Appendix D
Capacity Analysis Methodology and Initial Investments List

Overview

WSDOT worked with its service partners to examine current and future capacity on the Washington segment of the Pacific Northwest Rail Corridor (PNWRC); identify areas expected to be over-capacity; and develop preliminary infrastructure needs to support each of the preliminary alternatives.

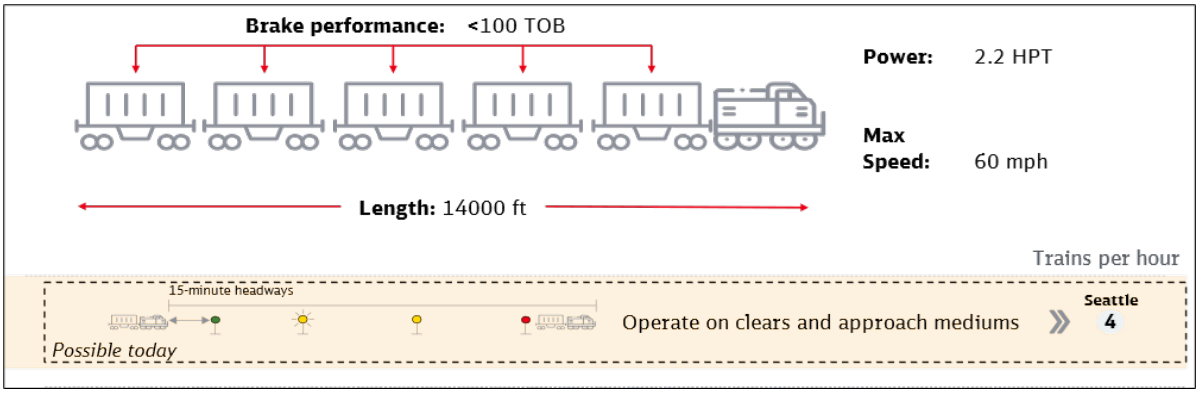
These infrastructure needs are a preliminary assessment of what will be needed for each preliminary alternative. This assessment is subject to further analysis, as well as discussions with host railroads and other stakeholders. While the results of this capacity analysis represent the collaborative efforts of the service partners, it does not indicate the host railroad's endorsement of the capacity study findings. The principles applied by BNSF Railway when considering new or additional passenger rail service on its routes are listed in **Attachment A**.

The capacity analysis was based on 2019 data documenting train movements and extrapolated out to 2045. On BNSF's recommendation, the study assumed all freight traffic would grow 2% annually. On Sound Transit's recommendation, the study assumed that Sounder service would include 41 one-way trains south of Seattle and eight one-way trains north of Seattle in 2045. Amtrak long distance trains in the corridor were kept at the current service level, with one daily roundtrip for both the Empire Builder and the Coast Starlight.

Capacity measurement

Capacity on a corridor is a function of the track and signaling (traffic control) infrastructure, the physical profile/limitations of the corridor, and the characteristics of the train operating over the corridor. While track infrastructure and the corridor profile are easily defined, train characteristics can vary significantly. To address this variable, the analysis used the concept of a 'standard train' to allow for a uniform measurement of how different trains consume corridor capacity. The standard train (shown in **Exhibit 1**) is based on the average characteristics of trains in the 95th percentile of length (and associated performance) in 2019. This conservative assumption about train length and performance was developed in cooperation with BNSF to ensure that capacity on the corridor was not overstated.

Exhibit 1: Standard train characteristics



By understanding the performance characteristics of the standard train on the corridor, the methodology created a defined unit of capacity to analyze the capacity consumption implications of operational and infrastructure decisions. This unit of capacity is based on the amount of time it takes the standard train to traverse a given segment of track. The number of times the standard train could traverse the segment of track (the throughput) in a 24-hour period is the amount of capacity on the given track segment. While the optimal use of a main track in any segment is trains traversing the line at track speed, there are other activities which occur on the main tracks which consume capacity. Since units of capacity are expressions of time, the methodology quantitatively captures the capacity impact of these other activities by identifying the amount of

time taken and simply converting it in the appropriate units of capacity. Capacity consumption was calculated for the following activities:

- Maintenance of way (track maintenance)
- Mainline staging
- Yard and facility entry/exit[4]
- Variability

Using the standard train characteristics and performance, the maximum throughput of multiple track segments was determined to be four trains per hour or 96 trains per day with 15-minute headways. Thus, segments of multiple main tracks have 96 units of capacity per main track, with each unit of capacity representing 15 minutes. The various ways in which capacity is consumed on the corridor are defined in terms of time and converted into units of capacity (i.e., if a staging event on the mainline occurs for 30 minutes, it would consume two units of capacity).

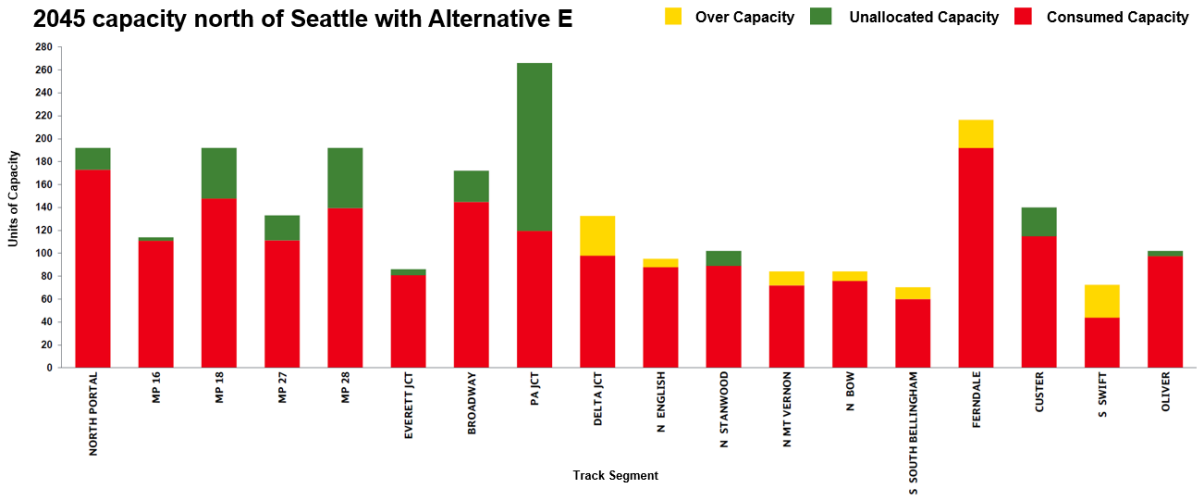
Capacity on segments of the corridor with a single main track function differently because trains operating in different directions cannot operate independently of each other as they theoretically can on a multiple track segment. To account for this, the capacity supply in single track segments was calculated by using the standard train characteristics and performance to determine the maximum throughput of trains on single track segments between passing sidings. Because the route distance and characteristics between passing sidings is not uniform, the amount of time it takes a train to travel that distance using the standard train characteristics varies between single track segments. Units of capacity supply vary from single track segment to single track segment, but the way in which capacity-consuming activities are calculated remains the same.

In general, capacity is most constrained at yards, customer facilities and junctions. These are all locations where trains enter or exit the main track.

Capacity improvements

The infrastructure improvements necessary for each preliminary alternative were identified by applying the future traffic volumes anticipated for Amtrak, Sound Transit, and BNSF in 2045 to determine locations where the anticipated traffic would exceed capacity. An example of this analysis is shown graphically in **Exhibit 2**. This capacity chart is based on Preliminary Alternative E, which has the highest increase in Amtrak Cascades service. It shows the locations between Seattle and Portland where there will not be enough capacity (labeled "over capacity") for the anticipated traffic in 2045.

Exhibit 2: Example rail capacity chart showing where capacity improvements may be needed



The infrastructure improvements were designed to support the estimated future traffic volumes with reasonable adjustments to operating patterns using the minimal amount of new construction. The amount of infrastructure improvements increases with the greater levels of service in each preliminary alternative. Additionally, preliminary alternatives with higher levels of service incorporate the infrastructure of previous the lower service preliminary alternative.

An overview of the infrastructure needs initially identified for each preliminary alternative are shown in **Exhibits 3** and **5** provided below. The locations of these preliminary capacity improvements are shown schematically in **Exhibits 4** and **6**, along with the segments identified as suitable for a 90-mph maximum speed limit.

These infrastructure improvements are an initial assessment of what may be needed for each preliminary alternative. The listing of infrastructure improvements in this Preliminary SDP does not constitute endorsement of the improvements by the host railroads. Further development and analysis will be conducted during the CID SDP process including conducting engineering analysis and cost estimates. In addition, extensive coordination with host railroads and other service partners regarding funding availability, infrastructure and operational impacts to existing capacity and velocity for current and future growth of freight and passenger traffic on the PNWRC will be conducted.

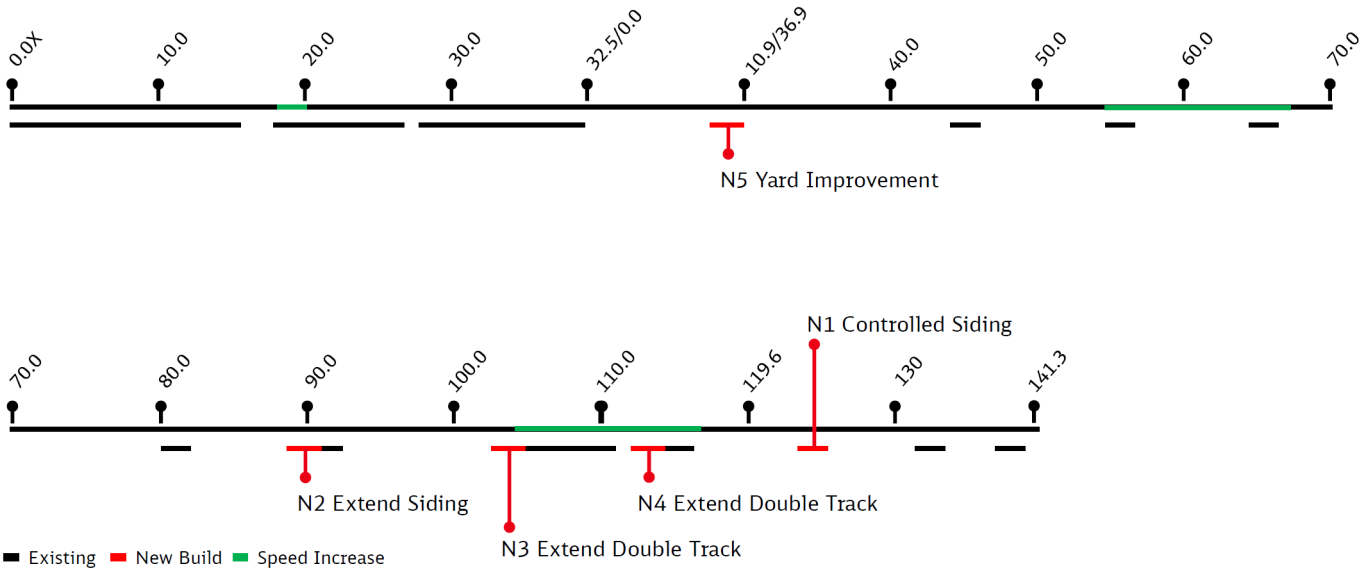
Exhibit 3: Preliminary list of capacity improvements (north of Seattle) *

No.	Improvement Type **	Details	Location	Preliminary Alternative 1	2	3	4	5
N1	Controlled Siding	Allows passenger traffic to pass on New Westminster Subdivision	WHITE ROCK (0.5 Miles)	✓	✓	✓	✓	✓
N2	Extend siding	Allows for additional freight traffic to hold off main	MP 89.9 to S SOUTH BELLINGHAM MP 91.9 (2 Miles)	✓	✓	✓	✓	✓
N3	Extend double track	Increases operational flexibility by extending existing double track	RABANCO MP 104.2 to FERNDALE MP 106.4 (2.2 Miles)		✓	✓	✓	✓
N4	Extend double track	Increases operational flexibility by extending existing double track	CUSTER MP 111.2 to MP 113.5 (2.3 Miles)	✓	✓	✓	✓	✓
N5	Expand Yard Facilities	Allows freight traffic staging for various Bellingham Subdivision customers to hold off main, allows freight traffic to pass	DELTA YARD MP 8.9	✓	✓	✓	✓	✓

** This listing of infrastructure improvements does not constitute endorsement of the improvements by the host railroads*

** * Does not include any necessary improvements in Canada between the Fraser River Bridge and Pacific Central Station in Vancouver, BC*

Exhibit 4: Preliminary locations of capacity improvements (north of Seattle)



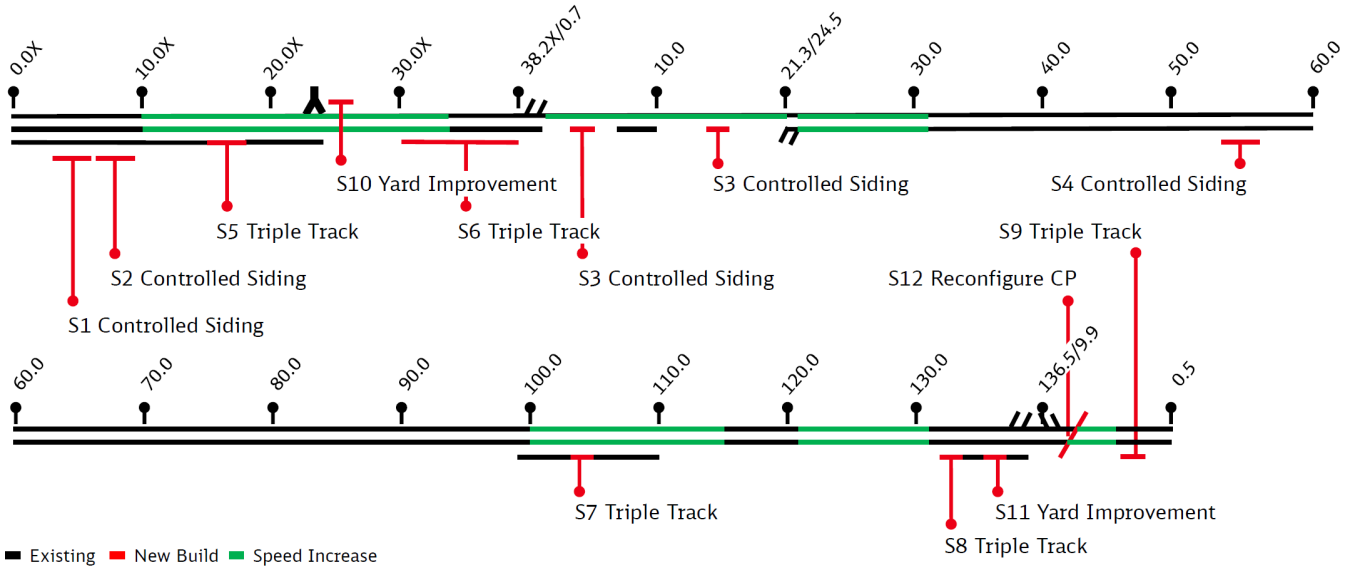
Source: DB E.C.O. North America, Inc.

*Exhibit 5: Preliminary list of capacity improvements (south of Seattle) **

No.	Improvement Type	Details	Location	Preliminary Alternative				
				A	B	C	D	E
S1	Controlled Siding	Allows freight traffic staging, enter/exit from adjacent facilities to do so off main tracks	ARGO MP 3.3X – BOEING MP 6.6X (3.3 Miles)	✓	✓	✓	✓	✓
S2	Controlled Siding	Allows freight traffic staging, enter/exit from adjacent facilities to do so off main tracks	BOEING MP 6.6X to RENTON MP 9.5X (2.9 Miles)					✓
S3	Controlled Siding	Allows passenger traffic to pass on Lakewood Subdivision	CP 40 (2.2 Miles)	✓	✓	✓	✓	✓
	Controlled Siding	Allows passenger traffic to pass on Lakewood Subdivision	DUPONT (0.2 Miles)	✓	✓	✓	✓	✓
S4	Controlled Siding	Minimizes impact to mainline operations in Chehalis area	CENTRALIA SOUTH MP 55.8 to CHEHALIS JCT MP 58.7 (2.9 Miles)			✓	✓	✓
S5	Extend Triple Track	Creates continuous triple track from MP 0.6X to MP 23.8X	JAMES ST MP 15.7X – THOMAS MP 18.5X (2.8 Miles)	✓	✓	✓	✓	✓
S6	Extend Triple Track	Creates triple track approach to/from Tacoma terminal area	CP SUMNER MP 29.7X – TR JCT 38.2X (8.5 Miles)	✓	✓	✓	✓	✓
S7	Extend Triple Track	Creates continuous triple track from MP 97.6 to MP 109.8	LONGVIEW JCT SOUTH MP 102.6 to PEAVEY MP 105.7 (3.1 Miles)	✓	✓	✓	✓	✓
S8	Extend Triple Track	Allows freight traffic staging, enter/exit from Vancouver Yard to do so off main tracks	MP 131.5 to FRUIT VALLEY MP 133.5 (2 Miles)	✓	✓	✓	✓	✓
S9	Extend Triple Track	Allows freight traffic staging, enter/exit from Willbridge Yard to do so off main tracks	WILLBRIDGE MP 4.1 – CP 22 MP 2.2 (1.9 Miles)					✓
S10	Expand Yard Facilities	Allows freight traffic staging, enter/exit from Auburn Yard and Stampede Subdivision to do so off main tracks	AUBURN YARD MP 21.8X	✓	✓	✓	✓	✓
S11	Expand Yard Facilities	Allows freight traffic staging, enter/exit from Vancouver to do so off main tracks	VANCOUVER YARD MP 135			✓	✓	✓
S12	Reconfigure Control Point	Creates at-grade diamond crossing with higher track speed to minimize impact of crossing traffic	N PORTLAND JCT MP 8.1	✓	✓	✓	✓	✓

** This listing of infrastructure improvements does not constitute funding availability or endorsement of the improvements by the host railroads*

Exhibit 6: Preliminary locations of capacity improvements (south of Seattle)



Source: DB E.C.O. North America, Inc.

Attachment A

BNSF Railway Passenger Principles

BNSF is willing to cooperate on passenger rail studies and provide federal, state, and local officials with information. Where passenger rail service is proposed on a minimally used line that BNSF is willing to sell, BNSF shall be paid fair market value for the property. Where passenger rail service is proposed on a line BNSF intends to continue owning and to be jointly used for passenger and freight use, the following principles apply:

- Any passenger rail operation cannot degrade BNSF's freight service, negatively affect BNSF's freight customers or BNSF's ability to provide them with service.

- BNSF must be compensated for any and all costs incurred in providing passenger rail service and make a reasonable return for providing the service.

- Capital investments necessary for passenger rail service are the responsibility of the public, including investments for future capacity which is potentially more expensive, especially in urbanized areas.

- BNSF will not incur any liability for passenger rail operations that it would not have but for those operations. These operations are provided by BNSF primarily as a public service; the relatively modest compensation BNSF receives does not begin to justify assuming the significant liability associated with passenger service.

- Studies of how passenger rail service might be provided must take into account not only the current freight traffic levels, but projected freight traffic growth.

- Investments made for passenger rail projects must not result in BNSF incurring a higher tax burden. Property improvements should not become part of our tax base; materials used should be exempt from all sales and use taxes, etc. or BNSF must be made whole for any increased tax burden.

- BNSF must retain operating control of rail facilities used for passenger rail service. All dispatching, maintenance and construction must be done under the control of BNSF. Passenger stations, parking lots and other non-rail facilities may be publicly owned and operated.

- Studies must reflect BNSF's actual operating conditions and cost structures. For example, construction work estimates must reflect our labor contract costs, schedules cannot assume that we will not operate any freight trains during peak commuter periods, etc.

- BNSF will limit passenger rail operations to the passenger schedules initially agreed upon and for which the capital improvement plan has been designed. Future expansions will have to undergo the same analysis and provide any required capital improvements before schedules can be altered, service added, or stations added.

- Improvements must include grade crossing protection and intertrack fencing as required to minimize the risk of accidents, due to liability and service interruption concerns.

BNSF's relationship with Amtrak intercity passenger service is governed by Federal regulation supplemented by an operating contract between BNSF and Amtrak. Please direct questions about passenger rail service on BNSF Railway to www.bnsf.com/about-bnsf/contact-us/ or the passenger rail sponsoring agency.

Includes revisions from August 2007 and February 2023