CAMBRIDGE SYSTEMATICS

Washington State Rail Plan

Technical Note 4b: Passenger Rail Ridership Forecasts

Final Report

prepared for

Washington State Department of Transportation

prepared by

Cambridge Systematics, Inc.

August 2013

www.camsys.com

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date

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1.0 Key Findings

This report summarizes projected future-year (2035) passenger rail ridership for Washington state. It builds off the findings from the Technical Note #3b: *Passenger Rail Usage and Impacts of the Rail System in Washington State* and previous alternatives developed, and evaluation conducted, by Washington State Department of Transportation (WSDOT) staff. This report presents anticipated ridership growth for long-distance, intercity and commuter rail. There is also additional detail about ridership alternatives for Amtrak Cascades based on various investment levels categorized as minimal, low, medium and high.

Passenger Rail Ridership Forecast Key Findings

- **Despite a decline in observed ridership in 2011, overall ridership is expected to increase steadily through 2035 for both the Empire Builder and Coast Starlight.** Ridership along the Empire Builder is estimated at 1.3 million in 2035, with 404,000 annual riders from Washington stations and Portland. Ridership along the Coast Starlight is estimated at 1.2 million people with 395,000 riders from Washington stations and Portland. Annually, ridership at Washington stations and the Portland, Oregon station contribute over 30 percent to route ridership on average for both routes. As such, each station is forecast to grow between 1 and 2 percent annually. Ridership forecast values are from Amtrak with an extension of projections by Cambridge Systematics.
- **Total 2035 system-level ridership on Amtrak Cascades is projected to be 1.2 million riders under the Baseline Alternative.** The Amtrak Cascades Baseline Alternative includes projects under development as part of the $800 million in federal funds secured by WSDOT. A sharp increase in ridership is expected following the year 2017, largely due to increasing the number of one-way train trips (train legs) between Seattle and Portland from eight to 12. A train leg is a one-way train trip within a segment, in this case between Seattle and Portland. It is estimated that by 2035 approximately 1.2 million annual riders will use Amtrak Cascades. The Seattle to Portland segment contributes the majority of both ridership and growth along the route between 2010 and 2035. Ridership values are from the Amtrak Cascades ridership model.
- **Amtrak Cascades potential improvements and associated ridership forecasts are outlined**. **The assumed scenarios result in ridership increases between 50 percent and 250 percent over 2010 ridership, depending on the improvements included.** The lowest growth in ridership assumes a small increase in reliability and a small increase in train length. The greatest increase in ridership assumes longer trains, more trains, higher reliability and significant travel time savings. Moderate growth over the Baseline is found

by lengthening trains and adding trips. The highest growth in ridership would require substantial investments—particularly as compared to the other alternatives. Ridership values are from the Amtrak Cascades ridership model. Scenarios were developed through conversations between WSDOT and Cambridge Systematics staff and are carried forward from previous plans, including the *Long-Range Plan for Amtrak Cascades* (2006), and *Amtrak Cascades Mid-Range Plan* (2008).

- **By 2035, it is estimated that Sounder will accommodate nearly 5.8 million annual riders.** The majority of these riders are anticipated to be between Lakewood and Seattle (South Corridor). According to historical ridership data, the South Corridor carries between 86 and 91 percent of the riders. In 2035, the South Corridor ridership is predicted to be approximately 5.1 million of the total 5.8 million riders. Ridership forecast values were obtained from correspondence with Sound Transit, with an extension of projections by Cambridge Systematics.

2.0 Introduction

As the Washington State Rail Plan has been developed, historic passenger ridership, existing passenger rail infrastructure, safety, environment and the macro-level interactions between passenger rail demand and mode choice, traffic volume and the economy have been considered. This technical note presents the forecasts for long-distance, intercity and commuter rail ridership in Washington. The information in this technical note will inform the analysis of project needs and the subsequent development of rail plan priorities and recommendations.

Section 3.0 of this report presents the methodologies used to forecast passenger rail ridership on long-distance rail (Empire Builder and Coast Starlight), intercity rail (Amtrak Cascades), commuter rail (Sounder) and the resulting 2035 ridership forecasts. Broadly, the ridership forecasts in Section 3.0 and Section 4.0 were developed from:

- **Empire Builder and Coast Starlight –** Forecasts provided by Amtrak with an extension by Cambridge Systematics.
- **Amtrak Cascades –** The Washington State Department of Transportation (WSDOT) ridership forecasting model for Amtrak Cascades.
- **Sounder –** Information provided via correspondence with Sound Transit with an extension of the forecasts by Cambridge Systematics.

Section 4.0 presents four alternative future Amtrak Cascades service scenarios and the associated forecast ridership. While these scenarios show future demand based on a variety of improvements and alternative service conditions, they do not forecast potential service capacity improvements based on future riders. For all passenger rail service types, the implications of these ridership forecasts on needs and statewide policy strategies will be considered in other technical notes.

3.0 2035 Passenger Rail Ridership Forecasts

This section presents the 2035 ridership forecasts on long-distance, intercity and commuter passenger rail. The information includes an overview of the methodologies, key variables in the development of the forecasts and the resulting ridership forecasts.

3.1 LONG DISTANCE

The passenger rail ridership forecasts for the Amtrak Empire Builder and Coast Starlight service were developed by:

1. Acquiring 2012 to 2017 ridership forecasts from Amtrak.
2. Developing growth factors to extend the 2017 forecast to 2035.

The following describes these steps in more detail.

Amtrak 2012 to 2017 Ridership Forecasts

Amtrak provided the following specific data: historical monthly ridership data at the station level for the entire system from October 2001 through September 2012, and future fiscal year (FY) annual station-level data for fiscal year 2012 (FY 2012) through FY 2017. According to Amtrak the FY 2012 through FY 2017 forecasts were calculated by:

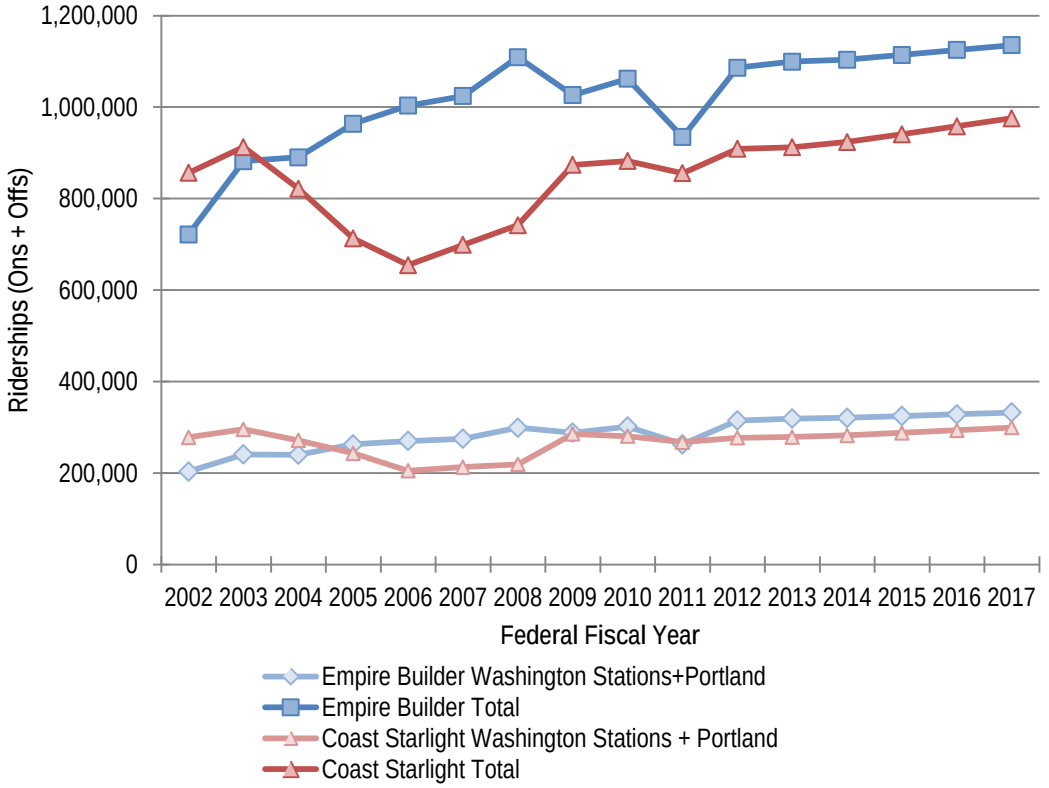
- Looking at the past 12 months of ridership demand for the markets around each station.
- Making adjustments to this demand based on population and household income growth information for each station area (within a 30-mile radius) derived from Moody's Corporation data.
- Considering the impact of service changes. Amtrak has no service changes planned for the Empire Builder and Coast Starlight.

The 2012 to 2017 Empire Builder and Coast Starlight ridership forecasts are shown in Figure 3.1. It is important to note that Amtrak defines ridership as the sum of ons and offs[1] at each station. This definition differs from that used in Technical Note 3b, which defines ridership as one-half the sum of ons and offs.

[1] Ons and offs refer to how many passengers got on or off the train at each station.

The entire sum of ons and offs is used in this instance due to the nature of the data reported by Amtrak.

Figure 3.1 Empire Builder and Coast Starlight Historical On-Off Ridership and Near-Term Amtrak Forecasting



Source: Amtrak historical on-off ridership for 2002 through 2011. Amtrak forecasts for 2012 through 2017.

Growth Factors

Next Cambridge Systematics developed simple annual growth factors calculated from short-term Amtrak forecasts and applied them to future fiscal years through 2035. Growth rates were estimated for each station in Washington and for the entirety of both the Empire Builder and Coast Starlight routes. In summary:

- For Empire Builder stations in Washington, station-level annual growth rates ranged from 0.94 percent to 1.94 percent with an annual growth rate of 1.07 percent in the state.
- The Empire Builder annual growth rate is 0.89 percent for stations across the entire Chicago to Seattle/Portland route. This shows that on-off ridership at stations within Washington is forecast to grow at a faster rate than at stations outside of the state.

- For Coast Starlight stations in Washington, the station-level annual growth rate ranged from 1.43 percent to 2.00 percent with an annual growth rate of 1.55 percent in the state.
- The Coast Starlight annual growth rate is 1.43 percent for stations across the entire Seattle to Los Angeles route. Like Empire Builder, this shows that on-off ridership at stations within Washington is forecast to grow at a faster rate than at stations outside of the state.

The methodology and resulting growth factors to estimate total annual and station-level on-off ridership was reviewed and confirmed with Amtrak staff.[2]

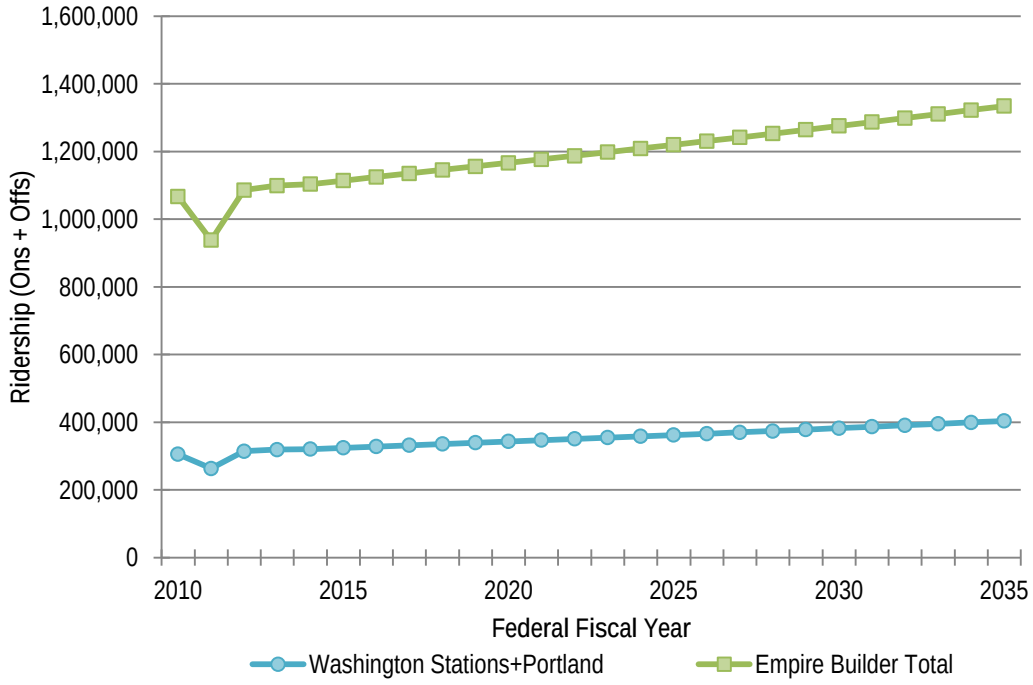
Results for both Empire Builder and Coast Starlight are provided below.

Empire Builder

Figure 3.2 shows Empire Builder on-off ridership forecast through 2035. As shown, it is estimated that over 1.3 million passengers annually will ride the Empire Builder, with nearly 404,000 riders from Washington and Portland stations. Eleven of the 46 Empire Builder stations are in Washington. Annually, these, along with on-off ridership from the Portland, Oregon station, contribute approximately 30 percent of total route on-off ridership.

[2] Correspondence with Bill Sheridan on October 23, 2012, and April 8, 2013.

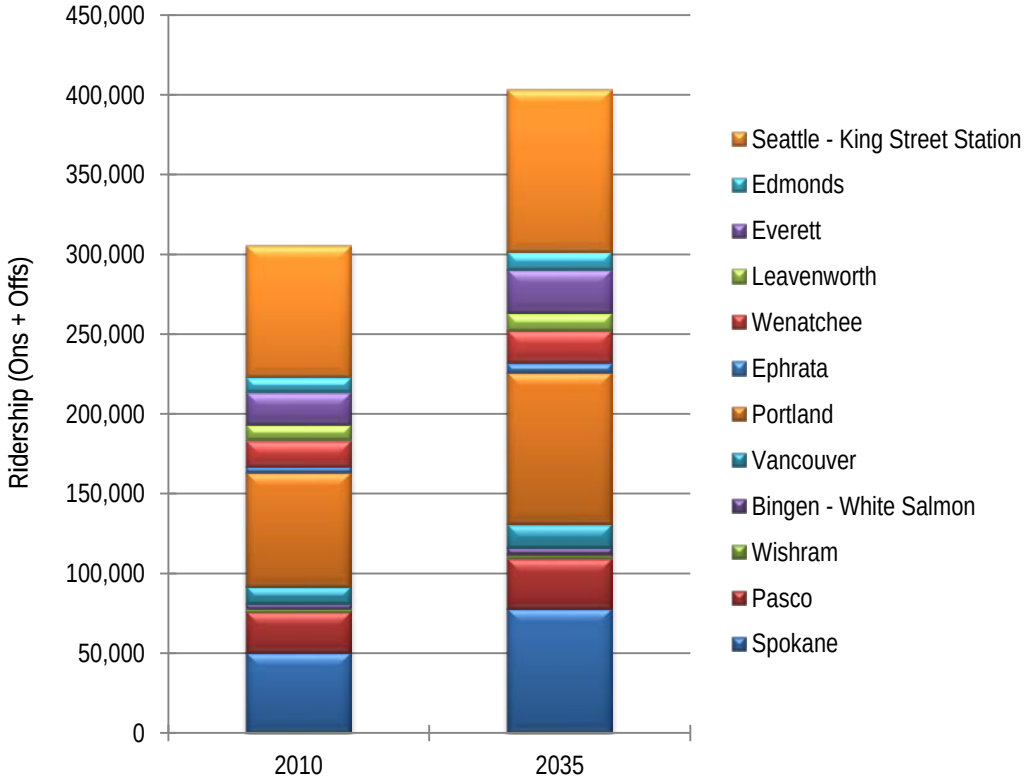
Figure 3.2 Empire Builder On-Off Ridership, 2010 through 2035



Source: Amtrak with Cambridge Systematics calculations for 2018 through 2035.

Despite a decline in observed on-off ridership in 2011, overall on-off ridership is expected to increase steadily through 2035. Figure 3.3 shows on-off ridership growth by station for all Washington stations and Portland. Today over 300,000 riders use the Washington and Portland stations on an annual basis. In 2035, approximately 404,000 riders will use the Washington and Portland stations. This is an increase of approximately 30 percent from 2010.

Figure 3.3 Empire Builder, Washington On-Off Ridership, 2010 and 2035



Source: Amtrak with Cambridge Systematics calculations for 2035.

Total WA (+ Portland) Ridership	305,640	403,805

Seattle, Portland and Spokane are the three highest volume stations. Washington stations represent 22.3 percent (29.0 percent with Portland) of Empire Builder route on-off ridership in 2012 and 23.2 percent (30.3 percent with Portland) in 2035. Between 2010 and 2035, growth in Empire Builder on-off ridership at individual Washington stations is expected to vary between 15 percent and 70 percent. See Table 3.1.

Table 3.1 Amtrak Empire Builder Station-Level On-Off Ridership, 2010 and 2035

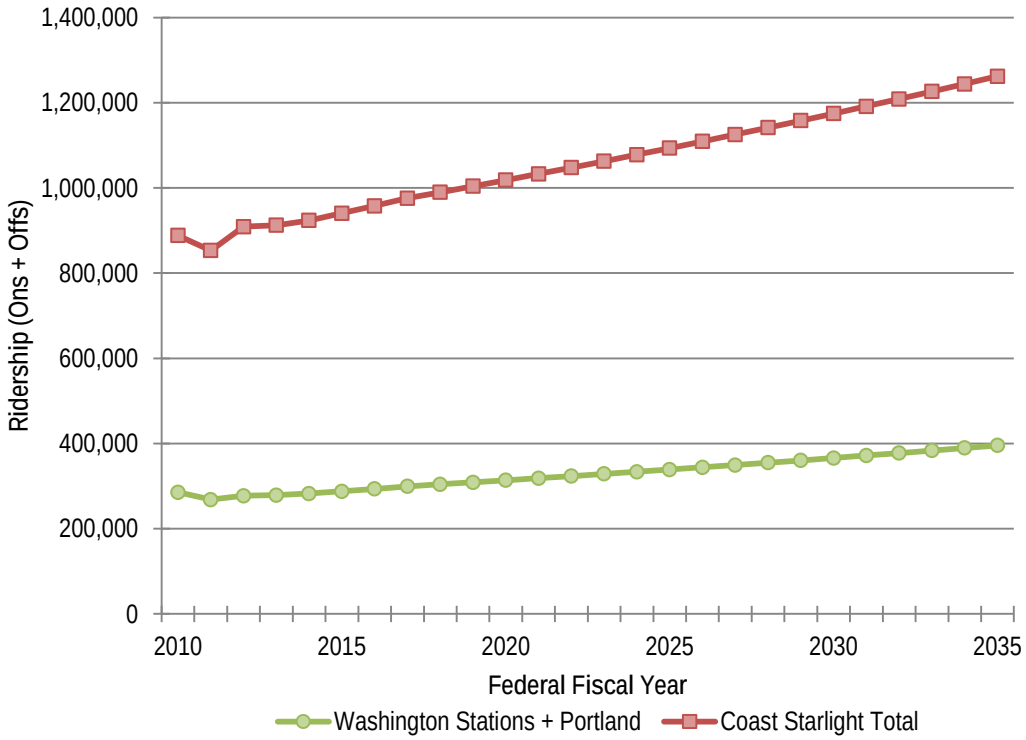
Station Name	2010 Observed	Future Year (2035)	Growth (Number of Riders)	Percentage of Growth	Annual Percentage of Growth
Seattle – King Street Station	82,559	102,069	19,510	24%	1.1%
Edmonds	9,162	11,160	1,998	22%	1.2%
Everett	20,535	27,352	6,817	33%	1.2%
Leavenworth	9,574	10,976	1,402	15%	1.1%
Wenatchee	16,912	20,400	3,488	21%	1.1%
Ephrata	3,543	6,029	2,486	70%	1.9%
Portland, OR	71,459	94,771	23,312	33%	1.1%
Vancouver, WA	10,903	14,858	3,955	36%	1.3%
Bingen-White Salmon	3,246	4,395	1,149	35%	1.5%
Wishram	1,580	2,141	561	36%	1.4%
Pasco	25,891	31,650	5,759	22%	0.9%
Spokane	50,277	78,004	27,727	55%	1.0%

Source: Amtrak with Cambridge Systematics calculations for 2035.

Coast Starlight

Figure 3.4 shows Coast Starlight on-off ridership forecast through 2035. As shown, it is estimated that over 1.2 million passengers annually will ride the Coast Starlight, with over 395,000 riders from Washington and Portland stations. Six of the 31 Coast Starlight stations are in Washington. Annually, these, along with on-off ridership from the Portland, Oregon station, contribute approximately 31 percent of total Coast Starlight route on-off ridership.

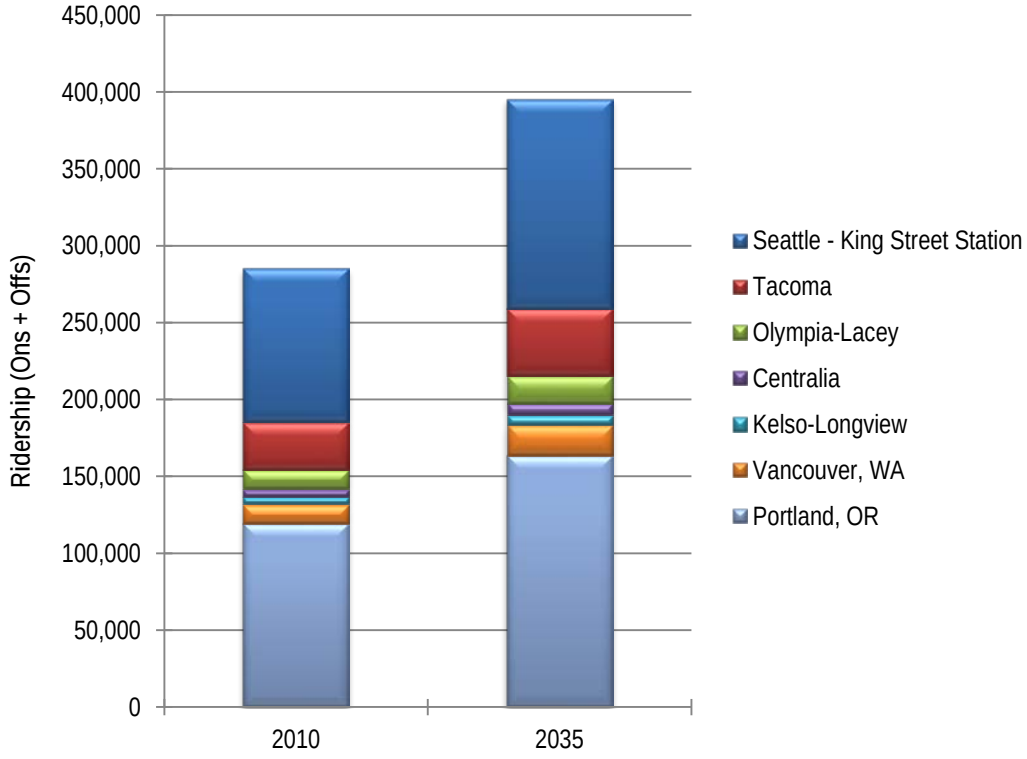
Figure 3.4 Coast Starlight On-Off Ridership, 2010 through 2035



Source: Amtrak with Cambridge Systematics calculations for 2018 through 2035.

Figure 3.5 shows Coast Starlight 2010 and 2035 on-off ridership at Washington stations and Portland. Seattle and Portland are the highest volume stations contributing over 75 percent of the riders on this route. Portland is the highest volume station, contributing over 40 percent of the annual riders to the Coast Starlight service. Washington station on-off ridership consistently represents approximately 18 percent (31 percent with Portland) of total annual Coast Starlight riders.

Figure 3.5 Coast Starlight, Washington On-Off Ridership, 2010 through 2035



Source: Amtrak with Cambridge Systematics calculations for 2035.

Total WA (+ Portland) Ridership	285,481	395,441

Considering growth at individual stations, between 2010 and 2035, Washington stations are expected to have between 36 percent and 56 percent growth in Coast Starlight riders. No stations are expected to experience a decline in on-off ridership. See Table 3.2.

Table 3.2 Amtrak Coast Starlight Station-Level On-Off Ridership, 2010 and 2035

Station Name	2010 Observed	Future Year (2035)	Growth (Number of Riders)	Percentage of Growth	Annual Percentage of Growth
Seattle – King Street Station	100,020	136,127	36,107	36%	1.4%
Tacoma	31,076	43,927	12,851	41%	1.7%
Olympia–Lacey	12,542	18,142	5,600	45%	1.7%
Centralia	5,055	7,239	2,184	43%	1.9%
Kelso–Longview	4,714	6,749	2,035	43%	1.5%
Vancouver, WA	12,535	19,610	7,705	56%	2.0%
Portland, OR	119,539	163,647	44,108	37%	1.6%

Source: Amtrak with Cambridge Systematics calculations for 2035.

3.2 INTERCITY RAIL

This section summarizes the Amtrak Cascades ridership forecasting model development and presents the 2035 Baseline ridership forecast. Unlike the long-distance ridership numbers in the previous section, intercity rail and commuter rail ridership are reported as number of tickets (or number of boardings for commuter rail). The 2035 Amtrak Cascades Baseline scenario includes projects under development as part of the $800 million in federal funds secured by the Washington State Department of Transportation (WSDOT). By the end of 2017, these improvements will support more frequent and reliable service, a 10-minute reduction in run time, and two additional daily round trips between Seattle and Portland.

WSDOT provided a spreadsheet ridership model to forecast 2035 Amtrak Cascades ridership. Cambridge Systematics enhanced the model by improving the user interface to simplify the user experience, and by adding features to convert station-level ridership to segment-level—Vancouver, British Columbia (B.C.) to Seattle, Seattle to Portland and Portland to Eugene—ridership estimates. Model inputs are mostly supply side, as they focus on improvements to Amtrak Cascades service and the potential ridership implications of improvements. Supply-based forecasting has validity due to the low percentage of actual intercity demand and limitations created by supply restrictions at times of peak demand for rail travel.

System-Level Versus Segment-Level Ridership Calculations

System-level ridership counts each passenger once, based on number of tickets. Segment-level ridership is defined as the total number of riders in each segment. A rider traveling in multiple segments is counted once in each segment. Thus,

segment-level ridership is higher than system-level ridership. Unless otherwise noted, "ridership" refers to system-level numbers.

Model Assumptions/Inputs

The 2035 Baseline ridership forecasts are based on:

- Drive time population (11.4 million in year 2035), which measures the population residing within a 30-minute drive of an Amtrak Cascades station.
- Historical ridership information from 1994 to 2012, at both a system level and station level.
- The number of "train legs"[3] that operated on the Amtrak Cascades route for the years 1994 to 2012.
- Utilization of 65 percent based on historical utilization information from 1994 to 2012 and forecast drive time population figures.
- Increase to 20 train legs in 2018 and through 2035.
- Travel time savings.
- Reliability of 88 percent by 2018.

Table 3.3 provides a complete summary of the model input variables (drive time population, utilization and train legs) and the observed ridership. Also shown is the ridership estimated by the forecasting model. Based on observed data, ridership has more than quadrupled from 1994 to 2012, rising from over 180,000 annual riders to over 836,000 annual riders. During this time period, train legs have risen from 3.8 in 1994 to 16 today. The table also allows a comparison of the model estimated ridership to the observed ridership. To achieve this, the model regression equations were applied to historic data to repredict ridership. As shown, the predictions are relatively close on a year-to-year basis and, therefore, can be relied upon for future year forecasts.

[3] Train legs refer to the segments on which Amtrak Cascades trains operate. There are three segments on the corridor: Vancouver, B.C. to Seattle, Seattle to Portland and Portland to Eugene. These are different from the number of daily trains that run on the corridor. In 2012, Amtrak Cascades operated 16 train legs each day, which is equivalent to 11 daily trains. As such, many trains operate on multiple segments. For example, three trains ran daily between Seattle and Eugene, Oregon (Trains 500, 507 and 509). All three of these trains cross two segments (Seattle to Portland and Portland to Eugene), thus, these three trains are counted as six train legs.

Table 3.3 Observed Amtrak Cascades Ridership and Model Inputs
1994 to 2012

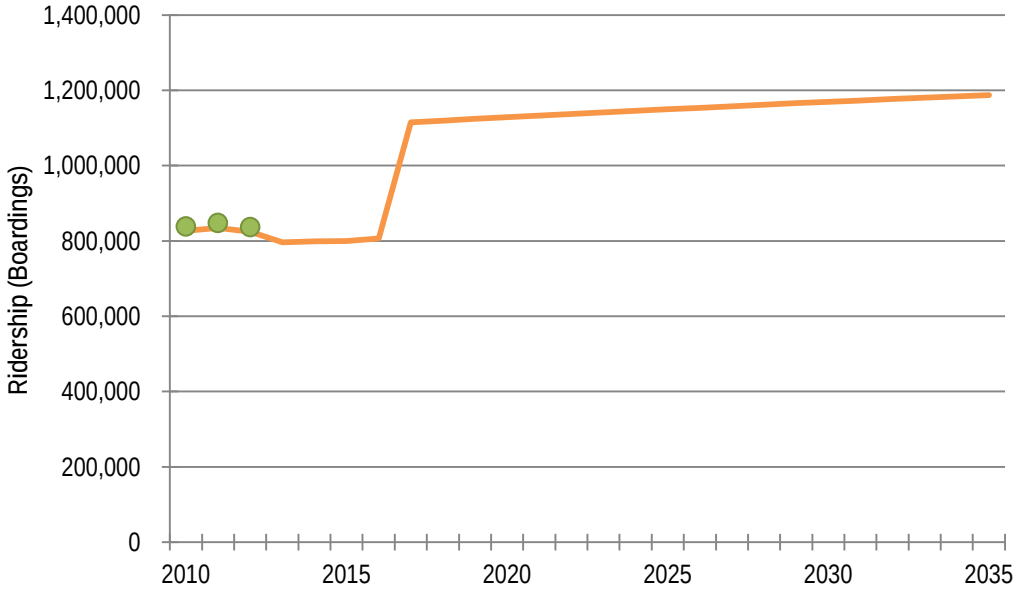
Year	Drive Time Population	Train Legs	Utilization	Observed Ridership	Estimated Ridership
1994	6,376,496	3.8	52%	180,209	212,419
1995	6,513,925	7.3	43%	286,656	255,985
1996	6,654,390	8.0	42%	304,566	271,428
1997	6,797,644	8.0	48%	349,761	349,763
1998	6,919,527	9.3	50%	425,138	435,421
1999	7,029,614	10.7	46%	452,334	451,229
2000	7,120,858	12.5	46%	530,218	534,536
2001	7,500,107	14.0	44%	560,381	567,916
2002	7,782,326	14.0	46%	584,346	590,842
2003	7,829,982	14.0	46%	589,743	596,059
2004	8,149,554	14.0	47%	603,059	608,246
2005	8,300,291	14.0	50%	636,892	641,453
2006	8,356,917	16.0	43%	629,996	646,594
2007	8,423,747	16.0	46%	676,765	687,150
2008	8,488,852	16.0	53%	774,531	772,183
2009	8,577,209	16.0	52%	761,610	760,616
2010	8,703,286	16.0	57%	838,251	827,020
2011	8,801,067	16.0	58%	847,712	834,939
2012	8,894,276	16.0	57%	836,324	824,692

Source: WSDOT Amtrak Cascades Ridership Model.

2035 Forecast

Figure 3.6 shows system-level ridership for Amtrak Cascades from 2010 through 2035. A sharp increase in ridership is expected from 2017 to 2018, largely due to the influence of an increase in train legs from 16 to 20 as part of the WSDOT $800 million funding program. As shown, it is estimated that by 2035 approximately 1.2 million annual riders will use Amtrak Cascades. This is based on a drive time population of 11.4 million, 65 percent utilization, 20 train legs, reliability of 88 percent, and a travel time savings of 10 minutes.

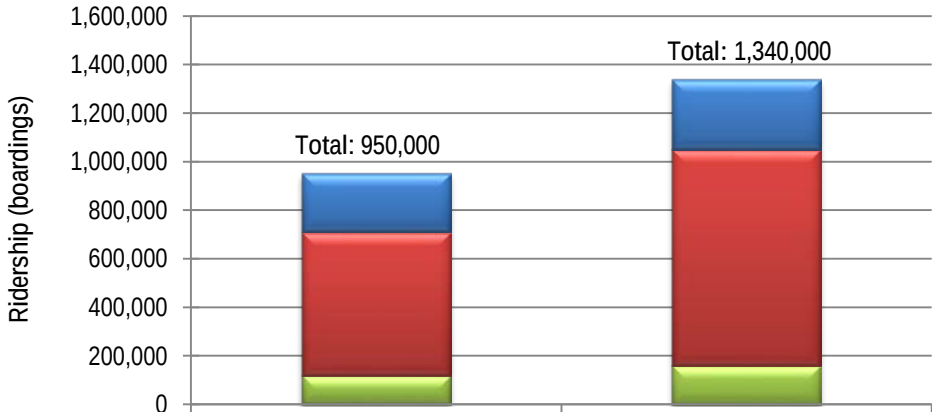
Figure 3.6 Amtrak Cascades Model Ridership



Note: Green dots represent observed ridership for calendar years 2010 through 2012, showing a good model fit of observed data.

Figure 3.7 shows the Amtrak Cascades 2010 and 2035 segment-level ridership. Total segment-level ridership is projected to be 1,340,000 in 2035, with ridership along the Seattle to Portland segment comprising two-thirds of total ridership.

Figure 3.7 Segment-Level Ridership 2010 and 2035



	2010	2035 Baseline
Seattle - Vancouver, B.C.	240,000	290,000
Seattle - Portland	590,000	890,000
Portland - Eugene	120,000	160,000

Source: WSDOT Amtrak Cascades Ridership Model with Cambridge Systematics calculations.

Note: Segment ridership rounded to the nearest 10,000.

The Seattle to Portland segment also contributes the majority of both ridership and growth along the route between 2010 and 2035, increasing by 300,000 riders. This represents 79 percent of total growth along the route and a 52 percent increase for the segment alone (see Table 3.4). This can largely be explained by the larger forecast drive time population and two additional daily round trips between these two cities. Total route ridership growth is projected to grow by 41 percent, or 390,000 riders. Table 3.5 shows the distribution of total ridership by segment for both 2010 and 2035. The Seattle to Portland segment increases its share of total ridership by 5 percent over this period.

Table 3.4 Percentage Growth By Segment

Segment	2010	2035	Growth	Percent Growth
Seattle – Vancouver, B.C.	235,959	286,775	50,816	22%
Seattle – Portland	586,209	888,157	301,948	52%
Portland – Eugene	124,771	156,139	31,368	25%
Total	946,938	1,331,071	384,133	41%

Source: WSDOT Amtrak Cascades Ridership Model with Cambridge Systematics calculations.

Note: Ridership numbers are reported to the nearest 10,000, while percentages are based on non-rounded values.

Note: "Percentage of total growth" is calculated by growth within the segment divided by total growth. "Percent growth" is calculated as growth divided by the base year value (i.e. 2010).

Table 3.5 Percent of Total Amtrak Cascades Segment-Level Ridership

Segment	2010	2035	Change
Seattle – Vancouver, B.C.	25%	22%	-3%
Seattle – Portland	62%	67%	5%
Portland – Eugene	13%	12%	-1%

Source: WSDOT Amtrak Cascades Ridership Model with Cambridge Systematics calculations.

3.3 COMMUTER

Projections for total ridership on Sounder through 2030 were provided by Sound Transit. These projections were calculated using statewide population and employment growth allocated to four counties of the Puget Sound Region by the Puget Sound Regional Council (PSRC) and Conway and Associates (economist under contract to state). These were then allocated to approximately 190 subareas within the Puget Sound Region by PSRC and provided to Sound Transit for growth factoring.

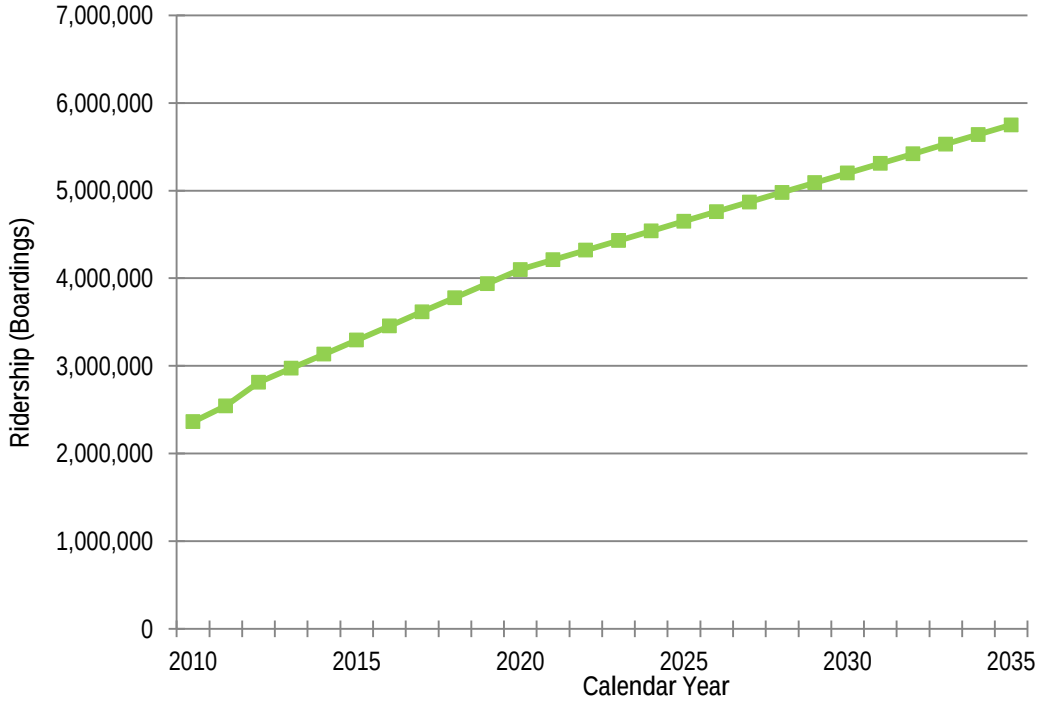
Major Sounder improvements included in Sound Transit's ridership forecasts include the use of four additional easements purchased from BNSF Railway

(BNSF), each allowing one additional round trip between Seattle and Tacoma. The first of these easements will be used to provide on additional round trip on the South Corridor in September 2013. Sound Transit also has other projects not related to ridership forecasts, including the installation of positive train control (PTC), possible development of a maintenance facility and provision of some environmental mitigation along the BNSF right of way.

The 2030 ridership information was extended to 2035 by developing and applying the linear growth rate derived from ridership numbers provided by Sound Transit for years 2020 and 2030.

Figure 3.8 shows the predicted Sounder ridership through the year 2035. As shown in the figure, by 2035 it is estimated that Sounder will accommodate nearly 5.8 million annual riders.

Figure 3.8 Total Ridership, through 2035



Ridership (Boardings)	2,360,000	3,300,000	4,100,000	4,700,000	5,200,000	5,800,000

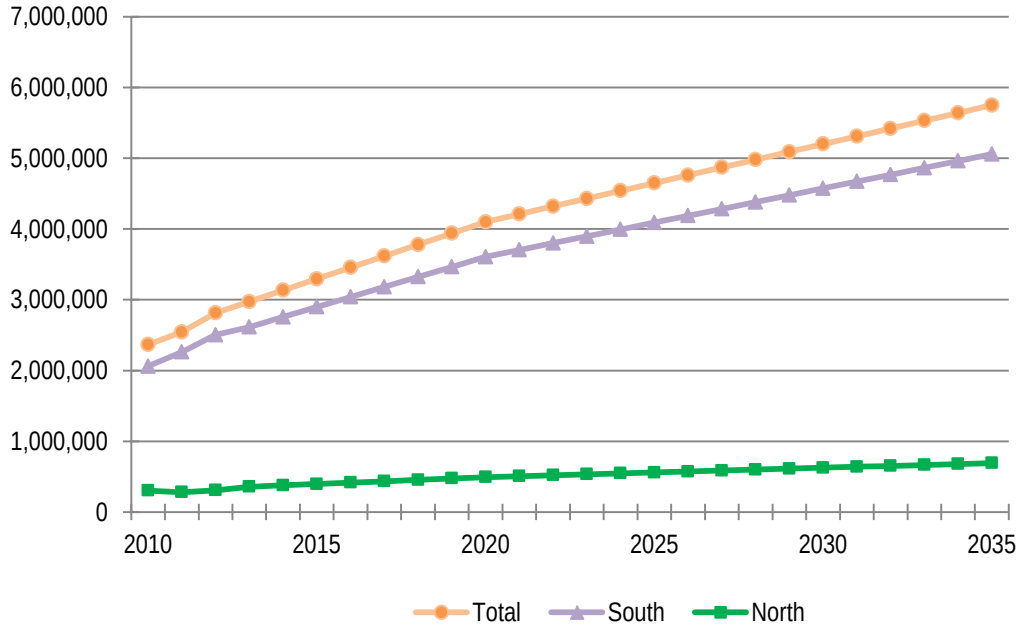
Source: Sound Transit 2010 through 2030 with Cambridge Systematics projections for 2031 through 2035.

Note: Forecast figures provided by Sound Transit for 2013 through 2030 are rounded to the nearest 100,000. Linear growth rate was used to calculate ridership levels through 2035 (also rounded).

Corridor-level (i.e., North Corridor and South Corridor) ridership projections were also estimated through 2035 using Sound Transit historical data and projections, as well as distribution factors based on historical ridership reports.

Figure 3.9 shows the 2010 through 2035 corridor-level ridership. Historical quarterly ridership data reports that ridership on the South Corridor (between Lakewood and Seattle) has been between 86 and 91 percent of total ridership numbers for every quarter from 2009 to 2012.[4] Therefore, a reasonable distribution of 88 percent along the South Corridor through 2035 was derived from historical data of total ridership and the remaining 12 percent on the North Corridor (Seattle to Everett). This information is shown graphically in Figure 3.9 and in Table 3.6.

Figure 3.9 Ridership by Corridor, 2010 through 2035



Source: Sound Transit correspondence on September 12, 2013, with extension by Cambridge Systematics for 2031 through 2035.

Note: Forecast figures provided by Sound Transit for 2012 through 2030 are rounded to the nearest 100,000. Linear growth rate was used to calculate ridership levels through 2035 (also rounded).

Table 3.6 Corridor Ridership, 2010 through 2035

	2010	2015	2020	2025	2030	2035
North Corridor	303,753	396,628	493,538	559,744	625,950	692,157
South Corridor	2,060,539	2,898,304	3,606,462	4,090,256	4,574,050	5,057,843

Source: Sound Transit correspondence on September 12, 2013, with Cambridge Systematics calculations.

[4] The Lakewood station opened in October 2012.

4.0 Amtrak Cascades Rail Alternatives

This section presents 2035 ridership forecasts, specifically for various service alternatives of Amtrak Cascades intercity service. For all passenger rail service types, the implications of these ridership forecasts on needs and statewide policy strategies will be considered in other technical notes.

The Washington State Department of Transportation (WSDOT) and Cambridge Systematics together defined potential improvements along the Amtrak Cascades route. Options were developed based on information in the Amtrak Cascades Mid-Range and Long-Range Plans, knowledge of current Amtrak Cascades plans, and conversations with WSDOT staff. These were developed into four additional alternatives beyond the baseline and are profiled below.

The analysis of rail alternatives will help inform future investment in the system and can assist in a more detailed cost benefit analysis of various projects and operational enhancement scenarios. Alternatives range from modest improvements to train length and reliability to a full set of enhancements that reflect the full vision of the *Long-Range Plan for Amtrak Cascades*. The assumed scenarios result in system-level ridership increases between approximately 40 percent and 230 percent over 2010 ridership. These forecasts will assist WSDOT as they continue making improvements towards the full vision of the Long-Range Plan, and will help predict ridership demand and potential capacity constraints that may result from various operational enhancements. The lowest growth in ridership assumes a small increase in reliability and a small increase in train length. The greatest increase in ridership assumes longer trains, more trains, higher reliability and significant travel time savings. Moderate growth over the Baseline is found by lengthening trains and adding trips. The highest growth in ridership would require substantial investments—particularly as compared to the other alternatives. See Table 4.1 for a full description of each alternative.

Figure 4.1 compares forecast system-level ridership for 2010, the Baseline scenario presented in Section 3.2, and the four additional alternatives.

Figure 4.1 2035 System-Level Ridership Comparison by Alternative

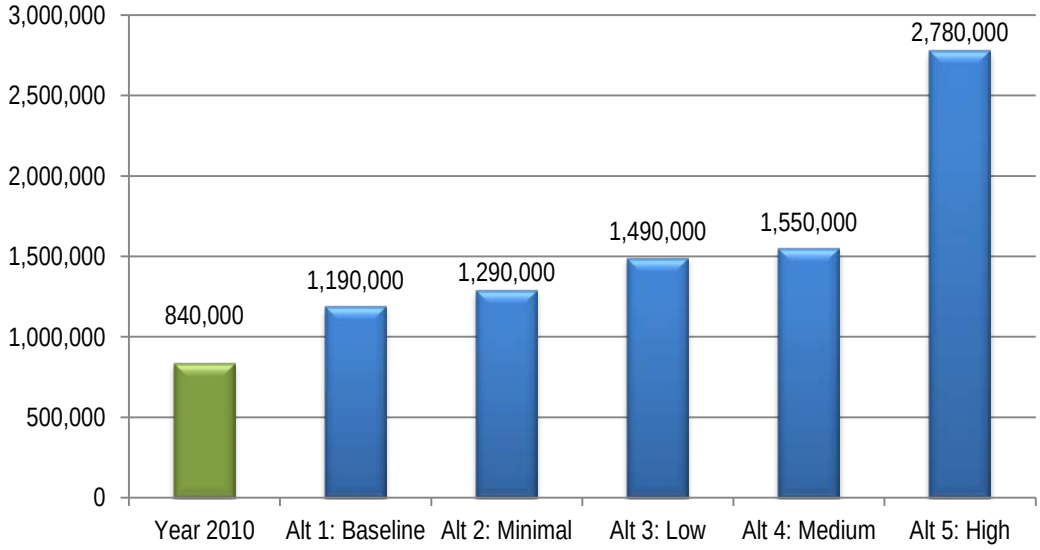


Table 4.1 Amtrak Cascades Alternatives

Alternatives	Description	Inputs					Train Legs (Number of Amtrak Cascades Trains Traveling within Each Segment)
		Annual Service Days	Seats in 2035	Planned Reliability in 2035	2010 Travel Time (Minutes)	2035 Travel Time Savings (Minutes)	
Baseline	Includes baseline inputs (drive time population of 11.4 million, 65% utilization, and 20 train legs in 2018) and adds reliability into the model. Reliability is assumed to improve to 88% by 2018. This reflects funded improvements that will be in place by 2018.	365	268.3	88%	210	10	
Alt 2 (Minimal)	Includes baseline inputs and increases capacity to 14 cars per train by 2021. Train legs will serve as a proxy for this. Reliability is assumed to increase marginally beyond baseline to 90%.	365	304.3	90%	210	10	• Assumes existing trains average 268.3 passengers. One coach car has 36 seats. Additional coach car would increase capacity by 13.4%. Increase train legs along corridor by 10%.[a]
Alt 3 (Low)	Includes baseline inputs and increases daily round trips between Seattle and Portland from 6 to 8 and daily round trips between Vancouver, B.C. and Seattle from 2 to 3. Reliability assumed to be at 90%. Assumes additional capacity is available in 2025.	365	268.3	90%	210	10	• Add additional 2 round trips (4 train legs) to Seattle to Portland baseline alternative. Add 1 additional round trip (2 train legs) to Vancouver, B.C. to Seattle baseline segment. Additional capacity available in 2025.
Alt 4 (Medium)	Alternative 3 plus additional 10 minutes of travel time savings. Assumes additional travel time savings available in 2025.	365	268.3	90%	210	20	• Same as Alternative 3.
Alt 5 (High)	Increase service in the far future to 13 round trips Seattle to Portland, 2 round trips Portland to Eugene, 4 round trips Vancouver, B.C. to Seattle, with 60 minutes of time savings and 95% on-time performance (OTP). Growth occurs in phases: Same improvements as Alternative 2 in 2020, then Alternative 4 in 2025, then additional growth to reach outlined maximum service increases in 2030.	365	304.3	95%	210	60	• Achieve Alt. 2 parameters in 2020. • Achieve Alt. 4 in 2025 PLUS an increase of one added coach car (10% increase in train legs along entire length of corridor). • Increase in 2030 to 38 train legs and additional time savings and OTP improvement (distributed as outlined in description)

[a] A 10 percent increase is assumed as a more conservative estimate rather than the full value based on percentage increase to capacity.

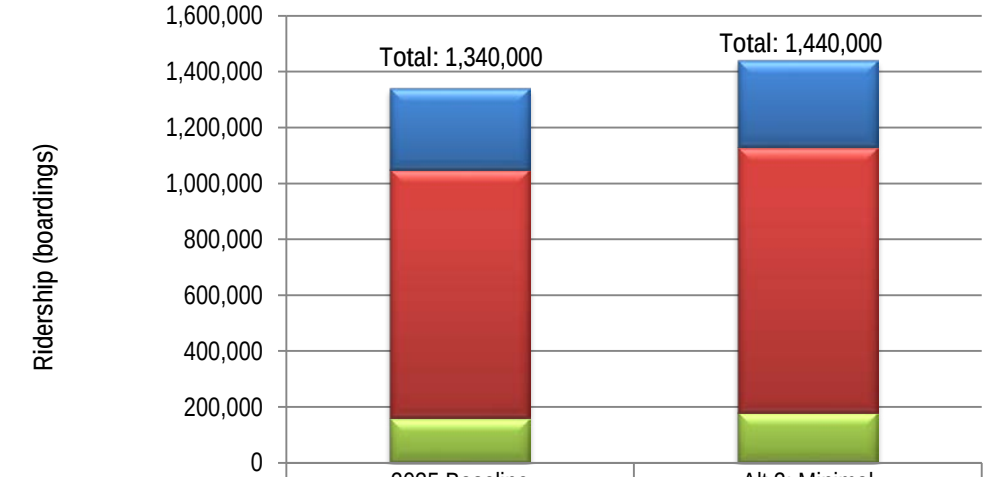
4.1 ALTERNATIVE TWO: MINIMAL

Alternative Two: Minimal includes Baseline operational and capacity improvements plus assumed additional new capacity by lengthening trains to 14 cars by 2020. Reliability is also assumed to increase marginally beyond the baseline of 88 percent to 90 percent. These improvements were developed based on capital investment options outlined in the *Amtrak Cascades Mid-Range Plan* (2008) and support aligned efforts with other planning programs as well as the overall State Rail Plan vision's focus on reliability. This increases system-level ridership to 1,290,000 and segment-level ridership to 1,440,000 annual riders.

Figure 4.2 shows the 2035 Baseline segment-level and Alternative Two: Minimal segment-level ridership. Total segment-level ridership is projected to be 1,440,000 annual riders. Given the improvements along the entire length of the corridor, there is considerable growth in annual ridership at stations other than Portland and Seattle.

Overall, assumptions and service enhancements included in the Alternative Two: Minimal scenario result in an 8 percent overall ridership increase from the 2035 Baseline of 1,340,000 annual riders.

Figure 4.2 Alternative Two: Minimal Segment-Level Ridership



	2035 Baseline	Alt 2: Minimal
Seattle - Vancouver, B.C.	290,000	310,000
Seattle - Portland	890,000	950,000
Portland - Eugene	160,000	180,000

Note: Segment ridership rounded to the nearest 10,000.

In Alternative Two: Minimal, the Seattle to Portland segment contributes the majority of ridership, as well as the majority of growth from the baseline (57 percent). Ridership on the Seattle to Vancouver, B.C. and Portland to Eugene

segments is forecast to increase by 8 percent and 14 percent, respectively. Ridership along the Seattle to Portland segment increases 7 percent. See Table 4.2.

Table 4.2 Segment-Level Ridership and Growth – Alternative Two: Minimal

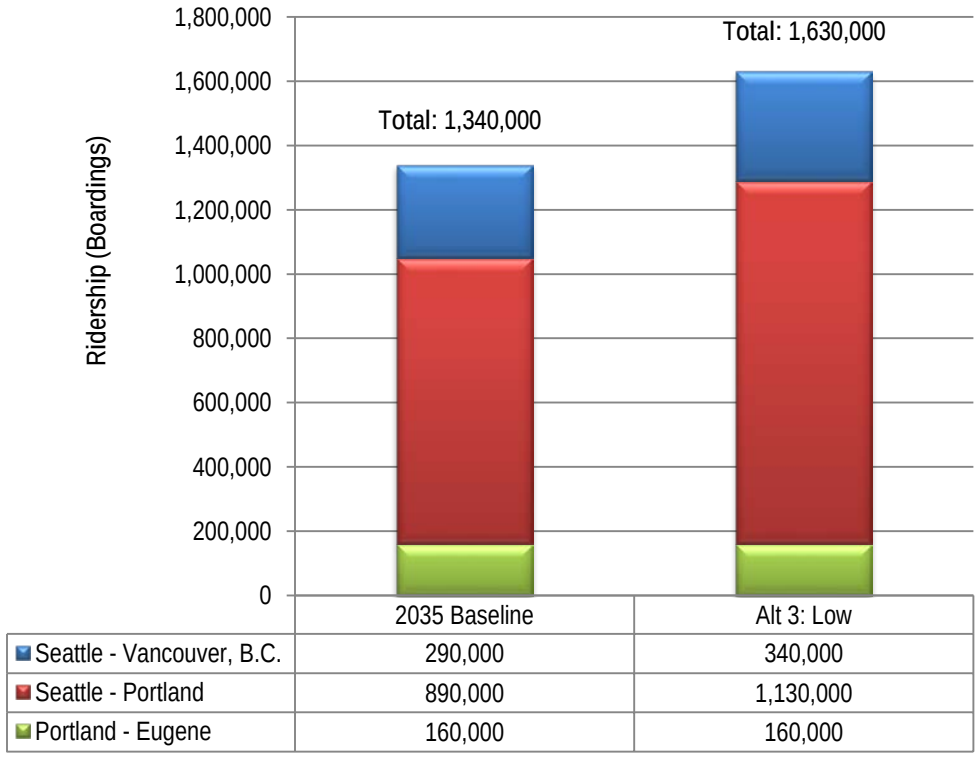
Segment	Ridership	Percent of Total Ridership	Growth from Baseline	Percent Growth from Baseline
Seattle – Vancouver, B.C.	310,000	22%	20,000	8%
Seattle – Portland	950,000	66%	60,000	7%
Portland – Eugene	180,000	12%	20,000	14%
Total	1,440,000	100%	100,000	8%

4.2 ALTERNATIVE THREE: LOW

Alternative Three: Low includes the Baseline operational and capacity enhancements, plus increasing the number of daily round trips between Seattle and Portland from six to eight. In addition, the number of daily round trips between Vancouver, B.C. and Seattle is assumed to increase from two to three. These improvements reflect components of capital investment options outlined in the *Amtrak Cascades Mid-Range Plan* (2008) and support aligned efforts with other planning programs that underpin long-term visioning and planning along the Amtrak Cascades corridor. These capacity enhancements are assumed to be in place by 2025. There is no change in capacity assumed between Portland and Eugene. Reliability is also assumed to be at 90 percent by 2025. These improvements increase system-level ridership to 1,490,000 and segment ridership to 1,630,000.

Figure 4.3 shows the 2035 Baseline and Alterative Three: Low segment-level forecast annual ridership. Total segment-level ridership is anticipated to be 1,630,000 given the improvements outlined above. This is a 23 percent increase beyond the Baseline alternative.

Figure 4.3 Alternative Three: Low Segment-Level Ridership



Increases in ridership in this alternative are primarily observed along the Seattle to Vancouver, B.C. and Seattle to Portland segments. This is a result of the increased service along these segments, as outlined in Table 4.1. As a result, 98 percent of the overall growth projected beyond the Baseline occurs along the Seattle to Portland and Seattle to Vancouver, B.C. segments. See Table 4.3.

Table 4.3 Segment-Level Ridership and Growth – Alternative Three: Low

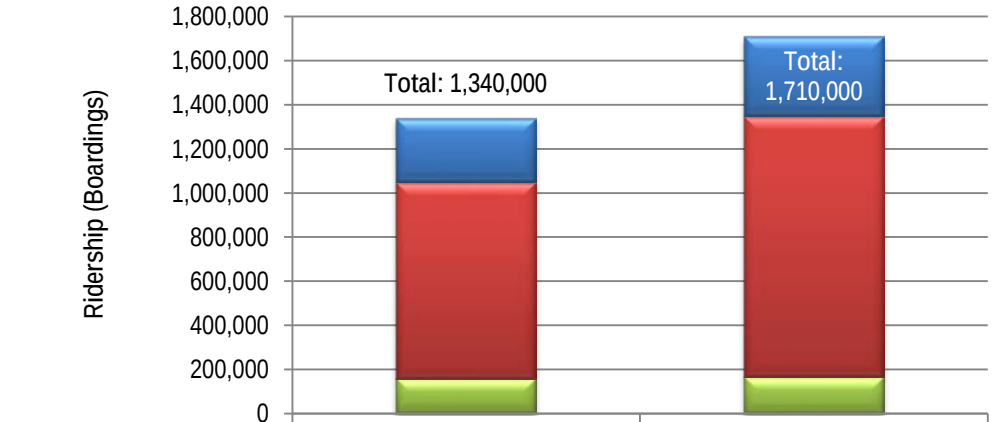
Segment	Ridership	Percent of Total Ridership	Growth from Baseline	Percent Growth from Baseline
Seattle – Vancouver, B.C.	340,000	21%	50,000	18%
Seattle – Portland	1,130,000	69%	250,000	28%
Portland – Eugene	160,000	10%	<10,000	3%
Total	1,630,000	100%	300,000	23%

4.3 ALTERNATIVE FOUR: MEDIUM

Alterative Four: Medium reflects enhanced capacity and reliability described in Alternative Three: Low plus an additional 10-minute travel time savings. This additional travel time savings is forecast to be in effect in 2025, and reflects the potential effect of an incremental time savings improvement in addition to frequency enhancements. Reducing travel time is consistent with the key issue of remaining an attractive alternative when compared to other modes. This increases system-level ridership to 1,550,000 and segment-level ridership to 1,710,000.

Figure 4.4 shows the 2035 Baseline and Alternative Four: Medium segment-level ridership. Total segment-level ridership is projected at 1,710,000, given the improvements outlined above. This is a 28 percent increase beyond Baseline growth and a 5 percent increase above the Alternative Two: Low forecast.

Figure 4.4 Alternative Four: Medium Segment-Level Ridership



	2035 Baseline	Alt 4: Medium
Seattle - Vancouver, B.C.	290,000	360,000
Seattle - Portland	890,000	1,180,000
Portland - Eugene	160,000	170,000

Increases in ridership in this alternative are primarily observed along the Seattle to Vancouver, B.C. and Seattle to Portland segments, similar to Alternative Two: Low. This is a result of the increased service along these segments. Ridership increases by 370,000 from the Baseline, an increase of 28 percent.

Table 4.4 Segment-Level Ridership and Growth – Alternative Four: Medium

Segment	Ridership	Percent of Total Ridership	Growth from Baseline	Percent Growth from Baseline
Seattle – Vancouver, B.C.	360,000	21%	70,000	25%
Seattle – Portland	1,180,000	69%	290,000	33%
Portland – Eugene	170,000	10%	10,000	10%
Total	1,710,000	100%	370,000	28%

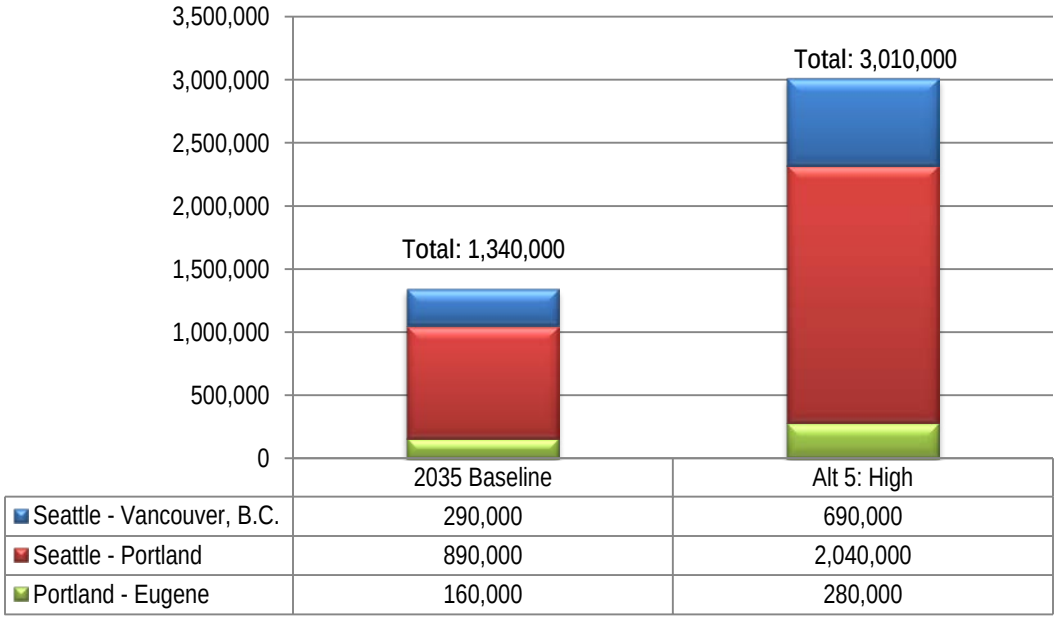
4.4 ALTERNATIVE FIVE: HIGH

Alternative Five: High reflects a level of investment similar to assumptions made in the 2006 *Long-Range Plan for Amtrak Cascades*. In Alternative Five: High it is assumed that there will be 13 daily round trips from Seattle to Portland, two round trips from Portland to Eugene, and four round trips from Vancouver, B.C. to Seattle. This is accompanied by 60 minutes of time savings and an increase in reliability to 95 percent. It is further assumed this would be achieved through incremental enhancements. As such, the Alternative Two: Minimal improvements would be in place by 2021, the Alternative Four: Medium enhancements would be achieved by 2025 and maximum enhancements would be in place by 2030 (see again Table 4.1). These improvements increase system-level ridership to 2,780,000 and segment-level ridership to 3,010,000.

Figure 4.5 shows the 2035 Baseline segment-level and Alternative Five: High ridership. Given the maximum service assumptions outlined, ridership would increase by 126 percent beyond Baseline growth to 3,010,000. However, given the magnitude of the service improvements outlined in this alternative, other demand factors should be considered when analyzing these ridership estimates. Filling the full vision outlined in the *Long-Range Plan for Amtrak Cascades* would require consideration of additional non-linear factors that may not be captured within the model. These factors could include travel time savings from faster run-time or added travel time flexibility from additional round trips; both could result in a greater or lesser impact on ridership than predicted by the model. These differences would arise from complexities due to large changes that are simply not addressed by the approach used in the model. Other estimates (for example, the 2006 *Long-Range Plan for Amtrak Cascades*) have provided similar results, generally suggesting that ridership with this level of service would exceed 3 million riders per year.

As service grows toward the full vision, the impact of these gains will be able to be assessed more thoroughly. Estimates included in this technical note are limited by the technical capabilities and available inputs of the Amtrak Cascades Ridership Forecasting model.

Figure 4.5 Alternative Five: High Segment-Level Ridership



Increases in ridership are significant along all segments in this alternative, with the Seattle to Vancouver, B.C. segment experiencing the most growth as a percentage of the Baseline alternative. The annual ridership on the Seattle to Vancouver, B.C. and Seattle to Portland segments more than double relative to the Baseline alternative. The Seattle to Portland segment increases the most in terms of absolute riders (1,150,000). See Table 4.5.

Table 4.5 Segment-Level Ridership and Growth – Alternative Five: High

Segment	Ridership	Percent of Total Ridership	Growth from Baseline	Percent Growth from Baseline
Seattle – Vancouver, B.C.	690,000	23%	400,000	141%
Seattle – Portland	2,040,000	68%	1,150,000	129%
Portland – Eugene	280,000	9%	120,000	81%
Total	3,010,000	100%	1,670,000	126%

4.5 SUMMARY OF ALTERNATIVE ANALYSIS

The implementation of various operational enhancement scenarios is largely dependent on current and future funding levels for Amtrak Cascades. Based on forecast ridership, diminishing returns begin to be apparent under Alternative 4: Medium, though the incremental improvement in travel time under this scenario may require less investment relative to other alternatives. The ridership forecast under Alternative 5: High represents the full version outlined in the *Long-Range*

Plan for Amtrak Cascades and would require significant investment over the long term. Incremental improvements that work towards achieving this vision are the most financially and logistically feasible for WSDOT as they consider funding constraints and potential operating conflicts under the full Amtrak Cascades vision.

Table 4.6 Segment-Level Ridership – All Alternatives

Segment	2035	Seattle – Vancouver, B.C.	Seattle -Portland	Portland – Eugene
Baseline	1,340,000	290,000	890,000	160,000
Alt 2: Minimal	1,440,000	310,000	950,000	180,000
Alt 3: Low	1,630,000	340,000	1,130,000	160,000
Alt 4: Medium	1,710,000	360,000	1,180,000	170,000
Alt 5: High	3,010,000	690,000	2,040,000	280,000