data

Population estimates and forecasting, provided by the Washington State Office of Financial Management (OFM), formed the basis of population data for Amtrak Cascades stations located in Washington State. OFM population forecasts were used given frequency of updates and their consideration of economic and employment factors in their migration factors along with the typical birth, death, and age attributes of population forecasting. OFM updates forecasts of the entire Washington State population annually in November of each year and also updates forecasts of county populations in Growth Management Act population projections. County population estimates are updated in June each year. OFM also publishes census tract populations for all of Washington in their Small Area Estimate Program.

The Office of Economic Analysis of Oregon (OEA) updated Oregon's state population forecast through 2015 in the 2008 second quarter issue of their *Economic and Revenue Forecast*. The OEA Web site also provides links to county level population estimates and forecasts; the forecast was last updated in 2004. The Metro of Portland Web site also provided census tract level populations (2000-2004) for Multnomah, Clackamas, and Washington Counties in the Portland area.

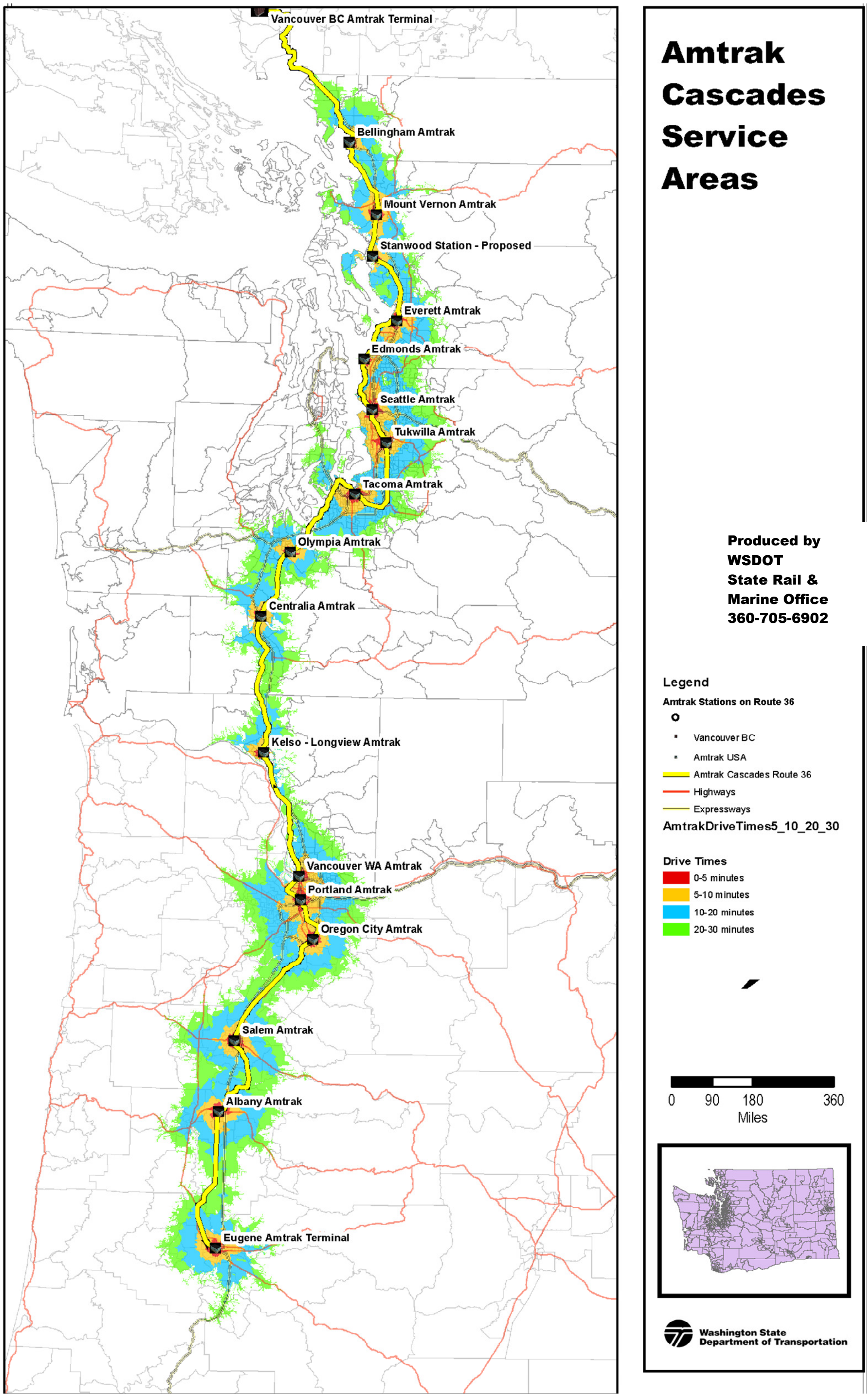
BC STATS provided population estimates (1986-2007) and projections (2007-2036) for locations near the Vancouver, B.C. Amtrak station. Projections are updated annually.

Service Area Population

A new and more refined technique of defining service area population was used for this forecast. The technique used the amount of time needed to drive to an Amtrak station. GIS software used WSDOT Cartographic Data and TeleAtlas Street Data with drive times calculated based on standard road impedances by ESRI Network Analyst Extension. Time intervals calculated ranged in minutes from <5, 5 to 10, 10 to 20, and 20 to 30. Populations defined by census tract, located within the geographical boundaries of each time interval, provided an estimate of the total population matched with each station.

Two additional population variables were calculated giving lower weights or damping to populations located further from the Amtrak station based upon drive time. This method assumes that as driving time to an Amtrak station increases the percentage of populations traveling by train decreases. No significant difference in modeling estimates and statistics resulted from the choice of the damping effect on population. The population variable chosen for final modeling weights 0 to 5 minutes at 100 percent, 5 to 10 minutes at 80 percent, 10 to 20 minutes at 60 percent, and 20 to 30 minutes at 40 percent. A map of all the Oregon and Washington Amtrak Cascades stations and drive-time populations is shown in Figure 7.

Figure 7: Amtrak *Cascades* Service Areas – Drive Times



For this modeling, to and from driving times are combined into round-trip driving times and assigned intervals of 5, 15, and 30 minutes.

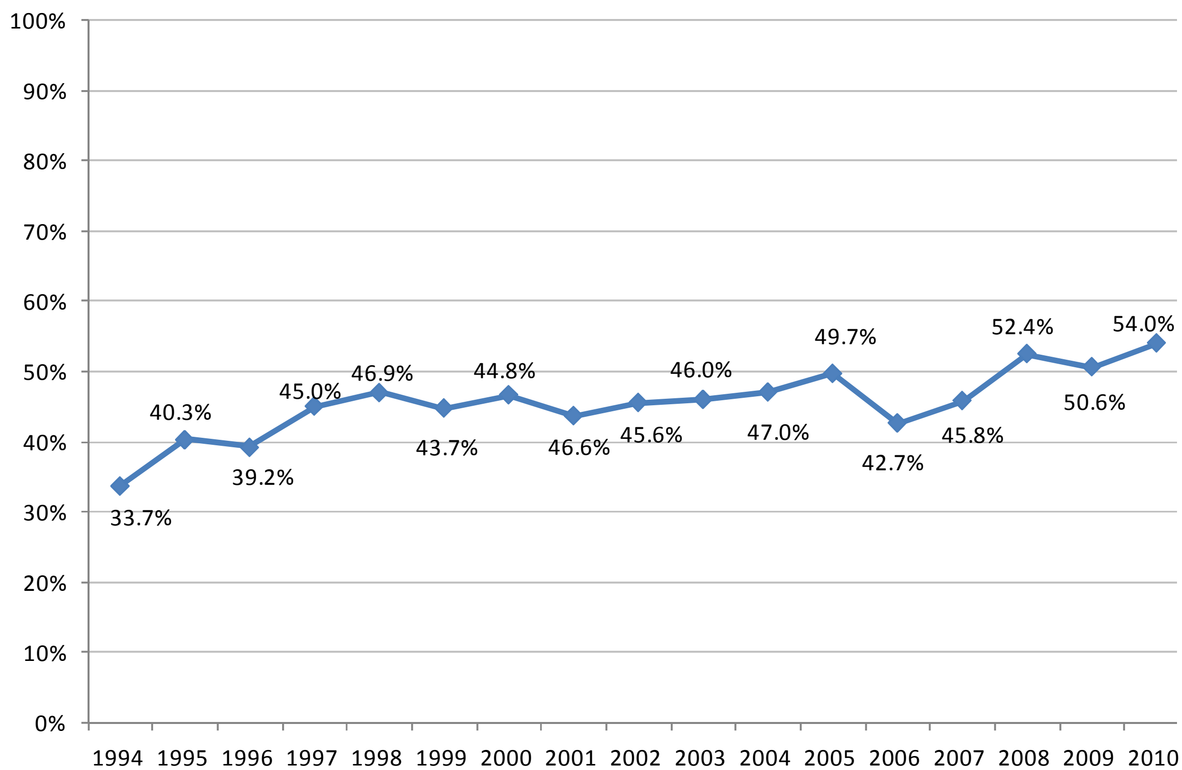
Energy Costs

WSDOT used energy costs as a predictor of the ridership forecast model in its *Amtrak Cascades Mid-Range Plan*. While energy costs are a driver of ridership, current forecasts, available from both Global Insights and The U.S. Energy Department (Energy Information Agency, EIA), are not accurate due to the wild fluctuation of energy costs driven by so many geopolitical factors. Consequently, forecasting ridership using energy prices could mask the effects of other ridership drivers. Therefore, energy pricing was not used as a predictor for this modeling given its strategic outlook of Pacific Northwest ridership dynamics.

Capacity Utilization

Utilization is expressed as the ratio of average daily rider per train compared with average seating capacity per train. Figure 9 shows the trend of utilization from 1994 to 2010.

Figure 9: Capacity Utilization 1994 - 2010

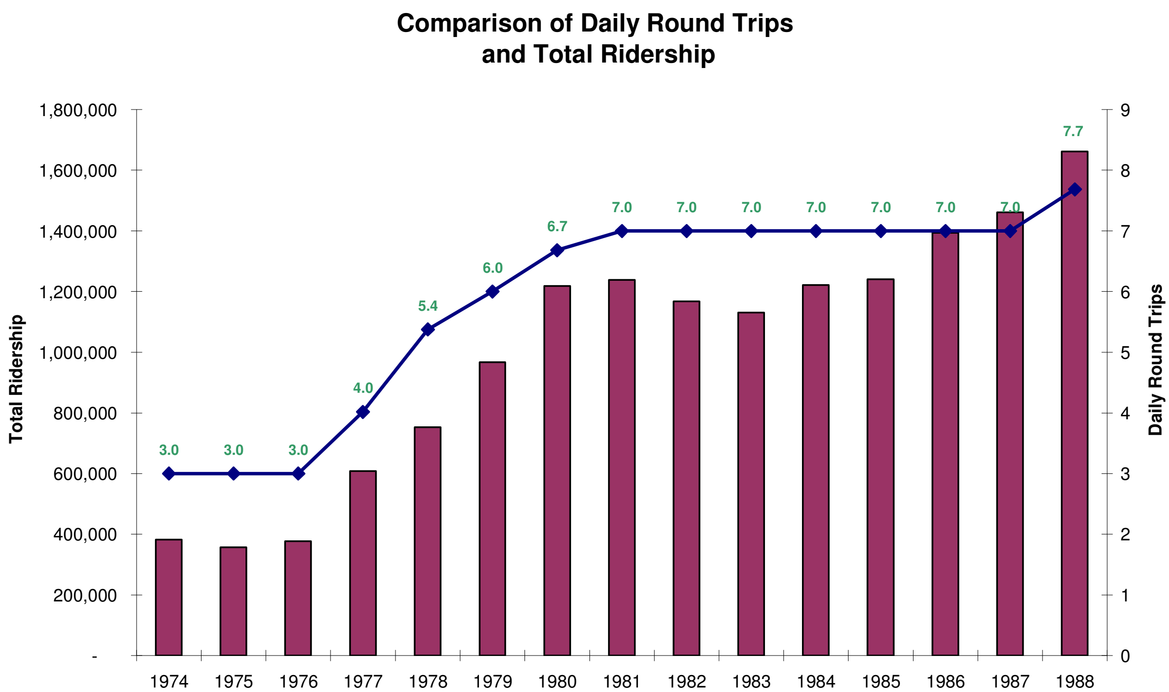


Source: *WSDOT State Rail and Marine Office*

Adding New Capacity or Frequency

The graph in Figure 10 illustrates the strong public response to added passenger services in high density population areas. This suggests that additional services of Amtrak Cascades in the PNWRC will gain similar market reaction. Amtrak Cascades plans to increase passenger rail services between Seattle and Portland from the current four round trips to six round trips with HSIPR funding. A sharp ridership increase is expected based on the historic experience of Amtrak's Pacific Surfliner.

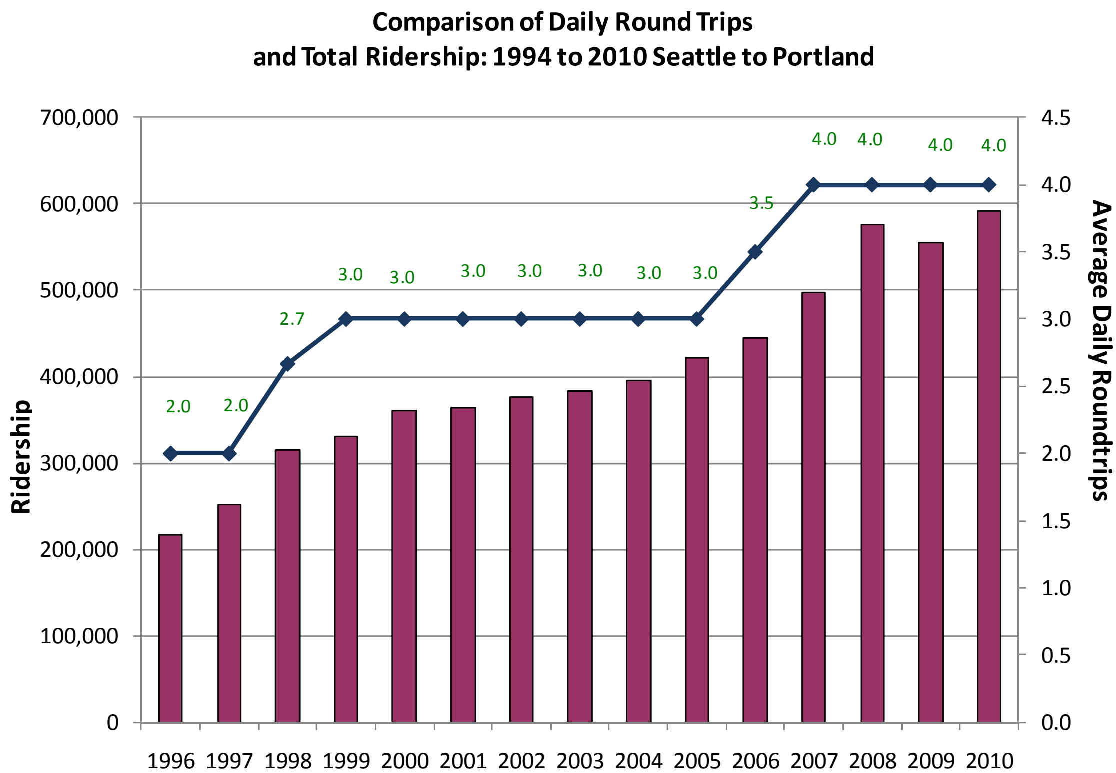
Figure 10: Pacific Surfliner Market Reaction to Added Service from Four Round Trips to Eight Round Trips



Source: *WSDOT State Rail and Marine Office*

When capacity is enhanced, the ridership will increase to respond to the supply, because the service is provided in different time schedules and the market is not saturated. Ridership is correlated strongly with train capacity and frequency of trips. The history of annual capacity of trains and trips travelling each segment (i.e. Seattle to Portland) was compiled from historical records within the WSDOT State Rail and Marine Office. Capacity changes over time resulted from the number of seats per train set, number of trips per day, and service disruptions. Adding capacity by increasing number of trips per day is also simpler and more convenient in forecasting various scenarios of capacity and trip changes. Figure 11 shows that ridership is strongly correlated to capacity change.

Figure 11: Effect of Adding Capacity – Historic Data of Amtrak *Cascades*



Source: *WSDOT State Rail and Marine Office*

Figure 12 shows added frequencies for Amtrak *Cascades* due to WSDOT's high-speed rail program funded by FRA.

Figure 12: Added Capacity (Frequencies)

Frequency (Round Trip) For Amtrak *Cascades* Routes		
Segment	**Base Year (FY09)**	**ARRA Award SEA-PDX 6 Round Trips**
SEA-VAC	2	2
SEA-PDX	***4***	***6***
PDX-EUG	2	2
Amtrak Cascades	8	10

Source: *WSDOT State Rail and Marine Office*

Scheduled Time Saving

Time is one of the main factors when people make travel mode selecting decisions. Economists show that when travel time decreases, the use of a specific travel mode will increase. This demand elasticity of time savings is a major driver of ridership growth. High-speed rail will gain more market shares over airplanes, automobiles, and intercity buses, when scheduled time of travel is reduced. Figure 13 illustrates how travel demand is related to travel time savings for different modes.

Figure 13: Elasticities of Demand for Intercity Passenger Service (Percent)

	Automobile	Bus	Rail	Air
For Vacation Trips				
Cost	-0.45	-0.69	-1.2	-0.38
Travel Time	-0.39	-2.11	-1.58	-0.43
For Business Trips				
Cost	-0.7	-0.32	-0.57	-0.18
Travel Time	-2.15	-1.5	-1.67	-0.16

Source: *A CBO Study: The Past and Future of U.S. Passenger Rail Service, September 2003.*

Source*: Steven A. Morrison and Clifford Winston, "An Econometric Analysis of the Demand for Intercity Transportation," Research in Transportation Economics, vol. 2 (1985), pp. 213-237.*

Note: *These elasticities show the percentage decrease in demand for a particular mode of transportation that would result from a 1 percent increase in cost or travel time.*

We use these elasticities in WSDOT models to calculate the ridership increase resulting from scheduled time savings caused by improvement of reliability.

Figure 14 shows scheduled time savings after completion of WSDOT's high-speed rail program.

Figure 14: Scheduled Time Saving from Capacity Enhancement

Scheduled Time Savings from Capacity Enhancement: Seattle - Portland			
Track 2 Application	**Number of Round Trips Operated**	**One-Way Running Time**	**Scheduled Time Savings (Minutes)**
Base Year (2010)	4	3:30	0
Completion of All Projects (2017)	6	3:20	10

Source: *WSDOT State Rail and Marine Office*

Reliability Improvement

Reliability, or on-time performance, is an important driver of ridership. When reliability improves, more people are willing to take passenger rail. This leads to ridership increase. Both reliability improvement projects and capacity enhancement projects lead to reduction in delay. When a project reduces delay, it has two effects. First, it reduces direct delays in the project area. In a system, delay in one location could trigger delays in other locations. This is the system effect. Therefore, reducing direct delays in one location will result in improvements in other locations.

Figure 15 provides information about reliability improvements resulting from WSDOT's high-speed rail program as outlined in the WSDOT/BNSF/Amtrak Service Outcome Agreement.

Figure 15: Reliability Improvements Through Delay Reductions

Delay Reduction		
Phase	**PNWRC Program Tasks***	**BNSF-Responsible Delay Minutes Per One-Way Trip Between Seattle and Portland**
0	Baseline - Current Service	19.8
1	Completion of BNSF Projects 2 & 7	18.6
2	Completion of Phase 1 Above and BNSF Projects 1 & 3 through 6	17.8
3	Completion of Phase 2 Above and WSDOT Work Items 1 through 3 (i.e., completion of PNWRC Program)	16
**As described and depicted in Exhibits 1 and 3 of the WSDOT/BNSF/Amtrak Service Outcome Agreement.*		

Source: *WSDOT State Rail and Marine Office*

Ridership Modeling

Amtrak Cascades Base Model

This model is developed to reflect current investment policy and operation results. The model has no new policy parameters and holds constant at current operation level. It uses drive time population as a demand base to forecast future ridership based on historic trends. It also uses capacity and utilization variables to explain the variation in historical ridership growth. It predicts ridership growth assuming we continue current operation and investment. The model results are used as a baseline to calculate the outcome of the PNWRC high-speed rail program funded by FRA. Figure 16 shows the model parameters and statistics and Figure 17 shows the base model results. Attachment 1 provides detailed data estimates.

The model is expressed as:

$$B_t = a + b_1 C_t + b_2 U_t + b_3 P_t + \varepsilon$$

Where:

B – Annual ridership estimated by Amtrak Cascades Base Model.
t – Subscript for time (year).

a, b_1, b_2, and b_3 – model parameters.
C – Capacity indicated by train frequency.
U – Utilization of capacity indicated by ratio of average riders per daily train to average seating capacity per train.
P – Driving time population surrounding Amtrak Cascades stations (less than 30 minutes driving time).
ε– Estimation error.

Figure 16: Amtrak *Cascades* Base Model – Statistics

Regression Statistics	
Multiple R	0.9981
R Square	0.9962
Adjusted R Square	0.9953
Standard Error	12669
Observations	17

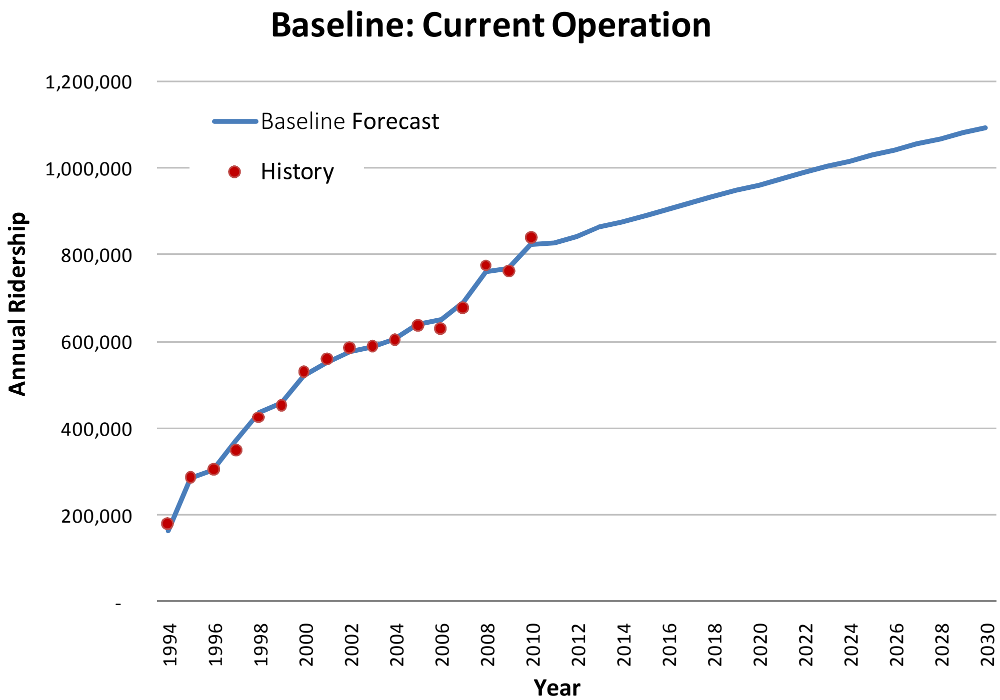
ANOVA

	df	*SS*	*MS*	*F*
Regression	3	542233494909	180744498303	1126
Residual	13	2086625087	160509622	
Total	16	544320119996		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-1008074	124332	-8.11	0.00
Capacity	28190	3465	8.14	0.00
Utilization	868298	112806	7.70	0.00
Driving Time Population	0.13	0.03	4.49	0.00

Source: *WSDOT State Rail and Marine Office*

Figure 17: Amtrak *Cascades* Base Model – Ridership History vs. Forecasts



Source: *WSDOT State Rail and Marine Office*

Amtrak Cascades Growth Model

This model is developed to estimate the ridership growth resulting from change in investment policy and service levels. It estimates ridership growth using five growth driving factors: driving time population, capacity or frequency of operation, utilization, scheduled time savings, and reliability improvements. The model is expressed as:

$$G_t = G_{ct} + S_t + L_t$$

$$G_{ct} = a + b_1 C_t + b_2 U_t + b_3 P_t + \varepsilon$$

Where:

G – Annual ridership estimated by Amtrak Cascades Growth Model.
t – Subscript for time (year).
c – Capacity reflects results of ARRA HSIPR program.
a, b_1, b_2, and b_3 – model parameters.
C – Capacity indicated by train frequency.

U – Utilization of capacity indicated by ratio of average riders per daily train to average seating capacity per train.
P – Driving time population surrounding Amtrak *Cascades* stations (less than 30 minutes driving time).
? – Estimation error.
S – Incremental ridership due to scheduled time savings.
L – Incremental ridership due to reliability improvements.

$$S_t = \frac{e * G_{ct} * v}{V}$$

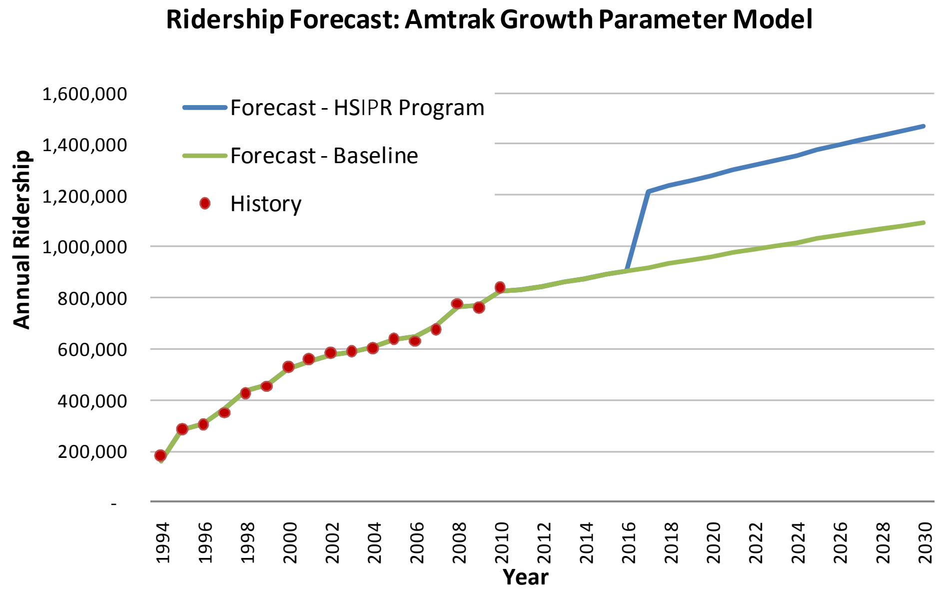
Where:

S – Incremental ridership due to scheduled time savings.
t – Subscript for time (year).
c – Capacity reflects results of implementing PNWRC HSIPR program.
e – Ridership demand elasticity of scheduled time savings.
v – Scheduled time saving resulting from the implementation of PNWRC HSIPR program.
V – Total scheduled running time indicated as minutes.

$$L_t = \frac{e * G_{ct} * z}{V}$$

L – Incremental ridership due to reliability improvements.
t – Subscript for time (year).
c – Capacity reflects results of ARRA HSIPR program.
e – Ridership demand elasticity of scheduled time savings.
z – Average time savings of reliability improvements.
V – Total scheduled running times.

Figure 21: Results of the Amtrak *Cascades* Growth Model



Source: *WSDOT State Rail and Marine Office*

Seattle-Portland Leg Base Model

This model is developed to reflect current investment policy and operation in the Seattle to Portland segment (Seattle-Portland Leg). The model has no new policy parameters and holds constant at current operation levels of four round trips. It uses drive time population as a demand base to forecast future ridership based on historic trends. It also uses capacity and utilization variables to explain the variation in historical ridership growth. It predicts ridership growth assuming we continue current operation and investment in the Seattle-Portland leg. The model results are used as a baseline to calculate the outcome of the PNWRC high-speed rail program funded by FRA using Amtrak ridership growth parameters provided by AECOM.

The model is expressed as:

$$M_t = a + b_1 C_t + b_2 U_t + b_3 P_t + \varepsilon$$

Where:

M – Annual ridership estimated by Seattle-Portland Leg Base Model.
t – Subscript for time (year).
a, b_1, b_2, and b_3 – model parameters.
C – Capacity indicated by train frequency (round trips).

U – Utilization of capacity indicated by ratio of average riders per daily train to average seating capacity per train.
P – Driving time population surrounding Amtrak Cascades stations (less than 30 minutes driving time).
 Estimation error.

Figure 19 shows the model parameters and statistics.

Figure 19: Seattle-Portland Leg Base Model - Statistics

Regression Statistics	
Multiple R	0.9973
R Square	0.9947
Adjusted R Square	0.9932
Standard Error	9186

ANOVA

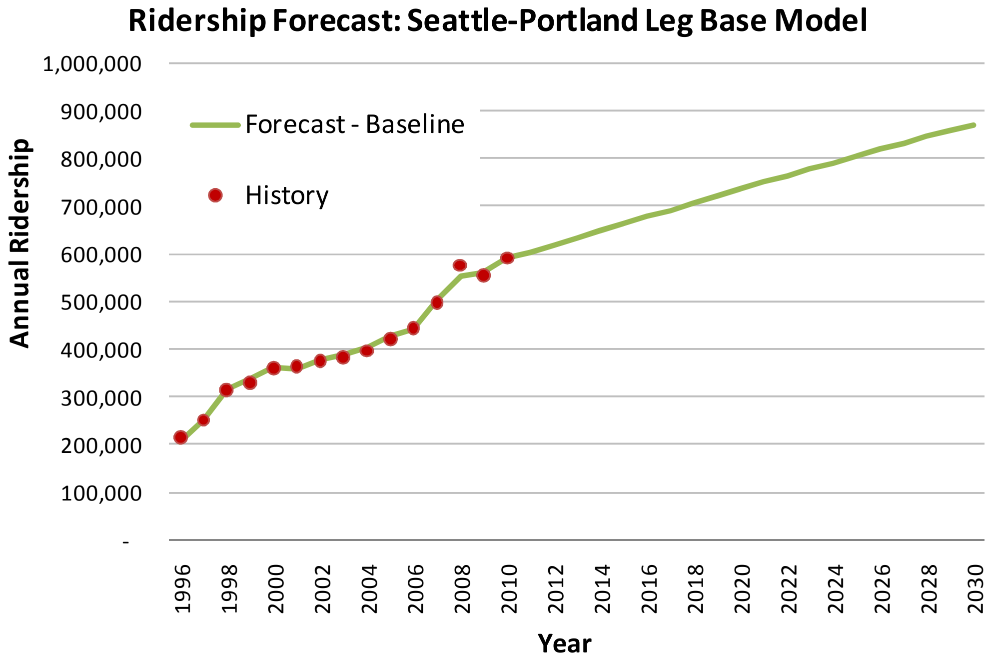
	SS	*MS*	*F*
Regression	174028083275	58009361092	688
Residual	928108828	84373530	
Total	174956192104		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-958366	87428	-10.96	0.00
X Variable 1	63157	11163	5.66	0.00
X Variable 2	507113	97171	5.22	0.00
X Variable 3	0.15	0.02	6.99	0.00

***Source:** WSDOT State Rail and Marine Office*

Figure 20 shows the base model results for the Sea-Portland Segment.
Attachment 1 provides additional ridership forecast data.

Figure 20: Seattle-Portland Base Model – Ridership History vs. Forecasts



Source: *WSDOT State Rail and Marine Office*

Amtrak Growth Parameter Model

This model is developed to estimate the ridership growth resulting from change in investment policy and service levels using Amtrak growth parameters provided by AECOM. It estimates ridership growth using the Seattle-Portland Leg Base Model as a baseline. Then it uses Amtrak growth parameters for capacity, scheduled time savings, and reliability improvements to estimate ridership effect of ARRA HSIPR investment. The model is used for two purposes. First it is used as an alternative method with WSDOT Amtrak Cascades Growth Model to mutually examine and validate estimates. Second, the model estimates are used with WSDOT Amtrak *Cascades* Growth Model estimates together to minimize estimate errors. The model is expressed as:

$$A_t = M_t + H_t + S_t + L_t$$

$$M_t = a + b_1 C_t + b_2 U_t + b_3 P_t + \varepsilon$$

Where:

A – Ridership estimated by Amtrak Growth Parameter Model.

M – Annual ridership between Seattle and Portland estimated by Seattle-Portland Leg Base Model under assumption of continuing current operation.
t – Subscript for time (year).
H – Ridership growth estimated due to capacity expansion (Train Frequency Increase) resulting from implementation of PNWRC HSIPR Program.

$$H_t = \frac{e_f * M_t * f}{F}$$

Where:

t – Subscript for time (year).
e_f – Ridership demand elasticity of frequency increase.
f – Increased frequency resulting from implementation of PNWRC HSIPR Program.
F – Current frequency.

S – Ridership growth due to scheduled time saving resulting from implementation of PNWRC HSIPR Program.

$$S_t = \frac{e_s * (M_t + H_t) * v}{V}$$

Where:

t – Subscript for time (year).
e_s – Ridership demand elasticity of scheduled time savings.
v – Scheduled time savings resulting from implementation of PNWRC HSIPR Program.
V – Current scheduled running times.

L – Ridership growth due to OTP improvement resulting from implementation of PNWRC HSIPR Program.

$$L_{t+1} = \frac{e_r * (M_t * H_t) * z}{V}$$

t – Subscript for time (year).
e_r – Ridership demand elasticity of OTP improvements.
z – Improved OTP indicated as minutes.

V – Current scheduled running time.

Figure 21 shows the parameters used in the Amtrak Growth Parameter Model.

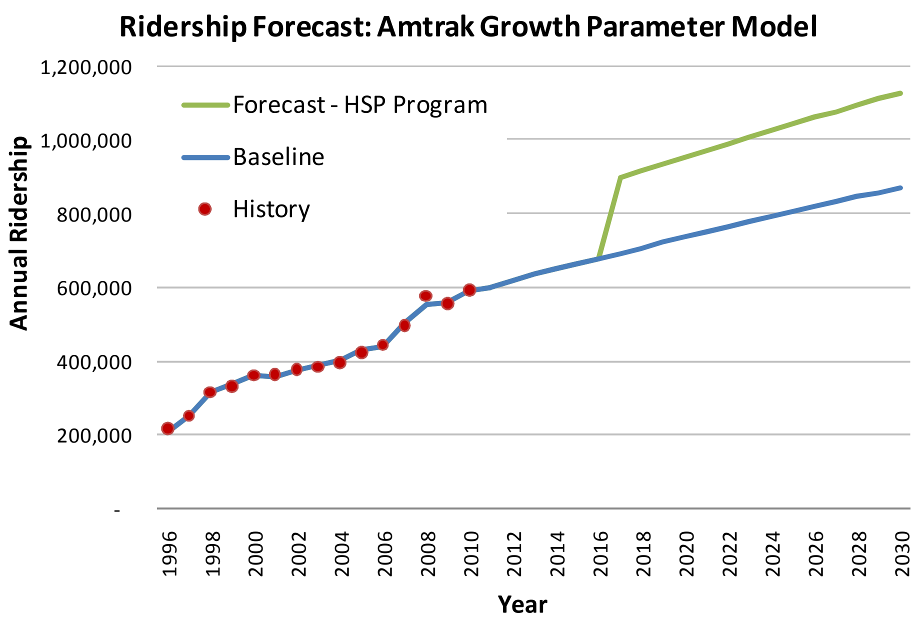
Figure 21: Ridership Growth Parameters

Amtrak *Cascades* Ridership Growth Parameters for WSDOT ARRA Applications	
Train Frequency	
Vancouver - Seattle	+5.9% per 10% freq. increase
Seattle - Portland	
Portland - Eugene	
Travel Times	
Vancouver - Seattle	+10% per 10% trip time improvement
Seattle - Portland	
Portland - Eugene	
On-Time Performance	
Amtrak *Cascades*	+1.1% per 5 point OTP improvement

Source: *WSDOT State Rail and Marine Office*

Figure 22 shows the estimated ridership based on Amtrak Growth Parameter Model.

Figure 22: Amtrak Growth Parameter Model Estimates Ridership History and Forecast



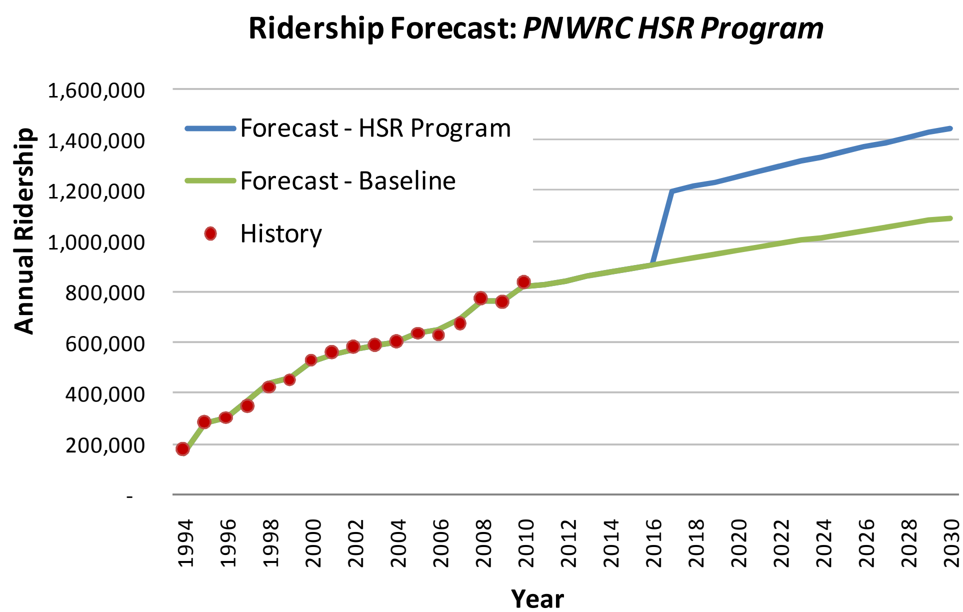
Source: *WSDOT State Rail and Marine Office*

Ridership Validation

Ridership Growth Estimates

Figure 23 shows the estimated ridership growth for the PNWRC HSIPR program based on integration of both Amtrak Growth Parameter Model and WSDOT Amtrak Cascades Growth Model.

Figure 23: Estimates for Ridership Growth Resulting from Implementation of PNWRC HSIPR Program



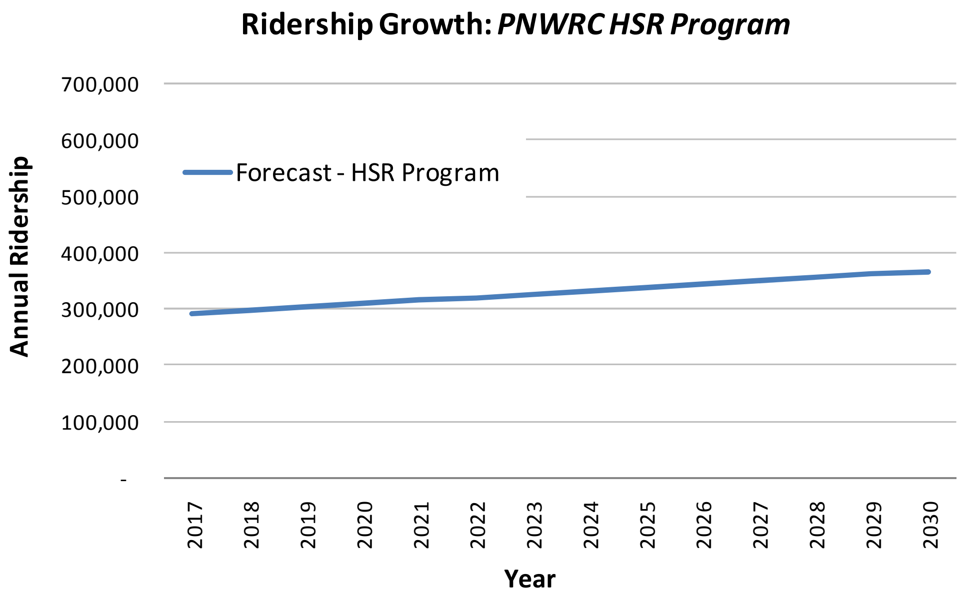
Source: *WSDOT State Rail and Marine Office*

Attachment 1 provides detailed data about ridership estimates produced by forecast models.

Ridership Growth

Incremental ridership is defined as the difference between the Amtrak *Cascades* ridership with the PNWRC HSIPR Program and the Amtrak *Cascades* ridership without the PNWRC HSIPR Program.

Figure 24: Incremental Ridership: PNWRC HSIPR Program

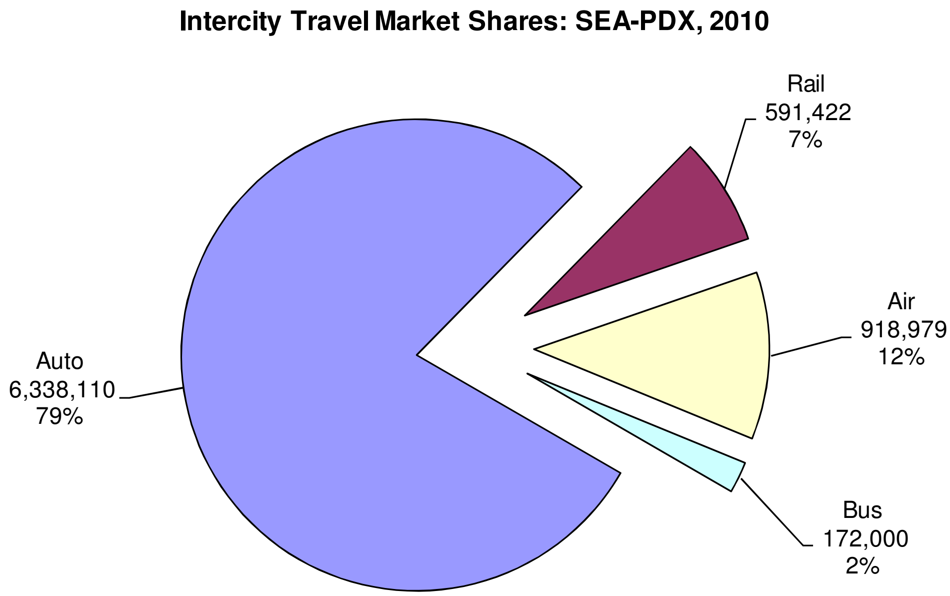


Source: *WSDOT State Rail and Marine Office*

There are two basic sources for ridership growth: riders diverted from other transportation modes and induced demand due to expansion of the market driven by many factors. Amtrak *Cascades* will provide two additional round trips between Seattle and Portland as a result of implementing the PNWRC HSIPR Program. Besides riders who change modes, additional riders will use passenger rail services just because the service exists. Otherwise, they will not travel. Such ridership growth is rail-induced growth. The other source of growth is to divert riders from other modes. When Amtrak passenger rail services are improved by price reduction, frequency increase, OTP improvement, and travel time reduction, some riders who used to use other modes would start to use passenger rail due to perceived price and quality advantages. This ridership growth is called diversion. The ridership growth stimulated by the implementation the PNWRC HSIPR Program will have both growth effects.

There are four major transportation modes that provide intercity services between Seattle and Portland. Figure 25 illustrates the percentage of intercity travel market shares in this segment of the PNWRC.

Figure 25: Intercity Travel Market Shares: Seattle-Portland – 2010

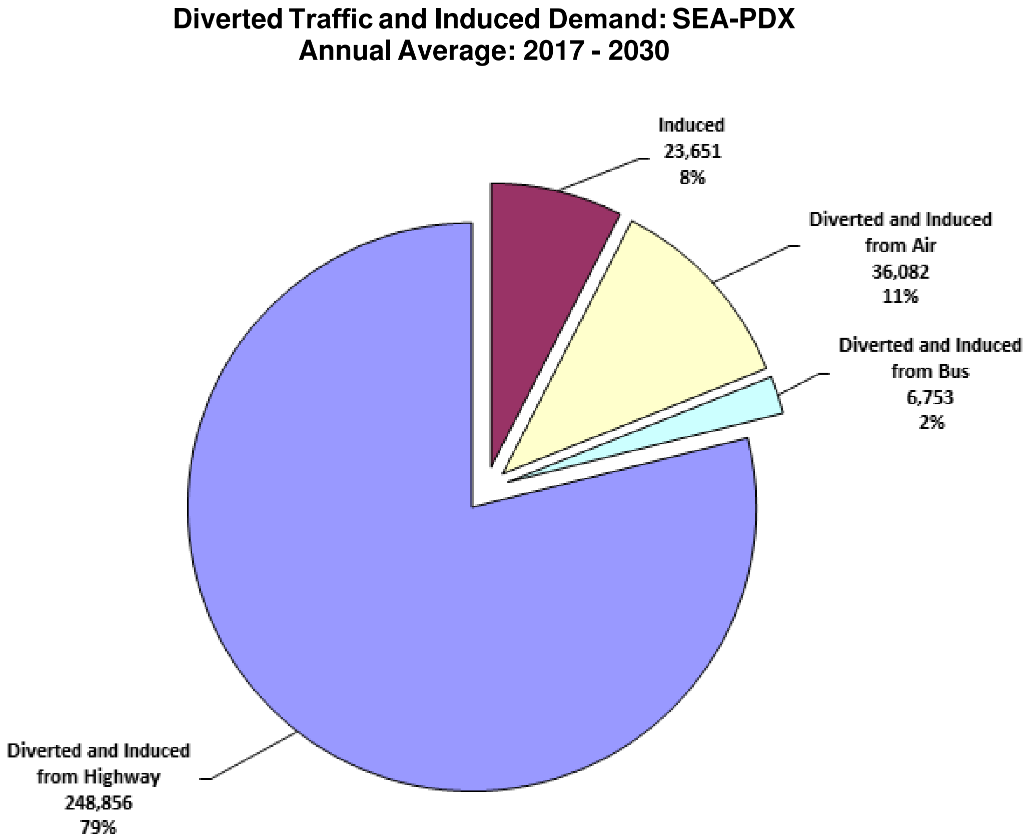


Sources: *Data derived from WSDOT Amtrak Cascades Ridership Database; Amtrak Cascades Long Range Plan, Statewide Travel & Collision Data Office, WSDOT; USDOT T-100 Domestic Segment (U.S. Carriers), On-Flight Market Passengers Enplaned by Origin for 2010; WSDOT VMT 2010 forecast; Greyhound Bus Schedules.*

Ridership diversions from different modes are not at the same rates. Passenger rail services directly compete with intercity buses, which have similar travel time and convenience. Since auto has the dominant market share, most riders diverted to passenger rail will come from the auto travel market. This will help relieve the I-5 congestion—detailed analysis can be found in *Amtrak Cascades Mid-Range Plan 2008*.

The best way to do diversion analysis is to use cross modal elasticities between passenger rail and other intercity travel modes. However, in our search for data, we could not find credible data to do the analysis. We assumed that riders will be diverted from different intercity transportation modes proportional to their market shares, although we know that some modes, such as intercity buses, will have a higher diversion rate than auto. Figure 26 shows the distribution of induced demand and diverted riders from three major modes: air, bus, and auto (annual average for 2017 to 2030).

Figure 26: Distribution of Ridership Growth: PNWRC HSIPR Program



Source: *WSDOT State Rail and Marine Office*

See Attachment 2 for detailed ridership growth and diversion data for each mode.

Attachment 1: Ridership Forecast Data

Figure 1-1: Amtrak *Cascades* Ridership Forecast - Baseline

Ridership Forecast			
Calendar Year	Baseline (Current Operation)		
	Amtrak Parameter Growth Models*	WSDOT Amtrak *Cascades* Growth Model**	Mid Point
2009	761,610	761,610	761,610
2010	838,251	838,251	838,251
2011	828,173	828,173	828,173
2012	842,306	842,306	842,306
2013	862,161	862,161	862,161
2014	874,569	874,569	874,569
2015	889,427	889,427	889,427
2016	904,077	904,077	904,077
2017	917,858	917,858	917,858
2018	932,188	932,188	932,188
2019	946,410	946,410	946,410
2020	960,395	960,395	960,395
2021	974,281	974,281	974,281
2022	988,020	988,020	988,020
2023	1,001,641	1,001,641	1,001,641
2024	1,015,166	1,015,166	1,015,166
2025	1,028,565	1,028,565	1,028,565
2026	1,041,580	1,041,580	1,041,580
2027	1,054,571	1,054,571	1,054,571
2028	1,067,431	1,067,431	1,067,431
2029	1,080,222	1,080,222	1,080,222
2030	1,092,925	1,092,925	1,092,925

* WSDOT staff developed the model using parameters provided by Amtrak modeling group - AECOM.

** WSDOT staff developed the model based on historic data on ridership, OTP, driving time population data and parameters from research literature.

Source: *WSDOT State Rail and Marine Office*

Figure 1-2: Ridership Forecast: With PNWRC HSIPR Projects

Amtrak *Cascades Total* Ridership Forecast			
Calendar Year	WithPNWRC HSR Projects		
	Amtrak Parameter Growth Models*	WSDOT Amtrak *Cascades* Growth Model**	Mid Point
2009	761,610	761,610	761,610
2010	838,251	838,251	838,251
2011	828,173	828,173	828,173
2012	842,306	842,306	842,306
2013	862,161	862,161	862,161
2014	874,569	874,569	874,569
2015	889,427	889,427	889,427
2016	904,077	904,077	904,077
2017	1,215,939	1,172,224	1,194,082
2018	1,236,538	1,192,934	1,214,736
2019	1,256,991	1,212,941	1,234,966
2020	1,277,138	1,232,773	1,254,956
2021	1,297,127	1,252,578	1,274,853
2022	1,316,908	1,272,220	1,294,564
2023	1,336,524	1,291,813	1,314,169
2024	1,356,002	1,311,342	1,333,672
2025	1,375,303	1,330,745	1,353,024
2026	1,394,061	1,349,593	1,371,827
2027	1,412,774	1,368,734	1,390,754
2028	1,431,304	1,387,673	1,409,489
2029	1,449,737	1,406,627	1,428,182
2030	1,468,043	1,425,484	1,446,764

* WSDOT staff developed the model using parameters provided by Amtrak modeling group - AECOM.

** WSDOT staff developed the model based on historic data on ridership, OTP, driving time population data and parameters from research literature.

Source: *WSDOT State Rail and Marine Office*

Figure 1-3: Ridership Forecast: Incremental

Ridership Forecast			
Calendar Year	Incremental		
	Amtrak Parameter Growth Models*	WSDOT Amtrak *Cascades* Growth Model**	Mid Point
2009			
2010	0	0	0
2011	0	0	0
2012	0	0	0
2013	0	0	0
2014	0	0	0
2015	0	0	0
2016	0	0	0
2017	298,082	254,367	276,224
2018	304,350	260,745	282,548
2019	310,581	266,531	288,556
2020	316,744	272,378	294,561
2021	322,846	278,296	300,571
2022	328,888	284,200	306,544
2023	334,884	290,173	312,528
2024	340,837	296,176	318,507
2025	346,738	302,180	324,459
2026	352,481	308,014	330,247
2027	358,203	314,162	336,183
2028	363,873	320,242	342,058
2029	369,515	326,404	347,960
2030	375,119	332,559	353,839

* WSDOT staff developed the model using parameters provided by Amtrak modeling group - AECOM.

** WSDOT staff developed the model based on historic data on ridership, OTP, driving time population data and parameters from research literature.

Source: *WSDOT State Rail and Marine*

Figure 1-4: Amtrak *Cascades* Total Passenger Miles Forecast: Baseline

Amtrak *Cascades* Total Passenger Miles Forecast			
Calendar Year	Baseline (Current Operation)		
	Amtrak Parameter Growth Models*	WSDOT Amtrak *Cascades* Growth Model**	Mid Point
2009	117,879,821	117,879,821	117,879,821
2010	132,561,190	132,561,190	132,561,190
2011	130,833,504	130,833,504	130,833,504
2012	133,066,307	133,066,307	133,066,307
2013	136,202,922	136,202,922	136,202,922
2014	138,163,123	138,163,123	138,163,123
2015	140,510,406	140,510,406	140,510,406
2016	142,824,822	142,824,822	142,824,822
2017	145,001,844	145,001,844	145,001,844
2018	147,265,731	147,265,731	147,265,731
2019	149,512,471	149,512,471	149,512,471
2020	151,721,747	151,721,747	151,721,747
2021	153,915,546	153,915,546	153,915,546
2022	156,086,014	156,086,014	156,086,014
2023	158,237,725	158,237,725	158,237,725
2024	160,374,379	160,374,379	160,374,379
2025	162,491,166	162,491,166	162,491,166
2026	164,547,261	164,547,261	164,547,261
2027	166,599,642	166,599,642	166,599,642
2028	168,631,206	168,631,206	168,631,206
2029	170,651,964	170,651,964	170,651,964
2030	172,658,645	172,658,645	172,658,645

* WSDOT staff developed the model using parameters provided by Amtrak modeling group - AECOM.

** WSDOT staff developed the model based on historic data on ridership, OTP, driving time population data and parameters from research literature.

Source: *WSDOT State Rail and Marine Office*

Figure 1-5: Amtrak *Cascades* Total Passenger Miles Forecast: With PNWRC HSIPR Projects

Amtrak *Cascades* Total Passenger Miles Forecast			
Calendar Year	With PNWRC HSR Projects		
	Amtrak Parameter Growth Models*	WSDOT Amtrak *Cascades* Growth Model**	Mid Point
2009	117,879,821	117,879,821	117,879,821
2010	132,561,190	132,561,190	132,561,190
2011	130,833,504	130,833,504	130,833,504
2012	133,066,307	133,066,307	133,066,307
2013	136,202,922	136,202,922	136,202,922
2014	138,163,123	138,163,123	138,163,123
2015	140,510,406	140,510,406	140,510,406
2016	142,824,822	142,824,822	142,824,822
2017	192,842,714	185,826,649	189,334,681
2018	196,112,605	189,114,298	192,613,452
2019	199,359,525	192,289,680	195,824,602
2020	202,557,801	195,437,369	198,997,585
2021	205,731,041	198,580,959	202,156,000
2022	208,871,207	201,698,936	205,285,071
2023	211,985,169	204,809,226	208,397,198
2024	215,077,283	207,909,495	211,493,389
2025	218,141,228	210,989,836	214,565,532
2026	221,118,997	213,982,177	217,550,587
2027	224,089,783	217,021,417	220,555,600
2028	227,031,315	220,028,764	223,530,040
2029	229,957,609	223,038,498	226,498,054
2030	232,863,683	226,033,016	229,448,350

* WSDOT staff developed the model using parameters provided by Amtrak modeling group - AECOM.

** WSDOT staff developed the model based on historic data on ridership, OTP, driving time population data and parameters from research literature.

Source: *WSDOT State Rail and Marine Office*

Figure 1-6: Amtrak *Cascades* Passenger Miles Forecast: Incremental

Passenger Miles Forecast			
Calendar Year	Incremental		
	Amtrak Parameter Growth Models*	WSDOT Amtrak *Cascades* Growth Model**	Mid Point
2009	-	-	-
2010	-	-	-
2011	-	-	-
2012	-	-	-
2013	-	-	-
2014	-	-	-
2015	-	-	-
2016	-	-	-
2017	47,840,869	40,824,805	44,332,837
2018	48,846,874	41,848,567	45,347,721
2019	49,847,054	42,777,209	46,312,132
2020	50,836,054	43,715,622	47,275,838
2021	51,815,495	44,665,413	48,240,454
2022	52,785,193	45,612,921	49,199,057
2023	53,747,444	46,571,502	50,159,473
2024	54,702,904	47,535,115	51,119,010
2025	55,650,061	48,498,669	52,074,365
2026	56,571,736	49,434,916	53,003,326
2027	57,490,142	50,421,776	53,955,959
2028	58,400,109	51,397,558	54,898,834
2029	59,305,645	52,386,534	55,846,090
2030	60,205,039	53,374,372	56,789,705

* WSDOT staff developed the model using parameters provided by Amtrak modeling group - AECOM.

** WSDOT staff developed the model based on historic data on ridership, OTP, driving time population data and parameters from research literature.

Source: *WSDOT State Rail and Marine Office*

Attachment 2: Ridership Growth and Diversion Data

Figure 2-1: Incremental Ridership – Diverted from Air

PNWRC HSR Program: Incremental Ridership - Diverted Traffic and Induced Demand		
Calendar Year	Diverted from Air	
	Ridership	Passenger Miles
2009	-	-
2010	-	-
2011	-	-
2012	-	-
2013	-	-
2014	-	-
2015	-	-
2016	-	-
2017	31,606	5,072,678
2018	32,330	5,188,803
2019	33,017	5,299,154
2020	33,704	5,409,424
2021	34,392	5,519,797
2022	35,076	5,629,483
2023	35,760	5,739,377
2024	36,444	5,849,169
2025	37,125	5,958,484
2026	37,788	6,064,778
2027	38,467	6,173,780
2028	39,139	6,281,667
2029	39,814	6,390,054
2030	40,487	6,498,025

Sources: *Data derived from WSDOT Amtrak Cascades Ridership Database; Amtrak Cascades Long Range Plan, Statewide Travel & Collision Data Office, WSDOT; USDOT T-100 Domestic Segment (U.S. Carriers), On-Flight Market Passengers Enplaned by Origin for 2010; WSDOT VMT 2010 forecast; Greyhound Bus Schedules.*

Figure 2-2: Incremental Ridership – Diverted from Highway

PNWRC HSR Program: Incremental Ridership - Diverted Traffic and Induced Demand		
Calendar Year	Diverted from Highway	
	Ridership	Passenger Miles
2009		
2010	-	-
2011	-	-
2012	-	-
2013	-	-
2014	-	-
2015	-	-
2016	-	-
2017	217,985	34,985,773
2018	222,976	35,786,680
2019	227,718	36,547,756
2020	232,456	37,308,276
2021	237,199	38,069,514
2022	241,913	38,826,006
2023	246,635	39,583,930
2024	251,353	40,341,159
2025	256,051	41,095,089
2026	260,618	41,828,189
2027	265,303	42,579,971
2028	269,939	43,324,051
2029	274,596	44,071,589
2030	279,236	44,816,254

Sources: *Data derived from WSDOT Amtrak Cascades Ridership Database; Amtrak Cascades Long Range Plan, Statewide Travel & Collision Data Office, WSDOT; USDOT T-100 Domestic Segment (U.S. Carriers), On-Flight Market Passengers Enplaned by Origin for 2010; WSDOT VMT 2010 forecast; Greyhound Bus Schedules.*

Figure 2-3: Incremental Ridership – Diverted from Bus

PNWRC HSR Program: Incremental Ridership - Diverted Traffic and Induced Demand		
Calendar Year	Diverted from Bus	
	Ridership	Passenger Miles
2009		
2010	-	-
2011	-	-
2012	-	-
2013	-	-
2014	-	-
2015	-	-
2016	-	-
2017	5,916	949,424
2018	6,051	971,158
2019	6,180	991,812
2020	6,308	1,012,451
2021	6,437	1,033,109
2022	6,565	1,053,638
2023	6,693	1,074,206
2024	6,821	1,094,755
2025	6,949	1,115,215
2026	7,073	1,135,109
2027	7,200	1,155,511
2028	7,325	1,175,703
2029	7,452	1,195,990
2030	7,578	1,216,198

Sources: *Data derived from WSDOT Amtrak Cascades Ridership Database; Amtrak Cascades Long Range Plan, Statewide Travel & Collision Data Office, WSDOT; USDOT T-100 Domestic Segment (U.S. Carriers), On-Flight Market Passengers Enplaned by Origin for 2010; WSDOT VMT 2010 forecast; Greyhound Bus Schedules.*

Figure 2-4: Incremental Ridership – Induced Demand

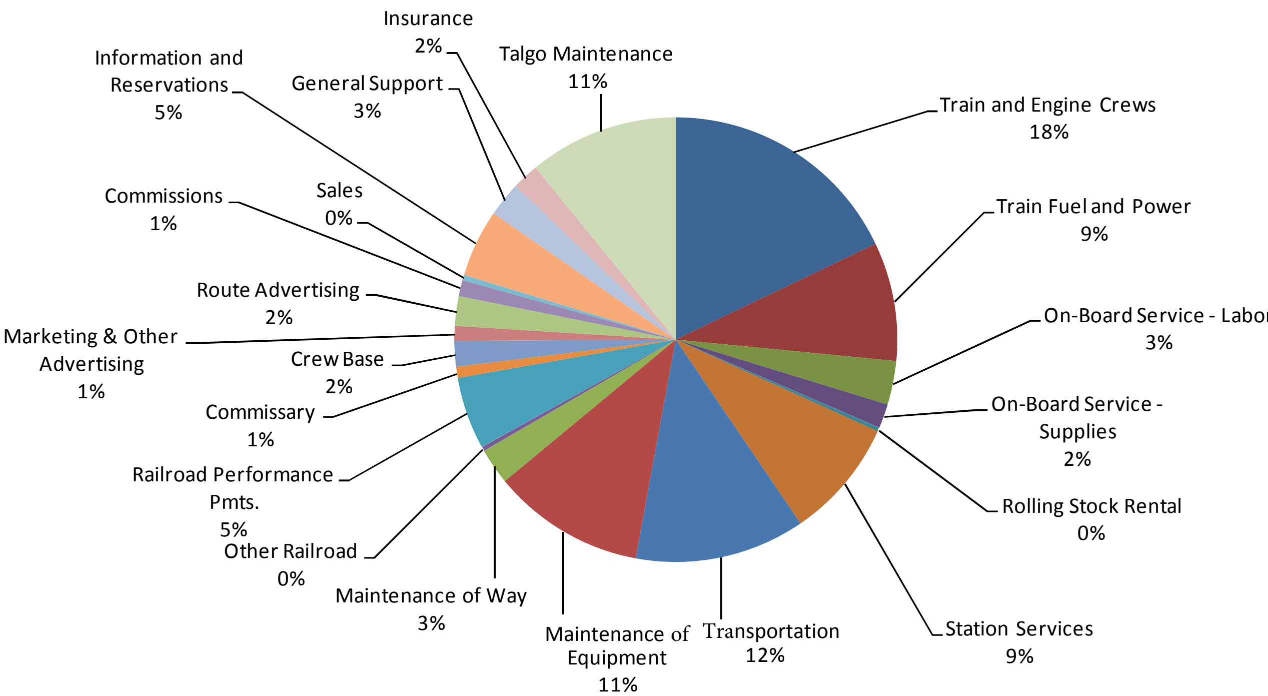
WSDOT ARRA HSR Program: Incremental Ridership - Diverted Traffic and Induced Demand		
Calendar Year	Induced Demand	
	Ridership	Passenger Miles
2009		
2010	-	-
2011	-	-
2012	-	-
2013	-	-
2014	-	-
2015	-	-
2016	-	-
2017	20,717	3,324,963
2018	21,191	3,401,079
2019	21,642	3,473,410
2020	22,092	3,545,688
2021	22,543	3,618,034
2022	22,991	3,689,929
2023	23,440	3,761,960
2024	23,888	3,833,926
2025	24,334	3,905,577
2026	24,769	3,975,249
2027	25,214	4,046,697
2028	25,654	4,117,413
2029	26,097	4,188,457
2030	26,538	4,259,228

Sources: *Data derived from WSDOT Amtrak Cascades Ridership Database; Amtrak Cascades Long Range Plan, Statewide Travel & Collision Data Office, WSDOT; USDOT T-100 Domestic Segment (U.S. Carriers), On-Flight Market Passengers Enplaned by Origin for 2010; WSDOT VMT 2010 forecast; Greyhound Bus Schedules.*

Appendix E

Analysis of Operation Costs and Farebox Return

Figure 1: Amtrak Cascades Operation Costs by Category for Washington State Sponsored Trains



Source: WSDOT State Rail and Marine Office - Analysis from Amtrak financial billings to WSDOT and Talgo maintenance data - Average of 2008 and 2009

Figure 2: Ridership, Revenue, Operating Cost, and Farebox Return Projections

Ridership, Revenue, Operating Cost, and Farebox return Projections 2010-2030 for Washington State sponsored Amtrak Cascades trains:

Calendar Year	Ridership	Revenues	Operating Costs	Net Revenue	Farebox Return
2009 (actual)	523,808	18,184,319	31,984,147	($13,799,828)	56.85%
2010	567,800	19,746,638	32,041,115	($12,294,478)	61.63%
2011	554,269	19,623,567	32,618,760	($12,995,193)	60.16%
2012	564,530	20,298,035	33,126,612	($12,828,577)	61.27%
2013	573,868	20,944,431	33,625,343	($12,680,912)	62.29%
2014	582,125	21,609,404	34,200,829	($12,591,425)	63.18%
2015	588,816	22,285,701	34,870,355	($12,584,654)	63.91%
2016	599,236	23,132,892	35,753,743	($12,620,851)	64.70%
2017	709,135	27,917,779	43,718,711	($15,800,932)	63.86%
2018	842,543	33,821,614	53,777,963	($19,956,349)	62.89%
2019	855,693	35,043,281	54,830,234	($19,786,954)	63.91%
2020	866,759	36,173,524	55,884,253	($19,710,730)	64.73%
2021	876,200	37,244,758	56,848,318	($19,603,561)	65.52%
2022	885,211	38,315,970	57,858,233	($19,542,262)	66.22%
2023	895,173	39,439,357	59,672,106	($20,232,749)	66.09%
2024	906,705	40,671,026	64,553,391	($23,882,365)	63.00%
2025	917,490	41,929,497	65,724,233	($23,794,736)	63.80%
2026	928,390	43,234,946	66,835,277	($23,600,331)	64.69%
2027	939,450	44,590,325	68,026,334	($23,436,008)	65.55%
2028	950,675	45,999,370	69,253,736	($23,254,367)	66.42%
2029	961,947	47,462,904	66,706,632	($19,243,728)	71.15%
2030	973,055	48,950,826	68,881,100	($19,930,274)	71.07%

Assumptions and Basis:

Note: This projection does not include Amtrak or State of Oregon sponsored trains

Ridership Forecast

Forecast is based on historical data and reflects effect of capacity expansion, reliability improvement, scheduled time savings and population increase.

Revenue

Growth based on ridership growth and inflation rate. General inflation rate based on the implicit price deflator for personal consumption forecasted by Global Inside (November 2010).

Operating Cost

Growth based on ridership growth and inflation rate. General inflation rate based on the implicit price deflater for personal consumption forecasted by Global Inside (November 2010).

Talgo maintenance expenses are included.

Operation costs from 2016 to 2030 include estimated maintenance expenses associated with use of the Point Defiance Bypass Route. These estimates are preliminary and subject to verification and negotiation.

Operation costs also include preliminary estimates for capitalized and operational maintenance expenses associated with use of BNSF tracks for high speed passenger rail services, assuming the payment will start after the program is completed in 2017.

The impact of PRIIA Section 209 (which goes into affect in October 2013) on WSDOT operation cost was not included given the policy and cost methodology were still in process at the time of this evaluation.

The impact of second train to Vancouver, BC on operation costs and revenues were not included.

Appendix F

Updated Cost Benefit Analysis and Economic Impact

1 Project Overview

The Pacific Northwest Rail Corridor (PNWRC) is a high-speed rail corridor connecting the states of Washington and Oregon, and British Columbia (B.C.), Canada. The PNWRC Program (Program) encompasses multiple projects and phases that provide combinations of intercity and high-speed improvements including capacity and speed improvement, freight/passenger separation, running time reduction, station improvements, signal and upgrades as well as grade crossing safety improvements. The Washington State Department of Transportation (WSDOT) applied and received High-Speed Intercity Passenger Rail (HSIPR) funding from the Federal Railroad Administration (FRA) through the Track 2 application processes. This document serves as an update to the original appendix for the draft Service Development Plan (SDP) based on a revised project scope.

Under Track 2, multiple projects provide combinations of intercity and high-speed improvements including capacity improvements, speed improvements, freight/passenger separation, running time reduction, station improvements, signal and upgrades, and grade crossing safety improvements.

2 Cost Benefit Analysis (CBA) Framework

The Cost Benefit Analysis (CBA) framework is a comparison of values – the cost to build and operate the Program represents the foregone value that could alternatively be invested elsewhere and the benefits represent the improvement in social welfare delivered by the Program. To be deemed economically worthwhile, projects must pass one or more value benchmarks: the total benefits must exceed the total costs of the project on a present value basis and/or the rate of return on the funds invested should exceed the cost of raising capital, often defined as the long-term treasury rate or the social discount rate.

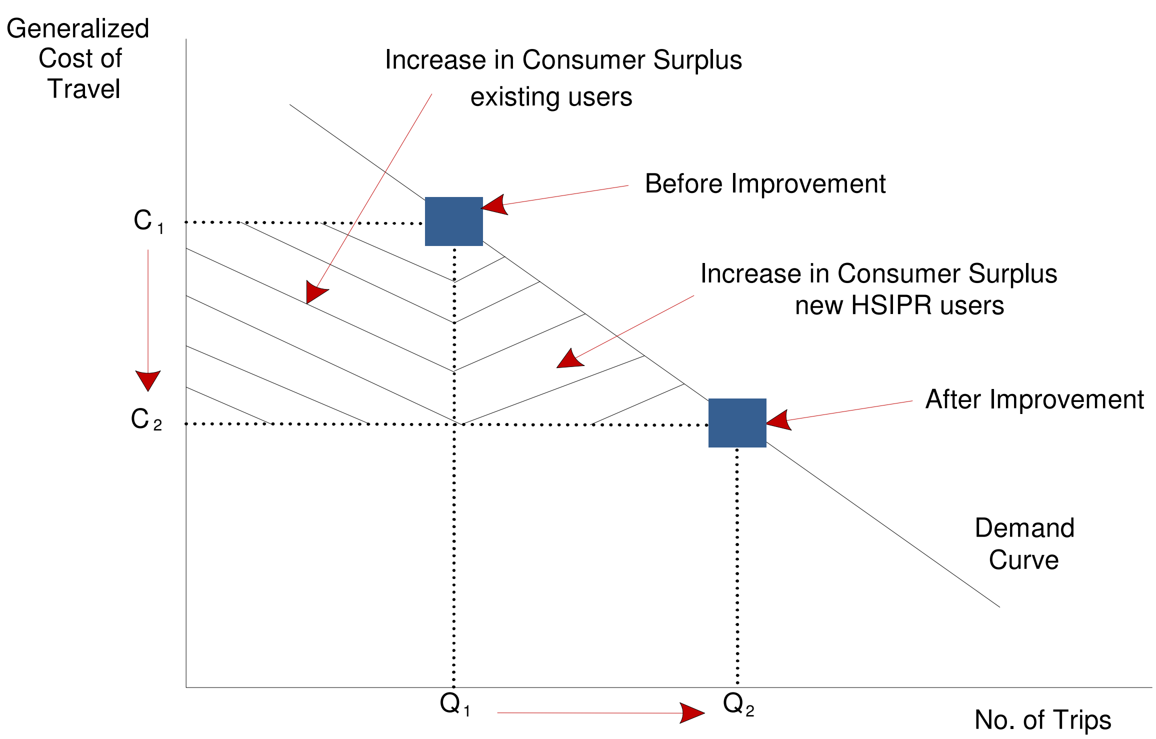
Benefits are estimated for current and future users, including remaining highway users, on an incremental basis - as the change in welfare that consumers and, more generally, society derive from the access to the new passenger rail service in comparison with an estimated no build situation. As with most transportation projects, the benefits derived from implementation, are actually a reduction in the costs associated with transportation activities. However, the reduction of costs due to the rail service affects users differently depending on their preferences and the way the project changes their specific transportation options and costs. These cost reductions may come in the form of time saved by users, travel cost savings, reduced costs of unreliability, reduction of pollution and accidents, or more generally, a combination of these effects.

In general, benefits primarily represent the creation of economic value from changes in the quantity of final uses and the quality (time spent, reliability, among other factors) of the services provided to affected travelers. For example, the total transportation costs for current travelers between Portland and Seattle includes the value of the total time spent traveling, plus the expenses associated with operating the vehicles used for the commute, plus other externalities, such as the cost of pollution and accidents generated by the specific level and composition of traffic.

3 Methodology

In general, the economic benefits of transportation investments can be illustrated with a simple graph relating the generalized cost of travel to the demand for travel, measured as the total number of trips per time period. The generalized cost of travel includes the value of travel time under different service levels, the costs of unreliability, and any out-of-pocket expenses such as fares for transit (for car users the generalized costs include fuel, oil and depreciation costs). This relationship, the travel demand curve, is illustrated in Figure 1, below.

Figure 1: The Demand for Travel



In the diagram the number of trips is represented on the horizontal axis and the generalized cost of travel on the vertical axis. The Travel Demand Curve is downward sloping: as the generalized cost of travel decreases, the number of trips increases. Investment in new rail systems, or new routes, can be evaluated by estimating the change in the generalized price of travel brought about by the investment, and the associated change in trip making.

Riders on the improved intercity passenger rail service may experience travel time savings compared to their previous travel mode; or they can be motivated by changes in the comfort and reliability of the system, or reductions in their trip expenses. In addition, the availability of transportation at a more affordable price will encourage users to travel more, increasing the total number of trips.

Highway users will also benefit from the improved service, as trip diversion from auto to rail frees up some capacity on the highways. Benefits to highway users will include benefits to both existing and new highway users, as the reduction in highway congestion (due to trip diversion) reduces the generalized cost of highway travel (travel time, fuel and oil consumption, accident costs, etc.)

The benefits of the passenger rail service could therefore be evaluated by considering the travel cost savings accruing to travelers switching from other modes, based on the consumer surplus methodology. This is accomplished by comparing transportation costs per trip between the base case and the implementation case. The social cost of a trip on a congested road includes travel time, vehicle operating cost, safety cost, and emission costs.

The availability of rail service can result in social cost savings. Congestion management benefits are expressed as the cost savings resulting from rail use, reductions in automobile use relative to the base case, including travel time savings, vehicle operating cost savings, emission cost savings, and accident cost savings. In compliance with the HSIPR application guidelines, the following sections discuss each category of benefits within the context of the evaluation criteria set forth by the HSIPR program.

4 Principles

The following principles guide the estimation of benefits and costs for this study:

- Only incremental benefits and costs are measured
    - The incremental benefits of the project include the transportation cost savings for the users of the service as a result of the implementation of the transportation improvements.
    - The incremental costs of implementation of the project include initial and recurring costs. Initial costs refer to the capital costs incurred for design and construction of a list of enhancements designed to increase the maximum speed limit on the existing tracks. Recurring costs include incremental operating costs,

and administration and marketing expenses. Only additions in cost to the current operations and planned investments are considered as costs of the project.

- Incremental in this situation means that only net additions in costs to the current situation will be considered. Any investments or operating costs required for the operation of the existing track are not considered costs associated with this project.
- Benefits and costs are valued at their opportunity costs: The benefits stemming from the implementation of the transportation improvement are those above and beyond the benefits that could be obtained from the best existing transportation alternative. For instance, the transportation costs savings for users are measured relative to the best existing alternative, which may be the highway or the existing bus service, depending on the type of user. The benefit is the net cost saving in transportation costs relative to the best alternative.

The costs of the project will only include those incremental costs that represent an opportunity costs to the funding entities. Expenditures are considered foregone opportunities to invest in the next-best alternative.

5 Guidance

U.S. Department of Transportation's (USDOT) Federal Railroad Administration (FRA) guidance (CFR Vol. 74 No. 119 Docket No. FRA-2009-0045) indicates that applications will be reviewed and assessed against three main categories, namely, public return on investment, project success factors and other attributes.

Metrics for the measurement of the first category, public return on investment, include service reliability, schedule and capacity, transportation in passenger miles, including diversion from other modes as well as induced ridership. Within this category, benefits are divided into three main evaluation criteria: transportation benefits, economic recovery benefits and other public benefits.

The transportation benefits criterion relates to improved intercity passenger rail service, as well as transportation network integration, including intermodal connections and transportation safety benefits. Economic recovery relates to preserving and creating jobs, particularly in economically distressed areas. The final criterion, other public benefits focuses on measuring environmental quality, energy efficiency and livable communities. Table 1 below summarizes benefits metrics.

The guidance indicates that analysis in support of HSIPR program funding should include careful and systematic economic analysis that quantifies and demonstrates the monetary value of user benefits and, if available, public benefits. FRA will consider benefits and costs using standard data provided by applicants and seek to evaluate applications in a manner consistent with Executive Order 12893, Principles for Federal Infrastructure Investments, 59 FR 4233, to base infrastructure investments on systematic analysis of expected benefits and costs, including both quantitative and qualitative measures.

In order to accomplish that, monetizing factors of project performance (e.g. accident costs per vehicle mile traveled (VMT)) are included in the analysis. However, in the absence of quantitative measures, other categories and measures of benefits are used, including qualitative assessments of potential benefits. Furthermore, in compliance with the Office of Management and Budget (OMB) circulars, A-4 and A -94, sensitivity analyses, for discount rates and other assumptions are conducted to provide for a complete perspective on the range of potential value for the project.

Table 1: Potential Benefits by Evaluation Criteria

Criteria	Criteria Description	Benefit Category
Transportation Benefits	Improved intercity passenger rail service, transportation network integration (including intermodal connections, transportation safety benefits)	User Cost Savings (existing and diverted riders) – Vehicle Operating Costs, Travel Time
		User Cost Savings to Remaining Roadway Users – Vehicle Operating Costs, Travel Time
		Induced Ridership
		Improved Reliability
		Improved Safety
		Savings in Facility and Equipment O&M
		Pavement Maintenance Savings
		Improved fluidity for freight
Economic Recovery[1]	Preserving and creating jobs, particularly in economically distressed areas	Short-Term Job Creation
		Long-term creation and preservation of jobs
Other Public Benefits	Environmental quality, energy efficiency; and livable communities	Reductions in Environmental Emissions
		Economic Development

All benefits and costs are estimated in 2009 dollars. The valuation of benefits makes use of a number of assumptions that are required to produce monetized values for all these non-pecuniary benefits. The different components of time, for instance, are monetized by using a "value of time" that is assumed to be equivalent to the user's willingness to pay for time savings in transit. Premiums to the value of time are also considered in association with reliability and other characteristics associated with the quality of the trip. Other estimates used in the monetization of benefits include the cost of operating a vehicle, including maintenance, repair, and depreciation, and the cost per ton of pollution, among other elements.

[1] The full short-term and long-term job report is provided in Appendix E - Economic Impact Assessment

6 General Assumptions

The methodology makes a number of assumptions that generally seek to avoid overestimation of benefits and underestimation of costs, including the following:

- The methodology assumes that the number of users of the rail service will increase as a result of its implementation. In other words, the implementation of the project will result in induced demand, producing more riders in the system than the existing alternatives.
- Congestion relief benefits derived by current and future users of other transportation alternatives are accounted for in the analysis.
- Average improvements in welfare are estimated for those riders that are expected to switch from other modes of transportation. Welfare improvements are approximated by the change in the average generalized transportation cost for those who switch.
- Input prices are adjusted to 2009 dollars.

7 Input Categories

Input values used in this analysis are taken from the United States Department of Transportation (USDOT) guidance on the preparation of Cost Benefit Analyses, including guidelines for the HSIPR program and TIGER Grant applications. Where USDOT has not provided valuation guidance or a reference to guidance, standard industry practice has been applied.

Estimates used in the monetization of benefits include the cost of operating a vehicle, including maintenance, repair, and depreciation.

Table 2 below lists input variables used in this analysis adjusted for 2009 dollars.

In calculating diversion benefits and in terms of the number of vehicles that would be taken off the road, the expected increase in ridership is used in conjunction with the average vehicle occupancy are used to estimate the reduction in the number of vehicles.

Meanwhile, benefits resulting from the reduction in the number of vehicles are based on values for congestion cost, pavement maintenance, noise pollution as well as accident costs, all in dollars per vehicle miles. Internal costs include those for fuel, both for vehicles as well as train miles, in addition to estimates for fare per passenger mile as well vehicle operating cost per car mile.

The average value of time for auto users is estimated at $20.10 per hour, based on the revised USDOT 2003 Departmental Guidance: Valuation of Travel Time in Economic Analysis, inflated to 2009 dollars. Meanwhile emission costs are expressed as dollars per ton and are based on the benefits associated with recently-adopted regulations that limit emissions of air pollutants from mobile sources, a category that includes passenger cars, light trucks, and other highway vehicles.

Table 2: Input Variables used in the Cost Benefit Analysis

Parameter	Units	Values
General Assumptions		
Discount Rates	%	7% and 3%
Period of Study (Lifecycle)	Years	30
Vehicle occupancy - normal (HSIPR)	Persons/Vehicle	1.10
External Costs – Vehicles		
Congestion cost per vehicle mile	$/Vehicle mile	0.055
Pavement maintenance cost per vehicle mile	$/Vehicle mile	0.003
Noise pollution cost per vehicle mile	$/Vehicle mile	0.001
Accident cost per vehicle mile	$/Vehicle mile	0.027
Automobile Parking	$/per trip	$10
Internal costs - Truck, Train, Vehicle		
Fuel cost per gallon	$/Gallon	3.47
Fuel cost of HSIPR per train mile	$/train mile	0.016
Fare per HSIPR passenger mile	$/passenger mile	0.20
Vehicle operating cost per car mile	$/Vehicle mile	0.37
Value of time		
Value of travel time (per hour) - Business	$/Hour	20.10
Fuel Consumption		
Gallons per mile – Car	gal/mile	0.050
Gallons per passenger mile - HSIPR	gal/pass mile	0.021
Emissions Costs per Ton		
NOX	$/ton	$4,166
SO2	$/ton	$16,447
PM	$/ton	$174,976
VOC	$/ton	$1,771
CO2	$/ton	$34
Air Travel Estimates		
User Cost	$/mile	$1.18
Average Daily Airport Parking	$ / day	$7

Note: * Based on FHWA Highway Economic Requirements System (HERS)

8 Cost Benefit Analysis Results

The benefits of the rail service are evaluated in this analysis based on the HSIPR funding evaluation criteria published in CFR Vol. 74 No. 119 Docket No. FRA-2009-0045.

8.1 Operational and Ridership Benefits Metrics

Ridership data was provided by WSDOT and Amtrak in an annual matrix. A midpoint ridership has been developed for the corridor relying on ridership data from both WSDOT and Amtrak. The analysis included ridership only for stations in Washington located along the I-5 corridor from Vancouver in British Columbia to Eugene, Oregon. The baseline ridership (status quo) was 761,610 in 2009 using the midpoint for all stations with an annual average growth rate of 1.6 percent applied throughout the study period. The number of HSIPR users from natural growth is subtracted from the estimated increase in ridership in the build scenario. This method prevents any double-counting between passengers who travel onboard the HSIPR due to anticipated growth and those who travel due to the reduction in travel time.

Table 3 below shows the estimated average annual additional ridership by mode and includes the average annual induced trips. The sum of all these represent the average annual trips on the completed HSIPR.

Table 3: Increased Incremental Ridership by Source

Variable	Passengers
Average Annual Trips[2]	336,487
Average Annual Trips Diverted From Autos	265,543
Average Annual Trips Diverted from Air Travel	38,502
Average Annual Trips Diverted from Bus	7,206
Average Annual Trips from Induced Demand	25,237

As a result of the above-mentioned diversion of trips from auto to HSIPR, Table 4 below shows the estimated average annual reduction in VMT and total amount of auto trips diverted throughout the study period. Induced trips are not included in these calculations, since induced users previously made no trips at all.

[2] The average output, for all variables in each table, will take into account the years of operation (2017-2038) too avoid the years of no benefits during construction which would weigh down the mean. In the previous CBA, the average included these years.

Table 4: VMT and Auto Reduction

Variable	Value
Average Annual VMT Reduced	38,745,074
Auto Trips Reduced Throughout Lifecycle	5,310,851

A result of the diversion from auto usage to the HSIPR, Table 5 below shows the total VMT avoided in addition to the pavement maintenance cost savings.

Table 5: VMT Reduction and Pavement Maintenance Savings

Variable	Value
Total VMT Avoided	852,391,618
Pavement Maintenance Savings	$756,434

Note: Pavement Maintenance Savings are calculated throughout the entire lifecycle at a 7% discount rate. First year of benefits is the opening year.

In terms of Vehicle Operating Cost (VOC) savings, Table 6 below illustrates the net VOC saving in addition to the induced demand benefits for new HSIPR users.

Table 6: VOC Net Savings to New Users and Induced Demand Benefits

Variable	Value
Net VOC Savings	$37,416,413
Induced Demand Benefits	$1,775,971

Note: VOC Savings and Induced Demand Benefits were calculated throughout the entire lifecycle at a 7% discount rate. First year of benefits is the opening year

As a result, benefits to existing users of rail amount to over 4 million hours saved, which amount to over $48 million during the study period (Table 7) This is a significantly lower than the previous CBA value caused by a combination of a lower estimate in time savings per passenger from WSDOT and a delay in the year of operation, from 2012 to 2017.

Table 7: Benefits to Existing Users

Variable	Value
Total Hours Saved	4,062,030
Travel Time Savings	$48, 149,052

Note: Hours Saved and Travel Time Savings were calculated throughout the entire lifecycle at a 7% discount rate. First year of benefits is the opening year

Meanwhile, benefits to remaining highway users include average annual VMT reduction, which results in reduced cost of congestion in addition to reduced accident costs. Table 8 below shows these benefits.

Table 8: Benefits to Remaining Highway Users and Safety Benefits

Variable	Value
Average Annual VMT Reduced	38,745,074
Reduced Cost of Congestion	$15, 327,937
Reduced Accident Costs	$6, 917,920

Note: Cost of Congestion and Accident Costs were calculated throughout the entire 30 year lifecycle at a 7% discount rate.

8.2 Environmental Benefits

Emission costs are dependent on the reduction of vehicle-miles diverted by the HSIPR. The analysis takes into account all modes of transportation affected by construction of a HSIPR. For Amtrak *Cascades*, this included the reduction in emissions from autos, aircraft, and buses compared to the increase in rail emissions. The consumption values for these modes were produced using Mobile 6 software, previous studies, and took into account future regulations and trends. While all emissions rates decrease over the thirty year period in all modes of transportation, the decline in these rates vary between modes and pollutants. While the rates decline, the trips growth in travel demand increases over time. In most cases the decline in the rates is outweighed by the growth in travel demand, and emission reductions move in a positive trend over time. VOC emission rates however decline at a rate faster than the growth in travel demand, and this leads to an annual reduction in VOC emission savings from the opening year until the forecasted emission rate has stabilized in future years. Per-unit costs were then applied to the emission rates to calculate annual emission costs in the build and no-build scenario with the difference being the cost savings. The carbon dioxide produced from the HSIPR is subtracted from the sum of vehicle emission cost savings to deliver the net emission savings.

Table 9 provides the quantified environmental benefits for the first, fifth and tenth year of operations as well as the total life-cycle environmental benefits.

Table 9: Environmental Reduction

Pollutant	First Year of Operation (2017)	Fifth Year of Operation (2021)	Tenth Year of Operation (2026)	Total for 30 Years of Analysis
Reduced Auto Trips	198,169	215,636	236,926	5,310,851
Reduced Gallons of Fuel	665,829	716,267	775,701	17,280,452
Reduced NOx Emissions (tons)	-21.3	-16.1	-9.4	(216.1)
Reduced PM Emissions (tons)	-0.5	-0.2	0.1	0.6
Reduced VOC Emissions (tons)	11.8	10.9	11.4	262.1
Reduced CO2 Emissions (tons)	10,302.9	11,381.3	12,723.8	285,364.9
Reduced SO2 Emissions (tons)	0.3	0.3	0.3	6.6

Meanwhile, Table 10 below shows the monetized net emission reduction savings over the life-cycle of forecast emission reduction.

Table 10: Cost Savings

Emissions Cost Savings	Value
NOx Cost Savings ($M)	($0.35)
PM Cost Savings ($M)	($0.09)
VOC Cost Savings ($M)	$0.14
CO2 Cost Savings ($M)	$2.88
SO2 Cost Savings ($M)	$0.03
Net Emission Cost Savings ($M)*	$2.62

Note: Net Emission Cost Savings subtracts the emissions being produced from rail from Total Vehicle Emission Cost Savings. These are then added with noise pollution costs from autos to calculate Environmental Benefits throughout the lifecycle at a 7% discount rate. The values represented in this table are totals for the 30 year lifecycle, discounted at 7%.

8.3 Findings and Overall Results

The table below summarizes the CBA findings. Annual costs and benefits are computed over a long-run planning horizon and summarized over the lifecycle of the project. The project is assumed to have a useful life of at least 30 years; that is the time horizon of the analysis. Construction is expected to be completed in 2017; but operating costs begin in the opening year and continue through the whole horizon of the project. Benefits also accrue during the full operation of the project.

Given all monetized benefits, the estimated rate of return is 1.88 percent. At a 7 percent discount rate, a $663.8 million investment results in over $492.5 million net benefits and a benefit to cost ratio approximately 0.74. At a 3 percent discount rate, a $855.2 million investment results in over $795.3 million in net benefits and a benefit to cost ratio approximately 0.93.

Table 11: Overall Results of the Cost Benefit Analysis

Variable	Results		
	7% Discount Rate	3% Discount Rate	0% Discount Rate
Total Discounted Benefits ($ millions)	$492.5	$795.3	$1,232.6
Total Discounted Costs ($ millions)	$663.8	$855.2	$1,081.7
Capital Costs ($ millions)	$563.2	$666.1	$760.7
O & M Costs ($ millions)	$100.5	$189.1	$321.1
Benefit - Cost Ratio	0.74	0.93	1.14
Net Present Value ($ millions)	($171.3)	($59.97)	$150.9
Internal Rate of Return	1.88%	1.88%	1.88%

Note: Values for benefits and costs represent cumulative totals at the specified discount rate for a 30 year timeframe of analysis.

Table 12: Detailed Results of the Benefit by Category

Benefit Category	Results		
Transportation Benefits	**7% Discount Rate**	**3% Discount Rate**	**0% Discount Rate**
Benefits to High Speed Rail Users			
Total Increased Ridership	7.4 M	7.4 M	7.4 M
Average Annual Increased Ridership	352,510	352,510	352,510
Average Annual Reduction in VMT	40.6 M	40.6 M	40.6 M
Monetized Benefits			
Benefits to High Speed Rail Users			
Transportation Cost Savings to Diverted Users ($ millions)	$140.4	$274.4	$480.2
Transportation Cost Savings to Existing Users ($ millions)	$48.1	$92.3	$159.1
Induced Demand Benefits ($ millions)	$1.8	$3.6	$6.5
System Revenues ($ millions)	$71.2	$137.3	$237.6
Economic Recovery Benefits			
Short-Term Employment Benefits for EDAs	$214.7	$256.2	$294.7
Benefits to Traffic			
Congestion Cost Savings ($ millions)	$15.3	$29.5	$51.1
Accident Cost Savings ($ millions)	$6.9	$13.3	$23.1
Pavement Maintenance Savings ($ millions)	$0.8	$1.5	$2.5
Noise Emission Savings ($ millions)	$0.3	$0.5	$0.9
Environmental Benefits ($ millions)	$2.6	$5.3	$9.5
NOx	-$0.3	-$0.6	-$0.9
PM	$0.0	$0.0	$0.0
VOC	$0.1	$0.3	$0.5
CO_2	$2.9	$5.6	$9.7
SO_2	$0.0	$0.1	$0.1

Note: Monetary values of benefits represent cumulative totals at the specified discount rate for a 30 year timeframe of analysis.

Appendix G

Updated Economic Impact Assessment

1. Overview

This document contains the revised results of the Economic Impact Assessment (EIA) for the Washington State Department of Transportation (WSDOT) Proposed Intercity Rail Passenger ARRA Track 2 projects. The economic impacts were estimated using both the Washington Input-Output Model developed by the Office of Financial Management (OFM) as well as the IMPLAN system. OFM provided state job multipliers for the different activities (pre-engineering, right-of-way acquisition and construction) occurring during the development phase (through 2017). The IMPLAN system was used to obtain U.S. multipliers for all activities occurring during the development phase and the operational phase. It was also used to derive state multipliers associated with operations and maintenance (O&M) expenditures. A complete discussion of the EIA methodology is included in Section 2.

This assessment analyzes both short-term economic impacts that stem from the engineering, right-of-way acquisition and construction spending associated with the Track 2 projects as well as the long-term economic impacts that stem from the additional rail service provided by the Track 2 projects. Therefore, economic impacts are calculated for both the costs associated with the construction of the Track 2 projects as well as the additional annual O&M expenditure associated with these projects. Capital costs, shown in Table 1, are non-escalated as the EIA modeling methodology uses current relationships between investment and economic outcomes and using escalated cost data would distort the results.

Table 1: Capital Costs by Task, Millions of 2009 Dollars

Task	Capital Cost (Millions of 2009 Dollars) [a]
Task 1: Infrastructure Improvements (D to M Street Connection)	$45.9
Task 2: Infrastructure Improvements (Point Defiance Bypass)	$89.1
Task 3: Infrastructure Improvements (Vancouver Rail Yard Bypass)	$28.5
Task 4: Infrastructure Improvements (Kelso Martin's Bluff Toteff Siding)	$36.5
Task 5: Infrastructure Improvements (Kelso Martin's Bluff - New Siding)	$34.7
Task 6: Infrastructure Improvements (Kelso Martin's Bluff - Kelso to Longview Jct.)	$123.0
Task 7: Infrastructure Improvements (Everett Storage Tracks)	$3.5
Task 8: Infrastructure Improvements (Corridor Reliability Upgrades - South)	$91.7
Task 9: Infrastructure Improvements (Advanced Wayside Signal System)	$60.7
Task 10: Infrastructure Improvements (King Street Station Tracks)	$50.4
Task 11: Equipment Acquisition - New Train Set	$23.5
Task 12: Program Management	$30.0
Task 13: Infrastructure Improvements (Corridor Reliability Upgrades - North)	$57.3
Task 14: Infrastructure Improvements (Vancouver New Middle Lead)	$10.0
Task 15: Infrastructure Improvements (Blaine-Swift Customs Facility)	$5.0

Task 16: Equipment Acquisition – New Locomotives	$46.7
Unallocated Contingency	$23.4
Total	**$760.1**

[a] *Costs modeled in EIA represent non-escalated total project costs, in millions of dollars.*

Based on information provided by the project team, it is estimated that 75 percent of the new train set costs will be domestically incurred, and therefore 75 percent of these costs are accounted for in the EIA. The remaining costs are assumed to be expended internationally and therefore are not included in our analysis. While these items will be domestically sourced, they may not be entirely sourced within the State of Washington. Therefore the analysis looks at both impacts at the state level and at the national level.

The long-term economic impacts are estimated based on the additional O&M costs. Additional annual O&M costs are summarized in Table 2 below.

Table 2: Additional Annual Operations and Maintenance Costs, Millions of 2009 Dollars

Year	Additional O&M Cost (Millions of 2009 Dollars)
2009	$0.0
2010	$0.0
2011	$0.0
2012	$0.0
2013	$0.0
2014	$0.0
2015	$0.0
2016	$0.0
2017	$14.6
2018	$14.6
2019	$14.6
2020	$14.6
2021	$14.6
2022	$14.6
2023	$14.6
2024	$14.6
2025	$14.6
2026	$14.6
2027	$14.6
2028	$14.6
2029	$14.6
2030	$14.6

Source: WSDOT State Rail and Marine Office - An analysis based on Amtrak Cascades operation data. Total costs include WSDOT costs, ODOT costs and Amtrak costs.

2. Methodological Aspects

Economic recovery impacts are estimated based on project expenditures between 2009-Q4 and project completion in 2017-Q4. Two different methodologies were applied to estimate the economic impacts of the Track 2 projects, depending on the type of spending (capital costs vs. O&M costs) and the study area (state of Washington vs. U.S.).

Washington Input-Output Model

WSDOT has worked with the Governor's Office of Financial Management (OFM) Forecast Division to develop a method to estimate the job impact associated with projects funded by money received as part of the 2009 American Recovery and Reinvestment Act (ARRA).

OFM was able to supply job multipliers associated with preliminary engineering, right-of-way acquisition and construction of highway-related projects. However, OFM did not have a similar, existing set of multipliers available to estimate job impacts associated with railroad construction. To overcome this, WSDOT provided spending pattern information for a previously completed project similar to the type of work expected to be completed with ARRA funds allocated for high speed rail projects. This information was used to derive state level job impact multipliers for railroad construction, similar to those WSDOT uses for highway construction projects. The state-level job impact multipliers WSDOT used to produce estimates for High Speed Rail projects are included in Table 1 below.

Table 3: Job Impact per $1 Million

Activity	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017
Pre-Engineering (PE)	15.784	15.108	14.433	13.789	13.175	12.590	12.032
Right-of-Way (RW)	0.871	0.830	0.789	0.750	0.713	0.678	0.645
Construction (CN Rail)	13.141	12.637	12.133	11.633	11.142	10.700	10.276

The IMPLAN System

The IMPLAN input-output model was also used to estimate the short-term economic impacts at the national level as well as the long-term economic impacts at both the national and state levels. The IMPLAN results are expressed in terms of employment (job-years),[1] value added and

[1] One job-year is defined as one job for one year; two job-years would be the equivalent of two persons employed for one year each or one person employed for two years.

labor income. Value added includes employee compensation, proprietor income (payments received by self-employed individuals as income), other property income, and indirect business taxes; it is roughly equivalent to the gross product of a given area (e.g., Gross Domestic Product for the U.S.). Labor income consists of employee compensation (wage and salary payments as well as health and life insurance, retirement payments, and any other non-cash compensation) and proprietary income; this is a subset of value added.

Impacts can be examined in terms of the type of impact. These effects are defined as:

- The **direct effect** represents the initial expenditures (construction expenditures, for instance) that are received by businesses located in the study area;
- The **indirect effect** represents the impact of the additional business spending that is generated as these businesses sell more output and in turn purchase additional inputs from their suppliers (machinery manufacturers, for instance); and
- The **induced effect** represents the increase in economic activity – over and above the direct and indirect effects – associated with increased labor income that accrue to workers and is spent on household goods and services purchased from businesses in the area.

Note that the spending pattern information on engineering, right-of-way acquisition and construction activities used by OFM to derive the state job multipliers was used in IMPLAN to derive job multipliers at the national level.

3. Short-Term Economic Impacts

The short-term impacts associated with engineering, right-of-way acquisition and construction expenditures were estimated at the state level using job-multipliers derived from the Washington Input-Output Model and provided by OFM. Note that the impacts associated with equipment acquisition are not estimated at the state level since the new train sets will be purchased out-of-state.

Short-Term Impacts on the Washington Economy

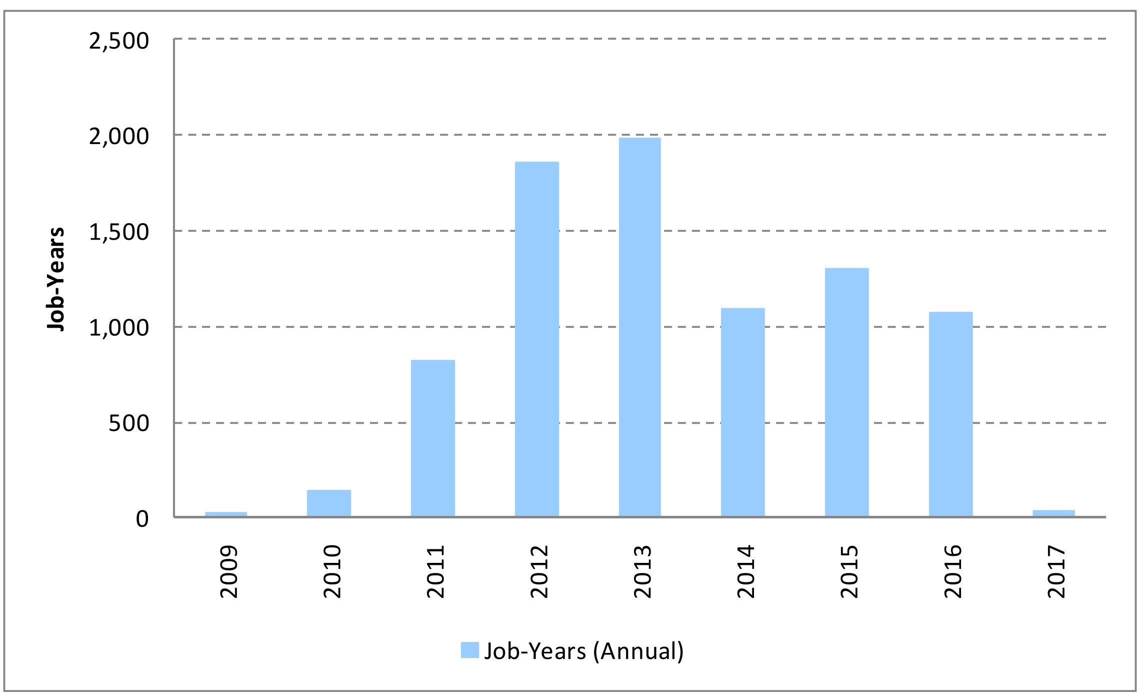
Table 4 below summarizes the short-term employment impacts of the Track 2 Projects at the state level. These values are based on spending expected to take place within the State of Washington. They do not include the costs associated with the procurement of new train sets. As shown in the table, engineering, right-of-way acquisition and construction activities will generate 8,309 job-years over the construction period (2009-2017).

Table 4: Employment Impacts Associated with Engineering, Right-of-Way Acquisition and Construction at the State Level (2009-2017), WA Input-Output Model

Activity	2009-2012	2013-2017	Total
Engineering	670	471	1,141
Right-of-Way Acquisition	1	4	5
Construction	2,169	4,994	7,163
Total	2,840	5,469	8,309

As evidenced in Figure 1 below, nearly 40 percent of the job creation will occur by the end of 2012.

Figure 1: Annual Employment Impacts Associated with Engineering, Right-of-Way Acquisition and Construction at the State Level (2009-2017), WA Input-Output Model



The short-term economic impacts on Economically Distressed Areas (EDAs) are also assessed for projects, or portions of projects, located within EDAs. EDAs are geographic areas that are deemed to be of high importance in the recovery of the nation's economy. These may be areas that have born a larger share of the impacts of the recent economic downturn or which may have a relatively more difficult path to recovery. An area is designated as an EDA by meeting either of the following criteria[2]:

- Unemployment is one percent or more above the national average, or
- The per capita income is 80 percent or less than the national average.

Three EDAs will be directly impacted by the construction of the Washington State High-Speed Rail Track 2 projects: Clark County, Cowlitz County and Lewis County. Short-term employment impacts in these three areas are shown by type of activity (engineering, right-of-way acquisition and construction) in Table 5 below. In total, nearly 3,800 job-years are expected, with construction accounting for more than 88 percent of the total.

Table 5: Employment Impacts Associated with Engineering, Right-of-Way Acquisition and Construction at the EDA Level (2009-2017), WA Input-Output Model

Activity	2009-2012	2013-2017	Total
Engineering	252	181	433
Right-of-Way Acquisition	0	4	4
Construction	940	2,385	3,325
Total	1,193	2,570	3,763

Short-Term Impacts on the U.S. Economy

At the national level, the Washington State High Speed Rail project produces economic impacts that differ in breadth and magnitude from those at the state level. Included in the analysis are impacts resulting from engineering, right-of-way acquisition, construction as well as railroad rolling stock. The analysis at the national level is necessary as a portion of the costs (new train set and locomotives) is expected to be spent on domestically produced items; however, these may not necessary all come from within the State of Washington.

[2] For an interactive map of economically distressed areas, see http://hepgis.fhwa.dot.gov/hepgis_v2/GeneralInfo/Map.aspx, which is maintained by the Federal Highway Administration and updated quarterly.

In general, the magnitude of the economic impact is strongly influenced by the size of the study area (or economic base): the larger the study area, the higher the impact. Indeed, impacts that occur from transactions between states would be lost when examining one state alone, though are included in the analysis at the national level. Accordingly, the economic impacts on the U.S. economy are larger than the economic impacts on the Washington economy.

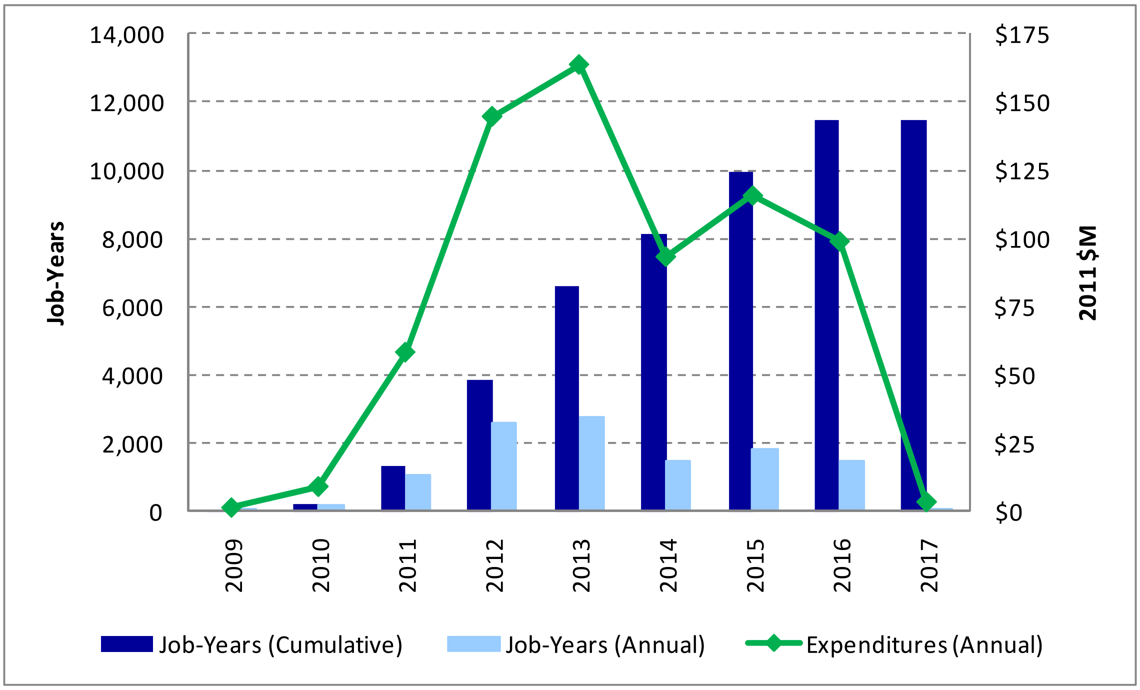
Table 6 below presents the short-term economic impacts associated with engineering, right-of-way acquisition and construction expenditures by type of effect at the national level.

Table 6: Direct, Indirect, & Induced Economic Impacts Associated with Engineering, Right-of-Way Acquisition and Construction at the National Level (2009-2017), IMPLAN

Impact Metric	Direct	Indirect	Induced	Total
Employment (Job-Years)	4,516	2,104	4,877	11,498
Value Added (2009 $M)	$280.3	$224.9	$406.3	$911.5
Labor Income (2009 $M)	$262.8	$141.9	$237.3	$641.9

Annual employment impacts are also graphically represented in Figure 2 below. The figure shows the cumulative growth in job-years (dark blue bars), annual job-years (light blue bars) and annual project spending (green line, measured along the secondary vertical axis). Spending on engineering, right-of-way acquisition and construction is expected to generate nearly 11,500 job-years in the U.S. from 2009 to 2017. Nearly half of the job growth (5,323) will occur in 2012 and 2013.

Figure 2: Job-Creation & Expenditures on Engineering, Right-of-Way Acquisition and Construction by Year at the National Level (2009-2017), IMPLAN



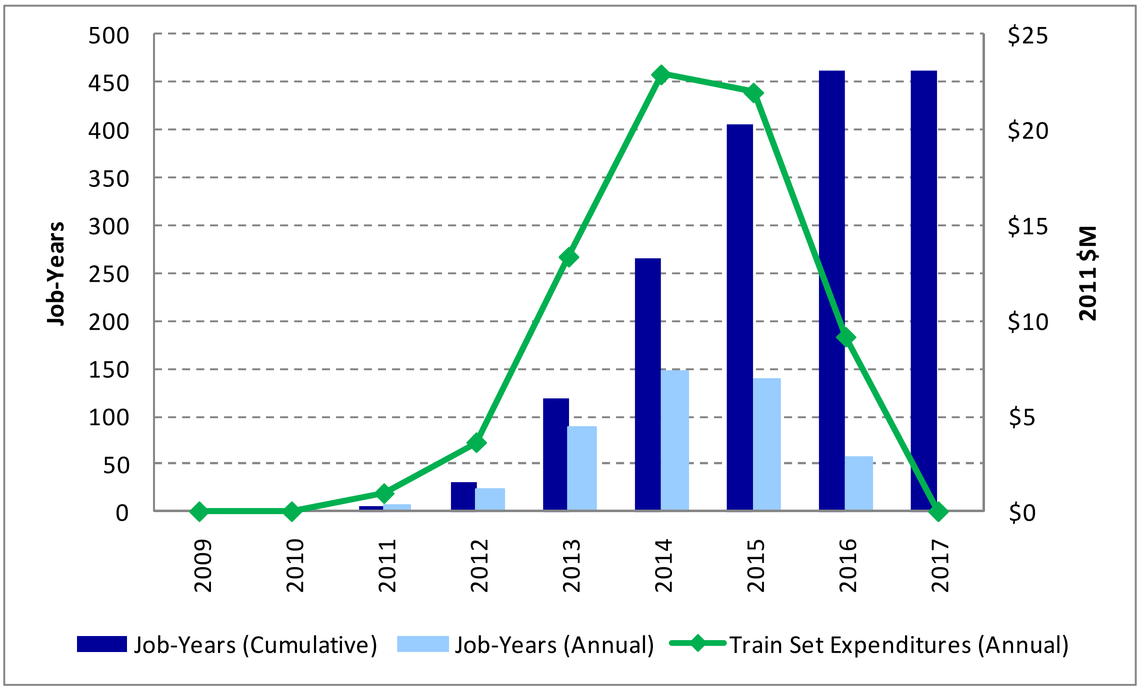
The purchase of new train set and locomotives will also stimulate the U.S. economy. These additional short-term economic impacts are shown in Table 7 below. In total, 463 job-years will be created. Moreover, $59.8 million will be generated in value added, of which over 48 percent is attributed to labor income.

Table 7: Direct, Indirect, & Induced Economic Impacts Associated with the Acquisition of New Train Sets at the National Level (2009-2017), IMPLAN

Impact Metric	Direct	Indirect	Induced	Total
Employment (Job-Years)	95	156	212	463
Value Added (2009 $M)	$23.8	$18.6	$17.4	$59.8
Labor Income (2009 $M)	$7.3	$11.0	$10.1	$28.5

Figure 3 below illustrates the cumulative growth in job-years (dark blue bars) along with annual jobs years (light blue bars), in response to the new train set and locomotives expenditures. Additionally, annual spending is represented by the green line, measured along the secondary vertical axis. Over 62 percent of the employment impact will be generated in 2014 and 2015.

Figure 3: Job-Creation & Expenditures Related to the Acquisition of New Train Sets by Year at the National Level (2009-2017), IMPLAN



4. Long-Term Economic Impacts

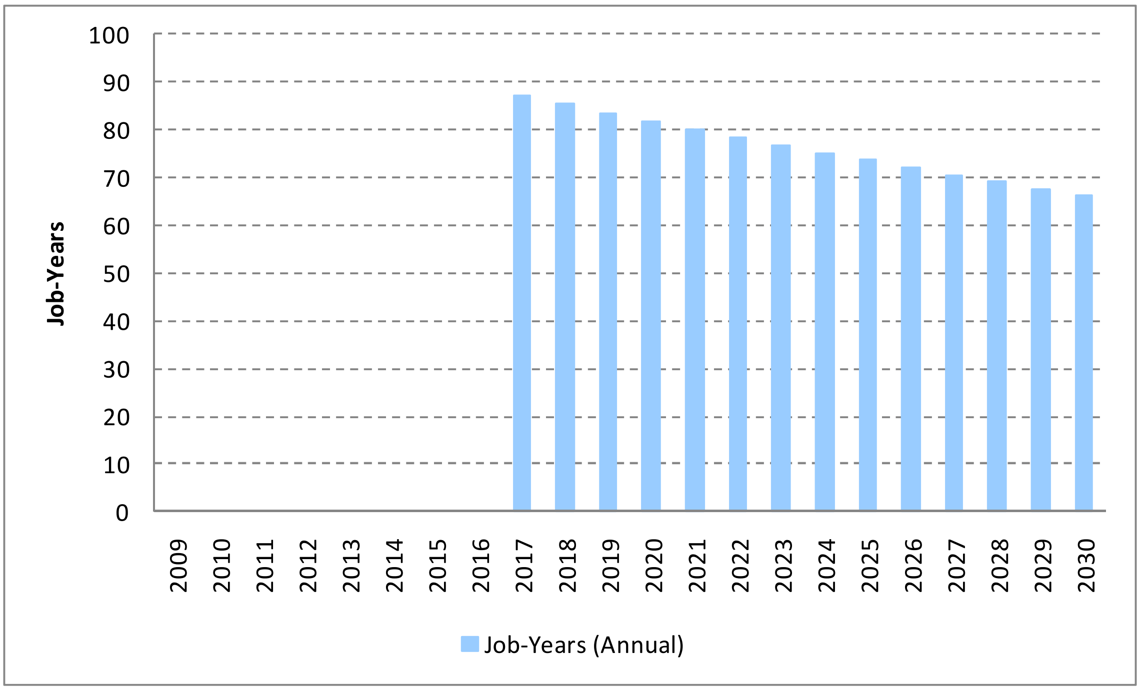
Additional expenditures on rail operations and maintenance (O&M) will spur economic activity as new levels of rail service are achieved after completion of the project in 2017. Note that a productivity index[3] has been applied to account for increases in worker productivity and advances in technology, effectively increasing output per dollar spent over time.

[3] O&M costs are discounted by a 2.1 percent average annual growth rate. This is based on the BLS data series MPU491003, 1987 – 2008, Multifactor productivity index, Output per hour, Private non-farm business sector.

Long-Term Impacts on the Washington Economy

At the state level, the additional spending on O&M is expected to generate 1,067 job-years through 2030. At peak (2017), those additional costs will create 87 job-years as shown in Figure 4 below. As explained above, the steady decline in job creation reflects improvements in productivity over time.

Figure 4: Annual Employment Impact of O&M at the State Level (2009-2030), IMPLAN



O&M impacts can also be expressed in terms of value added and labor income. Table 8 shows these impacts by type of effect based on the additional annual O&M costs from 2017 to 2030. At any given time over this period, on average, the gain in value added will be $9.0 million and that in labor income will be $5.2 million; the growth pattern is the same as that for O&M employment impacts.

Table 8: Average Annual Direct, Indirect & Induced Economic Impacts of O&M Expenditures at the State Level (2017-2030), IMPLAN

Impact Metric	Direct	Indirect	Induced	Total
Value Added (2009 $M)	$4.3	$2.5	$2.2	$9.0
Labor Income (2009 $M)	$2.2	$1.7	$1.3	$5.2

Table 9 below shows the top ten industries that are indirectly impacted by the additional spending on O&M. The indirect employment impact accounts for about 20 percent of the project's total impact, or 210 job-years. Maintenance and repair construction of nonresidential structures has the largest set of impacts, generating 62 job-years, $4.2 million in value added and $3.6 million in labor income over the 2017-2030 period.

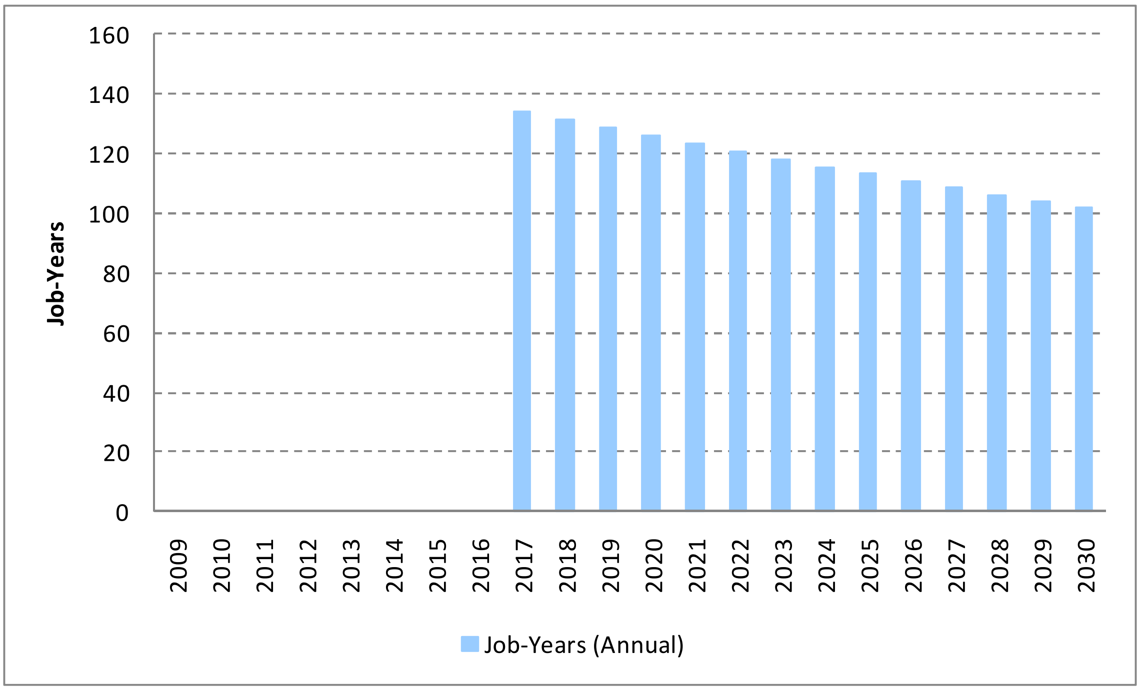
Table 9: Top Ten Industries Indirectly Impacted by O&M (2017-2030) at the State Level, IMPLAN

Industry	Employment (Job-Years)	Value Added ($M)	Labor Income ($M)
Maintenance and repair construction of nonresidential structures	62	$4.2	$3.6
Nondepository credit intermediation and related activities	21	$1.4	$1.4
Securities, commodity contracts, investments, and related activities	20	$2.4	$1.3
Wholesale trade businesses	19	$3.4	$2.0
Commercial and industrial machinery and equipment rental and leasing	19	$0.2	$0.2
Employment services	17	$2.2	$1.3
Services to buildings and dwellings	14	$0.8	$0.8
Accounting, tax preparation, bookkeeping, and payroll services	13	$0.4	$0.3
Computer systems design services	12	$0.9	$0.9
Real estate establishments	12	$1.6	$0.3
Total for key industries indirectly impacted	**210**	**$17.43**	**$12.03**

Long-Term Impacts on the U.S. Economy

At the national level, the additional spending on O&M is expected to generate a total of 1,642 job-years through 2030. At peak (2017), those additional costs will create 134 job-years as shown in Figure 5 below. Again, the steady decline in job creation reflects improvements in productivity over time.

Figure 5: Annual Employment Impact of O&M at the National Level (2009-2030), IMPLAN



O&M impacts can also be framed in terms of value added and labor income. Table 10 shows these impacts by type of effect based on the additional annual O&M costs from 2017 to 2030. On average, the gain in value added will be $12.8 million per year and that in labor income will be $7.5 million per year.

Table 10: Average Annual Direct, Indirect & Induced Economic Impacts of O&M at the National Level (2017-2030), IMPLAN

Impact Metric	Direct	Indirect	Induced	Total
Value Added (2009 $M)	$4.1	$4.1	$4.5	$12.8
Labor Income (2009 $M)	$2.2	$2.7	$2.7	$7.5