Final Report
July 2020

Feasibility of an East-West Intercity Passenger Rail System for Washington State

Washington State Joint Transportation Committee
Our ref: 23685001

DAVID EVANS AND ASSOCIATES INC.

steer

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Overview

The Washington State Legislature directed the Joint Transportation Committee to conduct a high-level feasibility analysis of an East-West intercity passenger rail system for Washington State, connecting Seattle with Spokane via the Stampede Pass corridor through Yakima and the Tri-Cities. Steer was commissioned by the JTC to assess the feasibility of a new East-West passenger rail service for state decision makers.

Key aspects of this feasibility study are summarized in Table 0.1.

Table 0.1: About the Feasibility Study

Category	Description	Approach
Ridership and Revenues	• Projecting of potential ridership and revenues	• Ridership model was developed using discrete choice methods using inputs from sources including cell phone data and surveys of existing travelers
Options Review	• Identifying of potential operational scenarios to provide a service including the number of departures, approximate schedules, train equipment needed and impact on rail freight	• Seattle to Spokane runtimes were calculated using track charts • Runtimes were aligned to schedules of existing operations using ATTune timetabling software • Eight service options were developed based on stakeholder feedback
Current Infrastructure Assessment	• Assessing current infrastructure conditions, including station stop locations with high-level cost estimates for necessary improvements and equipment	• Assumptions as agreed with the Joint Transportation Committee • Desktop research including discussions with BNSF • Google Earth
Community Survey	• Assessing community support for the rail service	• Online surveys • Focus groups
Operator Assessment	• Identifying potential operator options	• Desktop research

Source: Steer (2020).

This report identifies the results of the assessment including what would be required to support a service, station locations and infrastructure improvements. As this was a preliminary high-level study, further work will be required to confirm or refine its findings, including service definition, track and station design along with possible ridership and financial outcomes.

Background

The Stampede Pass, Kittitas and Yakima Valleys last saw passenger rail service in 1981 when the Amtrak Empire Builder service to Seattle was rerouted via the Stevens Pass. In the intervening years, there has been interest in the feasibility of restoring passenger rail service on the Stampede Pass corridor stemming the 1993 Washington Legislature statement to introduce new ground transportation between Seattle and Spokane. Studies have included the 'East-West passenger Rail feasibility study: A Preliminary Analysis' in June 2001 and more recently 'An Assessment of reinstating Passenger Rail Service on the Stampede Pass Corridor' was undertaken in December 2017. Rail freight movements through the Stampede Pass corridor have increased in recent years since BNSF Railway reacquired it.

The study considers East-West passenger rail services between Seattle and Spokane with proposed station stops at Tukwila (for south Seattle and SeaTac airport), Auburn, Cle-Elum, Yakima, Ellensburg, Tri-Cities, Toppenish and Spokane as shown in Figure 0.1. We examined three sections of corridor; Seattle to Auburn, Auburn to Pasco and Pasco to Spokane.

Figure 0.1: Route of Potential East-West Intercity Passenger Rail Service

Source: Steer (2020) analysis. Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC and other contributors.

Given capacity constraints, the study identified additional track infrastructure that would be needed in several locations including additional or longer passing tracks as well as new or expanded passenger rail stations and additional facilities to improve weather resilience such as snow sheds and plows.

Key Findings

The overall conclusion is that introducing a Seattle to Spokane service via the Stampede Pass was technically feasible and despite long journey times, could generate ridership above or comparable to some other Amtrak State Supported services. Table 0.2 provides a summary of the key findings from the analysis.

Table 0.2: Report Summary

Category	Summary	Details
Operations	Up to **two daily services** between Seattle and Spokane via Stampede Pass corridor could be introduced, but requires additional infrastructure	• Services would depart Seattle and Spokane in the morning or midday and arrive at their final destinations' late afternoon to evening • Eight service plan options were developed and assessed, ranging from a single daily service between Seattle to Yakima to a twice daily Seattle to Spokane service
Long Travel Times	Journey times **will be long** due to slow speeds and the high number of freight services	• Estimated journey times from Seattle to Spokane is 8 hours and 35 hours • This is considerably longer than by automobile, air or intercity bus for most city-to-city pairs
Low Expected Ridership	While comparable to some Amtrak State Supported Services, ridership **is not expected to be high** due to long journey times and relatively low number of long-distance car trips today compared to many other markets where state supported intercity rail services operate	• Ridership was heavily influenced by the long journey times compared to air, auto and bus • Annual ridership for year 2020 ranged from 31,000 to 205,000 annual trips with a further increase to 215,000 estimated if train journey times were reduced by one hour between Seattle and Spokane • Diversion from air or intercity bus was not included due to expected low diversion rates • This would make an East-West passenger rail service above or comparable to some Amtrak State Supported Services, but less than 25% of the trips on the Amtrak Cascades. • Minimal induced demand is expected and would not significantly change the ridership projections. • Adopting a fare structure consistent with Amtrak policies generated an estimate of between $0.6 million and $4.6 million depending on the service plan option, while food and beverage revenues are estimated at up to $1.6 million

Category	Summary	Details
Need for Local Transit Services	There is **demand** on journeys **within Kittitas and Yakima Valleys**	• Most of the trips are expected to be within the Kittitas and Yakima Valleys with very few trips to/from either Seattle or Spokane. • This suggests a market exists for non-auto alternatives across the valleys
High Upfront Costs	In order to operate services, **investments will need** to be made for additional rail infrastructure, new stations and acquiring a new fleet of trains - New funding, including from communities would need to be found	• Generally, the existing terrain allowed for limited locations where speed improvements could be achieved. • Four new stations and four station upgrades were identified to provide shelter and accommodate platforms at an estimated cost of between $6 million and $24 million per station, not including car parking. • Additional passing tracks and sidings along the rail corridor were also identified to be required at a total cost of between $64 million and $75 million. • Operating costs were estimated ranging from $6 million to $30 million per year.
High Community Support	**Over 70%** of participants agreed they would try the service.	• Several stakeholder meetings revealed support for the service and interest in the project amongst representatives of the surrounding cities of Yakima and Pasco and the Yakama Nation, as well as senior representatives of BNSF Railway • Only 4.4% of participants were opposed or strongly opposed to the service
Operator Options	Services contracted to a 3rd Party could be more **cost effective than Amtrak** but requires securing agreement with BNSF Railway	• Three options for delivering intercity rail services were discussed: public outsourcing, private outsourcing and state operated. • The relative strengths and weaknesses of these arrangements included: contract structure, operational performance, commercial and lifecycle costs, marketing/ branding, and operational or financial risks. • Overall, it was widely found to be important that appropriate contractual mechanisms can be developed to achieve consistent, high-quality service and minimize subsidy

Source: Steer (2020) analysis.

Further investigation of the capital and operating costs is recommended, specifically liaison and agreement with the host freight railway BNSF Railway. If services were to be further progressed, assessing the economic impacts of East-West passenger rail services should be considered. In addition, further investigation of the strengths and weaknesses of the broad operator options is needed, not only to identify fatal flaws of any individual option, but also to undertake a proper value assessment to better understand the balance of likely outcomes.

These core factors and results are summarized in Table 0.3 and Table 0.4. It is important to note that the main factor driving the significant decrease in ridership between Options 5 and 7 (and Options 6 and 8) is due the significant local estimated demand between Toppenish and Yakima. While eight-coach service options were also assessed, as they have no impact on ridership, are not required to operate passenger rail services, and add significant capital, train equipment and operating costs, these have not been included in Table 0.3 and Table 0.4.

Table 0.3: Summary Table of Finding for Daily Service Options (Four-Coach Trains)

Daily Service Options		Option 1	Option 3	Option 5	Option 7
Service	From	Spokane	Pasco	Toppenish	Yakima
	To	Seattle	Seattle	Seattle	Seattle
	End to End Journey Time (hh:mm)	8:35	6:05	4:59	4:43
	Average Speed (miles per hour)	44	39	35	33
	Number of Locomotives	6	6	6	6
	Number of Coaches	10	10	10	10
Infrastructure	New Stations	4	4	4	3
	New Passing Tracks	4	4	4	4
Financial Costs[A]	Infrastructure ($Millions)	$140	$140	$140	$120
	Train Equipment ($Millions)	$160	$160	$160	$160
	Operating Per Annum ($Millions)	$15	$9	$7	$6
Financial Revenue	Catering ($Millions)	>$1	$0.5	>$0.5	>$0.5
	Ticket Sales ($Millions)	$4	$4	$2	>$1
Ridership	Annual Trips (Thousands in 2020)	192	189	150	31

Source: Steer (2020) analysis.
Note: A. Financial costs have been rounded to the nearest million, which includes upfront investment in new/improved stations, sidings, trains and train maintenance facilities – it does not include costs to install PTC and should be considered indicative at this stage

Table 0.4: Summary Table of Finding for Twice Daily Service Options (Four-Coach Trains)

Twice Daily Service Options		Option 2	Option 4	Option 6	Option 8
Service	From	Spokane	Pasco	Toppenish	Yakima
	To	Seattle	Seattle	Seattle	Seattle
	End to End Journey Time (hh:mm)	8:35	6:05	4:59	4:43
	Average Speed (miles per hour)	44	39	35	33
	Number of Locomotives	10	10	10	8
	Number of Coaches	19	19	19	16
Infrastructure	New Stations	4	4	4	3
	New Passing Tracks	4	4	4	4
Financials Costs[A]	Infrastructure ($Millions)	$140	$140	$140	$120
	Equipment ($Millions)	$280	$280	$280	$200
	Operating Per Annum ($Millions)	$30	$18	$13	$12
Financial Revenue	Catering ($Millions)	$2	$1	>$1	>$1
	Ticket Sales ($Millions)	$5	$4	$3	$1
Ridership	Annual Trips (Thousands in 2020)	205	198	166	43

Source: Steer (2020) analysis.
Note: A. Financial costs have been rounded to the nearest million. Upfront investment in new/improved stations, sidings, trains and train maintenance facilities – it does not include costs to install PTC and should be considered indicative at this stage.

1 Introduction

Current Study

1.1 The Washington State Legislature directed the Joint Transportation Committee to conduct a high-level feasibility analysis of an East-West intercity passenger rail system for Washington State.

1.2 The Stampede Pass corridor (397 miles) and service between Seattle, Auburn, Cle Elum, Yakima, Ellensburg, Tri-Cities, Toppenish and Spokane, was identified as the focus of the analysis, as shown in Figure 1.1.

Figure 1.1: Route of Potential East-West Intercity Passenger Rail Service

Source: Steer (2020) analysis.
Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC and other contributors.

1.3 The goal of the study is not to provide recommendations but to provided information for decision makers, such as:

- Projections of potential ridership and revenues
- Determination and description of potential operational scenarios including the number and timing of departures per day, approximate schedules, passenger train sets needed, potential impact on rail freight movement and other factors
- Assessment of current infrastructure conditions, including station stop locations with high-level cost estimates for necessary improvements and equipment
- Assessment of community support through focus groups and an online survey
- Identification of potential operator options

1.4 The study focused on identifying what would be required to support a service, station location, infrastructure improvements and service strategies will need to be further reviewed and refined. As this was a preliminary high-level study, it did not include the development of a service definition or track and station design. For example, while Amtrak passenger trains should have priority over freight trains by U.S. federal law, the interface and scheduling requirements would need to be agreed with the host freight railroads which in this case would be BNSF. Therefore, we have taken a pragmatic view of BNSF and existing train services (including other passenger trains such as Amtrak Cascades and Sounder) in order to plan for a future East-West passenger rail service.

1.5 This report details the works undertaken in support of these needs and details the finding from the study.

Washington State Joint Transportation Committee

1.6 The Joint Transportation Committee (JTC) is a bipartisan, bicameral legislative agency that conducts transportation related studies and other activities to inform state and local government policymakers, including legislators and associated staff. The JTC is governed by an Executive Committee consisting of the Chairs and Ranking Members of the House and Senate Transportation Committees: Representative Jake Fey, Representative Andrew Barkis, Senator Steve Hobbs and Senator Curtis King. JTC studies and other activities are managed and/or conducted by non-partisan JTC staff.

The study is:

A preliminary step in providing more information to the legislature on the feasibility of intercity passenger rail service along the Stampede Pass corridor.

The study is not:

A plan for, or a commitment by the legislature to make future investments in East-West passenger rail service.

Report Outline:

1.7 The report is structured in the following sections:

- Introduction;
- Service Options;

- Option Testing;
- Infrastructure Improvements;
- Community Support; and
- Operator Options.

History of Corridor

Passenger Service

1.8 The Stampede Pass, Kittitas and Yakima Valleys last saw passenger rail service in 1981 when the Amtrak Empire Builder service to Seattle was rerouted via the Stevens Pass. This long-distance Chicago to Seattle service provided a daily train in each direction serving Spokane, Pasco, Yakima, Ellensburg, East Auburn and Seattle.

1.9 In the intervening years, there has been interest in the feasibility of restoring passenger rail service on the Stampede Pass corridor. There has been a number of previous studies and policy statements including the 1993 goal to introduce new ground transportation between Seattle and Spokane. Washington State Department of Transportation (WSDOT) undertook the 'East-West passenger Rail feasibility Study: A Preliminary Analysis' in June 2001 and the Central Washington University, 'An Assessment of reinstating Passenger Rail Service on the Stampede Pass Corridor' was undertaken in December 2017. A further study focused on using a short section on Stampede subdivision on the west side of the cascade mountains was undertaken by WSDOT the 'Southeast King County Commuter Rail Feasibility Study' in August 2010, this looked at the potential for a commuter service connecting with Sounder at Auburn Station.

Past Studies

East-West passenger Rail feasibility Study: A Preliminary Analysis

1.10 The 2001 study undertook a preliminary analysis of the operational and infrastructure requirements to implement a daily daytime passenger rail service along the Stampede Pass route. The study identified that a passenger service was feasible. The study did not consider or identify the possible ridership that would use the service.

1.11 The study identified the significant infrastructure improvements could be needed to support passenger rail service, this would include additional track to provide additional passing locations, signaling and grade crossing improvements, along with station improvements. Additional train equipment would also need to be purchased or leased.

1.12 The study recommended more work be undertaken to refine the capital and operating cost estimates, better understand origin and destination of trips and the ridership potential and greater understanding of the freight needs for the corridor.

Southeast King County Commuter Rail Feasibility Study

1.13 The 2010 feasibility study undertook an analysis of a Diesel-Multiple Unit (DMU) commuter rail service using the western section of the stamped rail corridor between Auburn and Maple Valley / Black Diamond. The service being designed to provide connectivity to the South Sounder Service.

1.14 The study considered different service scenarios, the ability to operates these and the potential ridership generated. The study identified that a 30-minute peak frequency could generate approximately 1,200 daily passenger journeys.

1.15 The current study has not considered a short-distance service for these communities and has only examined a longer distance East-West passenger service.

An Assessment of Reinstating Passenger Rail Service on the Stampede Pass Corridor

1.16 All Aboard Washington sponsored the Central Washington University to undertake the 2017 study. The study considered the increasing population of the regions a passenger rail service could connect with and the current dependence on the I-90 for connectivity to Seattle.

1.17 The study surveyed over 2,500 respondents, which identified support for rail service. It did though identify that a limited daily service could result in a reduced level of ridership potential and that the connectivity of people to stations could also limit ridership.

1.18 The work did identify the need for further study to estimate passenger demand, assess station locations and to understand the associated operating and capital costs and funding scenarios.

Corridor Today

1.19 The East-West rail corridor from Spokane Station to Seattle would use the main line to Pasco formed of the Spokane and Lakeside subdivision. Beyond Pasco Station, which would serve the three cities of Pasco, Kennewick and Richland, the route connects to the Stampede Pass main line making use of the Yakima and Stampede subdivisions, with possible stations at Toppenish, Yakima, Ellensburg and Cle Elum. The Stampede Pass corridor through the Cascade mountains travels through the 1.8-mile long Stampede tunnel before descending to connect with the BNSF north-south main line and the Seattle subdivision at Auburn with possible stops in Auburn, Tukwila (connectivity to SeaTac Airport) and Seattle.

1.20 The Stampede Pass corridor has received significant investment since BNSF Railway reacquired the route to increase East-West capacity through the combination of the Stevens Pass and Stampede Pass routes, the former capable of taking stacked containers and the later constrained to single high loads due to the more restricted clearance of the Stampede Tunnel.

Existing Freight Movements

1.21 Due to its inability to take double height stacked containers, the Stampede Pass corridor is mainly used for movements of bulk goods such as grain and coal trains. As trains often return empty cars from the west to the east, the corridor is predominantly west to east train movements between Auburn and Pasco. This focus on one direction reduces the need for passing tracks to support bi-directional freight movements.

2 Service Options

Background

2.1 The possible service options and train schedules developed for this study considers existing freight requirements as detailed in Section 1 and possible future increases in the tonnage handled. They also consider the interactions of the with other passenger services currently operating between Auburn and Seattle, between Pasco and Spokane and the opportunities for providing interchange where possible.

Existing Passenger Services

Empire Builder

2.2 This long-distance Amtrak service operates daily between Chicago and Portland or Seattle, serving St. Paul-Minneapolis with a total trip time of 46 hours. The service splits at Spokane to operate to both Portland and Seattle. The service provides the opportunity to connect with future East-West passenger services at Spokane and Pasco. The timing of these train services are detailed in Appendix A.

Coast Starlight

2.3 This Amtrak service provides a daily long-distance service between Los Angeles and Seattle serving Portland and Sacramento with a total trip time of 35 hours. The service could provide connectivity for East-West passenger services at Seattle. The timing of trains is detailed in Appendix A.

Cascades Service

2.4 The Cascades service is operated by Amtrak but directly supported by Oregon and Washington States. The service operates between Eugene via Salem, Portland, Tacoma, Seattle to Vancouver, BC. There are four daily services between Seattle and Portland. The services provide opportunities to connect with East-West passenger services at Tukwila and Seattle. The timing of the trains are detailed in Appendix A.

In addition to the train service, several Thruway bus services are also operated, providing additional interchange opportunities.

Sounder South Services

2.5 The Sounder South services are operated by BNSF on behalf of Sound Transit in the morning and Evening peak periods. There are 13 services in each direction connecting Seattle with several communities through to Tacoma and Lakewood. There is limited capacity along the BNSF line to operate additional passenger services such as East-West passenger services. The timing of trains is detailed in Appendix A.

Table 2.1 and Table 2.2 provide key statistics for the Amtrak services operating in Washington State.

Table 2.1: Amtrak Services Through State of Washington Key Statistics

Route	Description	Daily Frequency	2018 Annual Ridership	2018 Average Trip Length/ Fare	2018 Highest Ridership Pairs
Empire Builder	Chicago, IL – Seattle, WA/ Portland, OR (splits in Spokane)	1 roundtrip	423,703	709 miles $123	1. Chicago, IL – St. Paul, MN 2. Chicago, IL – Seattle, WA 3. Chicago, IL – La Crosse, WI 4. Portland, OR – Spokane, WA 5. Pasco, WA – Portland, OR
Cascades	Vancouver, BC – Eugene, OR	4 roundtrips[A]	801,567	156 miles N/A[B]	1. Portland, OR – Seattle, WA 2. Seattle, WA – Vancouver, BC 3. Portland, OR – Tacoma, WA 4. Seattle, WA – Vancouver, WA 5. Eugene, OR – Portland, OR
Coast Starlight	Seattle, WA – Los Angeles, CA	1 roundtrip[B]	412,490	466 miles $96	1. Los Angeles, CA – Seattle, WA 2. Los Angeles, CA –Portland, OR 3. Emeryville, CA – Seattle, WA 4. Los Angeles, CA – Oakland, CA 5. Portland, OR – Seattle, WA

Source: Steer (2020) analysis of Amtrak (2019) and Washington State Department of Transportation (2019).
Note: A. One daily direct roundtrip between Portland, OR and Vancouver, BC via Seattle, WA. One daily direct roundtrip between Seattle, WA and Vancouver, BC. Three daily roundtrips were using rail and bus connections. Seattle and Portland were served four times a day. | B. "N/A" stands for not applicable. An average fare was not reported for Cascades.

Table 2.2: Annual Amtrak Passenger Ons + Offs by Relevant Station Pairs (FY2018)

Route	Seattle, WA	Spokane, WA	Pasco, WA	Portland, OR	Tacoma, WA
Empire Builder	62,754	46,784	22,711	56,490	N/A[A]
Cascades	491,673	N/A[A]	N/A[A]	408.878	83,177
Coast Starlight	101,186	N/A[A]	N/A[A]	96,330	24,585

Source: Steer (2020) analysis of Railpassengers.org (2019) and Washington State Department of Transportation (2019).
Note: A. "N/A" stands for not applicable.

Other East-West Passenger Services Today

2.6 Several cities in the corridor, including Ellensburg, Yakima and the Tri-Cities, provide local transit within their communities. Yakima and surrounding communities are also connected by the People for People shared ride passenger services. However, the only comparable intercity passenger service today is provided by Greyhound which operates a twice daily service in the mornings between Seattle and Ellensburg. One of these services continues to provide connections to Yakima, Pasco and Walla Walla. The return services are also provided in the morning but on a more widely spaced schedule.

East-West Passenger Rail Service Considerations

2.7 The focus of the East-West Intercity Passenger Rail feasibility study has been on the Stampede Pass corridor and the potential for passenger rail service to serve Auburn, Cle Elum, Ellensburg Yakima, Toppenish, Tri-Cities, and Spokane. In addition to these possible station locations, Tukwila station was added as the service would pass through the station on route to Seattle, the station providing connections to SeaTac Airport and the surrounding metropolitan area. Potential additional station locations including Connell and Ritzville that should be analyzed in greater detail if this initiative continues to move forward.

2.8 The development and assessment of the possible service strategies has considered opportunities to better understand if a new service is operationally and economically feasible. The current long-distance bus service provides some context for the initial service frequency and the timing of the service. Operating one or two trains daily along the length of the corridor would match or better the current level of intercity bus service.

2.9 The study considers East-West passenger rail services along three sections of corridor; Seattle to Auburn, Auburn to Pasco and Pasco to Spokane. The Seattle to Auburn section of the corridor is used by freight, Amtrak Cascades and Sounder South services daily. The schedule for the possible East-West passenger will also need to avoid the timing of the existing rail services, particularly in the case of the morning and evening peak direction Sounder Services to minimize additional infrastructure that could be needed to support additional train service in this well used corridor.

2.10 On the Auburn to Pasco section, only freight trains operate, primarily in the west to east direction. To better understand the possible interaction of freight with a passenger service, the interaction of passenger train service has been modelled alongside hourly west to east freight services to stress test the possible impacts and infrastructure needs. Further validation with BNSF would be needed to validate that any proposal for passenger rail service was feasible and not impactful to their core freight business.

2.11 On the section between Pasco and Spokane, the current Amtrak service runs overnight or late evening depending on direction. Therefore, East-West passenger services should not conflict with the current Amtrak service. The current rail infrastructure provides a greater number of passing tracks to support the more frequent rail freight services. Depending on the volume of freight movements additional passing track or two track sections might be needed to provide BNSF confidence that the passenger rail service would not impact freight operations. This has not been considered in this study.

Potential Schedule Options

2.12 In order to understand the feasibility of a new intercity passenger rail service between Seattle and Spokane, including travel times of the new service and required infrastructure improvements needed to operate, a journey time and base schedule were developed to support the evaluation of the different potential service strategies.

Runtimes

2.13 Runtimes for the Auburn to Spokane corridors have been developed from the Lakeside, Stampede and Yakima subdivision track charts[1]. The track length, curvature and freight speed limits were considered and was used to identify the likely Superelevation[2] including unbalanced Superelevation characteristics for each of the curves along the route. Passenger trains can operate with a greater value of unbalanced Superelevation. This approach identifies the higher speed limit permissible for passenger trains. This was then used to identify the possible station to station runtimes for passenger trains, limited to a maximum speed of 79 miles per hour[3]. The resulting journey times are shown in Table 2.4.

Table 2.3: Runtime and Average Speed

Station	Journey Time Station to Station (hh:mm)	Average Speed (Miles Per Hour)
Seattle		
Tukwila	00:14	54
Auburn	00:10	54
Cle Elum	02:56	26
Ellensburg	00:33	47
Yakima	00:50	43
Toppenish	00:16	60
Pasco	01:06	59
Spokane	02:30	55
Total	**08:35**	**48**

Source: Steer (2020) analysis.

2.14 The overall runtime is slower compared to 1978, which possibly reflects the lack of significant investment in the corridor. In addition, the number of freight movements are likely higher today than in 1978. We are unable to compare these runtimes with the older track charts to better understand the differences in journey time. Run times are influenced by Federal Railroad Administration (FRA) regulations (49 CFR 236), where passenger trains can operate at up to 79 miles per hour without special approval or special safety requirements at at-grade crossings. Above 79 miles per hour, the cost to maintain track while hosting frequent freight train movements becomes significant. As such, most Amtrak intercity passenger services do not operate

[1] Railroad use track charts as a tool for managing corridor assets. A track chart typically provides a schematic of the track layout, geometry attributes (curves, tangents, grades) and the condition of the line to help inform train schedules, permitted speeds.

[2] Superelevation is where the outer rail is raised, which allows trains to operate at higher speed through curves (inches). Unbalanced Superelevation is a safe amount that can be assumed above the amount of Superelevation provided, this allows the speed of trains to be increased

[3] FRA provides regulations for safe railroad operation including maximum speed limits linked to track condition and signalling method – for most signalized lines (without automatic train stop), the maximum speed is 79 miles per hour.

at speeds above 79 miles per hour. The ridership model was used to test the effect of improved journey times on projected ridership, see Table 3.2.

Schedule

2.15 A schedule was developed to provide trains that operate at a time of day that would be useful for passengers considering their trip purpose and other daily activities. It also considered the time of arrival at destinations to provide opportunities for onward travel or other activities, as well as the Amtrak Cascades and Sounder South services operating on the Seattle subdivision as these services and freight movements could provide a constraint on a future East-West passenger rail service. The outline schedule was then tested by using a strategic timetabling software (ATTune) against hourly freight movements to optimize train services that minimize conflicts[4] and to identify where additional track infrastructure could be required to support both passenger and freight operation. ATTune also allows service assumptions such as station dwell times or the time for conflicting freight movements to pass a section to be documented. Further details on infrastructure requirements identified are set out in Section 4 of this report.

2.16 The outline schedule for the new East-West passenger rail services are detailed in Table 2.4 and Table 2.5.

Table 2.4: Base Schedule for Twice Daily Passenger Rail Services From Seattle to Spokane.

	Morning Service Schedule		Afternoon Service Schedule	
Station	**Arrival**	**Departure**	**Arrival**	**Departure**
Seattle	-	8:15 AM	-	12:15 PM
Tukwila	8:27 AM	8:29 AM	12:27 PM	12:29 PM
Auburn	8:37 AM	8:39 AM	12:37 PM	12:39 PM
Cle Elum	11:33 AM	11:35 AM	3:33 PM	3:35 PM
Ellensburg	12:06 PM	12:08 PM	4:06 PM	4:082 PM
Yakima	12:56 PM	12:58 PM	4:56 PM	4:58 PM
Toppenish	1:12 PM	1:14 PM	5:12 PM	5:14 PM
Pasco	2:18 PM	2:20 PM	6:18 PM	6:20 PM
Spokane	4:50 PM	-	8:50 PM	-

Source: Steer (2020) analysis.

[4] A conflict being a train needing access to a section of track that is already occupied – ATTune provides a strategic model to test timetable options for robustness and identify possible infrastructure changes (such as new passing loops or additional signals) that may be required

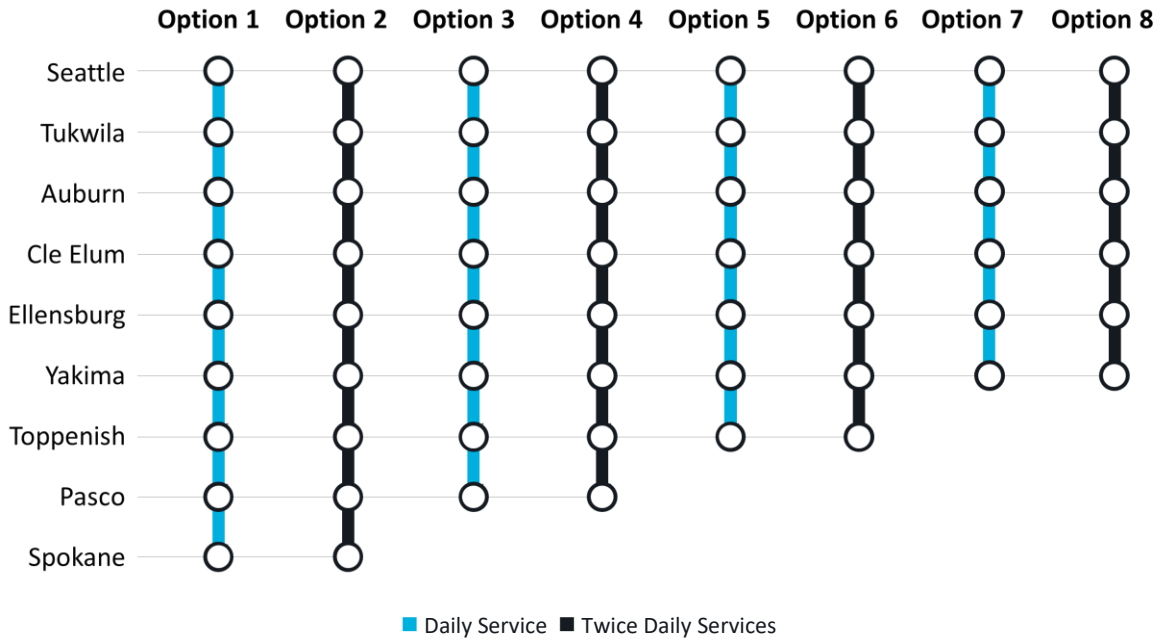
Table 2.5: Base Schedule for Twice Daily Passenger Rail Services From Spokane and Seattle.

	Morning Service Schedule		Afternoon Service Schedule	
Station	**Arrival**	**Departure**	**Arrival**	**Departure**
Spokane	-	7:45 AM	-	11:45 AM
Pasco	10:14 AM	10:16 AM	2:14 PM	2:16 PM
Toppenish	11:20 AM	11:22 AM	3:20 PM	3:22 PM
Yakima	11:36 AM	11:38 AM	3:36 PM	3:38 PM
Ellensburg	12:26 PM	12:28 PM	4:26 PM	4:28 PM
Cle Elum	12:59 PM	1:01 PM	4:59 PM	5:01 PM
Auburn	3:53 PM	3:55 PM	7:53 PM	7:55 PM
Tukwila	4:06 PM	4:08 PM	8:06 PM	8:08 PM
Seattle	4:19 PM	-	8:19 PM	-

Source: Steer (2020) analysis.

2.17 The schedules outlined above has been used to test different service strategies. These strategies include the initially envisaged end-to-end service between Spokane and Seattle. It also considers shorter distance service options (detailed in Figure 2.1) based on feedback and suggestions from the stakeholder events in Yakima and Pasco, where longer journey times were identified as possibly limiting the ridership and benefit of the service and that a shorter or more local connecting services might provide a greater benefit.

Figure 2.1: Service Strategies (Daily Roundtrips)



Source: Steer (2020).

Equipment Needs

2.18 The provision of the service would need a fleet of locomotives and passenger coaches. The cost estimates are based on the Siemens Charger locomotive and the Siemens single level Viaggio / Venture coaches being introduced on other Amtrak State-Supported services. The cost estimates detailed in Table 2.6 and Table 2.7 include spares provision for servicing and contingency for four and eight-coach trains respectively; given the mountainous terrain of the Stampede Pass, we have included two locos per train. It is important to note that no synergies have been assumed with existing Amtrak services in the pooling of spare equipment which could slightly reduce the number of locomotives and/or coaches. We also did not consider intercity diesel multiple units or Talgo equipment used on the Amtrak Cascades in this study as they may not be able to operate reliably on the steep gradients of the Stampede Pass and may require significant re-design.

Table 2.6: Equipment Costs (Four-Coach Train)

Service Option	Frequency	From Station	To Station	Loco's[A] Service/ Spares	Loco[A] Cost ($m)[B]	Coaches Service/ Spares	4-Coach Train ($m)[B]	Total ($m)[B]
Option 1	Daily	Seattle	Spokane	4/2	$109	8/2	$35	**$144**
Option 2	Twice Daily	Seattle	Spokane	8/2	$182	15/4	$70	**$252**
Option 3	Daily	Seattle	Pasco	4/2	$109	8/2	$35	**$144**
Option 4	Twice Daily	Seattle	Pasco	8/2	$182	15/4	$70.	**$252**
Option 5	Daily	Seattle	Toppenish	4/2	$109	8/2	$35	**$144**
Option 6	Twice Daily	Seattle	Toppenish	8/2	$182	15/4	$70	**$252**
Option 7	Daily	Seattle	Yakima	4/2	$109	8/2	$35	**$144**
Option 8	Twice Daily	Seattle	Yakima	4/4	$146	8/8	$35	**$180**

Source: Steer (2020) analysis.
Note: A. "Loco" stands for locomotives. | B. "$m" stands for millions of dollars.

Table 2.7: Equipment Costs (Eight-Coach Train)

Service Option	Frequency	From Station	To Station	Loco's[A] Service/ Spares	Loco[A] Cost ($m)[B]	Coaches Service/ Spares	8-Coach Train ($m)[B]	Total ($m)[B]
Option 1	Daily	Seattle	Spokane	4/2	$109	16/3	$67	**$1769**
Option 2	Twice Daily	Seattle	Spokane	8/2	$182	32/6	$133	**$315**
Option 3	Daily	Seattle	Pasco	4/2	$109	16/3	$67	**$176**
Option 4	Twice Daily	Seattle	Pasco	8/2	$182	32/6	$133	**$315**
Option 5	Daily	Seattle	Toppenish	4/2	$109	16/3	$67	**$1769**
Option 6	Twice Daily	Seattle	Toppenish	8/2	$182	32/6	$133	**$315**
Option 7	Daily	Seattle	Yakima	4/2	$109	16/3	$67	**$176**
Option 8	Twice Daily	Seattle	Yakima	4/4	$146	16/3	$67	**$212**

Source: Steer (2020) analysis.
Note: A. "Loco" stands for locomotives. | B. "$m" stands for millions of dollars.

3 Option Testing

Operations

3.1 The options tested are detailed in Section 2, which consider a single or twice daily service in each direction. The service options also consider the length of the service, testing options between Seattle and each of the following, Spokane, Pasco, Toppenish and Yakima to understand now the length of the service influences costs and ridership.

Ridership

Methodology Overview

3.2 To understand the ridership potential for different East-West rail service options, a ridership model has been developed using discrete choice methods. This model estimates the number of travelers who might switch from driving[5] to rail once the service is introduced. The inputs and process of the model development are outlined in Figure 3.1.

3.3 The approach is split into three core components:

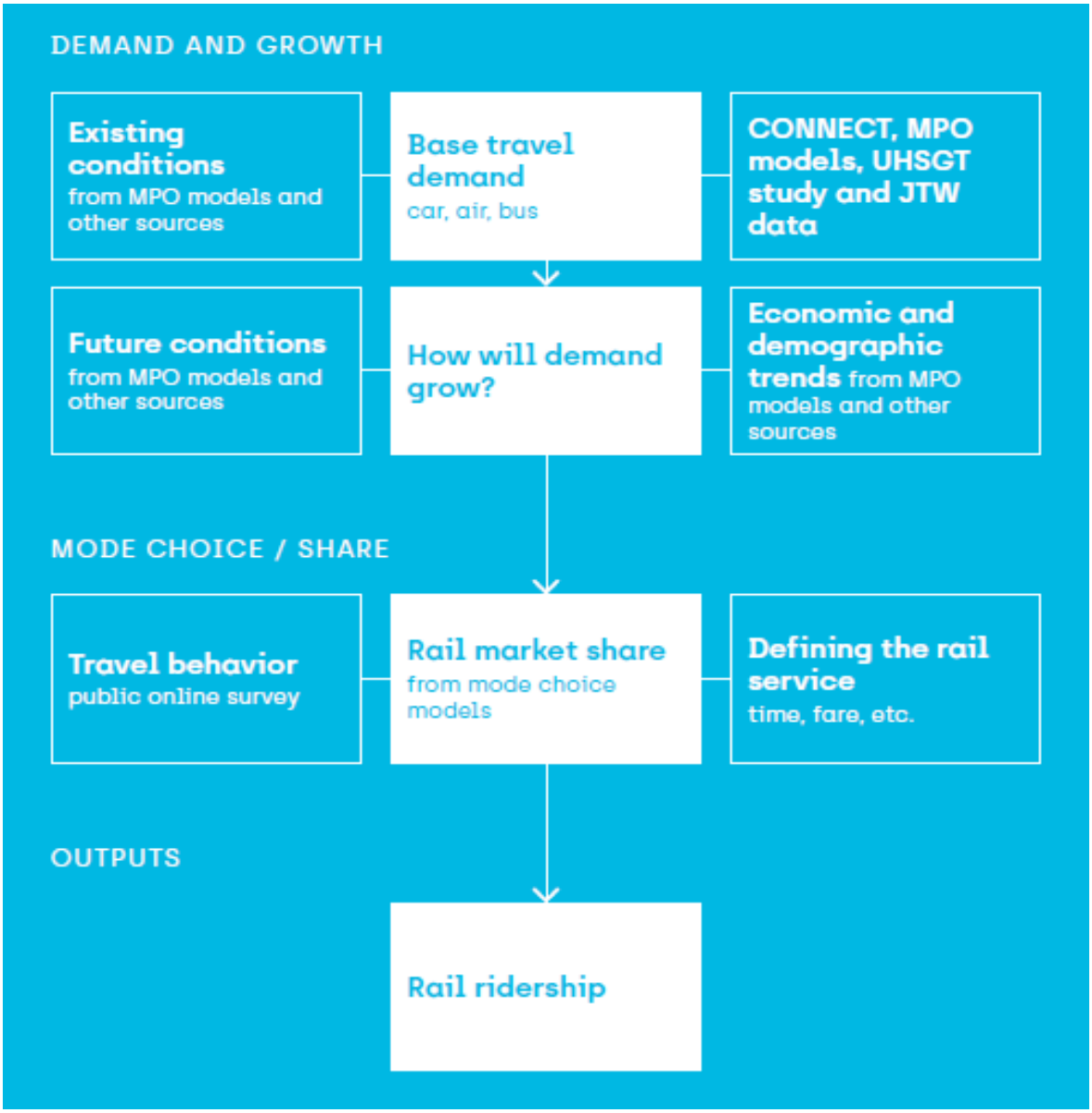
- Demand and growth: base (2020) and future year (2025[6], 2030) trip tables.
- Mode choice model: a calculation of the propensity to divert to rail given defined service plans and underlying auto conditions.
- Outputs: estimated ridership and revenue.

3.4 The model was used to test eight service plans. Each component of the model is outlined in detail below, with ridership estimates following.

[5] Competing travel by alternate modes, particularly, air travel, is discussed in subsequent sections.

[6] Earliest practical year for services to start to allow for negotiations with BNSF, rail infrastructure changes (including constructing new stations), acquiring trains and training of staff.

Figure 3.1: Demand Model Approach



Source: Steer (2020).

Demand and Growth

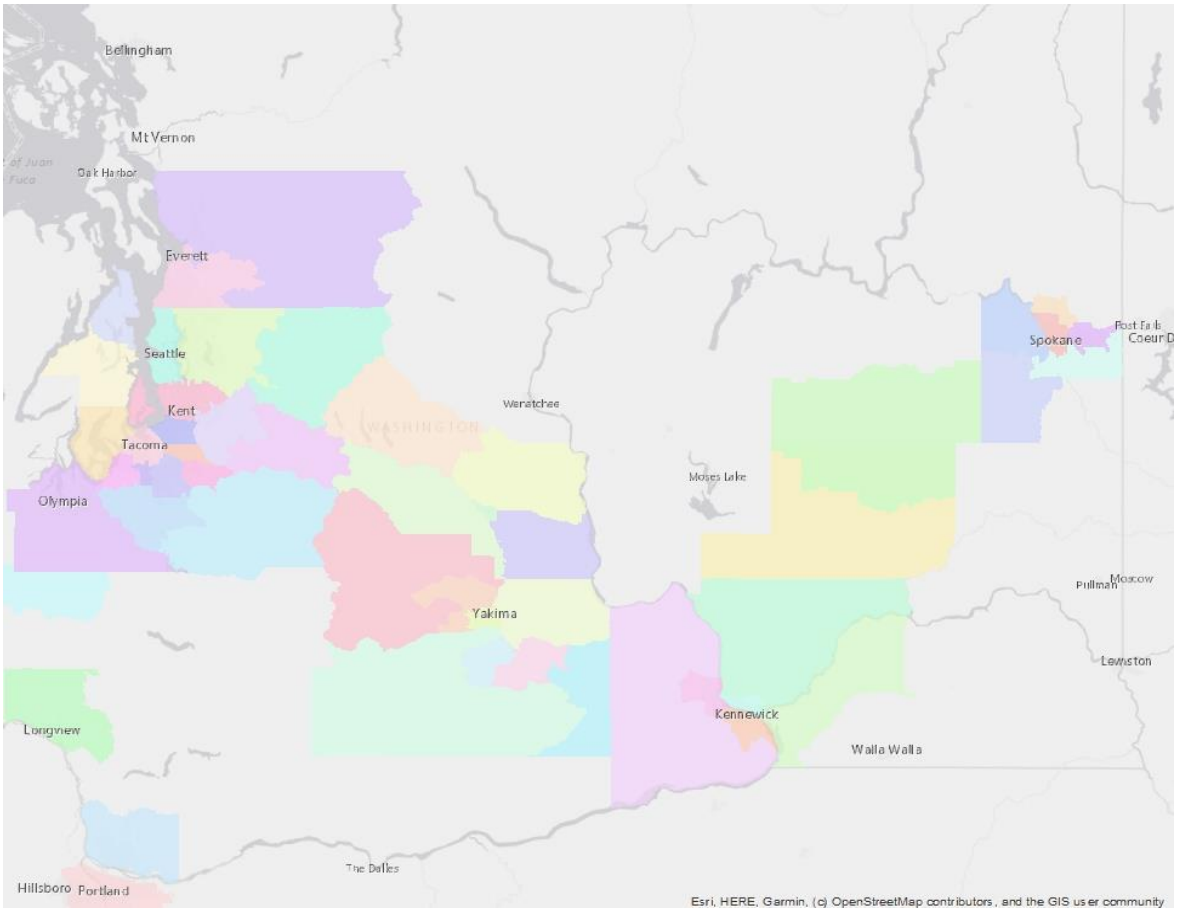
3.5 A key input into the described ridership model is an understanding of current trip-making patterns. Trip tables have been developed for two trip purposes (commute, non-commute) and for three times of day (AM peak, PM peak and off-peak). As no single data source offers this level of information, several sources were used:

- Census Transportation Planning Products (CTPP): commuting data collected as part of the American Community Survey, including commute volumes between residence and workplace locations;

- FRA CONNECT model: a sketch-level planning tool to evaluate user-defined rail corridors in the United States, providing auto volumes between urban centers (core-based statistical areas defined by the Census);
- Airsage data: cell phone location data collected by WSDOT for the north-south corridor on the western part of the state;
- MPO travel demand models: trip patterns from three planning agencies' travel demand models (PSRC, SRTC, and BFCOG); and
- Steer stated preference survey.

3.6 The trip table was developed for the zone system displayed in Figure 3.2. The zone system was built up from Census Tracts, with the sizes of the zones dependent on the relative density and distance from the proposed East-West rail stops.

Figure 3.2: East-West Rail Ridership Model Zoning System



Source: Steer (2020) with Esri/OpenStreetMap base.

3.7 The available trip-making data sources were converted into the above zone system and compared by city pair. This process confirmed prior understanding that the CONNECT volumes are most reliable between major metropolitan centers.

3.8 CTPP commute flows were therefore used as a starting point, with non-commute trips estimated as a share of the commute volumes. The relationship between commute and non-commute shares

came from a combination of sources: the PSRC travel model, CONNECT and Steer's survey. It is important to note that current flows along the Stampede Pass are relatively low compared to denser markets where state supported passenger rail services operate.

3.9 The trip tables are grown to future years using the Washington State Office of Financial Management county population projections – medium growth scenario.

Mode Choice Model

3.10 To predict shares for a new mode, where observations of travelers' actual choices are not available, mode choice models can be developed from statistical analysis of stated preference (SP) data in which travelers express their choices in hypothetical situations presented to them in a carefully structured survey.

Stated Preference Survey

3.11 To better understand the Seattle-Spokane travel market and to estimate behavioral parameters specific to corridor travelers, Steer conducted a behavioral and stated preference (SP) surveys of residents in the region. The behavioral survey was used to develop data and forecasting model inputs needed for the East-West Rail ridership and revenue study. A full description of the survey findings is included in Section 6, Community Support.

3.12 The SP questions in the survey formed the basis of the mode choice model parameters. SP questions ask respondents to make choices between hypothetical situations that involved:

1. Using a new East-West passenger rail service; and
2. Their existing auto travel.

3.13 These exercises were designed to assess the propensity to divert from auto to the proposed rail and the willingness to pay for such service. From these exercises, Steer estimated auto binary choice coefficients for both commute and non-commute travel. These coefficients provide the parameters for the Mode Choice Model and are within the range of parameters used on other similar studies. Air and intercity bus travel were not considered given their relatively low volumes and quicker journey times (please see Paragraphs 3.29 to 3.32 for further details).

Random Utility Model

3.14 Transportation modelers often use discrete choice models called random utility maximization (RUM) models to forecast mode shares. These models follow the microeconomic postulate that an individual's choice among a set of options can be represented as if each option provides a certain level of utility and the individual chooses the option with the highest level.

3.15 The distinguishing feature of RUM models is that an option's utility is assumed to have both a systematic (or deterministic) component as well as a random (or stochastic) component that reflects, among other things, modeler's inability to fully account for all the factors that influence a choice decision. Because of the stochastic component, these models predict the probability of choosing each of the available options rather than the actual choice made. The travel utility experienced by users of a mode is related to the mode's price and service levels, as well as to trip and user characteristics.

3.16 When estimating the mode choice models, a variety of explanatory variables is tested, including separate line-haul (in-vehicle) time, access and egress time, wait time, frequency, travel cost (including vehicle operating cost, parking, tolls and fare), and transfer time at terminals. Other factors that influence mode choice, such as travel safety or the environment, are not key factors in this model. Combinations of variables are examined, and various interactions between income and the cost variable are tested. Multiple possible travel time specifications are also tested, including different definitions of travel time as combinations of line-haul, access/egress and wait time. Several market segmentations are also tested. The most satisfactory model specifications are presented next; these are the models that were tested for application in the forecasting.

3.17 Two types of mode choice models were used:

1. Main mode choice models, assessing travelers' preferences for auto compared to the East-West rail mode; and
2. Access and egress mode choice models, assessing travelers' preferences among available access and egress modes to (access) and from (egress) the East-West rail train station.

3.18 Along with the base trip tables, the East-West rail mode choice models rely on an extensive set of service level information, discussed below.

Service Levels

3.19 Service level information for the following mode and trip components are the final key inputs into the ridership models:

- Auto alternative: drive times and costs between origin-destination zone pairs, differentiated by time of day (varying congestion levels);
- Rail alternative:
  - Rail service levels: in-vehicle rail times, service frequencies and costs; and
  - Rail access/egress characteristics: auto and transit travel times, wait times and costs for rail access and egress trip components.

3.20 A combination of different sources is used to collect the above service level information. Auto travel times were scraped from Google Maps. This process provides current associated times and distances at different times during the day which help estimate possible shifts from auto to rail. Distances and an average cost per mile ($0.15 per mile) form the basis of the drive costs. No parking costs are assumed.

3.21 Rail service levels come directly from the proposed schedules, for each of the eight options. Maximum wait times are assumed to be 15 minutes. Rail access and egress characteristics are provided by the MPO travel skims where available and supplemented with Google travel times.

Outputs

3.22 The model outputs ridership and ticket revenue estimates for the eight service options. The estimates are outlined in Table 3.1 and reflect the following assumptions:

- Ridership years of 2020, 2025 and 2030. The future years reflect a reasonable timeframe for the opening year if a decision was made in the next couple of years to implement a service.

- Ridership forecasts do not include any demand between Seattle-Auburn-Tukwila stations, as these stations are served by frequent Sounder services (13 times per day Monday to Friday).
- Fare structures are based on existing Amtrak fare structures (discussed in the Cost section of this report). Fares in the model are split into business and non-business fares. Business fares for commute trips assume an average of Business and Flexible fares, whereas non-commute trips assume an average of Value and Flexible fares.
- Connecting service from the Cascades and Coast Starlight in Seattle are modeled. However, even with favorable transfer assumptions they return very low rail volumes.
- Estimates for induced travel are typically tied to diversion rates seen in the ridership estimates. Given the low rates of diversion from auto, induced demand is not estimated and expected to be minimal.
- While there are likely to be some wider economic benefits from introducing East-West intercity passenger rail services, economic and wider economic benefits have not been estimated as part of this study.

Table 3.1: Ridership Estimates by Service Option

Service Option	Frequency	From Station	To Station	Annual Ridership Estimates (Thousands)		
				2020	2025	2030
Option 1	Daily	Seattle	Spokane	192	202	212
Option 2	Twice Daily	Seattle	Spokane	205	215	227
Option 3	Daily	Seattle	Pasco	189	199	209
Option 4	Twice Daily	Seattle	Pasco	198	208	219
Option 5	Daily	Seattle	Toppenish	150	157	164
Option 6	Twice Daily	Seattle	Toppenish	166	174	182
Option 7	Daily	Seattle	Yakima	31	32	34
Option 8	Twice Daily	Seattle	Yakima	43	45	47

Source: Steer (2020) analysis.

3.23 Associated ticket revenues with these ridership estimates are discussed in the Revenue sub-section of this report.

3.24 A key factor reducing potential rail ridership is that rail trip times are notably longer than the drive alternative, which is around four to five hours for a typical Seattle to Spokane trip. By contrast, rail travel also requires access, egress and waiting time at stations as part of the door to door journey. Drive time is favorable to rail time for all city pairs, but generally stations that are closer to each other offer relatively more competitive rail service, particularly between Yakima and Toppenish, where the in-vehicle rail time is 16 minutes. This helps explain the decrease in ridership for Options 7 and 8 compared to Options 5 and 6 where services end in Yakima and therefore not servicing the Yakima to Toppenish market.

3.25 This suggests that there is a relative lack of public transportation options in the Yakima Valley. It should be noted that WSDOT offers free weekday bus service connecting Yakima, Toppenish, and

Prosser. East-West Rail would provide improved journey times over the bus, but this relationship was not modelled explicitly, as the ridership model estimates diversion from auto modes only.

3.26 While demand can be considered relatively low compared to the upfront investment required (please see Section 4), East-West passenger rail services ridership would likely be above or comparable to several Amtrak State Supported services such as the North Carolina Charlotte to Raleigh Piedmont which had 212,000 trips in FY 2018/19 for three daily roundtrips. By comparison, it is significantly less than the busier state supported services such as Amtrak Cascades with more than 800,000 annual trips.

3.27 In addition to the above eight options, the model was used to test an improved journey time sensitivity on the Seattle/Spokane twice daily service plan (Option 2 above). This sensitivity tests a sixty-minute reduction in the Seattle-Spokane run time following discussions with stakeholders (please see Section 5 for further details) and results in approximately 10,000 additional annual riders. While this is a significant rail time improvement compared to Option 2, rail travel times are still significantly longer than typical auto trips along the East-West corridor.

3.28 While this study has not fully investigated the specific changes necessary to permit a sixty-minute reduction in end-to-end journey times, the types of changes needed would typically include:

- Straightening tight curves along key sections, which would be expensive and difficult to permit, but could include segments approaching each side of the Stampede tunnel, the segment in the Upper Yakima River Canyon between Cle Elum and Thorp, and the segment in Lower Yakima River Canyon between Ellensburg and Selah – some of the challenges are set out in Appendix C.
- Higher performance passenger train equipment to enter and leave stations and tight curves with less time slowing and accelerating (such as the Talgo equipment used on the Amtrak Cascades).
- High level platforms at intermediate stations that allow passenger to get on and off the train quickly to reduce dwell times compared to the average two minutes per station modelled assumption (or having fewer intermediate stations).
- Providing a safe way to open and close all doors on the train so that passengers can get on and off the train quickly to reduce dwell times.
- Not providing checked baggage at intermediate stops to reduce dwell times.

Table 3.2: Travel Time Sensitivity Test, 2020

Service Option	Frequency	From Station	To Station	Rail Run Time (hh:mm)	Annual Ridership Estimates 2020 (Thousands)
Option 2	Twice Daily	Seattle	Spokane	08:35	205
Option 2a	Twice Daily	Seattle	Spokane	07:35	215

Source: Steer (2020) analysis.

Air Travel and Other Modes

3.29 Diversion from air travel and other modes is not modelled due to expected low volumes of travel being diverted from non-auto modes. These markets are discussed in turn below.

3.30 The proposed East-West rail corridor includes three Washington state airports: Seattle-Tacoma International Airport, Spokane International Airport, Tri-Cities Airport (Pasco) and Yakima Air Terminal. Total air passenger volumes between these three airports in 2018 amounted to approximately 565,000. The volumes and associated air service are presented in Table 3.3.

Table 3.3: 2018 Air Service Levels and Passenger Volumes

City Pair	Daily Air Frequency	Average One-Way Trip Cost	Average Travel Time	Annual 2018 Passengers (Thousands)
Seattle – Spokane	22 roundtrips	$150	1.25 hours	487
Seattle – Pasco	11 roundtrips	$50	1 hour	79
Pasco - Spokane	9 roundtrips[A]	$175	3 hours (via Seattle)	4
Yakima - Seattle	3 roundtrips	Similar to Pasco	1 hour	19

Source: Steer (2020) analysis of U.S. Department of Transportation *Airline Origin and Destination Survey* (2019)
Note: A. Pasco-Spokane requires a transfer in Seattle; trips with less than two-hour transfer times are included.

3.31 Travelers choosing to fly between Washington State cities exhibit a high value of time given their preference for air over auto and the existing rail services in the state. Any diversion from air will be less than 0.5% particularly as East-West travel times will be much longer than air.

3.32 As previously mentioned, Greyhound service and local transit does exist along the corridor. This market was not modeled due to expected low market share and quicker journey times (for example Seattle to Yakima is approximately 3 hours and 30 minutes by bus compared to 4 hours and 30 minutes by train). An East-West passenger rail service could provide additional journey opportunities but could also impact the ridership currently using the long-distance bus service, which risks services withdrawn if ridership is reduced. It is unclear whether any savings in public subsidy could be realized if this were realized.

Costs

Operating Costs

3.33 Operating costs for East-West passenger rail services have been developed based on research undertaken on Amtrak service across the U.S. Amtrak 2018 data has been compared against the operated miles for Amtrak's three business units (Northeast region, state supported (including Amtrak Cascades route) and long-distance services). The resulting cost per mile operated has been further refined to remove the top and bottom 20% of the resulting service costs, to provide a more appropriate average service cost. This cost has been inflated to 2020 based on published Amtrak Service plans and proposed budgets to identify a cost per operated mile of $52.64. Key cost components include train crew, fuel, BNSF track access charges, marketing/ticketing charges and train and station maintenance costs. The cost operating cost for each of the options considered are detailed in Table 3.4. As discussed earlier, no synergies were assumed for

operating more than daily service given the early stage of study and that most costs are related to train crew, fuel costs and BNSF access charges which would see little, if any, economies of scale.

Table 3.4: Operating Costs ($2020)

Service Option	Frequency	From Station	To Station	Operating Costs ($m)[A]
Option 1	Daily	Seattle	Spokane	$15
Option 2	Twice Daily	Seattle	Spokane	$29
Option 3	Daily	Seattle	Pasco	$9
Option 4	Twice Daily	Seattle	Pasco	$18
Option 5	Daily	Seattle	Toppenish	$7
Option 6	Twice Daily	Seattle	Toppenish	$13
Option 7	Daily	Seattle	Yakima	$6
Option 8	Twice Daily	Seattle	Yakima	$12

Source: Steer (2020) analysis.
Note: A. "$m" stands for millions of dollars.

Other Costs

3.34 In addition to the infrastructure improvements identified, liaison and agreement with the host freight railway BNSF Railway would be needed beyond this early feasibility study. While the operating costs shown in Table 3.4 above will include track access charges, additional improvements may be required, resulting in additional infrastructure improvements and hence increased access usage fees.

Revenue

3.35 Two streams of revenue have been considered, fare revenue and food services.

Fare Revenue

3.36 Fare revenues considers the possible fare structure and pricing, including Value, Flexible and Business Fares as used by Amtrak to help maximize fare revenue while accommodating different user groups. A potential example is shown in Figure 3.3, while fare pricing for the different types are detailed in Table 3.5, Table 3.6 and Table 3.7.

Figure 3.3: Potential Example Fares

Value	• Low fare prices with limited availability • Changes and refunds permitted but change or cancellation fees may apply
Flexible	• Full fare prices • Changes and refunds permitted without change or cancellation fees
Business	• Premium travel experience and may feature extended leg room or complimentary amenities

Source: Steer (2020) analysis of Amtrak (2020).

Table 3.5: Value Fare Pricing ($2020)

Value	Seattle	Tukwila	Auburn	Cle Elum	Ellensburg	Yakima	Toppenish	Pasco	Spokane
Seattle									
Tukwila	$9.50								
Auburn	$12.00	$9.50							
Cle Elum	$18.00	$15.50	$12.00						
Ellensburg	$24.00	$21.50	$18.00	$9.50					
Yakima	$26.00	$23.50	$20.00	$11.50	$9.50				
Toppenish	$30.00	$27.50	$24.00	$15.50	$13.50	$9.50			
Pasco	$46.00	$43.50	$40.00	$31.50	$29.50	$25.50	$18.00		
Spokane	$58.00	$55.50	$52.00	$43.50	$41.50	$37.50	$30.00	$21.00	

Source: Steer (2020) analysis.

Table 3.6: Flexible Fare Pricing ($2020)

Flexible	Seattle	Tukwila	Auburn	Cle Elum	Ellensburg	Yakima	Toppenish	Pasco	Spokane
Seattle									
Tukwila	$17.00								
Auburn	$21.00	$17.00							
Cle Elum	$33.00	$29.00	$21.00						
Ellensburg	$43.00	$39.00	$31.00	$17.00					
Yakima	$45.00	$41.00	$33.00	$19.00	$17.00				
Toppenish	$54.00	$50.00	$42.00	$28.00	$26.00	$17.00			
Pasco	$99.00	$95.00	$87.00	$73.00	$71.00	$62.00	$33.00		
Spokane	$127.00	$123.00	$115.00	$101.00	$99.00	$90.00	$61.00	$56.00	

Source: Steer (2020) analysis.

Table 3.7: Business Fare Pricing ($2020)

Business	Seattle	Tukwila	Auburn	Cle Elum	Ellensburg	Yakima	Toppenish	Pasco	Spokane
Seattle									
Tukwila	$21.50								
Auburn	$21.50	$19.00							
Cle Elum	$30.00	$27.50	$21.50						
Ellensburg	$37.00	$34.50	$28.50	$26.00					
Yakima	$39.00	$36.50	$30.50	$28.00	$26.00				
Toppenish	$46.00	$43.50	$37.50	$35.00	$33.00	$22.00			
Pasco	$71.50	$69.00	$63.00	$60.50	$58.50	$47.50	$25.50		
Spokane	$90.00	$87.50	$81.50	$79.00	$77.00	$66.00	$44.00	$33.00	

Source: Steer (2020) analysis.

3.37 Fare revenue associated with the ridership estimates is reported in Table 3.8. This represents fare revenues in 2020 dollars, for the 2020 ridership estimates.

Table 3.8: Fare Revenue ($2020)

Service Option	Frequency	From Station	To Station	Revenue ($m)[A]
Option 1	Daily	Seattle	Spokane	$4
Option 2	Twice Daily	Seattle	Spokane	$5
Option 3	Daily	Seattle	Pasco	$4
Option 4	Twice Daily	Seattle	Pasco	$4
Option 5	Daily	Seattle	Toppenish	$2
Option 6	Twice Daily	Seattle	Toppenish	$3
Option 7	Daily	Seattle	Yakima	>$1
Option 8	Twice Daily	Seattle	Yakima	$1

Source: Steer (2020) analysis.
Note: A. "$m" stands for millions of dollars.

Food Service Revenue

3.38 The Amtrak 2018 operating cost data was reviewed to identify the possible uplift in revenue generated from onboard food services. The cost data highlights that on average food services provides a return of 6.45% on the operating costs. This would equate to a food service revenue for each of the service options as shown in Table 3.9.

Table 3.9: Food Service Revenue ($2020)

Service Option	Frequency	From Station	To Station	Revenue ($k)[A]
Option 1	Daily	Seattle	Spokane	$800
Option 2	Twice Daily	Seattle	Spokane	$1,600
Option 3	Daily	Seattle	Pasco	$500
Option 4	Twice Daily	Seattle	Pasco	$1,000
Option 5	Daily	Seattle	Toppenish	$400
Option 6	Twice Daily	Seattle	Toppenish	$800
Option 7	Daily	Seattle	Yakima	$400
Option 8	Twice Daily	Seattle	Yakima	$700

Source: Steer (2020) analysis.
Note: A. "$k" stands for thousands of dollars.

4 Infrastructure Improvements

4.1 Infrastructure improvements will be needed to support the provision of passenger rail, including new station facilities and additional passing tracks to support freight. In addition to the infrastructure improvements identified, liaison and agreement with the host freight railway BNSF Railway would be needed beyond this early feasibility study, for example, to protect freight. This could result in additional improvement requirements, one off access costs and ongoing usage fees.

4.2 The current alignment was reviewed to identify the quality of the rail infrastructure, opportunities for speed improvements, locations requiring additional passing loops to support the interaction of freight and a two-way passenger rail service and station infrastructure needs.

4.3 Since the Stampede and Yakima Valley subdivisions do not current host passenger trains speeds, no current speeds are presented, however with a fully compliant signal system, the maximum passenger train speed would be expected to be 79 miles per hour, as they are on the Lakeside Subdivision.

4.4 Railroad curves are defined by the angle that a curve takes to extend through a 100-foot chord; the shorter the radius of the curve, the larger the angle. The speed a train can pass through a curve depends on the “degree” of the curve and the Superelevation (aka banking) of the track. The Superelevation of track over which freight trains operate is limited, but passenger trains are usually allowed to run faster through the same curve as a freight train. Broad or shallow curves are on the order of two degrees (per 100-foot chord), as a passenger train can operate safely through it at 79 miles per hour. A tight curve in freight railroad would be on the order of seven degrees or more, requiring a passenger train to slow to 35 miles per hour or less.

Stampede Subdivision

4.5 Apart from most of the freight passing tracks, the rail corridor from East Auburn to Ellensburg is generally un-signalized territory[7], apart from those areas where there are passing sidings. Gradients in the corridor following the Green River, Big Soos, Jenkins Creek and Cranmar Creek do not exceed 1%. However, at Lester gradients increase to 2% or more as well as sharper curves. Here the line nearly doubles back twice to enter the 2-mile-long Stampede tunnel. After exiting the tunnel, there is a siding at Martin that could potentially be extended to provide a passing track. The line then slopes downhill with gradients exceeding 2%, again with sharp curves. Beyond West Easton, the tracks follow the Yakima River, with the gradient decreasing to around 1%, but still with sharp curves. East of Easton the line parallels Highway I90 with relatively shallow curvature through to Cle Elum.

[7] A section of railroad not controlled by Centralized Signal Control (CTC) but by train dispatchers and radio communications

4.6 From Cle Elum the tracks follow a short canyon of the Yakima River, where there are sharp curves to follow the terrain. Exiting the canyon, the track continues to Thorp and then onwards to Ellensburg with shallow or no curvature of the alignment, as the gradient over this section rarely exceeds 1%.

Speed improvements

4.7 In this subdivision, the maximum speed limit for freight is 49 miles per hour. Reduced speeds are a result of the repeated sharp curvature due to higher gradients. Consequently, there are limited locations where passenger train speed improvements can be achieved on the Stampede subdivision due to the existing terrain.

4.8 One potential area for improvements is between Curves 99A through 88A[8], southwest of Covington, although the need to cut into the hillside would involve significant excavations and substantial cost.

4.9 East of Covington, Curves 87 and 86 could also be broadened to maintain speeds through this relatively higher speed area.

4.10 Although there are other speed restrictions along the Stampede subdivision, a third location at Howard Hansen Reservoir, Curve 70B, could be broadened to provide a modest increase in speed. This is also an area where an additional passing track might aid freight and passenger operations.

Yakima Valley Subdivision

4.11 The Yakima Valley subdivision starts at Ellensburg and ends at Pasco. Here the territory is once again un-signalized, apart from those areas where there are passing sidings. From Ellensburg, the track enters the Yakima River canyon, closely following the river for 20 miles. In this canyon gradients are relatively low, but curves are tight. After leaving the canyon, the track crosses the river passing through Selah and a gap in the ridge to enter the industrial north end of Yakima. On leaving Yakima, the track cross through a gap in the Ahtanum Ridge to Parker. Beyond Parker and continuing to Prosser through Toppenish, the alignment supports higher speeds, with shallow curves and mild gradients. At Prosser, the alignment once again starts to follow the Yakima River. At Benton City the alignment has sharper curves as it turns towards the Columbia River crossing.

Speed improvements

4.12 On this section of the route, speed improvements are again limited either due to the terrain or because the existing alignment already supports higher speeds.

4.13 At Pomona, the series of curves before the crossing of the river could be eased but the crossing itself imposes the greatest speed restriction, limiting the overall benefit gained.

4.14 At Selah, there is a speed restriction which appears to be based on the grade crossing of Naches Avenue, which could possibly be improved through education and safety improvements.

4.15 Between Prosser and Benton City, curves 30A through 27B could be improved to increase speed. However, this would involve cutting into the hillside.

[8] For additional information on curves, please refer to Appendix C.

4.16 A further opportunity exists near East Kiona. Again, cutting into the hillside here could provide shallower curves and speed improvement.

Lakeside Subdivision

4.17 Between Pasco and Spokane there are a small number of opportunities to improve speeds within the Lakeside subdivision. However, the resulting benefits are expected to be insignificant compared to the overall journey times between Pasco and Spokane.

Stations

4.18 This section provides a summary of the station improvements identified in this analysis. For detailed information, please refer to Appendix D. The initial assessment has focused on identifying station locations that would allow for a train length of up to eight coaches, with a locomotive at each end. The platform should be a minimum of 16 feet-wide for boarding, with 30-foot-wide turnarounds at each end for baggage carts. Historic stations, such as at Yakima and Ellensburg were not considered at this stage given that they are no longer in railroad ownership and the ability to improve them to meet current passenger train standards may be difficult.

4.19 The station amenities are proposed to be kept simple in scale but suitable for all weather, similar in style to those at Winnemucca Station, Nevada as illustrated in Figure 4.1.

Figure 4.1: Winnemucca Station, Nevada

Source: Amtrak.

4.20 It is assumed the platform will be built to eight inches above top of rail (ATR). This would require concurrence from the FRA to comply with the Americans with Disabilities Act (ADA). BNSF Railway does not allow platforms greater than eight inches in height on main tracks as it may interfere with cars used for extra-dimensional loads. The ADA requirements and the 2011 U.S. Department of Transportation (U.S. DOT) rules, require passenger rail service providers to offer full-length, level-entry boarding at new or altered platforms where no platform track is shared with freight

trains or to seek federal concurrence for alternative compliance methods. Because freight trains share the tracks at each proposed station platform and the freight car envelopes would overlap a full-length, level-entry boarding platform, it is likely the operator will need to seek concurrence from the FRA, a U.S. DOT agency, on alternative compliance methods.

4.21 For alternate compliance, Amtrak, for most of their services, provides portable lifts for passengers with mobility impairments. On Amtrak Cascades, which use Talgo-built cars, the lifts are car-mounted. Commuter rail operators, such as Sounder, have often used a special "mini-high" platform that elevates the passenger which maintain the wider freight clearance; the mini-high platform requires a hand-placed ramp to bridge the over two-foot plus gap.

4.22 Additional/new station infrastructure would be required as described in Table 4.1.

Table 4.1: Additional/New Station Infrastructure

Station	Description
Tukwila	• For eight car train consists, platform lengthening
Auburn	• For eight car train consists platform lengthening
Cle Elum	• North side of railway, east of Bullit Avenue - Platform and shelters
Ellensburg	• East side of railway, south of West 5th Avenue - Platform (adding to existing platform area if possible and new shelter as existing station building are in private ownership and occupied) – Provides a connection to existing transit service
Yakima	• East side of railway, between W Martin Luther King Jr Boulevard and W Yakima Avenue - Platform (adding to existing platform area if possible and new shelter as existing station building are in private ownership and occupied) - Provides a connection to existing transit service
Toppenish	• Northeast side of railway, south of S Toppenish Ave - Platform (adding to existing platform area if possible and new shelter, existing station building are in private ownership and occupied by the railway museum
Pasco	• For eight car train consists platform lengthening

Source: Steer (2020) analysis.

Capital Costs

The preliminary station capital cost estimates (not including provision of car parking) are detailed in Table 4.2.

Table 4.2: Station – Capital Cost Estimates

Station	Eight-Coach Train ($m)	Four-Coach Train ($m)
Seattle (King Street)	$0	$0
Tukwila	$6	$0
Auburn	$6	$0
Cle Elum	$24	$0
Ellensburg	$24	$17
Yakima	$24	$17
Toppenish	$24	$17
Pasco	$8	$0.0

Source: Steer (2020) analysis.
Note: "$m" stands for millions of dollars.

Train Maintenance

4.23 When the trains reach their final destination, they need to be stored, cleaned, and restocked before they return in the opposite direction. The train equipment must also be inspected, fueled and maintained on a regular basis depending on the miles traveled.

4.24 Amtrak operates a maintenance facility in Seattle, just south of King Street Station, that accommodates the needs of all Amtrak services that terminate or originate in the Seattle, as well as the Sounder North and Sounder South services. This facility also accommodates the Sounder trains as they layover between the morning and afternoon peaks. While capacity at this facility is nearly exhausted, Amtrak has discussed plans to add at least one more track to the storage yard, which is planned as early as 2021. In addition, Sound Transit has begun constructing a maintenance facility for their own Sounder equipment at their current layover yard in Lakewood, WA[9]. Should additional train storage in Seattle be required, the costs could range between $10 million and $20 million depending on property costs and the length of trains, number of trains, and amount of spare equipment is required by the service.

4.25 A layover facility at other terminals discussed (Spokane, Pasco, Toppenish, or Yakima) would also be needed to store, clean and restock trains between their arrival and departure back to Seattle. The costs of such a facility can vary from $3 million to $12 million depending on the required amenities (lighting, drainage, crew buildings) and the number of trains to be stored. At Spokane, there are a number of existing yard tracks just over a mile east of the station and just east of N. Erie Street that could be leased or acquired to accommodate one or two trains. There are also possible locations for overnight sidings at Pasco, Yakima or Toppenish.

[9]Please see https://www.soundtransit.org/sites/default/files/documents/sounder-south-strategic-plan-final.pdf for both the Amtrak and Sound Transit planned improvements.

Additional Siding Tracks

4.26 To support the interaction between freight and passenger trains and to minimize the impact of either service on the other, additional passing siding tracks may be needed. Based on current BNSF practice on the Stampede and Yakima Valley subdivisions, the minimum siding capacity considered in this study is 8,000 feet, though several longer sidings are discussed. Please refer to Appendix B for additional detailed analysis.

Kanaskat to Lester

4.27 The siding would be located west of a bridge over the Green River, near the Howard A Hanson Reservoir. The west end of Humphrey Siding would be near mile (MP) 71.6 and the east end near MP 69.7. The approximate length of the siding would be 9,000 feet between clearance points. The east end of Humphrey would be nine miles from Lester and the west end about 10.5 miles from Kanaskat. The team chose to pursue this option because it is located near a projected meet point in the scheduling analysis. The siding is assumed to be located on the south side of the existing main track.

Cle Elum

4.28 Within Cle Elum, which is also being considered for a passenger stop, the west end of a siding would be located at MP 25.3, near two I-90 freeway overpasses. The east end of the siding would be at MP 23.0, near the SR-97 overpass. Approximate siding length would be 11,500 feet between clearance points. Cle Elum features a wide clear space adjacent to the tracks within town, the former site of a yard. Some Maintenance-of-Way (MOW) tracks remain on the north side of the tracks. To avoid removal of these tracks, the analysis assumed a new siding on the south side of the existing main track.

Thorp

4.29 The siding would be located on the south side of the existing main track to make use of the double tracked Bridge 7.90. This siding would begin at MP 9.1, just east of the Thorp Highway crossing. The siding would connect to the existing track 0748 and follow it through town. The existing turnout connecting to the main track would be removed and the siding would continue east, ending at MP 7.3. The siding's capacity would be 8,700 feet between clearance points. The 2nd Street crossing would be removed and replaced with a new crossing at MP 7.2 with a 2400-foot access road. The access road would require purchasing property from an adjacent ranch.

Ellensburg to Yakima

4.30 The west end of the siding would be at MP 123.1. The east end would be at MP 121.2, near a bridge over a tributary of the Yakima River. The siding is assumed to be on the southwest side of the existing main track. Approximate length of the siding would be 9,400 feet. There are two at-grade crossings of Ringer Loop Rd. It is assumed that the northernmost crossing (USDOT 085192E) would be moved about 1,700 feet north and the road adjusted to follow an existing driveway. The second crossing (USDOT 085193L) would be either left in place or removed. There appear to be wetlands in the vicinity of the proposed siding and thus mitigation would be required.

Capital Cost

4.31 The preliminary capital cost estimates for the siding provisions are detailed in Table 4.3.

Table 4.3: Siding – Capital Cost Estimates

Siding	Cost ($m)
Kanaskat to Lester	$15 – $18
Cle Elum	$15 – $18
Thorp	$15 – $18
Ellensburg to Yakima	$19 – $23

Source: Steer (2020) analysis.

Signaling and Positive Train Control

4.32 As noted in Section 2, the Stampede and Yakima Valley subdivisions have only islands of centralized traffic control (CTC) at existing meet/pass sidings. The siding projects discussed above include providing CTC. In order to operate passenger trains over these subdivisions, federal regulations[10] require a positive train control (PTC) system. BNSF has implemented PTC between Seattle and Auburn, and between Pasco and Spokane. Since PTC is also required for freight trains moving "poison- or toxic-by-inhalation hazardous materials" and since BNSF is rolling out PTC on most of its main routes, the study team has assumed that PTC will be in place on the entire route within the next few years in part to ensure safe and reliable operation of existing freight services. The incremental costs associated with installing PTC to allow for passenger rail services would likely be recovered either through the BNSF access fees or an additional upfront cost.

Snow Protection

4.33 Snow on Stampede Pass would be a key factor in a reliable operation. Snow sheds over the tracks, plowing the tracks, and switch heaters to keep switches clear of snow and ice are the three techniques commonly used to keep rail lines operational through the winter. BNSF currently maintains four snow sheds on Stampede Pass, all located near existing tunnels. The overall avalanche risk elsewhere appears minimal. There are two potential places where new snow sheds up to 500 feet may reduce the risk of the tracks being blocked; near mileposts 45.6 and 69.2. The sheds would cost between $10 million and $20 million apiece. Further study is recommended.

4.34 BNSF Railway ordinarily uses two specialized plows, a "wedge plow" and a "spreader," on Stampede Pass to clear the tracks of snow. This equipment is stored at Auburn to be deployed when needed. Costs for adding to this specialized plow fleet is not easily obtained as they are built to order but are likely to be between $500,000 to $1 million per unit.

4.35 Switch heaters are already installed at existing Centralized Train Control (CTC) controlled passing sidings to keep major turnouts usable, and BNSF Railway generally requires switch heaters on any new such sidings on the along their northern routes outside of southwest Washington. The cost of these is already accounted for when presented in Table 4.3.

[10] Please see Regulation 49CFR & 236

5 Operator Options

5.1 Until recently, Amtrak has been the sole provider of intercity rail services across the United States, outside of the Alaska Railroad. However, Virgin Trains USA initiated services from Miami to West Palm Beach, with an extension to Orlando under construction. Further privately-operated high-speed rail services are planned to connect Las Vegas with Southern California (XpressWest/Virgin Trains USA), across California (by California High Speed Rail or CHSR) and connecting Dallas with Houston (by Texas Central). In addition, there are several public and private operators for commuter rail services (for example, Sounder rail services operated by BNSF Railway), some which provide long distance connections.

5.2 Interest in contracting out rail services has increased as new rail services have been introduced and investments in rail infrastructure have led to alternative contracting options, most recently utilizing a Public-Private Partnership (P3) model to construct, operate, maintain and part finance the new 40-mile commuter rail network in Denver, Colorado. A local example of this is that Sounder operations are contracted out to BNSF who also own and operate much of the infrastructure utilized by this passenger service.

5.3 Broadly, there appear to be three options in delivering intercity rail services available to the state of Washington as described in Table 5.1.

Table 5.1: Operator Options

Option	Description
Public Outsourcing	• Washington State contracts Amtrak to operate the Seattle to Spokane rail services, similar to contractual arrangements in place for State Supported services across the United States including the Cascades linking Seattle with Portland/Eugene and Vancouver, Canada. • Assets including rolling stock, stations and any rail infrastructure would be funded and owned by Washington;
Private Outsourcing	• Washington State contracts a third-party/private company to operate Seattle to Spokane rail services. • While the core contracting mechanism would be similar to the Amtrak option (rail operations outsourced with any capita works and assets owned by Washington state), alternative procurement approaches available include the possibility of a P3 arrangement where a third-party consortium design, procure, operate and fund the delivery of services, recovering its costs through payments from the state of Washington – variations could include splitting the delivery/ownership of rolling stock from other rail assets

Option	Description
State Operated	• Washington State establishes an internal company to design, deliver and operate Seattle to Spokane rail services. • While this would be a significant undertaking to build up the capability, resources and financial obligations necessary to deliver services, if combined with taking over full responsibility for Amtrak Cascades services, there could be economies of scale and the ability to better cross-manage shared resources such as rolling stock, traincrew and management teams. Sub-options where WSDOT has more control over certain activities, akin to how California delivers State-Supported services, are also possible.

Source: Steer (2020) analysis.

Each of the three options can deliver the East-West intercity rail services proposed for Washington State. However, the options will have different arrangements which will lead to different strengths and weaknesses. There are several factors to consider against the three broad delivery options. e

- **Legal/Structure of Contract**: No matter which operator option is adopted; it is critical to ensure that services are delivered in a contractual manner. The contract would need to establish the key objectives, requirements and measures which will need to be delivered by the operator whether it is Amtrak, third-party private company or internal Washington state agency. A key component is to establish an output/outcomes based contract (such as on-time performance and customer satisfaction rates) rather than an input based mechanism (for example, number of trains and traincrew) as this focuses the operator to deliver what is really valued as well as allow greater flexibility to deliver services in the most cost effective manner. Ensuring that the incentive mechanisms are effective throughout the life of the contract can be difficult to calibrate, in particular for complex arrangements where capital assets and longer-term aspects are incorporated. Another factor is whether any ridership/revenue mechanisms are incorporated which in P3 style contracts tends to be in the form of availability payments linked not just to performance. The level of 'control' in shaping services delivered is another important factor to consider, for example setting fares, information provision/branding (see below).
- **Operational Performance**: An important factor is how to deliver consistently reliable and high-quality rail services. There is a strong link between reliability, customer satisfaction and ultimately ridership. While contracts can be put into place without outsourcing, mechanisms between public sector bodies tend to have less transparency and hence, less commercially effective. Effective contractual mechanisms are critical in achieving high performance, typically through clear data linkages to track outputs. Another factor is ensuring that ongoing operational (and other) performance is incentivized throughout the length of the contract as a target-based contract tend to discourage continuous improvement once thresholds are regularly achieved.
- **Commercial Including Lifecycle Costs**: Outsourcing public services typically reduce financial outlays compared to traditional delivery of public services which can be above 20% for simpler service delivery such as garbage collection to around 10% for more complex public

transportation contracts[11]. This is driven primarily by more efficient staffing plans, asset maintenance strategies and performance related incentives. However, this is by no means achieved universally and there are factors which can significantly reduce any savings. In particular, due to U.S. legislation on access to private rail infrastructure enacted back in 1971, Amtrak's payments to freight railroads can be three to four times less expensive per train mile than those operated by a private operator. Amtrak's avoidable cost accounting used under PRIIA 209 legislation for State-Supported services across the U.S. includes relatively low track access charges. This could easily outweigh the commercial benefits of lower staffing and other costs that have been witnessed in other countries where outsourcing to private companies is commonplace. Further investigation into the practical, financial and operational implications are warranted as this issue is being challenges by certain states, notably California.

- **Marketing/Branding**: One factor that is not often considered is the importance of marketing in delivering high quality (and ultimately well used) public services. In Europe, numerous rail services contracts have requirements for the outsourced operator to undertake regular and high-profile marketing activities, ranging from standard print and digital information campaigns to customer research and incentive-based activities. A key question is whether the overall branding umbrella is 'owned' by the State of Washington to ensure consistency across overlapping transportation services (such as Amtrak Cascades and local/regional bus connections) and to gain greater synergies through wider exposure than an East-West Rail specific package. In any event, some 'control' by Washington state would be advisable no matter which operating contractual approach is adopted.
- **Risks (Operational and Financial**): Some of the most important risks associated with a rail services delivery approach include:
    - **The Rail Operator's Commercial Performance** – as stated above under operational performance, calibrating contractual mechanisms can be difficult to get right and in particular changes during the term of contract. While Seattle to Spokane services are high likely to require significant subsidies, some form of ridership/revenue incentive has been shown to drive higher demand. Full ridership risk is unlikely to result in a value for money outcome; in many cases the incentive value in the contract should be set below that of the expected profit/net income generated.
    - **Price Paid by State of Washington (the Risk Premium)** – the risks inherent in delivering East-West rail services is critical in determining the cost that bidders will incorporate in their prices and where a single-source tender is involved (Amtrak or an inhouse operator), transparency of these risks is also important to ensure no post contract increases for unforeseen risks. The balance of risks which the operator can control (such as rolling stock or traincrew availability) versus activities which cannot be easily controlled (such as econometric factors that drive ridership) is important to assess before the final stages of any procurement.
    - **Freight Railroad Performance/Ability to Influence** – as stated above, the ability to incentivize freight railroads to deliver a time competitive and importantly, a

[11] Outsourcing Public Services: Contractibility, Cost and Quality; Fredrik Andersson, Henrik Jordahl, Jens Josephson; CESifo Economic Studies; 2019 plus other reports including from Government Accounting Office

consistently reliable service is constrained. A particular concern is how the contract operator can influence the host railway BNSF to provide a reliable service. BNSF, who is considered less hostile than many other U.S. freight railroads and directly operates some commuter rail services including Sounder trains, still insists on a series of strict principles or requirements to gain and pay for access and for others to fully fund any improvements needed. This could include funding costs associated with future freight rail expansion. A recent federal U.S. Supreme Court ruling requiring freight railroads to establish on-time performance metrics does provide some confidence that poor passenger rail performance across the U.S. could be improved. However, the ruling may only apply to Amtrak (commuter railroads are also investigating its impact elsewhere) so it may have limited impact if Amtrak was not to operate East-West rail services. The lack of influence and control is one of the reasons why the state of Virginia is in the process of purchasing over 225 miles of existing freight lines to enhance rail infrastructure to significantly expand passenger rail services.

- **Incentivizing Customer Satisfaction** – a sometimes overlooked factor is customer/passenger satisfaction. Research indicates that across most industries the importance of attracting and retaining customers. The quality of rail services is vitally important to the success of East-West rail, particularly as people have alternatives including air, bus and private auto. Recent passenger rail procurements have started to embed customer satisfaction metrics into contracts with some notable success. While prospective private rail operators may be reluctant to embrace some of the possible approaches, it is important to embed at some level.
- **Wider WSDOT/Public Priorities** – Another factor sometimes forgotten is ensuring that any procurement supports the wider policy priorities such as reducing greenhouse gas emissions, job creation or increasing affordable housing. While the underlying basis for reintroducing East-West intercity rail services is linked to state policy priorities, the procurement/delivery of this if implemented could easily overlook the value in securing public benefits. One approach which can help overcome this is to ensure that the evaluation criteria and contract incorporates a set of public policies for which each option or bid received can be measured.

5.4 These factors suggest that while a third-party/private outsourcing approach can deliver the most cost effective and highest quality outcomes for Washington State, there are constraints, in particular on the cost of private freight railroad track access charges incurred to deliver East-West rail services that could cause this option not to be viable. Likewise, while delivering East-West rail services within WSDOT or through a similar public body has certain advantages but the cost in time, resources and funding to establish a high-quality function are likely to be high and would only make sense if combined with the Amtrak Cascades services currently managed by WSDOT.

Case Studies

5.5 Below are three short case studies which set out some of the factors identified above:

- **Amtrak State Sponsored Contract/California:** The 17 states who contract Amtrak to operate state supported intercity rail services have similar arrangements which can be described as accounting based contracts linked where key inputs such as rolling stock operation/maintenance, train crews and station infrastructure are provided by Amtrak and there is limited direct control by the states except in funding and high-level planning. California has taken some additional responsibilities, establishing Joint Powers Authorities (JPAs) to take overall responsibility for planning, asset ownership/management (including rolling stock maintenance), funding and marketing. The Capitol Corridor route between San Jose, Oakland and Sacramento/Auburn, which has seen annual growth rates of 6% over the past five years still suffers from poor operational performance and financial cost control due in part to the lack of real contractual incentive mechanisms. The JPA, in conjunction with California State Department of Transportation (Caltrans), are in the process of developing a track access agreement template with the host freight railroads to improve performance and recognize a long-term public investment plan. It is too soon to see if this initiative, linked in part to the Supreme Court ruling, will provide a significant improvement in both operational and financial performance.
- **Third-Party Contract (Input Driven)/Boston Commuter Rail:** Massachusetts state transportation authority, the MBTA, contracts out the United States' sixth largest commuter rail services to a third-party private company, Keolis. Keolis is responsible for day to day operations, maintenance of rolling stock and MBTA-owned infrastructure and other functions. The MBTA oversee short- and long-term planning, fares and marketing as well as owns most of the rail lines and rolling stock used. Keolis, who operate transit services across Europe and North America, have little control over key aspects of the service as the contract is primarily input driven and assets are procured and owned by the MBTA. This has caused performance concerns, even where MBTA controls both the rail lines and rolling stock. Going forward, the MBTA is planning to significantly invest in its commuter rail system to play a more important role in the state's mobility. As part of the Rail Vision study, the MBTA are looking into alternative delivery models to move to a more output based contract, along with new investment contracting approaches to significantly improve operational performance, deliver investment and expand day to day services more cost effectively.
- **Third-Party (Output Driven)/Wales & Borders Rail:** The UK has over 30 years' experience in outsourcing rail services to third parties. While operational performance and ridership have significantly improved, there have been questions on whether financial outcomes represent value for money. The Welsh Government, as part of taking over responsibility of passenger rail services in 2018, implemented a refined procurement approach which is more output driven and incentivizes the winning private company (Keolis) to consistently improve operational performance, customer satisfaction and optimize investment delivery. Over $6 billion is being invested over the next 15 years to expand services across the country, introduce a new urban light rail metro network across the capital in Cardiff and cater for a more than doubling in planned demand from the current 35 million annual trips**.** The Welsh Government retains long-term planning, oversight of the output-based contract and

marketing/branding. However, it is important to note that the ability to secure performance related track access contracts and ownership/control of rail infrastructure is fundamentally different in the United Kingdom. This limits its transferability for East-West rail services in Washington State.

Conclusions

5.6 While each of the contracting options are likely to be viable to operate East-West intercity rail services, it is critically important to ensure appropriate contractual mechanisms are in place to deliver a consistently high-quality rail service as well as to minimize public subsidy. The other key factor to take into consideration is the ability to agree an effective contract with the host railroads that is also commercially affordable – this may constrain some of the contracting options.

5.7 Further investigation of the strengths and weaknesses of the broad operator options is needed, not only to identify any fatal flaw that may prevent a particular option from being implemented, but also do undertake a proper value assessment to understand the balance of likely outcomes.

6 Community Support

Workgroup

6.1 A workgroup to help guide the study and to review progress and deliverables was formed by the Washington State Joint Transportation Committee. The members of the Washington State Joint Transportation Committee are listed in Table 6.1.

Table 6.1: Washington State Joint Transportation Committee Members

Member	Role	Organization/Affiliation
Dave Catterson	Committee Coordinator	Joint Transportation Committee
David Ward	Senior Analyst	Joint Transportation Committee
Jennifer Harris	Counsel	House Transportation Committee
Danny Masterson	Fiscal Analyst	Senate Transportation Committee
Jason Beloso	Strategic Planning Manager	Rail, Freight, and Ports Division, WSDOT
Luis Moscoso	Government Affairs Director	All Aboard Washington
Johan Hellman	Executive Director of Government Affairs	BNSF Railway
Dana Quam	Senior Counsel	House Republican Caucus
David Bremer	Policy Analyst	House Democratic Caucus
Hannah McCarty	Senior Staff Counsel	Senate Democratic Caucus
Martin Presley	Associate Staff Counsel	Senate Republican Caucus

Source: Washington State Joint Transportation Committee (2020).

Stakeholder Meetings

6.2 A number of meting have been undertaken with key stakeholders to ensure they were aware of the study, the objectives, to gain support and to provide an opportunity to provide input to the study.

6.3 A meeting was undertaken with senior representatives of BNSF (who are also represented on the Workgroup) to discuss the scope and purpose of the study and to gain their participation with the study. They were supportive of the study and provided information to the study team to support the analysis. In the discussion they highlighted that one of the sighted benefits of the passenger rail link was improved connectivity during poor winter weather. They also commented that the Stampede Pass corridor was as susceptible to snow issues as the road network, with large snow fall, drifting snow and sliding events.

6.4 The team also undertook two stakeholder events on the corridor, one in Yakima and the other in Pasco, with representatives of the surrounding cities, area and the Yakama Nation. There was support for a service and interest in the project, with an awareness that the journey time and connectivity of the corridor might be more beneficial for Kittitas and Yakima Counties. The longer distance and the infrequent nature of a service to Pasco and Spokane might limit the benefit against competing modes. There was concern about the reduced frequency, connectivity and loss of intercity bus services, a benefit of a rail service could be the provision of an alternative to intercity bus services, particularly for those without access to motor vehicle.

Survey – Public Outreach

6.5 A public outreach marketing campaign was undertaken using an online survey open to the public to assess public support for the project, and to collect additional stakeholder feedback. The online public survey enhances the outcomes of the study in two key ways:

- Better understand the public support and need for passenger rail on the Stampede Pass corridor; and
- Enhances our understanding of current and future travel behavior.

6.6 Using normal and 'stated preference' questions, we can better understand:

- demographics;
- current travel behaviors;
- future travel behaviors if passenger rail is an option; and,
- propensity to use passenger rail.

The online survey also supports the delivery of a more robust set of ridership forecasts. The survey used a paid panel residing along the corridor and was also open to stakeholders and the public throughout March 2020.

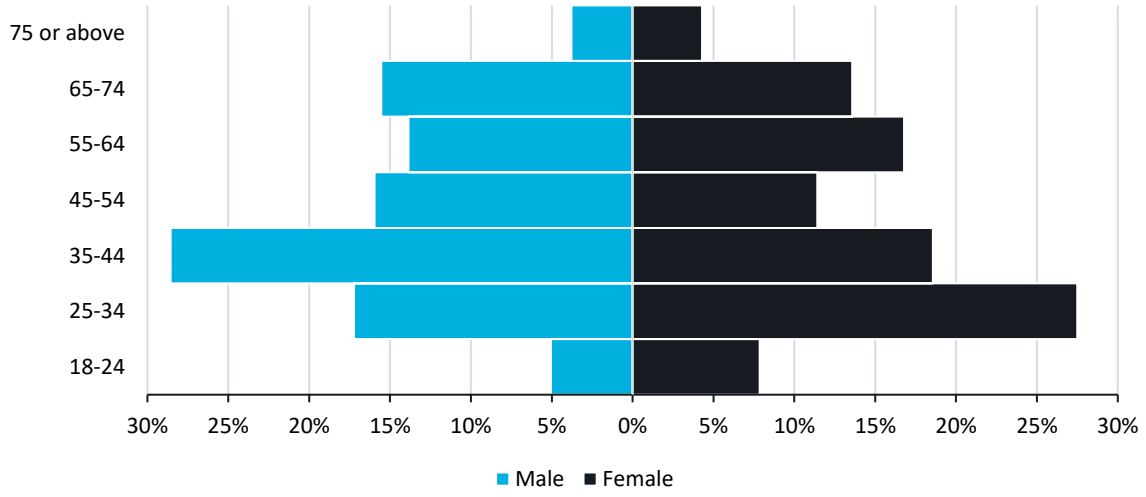
6.7 An overview of the complete survey results is contained in Appendix E.

Survey Respondent Characteristics

Age and Gender

6.8 Amongst all survey respondents, slightly more individuals identified as female (53.2%) than male (45.3%). Individuals aged 25 to 34 and 35 to 44 were best represented in the sample, accounting for 22.3% and 22.9% of participants respectively. Figure 6.1 shows the age and gender distribution of respondents.

Figure 6.1: Age and Gender Distribution of Survey Participants

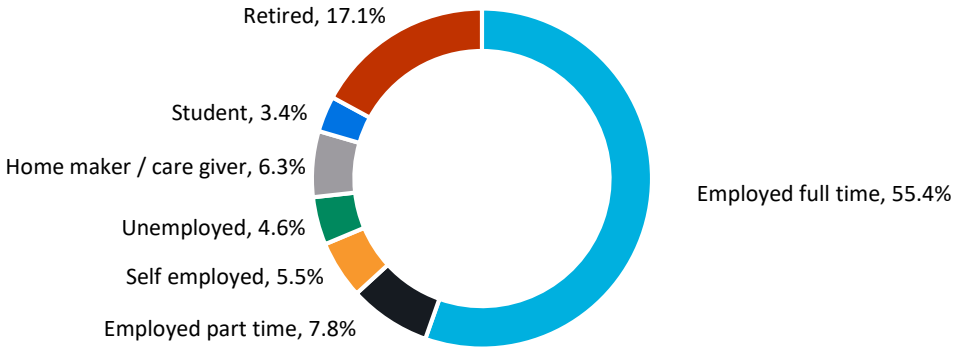


Source: Steer (2020) analysis.

Employment Status

6.9 Employment status of survey participants in shown in Figure 6.2. More than half of respondents reported being employed full time (working 30 or more hours a week). Retired was the second most common employment status.

Figure 6.2: Employment Status of Survey Participants

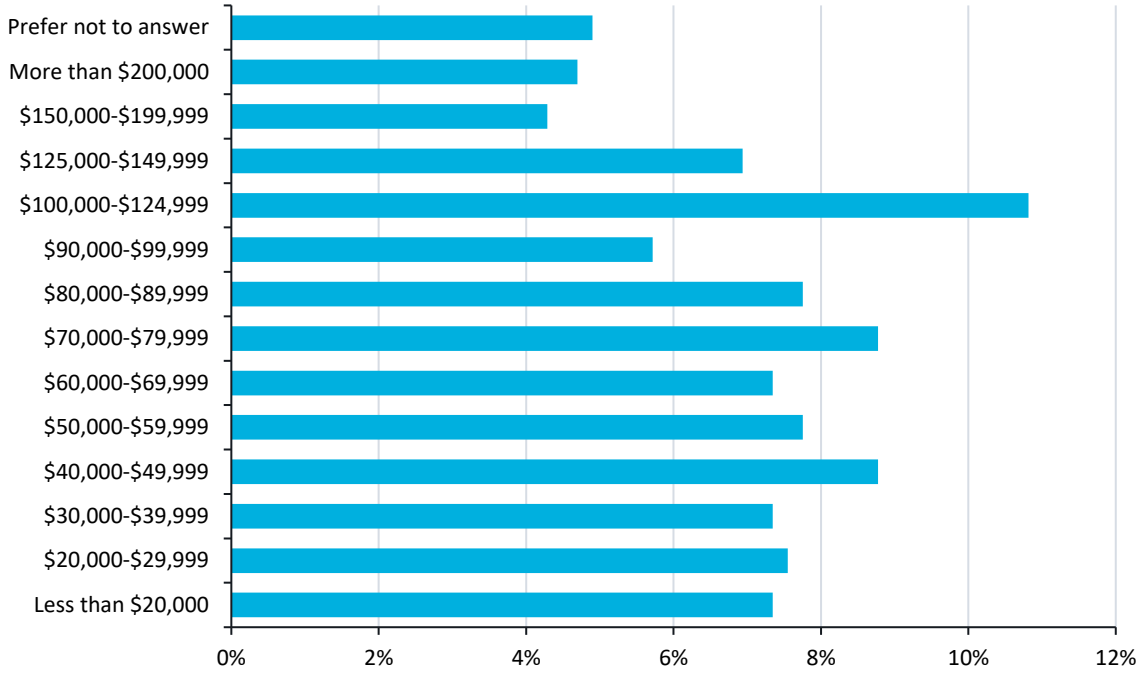


Source: Steer (2020) analysis.

Household Income

6.10 As shown in Figure 6.3, the household income of survey respondents was relatively evenly distributed. Participants reported that their households were generally composed of four or fewer persons (90.9%), with the greatest number of participants living in a two-person household (37.2%). Households were also most likely to have two vehicles (43.0%), with only 5.2% of participants reporting that their household did not own a vehicle.

Figure 6.3: Household Income Distribution of Survey Participants

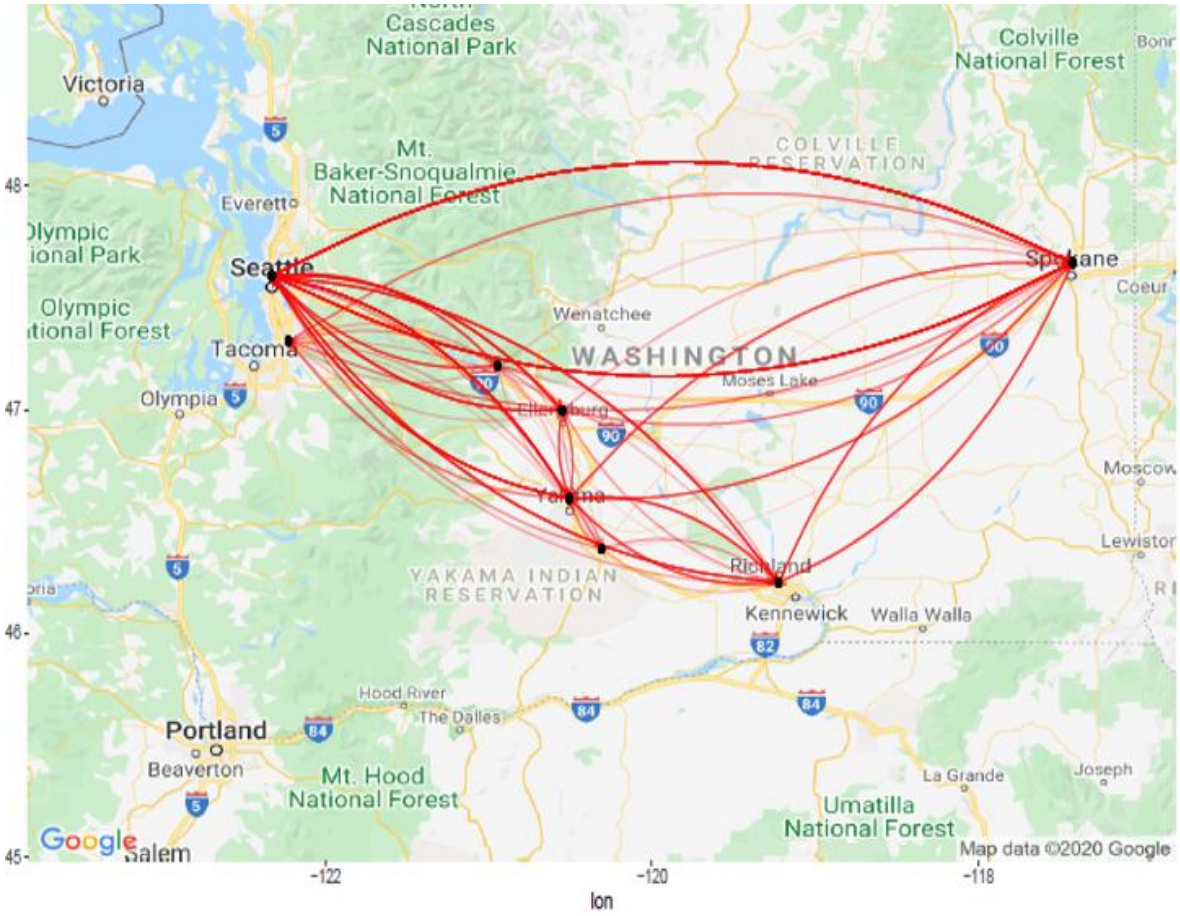


Source: Steer (2020) analysis.

Recent Trip Details

6.11 Survey participants were asked to recall their most recent trip in the Seattle – Yakima – Tri-Cities – Spokane corridor. Participants responded that they had primarily travelled alone (21.1%) or with one other person (46.2%). Overall, typical trip lengths tended to be two nights or shorter (75.5%). Fewer than five percent of trips lasted seven nights or longer. The complete frequency of all origin and destination pairs of recent trips by all survey participants are depicted spatially in Figure 6.4. Among all trip origins and destinations, Seattle was the most common. Toppenish was the least common origin and destination. One in ten trips started in Seattle and ended in Spokane.

Figure 6.4: Map of Origin and Destination Pairs for All Survey Participants



Source: Steer (2020) analysis. Base maps provided by Google Maps.

Table 6.2: Origin and Destination Pairs for All Survey Participants

	Destination								
Origin	**Auburn**	**Cle Elum**	**Ellensburg**	**Seattle**	**Spokane**	**Toppenish**	**Tri-Cities**	**Yakima**	**Total**
Auburn		0.6%	1.0%	8.6%	1.2%	0.3%	0.3%	0.4%	**12.3%**
Cle Elum	0.4%		0.7%	2.4%	0.3%	0.3%	0.1%	0.4%	**4.6%**
Ellensburg	0.4%	0.3%		3.6%	0.6%	0.1%	0.3%	1.0%	**6.2%**
Seattle	9.0%	2.2%	3.7%		10.2%	0.8%	3.7%	6.1%	**35.9%**
Spokane	1.1%	0.1%	1.1%	6.9%		0.1%	2.5%	1.9%	**13.9%**
Toppenish	0.0%	0.0%	0.6%	0.8%	0.1%		0.7%	0.8%	**3.0%**
Tri-Cities	0.4%	0.1%	0.7%	3.6%	2.2%	0.4%		1.9%	**9.4%**
Yakima	1.0%	0.3%	2.2%	5.3%	2.2%	1.0%	2.8%		**14.7%**
Total	**12.3%**	**3.6%**	**10.0%**	**31.2%**	**16.9%**	**3.0%**	**10.4%**	**12.6%**	**100.0%**

Source: Steer (2020) analysis.

Station Access

6.12 Nearly half (48.1%) of all survey respondents indicated that they would be most inclined to drive themselves and park at the station. Drop-off by a friends or family (26.7%), ride hailing (8.5%) and public transit (6.5%) were the next most common responses. Four-fifths of survey respondents (81.4%) listed parking as a somewhat important or very important amenity for passenger rail stations.

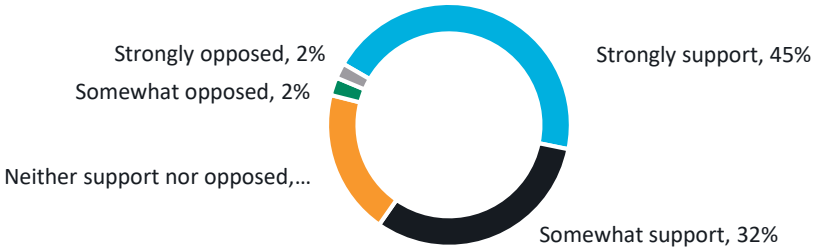
Departure Times

6.13 Respondents were presented with intervals for potential departure times between 6AM and 10PM and asked to select up to two one-hour intervals that would best accommodate their travel needs. The most popular intervals were in the morning and particularly between 7AM to 8AM and 8AM to 9AM (each preferred by 27.4% of respondents). Few participants preferred a departure time in the intervals between 7PM and 10PM.

Project Support

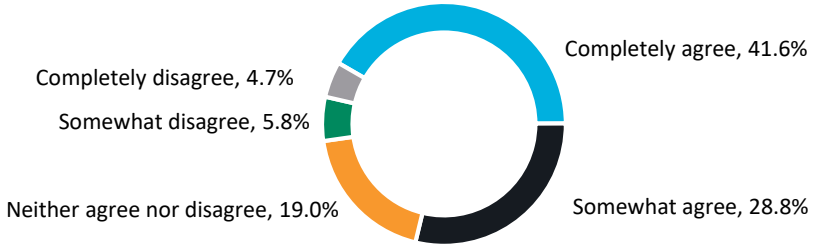
6.14 Opinions toward the potential East-West Rail service are captured in Figure 6.5. Survey respondents were generally supportive of the project. Only 4.4% of participants were somewhat opposed or strongly opposed. Similarly, a sizable majority (70.4%) of participants agreed they would try the service, as shown in Figure 6.6.

Figure 6.5: Level of Support for a Potential East-West Intercity Passenger Rail Service



Source: Steer (2020) analysis.

Figure 6.6: Level of Agreement – "I Would Definitely Try East-West Rail"



Source: Steer (2020) analysis.

Appendices

A Existing Passenger Service Schedules

Existing Passenger Services

Empire Builder

Table A.1: Empire Builder - Portland Service

Station	East to West	Station	West to East
Spokane	2:45 am	Portland	4:45 pm
Pasco	5:35 am	Vancouver	5:07 pm
Wishram	7:30 am	Bingen-White Salmon	6:21 pm
Bingen-White Salmon	8:04 am	Wishram	655:pm
Vancouver	9:18 am	Pasco	8:57pm
Portland	10:10 am	Spokane	12:13 am

Source: Steer (2020) analysis of Amtrak Timetables (January 2020).
Note: Stations underlines are potentially common to a Washington State East-West Passenger Rail Service and could provide opportunities to transfer between services.

Table A.2: Empire Builder – Seattle Service

Station	East to West	Station	West to East
Spokane	2:15 am	Seattle	4:40 pm
Ephrate	4:22 am	Edmonds	5:12 pm
Wenatchee	5:35 am	Everett	5:39 pm
Leavenworth	6:08 am	Leavenworth	8:00 pm
Everett	8:38 am	Wenatchee	8:42 pm
Edmonds	9:10 am	Ephrate	9:42 pm
Seattle	10:25 am	Spokane	12:40 pm

Source: Steer (2020) analysis of Amtrak Timetables (January 2020).
Note: Stations underlines are potentially common to a Washington State East-West Passenger Rail Service and could provide opportunities to transfer between services.

Coast Starlight

Table A.3: Coast Starlight

Station	North to South	Station	South to North
Seattle	9:45 am	**Arriving service from south**	3:32 pm
Tacoma	10:37 am	**Portland**	3:56 pm
Olympia-Lacy	11:27 am	**Vancouver**	4:16 pm
Centralia	11:51 am	**Kelso-Longview**	4:51 pm
Kelso-Longview	12:35 pm	**Centralia**	5:36 pm
Vancouver	1:18 pm	**Olympia-Lacy**	6:01 pm
Portland	2:00 pm	**Tacoma**	6:50 pm
Service continues south	2:25 pm	**Seattle**	7:56 pm

Source: Steer (2020) analysis of Amtrak Timetables (January 2020).
Note: Stations underlines are potentially common to a Washington State East-West Passenger Rail Service and could provide opportunities to transfer between services.

Cascades Service

A.1 Only those service schedules that could connect with an East-West Passenger Rail service are detailed in Table A.4 and Table A.5.

Table A.4: Cascades Service – North to South

Station	Train 501	Train 517	Train 505	Train 507	Train 519
Vancouver, BC		6:35 am			5:45 pm
Seattle	7:25 am	11:30 am	2:20 pm	6:10 pm	10:10 pm
Tukwila	7:39 am	11:44 am	2:34 pm	6:24 pm	
Tacoma	8:08 am	12:13 pm	3:03 pm	6:53 pm	
Olympia-Lacey	8:45 am	12:50 pm	3:40 pm	7:30 pm	
Centralia	9:06 am	1:11 pm	4:01pm	7:51 pm	
Kelso-Longview	9:47 am	1:52 pm	4:42 pm	8:32 pm	
Vancouver	10:25 am	2:30 pm	5:20 pm	9:10 pm	
Portland	10:55 am	3:00 pm	6:05 pm	9:40 pm	
Eugene			8: 40 pm		

Source: Source: Steer (2020) analysis of Amtrak Timetables (January 2020).
Note: Stations underlines are potentially common to a Washington State East-West Passenger Rail Service and could provide opportunities to transfer between services.

Table A.5: Cascades Service – South to North

Station	Train 516	Train 500	Train 504	Train 518	Train 508
Eugene		5:30 am			4:30 pm
Portland		8:20 am	12:00	3:00 pm	7:20 pm
Vancouver		8:38 am	12:18 pm	3:18 pm	7:38 pm
Kelso-Longview		9:11 am	12:51 pm	3:51 pm	8:11 pm
Centralia		9:52 am	1:32 pm	4:32 pm	8:52 pm
Olympia-Lacey		10:13 am	1:53 pm	4:53 pm	9:13 pm
Tacoma		10:55 am	2:35 pm	5:35 pm	9:55 pm
Tukwila		11:23 am	3:03 pm	6:03 pm	10:23 pm
Seattle	7:45 am	11:50 am	3:30 pm	6:30 pm	10:50 pm
Vancouver, BC	11:45 am			11:00 pm	

Source: Steer (2020) analysis of Amtrak Timetables (January 2020).
Note: Stations underlines are potentially common to a Washington State East-West Passenger Rail Service and could provide opportunities to transfer between services.

In addition to the train service a number of Thruway bus service are also operated, providing additional interchange opportunities.

Sounder South and Services

Table A.6: Sounder South Service – South to North (AM Schedule)

Station	1500	1502	1504	1506	1508	1510	1512	1514	1516
Lakewood	4:36	5:01	5:26	5:46	6:06	6:26	6:46		
South Tacoma	4:41	5:06	5:31	5:51	6:11	6:31	6:51		
Tacoma Dome	4:50	5:15	5:40	6:00	6:20	6:40	7:00	7:20	7:50
Puyallup	5:03	5:28	5:53	6:13	6:33	6:53	7:13	7:33	8:03
Sumner	5:08	5:33	5:58	6:18	6:38	6:58	7:18	7:38	8:08
Auburn	5:18	5:43	6:08	6:28	6:48	7:08	7:28	7:48	8:18
Kent	5:25	5:50	6:15	6:35	6:55	7:15	7:35	7:55	8:25
Tukwila	5:32	5:57	6:22	6:42	7:02	7:22	7:42	8:02	8:32
Seattle	5:52	6:17	6:42	7:02	7:22	7:42	8:05	8:22	8:52

Source: Steer (2020) analysis of Amtrak Timetables (January 2020).
Note: Stations underlines are potentially common to a Washington State East-West Passenger Rail Service and could provide opportunities to transfer between services.

Table A.7: Sounder South Service – North to South (PM Schedule)

Station	1509	1511	1513	1515	1517	1519	1521	1523	1525
Seattle	3:15	3:35	3:55	4:15	4:35	4:55	5:20	5:45	6:30
Tukwila	3:28	3:48	4:08	4:28	4:48	5:08	5:33	5:58	6:43
Kent	3:35	3:55	4:15	4:35	4:55	5:15	5:40	6:05	6:50
Auburn	3:42	4:02	4:22	4:42	5:02	5:22	5:47	6:12	6:57
Sumner	3:52	4:12	4:32	4:52	5:12	5:32	5:57	6:22	7:07
Puyallup	3:57	4:17	4:37	4:57	5:17	5:37	6:02	6:27	7:12
Tacoma Dome	4:17	4:30	4:57	5:10	5:30	5:50	6:15	6:40	7:25
S. Tacoma	:	4:39	:	5:19	5:39	5:59	6:24	6:49	7:34
Lakewood	:	4:51	:	5:31	5:51	6:11	6:36	7:01	7:46

Source: Steer (2020) analysis of Amtrak Timetables (January 2020).
Note: "S." stands for South | Stations underlines are potentially common to a Washington State East-West Passenger Rail Service and could provide opportunities to transfer between services.

B Analysis of Siding Locations

Summary

B.1 This memo summarizes the findings of an analysis of potential siding locations along the Auburn-Pasco portion of the proposed East-West Passenger Rail Initiative route. Portions of two subdivisions were analyzed: the Stampede Subdivision, at Cle Elum; Thorp between Kanaskat and Lester; and the Yakima Valley Subdivision, between Ellensburg and Yakima. The analysis focused on these areas because the ATTUne analysis of operations had determined that passenger and freight trains would incur significant delays in these segments. ATTune as a strategic timetabling tool, can identify both where train performance would be impacted by changes/additions (such as train delays) as well as propose possible solutions such as sidings or additional signalling points.

B.2 At each segment, the analysis attempted to determine suitable locations for a new CTC controlled passing siding. Once a suitable location was found, the analysis measured the approximate available distance for a siding and the approximate start and end mileposts (measured west to east) at the points of switch. Six such locations were identified. It is important to note that the ATTune analysis has not been reviewed by BNSF as it was outside the scope of this report, and further analysis would be required if East-West passenger rail services were to be implemented.

Key Criteria for Analysis

B.3 The segments and locations listed above were chosen based on a separate analysis of train operations. That analysis used string-line charts to show where conflicts between opposing trains would occur. At the locations analyzed, trains would incur significant delays waiting for other trains to clear the line using only the existing infrastructure. Extension of existing sidings and/or construction of new sidings will reduce or eliminate these delays.

B.4 The criteria was developed to determine which siding locations would create the best investment. For the purposes of this analysis, each location was identified by the approximate milepost if it did not have a name. Analysis used recent track charts and timetables provided by BNSF and Google Earth imagery and terrain mapping. Measurements of siding lengths were carried out in Google Earth along the length of the existing rail line. 800 feet was subtracted from measurements for turnouts and clearance points to find the final siding capacity. In analyzing possible curve realignments, the following assumptions were applied:

- The minimum recommended siding length is 8,000 feet, enough for two freight trains to comfortably pass.
- As BNSF has condemnation rights, the analysis assumed that any additional land required for a new siding could be purchased.
- A reasonable siding extension or new siding will result in a minimum of structural demolition (residential or otherwise). For example, it might be practical to purchase and remove one or two houses, but not an entire subdivision.

- Demolition of existing bridges over waterways and over the railroad is to be minimized, and new bridges over waterways of significant size, such as the Yakima or Green Rivers, should be avoided. New crossings of minor streams or canals are acceptable.
- Cuts and fills should not be of overly excessive height or steepness. Fills into waterways or wetlands should be avoided.
- New tunnels should be avoided.

Ellensburg to Yakima (MP 127.9 to MP 90.0, Yakima Valley Subdivision)

B.5 The analysis found few possible locations between Ellensburg (MP 127.0) and West Pomona (MP 99.1), the first CTC controlled siding before Yakima, for a new siding due to the nature of the Yakima River Canyon. There is an existing siding at Wymer (MP 110.4) that is not CTC controlled. The siding is approximately 6,300 feet long between clearance points and has No. 11 turnouts on both ends. Extension of Wymer Siding would require either extremely tall cuts or fill into the river on either end. The siding could be upgraded to full CTC control, but this may require replacing the turnouts, which would shorten the available capacity (passing length). Access for construction would be difficult, with only rough, unimproved roads to the site. The decision was made not to pursue work at Wymer.

Figure B.1: Existing Siding at Wymer

Source: Google Earth screenshot.

B.6 A potential siding location outside the canyon is at Thrall (MP 121.8). The west end of the siding would be at MP 123.1. The east end would be at MP 121.2, near a bridge over a tributary of the Yakima River. The siding is assumed to be on the southwest side of the existing main track. Approximate length of the siding would be 9,400 feet between clearance points. The topography is largely flat. Track grades are between 0.12% and 0.35%. There is an existing spur at Thrall, north of the existing main track, which would not need to be moved. There are two at-grade crossings of Ringer Loop Rd. It is assumed that the northernmost crossing (USDOT 085192E) would be moved about 1,700 feet north, and the road adjusted to follow an existing driveway. The second crossing (USDOT 085193L) would be either left in place or removed. There appear to be wetlands in the vicinity of the proposed siding, and thus mitigation would be required.

Figure B.2: Potential Siding at Thrall

Source: Google Earth screenshot.

Vicinity of Thorp (MP 10.0 to MP 7.0, Stampede Subdivision)

B.7 Thorp (MP 7.6) currently contains two spur tracks south of the existing main track. One track (0748) extends 1350 feet west along the main track, and ends across Bridge 7.90. This may be the remnant of an older passing siding. The other track (741) is a MOW spur. 2nd Street. (USDOT 085220F) crosses the main track east of 0748 at MP 7.6.

B.8 The analysis found space for a new siding at Thorp extending west. The siding would be located on the south side of the existing main track so as to make use of the double tracked Bridge 7.90. This siding would begin at MP 9.1, just east of the Thorp Highway crossing. The siding would connect to the existing track 0748 and follow it through town. The existing turnout connecting to the main track would be removed, and the siding would continue east, ending at MP 7.3. The siding's capacity would be 8,700 feet between clearance points. The topography is largely flat, with apparent wetlands adjacent to the tracks, and track grades between 0.25% and 0.45%. Upgrades would likely be required to track 0748. The 2nd Street crossing would be removed and replaced with a new crossing at MP 7.2 with a 2,400-foot access road. The access road would require purchasing property from an adjacent ranch.

Figure B.3: Potential Siding at Thorp

Source: Google Earth screenshot.

Vicinity of Cle Elum (MP 28.0 To MP 21.0, Stampede Subdivision)

B.9 The analysis found ample space for a passing siding within Cle Elum (MP 24.9) on either side of the main track. The focus of this analysis was a siding within Cle Elum, which is also being considered for a passenger stop. The west end of the siding would be at MP 25.3, near two I-90 freeway overpasses. The east end of the siding would be at MP 23.0, near the SR-97 overpass. Approximate siding length would be 11,500 feet between clearance points. Track grades are between 0.1% and 0.53%, ascending westward. Cle Elum features a wide clear space adjacent to the tracks within town, the former site of a yard. Some Maintenance-of-Way (MOW) tracks remain on the north side of the tracks. To avoid removal of these tracks, the analysis assumed a new siding on the south side of the existing main track. A location near Bullitt Avenue on the north side of the tracks is being considered for a station.

B.10 The new siding would cross two streets: Oakes Avenue (USDOT 085231T) and Owens Rd. (USDOT 085229S). Owens Rd. is the sole access point to a water treatment plant and several residences. Oakes Avenue is a primary access point to several residences, businesses, an RV Park, and I-90. The analysis assumed that siding construction would include the closure of the Owens Rd. crossing and construction of a new 2,600-foot access road connecting to SR-97.

Figure B.4: Potential Siding at Cle Elum

Source: Google Earth screenshot.

B.11 West of Cle Elum, there is space for a 10,500-foot (between clearance points) siding between MP 28.0 and MP 25.8. This would be difficult to connect to a siding within Cle Elum due to the nearby convergence of the BNSF main line, Charter Rd., S Cle Elum Way (USDOT 085232A), and two I-90 overpasses. To the east, there does not appear to be space to fit a second track beneath the SR-97 Bridge, and therefore extension of the siding would be difficult. The decision was made to only pursue a siding within Cle Elum, south of the existing main.

Kanaskat to Lester (MP 82.3 to MP 59.7, Stampede Subdivision)

B.12 The analysis identified a possible location between East Kanaskat (MP 81.9) and West Lester (MP 60.5) where a siding could be located. The siding would be located near a crossing of U.S. Forest Service Road NF-5460 (USDOT 928200B). The west end of Siding 66 would be near MP 67.4, and the east end near MP 65.6. The east end is near a bridge crossing a tributary of the Green River. Approximate length of the siding would be 8,000 feet between clearance points. The surrounding topography does not appear steep. Track grades are between 0.40% and 0.85%, ascending eastward. The east end of the siding would be 5 miles from Lester, while the west end would be

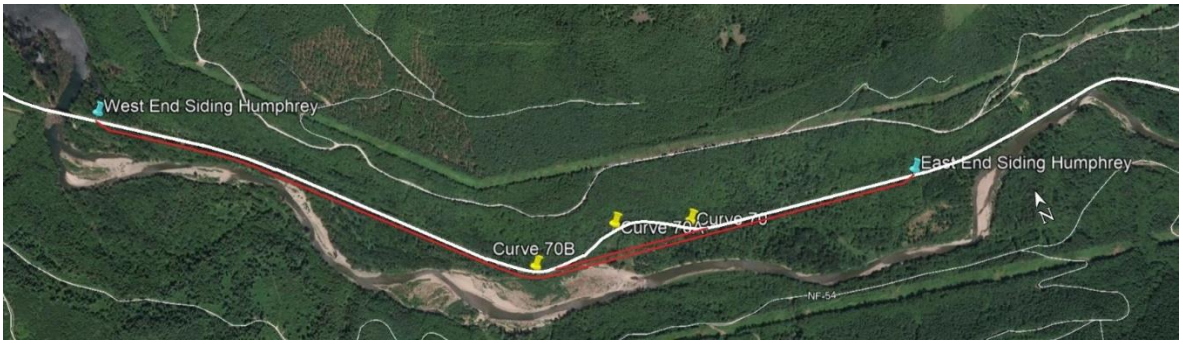
15 miles from Kanaskat. There appear to be wetlands near the track which would require mitigation. Historically, there was a siding called “Maywood” here, timetable length 6,684 feet.

Figure B.5: Potential Siding at MP 66

Source: Google Earth screenshot.

B.13 A second possible location is located further west, near Humphrey (MP 70.7). The siding would be located west of a bridge over the Green River, near the Howard A Hanson Reservoir. The west end of Humphrey Siding would be near MP 71.6, and the east end near MP 69.7. The approximate length of the siding would be 9,000 feet between clearance points. Construction of this siding could be tied to the realignment of curves 70B, 70A, and 70, as discussed separately, to increase passenger and freight train speeds. The surrounding topography is steep in some places, particularly near curve 70B. Track grades range from 0% to 1.43%, ascending eastward. The east end of Humphrey would be 9 miles from Lester, and the west end about 10.5 miles from Kanaskat. The team chose to pursue this option because it is located near a projected meet point in the scheduling analysis. The siding is assumed to be located on the south side of the existing main track.

Figure B.6: Potential Siding at Humphrey with Line Relocation



Source: Google Earth screenshot.

Cost Estimates

B.14 The analysis attempted to estimate the costs of each chosen siding project, accounting for elements such as track construction, excavation and embankment, new roads, culverts, signals, land acquisition, and wetland mitigation. The estimate also includes a 50% contingency for unknowns. The estimated cost for four sidings is $66.2 million to 79.8 million including the curve realignment at Humphrey. A summary table is described in Table B.1.

Table B.1: Summary of Costs

Location	Start MP	End MP	Capacity	Estimated Cost ($m)
Thrall	MP 123.1	MP 121.2	9,400 feet	$15.3-18.4
Thorp	MP 9.1	MP 7.3	8,700 feet	$14.8-17.8
Cle Elum	MP 25.3	MP 23.0	11,500 feet	$15.2-18.2
Humphrey (with Curve Realign)	MP 71.6	MP 69.7	9,000 feet	$21.2-25.4
Humphrey (without Curve Realign)	MP 71.6	MP 69.7	9,000 feet	$19.1-22.9

Source: Steer (2020) analysis.
Note: "$m" stands for millions of dollars.

Conclusion

B.15 After analyzing the route between Kanaskat and Yakima, it appears possible to add up to four sidings between the two locations. Between Ellensburg and Yakima, the existing uncontrolled siding at Wymer cannot be easily extended. A siding could be located north of the main canyon at Thrall, which is within a few miles of an existing siding at Ellensburg and would require a road relocation. Thorp also has space for a siding, which would follow part of an older siding. This would require rerouting a road and crossing. Cle Elum has ample space for a passing siding. One road in Cle Elum that crosses at-grade may require separation or an alternate outlet to avoid blockages. Between Kanaskat and Lester, the desired location is at Humphrey, between MP 71.6 and 69.7, which spaces the siding fairly evenly between those stations and could be combined with a major curve adjustment to improve train speeds.

Addendum: New Location at Eagle Gorge

B.16 After reviewing a 1970 Northern Pacific track chart, it appears there is one additional possible siding location. The location is called Eagle Gorge, near MP 74. Historically, there was a siding here with a timetable length of 6,960 feet; the removal date is unknown, but sometime after 1970. It would have been constructed in 1959 when the line was moved due to the creation of the Hanson Reservoir. By placing the west end of the new siding in approximately the same place (MP 74.5) and moving the east end about 2,600 feet east (MP 73.7), there would be space for a new 8,800-foot capacity siding. Some cutting of the adjacent hillside would be required beyond the historic east end, but otherwise there is more than sufficient space for an extra track. Forest Service Road NF-54 parallels the track at this location for about 4,000 feet. The estimated cost is $19.7 million to $23.6 million.

Figure B.7: Proposed Siding at Eagle Gorge

Source: Google Earth screenshot.

C Analysis of Curve Locations

Summary

C.1 This memo summarizes the findings of an analysis of curves along the proposed East-West Passenger Rail Initiative route. This route covers five subdivisions, of which three were analyzed: the Stampede Subdivision from Auburn to Ellensburg; the Yakima Valley Subdivision from Ellensburg to SP&S Junction near Pasco; and the Lakeside Subdivision from SP&S Junction to Spokane, WA. The Seattle Subdivision was excluded as it is heavily utilized by Amtrak Cascades and Sounder. The Spokane Subdivision was also excluded as it is used only for a short distance within Spokane. For each subdivision, the analysis tabulated the location of curves, degree of curve, and analyzed both the existing speeds and the maximum allowable speeds for each curve. In the case of the Stampede and Yakima Valley subs, the analysis included what the actual passenger speed through a curve could be, accounting for adjacent curves. The Lakeside Subdivision already sees passenger service and did not require calculations for speeds through curves. The analysis used the maximum allowable superelevation to determine speeds through curves; spiral length data was not available, and therefore the analysis assumes all curves have sufficient spirals for maximum speeds. Attached are tables of curves on each subdivision and working versions of the track charts with possible/existing passenger speeds noted.

Key Criteria of Analysis

C.2 The criteria were developed to determine which curve realignments could create the best investment. Analysis used recent track charts and timetables provided by BNSF and Google Earth imagery and terrain mapping. In analyzing possible curve realignments, the following assumptions were applied:

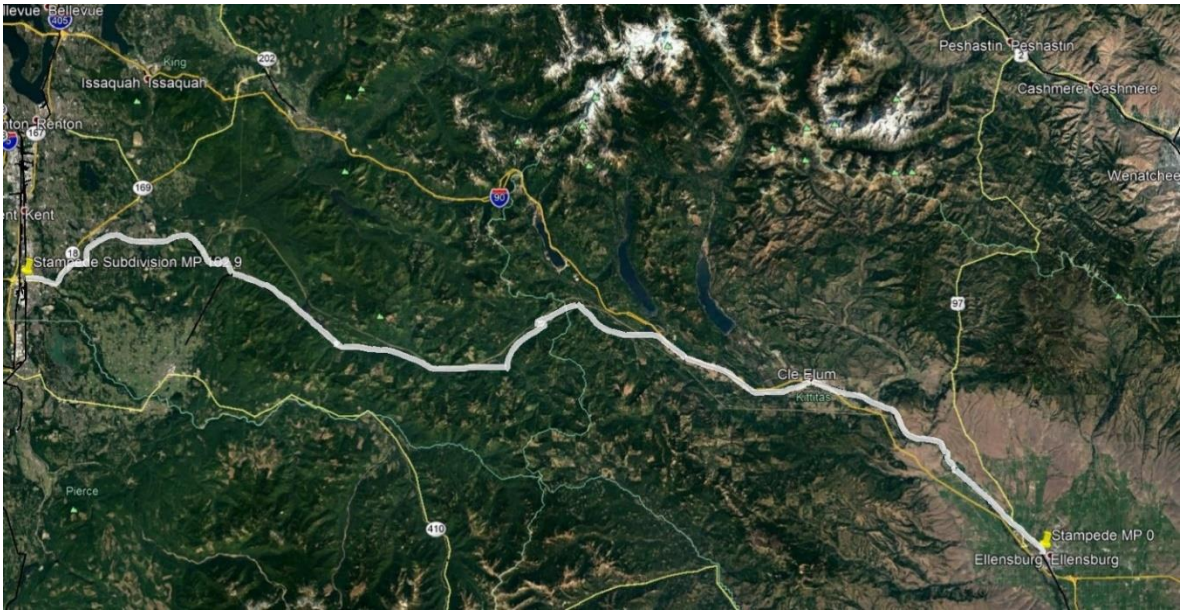
- As BNSF has condemnation rights, it is assumed that any additional land required for curve realignment could be purchased.
- In general, it is assumed that a curve to be broadened will move inwards, shortening tangents on either end.
- A reasonable curve realignment will result in a minimum of structural demolition (residential or otherwise). For example, it might be practical to purchase and remove one or two houses, but not an entire subdivision.
- Demolition of existing bridges over waterways is to be minimized; new bridges over waterways of significant size, such as the Yakima or Green Rivers, should be avoided. New crossings of minor streams or canals are acceptable.
- Cuts and fills are assumed; however, they should not be of overly excessive height or steepness. Fills into waterways or wetlands should be avoided.
- New tunnels should be avoided.
- Any signaling required for faster operation is assumed to be installed as much of the route is currently dark territory.

- The maximum acceptable passenger speed is 79 miles per hour, and the maximum acceptable freight speed is 60 miles per hour on all subdivisions
- To determine speeds within a curve, the BNSF standard of 3 inches unbalance for passenger and 2 inches unbalance for freight was used.
- If a curve is closely adjacent to other curves with a lower speed, that curve's actual speed is also the lower speed due to the time needed to accelerate and decelerate.
- This analysis is limited to determining if a curve appears to have potential for realignment that would increase speeds. The analysis does not attempt to determine how much it could be changed or what the time savings might be.

Stampede Subdivision

Route Description

Figure C.1: Overview of Stampede Subdivision



Source: Google Earth screenshot.

C.3 The Stampede Subdivision runs from Rainier Jct. (MP 102.9) in Auburn to Ellensburg, WA (MP 0.0). The west end is just north of the Auburn yard on the Seattle Subdivision (See Figure C.1). From the yard traveling east, with some exceptions, the line is dark territory under Train Warrant Control (TWC). The line briefly parallels SR18 through a residential area, then passes under the highway and makes a sharp turn north across the Green River. It follows Big Soos Creek and Jenkins Creek to the northeast, past low-density residential areas, to Covington (MP 94.7). At Covington there is an uncontrolled siding. The line then continues eastward along Cranmar Creek past lower density residential areas to Ravensdale (MP 88.2), which also has an uncontrolled siding. From here the line travels southeast through a rural environment uphill to Kanaskat, which has a 9,300-foot Centralized Traffic Control (CTC) controlled siding from MP 83.9 to MP 81.9. Grades on this segment generally do not exceed 1%, although there is a short 2% gradient near Covington.

C.4 After leaving Kanaskat, the line crosses the Green River on a tall bridge to reach Palmer Jct. (MP 81.3), the location of a wye and the junction to the Veazey Spur. The Stampede Subdivision proceeds uphill to the southeast, mostly paralleling the Green River. The line is high above the river on steep side slopes. At MP 75 the line passes the Howard A Hanson Dam and runs along the reservoir behind it. The line crosses the Green River again near MP 72. The tracks follow the river to Lester, where there is another CTC controlled siding between MP 60.5 and MP 59.0. Grades on this segment occasionally exceed 1%. Most curves do not exceed 6 degrees, with a few exceptions.

C.5 Leaving Lester at MP 59, the line goes east, then turns north along Sunday Creek. Grades exceed 2% on much of this portion of the line, with curves up to 10 degrees 30 minutes. The line nearly doubles back on itself twice before reaching Stampede (MP 49.0), a 1200-foot uncontrolled siding with little room for extension. The line then enters the almost 2-mile-long Stampede Tunnel at MP 48.5, emerging at Martin (MP 46.5). There is a 2,000-foot uncontrolled siding at Martin, which could potentially be extended and upgraded to full CTC control. The line travels downhill, at grades still exceeding 2%, and curvature still reaching 10 degrees 30 minutes. At West Easton, MP 41.1, CTC controlled double track begins. The line now parallels the Yakima River and the Iron Horse Trail. Grades generally decrease below 1% at this point, but curvature remains sharp, up to 10 degrees 8 minutes.

C.6 Easton (MP 38.1) has MOW sidings and a wye. From East Easton (MP 36.9), where double track and CTC end, the line travels southeast parallel to I-90. Curves are less frequent and rarely exceed 2 degrees. There is a lumber mill with industry tracks at Bullfrog (MP 29), where a mill may receive freight service. The line enters Cle Elum at MP 25, which has several MOW tracks.

C.7 Continuing to the southeast from Cle Elum, there is an 8,200-foot CTC controlled siding at Bristol (MP 18 to 16.3). The line then enters a short canyon along the north side of the Yakima River. Curvature in the canyon reaches up to 10 degrees 10 minutes. Exiting the canyon around MP 11, the line travels southeast toward Thorp (MP 7.6). There is a MOW spur at Thorp that could potentially be extended and upgraded to create a controlled siding. After crossing the Yakima River, the line travels without curves to Ellensburg (MP 0), which contains a controlled siding, yard tracks, and a depot. There is one 4-degree curve within Ellensburg. Grades on this segment rarely exceed 1% and are generally much less. Ellensburg is the end of the Stampede Subdivision.

Permanent Speed Restrictions

C.8 The maximum timetable speed for the Stampede Subdivision is 49 miles per hour for freight, and no timetable speed is listed for passenger trains. There are no bridge weight restrictions. Most of the route has permanent speed restrictions, all of which appear to be based on curvature. Some also appear to account for steep gradients. Approaching Auburn, the restriction is 20 miles per hour to 25 miles per hour freight at the yard and junction, between MP 102.9 and 101. The speed increases to 30 miles per hour freight from MP 101 to MP 98.4, 35 miles per hour from MP 98.4 to MP 95.6, and 40 miles per hour from MP 95.6 to MP 84.9, a location just west of Kanaskat. From Kanaskat to Humphrey (MP 70.7), the freight speed restriction is 35 miles per hour freight. After Humphrey, freight speeds vary from 25 miles per hour to 35 miles per hour to Lester (MP 59.7). At MP 57.6, freight speeds drop to 20 miles per hour, likely due to a combination of curvature and steep grades. This speed restriction remains in effect through the Stampede Tunnel and down into

Easton (MP 38.1). Freight speeds briefly increase to 40 miles per hour on Main 1 and 30 miles per hour on Main 2 until East Easton, at which point the line returns to one track and all restrictions end. (There is a short segment of restriction from MP 14.3 to 10.9 of 25 miles per hour to 35 miles per hour freight, this is in the Yakima River canyon noted above.) Shortly after entering Ellensburg, a 35 miles per hour freight speed restriction takes effect until the subdivision ends. All controlled sidings have a 30 miles per hour freight speed restriction. All uncontrolled sidings have a 10 miles per hour freight speed restriction.

Potential for Curve Realignment

C.9 The analysis of the curves found it possible for a passenger train on the existing alignment to achieve an average speed of 45 miles per hour between Auburn and Ellensburg. Due to the very urban nature of the western twenty miles, and mountainous terrain over the remaining distance, there are few places where curves could be modified to allow for higher speeds. Additionally, most curves that could more easily be realigned already provide passenger speeds in excess of 60 miles per hour, minimizing value.

C.10 One favorable location at Curves 99A, 99, 98B, and 98A (See Figure C.2). This is southwest of Covington in a 30 miles per hour freight speed restriction that would limit passenger trains to 35 miles per hour. Here the tracks pass a hill, then make a sharp turn into a much broader compound curve. The tracks appear to be far enough from Big Soos Creek that the curves could be combined into a single larger curve. This would likely require cutting into or possibly tunneling through the hillside. This change would eliminate curves restricting passenger speeds. However, there are curves at MP 100 and MP 96 which limit passenger train speeds to 40 miles per hour and would be difficult to realign. Furthermore, a significant outage may be required to move the tracks into the new location.

Figure C.2: Curve Realignment Near Covington

Source: Google Earth analysis.

C.11 A second favorable location is southeast of Ravensdale, which is east of Covington, between MP 87 and MP 86 (See Figure C.3). Broadening Curve 87, which currently allows 70 miles per hour passenger speeds, would result in small time savings. Broadening Curve 86, currently capable of 50 miles per hour passenger speeds, would result in a larger time savings. The latter curve also appears easier to modify.

Figure C.3: Curve Realignment Near Ravensdale

Source: Google Earth analysis.

C.12 A third possible location is east of the Howard A Hanson Reservoir at curves 70B, 70A, and 70 (See Figure C.4). This location is in a 25 miles per hour freight speed restriction. The track makes three sharp curves along the hillside before returning to tangent. With some moderate cutting and filling, Curve 70B could be broadened somewhat and Curves 70A and 70 replaced with a tangent, increasing speeds from 30 miles per hour to 45 miles per hour. However, there is a 35 miles per hour passenger speed restriction less than half a mile east at Curve 69A, reducing the benefit. The new tangent may require filling into a floodplain or wetland.

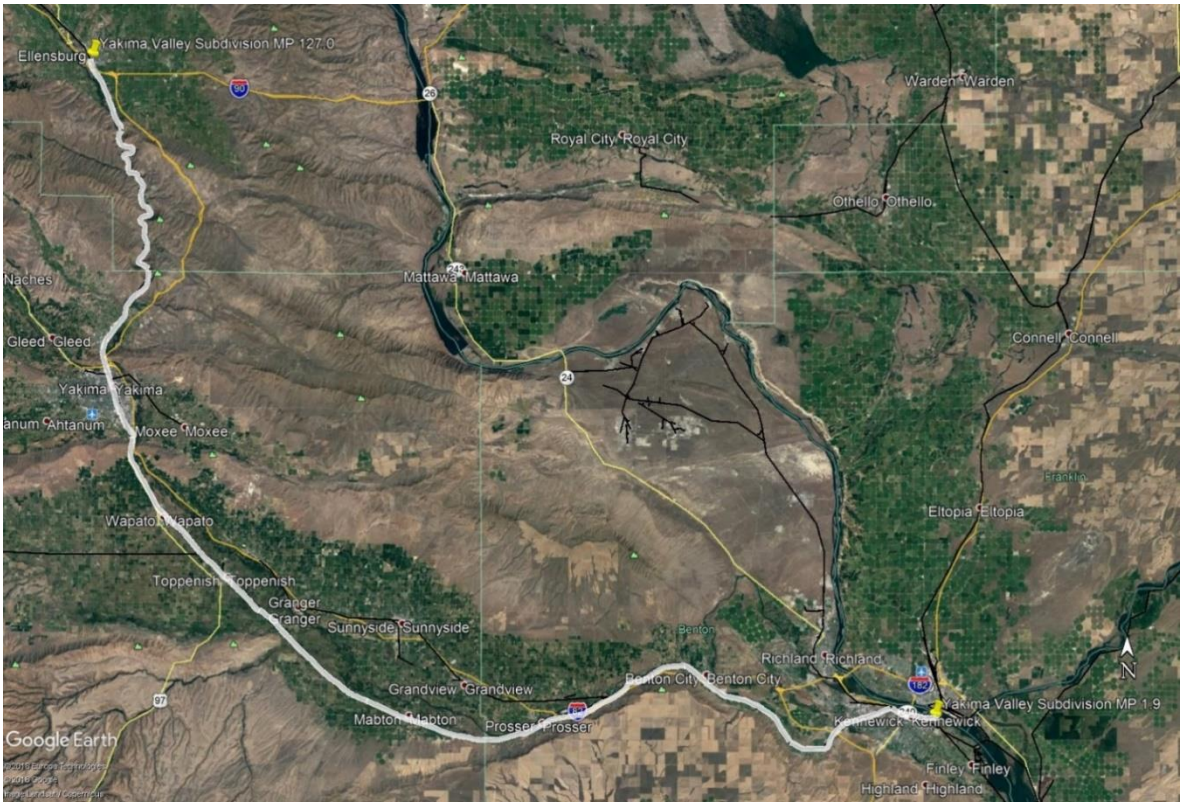
Figure C.4: Curve Realignment Near Howard A Hanson Reservoir

Source: Google Earth analysis.

Yakima Valley Subdivision

Route Description

Figure C.5: Overview of Yakima Valley Subdivision



Source: Google Earth screenshot.

C.13 The Yakima Valley Subdivision begins at the Ellensburg depot (MP 127) and ends at SP&S Junction (MP 1.9) near Pasco (See Figure C.5). Most of the subdivision is dark territory (TWC), with some CTC controlled sidings.

C.14 From Ellensburg, the line travels south, entering the Yakima River Canyon near Thrall (MP 121.8). For the next twenty miles the line closely parallels the Yakima River, crossing once near the north end of the canyon and once near the south end. Grades are mild, rarely exceeding 0.5%, but curvature is up to 10 degrees 30 minutes. There is an uncontrolled siding at Wymer, MP 110.4, approximately 6300 feet long. The line passes Rosa Dam at MP 103 and exits the Yakima River Canyon at MP 100. There is a 7,650-foot CTC controlled siding at Pomona, from MP 99.1 to 97.4. After crossing the Yakima River, the tracks pass through Selah, curve through a gap in the ridge, and enter the industrial area on the north end of Yakima.

C.15 Yakima (MP 90.0) contains both a yard and a large industrial district. It is also an interchange point with the Central Washington Railroad's Yakima-area operations. Leaving Yakima at MP 87.8, the line traverses a gap in the Ahtanum Ridge, then straightens out near Parker (MP 82.7). From Parker to Prosser, there are a few broad curves and mild grades, and the surrounding area is mostly farmland with some towns. Between Union Gap (MP 86.3) and Mabton (MP 52.1) this land

is part of the Yakama Indian Reservation. There is a short, uncontrolled siding at Wapato (MP 78.3) for industry access. North of Toppenish (MP 70.9), there is a 7,850f-oot CTC controlled siding, along with an interchange with the White Swan Branch Line shortline railroad. The CTC portion of the siding ends at MP 72.2 but continues after a crossover as industry track.

C.16 Departing Toppenish, the line travels southeast, passing through a number of small towns. There is a 7,650-foot CTC controlled siding at Byron (MP 45.9 to 44.2). At Prosser (MP 40.0) there is an industrial area with a short, uncontrolled siding. The line again follows the Yakima River from Prosser to a location near Benton City (MP 24). While the grades are mild, the curvature becomes sharper between MP 37.5 and MP 22, up to 5 degrees 30 minutes. At Gibbon (MP 34.4), there is a small yard and an interchange with Central Washington Railroad's southern operations. The line continues along the river, occasionally along steep terrain but generally following gentler grades.

C.17 Near Benton City, the line turns away from the river, passes under I-82 and enters an 8,330' CTC controlled siding at West Kiona (MP 24). From West Kiona the track continues east, loosely paralleling the Kennewick Main Canal and traveling through some low-density residential areas. The curvature becomes gentler after leaving Kiona, but the grades begin to increase up to 0.86%. There is a 4,600-foot long uncontrolled siding at Badger (MP 16.2). The line passes under I-82 again at MP 11.2, near Clearwater Ave. Another 7,900-foot uncontrolled siding is at Vista (MP 7.3). The line parallels the Tri-City Railroad starting near MP 5.0, crossing over it near MP 3.8. The line then passes through an industrial district in Kennewick before ending at SP&S Jct. (MP 1.9) just south of the bridge over the Columbia River.

Permanent Speed Restrictions

C.18 The maximum timetable speed on this subdivision is 49 miles per hour freight and there is no timetable passenger speed. There are no bridge weight restrictions. Several speed restricted zones are in the Yakima River Canyon between MP 121.1 and MP 87.4. Freight speeds through the canyon vary from 30 miles per hour to 35 miles per hour, with a two-mile-long stretch of 25 miles per hour near Rosa Dam. All of these restrictions appear to be curve dependent. While freight speed increases to 45 miles per hour through Pomona, it drops to 35 for a short, sharp curve near a bridge over the Yakima River at MP 96.7, before increasing to 40 miles per hour. The alignment in this segment allows for higher speeds. This restriction appears to be the crossings through Selah and the approach to Yakima, which has a 35 miles per hour restriction. From MP 87.4 to MP 36 there are no speed restrictions.

C.19 Another restricted zone starts at MP 36, just west of Gibbon and ends at MP 21.9 at East Kiona. Freight speeds drop from 49 miles per hour to 45 miles per hour, with a short 30 miles per hour curve near MP 32.5. Curiously, the track charts show Curve 32 as a 2-degree max compound curve, even though the restriction and aerial imagery suggest it is much sharper. Curve 29A is the opposite; the track chart considers it a 5-degree max compound curve, which should carry a 40 miles per hour restriction, but the timetable allows 45 miles per hour. There is another short 40 miles per hour curve at MP 28.8, and then again between MP 23 and 21.9. Freight speeds then return to 49 miles per hour until MP 4.3 near the U.S. 395 overpass, where a 35 miles per hour freight speed restriction is in place through Kennewick to SP&S Jct. Per the Lakeside Subdivision timetable, the turnout at SP&S Jct. carries a 25 miles per hour speed limit for freight and

passenger trains to and from the Yakima Valley Subdivision. All controlled sidings are 30 miles per hour for freight, uncontrolled are 10 miles per hour for all trains.

Potential for Curve Realignment

C.20 Although the Yakima Valley Subdivision is less mountainous than the Stampede, opportunities for curve realignment within the listed criteria are still limited. Many curves are either hampered by the topography or else already allow for higher passenger speeds. On the existing alignment the analysis determined a passenger train could average 55 miles per hour between Ellensburg and Pasco with 79 miles per hour maximum speed.

C.21 Between Ellensburg and Yakima, a slightly lower average speed of 50 miles per hour is possible.

C.22 The analysis did not identify curves suitable for realignment within the Yakima River Canyon. While some could be realigned, adjacent curves prevent subsequent passenger speed increases. At Pomona (MP 97.6), Curves 97A and 97 could be realigned (See Figure C.6). This would require adjusting adjacent industry tracks and sidings, and a canal uphill would limit space. This realignment would remove or reduce a 55 miles per hour passenger speed restriction. However, Curve 96A, located next to a bridge across the Yakima River, creates a 40 miles per hour passenger speed restriction shortly after the above curves. This curve cannot be realigned without moving or rebuilding the bridge across the river.

Figure C.6: Curve Realignment at Pomona

Source: Google Earth analysis.

C.23 Through Selah there is a 40 miles per hour freight speed restriction, which appears to be based on the grade crossing at Naches Avenue (See Figure C.7). A grade separation or safety improvement project, along with additional safety education, could allow for higher freight and passenger speeds. Similarly, there is a 35 miles per hour speed restriction through Yakima. If this restriction is also grade crossing dependent, then grade separation projects and/or safety upgrades could also allow for a faster speed limit. The freight yard may also be an influence. If so, a dedicated bypass track may be advisable here if space allows.

Figure C.7: Curve Realignment Near Gibbon

Source: Google Earth screenshot.

C.24 Most of the curves that could be easily realigned are located between Prosser and Benton City. Here the topography is gentler, allowing for shallower cuts and shorter fills. While most curves could be realigned, Curves 32A and 32 could produce the greatest benefit for the cost. Curve 32 contains a 30 miles per hour freight speed restriction and appears to be sharper than the track chart indicates, which suggests actual passenger speeds would be near 35 miles per hour to 40 miles per hour through the curve. By moving Curve 32A somewhat west, and cutting through the hillside, the sharpest part of Curve 32 could be eliminated.

C.25 A second favorable location is a series of curves between MP 30.7 and 27.7 (See Figure C.8). Curves 30, 29A, and 27B restrict passenger speeds to 45 miles per hour. Curves 30A and 28B restrict passenger speeds to 50 miles per hour. Realigning Curves 30 and 29A will likely involve also realigning adjacent Curves 30A and 29. Curve 29A is a compound curve, the sharpest part being 5 degrees, but this appears to be only a small portion of the curve. Realigning Curve 28B will require cutting into the hillside, which may result in the elimination of Curves 28A and 28. Realigning Curve 27B will also require cutting into the hillside. Together, these realignments could increase passenger speeds to a maximum of 65 miles per hour between MP 32.5 and 26.1, from an existing combination of 45 miles per hour to 50 miles per hour.

Figure C.8: Additional Curve Realignment Near Gibbon

Source: Google Earth screenshot.

C.26 Two more potential locations are between Curve 22B and Curve 22 at East Kiona, and at Curve 20 further east. 22A restricts passenger speeds to 45 miles per hour, and Curve 22 restricts passenger

speeds to 55 miles per hour (See Figure C.9). Cutting into the hillside and realigning adjacent Curve 22B could increase passenger speeds significantly. This would require moving the control point for East Kiona and removing part of a vineyard. To the east, there are no obstacles besides land acquisition to broadening Curve 20. Taken together these realignments would remove a one-mile long 45 miles per hour passenger restriction and a two-mile long 65 miles per hour passenger restriction.

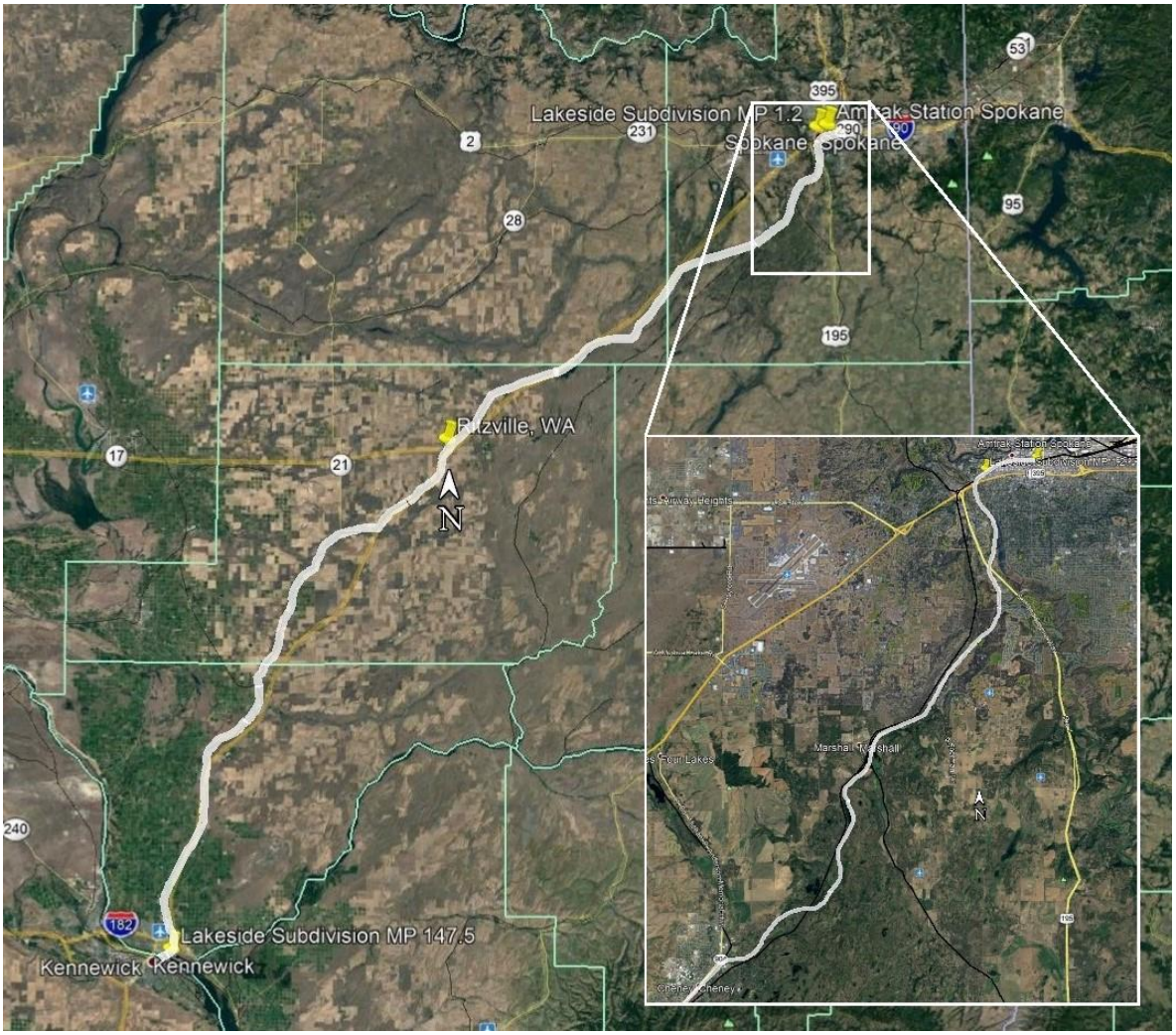
Figure C.9: Curve Realignment Near Kiona

Source: Google Earth screenshot.

Lakeside Subdivision

Route Description

Figure C.10: Overview of Lakeside Subdivision (With Inset of Area Between Cheney and Spokane)



Source: Google Earth screenshot.

C.27 The Lakeside Subdivision begins at SP&S Jct. (MP 147.5) near Pasco and ends at Sunset Jct. (MP 1.2), in Spokane (See Figure C.10). This subdivision is entirely CTC controlled and already sees passenger service in the form of the Portland section of Amtrak's Empire Builder (Trains 27/28). The line crosses the Columbia River on a single-track bridge with a lift span. The line then splits into two main tracks, with Main Track 2 going toward the Pasco Yard and Main 1 passing in front of the Pasco Intermodal Passenger Station (MP 145.6). After the station the two mains come together and a third main joins the pair through the yard. Main 3 appears to be mostly yard access, passing through a coal train re-spray facility and having a lower speed restriction of 40 miles per hour for all trains instead of 65 miles per hour for passenger and 60 miles per hour for freight. Main 3 ends at the north end of Pasco Yard (MP 140.2) and Main 2 ends at CP Glade (MP 137.0).

C.28 From Pasco the subdivision travels north/northeast following a seasonal stream in Esquatzec Coulee and Old Maid Coulee. There is a 4800foot uncontrolled siding at Sagemoor (MP 133.4). Further north, there is an 8,100' CTC controlled siding at Eltopia (MP 128.2 to MP 126.4). Another uncontrolled siding is located within Mesa (MP 119.6). Just north of town, at West Cactus (MP 118.8), approximately 5 miles of double track begins. This ends at East Cactus (MP 113.2). Connell (MP 109.7) has uncontrolled industry spurs, an 8,110-foot CTC controlled siding, and an interchange yard with the Columbia Basin Railroad. Grades are mild to moderate in this section. Curves are generally broad but reach 4 degrees south of Connell.

C.29 Traveling north, the stream turns west near MP 107. The railroad crisscrosses a dry streambed twenty-six times between Connell and Hatton (MP 101.2), mostly on bridges. The sharpest curves are 6 degrees 30 minutes, with one at 6 degrees 50 minutes near CP Hatton (MP 101.2). At Hatton, double track begins again. The curves are generally broader, but the grades are steeper, up to 1% in places. Near MP 95, there is evidence of line relocation. The date is uncertain, but the track chart does not appear to have been updated, as the curvature listed does not match the higher speeds in the timetable. A steady uphill grade continues until MP 89.9, near CP Beatrice, where the line crests. This crest is not named in track charts but is called "Providence" locally.

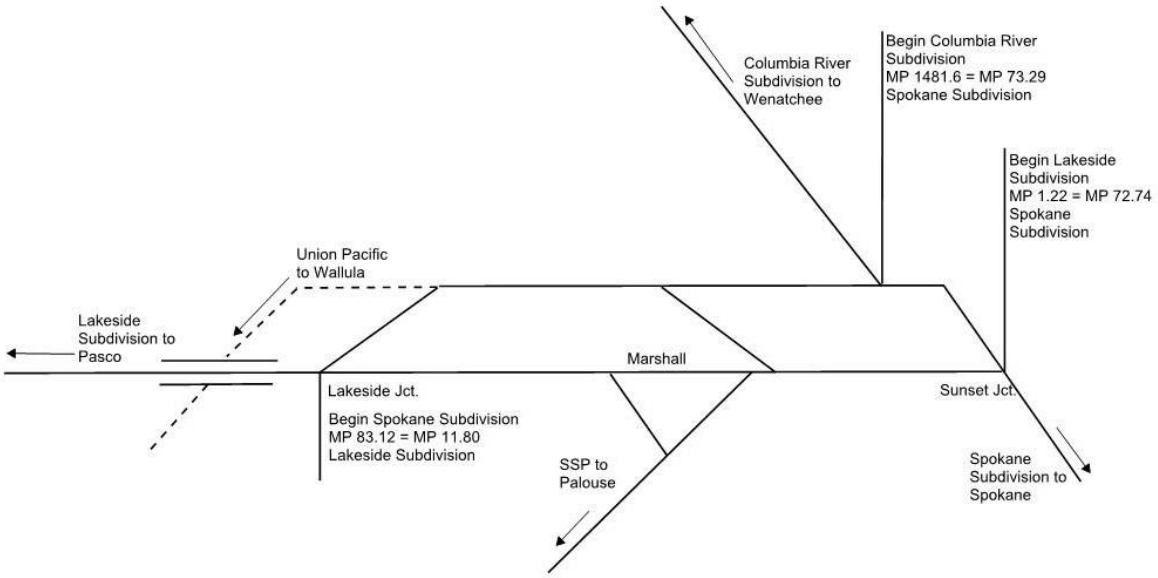
C.30 North from this crest, the curvature increases as high as 6 degrees 30 minutes as the grades descend at less than 0.6%. Double track ends at Lind, where there is also an uncontrolled siding and grain elevators. After curving under SR 21, the tracks parallel US 395 northward. The line again travels uphill on moderate grades. Curves are broad, no greater than 3 degrees 9 minutes. There are two CTC controlled sidings. One is 8,100 feet at Paha (MP 74.2 to 72.5), and another is 8,800 feet at Essig (MP 70.2 to 68.3). Near MP 66, the tracks pass under I-90 and enter Ritzville (MP 64.9), which has several uncontrolled industry tracks.

C.31 To the east of Ritzville, there is a large grain loading loop at Templin, just before the beginning of double track at West Tokio (MP 62.4). Double track ends at East Tokio (MP 57.8). There is an 8,800' CTC controlled siding at Keystone (MP 52.7 to MP 50.9). The maximum curve between Ritzville and Keystone is 2 degrees, and the maximum grade is 1%. Near MP 49, the line passes under I-90 and begins to follow Sprague Lake. Grades are mild to nonexistent along the lake, but curvature is as much as 6 degrees. Another CTC controlled siding, 8,100 feet long, is at Sprague (MP 43.8 to MP 42.1). The tracks continue into the town of Sprague (MP 41.0), where there is an uncontrolled siding and some industry tracks. The tracks ascend to a plateau near West Lamphier (MP 38.2) on a 1% grade. There is a 10,690-foot long CTC controlled siding at Lamphier. The siding ends at East Lamphier (MP 36), near a loop gravel loading plant at Missile Base (MP 35.6). Curves remain fairly broad as the line ascends at 1% to Fishtrap and an 8,100-foot CTC controlled siding (MP 31.4 to 29.7).

C.32 From Fishtrap, the line continues north on moderate to mild grades. There are a few sharper curves near Tyler (MP 28). Babb (MP 21.5) is the start of double track that continues through Cheney (MP 16.6), which has a few industries and an interchange with the Washington Eastern Railroad. Double track ends at East Cheney (MP 15.0). Starting in Cheney, the subdivision parallels Union Pacific's Spokane International line, and eventually also parallels the Columbia Plateau Trail.

C.33 As the line descends toward Spokane, grades increase to 1% and curvature to 5 degrees, crossing Union Pacific and the trail near MP 13.3. Lakeside Jct. (MP 11.8) a switch is the start of the BNSF Spokane Subdivision, which is also where the Union Pacific line connects (See Figure C.11). After passing Queen Lucas Lake, the line runs to Marshall (MP 8.9), with an interchange to the Spokane, Spangle, and Palouse Railway. The line descends toward Spokane on a 1% grade until just north of West Empire (MP 3.9). Here a 12,600-foot long CTC controlled siding begins, ascending on a 1% grade to East Empire (MP 1.3). The Lakeside Subdivision ends at Sunset Junction, MP 1.2. From here the Spokane Subdivision continues mostly on a viaduct toward the station about one mile to the east.

Figure C.11: Schematic of Lakeside Junction to Sunset Junction



Source: DEA analysis based on BNSF track layout maps

Permanent Speed Restrictions

C.34 The maximum speeds on the Lakeside Subdivision are 79 miles per hour passenger and 60 miles per hour freight. There are no bridge weight restrictions on the subdivision. Pasco contains speed restrictions for the river crossing and yard limits; northeast of that point there are some minor speed restrictions for curves. Connell (MP 109.7) also has restrictions greater than the curvature, 45 miles per hour passenger and freight, possibly for a quiet zone. Northeast of Connell, curves restrict passenger and freight speeds to 35 miles per hour until Hatton, where both become 60 miles per hour. Passenger speeds drop to 50 miles per hour two miles south of Beatrice (MP 90.8), then decrease to 35 miles per hour beyond that point for the increasing curvature down to Lind (MP 81.8). Passenger speed increases to 45 miles per hour through Lind, due to a sharp curve east of town. From here, passenger speeds return to 70 to 75 miles per hour, with short restrictions for curves at Essig (MP 69.3). Ritzville (MP 64.8) contains a 50 miles per hour limit on both passenger and freight speeds, likely due to crossing restrictions or nearby industrial track.

C.35 East of Ritzville, passenger speeds are generally 79 miles per hour until Sprague Lake, where they drop to 50 miles per hour. There is a 45 miles per hour passenger speed restriction through Sprague (MP 43.9 to MP 40.3). There is a short curve restriction north of Fishtrap at MP 28. Cheney (MP 16.3) contains a 35 miles per hour passenger speed restriction, lower than the nearby curves would require, possibly due to grade crossings. Passenger speeds increase to 45 miles per hour north of town, with a brief drop to 35 miles per hour at Lakeside Junction, where the Lakeside Subdivision takes the diverging route of a turnout. Passenger speeds become 40 miles per hour through Marshall (MP 8.9), then increase to 55 miles per hour to East Empire (MP 1.3). From East Empire to Sunset Junction speed is restricted to 25 miles per hour for all trains.

C.36 Most controlled sidings are 35 miles per hour to 40 miles per hour for passenger trains. Empire Siding is limited to 10 miles per hour. Uncontrolled sidings are limited to 10 miles per hour for all trains. Turnouts to second main tracks are 50 miles per hour for all trains, except at East Cheney which is 45 miles per hour for passenger and 35 miles per hour for freight. Crossovers are generally 35 miles per hour for all trains. SP&S Junction is 25 miles per hour for all trains to the Yakima Valley Sub.

Potential for Curve Realignment

6.15 Much of the Lakeside Sub has likely already been optimized for passenger and freight traffic, as evidenced by line changes near MP 95. However, there are a few more places where further realignment may reduce travel times. A passenger train traveling at 79 miles per hour maximum will average about 55 miles per hour between Pasco and Spokane, for a travel time of 2 hours 40 minutes. Currently, the Empire Builder is scheduled for 2 hours 50 minutes from Spokane to Pasco, and 3 hours 16 minutes from Pasco to Spokane. The latter includes recovery time. It appears that the Empire Builder (Trains 27/28) uses the Lakeside Subdivision between Lakeside Junction and Sunset Junction, and therefore that line was analyzed.

6.16 One potential location where curve realignment would benefit passenger trains is at Essig, where the tracks curve around a small rise (See Figure C.12). Cutting through the rise of about 30 feet could allow for elimination Curve 69 and realignment of Curve 69A, raising speeds above 55 miles per hour. Another limitation exists at the north end of Essig, Curve 68, but realignment of this curve may require moving the turnout. This realignment could be done as part of a future double-tracking project.

Figure C.12: Curve Realignment near Essig

Source: Google Earth screenshot.

C.37 A second location is near Tyler (MP 28), where Curves 28A and 28 avoid another rise on 4-degree 30-minute curves, resulting in a 50 miles per hour restriction (See Figure C.13). The rise is about 25 feet tall. Realigning these curves will increase passenger and freight speeds, particularly if adjacent Curve 27 (2-degree 32 minute) is also realigned. There appears to be some wetlands adjacent to these curves.

Figure C.13: Curve Realignment Near Tyler

Source: Google Earth screenshot.

C.38 In addition to the above two locations, both Ritzville and Cheney appear to restrict speeds to lower than what nearby curves would require. Such restrictions are likely due to the grade crossings within each city. If this is the case, these crossings could be modified with safety enhancements, and/or grade separation projects. Coupled with crossing safety education, these would allow for higher passenger train speeds.

Conclusion

C.39 There are few locations between Auburn and Ellensburg where curves can be realigned for faster operation. The prime locations appear to be outside of Covington and Ravensdale, and possibly in the Cascades between Kanaskat and Lester. Between Ellensburg and Yakima, there is some possibility for realignment around Pomona, particularly if a new crossing of the Yakima River is constructed. From Yakima to Pasco, most opportunities for curve realignment are east of Prosser along the Yakima River. From Pasco east, the line has already seen some optimization, but there are a few places to realign curves and save additional time, in addition to increasing speeds through Ritzville and Cheney.

D Stations Cost Estimates

Summary

D.1 This memo summarizes the cost estimates created for passenger stations along the proposed East-West Passenger Rail corridor. Proposed stations involved include Auburn, Cle Elum, Ellensburg, Yakima, Toppenish, and Pasco. Costs are mainly derived from recent separate work performed for Sound Transit related to their station improvement projects.

Assumptions

- The following assumptions are derived from information provided by Steer and from Google Earth analysis.
- The proposed train length is up to 8 cars with a locomotive on each end.
- As Siemens is currently the only firm producing single-level cars, their Viaggio/Venture trains are used as the basis of design. The cars are 87 feet long, slightly more than the 85 feet North American standard.
- The platform should be 700-foot long, enough to access all 8 cars. For a shorter train, reduce length by 87 feet per fewer car. The track should ideally have an extra 75 feet of clear space on each end of the platform, so the locomotives do not block highway, rail, or pedestrian traffic.
- The platform should be a minimum of 16 feet-wide for boarding, with 30-foot wide turnarounds at each end for baggage carts.
- Basic platform costs include platform upgrades, lighting, drainage, and two small bus stop-type shelters near the ends of the platform. A 30% contingency is included. The estimates do not include space for parking.
- A separate, unstaffed building is costed separate from the platform. The cost is based on an Amtrak Unstaffed Station standard design installed in Winnemucca, NV in 2012.
- Unless noted, it is assumed the platform will be built to 8 inches above top of rail (ATR). BNSF does not allow platforms greater than 8 inches in height on main tracks as it may interfere with cars used for extra-dimensional loads.
- If a platform greater than 8 inches in height is desired, a separate station track must be constructed at additional cost. BNSF will not allow a gantlet track.
- The service operator or WSDOT will need to acquire land at the station. Unless noted, it is assumed this land will include the full platform length and extend up to 50 feet from existing track to allow for additional facilities, such as a shelter building, and construction staging.

General Cost Estimates

D.2 Because Cle Elum, Ellensburg, Yakima, and Toppenish do not currently see passenger service and require similar work, a single estimate was used for each station.

D.3 At Cle Elum, there is no existing station building. The costs include construction of a new platform and building.

D.4 At Ellensburg, there is an existing station building owned by a private entity. It is assumed the existing 335-foot platform can be utilized and extended but is set at 0 inches ATR and will need to be rebuilt. A new building will need to be constructed.

D.5 At Yakima, there is an existing station building and baggage depot, both owned by a private entity. It is assumed the existing full-length platform can be utilized but is set at 0 inches ATR and will need to be rebuilt. A new building will need to be constructed. Space is somewhat constricted at the site.

D.6 At Toppenish, there is an existing station building owned by a local museum. It is assumed the existing full-length platform can be utilized but is set at 0 inches ATR and will need to be rebuilt. A new building may need to be constructed. Construction of the platform may require encroaching on the museum's storage area.

Auburn

D.7 The existing station at Auburn is used solely by Sound Transit for their Sounder service. It is assumed the passenger operator will be able to use this station for the new service, and that station improvements will be coordinated with Sound Transit.

D.8 The platform on Track 3 is approximately 600 feet long and will need to be extended about 100 feet south. There is no space to extend further than this due to the connecting line to the Stampede Subdivision and support piers for SR 18. The platform will likely be extended at 8 inches ATR. The height cannot exceed 25 inches in any case as this is the floor height of the Bombardier BiLevel cars used by Sound Transit.

D.9 There is no station building at Auburn, and a new one may need to be constructed. There are multiple existing shelters on the platform.

D.10 Note that stopped trains will block Main Street to the north of the station. As Sounder trains currently block the crossing when stopped, it is assumed this arrangement is acceptable.

Pasco

The existing station at Pasco is used by Amtrak's Empire Builder between Portland and Chicago. It is assumed the passenger operator will be able to use this station for the new service, and that station improvements will be coordinated with the station owner.

The existing platform is approximately 420 feet long and will need to be extended approximately 280 feet. There is space to the south (RR West) for this extension. The platform will likely be extended at 8 inches ATR. The height cannot exceed 15 inches in any case as this could interfere with boarding of Superliner cars (Floor height 17 inches).

There is an existing staffed station building at Pasco, so no new building is included.

Summary of Costs

Table D.1: Summary of Costs

Station	Cost
Auburn	$6,156,737
Cle Elum	$23,375,958
Ellensburg	$23,375,958
Yakima	$23,375,958
Toppenish	$23,375,958
Pasco	$8,174,201
Total	**$107,834,770**

Source: Steer (2020) from DEA analysis.

E Survey Results – East-West Intercity Passenger Rail Study

Survey Design

Travel Survey Background

E.1 To better understand the Seattle – Yakima – Tri-Cities to Spokane travel market, and to estimate behavioral parameters specific to corridor travelers, Steer conducted a behavioral and stated preference (SP) surveys of residents in Stampede Rail corridor and the City of Spokane. The behavioral survey was used to develop data and forecasting model inputs needed for the East-West Intercity Passenger Rail Feasibility study, specifically to better understand support for rail service and to support ridership forecasting.

E.2 This report covers the following:

- Survey goal, design, and implementation
- Sample profile results, including socio-economic profiles, corridor travelers, users' behavioral characteristics and trip frequencies and patterns
- Quantitative behavioral analysis of corridor travelers to derive the parameters (including values of time) to be used in the modelling of the combined travel choice and access mode choice, based on stated preferences from the survey and on observed (revealed) travel behavior

Survey Goals

E.3 The behavioral survey conducted by Steer was used to elicit qualitative and quantitative information from travelers who currently make trips along the Seattle – Yakima – Tri-Cities - Spokane corridor.

E.4 The specific goals of the behavioral survey included:

- Collecting trip pattern information to gain insight on the profiles of travelers; and
- Developing a qualitative and quantitative understanding of how people make choices between using their car, or alternative based on attitudinal questions.

E.5 The survey was designed to collect a wide range of contextual, attitudinal and choice data, as well as socioeconomic and demographic characteristics of current corridor travelers.

E.6 The socioeconomic and demographic data was important to identify characteristics of corridor travelers. Contextual data was gathered to identify the factors influencing people's current trip making characteristics (such as trip length, purpose, party size). Choice data was collected using Stated Preference (SP) techniques in order to understand people's travel preferences; and

attitudinal data was collected to evaluate people's inherent biases and opinions toward the provision of passenger rail in the Seattle – Yakima – Tri-Cities – Spokane corridor.

E.7 The web survey was designed and hosted online by Steer.

E.8 The main survey was completed in February 2020, and a total of more than 600 completed surveys were received from a sample of corridor travelers. The data was further cleaned and a sample of 528 surveys were retained for analysis.

Survey Design

E.9 The survey questionnaire collected revealed preference and stated preference (SP) data.

E.10 The revealed preference data gathered information on current corridor travelers' behavior, based on respondents' most recent auto or air trip within the corridor. Travel times and other key information as well as attitudinal information such as attitude toward passenger rail in the Seattle – Yakima – Tri-Cities – Spokane corridor. Other information – including more detailed data on trip purpose, income categories and behavioral statements to allow further segmentation – were also collected.

E.11 The SP data asked respondents to make choices between hypothetical situations that involved (1) using a new passenger rail service in the Seattle – Yakima – Tri-Cities – Spokane corridor, and (2) using auto. The choice exercises were designed to assess the propensity to divert from their existing mode (auto) to the passenger rail in the Seattle – Yakima – Tri-Cities – Spokane corridor and the willingness to pay for such a service.

E.12 The questionnaire took no more than 15 minutes to complete for half the respondents, with about 50 questions for any given respondent, including screening questions and the mode choice exercise. Induced demand was not explicitly considered in the survey. The survey was structured as follows:

- Screening question: passengers who did not complete an intercity auto within the corridor were not retained
- Detailed questions about the current trip including:
  - Trip purpose, time and day, and trip origin in the corridor area;
  - Mode of travel, total travel time;
  - Travel costs and travel party size and luggage.
- An introduction to the East-West Intercity Passenger Rail Feasibility study, including questions about respondents' attitudes toward the project;
- A mode choice exercise consisting of trade-off questions asking the respondent to make a choice among (1) using the passenger rail service, and (2) using their existing mode of travel;
- Attitudinal questions about choices;
- Questions regarding a potential usage; and
- Socio-economic questions including respondents' income, occupational status, and age.

Survey Implementation

E.13 Steer developed and analyzed the survey, and the survey was administered online.

E.14 The main survey was completed in February 2020.

E.15 A total of more than 600 completed questionnaires were received exceeding our original target of 500 completes. The respondents were made up of public participants and participants accessed through a survey "Panel" provider targeting potential respondents in the study area.

Survey Respondent Characteristics

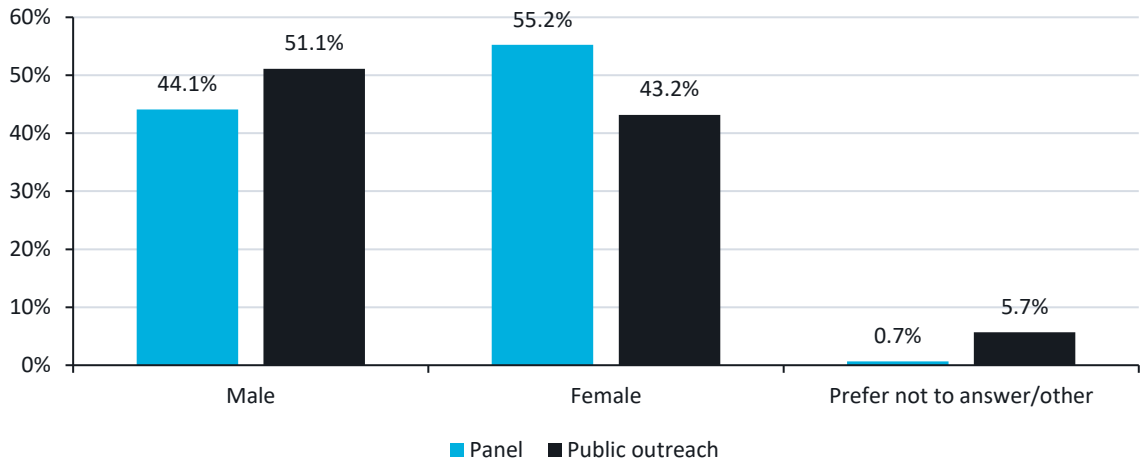
E.16 This section summarizes the socio-economic and demographic characteristics of the respondents Unless otherwise indicated, results are based on 528 responses: 440 from a panel of residents ("Panel") and 88 from social media and e-mail outreach to existing stakeholders ("Public outreach").

Socio-Economic Characteristics

Gender

E.17 Amongst all survey respondents, slightly more individuals identified as female (53.2%) than male (45.3%). This difference is reflective of the relatively higher percentage of female panel participants, while the greatest number of public outreach respondents identified as male in the survey. Figure E.1 shows the gender distribution of survey participants of both survey groups.

Figure E.1: Gender Distribution of Participants

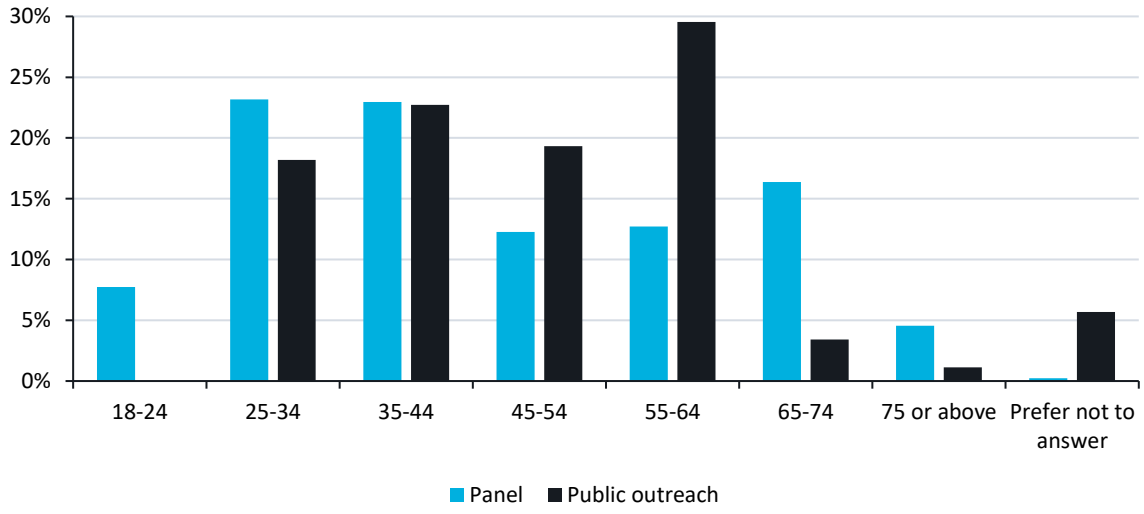


Source: Steer (2020) analysis.

Age

E.18 Panel participants were younger on average than public outreach participants. Public outreach participants were mostly between the ages of 25 and 64. While individuals between the ages of 18 and 24 or 65 and above were better represented amongst panel participants, almost half (46.1%) of respondents in this sample were between the ages of 25 and 44. Figure E.2 shows the age distribution of participants.

Figure E.2: Age Distribution of Participants

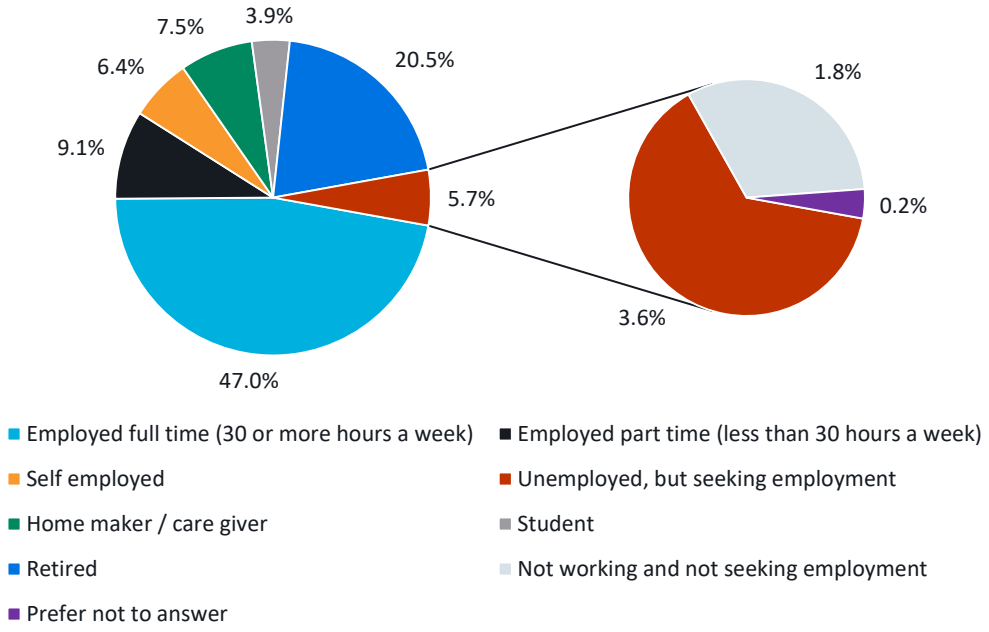


Source: Steer (2020) analysis.

Employment Status

E.19 The overwhelming majority of public outreach participants reported being employed full time (96.6%). Meanwhile, of the participants in the panel group, half were employed full time and one fifth were retired. The complete breakdown of employment status of panel participants is detailed in Figure E.3.

Figure E.3: Employment Status of Panel Participants

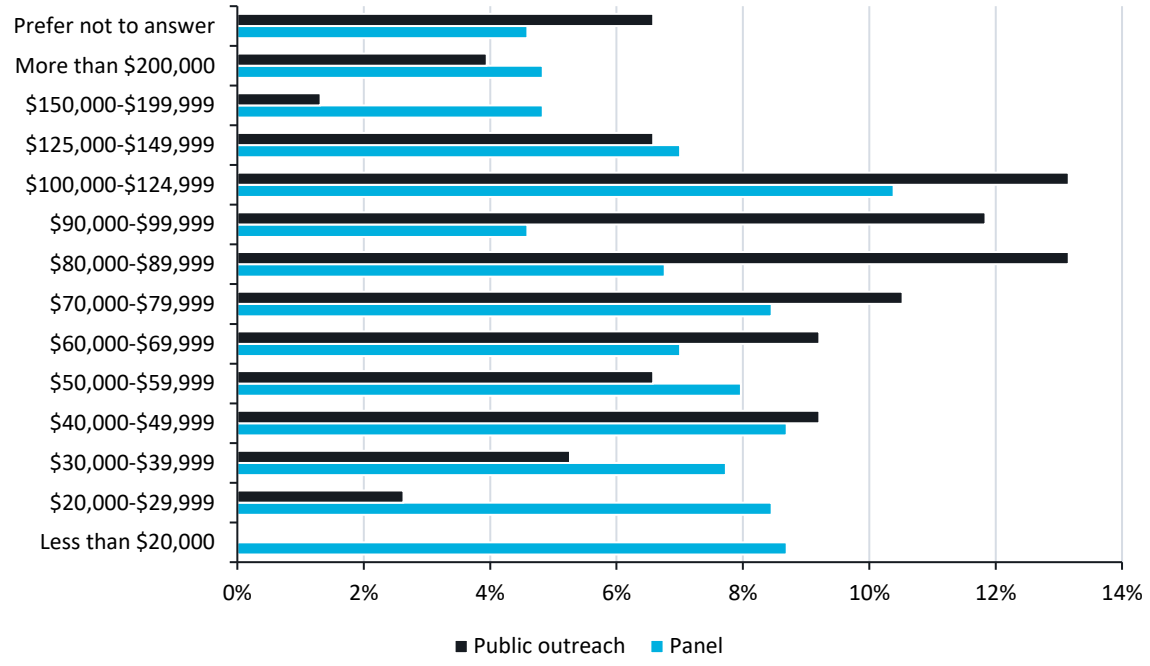


Source: Steer (2020) analysis.

Household Income

E.20 A household income between $100,000 and $124,999 was the most common bracket for both respondent groups. Nearly half (48.7%) of public outreach participants reported household incomes between $70,000 and $124,999. The income distribution of panel participants was less skewed and did include several participants with household incomes below $20,000. No individuals with a household income below $20,000 participated in the public outreach survey. Figure E.4 shows the income distribution of both survey groups.

Figure E.4: Household Income Distribution of Participants

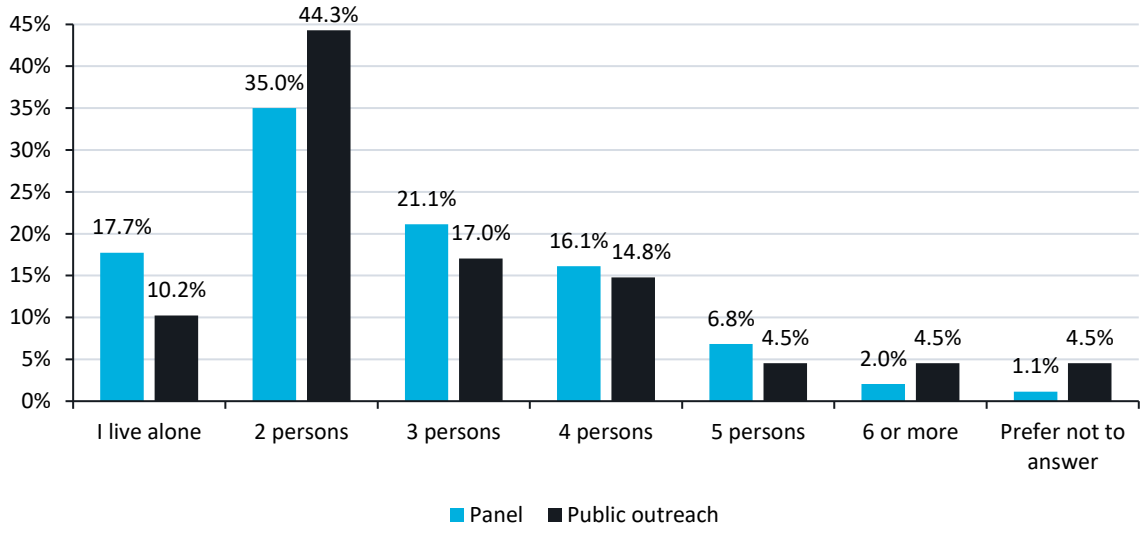


Source: Steer (2020) analysis.

Household Size

E.21 The most common household size across both study groups was 2. The distribution of household size was comparable between panel and public outreach groups, with slightly more single person households represented in the panel group. The distribution of responses from both groups is shown in Figure E.5.

Figure E.5: Household Size of Participants

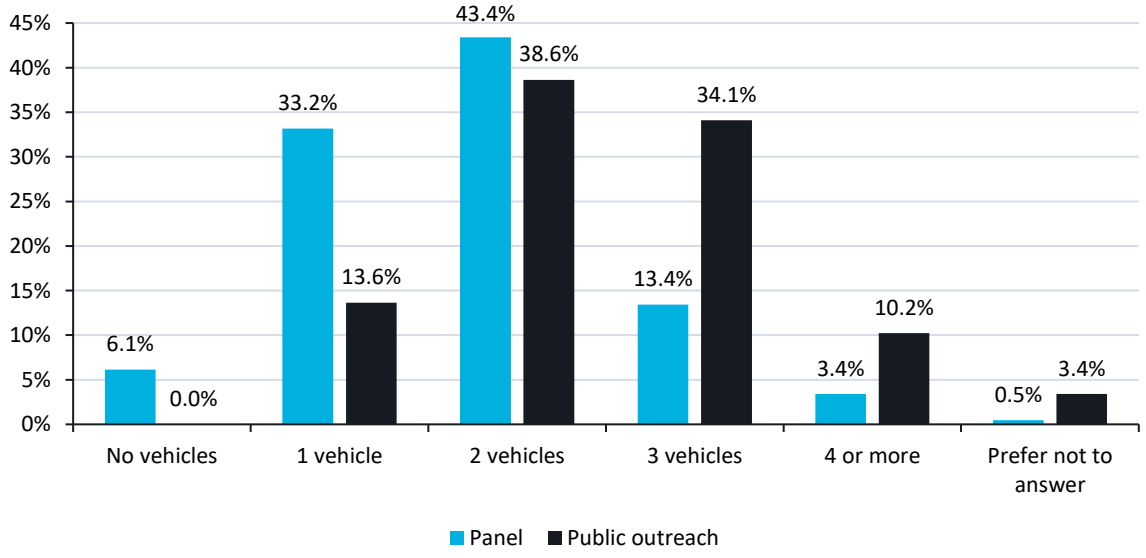


Source: Steer (2020) analysis.

Car Ownership

Figure E.6 shows the number of cars per household. While respondents in either survey group were most likely to have two cars for their household, public outreach participants were almost as likely to have three vehicles. No public outreach participants reported having zero vehicles for their household. Households with one or no cars were more prevalent among panel participants.

Figure E.6: Number of Cars Per Household of Participants



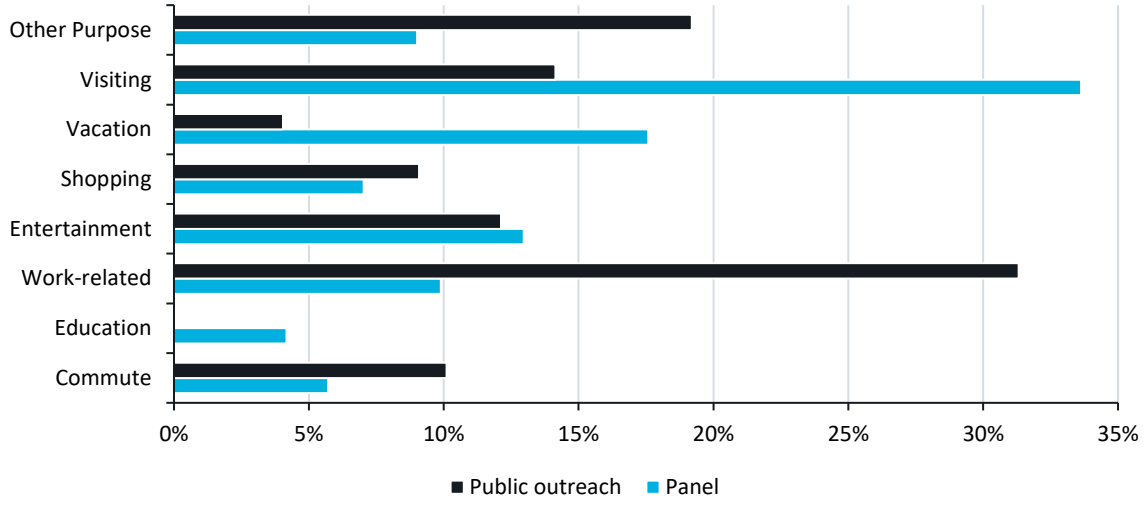
Source: Steer (2020) analysis.

Trip Patterns

Trip Purpose

E.22 Visiting was the most recent trip purpose for panel participants (33.6%), while public outreach participants were most likely to have travelled for work-related purposes (31.3%). Figure E.7 illustrates the most recent trip patterns across both groups.

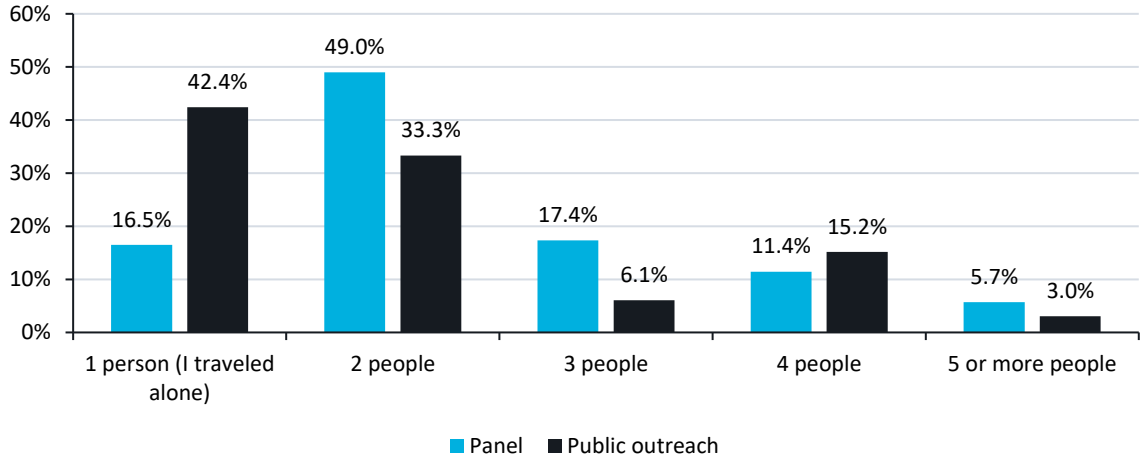
Figure E.7: Most Recent Trip Purpose



Travel Party Size

E.23 During their most recent trip, most respondents commuted in travel parties of only one (21.1%) or two (46.2%) people. Solo travel was most common for public outreach participants, while panel members were most likely to travel with another person. Travel party size by survey group is depicted in Figure E.8.

Figure E.8: Travel Party Size During Most Recent trip

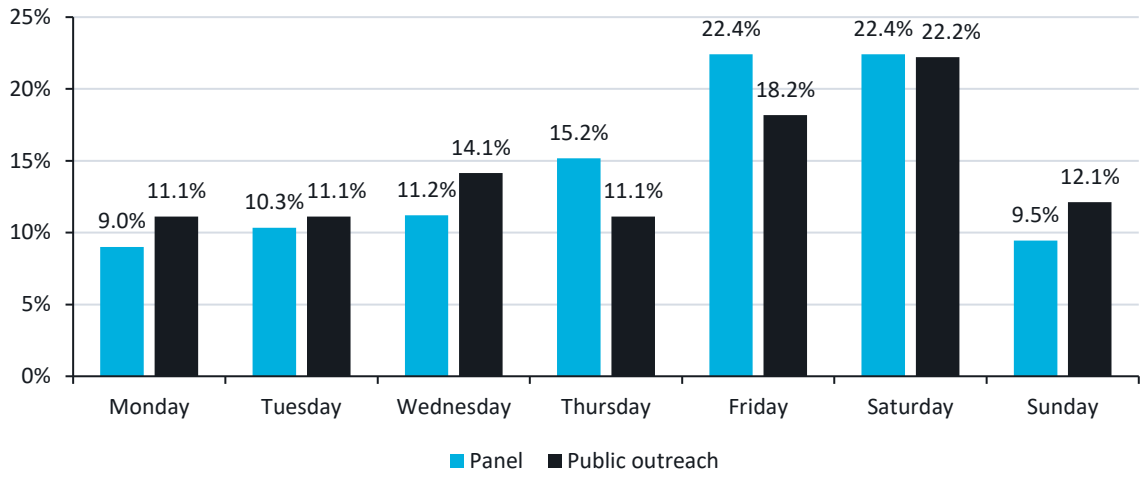


Source: Steer (2020) analysis.

Day of Departure

E.24 Figure E.9 shows the day of the week that survey participants left on for their most recent trip. Most participants reported leaving for their trip on a Friday (21.7%) or Saturday (22.4%). The distribution of departure days was relatively consistent between both survey groups.

Figure E.9: Day of Departure For Most Recent Trip

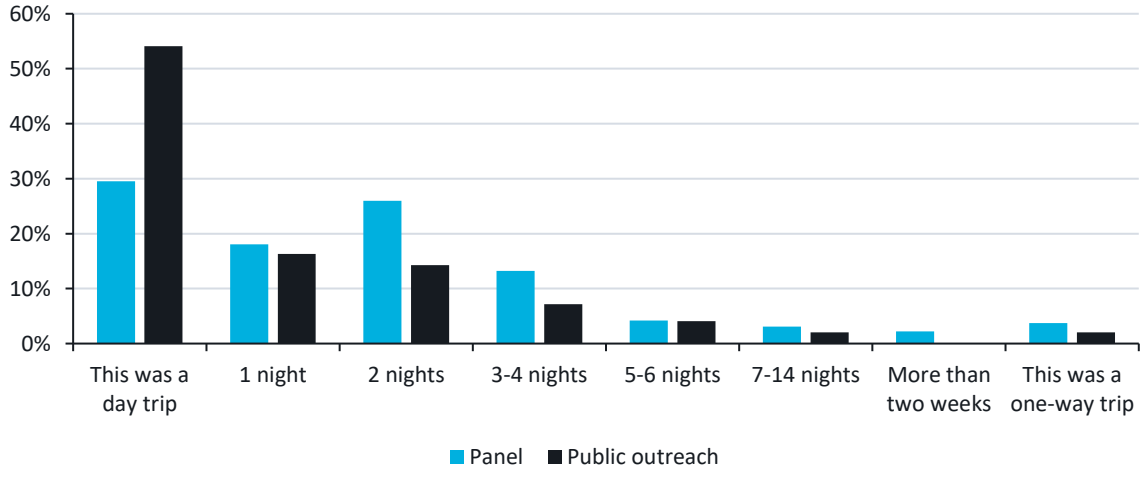


Source: Steer (2020) analysis.

Trip Length

E.25 Reported trip lengths during a respondent's most recent trip are reported in Figure E.10. Overall, typical trip lengths tended to be two nights or shorter (75.5%). Fewer than five percent of trips lasted seven nights or longer. More than half of public outreach participants reported that their most recent trip lasted only a single day.

Figure E.10: Length of most recent trip

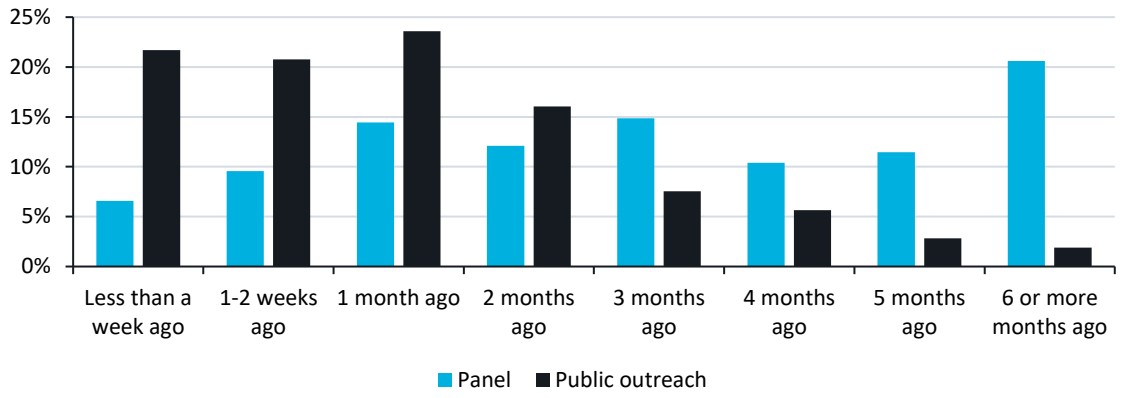


Source: Steer (2020) analysis.

Trip Occurrence

E.26 As shown in Figure E.11, reported time since a respondent's most recent trip varied across both survey groups. Panel members were most likely to have travelled at least six months ago while the majority of public outreach participants reported traveling within the last month (66.0%).

Figure E.11: Time Since Most Recent Trip

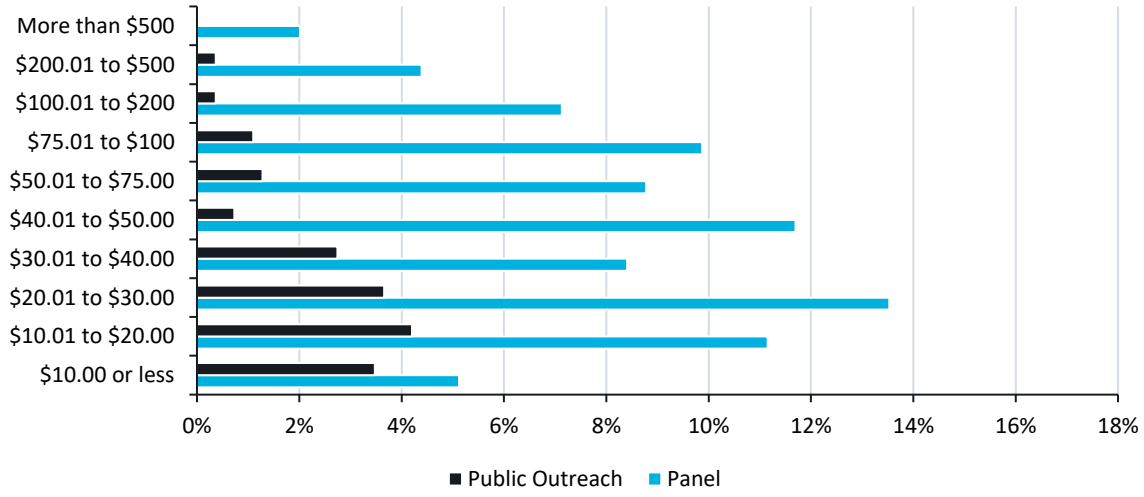


Source: Steer (2020) analysis.

Trip Cost

6.17 Survey respondents were asked to estimate the cost of a single direction of travel during their most recent trip. Participants reported travel costs with a mean of $113.29, a median of $40.00 and a mode of $50.00. As shown in Figure E.12, public outreach participants were more likely than panelists to report lower travel costs. Nearly two-thirds (63.3%) of public outreach participants reported costs of $30 or less. Slightly more than one third of panelists reported one-way costs of $30 or less.

Figure E.12: Estimated Cost to Travel One-Way During Most Recent Trip

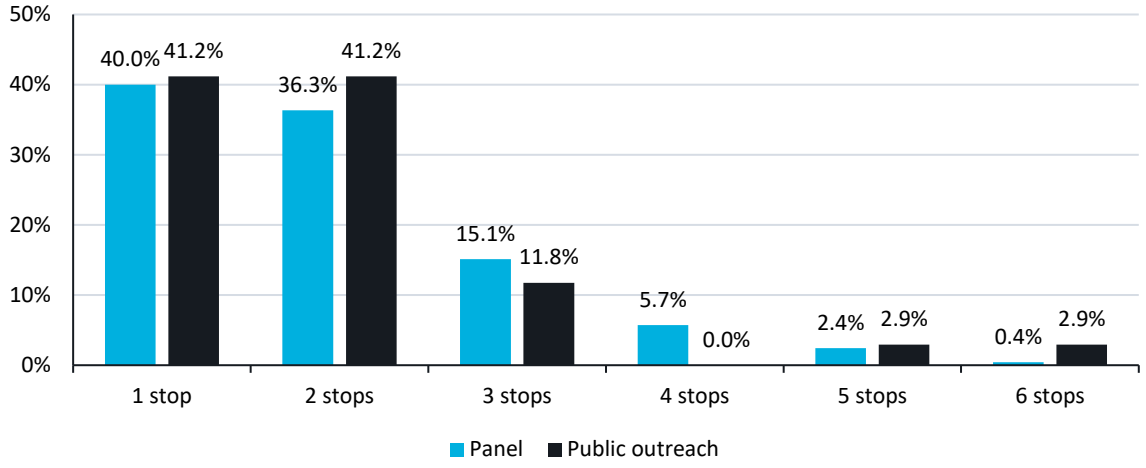


Source: Steer (2020) analysis.

Stops on Route

E.27 Approximately half (50.8%) of survey respondents stopped at least once during their most recent trip. Stops were more common among panel participants (54.2%) than public outreach participants (35.1%). Those respondents who stopped typically only stopped once (40.1%) or twice (36.9%). Figure E.13 depicts the frequency of stops for both survey groups.

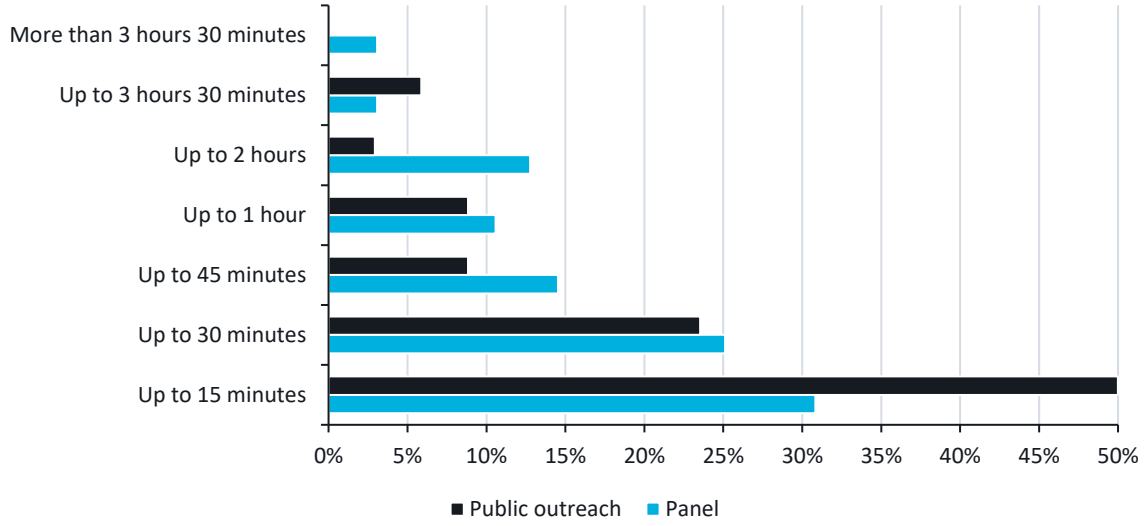
Figure E.13: Number of Stops During Most Recent Trip (Zero Stops Omitted)



Source: Steer (2020) analysis.

E.28 As shown in Figure E.14, stops were typically short in nature. More than half (58.2%) of participants reported that their longest stop took 30 minutes or less.

Figure E.14: Length of Longest Stop During Most Recent Trip



Source: Steer (2020) analysis.

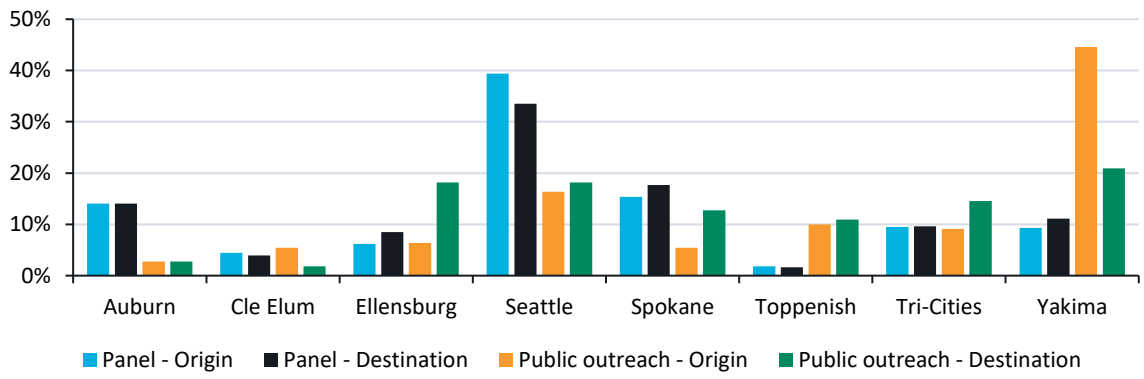
Need for Vehicle

E.29 During their most recent trip, 27.9% of panel participants and 35.1% of public outreach participants required a car for reasons other than completing their trip. More than two thirds (70.9%) of all survey participants did not require a car during the remainder of their trip.

Origin and Destination

E.30 The relative frequency of origins and destinations were similar within survey groups. Trips departing from and arriving in Seattle were more prevalent among panel participants, while public outreach participants reported considerably more travel to and from Yakima. Origins and destinations for each survey group are depicted in Figure E.15.

Figure E.15: Origin and Destination of Most Recent Trip



Source: Steer (2020) analysis.

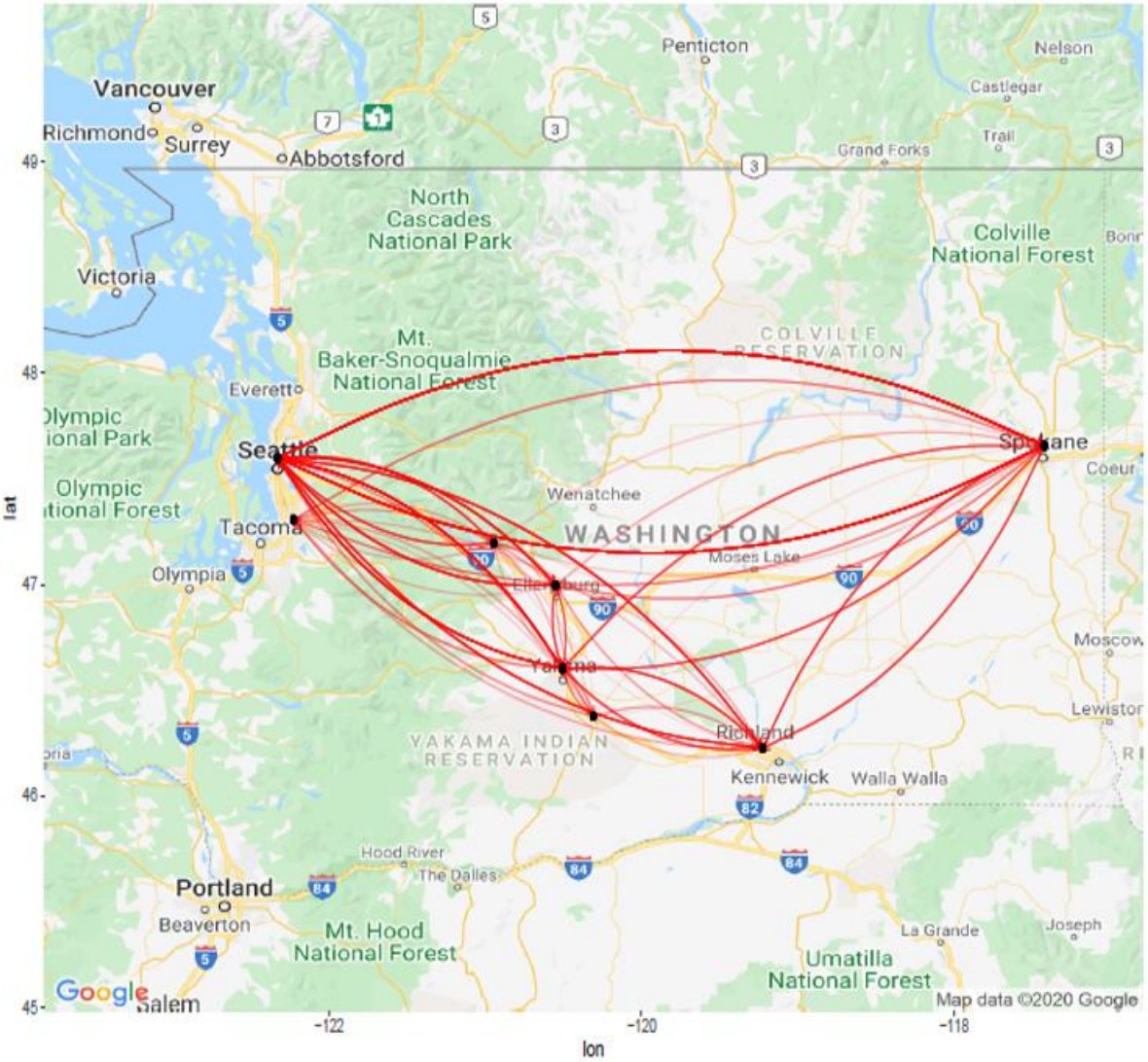
E.31 Among all trip origins and destinations, Seattle was the most common. Toppenish was the least common origin and destination. One in ten trips started in Seattle and ended in Spokane. Table E.1 details the complete frequency of all origin and destination pairs for all survey participants. Figure E.16 depicts the spatial distribution of these trips.

Table E.1: Origin and Destination Pairs For All Study Participants

	Destination								
Origin	**Auburn**	**Cle Elum**	**Ellensburg**	**Seattle**	**Spokane**	**Toppenish**	**Tri-Cities**	**Yakima**	**Total**
Auburn		0.6%	1.0%	8.6%	1.2%	0.3%	0.3%	0.4%	**12.3%**
Cle Elum	0.4%		0.7%	2.4%	0.3%	0.3%	0.1%	0.4%	**4.6%**
Ellensburg	0.4%	0.3%		3.6%	0.6%	0.1%	0.3%	1.0%	**6.2%**
Seattle	9.0%	2.2%	3.7%		10.2%	0.8%	3.7%	6.1%	**35.9%**
Spokane	1.1%	0.1%	1.1%	6.9%		0.1%	2.5%	1.9%	**13.9%**
Toppenish	0.0%	0.0%	0.6%	0.8%	0.1%		0.7%	0.8%	**3.0%**
Tri-Cities	0.4%	0.1%	0.7%	3.6%	2.2%	0.4%		1.9%	**9.4%**
Yakima	1.0%	0.3%	2.2%	5.3%	2.2%	1.0%	2.8%		**14.7%**
Total	**12.3%**	**3.6%**	**10.0%**	**31.2%**	**16.9%**	**3.0%**	**10.4%**	**12.6%**	**100.0%**

Source: Steer (2020) analysis.

Figure E.16: Map of Origin and Destination Pairs For All Survey Participants

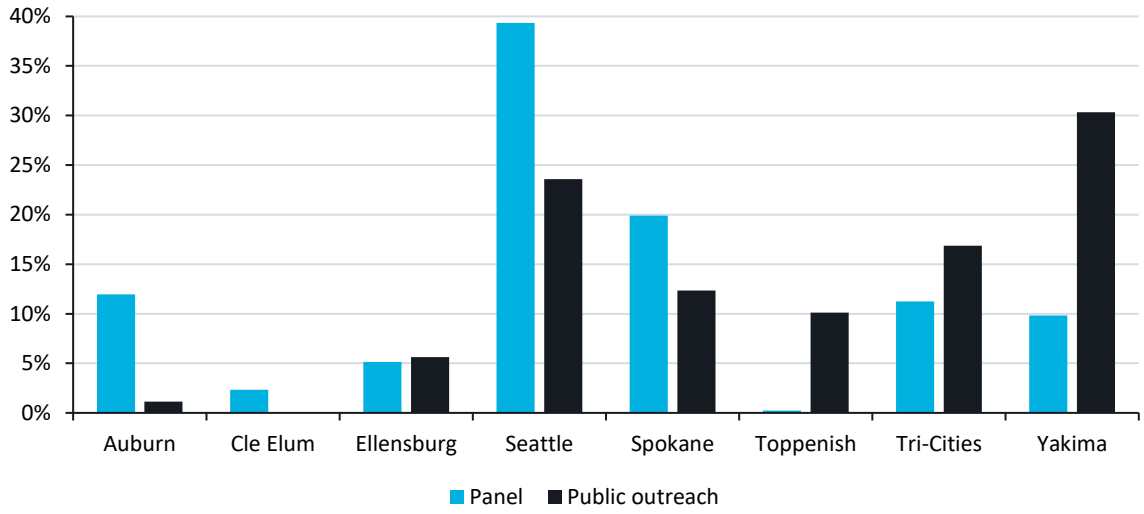


Source: Steer (2020) analysis. Base maps provided by Google Maps.

Preferred Station

E.32 Stated preferences for station access to a potential passenger rail service generally aligned with the reported origins and destinations of participants' most recent trips. As expected from the reported travel patterns, Seattle was the preferred station (39.3%) among panel participants and Yakima was the preferred station (30.3%) among public outreach participants.

Figure E.17: Preferred station for potential East-West intercity passenger rail service

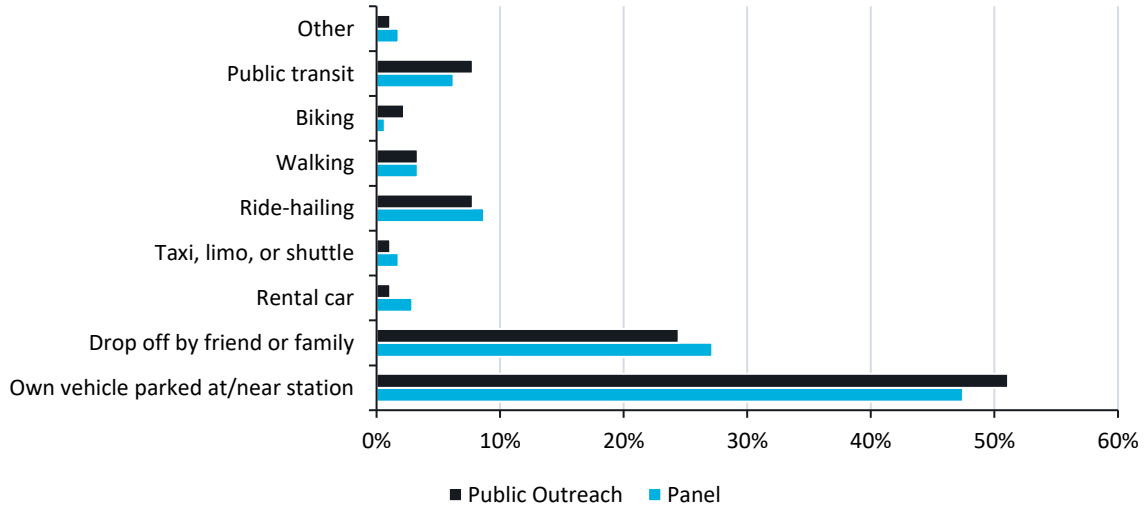


Source: Steer (2020) analysis.

Travel Mode to Station

E.33 Figure E.18 shows the most likely mode of travel reported by participant groups for accessing an East-West Rail station for future travel. Responses were similar across public outreach and panel survey groups. Nearly half (48.1%) of all survey respondents indicated that they would be most inclined to drive themselves and park at the station. Drop-off by a friends or family (26.7%), ride-hailing (8.5%), and public transit (6.5%) were the next most common responses. Fewer than 1% of participants selected cycling as their primary mode of travel to the station.

Figure E.18: Most Likely Mode of Travel to East-West Rail Station Nearest to Trip Origin

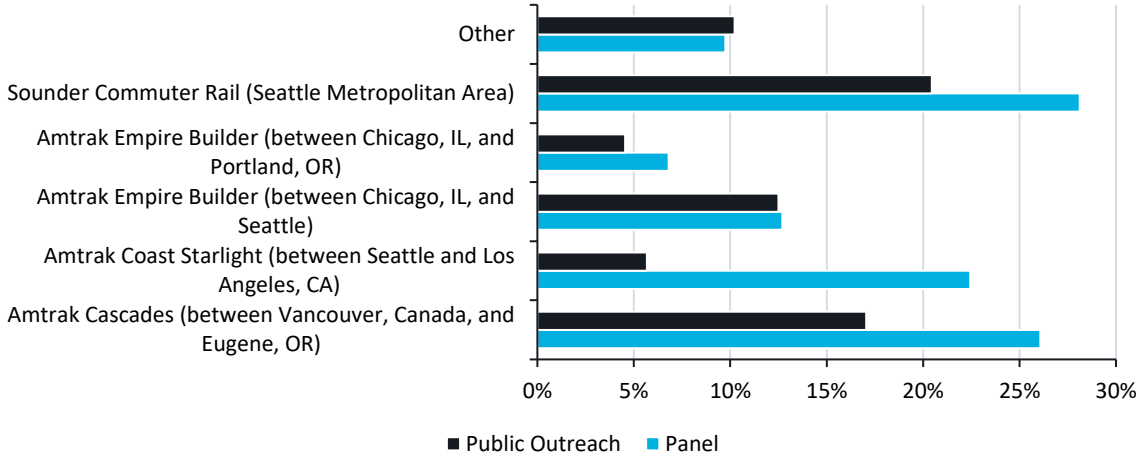


Source: Steer (2020) analysis.

Other Passenger Rail

E.34 Survey participants were also asked if they had used any other passenger rail services in Washington State. The percentages of participants who responded yes to having used each of the specific passenger rail services are shown in Figure E.19. No service had been used by more than 30% of participants across both survey groups. Far fewer public outreach participants had used Amtrak Coast Starlight. Respondents were most likely to have used Sounder Commuter Rail.

Figure E.19: Percentage of Respondents Who Reported Using Other Passenger Rail Services in Washington State



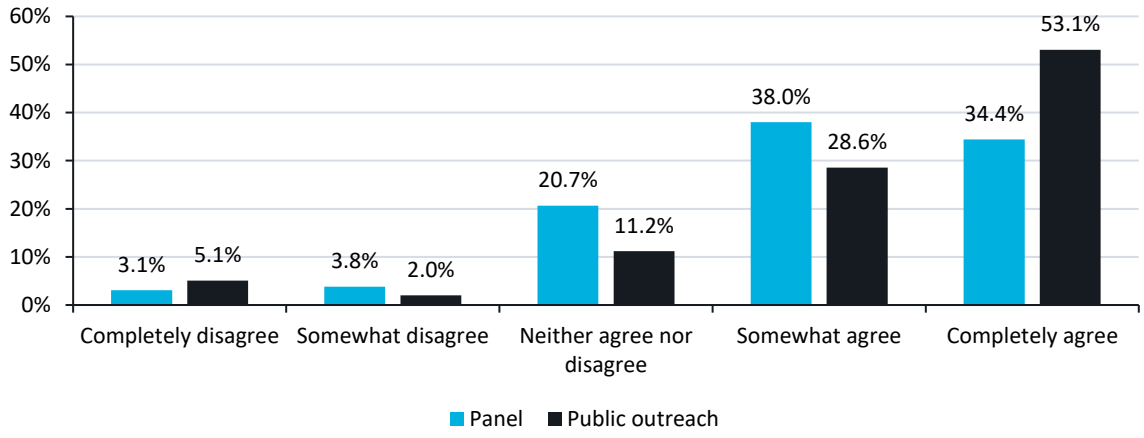
Source: Steer (2020) analysis.

Attitudes Towards East-West Rail

Fun

E.35 Almost three-quarters (74.1%) of all participants somewhat or completely agreed that East-West Rail “sounds like fun”. Meanwhile, 6.9% of respondents disagreed with this statement. As shown in Figure E.20, responses varied somewhat between participant groups, with considerably more public outreach participants indicating they completely agreed that East-West Rail sounds like fun.

Figure E.20: Level of Agreement – East-West Rail Sounds Like Fun

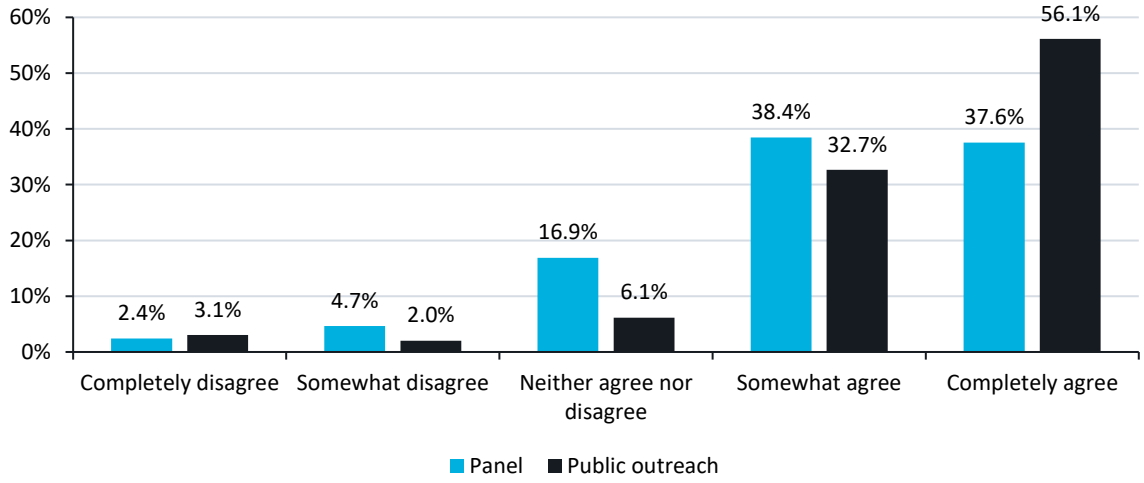


Source: Steer (2020) analysis.

Relaxing

E.36 Only 6.8% of participants somewhat or completely disagreed that East-West Rail "sounds like a relaxing way to travel". While most survey participants agreed with this statement, public outreach participants were slightly more likely to agree than panelists (88.8% of responses). As shown in Figure E.21, public outreach participants were most likely to completely agree with this statement.

Figure E.21: Level of Agreement – East-West Rail Sounds Like a Relaxing Way to Travel



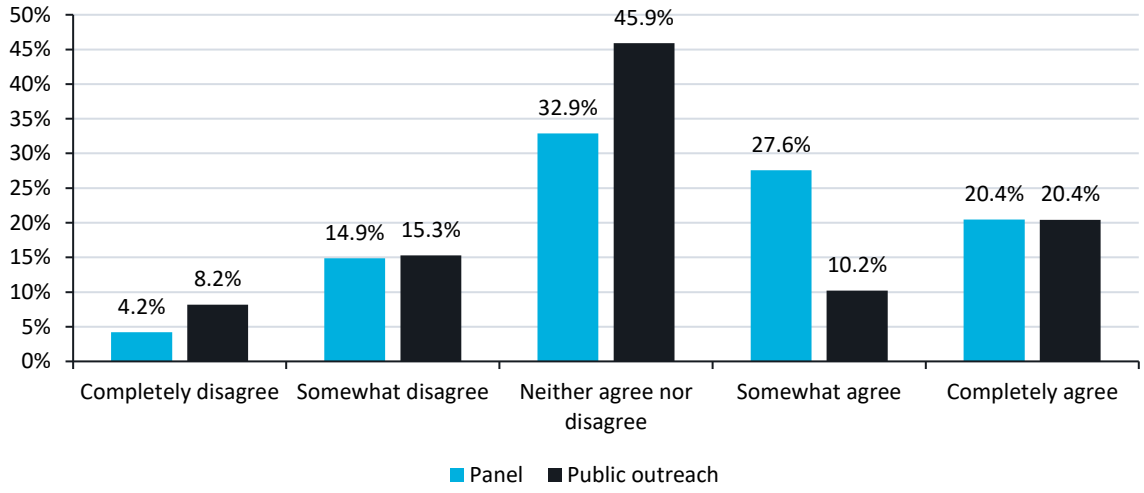
Source: Steer (2020) analysis.

Time Savings

E.37 More than twice as many respondents agreed that taking East-West rail would be quicker than their existing mode of travel by auto (44.9% somewhat or completely agree vs. 19.9% somewhat

or completely disagree). Neither agree nor disagree was the most common response across both survey groups. The level of agreement for both survey groups is detailed in Figure E.22.

Figure E.22: Level of Agreement – East-West Rail Would Definitely Be Quicker Than Taking a Car

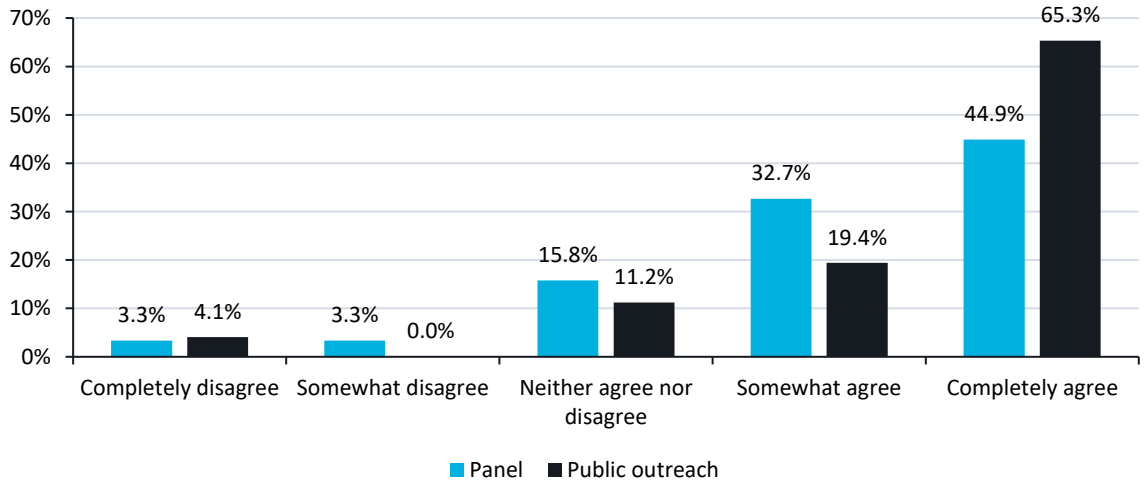


Source: Steer (2020) analysis.

Avoid Delays

E.38 Nearly half (48.5%) of all participants completely agreed that East-West Rail "means I will avoid other transportation delays". Only 6.2% somewhat or completely disagreed with this statement. Overall trends were similar across both survey groups, as shown by Figure E.23.

Figure E.23: Level of Agreement – East-West Rail Means I Will Avoid Other Transportation Delays

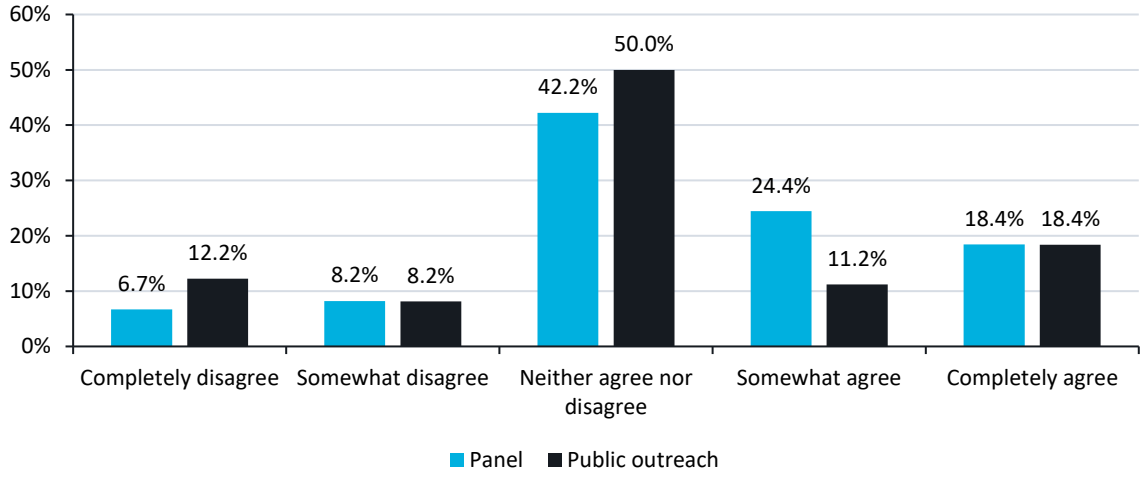


Source: Steer (2020) analysis.

Length of Stay

E.39 Fewer than half of the respondents (40.5%) felt that East-West Rail would allow them to stay longer at their destination. While Figure E.24 shows that the overall distribution of responses was similar across both survey groups, public outreach respondents were almost twice as likely to completely disagree that East-West Rail would allow them to extend their visit.

Figure E.24: Level of Agreement – East-West Rail Means I Can Stay Longer At My Destination

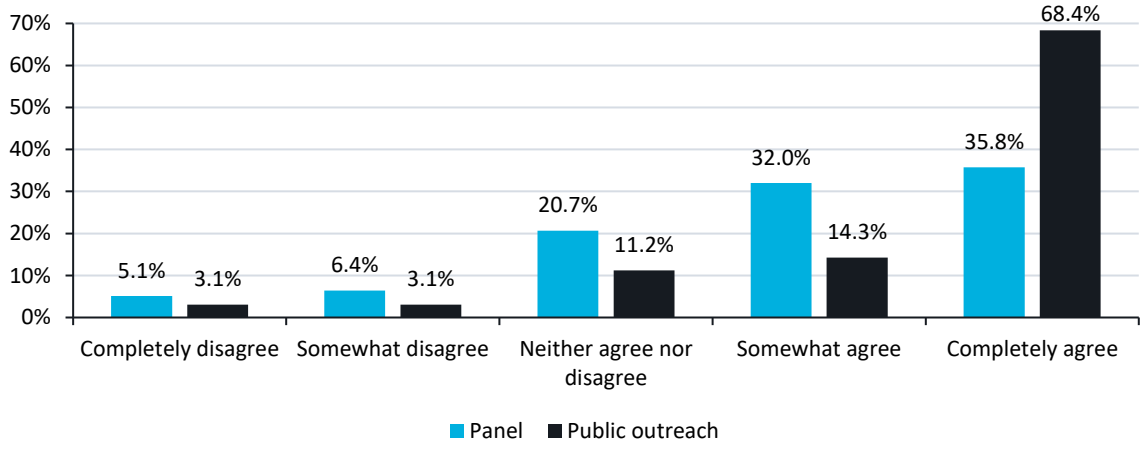


Source: Steer (2020) analysis.

Interest – Use of Service

E.40 Only 4.7% of all respondents completely disagreed and 5.8% somewhat disagreed that they would "definitely try East-West Rail". A sizable majority (70.4%) of participants agreed they would try the service. Public outreach participants were twice as likely as panel members to completely agree with this statement. Responses for both groups are displayed in Figure E.25.

Figure E.25: Level of Agreement – I Would Definitely Try East-West Rail

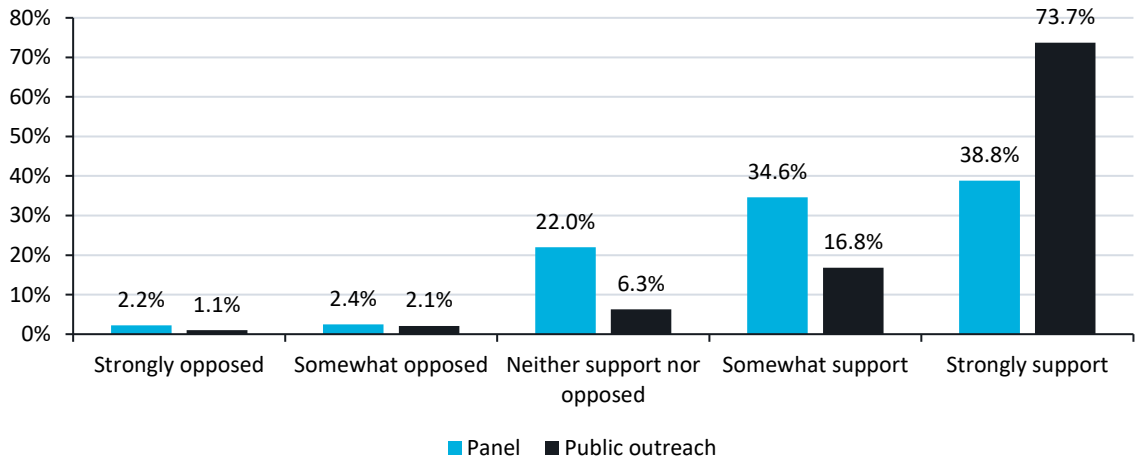


Source: Steer (2020) analysis.

Project Support

E.41 Opinions toward the potential East-West Rail service are captured in Figure E.26. Almost three quarters of public outreach participants strongly support the project. Strong support was less prevalent among panel participants, who were still generally supportive of the project. Across all survey participants, 76.4% were supportive (strongly or somewhat support) of the project. Meanwhile, only 4.4% were somewhat opposed or strongly opposed.

Figure E.26: Level of Support For a Potential East-West Intercity Passenger Rail Service

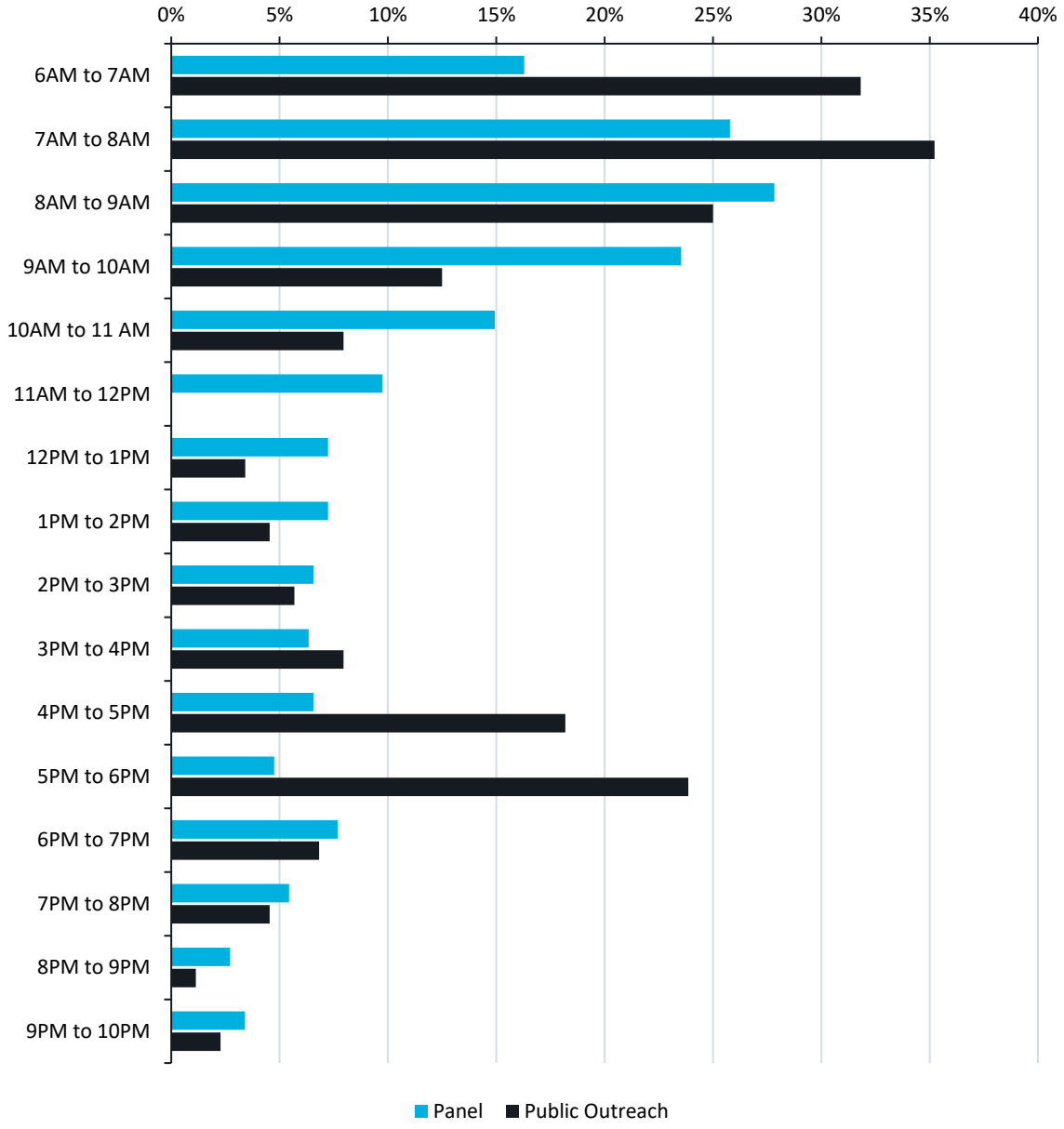


Source: Steer (2020) analysis.

Departure Times

E.42 Respondents were presented with intervals for potential departure times between 6AM and 10PM and asked to select up to two one-hour intervals that would best accommodate their travel needs. The most popular intervals were in the morning and particularly between 7AM to 8AM and 8AM to 9AM (each preferred by 27.4% of respondents). Few participants preferred a departure time in the intervals between 7PM and 10PM. Complete results are summarized in Figure E.27.

Figure E.27: Preferred Departure Times for East-West Rail Service

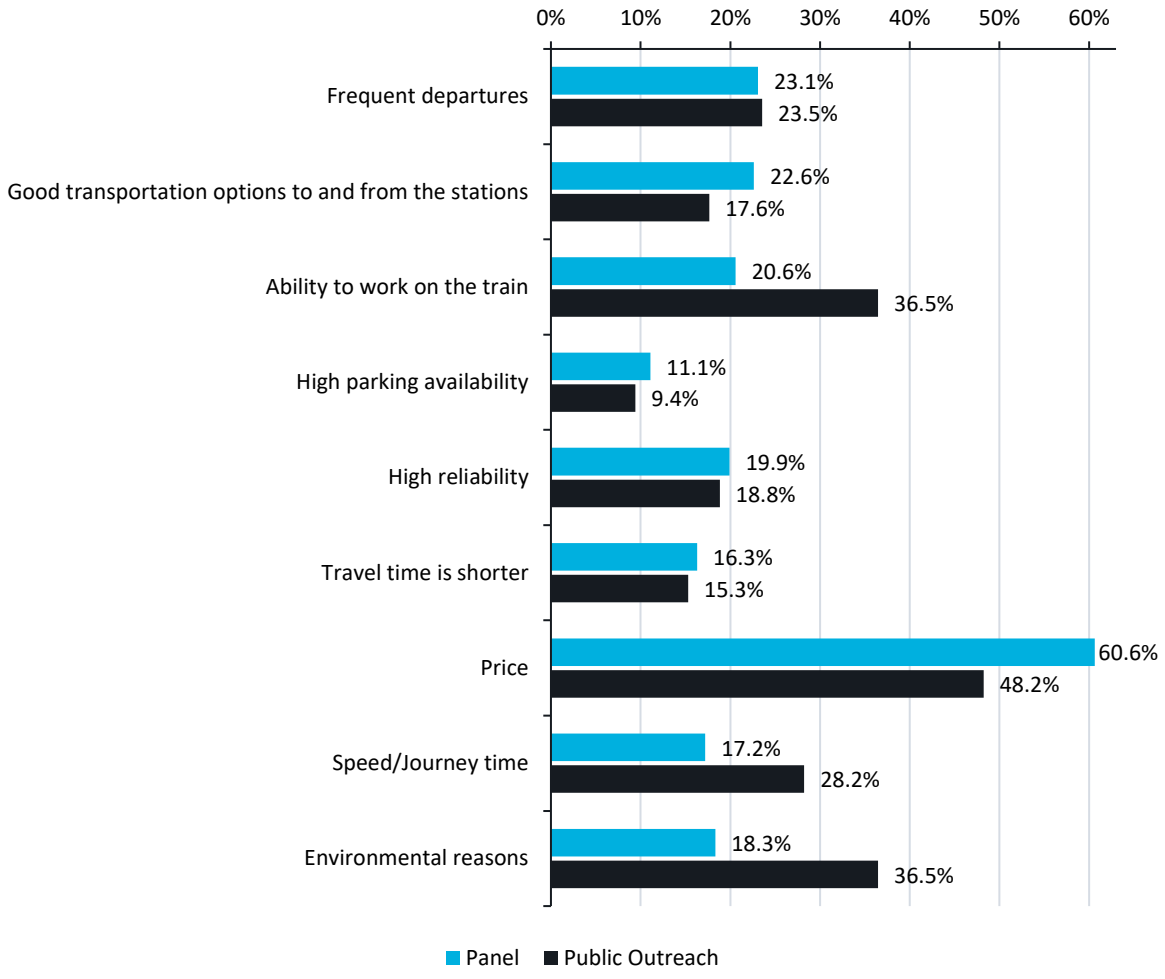


Source: Steer (2020) analysis.

Incentives

E.43 Survey participants selected up to three responses from a list of motivators that would positively influence their decision to take East-West Rail. Results for each survey group are summarized in Figure E.28. Responses were similar across survey groups, with public outreach participants more motivated by the opportunity to work on train. Price was the most common incentive selected by both survey groups (58.6% of all participants). “High parking availability” was selected by the fewest number of participants.

Figure E.28: Relative Importance of Positive Motivators for Taking East-West Rail

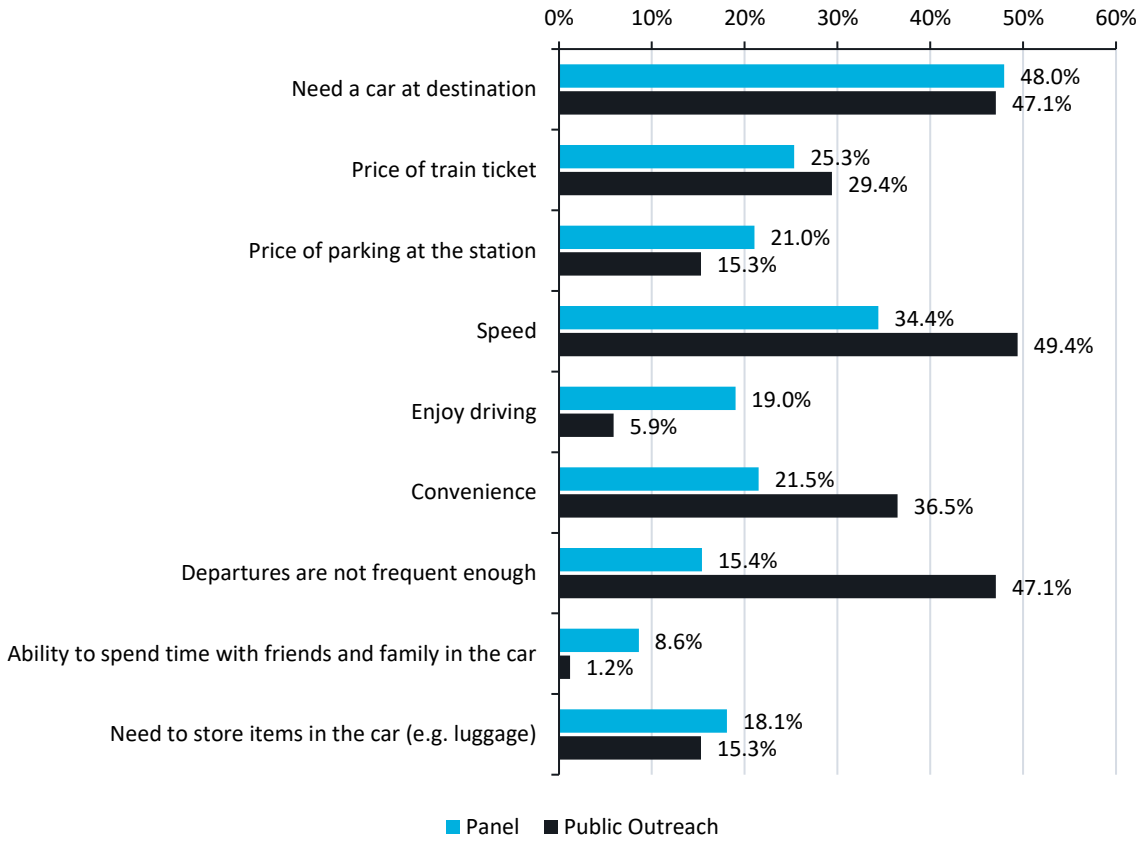


Source: Steer (2020) analysis.

Deterrents

E.44 Respondents were also asked to consider potential deterrents to their use of East-West Rail. Once again, they could select up to three responses. Three key motivators emerged for public outreach participants, each impacting roughly half of this survey group: relative speed, need for car at their destination, and infrequent departures. "Need a car at destination" was also identified as a deterrent by nearly half of panel participants. "Ability to spend time with friends and family in the car" was not found to be a strong motivator for either participant group. Complete results are detailed in Figure E.29.

Figure E.29: Relative Importance of Potential Deterrents Against Taking East-West Rail

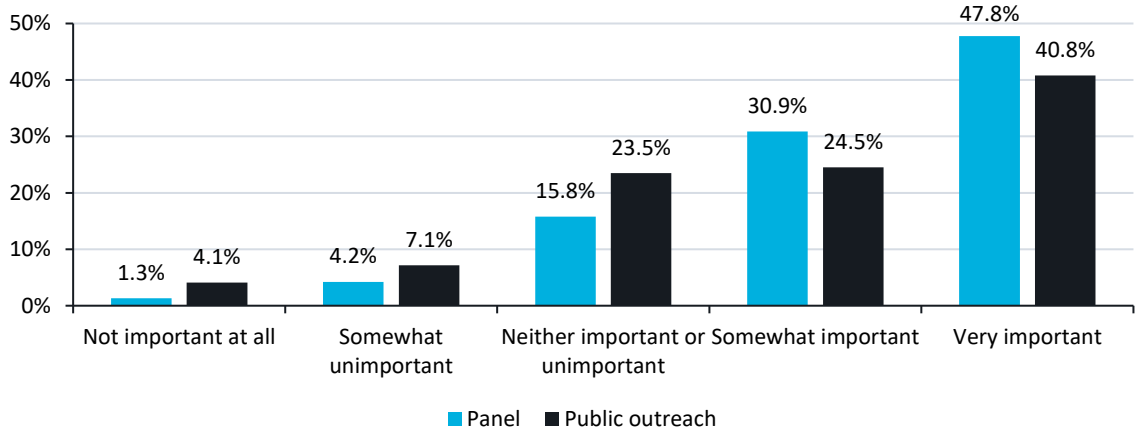


Station Amenities

Internet Access

E.45 Internet access was rated as not important by 1.8% of respondents while 46.5% of respondents rated this as very important. Generally, desires for internet access were comparable across participant groups. However, as shown in Figure E.30, this amenity was rated as somewhat more important amongst panel participants.

Figure E.30: Level of Importance – Availability of Internet Access at Stations

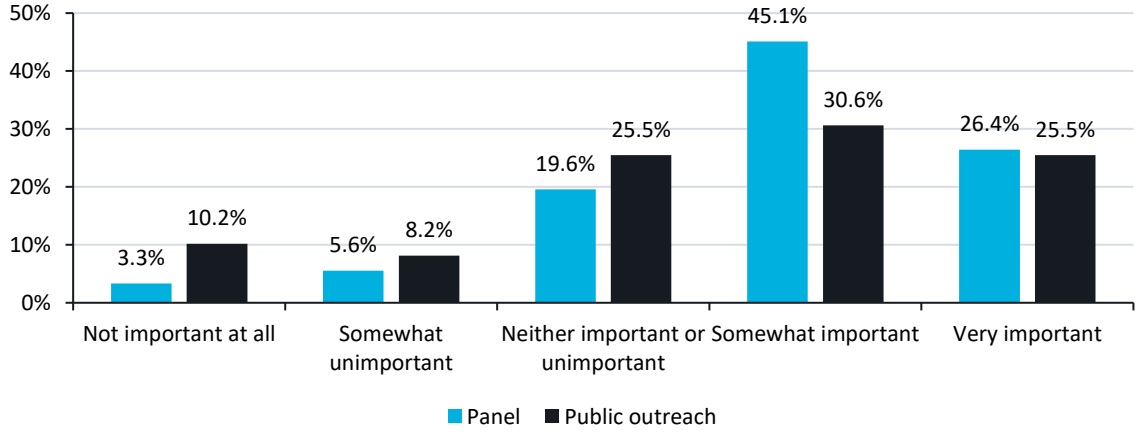


Source: Steer (2020) analysis.

Café Services

E.46 When compared to other amenities included in the survey, café services had the fewest number of respondents (26.3%) rate this amenity as very important. Unalike these other amenities, somewhat important (42.5%) was the most common response from participants. Responses across participant groups varied somewhat and are detailed in Figure E.31.

Figure E.31: Level of Importance – Availability of Café Services at Stations

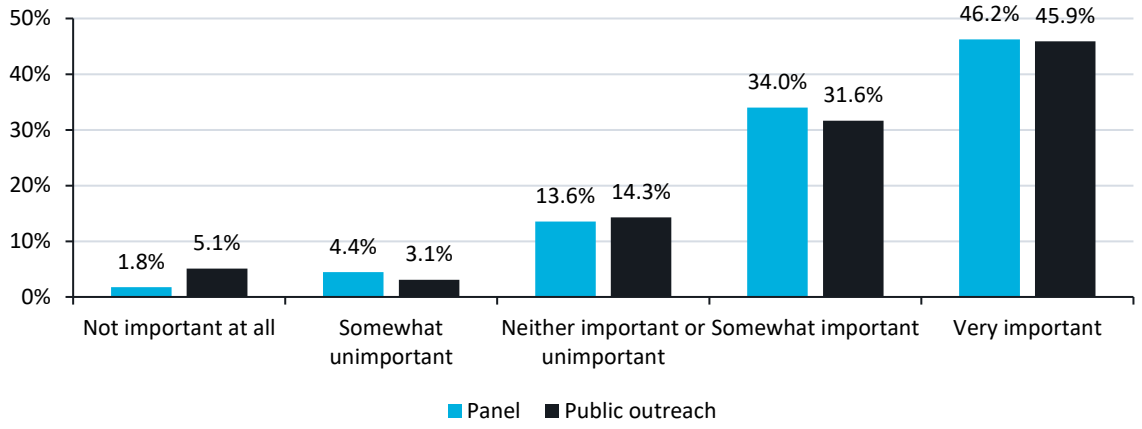


Source: Steer (2020) analysis.

Electrical Outlets

E.47 Four out of five of respondents felt that availability of electrical outlets was either very important (46.2%) or somewhat important (33.6%) at stations. Meanwhile, only 2.4% of respondents felt this amenity was not important at all. As shown in Figure E.32, responses were very similar across participant groups.

Figure E.32: Level of Importance – Availability of Electrical Outlets at Stations

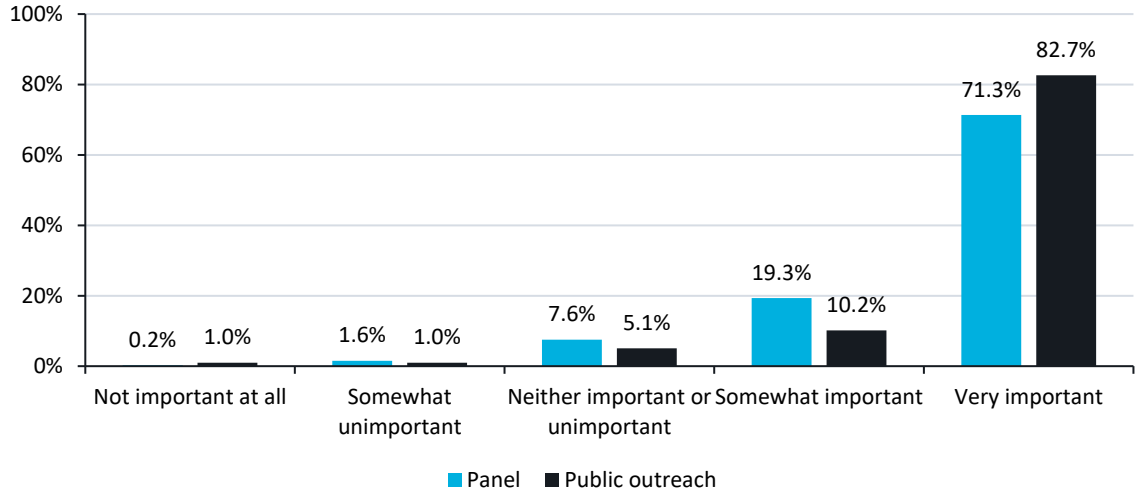


Source: Steer (2020) analysis.

Restrooms

E.48 More respondents identified restroom as very important than any other amenity. Over 90% of respondents felt that restroom access was either somewhat important or very important. Meanwhile, fewer than 2% of respondents felt restroom access was somewhat important or not important at all. Figure E.33 depicts the complete distribution of responses by both survey groups.

Figure E.33: Level of Importance – Availability of Restrooms at Stations

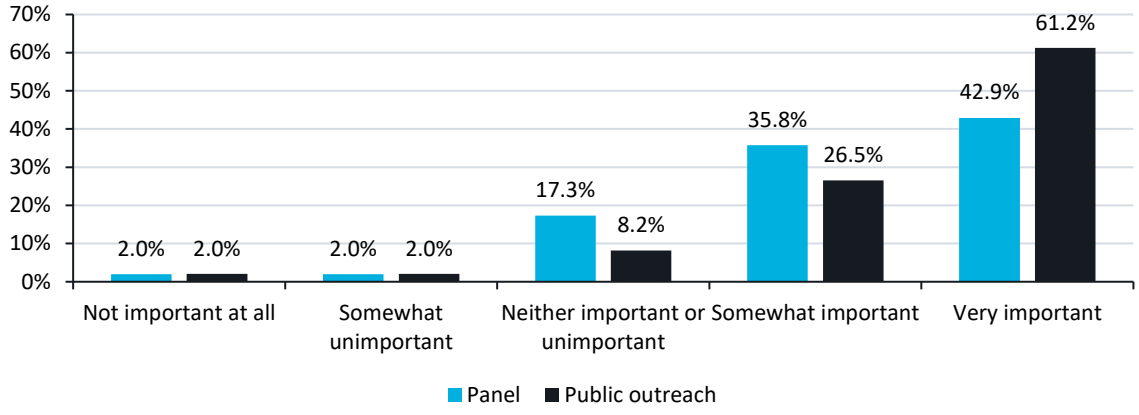


Source: Steer (2020) analysis/

Local Transit Connectivity

E.49 Figure E.34 presents the reported importance of local transit connectivity by both survey groups. Public outreach participants were most likely to rate connections to transit as very important. However, local transit connectivity was important across survey groups and was rated as somewhat or very important by approximately four-fifths (80.3%) of all respondents.

Figure E.34: Level of Importance – Connectivity to Local Transit at Stations

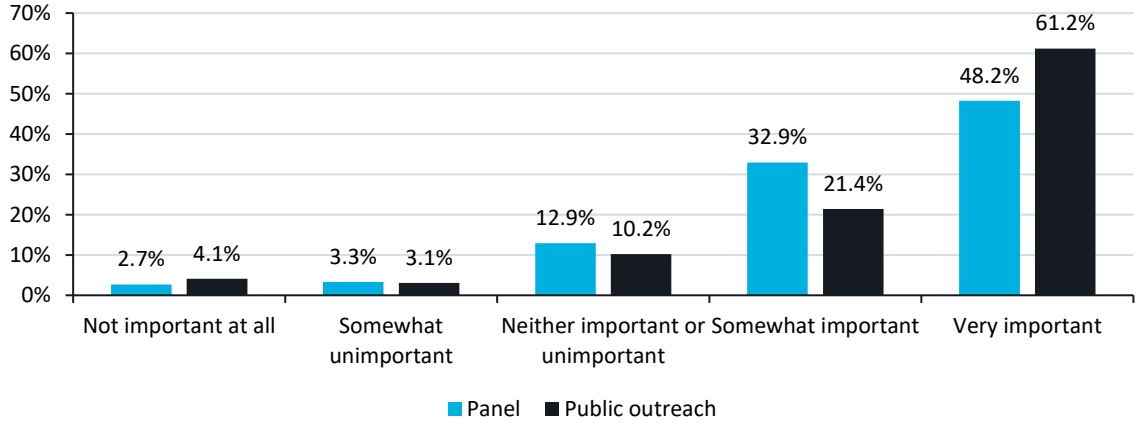


Source: Steer (2020) analysis.

Parking

E.50 Figure E.35 depicts the desirability of parking at stations as reported by both survey groups. Once again, four-fifths of survey respondents (81.4%) listed this amenity as somewhat or very important. Likewise, public outreach participants were more likely than panel participants to report access to parking was very important to them. Only 2.9% of all respondents felt access to parking at stations was not important at all.

Figure E.35: Level of Importance – Availability of Parking at Stations



Source: Steer (2020) analysis.

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