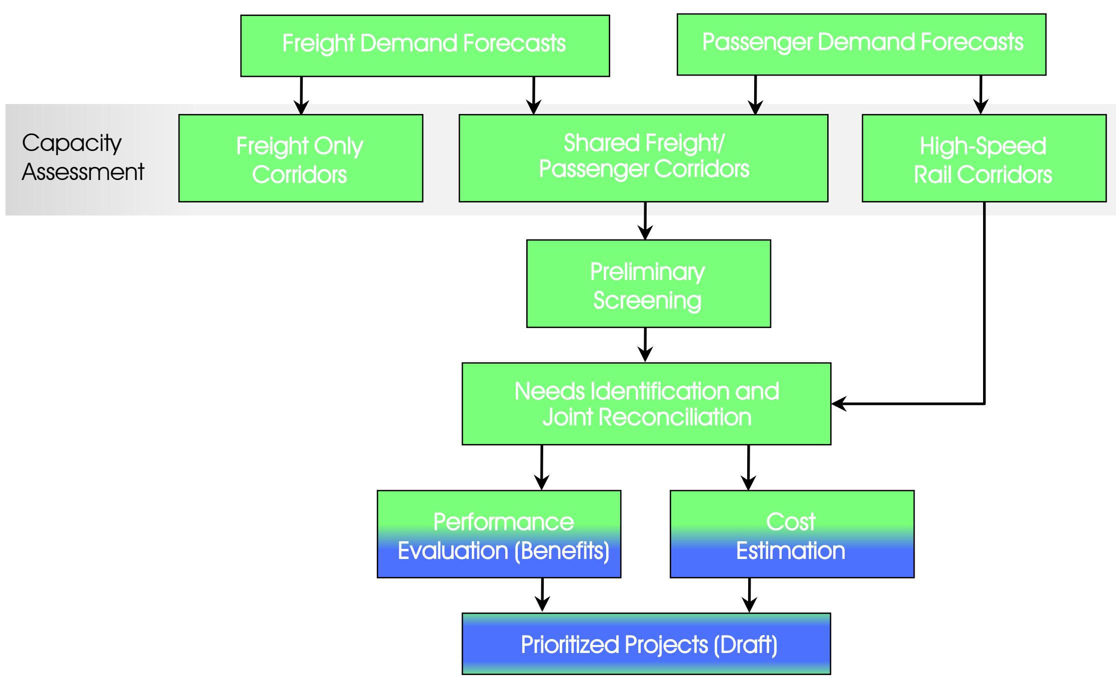
4 Investment Needs

4.1 Methodology

This section summarizes investment needs for passenger and freight rail corridors consistent with the visions for rail in Minnesota. The following process was used to identify and evaluate needs. Figure 4.1 outlines the overall approach. Detailed background data and assumptions are provided in Technical Memorandum 6.

- Define improvements for freight only segments of the rail system, organized first by rail operator and then by rail subdivision;
- Define improvements for shared freight and passenger corridors that are proposed to operate conventional intercity passenger rail service (79 to 90 mph); and
- Define improvements for passenger corridors that are proposed to operate HSR passenger service (110 to 150 mph).

Figure 4.1 Summary of Approach to Needs Identification and Evaluation



4.1.1 Preliminary Screening of Passenger Rail Corridors

Prior to undertaking a complete needs assessment of all rail lines in Minnesota, an initial screening process as shown in Table 4.1 was conducted of all passenger rail corridors and city pairs which have been under discussion or analysis. Different service levels were tested based on previous analyses and proposals, and likely demand as shown in Section 3.0. HSR services were assessed for connections to the Twin Cities from Rochester, Duluth, and Chicago. Eight train pairs per day was assumed for all HSR routings, and four to eight train pairs per day for all others. Conventional rail services were assumed to operate at 79 mph with the potential to go to 90 mph, and HSR services at a minimum of 110 mph with potential to go to 150 mph.

Based on this analysis, the following six city pairs were removed from further analysis:

- **Willmar-Fargo/Moorhead –** This corridor has lower potential ridership and comparatively poorer track conditions than the current corridor through St. Cloud. Therefore, it is not considered as a viable corridor since it serves a similar city pair.
- **Mankato-Worthington (Sioux City) –** This corridor has low potential ridership. Sioux City is a relatively small metropolitan area that is a significant distance (more than 250 miles) away from the Twin Cities. This corridor is not as viable in comparison to other city pairs. The goal of this study was to evaluate potential connections to other states, but not entire multistate routes; in this instance, a likely service would continue on to Omaha, which may result in substantially higher ridership volume than was estimated.
- **Minneapolis-Owatonna-Rochester –** This corridor is circuitous and slow in comparison to the other alternatives and thus would yield relatively low ridership numbers. The HSR corridor option has far higher potential for viability than this route.
- **Rochester-Winona –** The current alignment would not allow sufficient speeds for competitive passenger rail service. A separate high-speed alignment has been carried forward for further analysis.
- **Minneapolis-Norwood/Young America –** This corridor has low potential ridership and would require significant improvements to have trip times that are competitive with automobiles.
- **Norwood/Young America-Appleton –** This corridor has very low potential ridership and would require significant improvements to have trip times that are competitive with automobiles.

Table 4.1 Initial Screening, Data Evaluation

Corridor	Service Level (Round Trips)	Potential Ridership	FRA Track Class	Available Capacity
Minneapolis-Coon Rapids	4/Day	High	3	Low
Minneapolis-Coon Rapids	8/Day	High	3	Low
Minneapolis-Coon Rapids	HSR	High	N/A	N/A
Coon Rapids-Big Lake	4/Day	High	4	Medium
Coon Rapids-Big Lake	8/Day	High	4	Medium
Big Lake-St. Cloud	4/Day	High	4	Low
Big Lake-St. Cloud	8/Day	High	4	Low
St. Cloud-Fargo/Moorhead	4/Day	Medium	4	Low
Coon Rapids-Cambridge	4/Day	Medium	4	Low
Coon Rapids-Cambridge	8/Day	Medium	4	Low
Coon Rapids-Cambridge	HSR	High	N/A	N/A
Cambridge-Duluth	4/Day	Medium	4	Low
Cambridge-Duluth	8/Day	Medium	4	Low
Cambridge-Duluth	HSR	High	N/A	N/A
Minneapolis-Willmar	4/Day	Medium	4	High
Willmar-Fargo/Moorhead	**4/Day**	**Low**	**3**	**High**
Willmar-Sioux Falls, South Dakota	4/Day	Low	4	Medium
Minneapolis-St. Paul (BNSF)	4/Day	High	3	Medium
Minneapolis-St. Paul (CP)	4/Day	High	3	Medium
St. Paul-Hastings	4/Day	High	4	Medium
St. Paul-Hastings	HSR	High	N/A	N/A
Hastings-Winona (La Crosse)	4/Day	High	4	Medium
Hastings-Winona (La Crosse)	HSR	High	N/A	N/A
St. Paul-Northfield	4/Day	High	4	High
Northfield-Albert Lea (Kansas City)	4/Day	Low	4	High
Minneapolis-Mankato	4/Day	Medium	3	High
Mankato-Worthington (Sioux City)	**4/Day**	**Low**	**4**	**High**
St. Paul-Eau Claire, Wisconsin	4/Day	High	4	High
St. Paul-Owatonna-Rochester	4/Day	Medium	3	High
Minneapolis-Owatonna-Rochester	**4/Day**	**Medium**	**2**	**High**
Rochester-Winona	**4/Day**	**Low**	**2**	**High**
Minneapolis-Norwood/Young America	**4/Day**	**Low**	**3**	**High**
Norwood/Young America-Appleton	**4/Day**	**Low**	**3**	**High**
Twin Cities-Rochester	HSR	High	N/A	N/A

4.1.2 Needs Analysis

A needs analysis was conducted for all freight and potential passenger rail corridors in Minnesota. A process was developed so that a clear understanding of needs on the rail system for both freight and passenger operations, today and in the future (2030), could be derived. Key to this process is the understanding of the cumulative effect projects have on each other, and how important the underlying freight infrastructure is to the eventual development of a robust passenger rail network in the State (with a few exceptions where entirely new alignments are considered). The following evaluation process was used to establish needs.

- Corridors were evaluated to determine current freight Level of Service (LOS). A GIS-tool was used as a guide for determining LOS, complimented by expert opinions on Minnesota rail operations (Mn/DOT staff, consultant team, railroads, and others) to determine any additional system chokepoints that were not evident in the GIS-tool. For this evaluation, a LOS of C or better was considered acceptable. LOS C conditions describe a volume-to-capacity ratio of 0.4 to 0.7, meaning there exist low to moderate train flows in the corridor and there is enough available capacity to accommodate maintenance operations and to recover from incidents. Figure 4.2 shows current freight LOS with existing passenger rail services (Amtrak Empire Builder and Northstar) overlaid.
- Corridors were then evaluated to determine future freight LOS (see Figure 4.3), with the forecast levels of passenger trains as developed as part of the ridership forecasting process described in Section 3.0 applied to shared freight and passenger corridors. IHS-Global Insight TRANSEARCH data as presented in Section 3.0 was used to determine 2030 future freight flows. For corridors that were LOS D or worse (volume-to-capacity ratio of 0.7 or greater), improvements were identified to enable these corridors to be brought back to a minimum of LOS C. Improvements identified included additional tracks or signal systems, and more general improvements to overall operations and terminals.
- HSR services are proposed to be developed in new right-of-way in some corridors. Overall infrastructure, right-of-way, rolling stock, and operating and maintenance costs were identified. These improvements are effectively independent of the other improvements.

The outcome of the recommended improvements described in Section 4.2 are shown here in Figure 4.4 (2009) and Figure 4.5 (2030).

Figure 4.2 2009 Freight Level of Service
Without Improvements

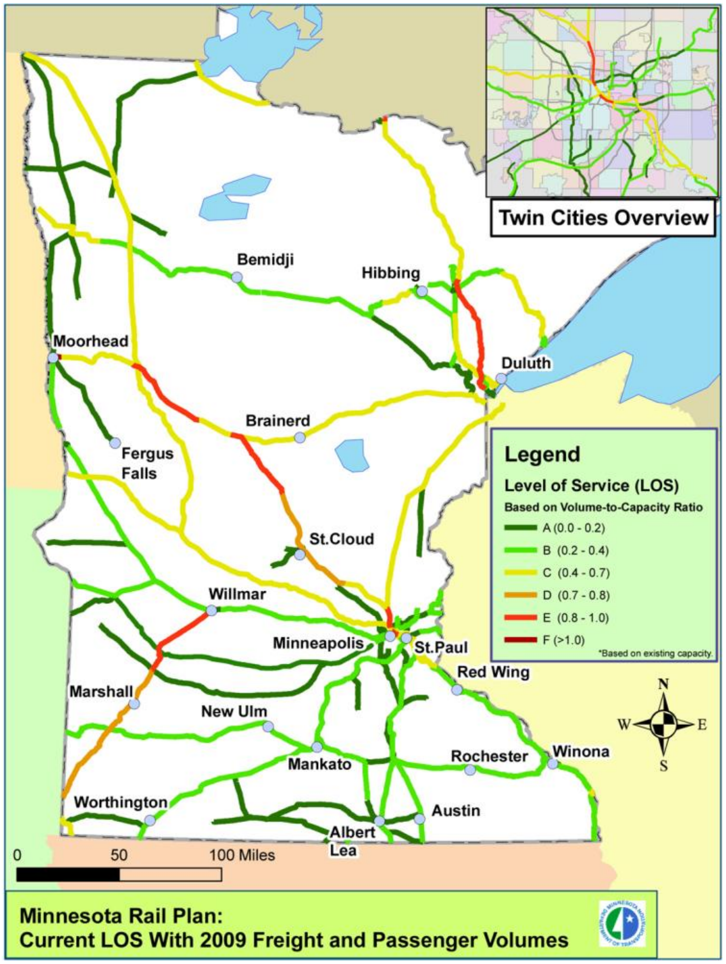


Figure 4.3 2030 Freight Plus 2030 Passenger Level of Service
Without Improvements

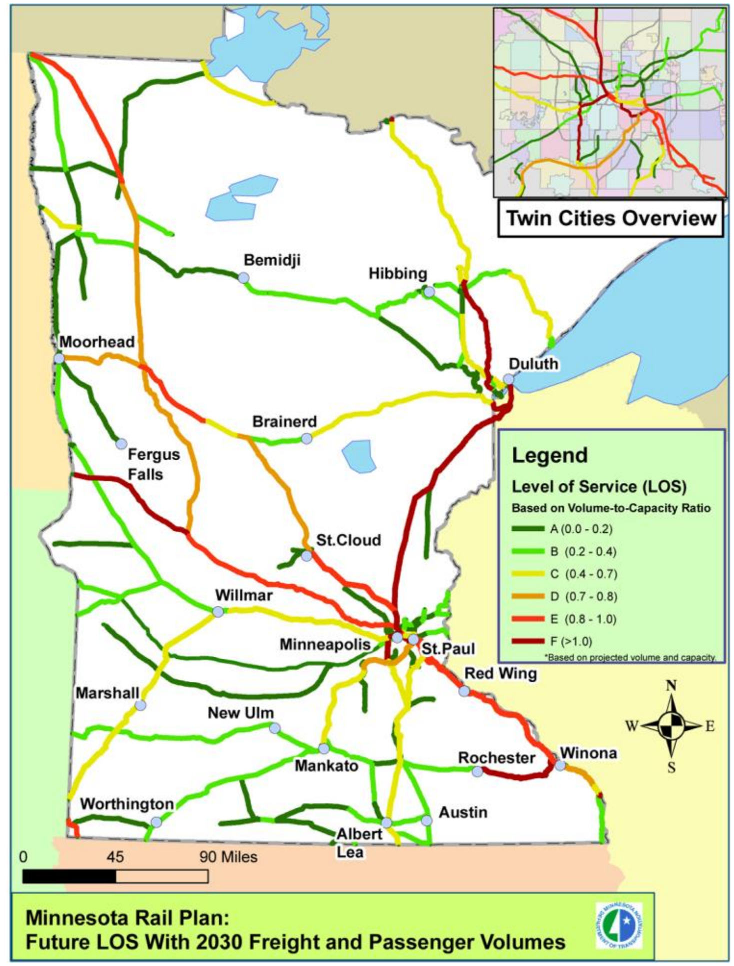


Figure 4.4 2009 Freight Level of Service
Shared Corridors with Recommended Improvements

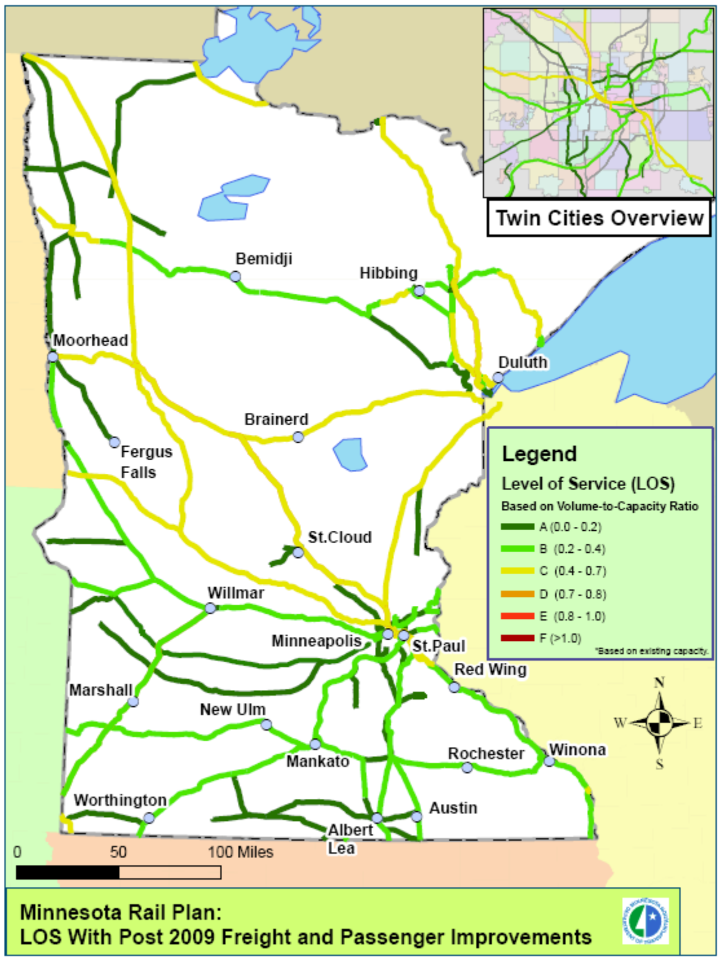
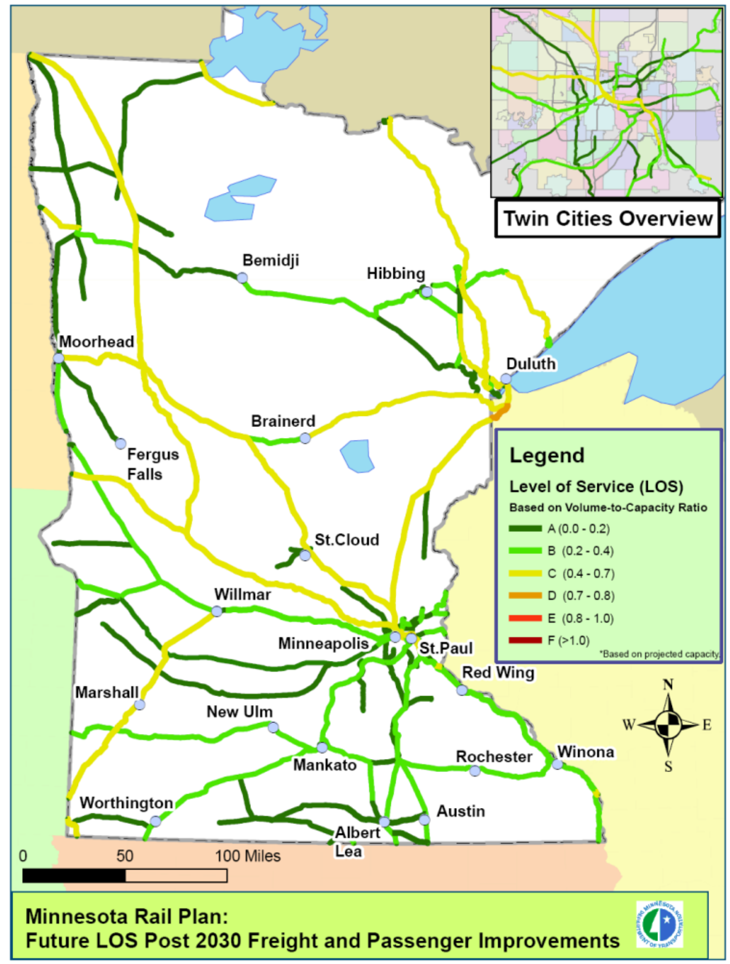


Figure 4.5 2030 Freight Plus 2030 Passenger Level of Service
Shared Corridors with Recommended Improvements



4.1.3 Improvement Cost Evaluation

After improvements were identified for each line or corridor, estimates were developed to quantify the costs of improvements and to start weighing the benefits versus costs of improvements. The cost estimates presented herein are general in nature and are not detailed engineering cost estimates. The intent is to use these order-of-magnitude cost estimates for an apples-to-apples comparison among corridors – much as was done with the ridership forecasts. Even though some corridors provide connections to points beyond the state border, this evaluation only reflects costs for work in the State of Minnesota.[22] Several of the corridors listed have gone through advanced levels of engineering assessment; those cost estimates should take precedence for evaluating subsequent steps of project development.

As described below, some cost elements have high degrees of uncertainty such as trackage rights on freight rail lines, O&M costs, contingencies, Positive Train Control (PTC) implementation (and also ridership and revenue as discussed elsewhere). For these cost elements, high (referred to as base) and low (referred to as best) cost estimates were developed. Data for individual rail segments and corridors is shown only for the base case. All summary tables show both sets of estimates.

Freight Rail Cost Estimates

Improvement cost estimates were developed using the assumptions and unit costs listed in Table 4.2. While use of unit costs for calculating improvements is the simplest approach, in several cases combinations of improvements were required and lump sum costs are displayed for various projects. Costs are provided for items such as track and signal upgrades, clearance restrictions, 286,000-railcar compliancy, and other categories of improvements. Cost estimates do not include right-of-way.

An alternative methodology was developed for the best case scenario assuming that the infrastructure of a conventional CTC system would not be added in conjunction with the installation of PTC. This would change the per mile cost to $100,000 for just the PTC architecture. In addition, a 10 percent contingency was applied to the best case scenario, rather than the 30 percent in the base case.

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[22] The one exception is the Eau Claire to Twin Cities corridor which is predominantly in Wisconsin. Including only Minnesota costs and benefits would have been meaningless.

Table 4.2 Cost Assumptions for Freight Rail

Cost Item	Cost	Unit	Source
Upgrade Track			
Class I to II	$63,360	Mile	TKDA
Class II to IV	$712,800[a]	Mile	TKDA
Class III to IV	$712,800[a]	Mile	TKDA
New Class IV	$1,709,000	Mile	TKDA
Signalization			
CTC (Single Track)	$550,000	Mile	Northstar
CTC (Double Track	$750,000	Mile	Northstar
PTC	$100,000	Mile	Estimated implementation cost of the Rail Safety Improvement Act (RSIA) of 2008 divided by Class I system mileage from the Bureau of Transportation Statistics (BTS)
Crossings			
Active Warning Device	$200,000	Signal	Mn/DOT
Additional Costs (Applied to Track and Signal)			
Engineering	10%		
Contingencies Base/Best Case	30%/10%		

[a] Costs are expected to be similar.

Passenger Rail Costs Estimates

Improvement cost estimates were developed using the assumptions and unit costs listed in Tables 4.3. Costs are provided for items such as track and signal upgrades, rolling stock, and operating and maintenance costs, and are based on a variety of sources, including recent Northstar[23] and Amtrak information.[24,25,26] Estimates do not include costs that may be associated with stations, nor do they include costs for any major structural modifications to railroad overpasses or underpasses. The following differences were applied to the base and best case scenarios:

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[23] Based on recent internal Northstar team communications

[24] Consolidated Financial Statements. National Railroad Passenger Corporation and Subsidiaries (Amtrak). For the Years Ended September 30, 2007 and 2006.

[25] System Mileage within the United States. Bureau of Transportation Statistics. http://www.bts.gov/publications/national_transportation_statistics/html/table_01_01.html. Retrieved 9/22/2009.

[26] U.S. Vehicle Miles. Bureau of Transportation Statistics. http://www.bts.gov/publications/national_transportation_statistics/html/table_01_32.html. Retrieved 9/22/2009.

- Operating and maintenance costs were varied between $70 and $55/mile. The $70 reflects Amtrak's fully allocated overhead costs, excluding depreciation and interest, for providing specific services, while the $55 cost reflects actual Amtrak direct costs, excluding infrastructure maintenance and system costs.
- Capacity rights costs were varied between $85,000/train mile and $40,000. These costs reflect only the cost of securing trackage rights from the private railroad operators of the lines, and not costs of any improvements to the lines. These costs could vary significantly depending on the excess capacity available now and as projected in the future by the freight railroad. Actual costs would have to be negotiated in each case, and represent one of the biggest unknowns in these estimates. Although Amtrak has the legal right to operate on freight tracks, the reality is that this right is exercised through negotiation of fees. The $85,000 estimate reflects the actual negotiated agreement between the Northstar commuter rail project and BNSF beyond the cost of capital projects. However, this BNSF corridor has the heaviest freight demand in the State, and commuter rail service is more intensive than intercity service. Therefore, a lower estimate was developed.

Another unknown is the cost of right-of-way for greenfield line segments. It has been suggested that greenfields in rural areas could be acquired inexpensively. It is likely that all landowners will fight hard for maximum compensation, even to the point of court actions, which regardless of the outcome will significantly increase the time and cost of acquisitions. It is likely that any rail alignments will split individually owned land parcels requiring premium payments. Therefore, a relatively high estimate of this cost has been carried through both scenarios.

Table 4.3 Cost Assumptions for Passenger Rail

Cost Item	Cost	Unit	Source
Rolling Stock			
High-Speed Rail	$23.5 million	Trainset	Talgo/Wisconsin
Conventional Rail	$18 million	Trainset	Northstar
Upgrade Track			
Class I to II	$63,360	Mile	TKDA
Class II to IV	$712,800	Mile	TKDA
Class III to IV	$712,800	Mile	TKDA
Class IV to VI	$79,200	Mile	TKDA
New Class IV/VI	$2,600,000	Mile	TKDA
Signalization			
CTC (Single Track)	$550,000	Mile	Northstar
CTC (Double Track	$750,000	Mile	Northstar
PTC	$100,000	Mile	Estimated implementation cost of the Rail Safety Improvement Act (RSIA) of 2008 divided by Class I system mileage from the Bureau of Transportation Statistics (BTS)
PTC Loco	$30,000	Locomotive	Northstar

Table 4.3 Cost Assumptions for Passenger Rail (continued)

Cost Item	Cost	Unit	Source
Crossings			
Grade Crossing Upgrade	$200,000	Mile	TKDA
Quad Crossing	$400,000	Mile	TKDA
Operations and Maintenance (O&M)			
HSR O&M – Base/Best Case	$70/$55	Annual Train Miles	Amtrak fully allocated expenses divided by train mileage from BTS/Amtrak direct costs divided by train mileage from BTS
Conventional O&M – Base/Best Case	$70/$55	Annual Train Miles	Amtrak fully allocated expenses divided by train mileage from BTS/Amtrak direct costs divided by train mileage from BTS
Right-of-Way (ROW)			
ROW	$910,000	Mile	$50,000/Acre and 150-foot ROW assumed
Capacity Rights			
Capacity Rights – Base/Best Case	$85,000/ $40,000	Daily Train Miles	Northstar/Reduction from Northstar amount to account for congestion on Staples subdivision
Additional Costs (Applied to Track and Signal)			
Engineering	10%		
Contingencies – Base/Best Case	30%/10%		

4.2 Freight-Only Corridor Needs

Freight-only corridors were evaluated with the GIS tool to determine what improvements are needed today or will be needed by 2030 to achieve a freight LOS of C or better on all lines in the State. This section specifically defines and costs improvements identified to mitigate those sections of congested LOS D, E, and F lines as shown previously in Figures 4.2 and 4.3 and improve them to the targeted capacity needed for LOS C. Needs and improvements are organized by freight rail operator, and then by subdivision. The investments are summarized in Table 4.4. Further detail on each subdivision of each railroad is provided in Technical Memorandum 6.

Table 4.4 Summary of Freight-Only Investments

Subdivision	2009	Cost to Upgrade (Millions of Dollars)
Track, Signal, Bridge		
	BNSF	$68.00
	CN	$68.00
	CP	$331.80
	UP	$35.40
Other Major Class I Improvements		
	Bottlenecks *(incl. in passenger line costs)*	–
	Bridges *(incl. in passenger line costs, except for Roberts Street Bridge)*	$51.00
	Intermodal Facilities	$150.00
Weight, Speed and Track Restrictions[a]		
	286k lb Upgrades	$548.00
	Bridge and speed restrictions	$13.00
	FRA Class 1 to 2 Upgrades (less 286k overlap)	$244.00
Positive Train Control		
	Class I Mainlines Base/Best Cases	$1,640.00/$335.00
Grade Crossings		
	Active Warning Devices (1,400)	$280.00
	Cost of Upgrades – Base/Best Cases	$3,173/$1,867
	10% Engineering/10-30% Contingency – Base/Best Cases	$1,269/$373
	Total Cost – Base Case/Best Case	**$4,442/$2,241**[a]

[a] Does not include unknown costs.

4.2.1 Burlington Northern Santa Fe (BNSF)

BNSF lines serve nearly every part of Minnesota, providing vital linkages to important freight hubs such as Chicago and the coal-rich Powder River Basin. Despite this, most BNSF freight-only corridors in the State show comfortable volume-to-capacity ratios through 2030 and do not require much investment. Two corridors – the Browns Valley and P-Line subdivisions – are recommended for investment based on either weight or speed restrictions today. Both of these subdivisions carry few trains and serve primarily grain producers in western parts of Minnesota. Only one freight-only corridor, the St. Croix subdivision, demonstrates a need for investment based on high freight volumes, but not until 2030.

Small portions of three other subdivisions (KO, Marshall, and St. Paul) also are recommended for improvement. Passenger rail service is slated for most of each of these three subdivisions, but small segments are identified as freight-only and will need investment due to volume and capacity issues. These improvements are summarized in Table 4.5. For each individual corridor, only the base case cost estimates are shown. Best case estimates are shown in the summary tables.

Table 4.5 Summary of BNSF Improvements on Freight-Only Corridors

Subdivision	2009	Cost to Upgrade (Millions of Dollars)	2030	Cost to Upgrade (Millions of Dollars)
Browns Valley	X	$54.6		
KO			X	$0.5
Marshall			X	$6.2
P-Line	X	$1.0		–
St. Croix			X	$1.4
St. Paul			X	$4.2
Cost of BNSF Upgrades				$67.9

4.2.2 Canadian National (CN)

CN's Minnesota network is concentrated primarily in the northeast between Duluth and International Falls, with some segments in the Twin Cities area and near the Iowa border, plus a transcontinental line in the northern part of the State. Of the freight-only corridors, three demonstrate an immediate need for improvement – two in the Duluth region and one east of the Twin Cities. The Rainy subdivision, which connects Duluth to International Falls and Ontario, shows an elevated volume-to-capacity ratio, due primarily to lack of modern signalization. Additionally, both the Dresser and Osage subdivisions have weight restrictions that necessitate investment. Interestingly, none of CN's lines show any need for further improvement in 2030 based on volume and capacity projections. These improvements are summarized in Table 4.6.

Table 4.6 Summary of CN Improvements on Freight-Only Corridors

Subdivision	2009	Cost to Upgrade (Millions of Dollars)	2030	Cost to Upgrade (Millions of Dollars)
Dresser	X	$13.1		
Osage	X	$20.6		
Rainy	X	$34.0		
Cost of CN Upgrades				$67.7

4.2.3 Canadian Pacific (CP)

CP's rail operations generally run southeast to northwest across the State, with Minnesota acting as a linchpin between CP's major operations on Canada's west coast and its operations in the U.S. Midwest and Montreal. In fact, a CP train could enter the far southeastern tip of the State near Minnesota Slough on the Marquette subdivision, which is owned by a CP affiliated railroad, and exit into Canada at Noyes in the far northwest.

Considering the important role Minnesota plays in CP's operations, it is not surprising that five CP subdivisions demonstrate a need for investment. However, of these recommended improvements, only two are immediate needs, and both are for lightly used lines. We recommend upgrading weight-restricted track and a bridge on the Bemidji subdivision and improving the Class I track on the MN&S subdivision. This last investment may prove more important, as CP could use the MN&S sub to bypass bottlenecks such as University Junction.

The remaining four subdivisions are major CP corridors in the State. While the volume-to-capacity ratios on these subs are acceptable currently, growth is expected to occur on them by 2030, necessitating investment. These improvements are summarized in Table 4.7.

Table 4.7 Summary of CP Improvements on Freight-Only Corridors

Subdivision	2009	Cost to Upgrade (Millions of Dollars)	2030	Cost to Upgrade (Millions of Dollars)
Bemidji	X	$29.6		
Detroit Lakes			X	$84.0
Elbow Lake			X	$38.5
MN&S	X	$24.4		
Noyes			X	$28.2
Paynesville			X	$48.2
DM&E Waseca		$77.5		
ICE Owatonna		$1.4		
Cost of CP Upgrades				$331.8

4.2.4 Union Pacific (UP)

Union Pacific is the nation's largest railroad with connections to every major port on the west and gulf coasts. In Minnesota, UP's service is concentrated in the State's south, with connections to Iowa, Nebraska, Chicago, and points beyond. Four UP subdivisions demonstrate a need for immediate improvement and all four lines are lightly used collection/distribution routes where various restrictions are found. In fact, the Hartland, Montgomery, Rake, and Winona subdivisions share many similarities. All are short in length, ranging from the 1.8-mile Winona sub to the 21-mile Montgomery sub, and all are used as branch lines. These improvements are summarized in Table 4.8.

Table 4.8 Summary of UP Improvements on Freight-Only Corridors

Subdivision	2009	Cost to Upgrade (Millions of Dollars)	2030	Cost to Upgrade (Millions of Dollars)
Hartland	X	$18.7		
Montgomery	X	$10.4		
Rake	X	$4.1		
Winona	X	$2.2		
Cost of UP Upgrades				$35.4

4.2.5 Weight, Speed, and Track Restrictions

In the volume-to-capacity analysis of the State's rail network, none of the non-Class I railroads exhibited elevated volume-to-capacity issues. In most cases, train volumes on these lines are minimal. There are, however, a number of conditions which affect 2009 freight flows, including 286k-lb. compliance, bridge restrictions, track restrictions, and FRA Class 1 track. These needs are listed in Table 4.9. No 2030 restrictions were found on these lines, indicating that these repairs, for a total investment of over $772.1M, will carry these segments' needs through 2030.

Table 4.9 Weight, Speed, and Track Restrictions

Owner	Subdivision	286k	Bridge	Speed	Track Class	Total Cost
BNSF	Browns Valley	X	X			$54.6
CN	Dresser	X	X			$13.1
CN	Osage	X	X			$20.6
CP	Bemidji	X	X		X	$29.6
CP	MN&S Spur				X	$24.4
CP	Owatonna			X		$1.4
CP	Waseca	X	X			$77.5
CTRR		X	X	X	X	$6.7
MDW				X		$5.6
MNN	P-Line			X	X	$61.5
MNN	Warroad	X	X	X	X	$146.6
MNN	Ada			X	X	$21.9
MNNR	Hugo			X	X	$19.0
MNNR	St. Paul-Fridley			X	X	$18.1
MPLI	Redwood Falls	X	X	X	X	$110.3
MSWY	LaVerne	X	X	X	X	$56.4
NLR	Cold Spring		X	X	X	$24.0

Table 4.9 Weight, Speed, and Track Restrictions (continued)

Owner	Subdivision	286k	Bridge	Speed	Track Class	Total Cost
NLR	East Side			X	X	$2.7
NLR	St. Joe			X	X	$7.0
OTVR	Barnsville		X			Unknown
PGR	Cannon Falls			X	X	$12.3
PGR	Dan Patch		X	X	X	$12.8
PGR	Eagandale		X	X	X	$12.3
PGR	Faribault			X	X	$2.5
PGR	Jesse James			X	X	$28.9
SCXY	Amber		X			$0.6
UP	Hartland	X	X		X	$18.7
UP	Montgomery	X	X			$10.4
UP	Rake	X	X			$4.1
UP	Winona				X	$2.2
					Total Cost	$805.7

[a] Does not include costs for "unknown" improvements.

The American Short Line and Regional Railroad Association (ASLRRA) released a report in 2000 that identified $6.9 billion in costs (1999 dollars) to upgrade the track of America's short line and regional railroads to accommodate the current standard weight of 286,000 pounds. This estimate was updated as part of the AAR *National Rail Freight Infrastructure Capacity and Investment Study*[27] that derived a new value for upgrading short line and regional railroad track to accommodate 286,000-pound loads of $7.2 billion (in 2007 dollars).

In Minnesota there are 453 miles of railroad that currently cannot handle 286,000 pound railcars. Most noncompliant lines are restricted from carrying any heavy railcar in excess of 263,000 pounds. Based on this study's assessment, the cost to upgrade these noncompliant lines to carry 286,000-pound railcars is nearly $550 million, roughly eight percent of the national total.

4.2.6 Other Major Capacity Improvements

Table 4.10 highlights other major capacity project needs and the cost to alleviate these present day bottlenecks. Following the table is a brief description of each of these bottlenecks. While these projects are each on the freight system today, many of these upgrades only become critical as passenger service is introduced on the line. Section 4.3 discusses specific passenger corridors that require these major capacity improvements.

[27] National Rail Freight Infrastructure and Investment Capacity Study, Association of American Railroads, 2007.

Not included in these identified structural improvements is the issue and potential costs associated with limited capacity in downtown Minneapolis on the BNSF Wayzata sub, specifically at the site of Target Stadium and the new Northstar commuter rail station, also known officially as the "Minneapolis Interchange." The constricted right-of-way at the Stadium site currently allows one through freight track, utilized by BNSF and TC&W for significant volumes of through train movements, and two passenger tracks on either side of a center platform. All of the track, approaches, signals, and overpasses have just been upgraded to accommodate Northstar. The Plan assumes freight traffic will continue to grow, and there is currently no easily accessed alternative for rerouting freight in this corridor. Adding to capacity needs is a projected large increase in intercity and commuter trains calling at this site. There will be a need for major expansion of the passenger rail terminal and associated passenger train storage and servicing facilities in the area. An independent station study is currently being conducted to determine expansion needs at this site.

Table 4.10 Other Major Capacity Improvements

Project	Cost to Upgrade (Millions of Dollars)
Junctions	
Coon Creek Junction/Third Main	$100
Dan Patch Interchange (Savage)	$10
Hoffman Interlocking	$54
Minneapolis Junction	$33
Moorhead Junction	$5
Shakopee Realignment	$163
St. Anthony Junction	$29
St. Louis Park Interchange	$70
University Interlocking	$14
Bridges	
BNSF Bridge 28.3	$4
BNSF Bridge 30.2	$6
BNSF Bridge 62.4	$13
BNSF Bridge 91.8	$2
Grassy Point Swing Bridge (BNSF) over Saint Louis River	$51
Hastings (CP) over Mississippi River	$90
Hudson (UP) over St. Croix River	$87
La Crescent Bridge (CP)	$117
Mendota Heights (UP) (Omaha Road Bridge Number 15) over Mississippi River	$44
Pigs Eye Bridge (UP) over Mississippi River	$76
Robert Street Vertical Lift Bridge (UP) over Mississippi River	$51
Savage Bridge over Minnesota River	$34
Intermodal Facility – New Twin Cities Area Facility	$150
Total Cost	**$1,203**

Junctions

Coon Creek Junction/BNSF Third Main. Coon Creek junction is the location on the Staples subdivision where the Hinckley subdivision begins and heads north toward Duluth. Besides the need to improve speed and capacity at this junction, this bottleneck extends south approximately seven miles to International Junction, where BNSF and CP transcontinental routes from Chicago to the Pacific Northwest cross. This track segment and the junction sits astride BNSF's busiest freight route and is also used by CP and UP to serve Duluth and Superior. It is the route for Northstar Commuter Rail and the Empire Builder. The NLX high-speed passenger service to Duluth would utilize this track and junction to enter the Hinckley subdivision and access the proposed "raceway" of double track between Coon Creek Junction and Sandstone. It also is the site of a proposed north suburban station at Foley Boulevard, site of freeway access and the Twin Cities' largest Park-and-Ride facility. This site would be consistent with FRA guidance for key suburban stops for intercity service to enhance urban service coverage and convenience for riders, similar to proposals for Rosemount or Hastings in the southeast. The possibility of an additional third mainline track from Coon Creek junction to International Junction would significantly improve the capacity of this location.

Dan Patch Interchange (Savage). In order to provide passenger service from Mankato to Minneapolis a connecting piece between the Mankato subdivision and the Dan Patch line would need to be built. The two railroads are grade separated so a significant amount of track would need to be built in order to accommodate a small grade. Several rail-dependent bulk terminals currently abut or occupy the right-of-way that would need to be acquired.

Hoffman Interlocking. Hoffman Junction is one of the current major bottlenecks in the State of Minnesota. Three of the four Class I railroads serving Minnesota operate over part or all of this facility. The UP movement crosses the CP and BNSF main lines to access the Pigs Eye area. This movement limits capacity for all three rail carriers. The identified improvement will provide for grade separation between the UP movement and the CP and BNSF mainlines and thus increase capacity through the junction. Ramsey County Regional Rail Authority has commissioned a study to positively identify the demands, alignments, and investments that will be needed in this area, in cooperation with the railroads, passenger projects, Mn/DOT, and the Metropolitan Council.

Minneapolis Junction. Minneapolis Junction is one of the major emerging bottlenecks in the State of Minnesota. The potential capacity of the junction could be increased with the addition of a second main along the west leg of the wye. This improvement would not satisfy the lack of speed through the west leg of the wye. The curve currently is a seven degree curve therefore restricting the speed of passenger trains to 25 mph. A true fix to the current bottleneck would include property acquisition and the easing of the curve around the west leg of the wye. There are many businesses within the affected area that would need to be purchased and leveled to accommodate the new alignment. Several bridges, particularly the Hennepin Avenue overpass, would need to be reconstructed as well to implement this easing of curvature.

Moorhead Junction. Larger turnouts are needed to increase speed.

City of Shakopee Track Realignment. To increase the speed through the city of Shakopee a bypass may need to be constructed for the Union Pacific's Mankato subdivision. The rerouting could provide 10 miles of track around the downtown area of Shakopee, bypassing an area of what is essentially 10 mph street running on City-owned right-of-way.

St. Anthony Junction. The CP alternative to connect commuter and intercity rail from St. Paul to Minneapolis requires traveling through the Minnesota Commercial Railroad's A yard before joining the BNSF mainline leading to Minneapolis Junction. An option to increase speed through the A yard would be to relocate some of the track. This would minimize existing curvature and increase speeds. A multiple-track, high-speed interlocking would also need to be installed.

St. Louis Park Interchange. A study is currently underway to determine the future for the St. Louis Park Interchange. Based on Hennepin County's desire to utilize the Kenilworth corridor east of the interchange for other transportation alternatives, improving the interchange between TC&W and the CP is the preferred route modification. Although the improvement faces major geometric challenges of grade and curvature, a successful project would provide TC&W and CP with expanded route options between the southwest metro area and Class I yards and interchanges.

County-commissioned engineering estimates suggest a cost of $48 million for improvements, and within a variety of assumptions on potential grades, curvatures, and line displacements, final costs are expected to fall in the $40 to $70 million range. More advanced work on engineering, mitigation, and possible agreements with CP and TC&W are scheduled for 2010.

University Interlocking. University interlocking is a station location on the BNSF. The speeds though this junction are adequate for the BNSF but the CP has slow speeds as it leaves the BNSF and begins the Paynesville subdivision. To avoid congestion on the BNSF line a track could potentially be built to the east for the CP to exit the BNSF at higher speeds. In order for the CP to continue at higher speeds on the Paynesville subdivision there would need to be either easing of the curve leading to the bridge or construction of a new bridge for CP over BNSF that is not as perpendicular to the BNSF as the current bridge.

Bridges

The following cost estimates do not include demolition of the current bridges and assume that the new bridges would be constructed at least 25 feet from the existing structures. Approach construction, engineering, and contingencies are not included in the cost. Parts of bridges on either side of the spans described below are assumed to be constructed using plate girder spans.

BNSF Bridges on Hinckley Subdivision. Four single track bridges on the BNSF's Hinckley subdivision. The cost to replace all four bridges on the Hinckley subdivision would be $25 million.

Grassy Point Bridge. The Grassy Point Bridge crosses the St. Louis River on the BNSF's line between Superior, Wisconsin and Duluth, Minnesota. The current bridge is a steel through truss center pivot swing span. A proposed replacement bridge would be a 240-foot-long single track vertical lift span. The estimated cost of the bridge is $51 million. A relocated channel crossing between Superior and Rice's Point (Duluth CP and BNSF yards) could also potentially improve HSR travel times into Duluth and open up Duluthport to through intermodal container services.

Hastings Bridge. The Hastings Bridge crosses the Mississippi River on the Canadian Pacific's River Subdivision. The current bridge is a single track through truss vertical lift span. A proposed replacement bridge would be a 324-foot-long double track vertical lift span. The estimated cost of the bridge is $90 million.

Hudson Bridge. The Hudson Bridge crosses the St. Croix River on the Union Pacific's Altoona Subdivision. The current bridge is a steel through truss center pivot swing span. A proposed replacement bridge would be a 160-foot-long single track vertical lift span. The estimated cost of the bridge is $87 million.

La Crescent Bridge. The La Crescent Bridge consists of four different bridges that cross the Mississippi River, the east channel of the Mississippi, the Black River, and the French slough. The bridges are located on the Canadian Pacific's Tomah Subdivision. The types of current bridges listed above are respectively a steel through truss center pivot swing span, a steel deck plate girder, a steel through truss draw span, and a steel deck plate girder. The proposed replacement will be a fixed span, perhaps on a different alignment. The estimated cost for all of the bridges is $117 million.

Mendota Heights Bridge. The Mendota Heights Bridge crosses the Mississippi river on the Union Pacific's Mankato Subdivision. The current bridge is a steel through truss swing span. A proposed replacement bridge would be a 200-foot-long single track vertical lift span. The estimated cost of the bridge is $44 million.

Pigs Eye Bridge. The Pigs Eye Bridge crosses the Mississippi River on the Union Pacific's Albert Lea Subdivision. The current bridge is a steel through truss center pivot swing span. A proposed replacement bridge would be a 240-foot-long single track vertical lift span. The estimated cost of the bridge is $76 million.

Robert Street Bridge. The Roberts Street Bridge crosses the Mississippi river on the Union Pacific's State Street Industrial Lead. The current bridge is a through truss vertical lift span. A proposed replacement bridge would be a 200-foot-long single track vertical lift span. The estimated cost of the bridge is $51 million.

Savage Bridge. The bridge in Savage, Minnesota crosses the Minnesota River on the MN&S line, but owned by the TC&W. Currently out of service, this bridge is a steel through truss center pivot swing span. A proposed replacement bridge would be a single track 160-foot-long through truss vertical lift span. The estimated cost of the bridge is $34 million.

Intermodal Services

In its present form, rail intermodal (the haulage of containers and trailers) services available in Minnesota are limited geographically and capacity-wise. Existing terminals are all located in the Twin Cities, and the only direct services available connect to Chicago and the Pacific Northwest. Efforts to provide service in other parts of the State have not been successful, with a public terminal opening and closing in the western part of the State at Dilworth. Elsewhere, a private intermodal operation at Montevideo has handled grain products on a seasonal basis.

The stakeholder conversations revealed a strong desire for additional terminal capacity in the Twin Cities, as well as access to intermodal service in other parts of the State.

The stakeholder conversations revealed a strong desire for additional terminal capacity in the Twin Cities, as well as access to intermodal service in other parts of the State. From the Twin Cities, service to regions other than Chicago and the Pacific Northwest is either unavailable or circuitous, which has made intermodal a relevant and economical choice for only a small subset of shippers. While terminal capacity is adequate for the markets that currently are being served, it would be difficult to add service to new markets. Providing new terminal capacity has been a difficult issue, as was evident during an ultimately unsuccessful effort in the 1990s by Mn/DOT to locate a new terminal in the Twin Cities. With large volumes of truck traffic, terminals are not attractive neighbors, and drayage costs make their geographic location sensitive to shippers, at least for domestic traffic. Thus, the existing central locations of the BNSF in St. Paul and CP in Shoreham will be hard to beat.

Offering intermodal service beyond the Twin Cities in locations such as Duluth or western Minnesota would be beneficial given the size of the State. However, intermodal service is heavily density driven, and, given that direct access is only provided to a few major markets, there must be sufficient demand in those lanes to justify daily service. For a terminal served by a Class I railroad, the minimum threshold is around 25,000 units, while for a short line 10,000 and sometimes fewer units are sufficient. Smaller volumes are usually insufficient to justify a daily frequency that represents the minimum threshold for quality service that is attractive to a range of shippers. For specialty purposes, such as containerized grain for export, less frequent or even seasonal service may meet the need, but it must be understood that the clientele for such a service will be quite limited.

A major influence on the competitiveness of a terminal is the availability of equipment for shippers in smaller, lower density markets. For export moves, empty containers are generally concentrated in major markets such as Chicago. Thus, if a western Minnesota shipper requests equipment for a West Coast export move, most likely an empty box must be relocated 700 miles from Chicago to the point of loading. The cost of this move can be substantial, and can result in the intermodal shipping cost exceeding an equivalent all-truck move. Adding to that are volatile equipment management strategies that can quickly change the economics of using intermodal from attractive to unattractive. This was the case at the Dilworth terminal, as well as the seasonal operation out of Montevideo.

Public involvement raises tricky competitive issues for railroads, who strongly prefer to control their own terminals. In the Twin Cities, this issue is most clearly manifested by the lack of service along the I-35 corridor between Minnesota, Iowa, Kansas, Texas, and Mexico. Although volumes are sufficient to support competitive service in this corridor, it does not exist largely because UP – the carrier that has the most direct route paralleling I-35 – does not have a suitable site for an intermodal terminal in the Twin Cities.

In spite of these impediments, expansion of intermodal service is important enough that a collaborative effort among the stakeholders should be initiated to ensure expanded intermodal service options in Minnesota.

4.2.7 Positive Train Control

Positive Train Control (PTC) refers to technology that is capable of preventing train-to-train collisions, overspeed derailments, and casualties or injuries to roadway workers (e.g., maintenance-of-way workers, bridge workers, and signal maintainers), operating within their limits of authority, as a result of unauthorized incursion by a train. The technology combines GPS locating of all trains, infrastructure switches, crossings, and junctions; computer cataloging of speed restrictions and traffic conditions; and wireless communications between all operating units including engineers, dispatchers, and work crews. Prior to October 2008, PTC systems were being voluntarily installed by various carriers. However, the Rail Safety Improvement Act of 2008 (RSIA) (signed by the President on October 16, 2008, as Public Law 110-432) mandated the widespread installation of PTC systems by December 2015 on all lines handling passenger trains or hazardous materials, essentially the majority of the entire national rail system.[28]

For the purpose of the base case it was assumed that all Class I railroads in Minnesota would be required to comply with this ruling. Calculating the cost for this systemwide upgrade involved two steps: first, identifying those signals on the Class I system that needed to be upgraded to Centralized Traffic Control (CTC), essentially a comprehensive hard-wired conventional signal system; and second, calculating the cost of installing PTC along the entire Class I network. This cost was estimated to be approximately $1.64 billion. It should be noted that there are a number of passenger rail projects being pursued in the state and cost sharing for the installation of this technology is likely between the freight railroads and passenger service implementers. It also is likely that the strategy for implementation of this mandate will undergo further discussion and revision in the coming years.

[28] Federal Railroad Administration, www.fra.dot.gov.

While some short lines also may need to equip locomotives with PTC so as to interface with the Class I's, this cost has not been included.

If it is possible for the freight railroads to move directly to PTC rather than implementing CTC first, then the total cost could be reduced to $335 million.

4.2.8 Freight Rail Relocation

Freight rail tracks and associated infrastructure represent significant capital investments at fixed locations. Nonetheless, there are circumstances under which the relocation of freight rail lines may be warranted. Similarly, freight rail traffic itself can be deployed differently across the network. States, cities, and the railroads themselves have pursued changes in the freight rail network and freight rail operations in order to accomplish a variety of objectives. These include:

- Rationalizing network operations to reduce freight rail operating costs and improve service reliability, particularly through enhanced speed, capacity, connectivity, and flexibility;
- Freeing up rail line capacity so as to accommodate passenger rail operations;
- Mitigating the impacts of rail operations in communities, including noise, vibration, and aesthetics;
- Minimizing risk exposure of hazmat freight rail operations; and
- Providing service to freight facilities such as new intermodal (container) terminals or improving access to water ports.

The relocation of freight rail lines or operations can ease rail bottlenecks, reduce vehicle traffic delays at grade crossings, improve safety, and spur economic development opportunities. At the same time, when rail service is introduced to newly served areas or significantly increased along existing lines, there is potential for realizing negative impacts on those communities, including land use, safety, and environmental concerns. These impacts may require mitigation, such as noise walls, grade separations, and other strategies.

Substantial freight rail relocation projects, such as a rail bypass or a new line, require the review and approval of the Federal Surface Transportation Board (STB). Such projects may be initiated either by private entities (such as a railroad) or a public agency. Typically the STB requires extensive environmental documentation and assessment to be completed for major projects. In addition, other state and Federal environmental requirements apply to such projects, particularly when public funding is involved.

In Minnesota, the issue of freight rail relocation will become increasingly important as the passenger rail network develops and as communities grow. Currently, there are several relocation projects in the State that are under consideration.

In Rochester, the Southern Rail Corridor coalition, including the Olmsted County Regional Rail Authority, the City of Rochester, and the Mayo Clinic have proposed a 48-mile freight rail bypass south of Rochester to replace downtown freight rail service operated by the Canadian Pacific (CP/DM&E). The coalition has identified far-reaching benefits that would result, including improved community safety, enhanced economic development, improved freight rail service, and better integration with passenger rail service. At the same time, the Citizens Against Rochester's Bypass (CARB) actively opposes the proposal, citing far-reaching negative impacts, including environmental concerns, loss of productive farmland, impacts on landowners, safety concerns, and lack of need for the relocation. The Dodge County Regional Rail Authority, through which a portion of the rail bypass would pass, has approved a resolution opposing the proposal for many of the same reasons. The CP/DM&E railroad has expressed neither support nor opposition to the proposal, and has recently completed a rehabilitation of track work through downtown Rochester.

In Hennepin County, the Twin Cities and Western Railroad (TC&W) currently operates freight rail service along the Kenilworth Corridor through the City of St. Louis Park and the City of Minneapolis providing a connection into downtown Minneapolis. Hennepin County owns the rail line. Kenilworth was originally intended to "temporarily" accommodate freight rail traffic that originally crossed the TH55/Hiawatha LRT corridor at-grade. However, freight rail service has operated over 10 years on Kenilworth, which has required County investment for infrastructure improvements. The County and its municipal partners are exploring future alternative routings to select a long-term solution for freight rail service. A bike/pedestrian trail also operates in the Kenilworth Corridor, and the corridor also is under consideration as a segment of the preliminary locally preferred alternative for the Southwest LRT Transitway.

Both the Rochester Southern Rail Corridor and Hennepin County Kenilworth freight rail relocation examples suggest the need for full consideration of:

- A public and transparent planning process that allows all affected stakeholders to fairly represent their interests;
- State, regional, and local comprehensive, transportation, and land use plans, including those for passenger rail development;
- The impacts, costs, and benefits of proposed relocation projects, including the "no-build" alternative;
- Equitable sharing of costs and benefits for the project amongst governmental units, the railroad, and other stakeholders as warranted;
- The need to preserve and enhance freight rail service and to provide adequate capacity to meet current and future demand; and
- The need to preserve and enhance communities through which freight rail lines pass by means of effective mitigation and design strategies.

It is recommended that both the Southern Rail Corridor and Kenilworth projects should proceed through further study development and evaluation, led by locally responsible public agencies. The State of Minnesota should cooperate in these efforts, providing technical resources, potential access to Federal funds, and to assess consistency of the proposals with the State Rail Plan. The consequences of pursuing and also not pursuing these projects should be fully understood prior to decision-making about funding and implementation. Environmental clearances would be required from all regulatory agencies.

4.2.9 Railroads and Hazardous Materials

Following a rash of severe releases of hazardous materials in the 1970s, the individual railroads, together with the Association of American Railroads, the U.S. Department of Transportation, and the chemical industry, have been actively engaged to improve the safe transport of hazardous materials by rail. Substantial progress has been made in the design of and materials used in tank cars, reporting, custody, education, communications, and safe handling. The railroads and car builders have responded with better steels and coatings, higher build quality, repositioned vents and valves, shelf couplers, and puncture shielding that have made the tank car much more able to survive an accident without spillage. Concurrently, the rail infrastructure has improved materially, reducing the incidents of equipment failures and derailments to the lowest levels in history. The net result has been that injuries and fatalities related to rail transportation of hazardous materials to be just one-eighth of those related to truck transportation for the same year, with comparable miles and tons moved.

Only a few cars releasing TIH – approximately 20 – resulted in 15 deaths, over 400 injuries, thousands of evacuees from dozens of square miles of commercial and residential neighborhoods, and tens of millions of dollars in damages.

In spite of the excellent safety record, the most dangerous of these commodities, Toxic Inhalation Hazards (TIH), have caused increasing concerns among the railroads and governments in recent years. Although a very small part of the rail traffic mix (with 5,000 carloads on Minnesota's railroads in 2007, of which 240 were handled by short lines), the security and operational risks associated with handling TIH have been viewed as increasingly difficult and insufficiently compensatory for the risks incurred. Since 2001, there have been several high-profile incidents involving TIH releases from pressure tank cars. Only a few cars releasing TIH – approximately 20 – resulted in 15 deaths, over 400 injuries, thousands of evacuees from dozens of square miles of commercial and residential neighborhoods, and tens of millions of dollars in damages.

Although all of these incidents were determined to be industrial accidents, the risks associated with the handling of these commodities were brought into stark relief. As a result, the industry has become increasingly reluctant to handle TIH, and has embarked on efforts to not only increase the safety of their transport, but also to greatly reduce the volumes that are being handled. Since 2005, new initiatives have been aimed at further car improvements, facility and track upgrades, and other safety improvements. Presently, new hazardous materials routing standards, tied to systematic risk assessments by the railroads and shippers are being designed and are scheduled for implementation in 2010.

Because of the nature of interstate commerce, the constitutional responsibility of the Federal government, and the large distances and volumes transported in bulk via rail, Federal authorities have overseen the regulation and control of the transport of these materials. Both the economic costs and public exposure aspects suggest that rail transport of these often essential materials should remain as the preferred method of transport where applicable. The State of Minnesota relies on the Federal Railroad Administration Hazardous Materials Inspector for inspections of facilities and methodologies involving the movement and storage of hazardous materials. In addition, the State also utilizes the services of the State Motor Carrier Hazardous Material Inspector, in the event of a complaint or a significant release of hazardous materials.

The Federal program provides a dedicated Hazardous Material Inspector for the State of Minnesota and portions of Wisconsin. The Federal inspector is expected to enforce all Federal regulations regarding the movement of hazardous materials by rail. Inspections are conducted at railroads, intermodal facilities, freight forwarders/agents, chemical shippers, and tank car manufacturers and repair facilities. Inspectors also review methods of construction and testing of specification containers used for the transport of hazardous materials. Finally, inspectors review and observe procedures used by those who offer hazardous materials for transportation by rail and a review of rail carrier documentation and procedures for loading, unloading, switching, and transportation of rail cars containing hazardous materials.

The Federal Inspector also participates in investigations of hazardous material spills that result in evacuations or casualties resulting from a release. Federal Inspectors have the authority to issue citations when violations of Federal regulations are discovered during inspections. The FRA also cooperates with the railroads and local Emergency Response agencies in ongoing education as to characteristics of materials and threats, response methods, and interorganizational coordination.

4.3 Shared Freight and Passenger Rail Corridors

Shared freight and passenger rail corridors were evaluated with the GIS-tool to determine what improvements are needed today and will be needed in 2030 to achieve a freight LOS C or better. The corridors were then evaluated to determine what additional improvements would be needed when proposed passenger rail service is added to the line to maintain a LOS C or better. This section discusses specific improvements identified to mitigate sections of LOS D, E, and F.

Needs and improvements are organized by major corridor city pair. Further detail broken down by freight subdivision is provided in Technical Memorandum 6.

In several cases city pair segments overlap each other, and on any given corridor two or three different passenger services may be provided. The "2030 Passenger Service Needs" provided in tables within the city pair discussion include the cost for track and signal improvements, and other essential costs like rolling stock, capacity rights, etc., for that segment only. Table 4.11 provides a summary of each service which was analyzed and the passenger service levels assumed.

Table 4.11 2030 Shared Freight and Passenger Rail Corridors Reviewed

City Pair/Description	Corresponding Minnesota Subdivisions	Freight Rail Operator	Type of Service Reviewed	Train Pairs/Day
Twin Cities to Cambridge				
Northstar – Cambridge Ext.	Wayzata, Midway, Staples, Hinckley	BNSF	79 mph	4
Twin Cities to St. Cloud				
Northstar – Expanded to St. Cloud	Wayzata, Midway, Staples	BNSF	79 mph	8
Twin Cities to Fargo/Moorhead				
Expanded Empire Builder	Wayzata, Midway, Staples, KO, Prosper	BNSF	79 mph	2
Twin Cities to Willmar/Sioux Falls, South Dakota				
Little Crow	Marshall, Morris, Wayzata	BNSF	79 mph	4
Twin Cities Connection (as part of MWRRI)				
Minneapolis – St. Paul (BNSF)	St. Paul, Merriam Park, Midway, Wayzata	BNSF	79 mph	4
Minneapolis – St. Paul (CP)	Merriam Park, Midway, Minn. Comm., Wayzata	CP, BNSF MNNR	79 mph	4
Twin Cities to Albert Lea (Kansas City, Missouri)				
	MN&S, Savage, Merr. Park, Albert Lea	CP, UP, PGR	79 mph	4
Twin Cities to Mankato (Sioux City, Iowa)				
Minnesota Valley Line	MN&S, Wayzata, Mankato	BNSF, UP	79 mph	4
Twin Cities to Eau Claire, Wisconsin				
	Merriam Park, St. Paul, Altoona	UP, CP, BNSF	79 mph	4
Twin Cities to Chicago(via MWRRI River Route) – HSR				
MWRRI	Merriam Park, River, Tomah	CP	110 mph	8
Twin Cities to Duluth – HSR				
Northern Lights Express	Midway, Staples, Hinckley	BNSF	110 mph	8
Twin Cities to Rochester – HSR				
Rochester Rail Link			110 mph	8
Twin Cities to Chicago (via Rochester) – HSR				
			110 mph	8

4.3.1 BNSF: Twin Cities to Cambridge

Needs in this corridor include freight needs and standard (79 mph) passenger service needs for Northstar's Cambridge Extension. This city pair also is designated for HSR (110 mph) passenger service to Duluth as part of the Northern Lights Express (NLX) project. This corridor has been divided into segments from Minneapolis to Coon Rapids and Coon Rapids to Cambridge. Investment needs for passenger service on the Cambridge to Duluth pair are only addressed in the HSR alternative and can be found in Section 4.4.2; however, freight needs are identified for the entire corridor. Table 4.12 summarizes corridor freight and passenger needs by year.

Table 4.12 Summary of Twin Cities to Cambridge Improvements

	Year	Need	Cost to Upgrade (Millions of Dollars)
Needs for Freight			
Staples Subdivision	2009	Additional passing sidings totaling 3.57 miles	$6.1
Midway Subdivision	2030	Additional passing sidings totaling 0.624 miles	$1.1
Staples Subdivision	2030	Adding third main track, a total of 6.08 miles of additional track	$10.3
Hinckley Subdivision	2030	Additional passing sidings totaling 23.54 miles	$10.7
		University Interlocking	$14.0
		Minneapolis Junction	$33.0
		Coon Creek Junction	$100.0
		10% Engineering	$17.5
		30% Contingency	$52.5
		Total Freight Needs	**$245.2**
2030 Passenger Service Needs – Twin Cities to Cambridge, only [a]			
Staples Subdivision		5.4 miles new track	$19.4
		Upgrade 14 miles of track from FRA 3 to FRA 4	$28.0
Hinckley Subdivision		29.9 miles, install CTC signals	$23.0
Midway Subdivision		0.56 miles new track	$2.0
Other Costs		Rolling Stock (four train sets)	$72.0
		Positive Train Control (four train sets)	$4.6
		Grade Crossing Improvements	$1.2
		Capacity Rights – Minneapolis to Cambridge[b]	$29.9
		Operations and Maintenance Costs[c]	$7.4

[a] Passenger service need estimates include engineering and contingency costs.

[b] Negotiated on a case by case basis.

[c] Cost is post implementation.

4.3.2 BNSF: Twin Cities to St. Cloud

This section represents expanded Northstar service to St. Cloud with eight train sets per day. This corridor overlaps the proposed Northstar Cambridge Extension as well as Amtrak's Empire Builder. Segments on this line include Minneapolis to Coon Rapids, Coon Rapids to Big Lake, and Big Lake to St. Cloud. Improvements are summarized in Table 4.13.

Table 4.13 Summary of Twin Cities to St. Cloud Improvements

	Year	Need	Cost to Upgrade (Millions of Dollars)
Needs for Freight			
Staples Subdivision	2009	Additional track and passing sidings totaling 4.2 miles	$7.3
Midway Subdivision	2030	Additional passing sidings totaling 0.624 miles	$1.1
Staples Subdivision	2030	Additional track totaling 37 miles, including a full third main track between University and Coon Creek junctions	$62.8
		University Interlocking	$14.0
		Minneapolis Junction	$33.0
		Coon Creek Junction	$100.0
		10% Engineering	$21.8
		30% Contingency	$65.4
		Total Freight Needs	**$305.4**
2030 Passenger Service Needs[a]			
Staples Subdivision		24 miles new track	$86.6
		Upgrade 14 miles of track from FRA 3 to FRA 4	$28.0
Midway Subdivision		0.4 miles of new track	$1.4
Other Costs		Rolling Stock (eight train sets)	$144.0
		Positive Train Control (eight train sets)	$7.4
		Grade Crossing Improvements	$3.5
		Capacity Rights – Minneapolis to St. Cloud[b]	$91.1
		Operations and Maintenance Costs[c]	$22.5

[a] Passenger service need estimates include engineering and contingency costs.

[b] Negotiated on a case by case basis.

[c] Cost is post implementation.

4.3.3 BNSF: Twin Cities to Fargo/Moorhead

Needs in this corridor include freight needs and standard (79 mph) passenger service needs for expanded Amtrak service on the Empire Builder. This corridor overlaps the existing Northstar service to Big Lake as well as the proposed Northstar Cambridge Extension. Segments on this line include Minneapolis to Coon Rapids (also discussed in Section 4.2.1), Coon Rapids to Big Lake, Big Lake to St. Cloud, and St. Cloud to Fargo/Moorhead. Improvements are summarized in Table 4.14.

Table 4.14 Summary of Twin Cities to Fargo/Moorhead Improvements

	Year	Need	Cost to Upgrade (Millions of Dollars)
Needs for Freight			
Staples Subdivision	2009	Additional track and passing sidings totaling 25.46 miles, including full double main build-out between St. Cloud and Little Falls	$43.3
Staples Subdivision	2009	Installation of CTC signaling on a 32-mile segment from St. Cloud to Little Falls	$24.6
KO Subdivision	2009	Additional passing sidings totaling 1.16 miles beyond the existing double main track	$2.0
KO Subdivision	2009	Installation of CTC signaling on entire 5.5-mile line	$4.1
Midway Subdivision	2030	Additional passing sidings totaling 0.624 miles	$1.1
Staples Subdivision	2030	Additional track totaling 80.25 miles, including a full third main track between University and Coon Creek junctions	$136.4
Staples Subdivision	2030	Installation of CTC signaling on a 45.19-mile segment from Bluffton to Detroit Lakes	$33.9
KO Subdivision	2030	Additional passing sidings totaling 1.25 miles	$2.1
		University Interlocking	$14.0
		Minneapolis Junction	$33.0
		Coon Creek Junction	$100.0
		Moorhead Junction	$5.0
		10% Engineering	$40.0
		30% Contingency	$119.9
		Total Freight Needs	**$559.4**
2030 Passenger Service Needs[a]			
Staples Subdivision		5.9 miles new track	$21.2
		Upgrade 14 miles of track from FRA 3 to FRA 4	$28.0
KO Subdivision		0.22 miles of new track	$0.8
Prosper Subdivision		0.53 miles, upgrade ABS to CTC signals	$0.6
Other Costs		Rolling Stock (one train set)	$18.0
		Positive Train Control (one train set)	$24.3
		Grade Crossing Improvements	$3.6
		Capacity Rights – Minneapolis to Fargo/Moorhead[b]	$41.1
		Operations and Maintenance Cost[c]	$10.2

[a] Passenger service need estimates include engineering and contingency costs. It is possible that from Coon Rapids to St. Cloud rolling stock could be shared with Twin Cities to Duluth.

[b] Negotiated on a case by case basis.

[c] Cost is post implementation.

4.3.4 BNSF: Twin Cities to Sioux Falls, South Dakota

Needs in this corridor include freight needs and standard (79 mph) passenger service needs to accommodate four train set per day via the proposed Little Crow route. The corridor includes the segments from Minneapolis to Willmar and Willmar to Sioux Falls, South Dakota. For the purpose of this analysis, costs are only provided for the Twin Cities south to the state line only for operations within the State of Minnesota. Improvements are summarized in Table 4.15.

Table 4.15 Summary of Twin Cities to Sioux Falls, South Dakota Improvements

	Year	Need	Cost to Upgrade (Millions of Dollars)
Needs for Freight			
Marshall Subdivision	2009	Installation of CTC on 122.6 miles from Willmar to South Dakota border	$67.4
		10% Engineering	$6.7
		30% Contingency	$20.2
		Total Freight Needs	**$94.3**
2030 Passenger Service Needs[a]			
Marshall Subdivision		Upgrade 91 miles of track from FRA 3 to FRA 4	$91
Other Costs		Rolling Stock (four train sets)	$72.0
		Positive Train Control (four train sets)	$23.9
		Capacity Rights – Minneapolis to State Line[b]	$161.2
		Operations and Maintenance Costs[c]	$39.8

[a] Passenger service need estimates include engineering and contingency costs.

[b] Negotiated on a case by case basis.

[c] Cost is post implementation.

4.3.5 Twin Cities Connection: Minneapolis and St. Paul

Needs in this corridor include freight needs and standard (79 mph) passenger service needs for expanded Amtrak service on the Empire Builder to four trains per day. This connection also is being studied to provide both Minneapolis and St. Paul with intercity rail stations connecting a future Amtrak and HSR station at Union Depot in St. Paul to a downtown Minneapolis station for commuter rail and potential intercity rail services, including HSR. From a system standpoint, this connection between western and northern corridors, and eastern corridors is an absolute necessity to provide system efficiencies and advantages gained from run-through routing, rider convenience, and time advantages to final destinations (platform-to-platform times are projected to be 20 minutes between the downtowns' CBD's). Direct service and station stops within separated and distinct CBDs is also recommended in the FRA "Corridor Transportation Plan: A Guidance Manual" (2005), as are limited but key suburban stops.

Currently, Amtrak provides Empire Builder service to the Twin Cities (via CP, with portions of BNSF and Minnesota Commercial Railroad) with a stop at the Midway Amtrak station in between the two downtowns.

While the CP line is the current Empire Builder route, operating with once daily service between Chicago and Seattle, either the CP or BNSF routes between the Twin Cities could serve larger purposes in the future. Red Rock commuter rail service has been studied along both the BNSF and CP alignments as part of the feasibility analysis conducted for the Red Rock Corridor Commission.[29] Coordination with existing freight rail and the associated cost for track and signal improvements have been two challenges to implementation. One of the potential draw-backs of the BNSF route is the need to "back-out" of the St. Paul Union Depot for trains coming from the south and east and wanting to go north and west. Previously, these lines have been studied as Central Corridor commuter rail alignments, but environmental documentation and design are proceeding on a new light rail alignment along University and Washington Avenues. Improvements are summarized in Table 4.16. Considerable detail is provided on these alignments in Technical Memorandum 6.

The BNSF line (known as the "south main"), originally the Great Northern mainline between St. Paul and Minneapolis, is a high-speed alignment historically allowing 70 mph service over the majority of the route. Double track is still in place from the Hoffman Junction wye to St. Anthony Junction, where it joins CP and Minnesota Commercial. The line is essentially grade separated for its entire length. From that point to Minneapolis Junction it involves multiple interlockings and single track, an area shared by both possible routes and requiring significant upgrades. Right-of-way and bridges are sufficient to allow all needed expansion.

The CP line (known as the "short line") is single tracked for its entire length, but was originally was double tracked and capable of 50 mph speeds over the majority of the route. The right-of-way and all overpasses are still sufficient for relaying double track, with the exception of two single track rail bridges over Snelling and Prior avenues. The City of St. Paul is currently attempting to condemn part of the right-of-way for trail use, which would severely damage the ability to restore the speed and capacity of this route. The Minnesota Commercial portion of the route contains two sharp seven-degree curves, one of which can be eased completely in Commercial's "A" yard, and one that could be moderately eased just north of Prior Avenue. As noted with the BNSF route, the track from Saint Anthony Junction to Minneapolis Junction will need double tracking and upgrades. While much of the line is grade-separated, there are six at-grade crossings on the CP segment in St. Paul that will require upgrading.

For the purposes of this analysis, the cost of the CP routing is assumed because it does not require the back-out move out of St. Paul, and is expected to remain as the preferred route for the Empire Builder after the 2012 move of Amtrak to St. Paul Union Depot. Additionally, rolling stock is not included as it is assumed it will be part of the MWRRI service and will use trainsets from that line's operation. A full engineering and operational analysis will be needed to finalize route selection.

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[29] http://www.redrockrail.org/.

These routings are shown in Figure 4.6.

Figure 4.6 Twin Cities Metro Rail Connections

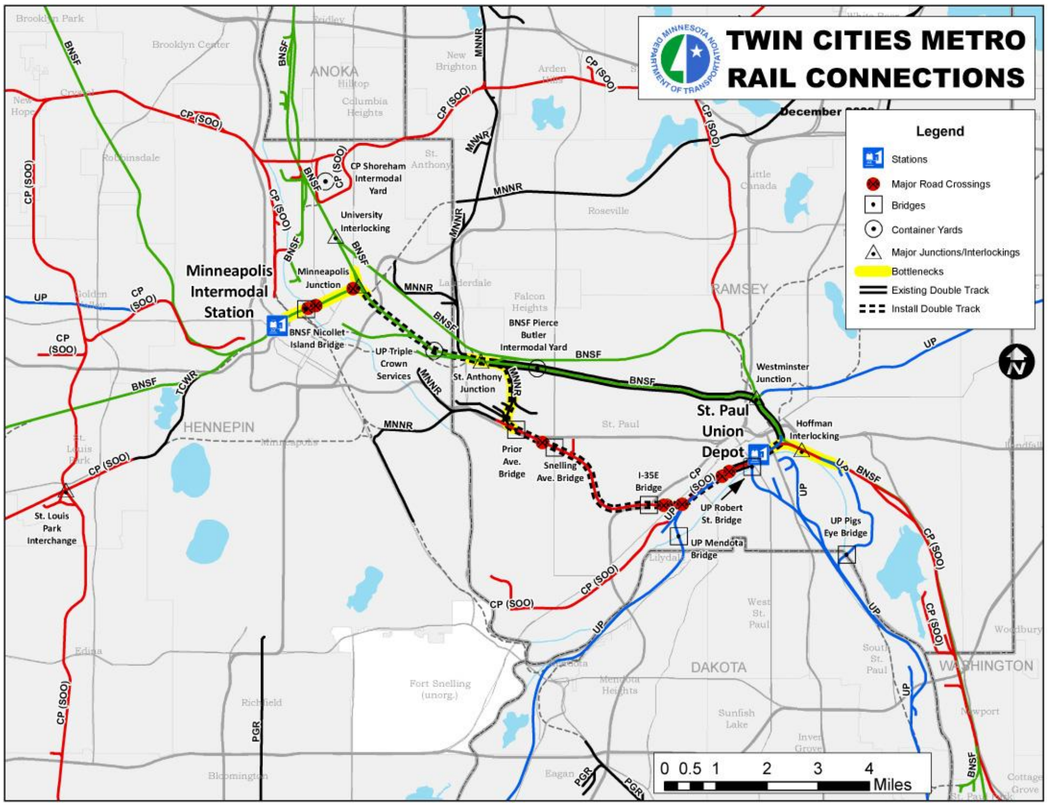

Table 4.16 Summary of Minneapolis to St. Paul Improvements

	Year	Need	Cost to Upgrade (Millions of Dollars)
Needs for Freight			
BNSF Corridor			
Midway Subdivision	2009	Additional passing sidings totaling 0.52 miles	$0.9
Midway Subdivision	2030	Completing double track build-out by adding 1.9 miles of new track	$3.3
St. Paul	2030	Adding 0.26 miles of additional track to the existing double main track between Seventh Street and Hoffman Junction	$0.4
		Hoffman Interlocking	$9.0
		St. Anthony Junction	$27.0
		Minneapolis Junction	$33.0
		10% Engineering	$7.4
		30% Contingency	$22.1
		Total Freight Needs	$103.1

Table 4.16 Summary of Minneapolis to St. Paul Improvements (continued)

Year	Need	Cost to Upgrade (Millions of Dollars)
CP Corridor		
	Prior Ave Jct. Easement/Merriam Park Jct.	$20.0
	Prior Ave Bridge	$3.0
	Snelling Ave Bridge	$10.0
	MN Commercial Yard "A" curve easement (St. Anthony Junction)	$29.0
	Minneapolis Junction	$33.0
	10% Engineering	$9.5
	30% Contingency	$28.5
	Total Freight Needs	**$133.0**
2030 Passenger Service Needs[a]		
BNSF Corridor		
St. Paul Subdivision	Add 0.24 miles of track	$0.9
Midway Subdivision	0.52 miles of new track	$1.9
	Upgrade 14 miles of track from FRA 3 to FRA 4	$14.0
Other Costs[b]	Positive Train Control (four train sets)	$1.5
	Capacity Rights[c]	$9.5
	Operational and Maintenance Costs[d]	$2.4
CP Corridor		
Midway Subdivision	0.52 miles of new track	$1.9
Midway/Merriam Park Subdivision	Upgrade 13 miles of track from FRA 3 to FRA 4	$13.0
Merriam Park Subdivision	9 miles of new track	$32.4
Minnesota Commercial Yard	1.1 miles of CTC signal	$0.8
Other Costs[b]	Positive Train Control (four train sets)	$1.4
	Capacity Rights[c]	$8.8
	Operations and Maintenance Costs[d]	$2.2

[a] Passenger service need estimates include engineering and contingency costs.

[b] Rolling stock may not be necessary if other corridors are implemented.

[c] Negotiated on a case by case basis.

[d] Cost is post implementation.

4.3.6 UP: Twin Cities to Albert Lea (Kansas City, Missouri)

Needs in this corridor include freight needs and standard (79 mph) passenger service needs to accommodate four train sets per day. The corridor includes the segments from St. Paul and Minneapolis to Northfield, Northfield to Albert Lea, and Albert Lea to Kansas City, Missouri, utilizing the previously proposed Dan Patch commuter rail corridor alignment. For the purpose of this analysis, costs are provided from the Twin Cities south to Albert Lea; therefore, all costs here are only for operations within the State of Minnesota. Improvements are summarized in Table 4.17.

Table 4.17 Summary of Twin Cities to Albert Lea Improvements

	Year	Need	Cost to Upgrade (Millions of Dollars)
Needs for Freight			
Albert Lea Subdivision	2030	Installing CTC signaling between St. Paul Yard across the St. Paul Union Pacific Bridge	$1.6
		Hoffman Interlocking	$54.0
		St. Louis Park Interchange	$70.0
		Dan Patch Interchange (Savage)	$10.0
		Savage Bridge over Minnesota River	$34.0
		Pigs Eye Bridge (UP) over Mississippi River	$76.0
		10% Engineering	$24.6
		30% Contingency	$73.7
		Total Freight Needs	**$343.9**
2030 Passenger Service Needs[a]			
MN&S Subdivision		12.7 miles, install CTC signal	$9.8
Savage Subdivision		20.9 miles, install CTC signal	$16.1
Albert Lea Subdivision		5.6 miles, convert ABS to CTC signal	$4.3
Other Costs		Rolling Stock (four train sets)	$72.0
		Positive Train Control (four train sets)	$11.5
		Capacity Rights[b]	$76.8
		Operations and Maintenance Costs[c]	$19.0

[a] Passenger service need estimates include engineering and contingency costs.

[b] Negotiated on a case by case basis.

[c] Cost is post implementation.

4.3.7 UP: Twin Cities to Mankato (Sioux City, Iowa)

Needs in this corridor include freight needs and standard (79 mph) passenger service needs to accommodate four train sets per day via the proposed Minnesota Valley Line. The corridor includes the segments from Minneapolis/St. Paul to Mankato, Mankato to Worthington, and Worthington to Sioux City, Iowa. As discussed in the preliminary screening (Section 3.0) service between Mankato and Worthington had low ridership potential due to the relatively small metropolitan area around Sioux City, as well as the significant distance (more than 250 miles) from the Twin Cities. Thus, only the segment between Minneapolis/St. Paul and Mankato was evaluated and all costs are only for operations within the State of Minnesota. The preferred routing includes a "y" shaped route to both downtowns, diverging at Savage. Improvements are summarized in Table 4.18.

Table 4.18 Summary of Twin Cities to Mankato Improvements

Year	Need	Cost to Upgrade (Millions of Dollars)
Needs for Freight		
	St. Louis Park Interchange	$70.0
	Dan Patch Interchange (Savage)	$10.0
	Shakopee Realignment	$163.0
	Savage Bridge over Minnesota River	$34.0
	Mendota Heights (UP) (Omaha Road Bridge Number 15) over Mississippi River	$44.0
	10% Engineering	$32.1
	30% Contingency	$96.3
	Total Freight Needs	**$449.4**
2030 Passenger Service Needs[a]		
MN&S Subdivision	12.7 miles, install CTC signal	$9.8
Mankato Subdivision	82.6 miles, convert NS, ABS and TWC to CTC signal	$63.6
	Upgrade 84 miles of track from FRA 3 to FRA 4	$84
Other Costs	Rolling Stock (four train sets)	$72.0
	Positive Train Control (four train sets)	$8.5
	Capacity Rights[b]	$57.1
	Operations and Maintenance Costs[c]	$14.1

[a] Passenger service need estimates include engineering and contingency costs.

[b] Negotiated on a case by case basis.

[c] Cost is post implementation.

4.3.8 UP: Twin Cities to Eau Claire, Wisconsin

Needs in this corridor include freight needs and standard (79 mph) passenger service needs to accommodate four train sets per day between the Twin Cities and Eau Claire, Wisconsin. This route has potential to be a bistate intercity commuter corridor, and while ridership has been reviewed to take into consideration Wisconsin ridership, costs are summarized by state. Since most of this alignment is in Wisconsin, Wisconsin data is essential to evaluating this corridor. Improvements are summarized in Table 4.19.

Table 4.19 Summary of Twin Cities to Eau Claire, Wisconsin Improvements

	Year	Need	Cost to Upgrade (Millions of Dollars)
Needs for Freight			
St. Paul Subdivision	2030	Adding 0.26 miles of additional track to the existing double main track between Seventh Street and Hoffman Junction	$0.4
		Hoffman Interlocking	$9.0
		Hudson (UP) over St. Croix River	$87.0
		10% Engineering	$9.6
		30% Contingency	$28.9
		Total Freight Needs	**$134.9**
2030 Passenger Service Needs[a]			
Minnesota			
St. Paul Subdivision		Add 0.24 miles of track	$0.9
Altoona Subdivision		Minnesota – 18 miles, convert ABS to CTC signal	$13.9
Other Costs		Rolling Stock (4 train sets)	$72.0
		Minnesota – Positive Train Control (4 train sets)	$1.9
		Minnesota – Capacity Rights[b]	$12.2
		Minnesota – Operations and Maintenance Costs[c]	$3.0
Wisconsin			
Altoona Subdivision		Wisconsin – 68.9 miles, convert ABS to CTC signal	$73.2
Other Costs		Wisconsin – Positive Train Control (4 train sets)	$7.0
		Wisconsin – Capacity Rights[b]	$46.9
		Wisconsin – Operations and Maintenance Costs[c]	$11.6

[a] Passenger service need estimates include engineering and contingency costs.

[b] Negotiated on a case by case basis.

[c] Cost is post implementation.

4.4 High-Speed Rail Passenger Service Needs

In addition to the needs identified for conventional passenger service (79 mph) in Section 4.3, needs were identified for HSR, 110 mph service implementation in four corridors that showed significant potential for an upgraded level of service between the Twin Cities, Chicago (via the River Route and via Rochester), Duluth, and Rochester. The specific needs for implementing high-speed service are described for each of these corridors below.

Any new construction should not preclude 150 mph service implementation at a later date. Other than larger radius curves, 150 mph service will require complete grade separation and tighter tolerances in track construction. In addition, electrification may be desirable depending on rolling stock options procured for higher speed service. High-speed service may share right-of-way with existing freight lines, but it is assumed in this Memorandum that it will operate on dedicated track. Further detail on each corridor is provided in Technical Memorandum 6.

4.4.1 Midwest High-Speed Regional Rail Initiative – Twin Cities to Chicago (via River Route)

This scenario addresses HSR service between the Twin Cities and Chicago for the portions of the corridor that are within Minnesota. The segments evaluated include St. Paul to Hastings and Hastings to Winona. While this service is proposed to be on dedicated track, and not interfere or require improvements to the freight railroads, implementing HSR service on this corridor will still require significant investment as shown in Table 4.20.

Table 4.20 Summary of Midwest High-Speed Regional Rail Initiative Twin Cities to Chicago (River Route) Improvements
Minnesota Costs

	Need	Cost to Upgrade (Millions of Dollars)
Existing Line Costs		
	Merriam Park Sub, add 1.05 miles track	$1.8
	MNNR Yard, add 0.3 miles track, 1.4 miles signal	$1.3
	Midway Sub, add 0.59 miles track	$0.1
	Wayzata Sub, add 0.5 miles track	$0.8
	Hoffman Interlocking	$54.0
	St. Anthony Junction	$27.0
	Minneapolis Junction	$33.0
	La Crescent Bridge (CP)	$117.0
	Hastings (CP) over Mississippi River	$90.0
	10% Engineering	$32.5
	30% Contingency	$97.5
	Total Freight Needs	**$455.0**
Capital Costs[a]		
	Upgrade 127 miles from Class 4 to Class 6 track	$16.0
	Add 99.2 miles of new Class 6 track	$357.1
	Upgrade 127 miles to CTC	$79.2
	Add 127 miles of Positive Train Control	$13.2
	Grade Crossing Improvements	$50.8
	Rolling Stock (eight train sets)	$188.0
	Capacity Rights[b]	$172.7
O&M Costs		
	Operations and Maintenance Costs[c]	$42.7

[a] Passenger service need estimates include engineering and contingency costs.

[b] Negotiated on a case by case basis.

[c] Cost is post implementation.

4.4.2 HSR: Twin Cities to Duluth

This scenario addresses HSR (110 mph) service between the Twin Cities and Duluth, as prescribed in the Northern Lights Express study.[30] The segments evaluated include Twin Cities to Coon Rapids, Coon Rapids to Cambridge, and Cambridge to Duluth. The HSR segment of this service, between Coon Rapids and Sandstone, is proposed to be on dedicated track, and not interfere or require improvements for the freight railroads. The segment between Sandstone and Superior is proposed in the NLX business plan to be operated on shared trackage at 90 mph. This will require additional and lengthened sidings.

Five bridges on this line will ultimately need to be replaced or undergo major rehabilitation, including the Grassy Point Swing Bridge at a cost of $51 million. These costs are not included in the NLX business plan. This study identifies all needs and assigns them to specific corridors. Other major differences associated with the NLX plan include the cost of CTC and PTC.

Costs are shown in Table 4.21.

Table 4.21 Summary of Twin Cities to Duluth High-Speed Rail Improvements
Minnesota Costs

	Need	Cost to Upgrade (Millions of Dollars)
Existing Line Costs		
	Staples Sub, add 5.4 miles new track	$9.2
	Midway Sub, add 0.94 miles new track	$1.6
	Wayzata Sub, add 0.47 miles new track	$0.8
	University Interlocking	$14.0
	Minneapolis Junction	$33.0
	Coon Creek Junction	$100.0
	Grassy Point Swing Bridge (BNSF) over Saint Louis River	$51.0
	BNSF bridge 28.3	$4.0
	BNSF bridge 30.2	$6.0
	BNSF bridge 62.4	$13.0
	BNSF bridge 91.8	$2.0
	10% Engineering	$23.5
	30% Contingency	$70.4
	Total Freight Needs	**$328.5**

[30] http://www.northernlightsexpress.org/joomla/index.php.

Table 4.21 Summary of Twin Cities to Duluth High-Speed Rail Improvements (continued)
Minnesota Costs

	Need	Cost to Upgrade (Millions of Dollars)
Capital Costs[a]		
	Add 121 miles for new Class 6 track	$435.6
	Add 152 miles to CTC	$159.6
	Add 152 miles of Positive Train Control	$15.8
	Grade Crossing Improvements	$60.8
	Rolling Stock (six train sets)	$141.0
	Capacity Rights[b]	$206.7
O&M Costs		
	Operations and Maintenance Costs[c]	$45.7

[a] Passenger service need estimates include engineering and contingency costs.

[b] Negotiated on a case by case basis.

[c] Cost is post implementation.

4.4.3 HSR: Twin Cities to Rochester

This scenario addresses HSR (110 mph) service between the Twin Cities and Rochester, as prescribed in the Rochester Rail Link Feasibility study.[31] A large portion of this alignment is greenfield; however, there are still significant investment requirements for HSR implementation as shown in Table 4.22. The costed alignment is consistent with the independent Rochester studies, and assumes routing via the Minneapolis-St. Paul International Airport, with service continuing to downtown St. Paul. For reasons discussed in Section 4.13, the ROW estimates below are considerably higher than those used in the Rochester-specific studies.

[31] http://www.dot.state.mn.us/passengerrail/onepagers/rochesterstudy.pdf.

Table 4.22 Summary of Twin Cities to Rochester High-Speed Rail Improvements

	Need	Cost to Upgrade (Millions of Dollars)
Existing Line Costs		
	Eagandale Sub, upgrade 9 miles of track from FRA 1 to FRA 4	$7.0
	Mankato Sub, upgrade 7 miles of track from FRA 3 to FRA 4	$5.0
	Merriam Sub, upgrade 1 mile of track from FRA 3 to FRA 4	$0.7
	Mendota Heights (UP) (Omaha Road Bridge #15) over Mississippi River	$44.0
	10% Engineering	$5.7
	30% Contingency	$17.0
	Total Freight Needs	**$79.4**
Capital Costs[a]		
	Minnesota River Crossing to MSP	$163.8
	Connection from Eagandale Sub to Minnesota River Crossing	$90.0
	Add 91 miles for new Class 6 track	$328.0
	Add 86 miles to CTC (Existing Freight and Passenger Lines)	$66.2
	Add 87 miles of Positive Train Control (Existing Freight and Passenger Lines)	$9.1
	Grade Crossing Improvements	$34.8
	Rolling Stock (four train sets)	$94.0
	Right-of-way[b]	$63.7
	Capacity Rights[b]	$23.1
O&M Costs		
	Operations and Maintenance Costs[c]	$28.9

[a] Passenger service need estimates include engineering and contingency costs.

[b] Negotiated on a case by case basis.

[c] Cost is post implementation.

4.4.4 HSR: Twin Cities to Chicago (via Rochester Route)

This scenario addresses HSR (110 mph) service between the Twin Cities and Chicago via the Greenfield route through Rochester. This scenario includes all of the costs associated with the stand-alone Greenfield route between Rochester and the Twin Cities as detailed in Section 4.4.3, plus the costs of a Greenfield route connecting Rochester to the rest of the MWRRI alignment probably in the vicinity of La Crosse, Wisconsin. A large portion of this alignment is Greenfield; however, there are still significant investment requirements for HSR implementation as shown in Table 4.23.

Table 4.23 Summary of Twin Cities to Chicago (via Rochester) High-Speed Rail Improvements

	Need	Cost to Upgrade (Millions of Dollars)
Existing Line Costs		
	Eagandale Sub, upgrade 9 miles of track from FRA 1 to FRA 4	$7.0
	Mankato Sub, upgrade 7 miles of track from FRA 3 to FRA 4	$5.0
	Merriam Sub, upgrade 1 mile of track from FRA 3 to FRA 4	$0.7
	Mendota Heights (UP) (Omaha Road Bridge #15) over Mississippi River	$44.0
	La Crescent Bridge (CP)	$117.0
	10% Engineering	$17.4
	30% Contingency	$52.1
	Total Freight Needs	**$243.2**
Capital Costs[a]		
	Minnesota River Crossing to MSP	$163.8
	Connection from Eagandale Sub to Minnesota River Crossing	$90.0
	Add 182 miles for new Class 6 track	$655.2
	Add 156 miles to CTC (Existing Freight and Passenger Lines)	$120.1
	Add 157 miles of Positive Train Control (Existing Freight and Passenger Lines)	$16.3
	Grade Crossing Improvements	$62.8
	Rolling Stock (eight train sets)	$188.0
	Right-of-way[b]	$127.4
	Capacity Rights[b]	$23.1
O&M Costs		
	Operations and Maintenance Costs[c]	$52.8

[a] Passenger service need estimates include engineering and contingency costs.

[b] Negotiated on a case by case basis.

[c] Cost is post implementation.

4.5 Cost of Project Implementation

As previously noted in this study, Minnesotans have been active in the pursuit of passenger rail service from studying corridors to actual service implementation. Much ground work has been laid to help development of this state rail plan. In fact, a number of passenger rail studies have developed cost estimates for line construction, capacity rights, and annual operating and maintenance costs. This study's estimates are not intended to supersede engineering studies that already have been conducted using much more detailed data. It is important to note that freight and passenger needs identified in this study have been determined through use of a GIS-tool developed specifically for this project – each corridor in the State has been analyzed using the same assumptions and costs derived to provide a high-level apples-to-apples comparison. Output from the GIS-tool has been augmented by expert advice throughout cost development.

This study shows that cost of project implementation can vary depending on how the program is developed and what assumptions are made regarding cost input factors. Table 4.23 (base case) and Table 4.24 (best case) provide the cumulative costs of implementing full build passenger service for each individual city pair. The total cost for implementing passenger service on a corridor-by-corridor basis is roughly $6.8 to $8.4 billion.[32]

In several cases city pair segments overlap each other, and on any given corridor two or three different passenger services may be provided. A key corridor where this can be shown is along BNSF's Staples subdivision; this corridor is a conduit for service to Duluth, Cambridge, St. Cloud, and Fargo/Moorhead. Table 4.26 builds on Tables 4.24 and 4.25 and provides the cost for implementing all of these city pair corridors through sharing infrastructure among projects. The total cost for implementing passenger service as a system is $5.4 to $6.7 billion.

While it is important to proceed with a "system approach" for implementation, it is possible to identify those projects that provide the biggest bang for the buck investment. Table 4.28 builds on Table 4.27 and assumes that projects in shared corridors with shared infrastructure are pursued; however, it only includes those projects that have been identified as higher priorities. Those higher-priority projects include:

- HSR service of 110 to 150 mph between the Twin Cities and Duluth, Rochester, and Chicago; and
- Enhanced conventional rail service of up to 90 mph between the Twin Cities and St. Cloud, Mankato, Fargo and Eau Claire, Wisconsin, and between St. Paul and Minneapolis.

As shown in Figure 4.7, higher priority projects are described as Phase I projects, and all other projects are described as Phase II projects. These phases will be referred to again in Section 5.0 Performance Evaluation. It is notable that BNSF's and CP's stated passenger implementation principles accept speeds on their right-of-way of up to 110 mph, with clearly defined standards for safety, operating control, and segregation between freight and passenger trains. UP's principles accept up to 90 mph with similar provisions, applicable to the Mankato and Eau Claire corridors. Review of track and signal costs, only, indicate the total cost for implementing higher priority passenger corridors as a system is $4.7 to $5.9 billion.

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[32] These costs are derived by adding together the infrastructure total and capacity rights columns.

Figure 4.7 Phase I and Phase II Passenger

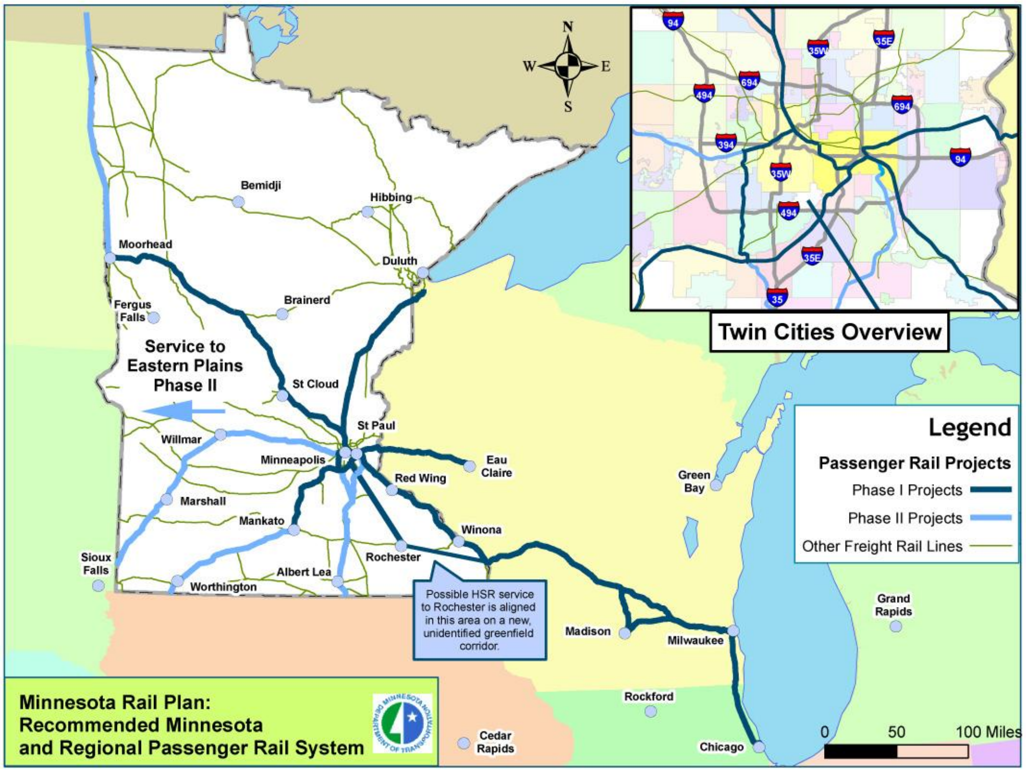

Table 4.24 2030 Shared Freight and Passenger Rail Corridors Reviewed – BASE CASE

Costs for All Improvements between City Pairs (Does Not Assume Improvements Build Upon Each Other)

City Pair/Description	Type of Service Reviewed	Train Pairs/Day	Freight Capital Costs 2009-2030[a] (Millions of Dollars)	2030 Passenger Infrastructure Costs (Millions of Dollars)	Infrastructure Total (Millions of Dollars)	Rolling Stock (Millions of Dollars)	Capacity Rights (Millions of Dollars)	Annual O&M Costs (Millions of Dollars)
Twin Cities to Cambridge								
Northstar-Cambridge Extension	79 mph	4	$245.2	$222.2	$467.4	$72.0	$29.9	$7.4
Twin Cities to St. Cloud								
Northstar-Expanded to St. Cloud	79 mph	8	$305.4	$126.9	$432.3	$144.0	$91.1	$22.5
Twin Cities to Fargo/Moorhead								
Expanded Empire Builder	79 mph	2	$559.3	$78.5	$637.8	$18.0	$41.1	$10.2
Twin Cities to Fargo/Sioux Falls, South Dakota								
Little Crow	79 mph	4	$94.4	$114.9	$209.3	$72.0	$161.2	$39.8
Twin Cities Connection[b]								
Minneapolis-St. Paul (CP)	79 mph	4	$133.0	$49.5	$182.5	0[c]	$8.8	$2.2
Twin Cities to Albert Lea (Kansas City, Missouri)								
	79 mph	4	$343.8	$41.7	$385.5	$72.0	$76.8	$19.0
Twin Cities to Mankato (Sioux City, Iowa)								
Minnesota Valley Line	79 mph	4	$449.4	$165.9	$615.3	$72.0	$57.1	$14.1
Twin Cities to Eau Claire, Wisconsin								
Minnesota	79 mph	4	$135.0	$16.7	$151.7	$72.0	$12.2	$3.0
Wisconsin	79 mph	4	$0	$80.2	$80.2	*(incl. in MN)*	$46.9	$11.6
Twin Cities to Chicago (via River)-HSR								
MWRRI	110 mph	8	$455.0	$516.3	$971.3	$188.0	$172.7	$42.7
Twin Cities to Duluth-HSR								
Northern Lights Express	110 mph	8	$328.4	$671.8	$1,000.2	$141.0	$206.7	$45.7
Twin Cities to Rochester-HSR								
Rochester Rail Link	110 mph	8	$79.4	$755.6	$835.0	$94.0	–	$28.9
Twin Cities to Chicago (via Rochester)-HSR								
	110 mph	8	$243.2	$1235.6	$1,478.8	$188.0	–	$52.8
Totals			$3,371.6	$4,075.9	$7,447.5	$1,133.0	$950.7	$299.9

[a] Some unknown freight costs have not been accounted for.

[b] Higher-cost option used between BNSF and CP.

[c] Cost included in MWRRI.

Table 4.25 2030 Shared Freight and Passenger Rail Corridors Reviewed – BEST CASE

Costs for All Improvements between City Pairs (Does Not Assume Improvements Build Upon Each Other)

City Pair/Description	Type of Service Reviewed	Train Pairs/Day	Freight Capital Costs 2009-2030[a] (Millions of Dollars)	2030 Passenger Infrastructure Costs (Millions of Dollars)	Infrastructure Total (Millions of Dollars)	Rolling Stock (Millions of Dollars)	Capacity Rights (Millions of Dollars)	Annual O&M Costs (Millions of Dollars)
Twin Cities to Cambridge								
Northstar-Cambridge Extension	79 mph	4	$210.2	$157.7	$367.9	$45.0	$14.1	$5.8
Twin Cities to St. Cloud								
Northstar-Expanded to St. Cloud	79 mph	8	$261.8	$109.4	$371.2	$72.0	$42.9	$17.7
Twin Cities to Fargo/Moorhead								
Expanded Empire Builder	79 mph	2	$479.4	$61.2	$540.6	$18.0	$14.0	$5.8
Twin Cities to Fargo/Sioux Falls, South Dakota								
Little Crow	79 mph	4	$80.9	$101.9	$182.8	$54.0	$75.8	$31.3
Twin Cities Connection[b]								
Minneapolis-St. Paul (CP)	79 mph	4	$114.0	$42.5	$156.5	*(incl. in MWRRI)*	$4.2	$1.7
Twin Cities to Albert Lea (Kansas City, Missouri)								
	79 mph	4	$294.7	$37.4	$332.1	$54.0	$36.2	$14.9
Twin Cities to Mankato (Sioux City, Iowa)								
Minnesota Valley Line	79 mph	4	$385.2	$143.4	$528.6	$45.0	$26.9	$11.1
Twin Cities to Eau Claire, Wisconsin								
Minnesota	79 mph	4	$115.7	$14.6	$130.3	$45.0	$5.8	$2.4
Wisconsin	79 mph	4		$69.7	$69.7	*(incl. in MN)*	$22.0	$9.1
Twin Cities to Chicago (via River)-HSR								
MWRRI	110 mph	8	$390.0	$444.1	$834.1	$188.0	$81.3	$33.5
Twin Cities to Duluth-HSR								
Northern Lights Express	110 mph	8	$281.5	$579.3	$860.8	$141.0	$97.3	$35.9
Twin Cities to Rochester-HSR								
Rochester Rail Link	110 mph	8	$68.1	$656.7	$724.8	$94.0	–	$22.7
Twin Cities to Chicago (via Rochester)-HSR								
	110 mph	8	$208.5	$1,070.2	$1,278.7	$188.0	–	$41.5
Totals			**$2,890.0**	**$3,488.2**	**$6,378.1**	**$944.0**	**$442.3**	**$233.4**

[a] Some unknown freight costs have not been accounted for.

Table 4.26 2030 Shared Freight and Passenger Rail Corridors Reviewed – Built as a System

Costs for All Improvements between City Pairs (Assumes Improvements Built upon Each Other)

	Improvement Type	Base Case Cost ($M)	Best Case Cost($M)
Junctions, Bottlenecks and Bridges	BNSF Bridge 28.3	$4.0	$4.0
	BNSF Bridge 30.2	$6.0	$6.0
	BNSF Bridge 62.4	$13.0	$13.0
	BNSF Bridge 91.8	$2.0	$2.0
	Coon Creek Junction	$100.0	$100.0
	Dan Patch Interchange (Savage)	$10.0	$10.0
	Grassy Point Swing Bridge (BNSF) over Saint Louis River	$51.0	$51.0
	Hastings Bridge (CP) over Mississippi River	$90.0	$90.0
	Hoffman Interlocking	$54.0	$54.0
	Hudson Bridge (UP) over St. Croix River	$87.0	$87.0
	La Crescent Swing Bridge (CP)	$117.0	$117.0
	Mendota Heights (UP) (Omaha Road Bridge Number 15) over Mississippi River	$44.0	$44.0
	Minneapolis Junction	$33.0	$33.0
	Moorhead Junction	$5.0	$5.0
	Pigs Eye Bridge (UP) over Mississippi River	$76.0	$76.0
	Prior Ave Bridge	$3.0	$3.0
	Prior Ave Jct. Easement/Merriam Park Jct.	$20.0	$20.0
	Savage Bridge over Minnesota River	$34.0	$34.0
	Shakopee Realignment	$163.0	$163.0
	Snelling Ave Bridge	$10.0	$10.0
	St. Anthony Junction	$27.0	$27.0
	St. Louis Park Interchange	$70.0	$70.0
	University Interlocking	$6.1	$6.1
	Engineering and Contingencies (40% Base/20% Best)	$410.8	$205.4
	Total Existing Line Costs	**$1,437.9**	**$1,232.5**
Shared Corridors	2009 Freight Shared Track and Signal	$245.3	$210.3
	2030 Freight Shared Track and Signal	$264.4	$226.6
	2030 Conv. – Passenger Track and Signal	$387.5	$322.9
	2030 HSR – Passenger Track, Signal, and ROW	$2,441.5	$2,108.8
	Capacity Rights	$950.7	$442.3
	Total Shared Corridor Track and Signal Cost	**$4,289.4**	**$3,310.9**
	Total Cost	**$5,727.3**	**$4,543.4**

Note: Does not include rolling stock or annual operations and maintenance costs.

Table 4.27 2030 Shared Freight and Passenger Rail Corridors Reviewed – High-Priority Corridors

(Assumes Improvements Built upon Each Other)

	Improvement Type	Base Case Cost ($M)	Best Case Cost ($M)
Junctions, Bottlenecks and Bridges	BNSF Bridge 28.3	$4.0	$4.0
	BNSF Bridge 30.2	$6.0	$6.0
	BNSF Bridge 62.4	$13.0	$13.0
	BNSF Bridge 91.8	$2.0	$2.0
	Coon Creek Junction	$100.0	$100.0
	Dan Patch Interchange (Savage)	$10.0	$10.0
	Grassy Point Swing Bridge (BNSF) over Saint Louis River	$51.0	$51.0
	Hastings Bridge (CP) over Mississippi River	$90.0	$90.0
	Hoffman Interlocking	$54.0	$54.0
	Hudson Bridge (UP) over St. Croix River	$87.0	$87.0
	La Crescent Swing Bridge (CP)	$117.0	$117.0
	Mendota Heights (UP) (Omaha Road Bridge Number 15) over Mississippi River	$44.0	$44.0
	Minneapolis Junction	$33.0	$33.0
	Moorhead Junction	$5.0	$5.0
	Pigs Eye Bridge (UP) over Mississippi River	$76.0	$76.0
	Prior Ave Bridge	$3.0	$3.0
	Prior Ave Jct. Easement/Merriam Park Jct.	$20.0	$20.0
	Savage Bridge over Minnesota River	$34.0	$34.0
	Shakopee Realignment	$163.0	$163.0
	Snelling Ave Bridge	$10.0	$10.0
	St. Anthony Junction	$27.0	$27.0
	St. Louis Park Interchange	$70.0	$70.0
	University Interlocking	$6.1	$6.1
	Engineering and Contingencies (40% Base/20% Best)	$410.8	$205.4
	Total Existing Line Costs	**$1,437.9**	**$1,232.5**
Shared Corridors	2009 Freight Shared Track and Signal	$152.5	$121.5
	2030 Freight Shared Track and Signal	$269.6	$231.1
	2030 Conv. – Passenger Track and Signal	$334.0	$278.4
	2030 HSR – Passenger Track, Signal and ROW	$1,961.5	$1,695.3
	Capacity Rights	$950.7	$442.3
	Total Shared Corridor Track and Signal Cost	**$3,668.3**	**$2,768.6**
	Total Cost	**$5,106.3**	**$4,001.1**

Note: Does not include rolling stock or annual operations and maintenance costs.

These tables show that there is a long list (21 projects) of junctions and bridges that require improvement. And while a few of these projects are related to a specific corridors' implementation (e.g., four BNSF bridges on the Hinckley Subdivision for the Duluth NLX project) even more of these projects are required due to the complex intertwined network of railroads present in the Twin Cities area. This web of rails is further challenged by the fact that the Twin Cities is proposed as the "hub" for a network of rail "spokes" emanating throughout the State and Midwest. This means that improvements to a bottleneck like Hoffman Junction will provide benefits to multiple passenger rail projects, as well as to freight service in general, and highlights the importance of building projects as a "system." As previously stated, a project like BNSF's third mainline on the Staples subdivision can provide increased capacity to several services.

Work already is underway to secure funding for several projects that have detailed engineering studies already complete. Table 4.28 shows the estimated capital and operating and maintenance costs anticipated for these studies, as well as the amount of funding applied for by source.

Table 4.28 Passenger Rail Project Grant Requests

Study/Corridor	Capital Cost Estimate	Operating and Maintenance Cost Estimate	Requested Grant Amount	Grant Source
Rochester Rail Link Study	$697,327,000 to $768,719,000	$37.59 per train mile		
Tri-State III	$973,000,000			
Southern Rail Corridor	$334,253,853		$10,000,000	TIGER
NLX	$360,000,000	$33.34 per train mile	$45,000,000	HSIPR
BNSF Staples Subdivision Third Main	$113,500,000		$99,000,000	TIGER
Northstar Phase II	$150,000,000	$125 per train mile	$75,000,000	TIGER