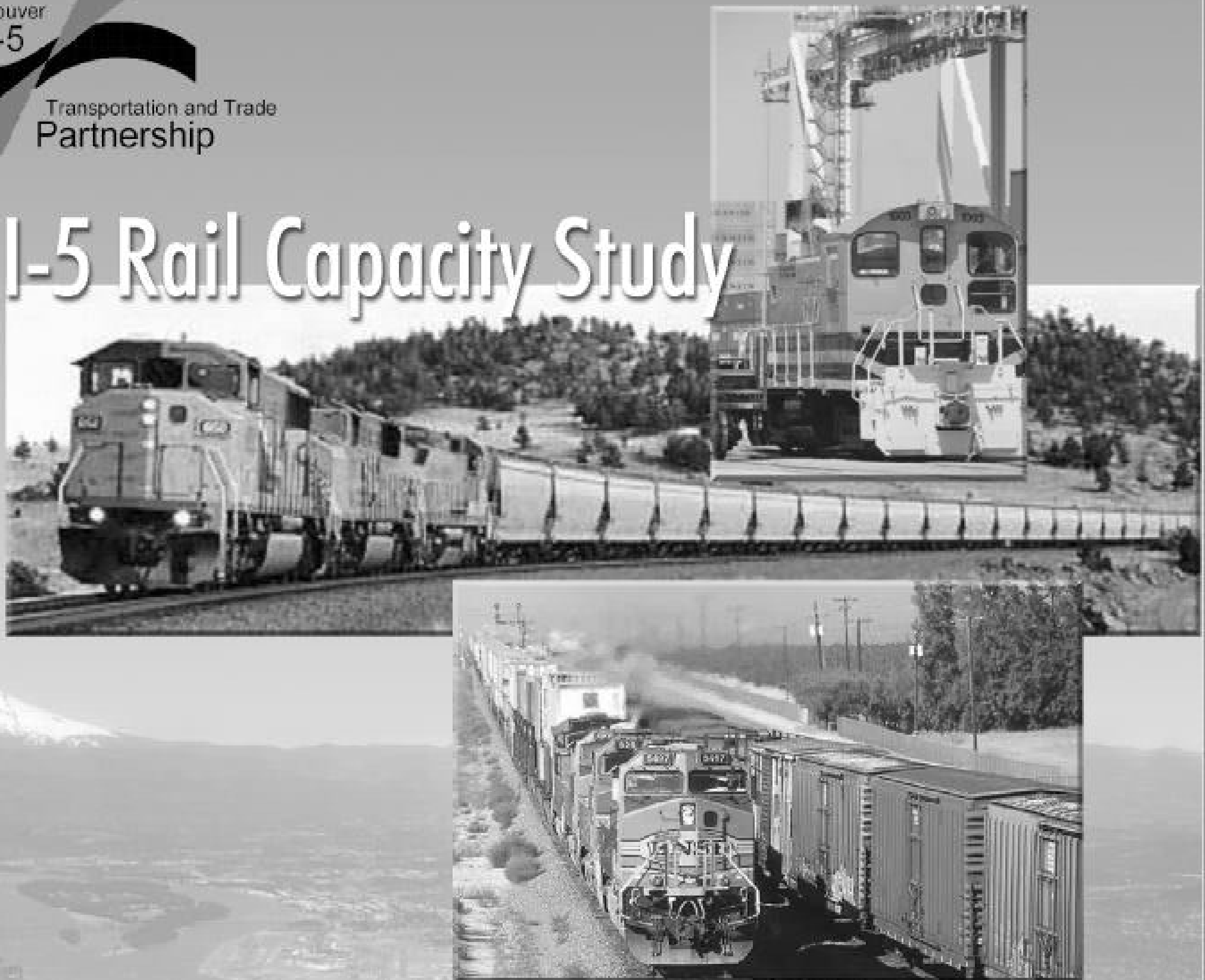
Portland / Vancouver
I-5
Transportation and Trade
Partnership

I-5 Rail Capacity Study



February 2003

submitted by HDR

I-5 Rail Capacity Study

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Preface

The I-5 Transportation and Trade Partnership brought together Washington and Oregon citizens and leaders to respond to concerns about growing congestion in the I-5 Corridor. Governors Gary Locke and John Kitzhaber appointed a bi-state Task Force of community, business, and elected representatives to develop a strategic plan for the I-5 Corridor between I-84 in Oregon and I-205 in Washington. In developing the strategic plan, the Task Force was guided by the following Problem Statement:

> *The Interstate 5 Corridor is the most critical segment of the regional transportation system in the Portland/Vancouver metropolitan area. The Corridor provides access to many of the region's most important industrial sites and port facilities, and is a link to jobs throughout the Portland/Vancouver region. Due to infrastructure deficiencies, lack of multi-modal options, land use pattern and increasing congestion, businesses and individuals experience more frequent and longer delays in the Corridor. Without attention, the Corridor's problems are likely to increase significantly, further impacting the mobility, accessibility, livability and economic promise of the entire Region.*

Rail Capacity Study

As part of the ongoing I-5 Transportation and Trade Partnership Study, the Oregon and Washington Departments of Transportation examined the long-term need for, and availability of, rail capacity in the I-5 Corridor between I-205 and I-84, and how it is affected by and affects operations throughout the Northwest. The analysis examined current conditions, the likely increased demand and capacity for passenger and freight rail service over short- and long-term periods. Demand and capacity were compared to assess the need for operational or physical improvements to the rail network and support facilities. The role of freight rail service in the Portland/Vancouver regional economies was a key consideration of potential benefits of improvements.

The technical advisory committee for this Rail Capacity Study included representatives from Burlington Northern Santa Fe (BNSF) and Union Pacific (UP) railroads, Amtrak, the Oregon and Washington State Departments of Transportation (ODOT and WSDOT), the ports of Portland and Vancouver, the cities of Portland and Vancouver, the Southwest Washington Regional Transportation Council (RTC), and the Portland Metro (Metro). The final report was provided to the I-5 Partnership Task Force, which made findings and recommendations that are included in this report.

Parallel to this study was an assessment of commuter rail. The I-5 Rail Capacity Study made findings regarding the capacity of the current rail system to accommodate commuter services, but did not include evaluation of commuter rail proposals, which was completed by ODOT, WSDOT, Metro and RTC.

The Final Report

This final report of the I-5 Rail Capacity Study is available in both written and electronic format. The electronic format also contains MS PowerPoint® presentations made to the I-5 Task Force.

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Executive Summary

Summary of Issues

The Portland/Vancouver area is a key transportation hub. Its deep draft ports at the confluence of the Columbia and Willamette rivers meet the 600-mile Columbia-Snake river system. It hosts two transcontinental railroads with water-level routes to the east, and north-south connections with Washington State and California. Interstate 84 provides a water-level route to the east, while Interstate 5 is one of the nation's most significant north-south international corridors.

Rail is an important component of the Portland/Vancouver transportation hub. The region's freight rail network, as shown in Figure ES-1, includes five major rail yards, numerous lesser rail yards, and port terminals. The system serves the state's largest collection of industrial customers and provides access to the ports of Portland and Vancouver.

The Burlington Northern/Santa Fe Railroad (BNSF) serves the area from yards in Vancouver and Portland. Its mainline crosses the Columbia River on a double-track, swing-span bridge that is used by Union Pacific Railroad (UP) and Amtrak, as well as BNSF. Its mainlines run north to Seattle and east along the north side of the Columbia River (known as the Fallbridge subdivision). The UP serves the Portland area through several yards with connections east along the south side of the Columbia River and south on the former Southern Pacific line. UP has access to the Seattle area over the BNSF mainline. The freight rail system is rounded out by several shortline and switching railroads providing local services.

Intercity passenger rail services are provided by Amtrak, which operates the *Coast Starlight*, the *Empire Builder*, and *Cascades* trains. Amtrak operates over the UP line south of Portland to points in Oregon and California, and over the BNSF north to Seattle and northeast to Spokane. Because the rail lines over which Amtrak operates are privately owned and operated, expansion requires cooperative agreements with the freight railroads.

Nearly 150 freight trains and 10 passenger trains per day are dispatched through this rail network. Sixty-three freight trains and 10 Amtrak trains per day cross the BNSF Columbia River railroad bridge. Bridge crossings by freight trains are projected to reach 90 per day in 20 years, while long-range passenger service plans anticipate 26 trains per day. The flow of these trains is interrupted several times per day by openings of the BNSF Columbia River railroad bridge for marine traffic.

The capacity of the Portland/Vancouver rail network is significant because:

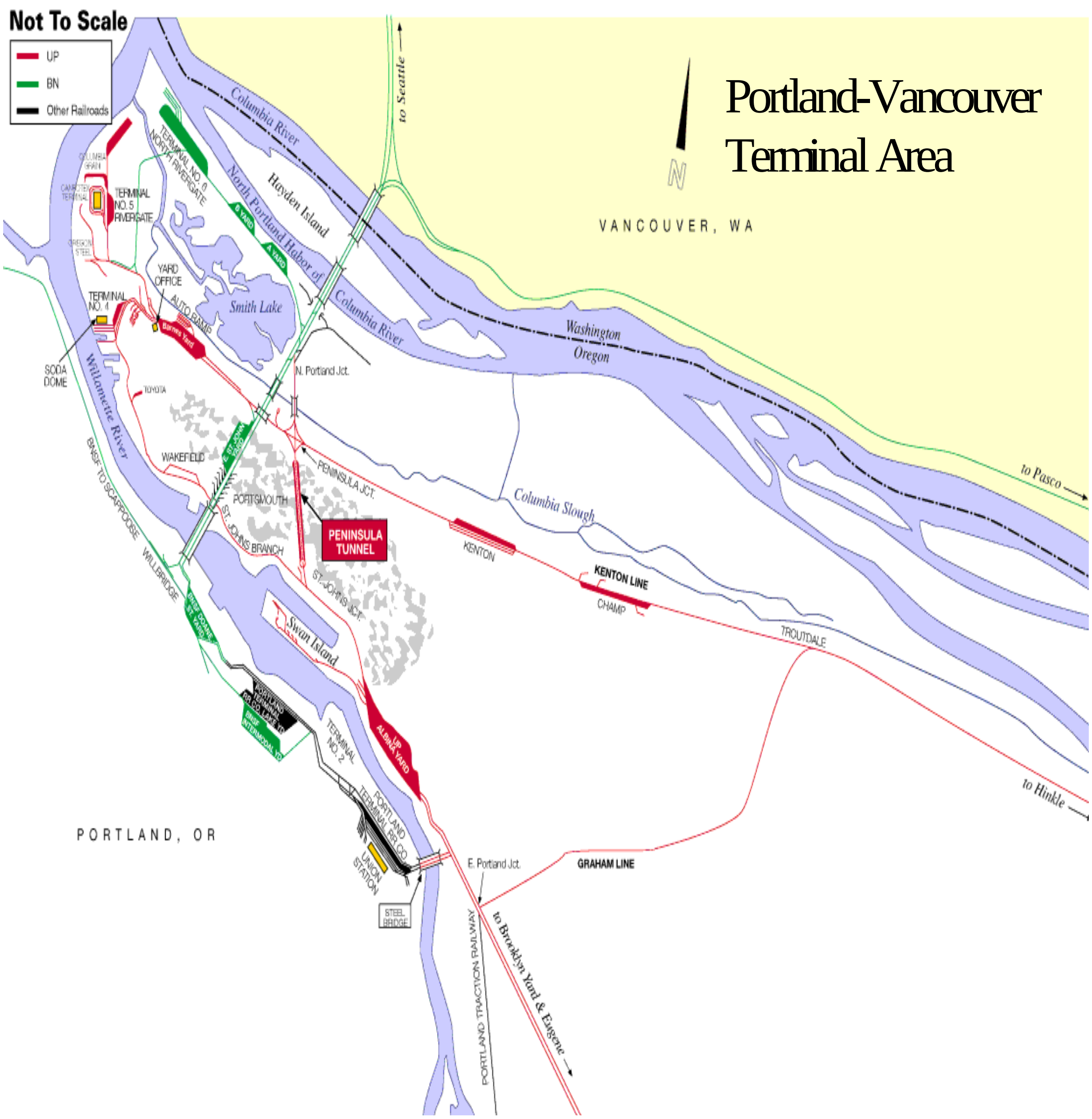
- Rail is critical to the area's economy.
- Rail passenger service is a key element in the region's transportation system.
- Solutions to rail capacity will require joint public-private cooperation.

The I-5 Rail Capacity Study

Analyses using a sophisticated computer simulation model, the Rail Traffic Controller Model (RTC), estimated the existing and future capacity of the Portland/Vancouver rail network and determined the improvements that could improve capacity of both freight and passenger services.

A technical advisory committee composed of representatives of the BNSF and UP railroads, Amtrak, the ports of Portland and Vancouver, the cities of Portland and Vancouver, the two state departments of transportation, Southwest Washington Regional Transportation Council, and Metro, reviewed the results of simulations, and made recommendations to the I-5 Partnership Task Force.

Figure ES-1. Portland/Vancouver Railroad Network



The study posed several key questions. The questions and the answers to those questions are both sobering and encouraging: *sobering* because the capacity of the system turned out to be worse than anticipated when the study commenced; *encouraging* because the improvements needed to correct the situation are incremental in nature and less expensive than expected given the severity of existing restrictions. The key questions and the study results follow.

What is the capacity of the Portland/Vancouver rail network to meet present and future freight and passenger needs?

- Is capacity sufficient to accommodate present and future rail freight needs?

  No, the system is saturated. Train delay ratios in this corridor already approach levels experienced in much larger, denser corridors such as those within the Chicago area.

- Is there sufficient capacity to support future development of the ports of Portland and Vancouver?

  No, the study found that trains were significantly delayed getting into and out of Port of Portland terminals and there is very little capacity to add the additional trains that would be needed if the terminals expanded or if a new terminal was added. Among the fastest-growing train types are intermodal (container) and auto trains, which are time-sensitive, and unit trains which need large areas to enter, exit, and turn at terminals.

- Will there be sufficient capacity to support increased intercity passenger service from Eugene to Portland to Seattle?

  No, additional capacity will have to be found if additional passenger trains are to operate in the system.

What improvements are needed in the rail network to ensure adequate capacity now and in the future?

- *Some relatively low-to-medium-cost solutions can significantly improve existing capacity.*
- *In the long term, major improvements will be needed to accommodate growth of both passenger and freight rail.*

What happens if rail capacity does not increase?

- *Shipping costs will increase and reliability will decrease. Rail shippers will be forced to divert traffic, change modes, or relocate.*
- *Intercity passenger service cannot grow.*

Findings of the I-5 Partnership Task Force

The I-5 Partnership Task Force was a bi-state committee appointed by the governors of Oregon and Washington to develop a strategic plan for the I-5 Corridor between I-84 in Oregon and I-205 in Washington. In developing the strategic plan, the Task Force looked at the needs of the highway, transit and heavy rail systems in the corridor. Based on the results of the I-5 Rail Capacity Study, the Task Force advanced the following findings regarding rail freight, intercity passenger services and needed improvements to the heavy rail network in the Portland/ Vancouver area.

To view the complete text of the I-5 Partnership Task Force Recommendations for Rail, please see Appendix B.

Summary of Findings for Freight and Intercity Passenger Rail

(a) Several low-to-medium-cost solutions can significantly improve existing rail capacity.

(b) Additional passenger service in the Portland/Vancouver corridor will require major rail capacity improvements as well as agreements between the railroads and affected state Departments of Transportation.

(c) Principal "incremental" improvements include:

- i. Two-main track bypass around BNSF's Vancouver Yard
- ii. Revised crossovers and higher turnout speeds at North Portland Junction
- iii. Second main track and increased track speeds between North Portland Junction, Peninsula Junction, and Fir on UP's Kenton Line
- iv. Expanded capacity and longer tracks at Ramsey and Barnes yards
- v. Connection in the SE quadrant at East Portland between UP's Brooklyn and Graham Lines
- vi. Increased track speeds between UP Willsburg Junction and UP Albina Yard
- vii. An upgraded "Runner" or River Lead between Albina and East Portland, and a second track through the East Portland interlocking

(d) The "incremental improvements" are sufficient to address capacity needs for approximately 5 to 10 years.

(e) In approximately 10 to 20 years, additional improvements beyond the identified "incremental improvements" will be needed to accommodate growth.

(f) Within the next 10 to 20 years, improvements to accommodate the growth on the rail system may include the separation of the UP and BNSF rail lines at North Portland Junction.

(g) The incremental improvements, and later additional improvements noted in (e) above, will provide acceptable freight capacity for 10 to 20 years, and some marginal capacity to accommodate the 10-year plans for eight additional intercity passenger trains, but not for commuter rail service.

(h) Determining the exact nature and cost of these incremental and additional future improvements will require further study.

(i) If rail capacity does not increase, reliability will decline and travel time and shipping costs may increase.

(j) If intercity passenger rail service is to expand, privately owned rail facilities would require public-private cooperation to address capacity issues.

(k) The economics of freight movement result in freight rail not being as competitive with trucks at distances of less than 500 miles, depending on commodity shipped.

(l) If capacity improvements are not implemented, rail congestion will increase, and shippers will consider alternative modes of moving freight.

(m) The cost of delay to the freight railroads – as related to direct rail-operating costs – will vary depending on geographic area, and types of trains and commodities shipped.

(n) A relocated lift span in the center of the BNSF's Columbia River railroad bridge would result in greater and safer use of the center span of the Interstate bridges by barge traffic.

Summary of Rail Freight Recommendations

(a) The proposed Bi-State Coordination Committee should establish a public-private forum to implement these rail recommendations.

(b) The Bi-State Coordination Committee, through the Rail Forum, should initiate an aggressive program to:

i. Facilitate the efficient rail movement of freight

ii. Coordinate the multi-modal transportation services and streamline the movement of freight

iii. Coordinate with other freight movers to facilitate intermodal connections, minimize conflicts among modes, and maximize cooperation

iv. Develop strategies to implement the findings of the I-5 Partnership Rail Capacity Study

(c) Study and pursue the rail infrastructure improvements required to accommodate anticipated 20-year freight rail growth and frequent, efficient intercity passenger rail service between Seattle, Portland, and Eugene.

(d) The Bi-State Coordination Committee, through the Rail Forum, should also:

i. Negotiate the cost-allocation responsibilities between public and private stakeholders.

ii. Work collaboratively with regional governments and agencies to advocate for the funding and implementation of rail projects at federal, state, regional and local levels.

iii. Explore means to facilitate the operation of the BNSF Columbia River Rail Bridge by seeking funding for the replacement of the existing swing span with a lift span located closer to the center of the river channel.

iv. Coordinate with the Congressional delegations of both states, regional agencies, and railroads, to encourage the U.S. Coast Guard to recognize the hazard to navigation caused by the location of the existing BNSF Columbia River railroad bridge's swing span opening, and to award Truman-Hobbs Act funding to replace the existing swing span with a lift span.

Summary of Intercity Passenger Rail Recommendations

(a) The Bi-State Coordination Committee, through the Rail Forum, should:

i. Coordinate efforts by both states to encourage greater funding at the state and federal levels for additional intercity passenger rail service along the federally designated, Pacific Northwest High Speed Rail Corridor, recognizing the need to ensure compensating capacity to the private railroads for any loss of freight capacity.

ii. Coordinate with the Congressional delegations of both states to encourage passage of pending federal legislation for enhanced funding of High Speed Rail service in the Corridor.

iii. Work cooperatively with freight railroads to add capacity to the existing rail lines, where appropriate, to enable additional operation of intercity passenger rail service.

iv. Support efforts to add capacity outside the Portland/Vancouver region that will improve train speeds and enable additional intercity passenger rail service.

Figure ES-2, on the following page, illustrates the improvements recommended to preserve and improve heavy rail capacity in the Portland/Vancouver area. These improvements would improve service considerably for the next 5 to 10 years by significantly reducing train interference. A preliminary estimate places the cost range for these improvements at $170 million.

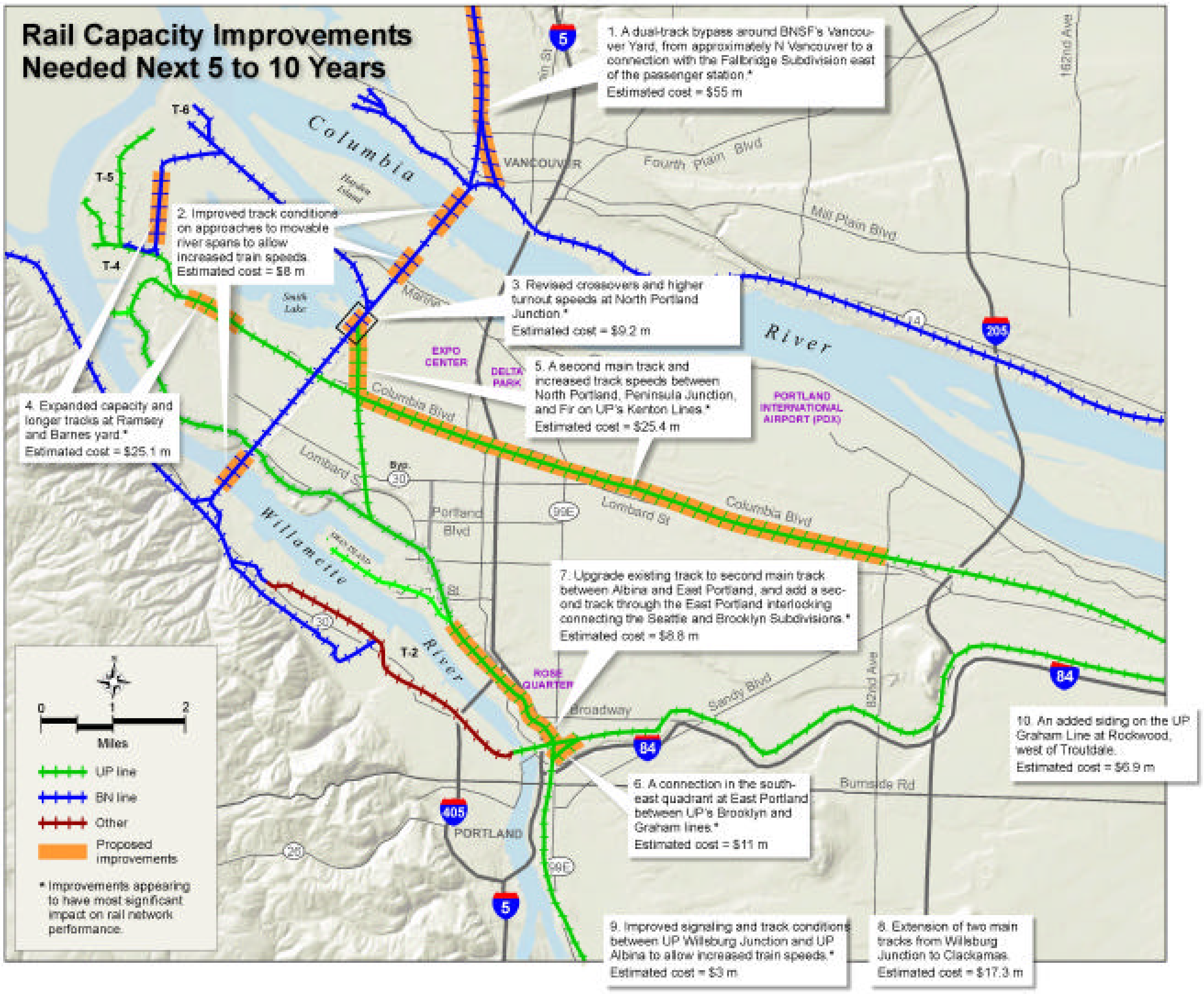
In the longer term, as the number of trains in the corridor continues to increase, it will also be necessary to provide an additional improvement to alleviate the need for UP and BNSF trains to cross in front of each other when entering and exiting the mainline in the area of the BNSF Columbia River railroad bridge between Vancouver Junction and North Portland Junction. That improvement, coupled with those described in the map, would accommodate projected growth for 10 to 20 years.

Table 1. Incremental Improvements

No.	Proposed Improvements**	Estimated Costs
1.*	**A two-main track bypass around BNSF's Vancouver Yard, from approximately N. Vancouver to a connection with the Fallbridge subdivision east of the passenger station.** *This improvement eliminates conflicts with trains moving from the BNSF mainline on the north side of the Columbia River (the Fallbridge subdivision) and north of Vancouver. The project is in the environmental phase.*	$55.0M
2.	**Increased track speeds across the movable river spans.** *The purpose of this improvement is to increase train speeds to more quickly clear the mainline in the area of the Columbia River and Oregon Slough.*	$8.0M
3.*	**Revised crossovers and higher turnout speeds at North Portland.** *Trains moving between the BNSF mainline and the Union Pacific line at North Portland tie up the mainline until the move is completed. The improvements increase speeds and reduce blockage time.*	$9.2M
4.*	**Expanded capacity and longer tracks at Ramsey and Barnes yards.** *Some of the capacity problems identified in the base run were the result of inadequate capacity in these yards.*	$25.1M
5.*	**A second main track and increased track speeds between North Portland, Peninsula Junction, and Fir, on UP's Kenton Line**. *This would permit more trains to pass each other in this area.*	$25.4M
6.*	**A connection in the southeast quadrant at East Portland between UP's Brooklyn and Graham lines**. *Currently, northbound trains on the old SP mainline cannot turn onto the Graham line and must proceed north through the yards to the Kenton line, and vice versa for trains going south on the old SP mainline.*	$11.0M
7.*	**Increased track speeds between UP Willsburg Junction and UP Albina Yard.** *This would help to move trains in and out of Albina Yard more quickly.*	$8.8M
8.	**Extension of two main tracks from Willsburg Junction to Clackamas.** *Allows trains to pass and improves access to Albina Yard.*	$17.3M
9.*	**An upgraded "Runner" or River Lead through Albina Yard.** *Allows trains to move along the river with less interference to through trains.*	$3.0M
10.	**An added controlled siding (4 alternatives) on the UP Graham Line at Rockwood, west of Troutdale.** *Allows more efficient passing of trains.*	$6.9M
Total (*Approximate*)		**$169.6M**

*****Improvements that appear to have most significant impact on performance of rail network.*
******This list does not include the longer-term need for a flyover or under-crossing of the BNSF mainline.*

Figure ES-2. Portland/Vancouver Rail Network – Rail capacity improvements needed in the next 5 to 10 years.



Chapter 1: Background

Analysis of rail service was a key element of the I-5 Transportation and Trade Partnership strategic planning process. Rail is a critical component of the area's economy, and Amtrak service is important to the region's transportation system. The map, Figure 1-1 on the following page, identifies the major features of the Portland/Vancouver rail network. Limited rail system capacity is a threat to the transportation system, to the local economy, and to expansion of intercity passenger services. Solutions to rail capacity will require joint public-private cooperation.

The I-5 Rail Capacity Study considered a number of key questions:

- What is the capacity of the Portland/Vancouver rail network to meet present and future freight and passenger needs?
- Is capacity sufficient to accommodate present and future rail freight needs?
- Is there sufficient capacity to support future development of the ports of Portland and Vancouver?
- Will there be sufficient capacity to support increased intercity passenger service from Eugene to Portland to Seattle?
- What improvements are needed in the rail network to ensure adequate capacity now and in the future?
- What happens if rail capacity does not increase?

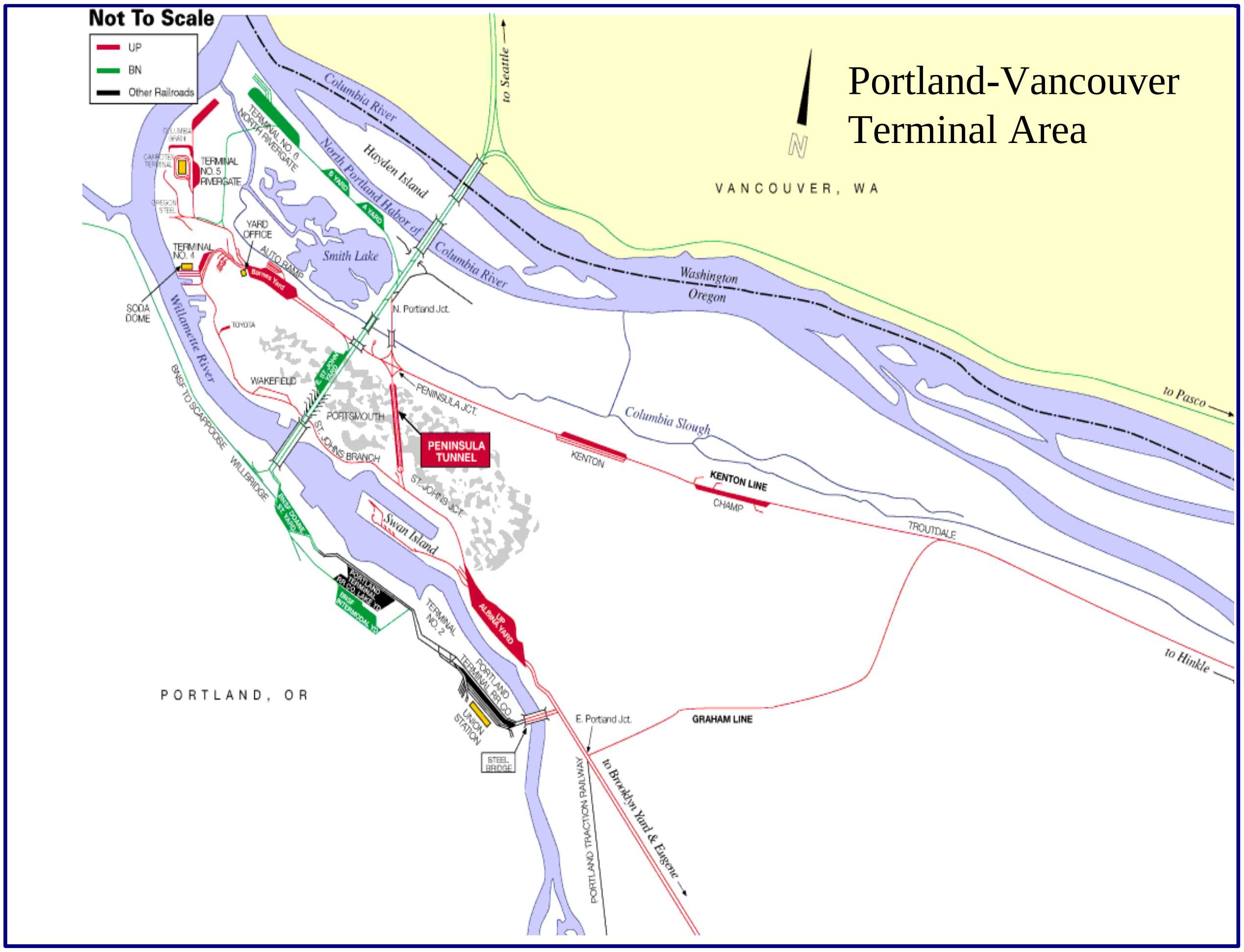
To address these issues, a Technical Advisory Committee comprised of officials from local and regional governments, Oregon and Washington Departments of Transportation, and the three railroads, was established. A rail traffic computerized simulation model was used to analyze the current level of service and alternatives for improving service and addressing growth needs.

This chapter describes the study objectives, the simulation model used to analyze rail capacity needs, and the work of the Rail Capacity Technical Advisory Committee. Chapter 2 describes existing operating conditions. Chapter 3 describes projects that could be implemented to provide incremental improvements to the existing system and how they would affect operations. Chapter 4 provides an analysis of projected growth and its effects on the system. Conclusions are presented in Chapter 5.

Description of the Simulation Model

The Rail Traffic Controller (RTC) Model is a computer simulation model that mimics the dispatching decisions that would be made to send trains through a rail network. It contains a network description that includes track lengths and speeds, signaling systems, and switches. Trains are run through the network with descriptions of lengths, speeds, priorities, and other information that would be used by dispatchers in real situations. The model contains algorithms for resolving conflicts and permits the operator to enter his or her own judgment about dispatching trains in the system. It tracks the progress of trains and accumulates information on train delay that occurs as a result of train conflicts or other factors. The RTC model is used by freight railroads for analysis of operations and planning improvements.

Figure 1-1. Portland/Vancouver Railroad Network



Simulations were run for a 96-hour period from noon Wednesday to noon Sunday. This time frame was chosen because experience has shown that it represents a typical high-volume period with enough additional time to resolve most train conflicts. Running this limited time period is an economical way of identifying the most significant issues that arise in a typical dispatching period, and for determining the impact of different “conflict solutions” and additional train traffic.

Base Operation Levels

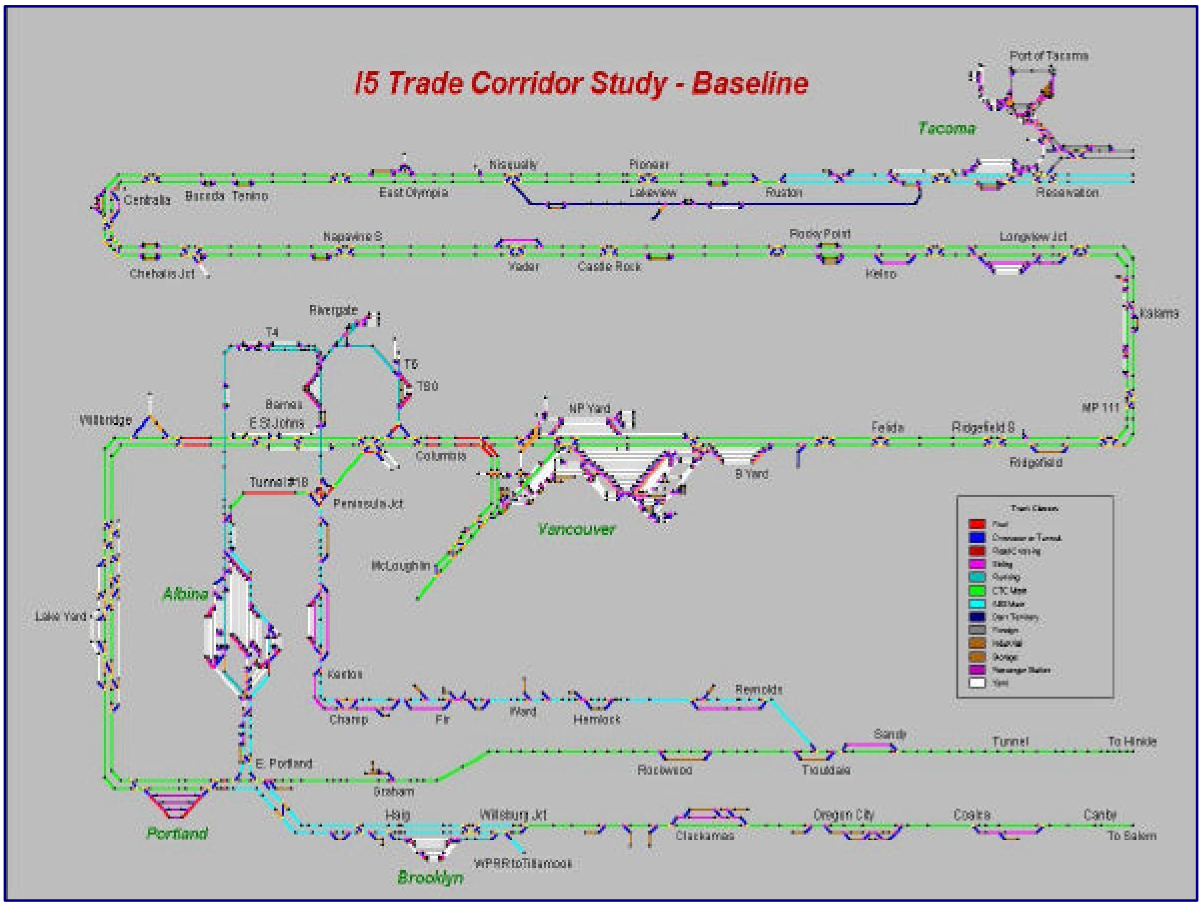
The RTC model was used for the I-5 Rail Capacity Study because it is the preferred analytical tool of both UP and BNSF. The railroads supplied actual train operations files to be used in analysis of the base case. Since passenger trains operate over the freight railroad system, these data included Amtrak trains.

The RTC model was calibrated using a base case of actual train operation. Subsequent simulations included improvements to the networks and additional trains. This allows the analyst to understand how system performance is affected by these changes. Detailed examples drawn from the actual simulation runs are contained in Appendix D.

The Base Network

The Base Case RTC network (see Figure 1-2 below) represents all mainline, principal secondary mainlines, and sufficient yard trackage to represent typical operations, in the area between Reservation interlocking at Tacoma, the BNSF Station at McLoughlin, WA, and the UP stations at Canby, OR and Sandy, OR. In this way, all UP/BNSF joint operations in the area between Portland and Tacoma are measured, as well as both carriers' operations throughout the Portland/Vancouver terminal areas, as well as those adjacent to the ports at Kalama and Longview, WA.

Figure 1-2. RTC Model Base System Map



RTC Output Measures

This section defines the output measures generated by the RTC model. These measures appear in the column headings of the RTC statistical summary reports presented in the following chapters. These summary reports include performance measures for all freight and passenger trains in the exercise by train type. The measures in the network summary RTC report are defined in Table 1-1 below.

Table 1-1. RTC Output Measures

Output Measure	Definition
Run Time Train Count	The number of trains that completed their trip within the 96-hour simulation "window."
Average Speed with Dwell	Average speed calculated from the time the train is "offered" for movement at the initial location, until it completes its RTC journey. Any intermediate dwell time or waiting on schedule time is figured into the average speed: any Initial Terminal Delay (ITD) within a yard is not, but if a train was ready to go at an initial yard, and was then held or delayed because of congestion, that delay is included as Origin Hold Delay.
Total Train Miles	RTC train miles for the relevant lines or line segments.
Delay Minutes per 100 Train Miles	A delay ratio that divides True Delay by train miles.
Total Dwell	Time spent stopped at an intermediate point, usually calculated by RTC when a specific length of stop is entered. The model will protect the desired duration of the stop regardless of whether the train is early or late on a schedule, if the train has a schedule.
Wait on Schedule	Time spent stopped at an intermediate point, usually calculated by RTC, when a specific leaving time is entered. That is, the model computes whatever time elapsed from arrival to the specified departure time.
True Delay or Stop Delay	This is actual meet/pass delay accumulated from conflicts between trains on-line. True Delay includes the acceleration and deceleration time required to make the meet or pass; Stop Delay includes only the time actually spent at 0 speed. (In calculating performance over Corridors or Divisions, where only a portion of a train's run is measured, RTC cannot compile True Delay – it requires the entire train run to do this. Hence, the separate definition for Stop Delay.)
Total Elapsed Time	The sum of Run time, Dwell time, Wait on Schedule time, True Delay time, and Origin Hold time.
In addition to the standard summary report, this analysis also calculated a delay ratio, which can be used to compare operations in different areas such as Chicago and Northern California.	
Delay Ratio	Total delay time divided by total train hours.

The Rail Capacity Technical Advisory Committee (TAC)

The rail advisory committee provided information and advice for running the RTC analyses. The BNSF and UP representatives on the advisory committee provided train files for use in simulating actual operating conditions. The committee reviewed and endorsed projections to be used in evaluating future growth. After each model run the TAC met to review the results and provide advice on ways to reduce operating conflicts and increase capacity. Findings and recommendations of the TAC were forwarded to the I-5 Partnership Task Force for its consideration. Several members of the TAC, including those from the railroads, met with the Task Force to answer questions and provide input. Based on these discussions and the technical analyses, the Task Force prepared a set of recommendations, which are contained in Appendix B.

Chapter 2: Analysis of Current Conditions

This chapter presents the results obtained from analyzing how the rail system currently performs given the number of freight and intercity passenger trains using the tracks. The chapter includes:

- Description of the trains included in the Base Case, along with a description of what is measured and what is not measured.
- Presentation of results for the entire network, and all trains, as a whole.
- Comparison of the delay statistics in the Portland Terminal Area with those of Chicago and Northern California.
- Selected simulation illustrations of particularly congested periods in the simulation animation sequence, presented as "freeze frames."

Base Case Description

The Base Case represents the current freight and intercity passenger trains on the rail system. It includes 619 trains dispatched over a 96-hour period. The model successfully dispatched all of these trains, with conflicts successfully resolved as part of the calibration process.

Of the 619 trains, the performance of 568 trains was measured in the RTC model. The remaining 51 trains completed their runs after the chronological measurement “window” of 96 hours was complete. In other words, the 568 measured trains include only those which made their entire runs within the RTC network between the four complete 24-hour periods that this study replicated (i.e., from Wednesday at noon to Sunday at noon). The following discussion restricts the analysis to the 568 trains. In addition, we have segregated freight train performance from passenger performance and have shown the freight statistics on a stand-alone basis.

Table 2-1 below summarizes the trains in the Base Case, whether they are included in, or left out of, the Base Case measurements, and whether they are included in, or left out of, those reports that are part of this paper.

Table 2-1. Summary of Trains in Base Case

Type	Total	Measured in RTC	Not Measured in RTC
Freight Trains	581	532	49
Amtrak Passenger Trains	38	36	2
Totals	**619**	**568**	**51**

Table 2-2 below illustrates the 532 measured freight trains when viewed by train type.

Table 2-2. Freight Train Counts by Train Type Measured Freight Trains	
Train Type	**Number**
Premium Intermodal/ Intermodal/Double Stack	83
Vehicle (Auto)	13
High Priority Merchandise	23
Merchandise	98
Loaded Grain	25
Empty Grain	17
Other Unit	32
Locals	127
Yard Engines	114
Total	**532**

Of the 568 measured trains in the simulation, all 36 passenger trains were identified as Amtrak, while the freight trains in the 96 hours broke down between BNSF and UP as shown in Table 2-3, below.

Table 2-3. Breakdown of Train Counts by Types and Carrier			
Train Type	**Amtrak**	**BNSF**	**UP**
Passenger	36	-	-
Premium Intermodal/ Intermodal/Double Stack	-	27	56
Auto	-	6	7
Priority Manifest	-	4	19
Manifest	-	45	53
Unit (ex. Grain)	-	14	18
Loaded Grain	-	18	7
Empty Grain	-	10	7
Locals/Yard Engines	-	136	105
Total	**36**	**260**	**272**

Results for Entire Network

Table 2-4 below summarizes the network performance for the Base Case simulation. The 36 measured passenger trains had a composite average speed of 41.27 mph (the Talgo trains were typically about 9 mph faster than the conventional trains, but the latter group includes Amtrak 27 and 28, which only operate in the simulation in relatively slow-speed territory between Portland and McLoughlin). The 532 measured freight trains had an average speed of 12.29 mph, but the average speeds vary widely by type, and are depressed by high levels of terminal congestion and by the large numbers of yard engines and locals (45% of total freight trains). Excluding yard engines and locals, through freight trains averaged 17.7 mph.

Table 2-4. Summary of Train Performance: Base Case

Train Type	Number	Average Speed (mph)	True Delay (Hours)
Talgo Passenger	18	45.74	1.25
Conv. Passenger	18	36.80	.67
Premium Intermodal/ Intermodal/Double Stack	83	17.35	86.25
Auto	13	25.16	10.30
Priority Manifest	23	15.81	16.00
Manifest	98	15.63	101.25
Unit Trains (ex. Grain)	32	22.24	38.00
Loaded Grain	25	19.77	25.25
Empty Grain	17	16.94	13.75
Locals/Yard Engines	241	3.41	110.75

Much of the accumulated passenger delay was due to trains waiting for the movable bridges rather than trains waiting for other trains. The freight train delay hours, by contrast, are mostly congestion-related, and the delay pattern (which affects all train types) indicates that congestion is severe, and spread throughout terminals and rail yards as well as on through lines.

The 532 measured freight trains accumulated a total of 402 hours of delay over the 96 hours in the simulation, or 100.5 hours per 24-hour operating day. These same 532 freight trains accumulated an elapsed time of 2,207 train hours during the 96-hour period (elapsed time includes all time required for work, as well as running time and delay time). This is a high ratio, comparatively speaking: it is almost 40% of the "ideal" running time, which is the theoretical number of train hours that would be required if there were no congestion-related delay to encounter. In other words, despite the fact that the Base Case includes the 130-plus miles of multiple main track between Vancouver, WA and Tacoma, which is a higher-speed operation, the results are more typical of congested major terminals, such as those in the Chicago area.

Albina, Vancouver, and the Rivergate/T6 areas were all significant sources of congestion at various times during the 96 hours simulated. So were North Portland/East St. Johns, Peninsula Junction, and UP's Kenton Line between Peninsula Junction and Troutdale.

A frequency distribution of individual train delays by degree of delay shows:

- Trains delayed over 1 hour, but less than 2 hours: 89 (32 BNSF, 57 UP)
- Trains delayed over 2 hours, but less than 3 hours: 41 (14 BNSF, 27 UP)
- Trains delayed over 3 hours: 18 (2 BNSF, 16 UP)

Illustrations of the RTC Base Case model run can be found in Appendix D1.

Comparisons to Other Terminal Areas

Performance measurements obtained in the Portland Base Case are compared in Table 2-5 on the following page to similar results obtained in analyses covering the Chicago Switching District and Union Pacific's Northern California track network (the area between Oroville and Salinas including Roseville, Oakland, San Jose, and Stockton terminals).

The other two tables summarize the Portland Area Base Case. The comparison supports the following assessment:

1. Chicago and Portland/Vancouver areas suffer from similar – and high – levels of congestion-related delay.

2. Both Chicago and UP's Northern California area already have far more intensive passenger operations to contend with than does Portland/Vancouver.

3. The differing amounts of "open country" mainline trackage, with higher track spreads, helps improve results in California, depresses results in Chicago, and only moderately helps Portland/Vancouver, suggesting that the Portland/Vancouver area is very congested (more like Chicago than California).

4. Note that the Portland/Vancouver area already has half the delay hours of Chicago with only about one-quarter the number of freight trains per day.

Conclusions

The existing rail system currently experiences significant congestion-related delay. Improvements are needed to relieve this congestion and to increase the efficiency of the system.

Table 2-5. Performance Comparison

RTC Simulation Studies

Portland, Chicago, Northern California

Study	Simulation Hours	Number of Freight Trains	Number of Passenger Trains	Total Freight Train Hours	Freight Delay Hours	Average Delay Hours Per Day	Freight Delay Ratio 1/	Average Freight Train Speed (mph)
Portland	96	532	36	2211	406.5	101.60	18.4%	12.3
Chicago	96	1977	1542	4127	813.0	203.25	20.0%	12.52
Northern California	168	688	762	2050	194.5	27.80	9.5%	17.90

1/ Delay Time ÷ Elapsed Time

[1] *Delay ratio = Delay Time/Elapsed Time. In the Chicago Switching District RTC Base Case, the delay ratio was 20%; 1,977 freight trains in 96 hours accumulated 813 hours of delay. In other words, Portland has ¼ the number of trains, but ½ the delay of Chicago, which is frequently very congested.*

Chapter 3: Analysis of Base Case with Incremental Improvements

Analysis of current conditions on the rail system indicates that immediate improvements are necessary to efficiently handle existing train traffic. The next step in the Rail Capacity Study was to determine how much of the capacity and delay problems on the rail system could be resolved with modest capital and operating improvements. This chapter presents the results obtained when a series of incremental improvements are added to the rail system at specific locations.

The model run described in this chapter evaluates performance of the system with incremental improvements, but with no growth in the number of freight or passenger trains.

Selection of Improvements

To select improvements that were truly incremental and could actually be implemented in a relatively short period, several limitations were placed on the selection of improvements:

- They had already been identified in previous studies by the Port of Portland or the Departments of Transportation in Oregon and Washington
- They would add capacity
- They were either:
  1. Relatively low-cost, incremental improvements
  2. Improvements already underway (as in the case of the Vancouver Yard Bypass)
- They had been previously reviewed with the railroads and were considered by the railroads to be reasonable if funding were available.

An initial list of 30 projects was reviewed with the railroads and the technical advisory committee. These projects were reduced and consolidated into 10 improvements, as shown in Figure 3-1 and described in Table 3-1. Drawings of the 10 improvement projects, along with descriptions of their advantages, disadvantages, costs, and objectives, are found in Appendix E.

Results

This section presents the results obtained from using the RTC model to run the existing freight and intercity passenger trains on a network with the incremental improvements described above. Figure 3-1 on the following page depicts the RTC network revisions for the incremental improvements. In the following analysis, the package of incremental improvements is referred to as “Case 1a.” Results are compared to those obtained in the Base Case. Illustrations of the impacts of incremental improvements can be found in Appendix D2.

Figure 3-1. Portland/Vancouver Rail Network – Rail capacity improvements needed in the next 5 to 10 years.

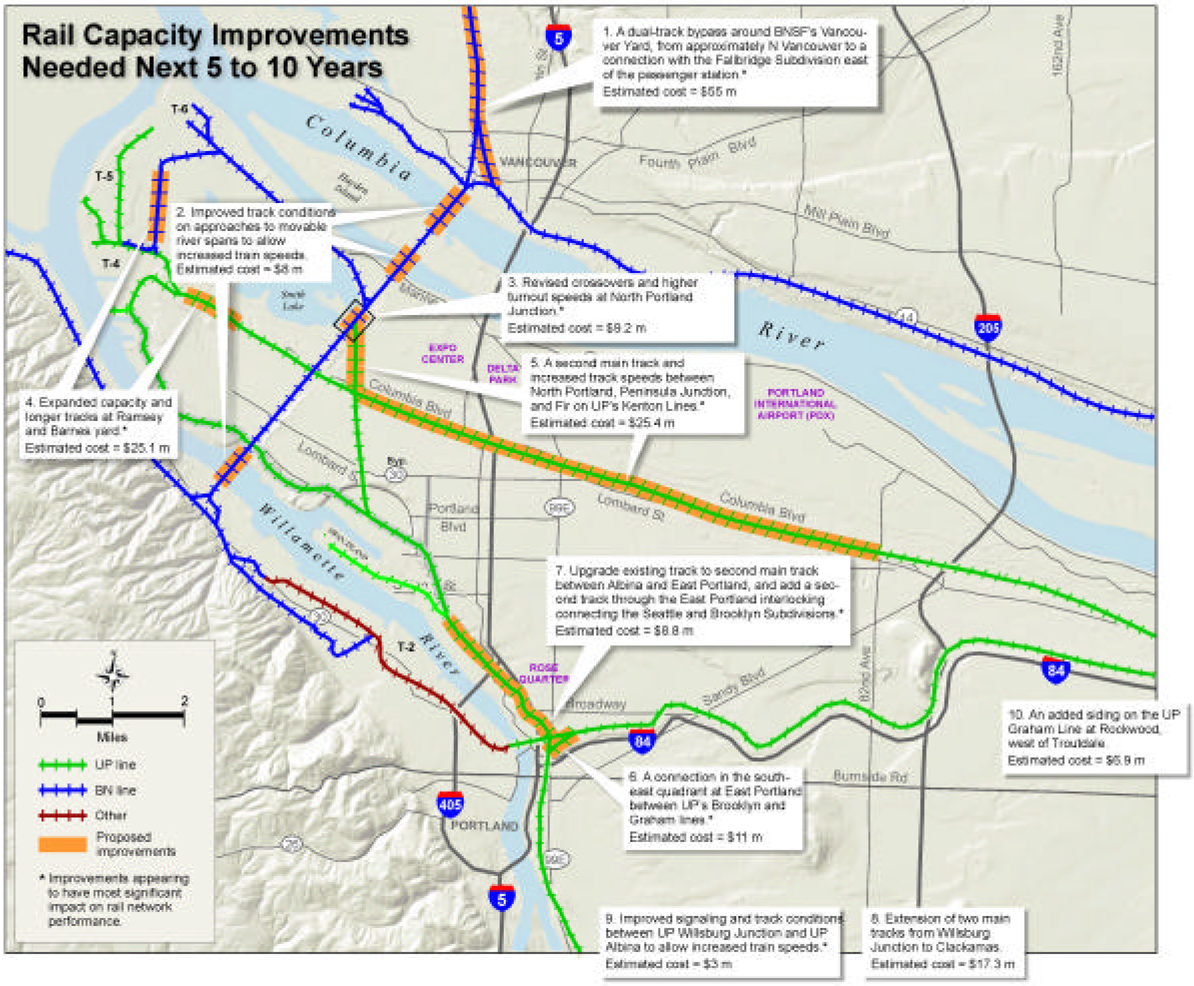


Table 3-1. Incremental Improvements		
No.	**Proposed Improvements****	**Estimated Costs**
1.*	**A two-main track bypass around BNSF's Vancouver Yard, from approximately N. Vancouver to a connection with the Fallbridge subdivision east of the passenger station.** *This improvement eliminates conflicts with trains moving from the BNSF mainline on the north side of the Columbia River (the Fallbridge subdivision) and north of Vancouver. The project is in the environmental phase.*	$55.0M
2.	**Increased track speeds across the movable river spans.** *The purpose of this improvement is to increase train speeds to more quickly clear the mainline in the area of the Columbia River and Oregon Slough.*	$8.0M
3.*	**Revised crossovers and higher turnout speeds at North Portland.** *Trains moving between the BNSF mainline and the Union Pacific line at North Portland tie up the mainline until the move is completed. The improvements increase speeds and reduce blockage time.*	$9.2M
4.*	**Expanded capacity and longer tracks at Ramsey and Barnes yards.** *Some of the capacity problems identified in the base run were the result of inadequate capacity in these yards.*	$25.1M
5.*	**A second main track and increased track speeds between North Portland, Peninsula Junction, and Fir, on UP's Kenton Line**. *This would permit more trains to pass each other in this area.*	$25.4M
6.*	**A connection in the southeast quadrant at East Portland between UP's Brooklyn and Graham lines**. *Currently, northbound trains on the old SP mainline cannot turn onto the Graham line and must proceed north through the yards to the Kenton line, and vice versa for trains going south on the old SP mainline.*	$11.0M
7.*	**Increased track speeds between UP Willsburg Junction and UP Albina Yard.** *This would help to move trains in and out of Albina Yard more quickly.*	$8.8M
8.	**Extension of two main tracks from Willsburg Junction to Clackamas.** *Allows trains to pass and improves access to Albina Yard.*	$17.3M
9.*	**An upgraded "Runner" or River Lead through Albina Yard.** *Allows trains to move along the river with less interference to through trains.*	$3.0M
10.	**An added controlled siding (4 alternatives) on the UP Graham Line at Rockwood, west of Troutdale.** *Allows more efficient passing of trains.*	$6.9M
Total (*Approximate*)		**$169.6M**

***Improvements that appear to have most significant impact on performance of rail network.*
****This list does not include the longer-term need for a flyover or under-crossing of the BNSF mainline.*

Case 1a Train Files

Case 1a includes the same 619 trains that were modeled in the Base Case. As in the Base Case, all of these trains were successfully dispatched by the model, with all conflicts resolved. Of the 619 trains, the performance of 575 was measured, compared to 568 in the Base Case. (The improved performance, with more trains completing their runs in the 96-hour "window," accounts for the difference.) As with the Base Case results, the discussion will incorporate statistics only from the measured trains. Table 3-2 on the following page compares the train counts as between the two cases.

Table 3-2. Summary of Trains by Train Type
Base Case vs. Case 1a

Type	Base Case	Case 1a
Passenger	36	36
Premium Intermodal/	83	85
Intermodal/Double Track	13	13
Vehicle (Auto)	23	23
High Priority Merchandise	98	99
Merchandise	25	25
Loaded Grain	17	17
Empty Grain	32	35
Other Unit	127	128
Locals	114	114
Yard Engines		
Totals	**568**	**575**

By carrier, the Case 1a results incorporate 36 Amtrak (no change from Base Case), 261 BNSF (+ 1 from Base Case), and 278 UP (+6 from Base Case) trains.

Comparison to Base Case

Table 3-3 on the following page summarizes the network performance for Case 1a and compares it to the performance in the Base Case. While passenger train speeds only increased by about 2%, freight train speeds increased by almost 12%. More significantly, delay minutes per 100 train miles improved by 46%; freight delay hours fell from 402 to 226, or from 100.5 per day to 56.5 per day; and the delay ratio compared to elapsed time fell from 18.2% to 11.3%.

Thus, Case 1a improvements reduced freight train delay hours by almost 44%, and some groups or types of freight trains (priority manifest and auto trains, for example) showed as much as a 60-65% reduction in delay. Looking at "ideal" running times, the Case 1a delay ratio was about 23%, compared to almost 40% in the Base Case.

Some of the improvements incorporated in Case 1a had a more significant impact on network performance than others. An analysis of the animation, and an examination of the exceptionally congested periods in the Base Case, show that:

- The Vancouver Bypass relieved significant congestion on the main tracks near the Fallbridge subdivision, so much so that much of the congestion at North Portland disappeared as well. It seems clear that southbound BNSF trains crossing over to the Fallbridge subdivision at Vancouver create "ripple effect" delays which are compounded by southbound UP trains crossing over a short distance beyond, at North Portland.

Table 3-3. Summary of Train Performance Base Case vs. Case 1a

Train Type	Base Case			Case 1a		
	Number	Average Speed (mph)	True Delay (Hours)	Number	Average Speed (mph)	True Delay (Hours)
Talgo Passenger	18	45.74	1.25	18	46.73	1.00
Conv. Passenger	18	36.80	.67	18	37.78	.75
Premium Intermodal/ Intermodal/Double Stack	83	17.35	86.25	85	19.06	58.50
Auto	13	25.16	10.30	13	31.11	2.75
Priority Manifest	23	15.81	16.00	23	19.21	6.00
Manifest	98	15.63	101.25	99	18.32	58.25
Unit Trains (ex. Grain)	32	22.24	38.00	35	25.98	14.00
Loaded Grain	25	19.77	25.25	25	21.62	8.25
Empty Grain	17	16.94	13.75	17	16.94	5.50
Locals/Yard Engines	241	3.41	110.75	242	3.54	71.00

- The connection in the southeast quadrant at East Portland materially improved operations all the way through UP's Portland terminal. Trains between Eugene and Hinkle, in both directions, saved significant amounts of both running time and delay time.

- The capacity expansions at Ramsey and Barnes yards significantly reduced the delay hours experienced by yard engines and transfer jobs working the west end of Hayden Island, including Rivergate and T6.

- The improvement of the Albina "Runner" into a second main, with connections to the Graham Line, the Brooklyn Subdivision, and the River Lead at Albina, materially reduced delays to both through and originating/terminating trains at Albina.

- The combined effect of the "East Portland/Albina" package (including the Graham Line connection), and the Vancouver Bypass, reduced much of the Base Case congestion between North Portland, Peninsula Junction, and on UP's Kenton Line, suggesting that this part of the improvement package could probably be postponed until the other improvements are put in place.

Conclusions

A package of incremental improvements can significantly add to the capacity of the rail system.

Chapter 4: Analysis of Capacity with Incremental Improvements and Projected Growth

This chapter presents the impact of growth in train demand on rail network capacity. Knowing that the series of incremental improvements described and analyzed in Chapter 3 can significantly improve existing rail system performance, the next question was how quickly will the new capacity be "used up" as freight and intercity passenger trains increase in the system. This chapter describes the projected growth in freight and intercity passenger trains, analyzes how growth will impact the system, and evaluates the potential causes and solutions to future capacity constraints.

Projected Growth

Freight Train Growth

Projected 10-year increases in freight train growth are shown in Table 4-1. Growth is projected at 3.25% per year based on the standard planning growth rates used by the BNSF and UP. As shown in the table, some train types are projected to grow faster than others. Intermodal (containers), auto and unit trains other than grain (mainly non-metallic ores shipped through the ports of Portland and Vancouver), are projected to grow at a faster rate than the average. Merchandise trains (mixed manifest) are expected to grow more slowly. These forecasts do not include local and switching trains.[1]

Table 4-1. Summary of 96-Hour Freight Train Forecast Base Case and 10-Year Forecast

Train Type	Base Case	10-Year Forecast	
	Number	Number	Annual Growth Rate
Intermodal	83	122	3.9%
Auto	13	19	3.9%
Priority Merchandise	23	29	2.2%
Merchandise	98	122	2.2%
Loaded Grain	25	35	3.4%
Empty Grain	17	23	3.2%
Other Unit Trains	32	51	4.9%
Totals	291	401	3.8%

[1] Empty grain trains are lower-priority trains and are moved at times outside the 96-hour window being analyzed.

A significant feature of these forecasts (in terms of required capacity) is that some of the fastest-growing train types are unit trains requiring priority treatment and unit trains serving port facilities.

Intercity Passenger Train Growth

Forecasts of intercity passenger trains are shown in Table 4-2 below. These forecasts are based on the Pacific Northwest Rail Corridor Operating Plan. Based on this forecast, four additional round trips per day between Portland and Seattle were introduced into the simulation model.

Table 4-2. Passenger Train Forecast

	Daily Crossings of the Columbia River Bridge
Base 2001	10
10-year Base	18
Full Build-Out	26

Results

This section presents the results obtained from running a growth-driven planning case, called Case 2a, using the RTC model. The network used in Case 1a was assumed for Case 2a, which includes the incremental improvements described in Chapter 3. Train files were adjusted to reflect growth forecasts of both freight and passenger trains.

The analysis concludes that under these forecasts, even with incremental improvements, the network would be more congested than it is today within 5 to 10 years. A series of sensitivity tests indicates that this congestion is primarily the result of UP and BNSF trains sharing the mainline between Vancouver Junction and North Portland Junction. In this scenario, passenger trains are more often the victim than the cause of congestion.

Regarding passenger trains, it must be noted that the additional trains introduced into this analysis will require track capacity improvements between Tacoma and Vancouver, WA. This additional capacity is assumed, but not modeled in the following analysis, which, for the sake of time and cost, was limited to the Portland/Vancouver area.

Illustrations of the Growth Case can be found in Appendix D3.

Case 2a Train Files

Case 2a, the Growth Case, includes 764 trains, an increase of 145 from the 619 in the Base Case and Case 1a. As in the previous cases, the model successfully dispatched all of these trains.

Of the 764 trains, the performance of 703 was measured in Case 2a, compared to 568 in the Base Case and 575 in Case 1a. The 703 measured trains include 65 passenger trains (up from 36 in the previous two cases), and 638 freight trains (up from 532 and 539, respectively, in the previous two cases).

As with the results from the previous cases, the discussion incorporates statistics only from the measured trains. Table 4-3 below compares the train counts between the previous two cases.

Table 4-3. Summary of Trains by Train Type
Case 2a vs. Case 1a

Type	Case 2a	Case 1a
Passenger	65	36
Premium Intermodal/ Intermodal/Double Track	118	85
Vehicle (Auto)	19	13
High Priority Merchandise	29	23
Merchandise	120	99
Loaded Grain	38	25
Empty Grain	24	17
Other Unit	49	35
Locals	127	128
Yard Engines	114	114
Totals	**703**	**575**

The growth by train type was driven by the demand forecast by commodity type in a 10-year forecast. Only through trains were increased in number; locals and yard engines remained as shown in Case 1a. By carrier, the Case 2a results incorporate 65 Amtrak, 308 BNSF (+ 47 from Case 1a), and 343 UP (+65 from Case 1a) trains.

Table 4-4 summarizes the network performance for Case 2a and compares it to the performance in Case 1a. In the Growth Case, intermodal, manifest, and grain trains all lost the performance gains from Case 1a and suffered significant delays compared to Base Case performance.

Performance eroded to more than 500 hours of train delay over 96 hours, or about 25% worse than in the Base Case. Case 2a growth expended the capacity provided by the incremental improvement package, and then some. In certain categories, performance eroded to as much as 70% worse than the already poor performance of the Base Case.

The growth-related congestion reappeared at some, but not all, of the locations that experienced congestion in the Base Case, and which were helped by the improvement package in Case 1a:

- At Vancouver, WA, congestion reappeared, and got significantly worse, for southbound trains entering the BNSF's Columbia River railroad bridge. This congestion appears more related to trains entering and leaving the BNSF Fallbridge subdivision than to limitations on the UP south of North Portland, which was the cause for much of the Base Case congestion at this point.

Table 4-4. Summary of Train Performance Case 2a vs. Case 1a						
Train Type	Case 2a			Case 1a		
	Number	Average Speed (mph)	True Delay (Hours)	Number	Average Speed (mph)	True Delay (Hours)
Talgo Passenger	47	37.10	3.00	18	46.73	1.00
Conv. Passenger	18	37.60	.75	18	37.78	.75
Premium Intermodal/ Intermodal/Double Stack	118	17.75	146.00	85	19.06	58.50
Auto	19	26.69	14.00	13	31.11	2.75
Priority Manifest	29	19.03	9.00	23	19.21	6.00
Manifest	120	17.12	125.00	99	18.32	58.25
Unit Trains (ex. Grain)	49	24.66	50.25	35	25.98	14.00
Loaded Grain	38	21.06	45.50	25	21.62	8.25
Empty Grain	24	17.05	17.00	17	16.94	5.50
Locals/Yard Engines	241	3.45	96.50	242	3.54	71.00

- Some of the observed increase in congestion was related to movements between the main track at North Portland and the T-6/Rivergate area. This connection is immediately opposite the UP connection to Peninsula Junction, and the combined effect of both crossing movements produced congestion-related delay that the improvements on the UP south and east of North Portland could not address.

- There was some increase observed in congestion at points in the network well north of the greater Portland/Vancouver area (e.g., Kalama-Longview, the Nelson Bennett Tunnel at Point Defiance, and Reservation, at Tacoma). Sensitivity tests were run to determine the role of this "extra-territorial" increase in delay. These tests showed that, even allowing for these other congested locations, most of the deterioration in performance resulted from conditions in the Portland/Vancouver area (see below).

Added Passenger Service

Four northbound and four southbound passenger trains were added in the Growth Case to the network between Portland Union Station and MP 113, north of Vancouver and south of Kalama. The added runs of these trains were foreshortened so as not to overload the track north of Kelso.[2] Therefore, the Growth Case, by design, measures only the marginal impact of added passenger

[2] It has already been determined from other studies that this many intercity passenger trains cannot be added to the existing joint track between Vancouver and Tacoma without major investment in added capacity at Kelso-Martin Bluff, at Napavine, and (to circumvent Point Defiance) between Nisqually and Tacoma.

service in the immediate area between Portland Union Station and an area just north of Vancouver.

Again, as a sensitivity test, these added passenger trains were subsequently deleted from the Growth Case to determine if they were a significant cause of the Growth Case deterioration in performance (see discussion below).

Initial Findings and Sensitivity Tests

The principal finding of the Growth Case simulation (Case 2a) is that the projected increase in demand over the next 10 to 20 years exceeds the capacity provided by the package of incremental improvements, but not to the same extent in all parts of the region. Thus, a "bigger fix" is needed than the currently defined package, but not necessarily an entirely different approach.

- Congestion reappears in the segment between the Vancouver passenger station and North Portland largely because UP and BNSF trains are essentially crossing in front of each other in this area. The BNSF trains are moving between the Fallbridge subdivision and either the Port of Portland or Lake Yard/Willbridge, while the UP trains are moving between the joint track to the north and Peninsula Junction. This crossing-over conflict is not addressed by the elements of the incremental improvement package that help alleviate congestion on either side of this "X" at the BNSF Columbia River railroad bridge, namely, the Vancouver Bypass and the UP double track south and east of North Portland.

- Those elements of the incremental improvement package that were intended to relieve Base Case congestion at East Portland, on the UP Kenton Line, in the Port, and around the east side of Vancouver Yard, worked well under the Growth Case; they simply weren't sufficient to provide the necessary capacity.

Sensitivity Tests

Four sensitivity tests were run on the Growth Case to help pinpoint the origins of the increase in congestion and the causes.

1. To determine how much delay could be eliminated by only removing freight trains, the growth in freight demand was reduced by 44 trains, or about 40%. This produced a 128-hour reduction in delay over 96 hours, or about a 25% reduction in delay hours, to 381 (about 95% of Base Case delay).

2. In a second sensitivity test, all new passenger trains were eliminated, plus an additional half-dozen freight trains, so that about half the percentage of expected growth was accounted for on the freight side, and none of the passenger growth. This test yielded 334 hours of delay, or about 35% less than the full Growth Case, and about 17% less than the Base Case delay.

3. Since the preceding sensitivity test suggested that the Growth Case passenger trains might be a part of the problem, another test was done with 100% of the freight growth, but no added passenger trains. Delay hours returned to 510 over 96 hours, indicating that on the margin, the added passenger service between Portland and MP 113 was not itself the cause of the increased congestion.

4. Finally, to eliminate the effect of added congestion at Nelson Bennett, and at Reservation (both near Tacoma), and to eliminate the possibility that continued congestion south of North Portland on the UP was somehow distorting results, a test was made of the effect of double-tracking all these bottlenecks. Performance improved slightly; delay dropped to just under 500 hours. The conclusion is, therefore, that the "extra-territorial" bottlenecks were not, by themselves, the heart of the problem.

Conclusions

Under the Portland/Vancouver region's projected growth rates in freight and passenger rail traffic, the "incremental improvements" identified in Chapter 3 are sufficient to address capacity needs for the next 5-10 years. Additional improvements beyond the identified "incremental improvements" will be needed to accommodate continued growth in the 10-20 year future horizon. Three concepts are provided in Appendix F, including the separation of the X-shaped crossing movements that occur between the BNSF Fallbridge Subdivision at the Vancouver depot and North Portland Junction (where UPRR's Kenton Line meets the BNSF's mainline).

Chapter 5: Study Conclusions

The purpose of this study was to analyze capacity of the freight and intercity passenger rail system in the Portland/Vancouver Terminal Area. The analysis reached important conclusions about the region's available system capacity and the means of expanding it. These conclusions have important implications for transportation costs and the economic health of the region. The first section of this chapter presents conclusions about the rail system. The second section discusses implications for transportation costs and the regional economy.

Rail System Conclusions

1. The rail system in the Portland/Vancouver region is very congested, with little capacity for additional trains.

   Base model runs found that existing levels of delay to freight trains are very high. The 532 freight trains measured had an average operating speed of only 12.3 mph and experienced 402 hours of delay. These results were compared to the Chicago terminal area, which has five times the number of trains but only twice the delay hours. Passenger train delay was minimal as these trains receive priority.

   Factors contributing to this congestion include: (1) hilly geography resulting in narrow corridors with little opportunity for expansion, (2) a large number of yards and terminals in a confined area, and (3) industrial locations that require local trains and switchers to operate on the mainline tracks.

2. A set of relatively small, incremental projects could restore capacity and operational efficiency for another 5 to 10 years under existing forecasts. A list of these improvements is provided in the Executive Summary and in Chapter 3. The most important of these improvements are:

   i. Two main track bypasses around BNSF's Vancouver Yard
   ii. Revised crossovers and higher turnout speeds at North Portland Junction
   iii. Second main track and increased track speeds between North Portland Junction, Peninsula Junction, and Fir on UP's Kenton Line
   iv. Expanded capacity and longer tracks at Ramsay and Barnes yards
   v. Connection in the SE quadrant at East Portland between UP's Brooklyn and Graham lines
   vi. Increased track speeds between UP Willsburg Junction and UP Albina Yard
   vii. An upgraded "Runner" or River Lead between Albina and East Portland, and a second track through the East Portland interlocking

3. Even with incremental improvements, projected growth in freight and passenger trains will once again consume available capacity unless additional improvements are made.

   The number of freight trains originating, terminating, or passing through the Portland/Vancouver terminal area is projected to increase at a rate of 3.25% per year. At that rate, the additional capacity created by the incremental projects would be used up in a little more than five years and congestion would be worse than it is today.

4. The most significant problem contributing to congestion in the growth scenario was trains crossing in front of each other going on and off the BNSF mainline between Vancouver and North Portland junctions. Beyond the incremental improvements, at some point it will be necessary to separate these trains. The most likely alternatives to address this issue are a flyover or under-crossing of the BNSF mainline south of the Columbia River railroad bridge. In conjunction with the incremental projects, this would provide additional capacity for an additional 10 to 20 years.

5. Construction of a new heavy rail bridge is not necessary under existing forecasts, nor is lack of capacity on the bridge itself responsible for current congestion. However, incidental to untangling the UP and BNSF trains, it may be desirable to expand the existing bridge and replace the current swing span with a lift span.

6. In this context, the proposed Truman-Hobbs Act project to move the opening of the BNSF Columbia River railroad bridge should be considered as an opportunity to provide for future expansion of bridge capacity by creating a three-track lift span.

7. Regarding future intercity passenger service, the identified incremental capacity improvements provide an opportunity to create needed capacity for new trains in the Portland/Vancouver corridor. Without additional capacity, there will be virtually no opportunity to expand intercity passenger service.

8. This analysis concluded that passenger trains were not the primary cause of congestion in the network. However, improvements to add equivalent capacity that is used up by the passenger trains are normally a condition for starting new services. The incremental projects indicate how that capacity could be provided.

9. Commuter rail service cannot be accommodated on the BNSF and UP systems under any of the scenarios considered in this study. There is insufficient capacity to accommodate the frequency and timing of trains necessary for this type of service. Improvements needed to provide capacity for freight and intercity passenger services would not create the type of capacity needed for commuter services.

Implications for the Regional Economy

The Portland/Vancouver area has long been established as an important transportation hub. Its deep draft ports at the confluence of the Columbia and Willamette rivers meet the 600-mile Columbia-Snake river system. It hosts two transcontinental railroads with water level routes to the east, and north-south connections with Washington State and California. Interstate 84 provides a water-level route to the east, while Interstate 5 is one of the nation's most significant international corridors. But the congestion that threatens the efficiency of the region's rail network likewise threatens its position as a transportation hub and has important implications for the region's economy.

1. Congestion creates significant costs for railroads and the regional economy.

   UP estimated the average delay cost of a train at $300 per hour. Lack of reliability costs the railroads business, and threatens local businesses and port activities.

2. The lack of rail capacity threatens the long-term economic health of the region.

   Eventually, trains will likely be routed around the area to avoid congested conditions, thus reducing Portland's position as a transportation hub. Businesses and industries that rely on rail service may have to consider other locations.

3. Expansion of port facilities will be difficult if additional trains cannot be accommodated efficiently. It will become more difficult to attract important container business if intermodal trains cannot move in and out of the area on reliable time schedules.

Other Issues not Addressed in the Analysis

Because the analysis considered only the rail system in the Portland/Vancouver terminal area, there were several issues that may be important to investigate, but were not a part of this study. The analysis did nevertheless point to implications that should be considered in future analyses.

- *What improvements outside the study area would be required to support additional intercity passenger trains?*

  Track improvements to separate passenger trains from freight between Vancouver and Tacoma will be required and were identified in Chapter 4, but they were not considered in this study.

- *What are the implications of rail capacity for truck-rail competition?*

  This issue was not studied directly. Trucking and rail do not normally compete at distances under 500 miles, where truck tends to dominate. Above this distance, rail intermodal service can compete with trucking. To the extent that congestion in the system threatens the efficiency of priority intermodal services, this is hurting the ability of rail to compete. This may be especially important along the west coast where distances are ideal for competition. However, analysis of truck-rail competition was outside the scope of this study.

- *Could bypassing the Portland/Vancouver area with certain types of trains solve some of the congestion problems?*

  Some of the solutions to congestion in the Portland/Vancouver rail network may involve development of bypass routes that avoid congestion. Depending on the commodities and services that bypass the area, this could have both positive and negative implications. It could reduce the need for some improvements. It could also hurt the area economy if the area's role as a freight hub is diminished. Alternative bypass routes were not studied.

- *Could another track be added to the existing BNSF Columbia River railroad bridge? Would this require construction of a new bridge?*

  This analysis did not identify the need for another bridge. If a new track were required on the existing bridge, there are a number of alternatives. One alternative would, in effect, build a new bridge next to the existing bridge by placing new pilings downstream from the existing bridge. It would appear to the casual observer as one bridge, but would be two separate structures. Another possible alternative would be to reinforce the existing piers and replace the existing two track spans with three track spans. The exact solution will require more study when a third track is needed.

- *Would construction of a new track on the existing BNSF Columbia River railroad bridge be equivalent to construction of a new bridge?*

  This analysis did not identify the need for a new track on the existing bridge, however, RTC's 1999 *Commuter Rail Feasibility Study*[1] did undertake the question of adding a third main to the Columbia River Bridge, and determined that the bridge itself does not represent a choke point in the system. Rather, the North Portland Junction area, and the multiple yards and junction in close proximity to one another, single-track locations and requirements for additional sidings, are the chokepoints in the system – each of which has been addressed in projects 1-11.

  Whether the third track would be equivalent to another bridge in terms of either cost or capacity will require additional study. However, it appears that it would cost much less than an entirely new bridge at a new location. Combined with other improvements, it may provide additional capacity for freight and intercity passenger, but it could not provide the additional capacity required to support commuter rail service.

- *Could joint dispatching between the two freight railroads help solve capacity and congestion problems?*

  This issue was raised during meetings of the technical advisory committee. The model assumes seamless dispatching of trains. In that sense, joint dispatching would not change the model results. If current dispatching arrangements are adding to congestion, then the situation is worse than indicated by the model. That situation was not analyzed in this study.

- *How should the cost of making capacity improvements be divided among the freight railroads, passenger services, and the public?*

  A public-private partnership is undoubtedly a key to adding rail capacity and unraveling the congestion that threatens the area's rail network to improve both freight and passenger services. While this analysis may have implications for cost sharing and partnership arrangements, this issue was not specifically addressed.

[1] *Commuter Rail Feasibility Study*, prepared for the SW Washington Regional Transportation Council, by HDR, Inc., May 1999