CAMBRIDGE SYSTEMATICS

Minnesota Comprehensive Statewide Freight and Passenger Rail Plan

Passenger Rail System

draft technical memorandum 3

prepared for

Minnesota Department of Transportation

prepared by

Cambridge Systematics, Inc.

with

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TKDA, Inc.

July 17, 2009

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Executive Summary

Mn/DOT, regional railroad authorities, and local governments have been studying the possibilities of expanded passenger rail service for almost two decades. These studies have involved multiple rail technologies and operating practices, have involved service within the Minneapolis and St. Paul regional area, intercity connections within Minnesota, and intercity connections to cities in nearby states. This technical memorandum will examine passenger rail corridors suggested for possible service and identify relative passenger rail demand among those corridors.

This memorandum will discuss passenger rail corridors-intercity, commuter and light rail, not simply because the general public refers to all such services as “rail.” The primary focus of this technical memo is in passenger rail service that serves longer distance city pairs with nonpeak-related service. However, some of these intercity corridors will use the same existing rail rights-of-way or tracks that are being implemented or planned for commuter rail operations, so this study will consider the relationships of all planned uses of existing rail property and infrastructure for passenger rail purposes. Therefore, this study will identify various kinds of rail services being suggested within an intercity corridor and describe some of the results of previous rail studies.

Examination of these corridors also will consider the underlying condition and uses of the freight railroad lines over which almost all of these passenger rail services will expect to operate. Using data collected in the freight rail inventory for this Rail Plan (Technical Memorandum 2A), this Technical Memorandum will highlight elements of the freight rail lines that pose challenges or opportunities for passenger rail service, such as track condition, freight train counts, and numbers of grade crossings. Corridors with more track allowing higher train speeds will require less additional improvements to permit 79 to 90 mph passenger rail services; adding passenger service to freight lines with lower freight train counts will pose less congestion and require less additional track and signal capacity.

Because so many of these various rail studies and corridor suggestions have such a variety of information on possible utility of the routes (ranging from detailed ridership forecasts to simpler aspirations), this Technical Memorandum will describe the efforts of the Study Team to provide a common framework for assessing possible passenger demand for various corridors. Since most of the passenger rail corridors connect to Minneapolis and/or St. Paul, the demand modeling was based on city pairs, including the Twin Cities (see Figure 3.1 for the corridors and city pairs studied). This technical memo and its appendices have detailed explanations of how demand models were created for this study, but it follows these general steps:

1. Intercity travel demand among city pairs under current conditions are estimated for auto, air, bus, and rail.

2. Underlying demographic projections of population and employment growth are used to project growth of total travel demand.

3. A spreadsheet-based demand model is created to estimate total travel demand for all modes for a future date (in this case, 2030) for the city pairs. The model also predicts shares of future travel among various modes, including for proposed new passenger rail services.

Based on all of the factors examined in this technical memo, the Study Team concludes additional attention be given to expanding station and track capacity in and between Minneapolis and St. Paul and further finds that the following corridors appear to be initially promising:[1]

- River route service to La Crosse, Madison, Milwaukee, and Chicago;

- Additional planning for the optimal route for 110 mph rail service between Madison and the Twin Cities, which would include study of routes through Rochester and Eau Claire;

- Incremental passenger rail service improvements to Hinckley and Duluth; and

- Incremental service improvements in shorter corridors from the Twin Cities to Mankato, Northfield, St. Cloud, and Eau Claire.

[1] Subject to future analyses in remaining tasks of the Rail Plan, including application of performance metrics and integration of passenger and freight rail growth potential.

1.0 Objective

Mn/DOT and other agencies have studied options for passenger rail service in the State. The objective of this task is to identify a Minnesota passenger rail system network by synthesizing and adding value to the available information about the railroad network and passenger rail demand.

2.0 Methodology

In Section 3.0, we highlight the major findings of the memorandum. In Section 4.0, we describe the operating and capacity conditions along each potential passenger rail corridor based on the consultant team industry knowledge and research, and any ridership forecasts which have been completed by others for those corridors. The included passenger rail corridors have been suggested through public meetings, proposals from communities or elected officials. This section describes the routes, the origin of their suggestion, and includes information about the condition of the freight lines upon which passenger traffic might travel.

In Section 5.0, we present a spreadsheet-based forecasting approach which enables us to make an apples-to-apples comparison of potential ridership demand across all of the corridors, albeit not at the same level of detail developed independently by others for some of the corridors. We also compare these forecasts to actual existing rail demand around the country and to other similar studies.

Minnesota has seen two levels of passenger rail studies in the past two decades: 1) transit-oriented routes radiating from Minneapolis and St. Paul; and 2) intercity passenger rail studies that have focused on high-speed rail service. It is useful to distinguish between commuter/urban-oriented service and intercity service by their functions. Transit service, whether commuter rail or light rail, is typically focused on peak-period passenger movements into and out of the urban core and has relatively shorter distances (60 miles or less) and frequent stops. Intercity passenger rail service is designed for corridors between city pairs 100 to 600 miles apart, focuses on daily movements, and offers longer distances between stops.

Transit Studies. The metropolitan planning organization for the seven counties in the Minneapolis-St. Paul metro area, the Metropolitan Council (MetCouncil), has produced a number of transit studies that have identified corridors for transit service using a variety of vehicles: high-occupancy toll lanes, bus rapid transit lanes, light rail, and commuter rail. These corridor studies follow the designation of corridors in studies performed by the Minnesota Department of Transportation (the 1999 *Twin Cities Metropolitan Commuter Rail Feasibility Study* and the 2000 *Commuter Rail System Plan*).

In 1999/2000, the following corridors were designated as priorities as shown in Table 2.1.

Table 2.1 Designated Rail Corridors
1999-2000

Tier One	Tier Two
Northstar Corridor: Minneapolis to Big Lake along BNSF	Rush Line Corridor: St. Paul to Hinckley along existing and abandoned ROW
Red Rock Corridor: Minneapolis to Hastings through St. Paul along BNSF and CP	Bethel Corridor: Minneapolis to Bethel and Cambridge along BNSF
Dan Patch Corridor: Minneapolis to Northfield	Norwood-Young America Corridor: Minneapolis to Norwood-Young America along TCWR

In 2002, impelled by objections to the Dan Patch Corridor by certain interests along its route, the Minnesota Legislature enacted legislation that prohibited any further study of the corridor by any governmental entity. By the adoption of priorities in the 2030 Transportation Plan in 2004 by the MetCouncil, the Red Rock and Rush Line corridors were still under consideration. In addition, the plan included a Northwest/Bottineau Boulevard transitway study that featured BRT/LRT alternatives along Burlington Northern Santa Fe (BNSF) and Canadian Pacific (CP) rail lines.

A number of these light rail and commuter rail corridors use existing or abandoned freight rail lines. In this Comprehensive State Passenger and Freight Rail Plan, we will be highlighting transit services using rail rights-of-way, since such services would affect the use of those corridors for intercity passenger rail (pro and con), but also looking at proposed routes along new or unused corridors.

Intercity Passenger Rail Studies. The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) identified high-speed rail corridors throughout the nation. At around the same time, the state departments of transportation from Minnesota, Wisconsin, and Illinois were completing a Tri-State Rail Study in 1991, outlining routes and rail service and speed alternatives between Chicago, Milwaukee, and the Twin Cities. That study looked at two broad corridors – a northern option and a southern option. The Southern Corridor looked at three route alternatives within the corridor, one along the existing Amtrak route, one including Rochester, and another one that included both Madison and Rochester. The Northern Corridor included four alternative routes. By 1996, Minnesota was part of the Midwest Regional Rail Initiative (MWRRI), which envisioned a high-speed rail network serving the Midwestern states centered around a Chicago hub. In 2000, Minnesota and Wisconsin commissioned the Tri-State Study II. This study showed that a Milwaukee to Twin Cities connection through Rochester, including a route that involved new alignments between the Twin Cities and Rochester and between Rochester and Winona had the best benefit/cost ratio of the alternatives studied and should be implemented as soon as possible following the incremental upgrading of the existing Amtrak route. By 2004, the MWRRI routes showed Milwaukee to Twin Cities through

Madison but not Rochester. The Madison-Twin Cities route continued to be studied through subsequent environmental document preparations through 2008.

As these studies were occurring, two other intrastate intercity high-speed rail corridors were being examined. The Minneapolis-Duluth/Superior corridor, now known as the Northern Lights Express, was studied to restore passenger rail service that was suspended by Amtrak in 1985. In 2000, an initial concept study for intercity passenger rail service was produced. In 2007, a more comprehensive business plan for 110 mph rail service was prepared for a consortium of counties and regional rail authorities, which led to the creation of the Minneapolis-Duluth/Superior Passenger Rail Alliance (a group of county regional rail authorities). Mn/DOT has received FRA funding for preparation of a Preliminary Environmental Impact Statement for the proposed route along the BNSF rail lines, based on this business plan and feasibility study.

High-speed rail in Rochester has been discussed in Midwest high-speed rail studies going back to the 1991 Tri-State Study and in early Midwest Regional Rail Initiative reports. In 2003, Mn/DOT, with the cooperation of the City of Rochester, produced a study on the feasibility of a new route for HSR between the Minneapolis-St. Paul International Airport and the Rochester International Airport. In 2009, the City of Rochester and other organizations formed the Southern Rail Corridor, advocating a route similar to that suggested in the 2000 Tri-State Study as a freight bypass, with new engineering and travel demand studies to support the new alignment.

3.0 Overview of Findings

In deriving the Annual Passenger Estimations for the Year 2030 Scenario, an average of the growth rates for various study corridors and segments was analyzed to produce an annual growth rate of roughly two percent. This growth rate is in line with projected traffic growth over the planning horizon and was applied to each corridor to derive the 2030 values presented below. One difference in the assumptions between the various lines was the number of annual operating days. For commuter rail corridors, 250 annual operating days were assumed to be the average.[2] Meanwhile 300 annual operating days was assumed for high-speed rail corridors. The values presented below in Table 3.1 provide for an apples-to-apples comparison of the annual ridership forecasts for each of the corridors, but do not differentiate between corridor costs.

The ridership forecasts for the majority of these corridors were developed at a time when gasoline was reasonably affordable and not anywhere near the prices witnessed in the summer of 2008. It would seem reasonable that as motor fuel prices increase, the transit and rail ridership levels could progress at a rate faster than previously forecasted. In order to keep the analyses consistent, we have not attempted to approximate the effects of fuel price increases on ridership within any of the corridors at this point, but will do so in the future.

It should be noted that among the ridership forecasts for these corridors, only that done for Northstar conformed to the more rigorous and conservative Federal Transit Administration (FTA) methodology for Federal New Starts projects. This explains why Northstar may have a lower forecast than some of the other corridors which have not yet been accepted into the New Starts program and hence could use other more expansive ridership forecasting methodologies and assumptions.

[2] The Federal Transit Administration approved the use of 290 days for annualizing the Northstar ridership, but in order to make a consistent comparison across the corridors, 250 days is used in the table.

Table 3.1 2030 Ridership Projections from Minnesota Rail Studies[a]

	Projected Annual Passengers in 2030
High-Speed Rail Corridors	
Northern Lights Express	1,344,500
Rochester Rail Link	2,029,100
Midwest High-Speed Rail – Minnesota	535,900
Commuter Rail Corridors	
Northstar Commuter Rail[b]	1,549,800
Dan Patch Commuter Rail	2,305,900
Red Rock Commuter Rail	1,813,900
Light Rail Corridors	
Southwest Transitway LRT	9,599,500
Central Corridor LRT	14,965,000

[a] While many of the existing studies used a 2030 forecast date, for those that had a different forecast year, the projections were inflated to 2030 assuming a 1.5 percent annual growth in ridership.

[b] Only project subject to FTA New Starts forecasting methodology.

Taking into consideration the demand analysis developed in Section 5.0 of this memo by the project team, and the overall track condition and traffic density of freight lines outlined in Section 4.0, Table 3.2 summarizes information for all of the potential corridors. The first column lists the percentage of track miles that allow passenger train speeds of 79 mph, which is a proxy measurement for the relative track condition improvements that would need to be made to increase train speeds to permit competitive trip times. The second column includes a measurement of relative train count density – the number represents the difference between the corridor's weighted average train count and the overall average across all corridors (18 trains per day), with the lower the number, the fewer trains. Inserting passenger trains on relatively busy freight lines will likely require expensive capacity improvements to the freight line. The third column is the 2030 demand in thousands for that city pair for the improved service level as developed and shown in detail in Section 5.0. The fourth column is the resulting forecast overall rail market share. The overall rankings for corridor conditions and city pair demand also are included for relative comparisons across corridors/city pairs. These corridors and those mentioned elsewhere in this technical memorandum are shown in Figure 3.1.

Figure 3.1 Potential Passenger Rail Corridors

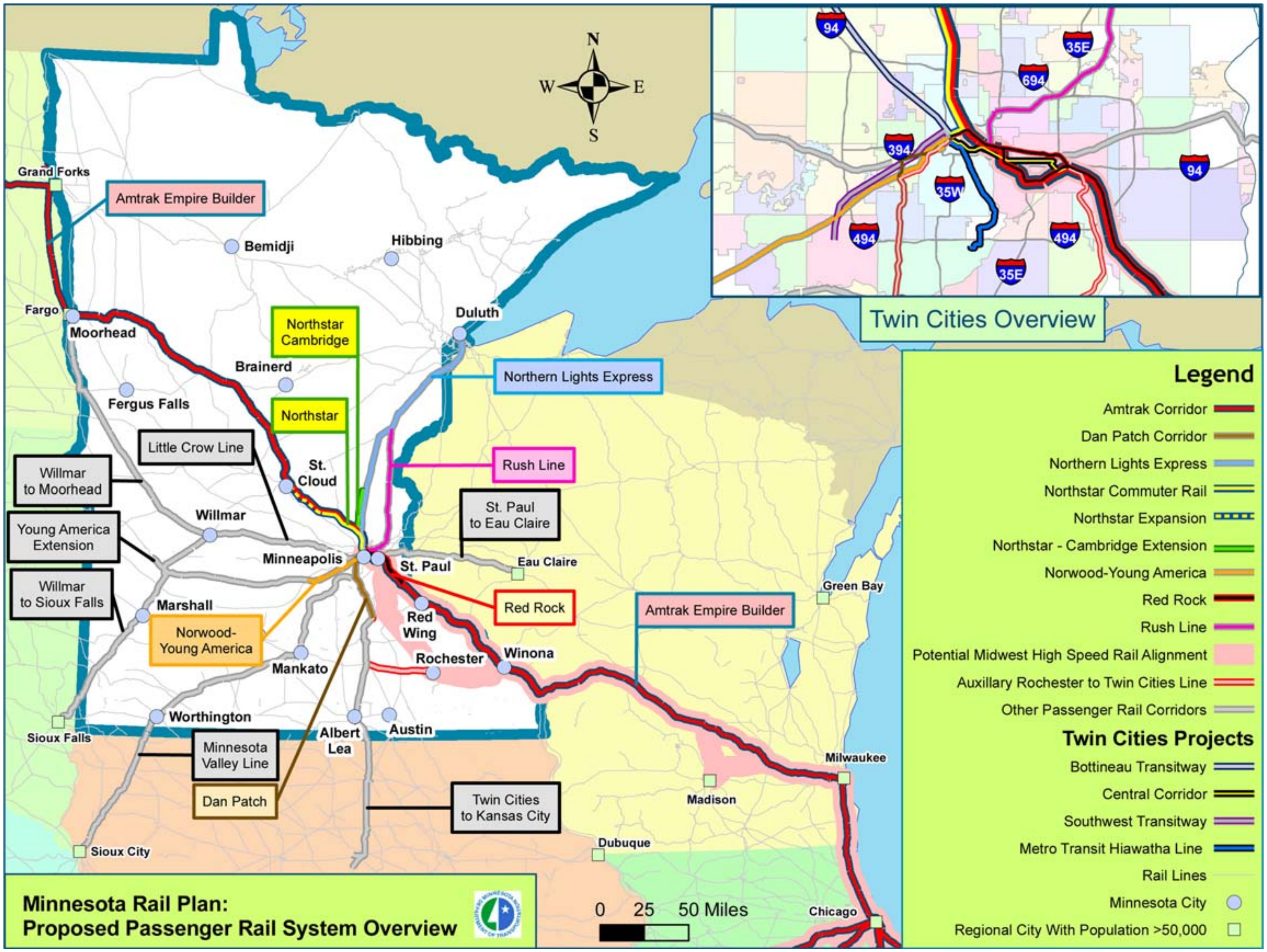

Table 3.2 Inventory of Possible Passenger Rail Corridors

	Implementation		Demand		Ranks			
Route: Twin Cities to:	Track Mile % ≥ 49mph[a]	Train Count Index[b]	2030 Demand (Thousands)	Rail Share	Track	Train Count	Demand	Rail Share
La Crosse-Chicago	85	48			3	6		
River Cities			132	5.0			7	4
Madison			83	1.7			9	11
Chicago			299	2.9			2	9
Rochester	N/A	N/A	215	3.5			6	7
St. Cloud-Fargo	91	177			2	7		
St. Cloud			712	5.5			1	2
Fargo			36	0.9			12	
Hinckley-Duluth	94	3			1	5		
Hinckley			224	3.5			5	6
Duluth			80	2.0			10	10
Northfield-Des Moines-Kansas City	48	(38)			6	2		
Northfield			110	5.5			8	3
Des Moines			18	0.6			14	14
Kansas City			2	0.1			16	16
Willmar-Sioux Falls	53	(23)			5	4		
Willmar			54	3.5			11	8
Sioux Falls			18	1.2			13	12
Mankato-Sioux City	54	(71)			4	1		
Mankato			228	5.6			4	1
Sioux City			2	0.3			15	15
Willmar-Fargo	14	(32)			7	3		
Willmar			54	3.5			11	8
Fargo			36	0.9			12	13
Eau Claire	0	(71)	257	3.9	8	1	3	5

Source: Cambridge Systematics and Study Team analysis of available data.

[a] Number of miles of track at freight speeds greater than or equal to 49 mph divided by the total number of track miles.

[b] Weighted average daily train count minus the total average train count (18), divided by 18, multiplied times 100.

4.0 Operating and Capacity Conditions and Existing Ridership Forecasts for Potential Passenger Rail Corridors

4.1 CP: Rochester-Winona

4.1.2 Operating and Capacity Conditions

This corridor is under consideration as part of a high-speed rail route between Chicago and the Twin Cities. It is an alternative route to the one envisioned by the Midwest Regional Rail Initiative for incremental high-speed service. This route has been studied by the Minnesota and Wisconsin departments of transportation. A portion of this corridor currently is being studied by consultants for the Mayo Clinic to look at a "Southern Rail Corridor" that would bypass Rochester to the south. This would move freight off the old "DM&E" line (now CP) running through downtown Rochester. This study covers a 48-mile corridor roughly 24 miles on each side of Rochester. In addition to conflicts with slower moving freight traffic, one challenge to the implementation of high-speed rail on this corridor is cost associated with new right-of-way, environmental clearance, and new rail line construction. Although existing railroads connect Rochester and the Twin Cities via Owatonna and Northfield, Rochester high-speed rail supporters are requesting a new alignment between Rochester and the Twin Cities.[3]

[3] Since much of the route for the proposed Rochester service, as supported by local leaders, is on new, non-rail alignments, there are no details on existing rail facilities provided for the Rochester-Winona rail corridor.

4.1.2 Rochester Rail Link Feasibility Study

The Rochester Rail Link study examined the implementation of the highest speed technology studied among Minnesota corridors.[4] For purposes of comparison, the numbers in Table 3.2 above were for the 150 mph option which was the slowest speed analyzed within the feasibility report. Overall, this corridor would move daily travelers between Rochester and the Twin Cities, specifically by connecting the two airports – with Rochester serving as a reliever airport for the Minneapolis/St. Paul International (MSP) Airport. This has occurred to a limited extent with FedEx locating a regional hub at the Rochester International Airport. The analysis presented assumes 300 operating days per year to derive the more than two million annual riders.

No major trip generators were presented, including any detailed analysis of the impacts of the Mayo Clinic nor use of the Rochester airport to relieve the MSP Airport. Nevertheless, the corridor projections appeared to rely very heavily on the Rochester airport functioning as a significant reliever airport, without showing cause for why Minneapolis-St. Paul International Airport would need the relief or why Rochester would be the best alternative. Additionally, the corridor ridership relied on a significant diversion of individuals from air travel to train travel. If residents of the Twin Cities are more likely to drive the one to two hours necessary to get to Rochester, and passengers arriving via airplane might not switch modes to a train connection, the overall ridership estimates would be high.

The corridor proposed for use within the study relies on right-of-way along highway corridors that have since been rebuilt, and the availability of right-of-way for rail purposes is not well-defined.

In 2009, the same consultant (TEMS) was retained to update the earlier Rochester study, this time in the context of how Rochester might fit into the MWRRI network. Although a final report had not yet been published, the consultant provided a presentation summarizing the results, and participated in a discussion with the Study Team for this Rail Plan. Technology considered was 110 mph diesel generally operating over existing right-of-way, and a greenfield 220 mph TGV-style electric-powered train service. Two primary route options were evaluated, one bypassing Rochester that follows the existing CP route through Wisconsin and along the Mississippi River, and the other consisting of new construction from the Mississippi River to Rochester and then on to either downtown St. Paul or to the MSP Airport with continuing connections to one of the downtowns. An economic analysis incorporating estimated implementation costs, operating costs and revenue projections was completed for the different options. Not taken into account were the multi-year differences in the time required to implement the various options. Also, as with the prior study,

[4] Transportation Economics and Management Systems, Inc. [TEMS] with HNTB. 2003. Rochester Rail Link Feasibility Study. Report submitted to Minnesota Department of Transportation, January 2003.

publicly available rights-of-way would be used for the new alignments when possible, and, where necessary, private land could be acquired for cropland value.[5]

The analysis was conducted using TEMS' standard model that was calibrated for MWRRI in 2004, and updated to use 2008 fuel costs and demographics. Special generators, such as the Mayo Clinic, did not appear to be explicitly addressed, other than what already was incorporated into the MWRRI model. Furthermore, use of the Rochester Airport as a reliever facility was not considered. From this analysis, annual ridership in 2020 was estimated to be 1.956 million along the segment between St. Paul and Rochester for the 110 mph option, and 3.539 million with the 220 mph option. Although these volumes bracket the prior study, they include travel along the entire route between the Twin Cities and Chicago, and not just to and from Rochester.

■ 4.2 CP: St. Paul-Red Wing-Winona-La Crosse

4.2.1 Operating and Capacity Conditions

This corridor is under consideration for service between Chicago and the Twin Cities as part of the high-speed rail network envisioned by the Midwest Regional Rail Initiative. This corridor has been further studied by the Minnesota, Wisconsin, and Illinois departments of transportation in two Tri-State Rail studies.[6],[7] The corridor currently serves intercity passenger rail traffic via the Amtrak Empire Builder route between St. Paul and the Wisconsin state line. The Empire Builder operates with once daily service between Chicago and Seattle.

This corridor also is part of the planned Red Rock Corridor, which is a commuter rail line from Hastings northward to St. Paul. The Red Rock Corridor study was commissioned by the Red Rock Corridor Commission which is led by the Washington County Regional

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[5] Railroads and roadways have different design characteristics (grades, curves) because of the performance characteristics of the vehicles in question. Some roadway segments may not be suitable for railroad alignments, particularly higher speed rail that requires straighter, smoother routes. To the extent public rights of way cannot be used, this would occasion more complicated environmental clearance and right of way acquisition, which would expose a rail project to time and cost uncertainties.

[6] TMS/Benesch High-Speed Rail Consultants. 1991. Tri-State High-Speed Rail Study: Chicago – Milwaukee-Twin Cities Corridor. Report presented to Illinois Department of Transportation, Minnesota Department of Transportation, and Wisconsin Department of Transportation, 1991.

[7] Transportation Economics and Management Systems, Inc. [TEMS] 2000. High-Speed Rail Feasibility Study: Chicago – Milwaukee-Twin Cities Corridor. Report presented to Illinois Department of Transportation, Minnesota Department of Transportation and Wisconsin Department of Transportation, February 2000.

Railroad Authority and includes the Hennepin County Regional Rail Authority (HCRRA), the Ramsey County Regional Rail Authority (RCRRA), and the Dakota County Regional Rail Authority (DCRRA).

One major challenge of this corridor is the potential alignment issues as the tracks follow the river. The ability to reach higher speeds could be difficult in this corridor with its many curves. Amtrak trains currently average about 40 miles per hour with stops between La Crosse and St. Paul, and roughly 55 mph between La Crosse and Chicago. Freight traffic also is relatively heavy on this corridor, and multiple passenger rail services (high-speed and commuter) would introduce additional congestion on the corridor, which could require extensive additional capacity. Another bottleneck would occur at Hoffman Junction in downtown St. Paul, where CP, BNSF, and Union Pacific (UP) all have rail lines. Creating a through movement passenger rail corridor in this area will be difficult. In addition, the RCRRA currently is moving forward with planning for a large intermodal train station at the St. Paul Union Depot. The ability to achieve access to each line in this station will be a challenge for implementing a true intermodal center at the St. Paul Union Depot.

Operating statistics for this corridor are shown in Table 4.1.

Table 4.1 Characteristics of CP Rail Line from Twin Cities to La Crosse

Segments on Railroad	Length (Miles)	Average Train Counts	Grade Crossings
Merriam Park Subdivision	2.7	12	3
River Subdivision	119.4	28	70
Tomah Subdivision	4.4	0	1
Corridor Totals/Weighted Means	126.5	27	74

Freight Train Speed	Miles of Track at Train Speed
25	0.8
30	5.4
35	0.7
40	2.6
45	3.6
50	0.6
60	3.9
65	59.8
70	12.7
75	8.4
79	23.6
Unknown	4.4

Source: CP data analyzed by CS Study Team, Segments include portions of subdivision along proposed passenger route, totaled from RR segment designations. Train counts are a weighted average of number of daily trains times segment distance.

4.2.2 Midwest Regional Rail Initiative

Since 1996, studies of the Midwest Regional Rail Initiative, a joint project of the departments of transportation of the states of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, Ohio, and Wisconsin, had identified the river route from Wisconsin to the Twin Cities as the preferred route for 110 mph high-speed rail from Madison and Milwaukee, Wisconsin, and Chicago hubs. The market analysis carried out by TEMS as part of the Midwest Regional Rail Initiative suggests that ridership between Chicago and the Twin Cities was approximately 50,000 in 2000 (just over 15 percent for business purposes and the rest for leisure)[8] The 2025 figures for the corridor show nearly 1.5 million passengers between Chicago and Milwaukee, dropping to below 350,000 passengers by the time the train reaches the Twin Cities.[9] 2020 Origin-Destination tables for individual city pairs shows ridership of 219,746 between Chicago and Minneapolis/St. Paul, and 39,648 between Milwaukee, Wisconsin, and the Twin Cities.[10]

4.2.3 Red Rock Commuter Rail Corridor

The Red Rock corridor primarily serves riders destined for St. Paul Union Depot.[11] This corridor is unique in this regard given that the majority of other corridors are destined for Minneapolis. Seventy-five percent of the patrons in the corridor travel within the St. Paul to Hasting segment of the corridor. It is unclear whether or not the ridership analysis included the implementation of the Central Corridor LRT project, which could diminish commuter rail ridership by 10 percent as the Red Rock and Central Corridor projects can be considered direct competitors for any trip with an origin or destination in Minneapolis. The Red Rock studies suggest that this potential competition has a moderate scope: 15 percent of the trips from the corridor originate in or are destined to Minneapolis.[12]

Given the competing routes that are under design in the Red Rock Corridor, it is feasible that after another round of review, the Red Rock Corridor might have the highest annual ridership of any Commuter Rail Corridor. One scenario that would be interesting to test

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[8] Transportation Economics and Management Systems, Inc. [TEMS] with HNTB. 2004. Midwest Regional Rail System, Section 4.0: Market Analysis, pages 4-18. Report submitted to Midwest Regional Rail Initiative, September 2004.

[9] Transportation Economics and Management Systems, Inc. [TEMS] with HNTB. 2004. Midwest Regional Rail System, Section 4.0: Market Analysis, pages 4-51. Report submitted to Midwest Regional Rail Initiative, September 2004.

[10] Transportation Economics and Management Systems, Inc. [TEMS] with HNTB. 2004. Midwest Regional Rail System, Section 4.0: Market Analysis, Appendix 4, pages 31, 161. Report submitted to Midwest Regional Rail Initiative, September 2004.

[11] Parsons Brinckerhoff. 2001. Dan Patch Corridor: Commuter Rail Feasibility Study, page 6-5. Final report submitted to Dakota County Regional Railroad Authority, December 2001.

[12] Red Rock Corridor: Commuter Rail Feasibility Study. Final report submitted to Red Rock Corridor Commission, July 2001.

would be the ridership of the Red Rock Commuter Rail with augmented feeder transit systems (with its dedicated right-of-way) versus the in-street operations of the Central Corridor LRT. It does seem likely given the growth in population southeast of St. Paul, the potential for services in the I-94 corridor, and the propensity of the projected riders in the corridor to travel to St. Paul, that the ridership levels forecasted might be attained by 2030.

■ 4.3 BNSF: Minneapolis-Coon Rapids-Big Lake-St. Cloud-Fargo/Moorhead

4.3.1 Operating and Capacity Conditions

This corridor currently serves intercity passenger rail traffic via the Amtrak Empire Builder route between Fargo/Moorhead and Minneapolis. The Empire Builder operates with once daily service between Chicago and Seattle. Facilities currently are under construction for Northstar commuter rail service from Big Lake to Minneapolis. The Northstar line was planned by the Northstar Corridor Development Authority (NCDA) which is a joint powers board of 30 counties, cities, and townships along the corridor. Mn/DOT is the grantee on this Federally funded project with the Metropolitan Council acting as the operations/maintenance provider.

There is growing momentum to extend the Northstar commuter line beyond Big Lake to St. Cloud in the next two to four years depending on available funding. The corridor currently also is under study by Amtrak as it considers reinstating North Coast Hiawatha service between Chicago and Seattle. The North Coast Hiawatha line shares the Empire Builder route from Minneapolis to Fargo and then heads west through Bismarck, North Dakota while the Empire Builder heads north through Grand Forks, North Dakota. The two routes converge again in Sand Point, Idaho.

This BNSF rail line has a relatively high volume of train traffic and high-quality track. The biggest challenge to increasing passenger rail service in this corridor will be the ability to acquire the trackage rights from BNSF to accommodate both the heavy freight traffic and additional intercity passenger rail.

Operating statistics for this corridor are shown in Table 4.2.

Table 4.2 Characteristics of BNSF Rail Line from Twin Cities to Fargo/Moorhead

Segments on Railroad	Length (Miles)	Average Train Counts	Grade Crossings
Midway Subdivision	2.0	32	2
Staples Subdivision	231.9	50	237
KO/Prosper Subdivisions	4.8	65	10
Corridor Totals/Weighted Means	238.7	50	249

Freight Train Speed	Miles of Track at Train Speed
10	4.3
25	9.5
30	2.95
35	0.2
40	0.1
45	3.2
50	0.8
60	11.02
70	7.1
75	136.2
79	69.78

Source: BNSF data analyzed by CS Study Team, Segments include portions of subdivision along proposed passenger route, totaled from RR segment designations. Train counts are a weighted average of number of daily trains times segment distance.

4.3.2 Northstar Commuter Rail

The originally proposed Northstar Corridor was revised to allow for an interim terminus in Big Lake, Minnesota, with two future termini located in Cambridge and St. Cloud.[13] The revision to a shorter route was in response to cost and ridership projections for the extension beyond Big Lake (relatively higher cost and lower ridership), and the corridor FEIS was subsequently revised resulting in a projected daily ridership of 5,590 in 2025 (6,200 in 2030). The assumptions for annual growth rates used throughout this document

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[13] Kimley-Horn and Associates, Inc. 2009. Northstar Corridor Commuter Rail: Cambridge Extension Feasibility Study. Draft report submitted to Anoka County Regional Rail Authority, March 2009.

were primarily derived from the Northstar Corridor report[14] (the FTA has reviewed the overall methodology and deemed that the assumptions were appropriate). Additionally, each segment of the corridor assumed slightly different growth percentages suggesting that certain station areas along other routes may actually witness higher or lower than average annual growth.

The likely potential for the Northstar Commuter Rail Corridor to reach the 2030 ridership projections (for its current route) is high given the level of travel demand within the corridor, combined with development strategies in communities that will allow higher intensity development near the station locations. Recent research has suggested that increased density near transit stations, combined with regular service and a commuter group already accustomed to a comparable commute time, are much more likely to use transit service given its reliability (see TCRP Report 102 in particular). Therefore, Northstar's potential ridership seems attainable.

■ 4.4 BNSF: Minneapolis-Coon Rapids-Cambridge-Hinckley-Superior/Duluth

4.4.1 Operating and Capacity Conditions

This corridor currently serves intercity passenger rail traffic via the Amtrak Empire Builder route between Coon Rapids and Minneapolis; there are no stops along this section of the corridor. The Empire Builder operates with once daily service between Chicago and Seattle. The Coon Rapids to Minneapolis section of the route also is part of the Northstar commuter rail line. The route from Cambridge to Minneapolis is under consideration by Mn/DOT as the future "Bethel" commuter rail line. The Anoka County Regional Rail Authority (ACRRA) has recently completed a feasibility study on the section from Cambridge to Minneapolis known as the "Northstar Cambridge Extension." The idea behind the feasibility study is to utilize some of the existing fleet and maintenance facility to allow commuter rail service to be implemented on a portion of this corridor.

Additionally, the entire corridor is under consideration for a high-speed rail route between Duluth and Minneapolis. This route has been studied by the St. Louis and Lake Counties Regional Rail Authority, and is referred to as the "Northern Lights Express." The route has been the subject of a number of feasibility studies conducted by the Regional Rail Authority, and Mn/DOT recently received funding from the Federal Railroad Administration to conduct an environmental impact statement for the proposed service. Light freight traffic added to multiple passenger rail lines could introduce the need for double tracking of this corridor or providing additional sidings within the corridor.

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[14]See Appendix A of Kimley-Horn 2009 for a more extensive discussion of growth rate assumptions.

Operating statistics for this corridor are shown in Table 4.3.

Table 4.3 Characteristics of BNSF Rail Line from Twin Cities to Duluth/Superior

Segments on Railroad	Length (Miles)	Average Train Counts	Grade Crossings
Midway Subdivision	1.9	32	2
Staples Subdivision	9.7	63	5
Hinckley Subdivision	112.1	14	123
Corridor Totals/Weighted Means	123.7	18	130

Freight Train Speed	Miles of Track at Train Speed
25	1.1
30	1.95
40	0.7
45	3
50	111.38
79	5.55

Source: BNSF data analyzed by CS Study Team, Segments include portions of subdivision along proposed passenger route, totaled from RR segment designations. Train counts are a weighted average of number of daily trains times segment distance.

4.4.2 Northern Lights Express (Minneapolis-Duluth)

The Northern Lights Express (NLX) report focused on the development of High-Speed Rail alternatives between Minneapolis and Duluth, Minnesota.[15] Several station locations along the route were identified in very general terms although the station options around a casino location in Hinckley, Minnesota provided the greatest range of ridership variations throughout the corridor. The study recommendation of 110 mph trains at frequencies of eight trips per day yields roughly 4,480 daily riders. Seventy-three percent of these passenger trips are for corridor activities, and 27 percent are for Casino trips or Midwest High-Speed Rail connections.

[15] Transportation Economics and Management Systems, Inc. [TEMS] with SRF Consulting Group and Krech Ojard Associates. 2007. Minneapolis-Duluth/Superior: Restoration of Intercity Passenger Rail Service Comprehensive Feasibility Study and Business Plan. Report submitted to St. Louis and Lake Counties Regional Railroad Authority, December 2007.

The operating plan seems reasonable for the amount of trips that might be generated; however, several assumptions within this report have effects on overall ridership. Depending upon how these items are integrated into the final allocation of ridership, the ridership values could be different. The assumptions that were used to create the annual ridership projection of 1,344,500 were the following: eight train sets daily, 110 mph operating speed, and no direct connection to the casino.

The number of Casino trips utilizing rail seemed high and this type of special generator warrants some additional analysis. Many casino trips around the nation are provided by inexpensive charter bus services contracted by affinity groups. Shifting a significant amount of this demand to individual rail travel could be problematic. Additionally, the amount of induced trips with the higher speed (125 mph) alternative of 200,000 per year seems high. Overall, a daily ridership estimate of roughly 3,300 (990,500 annually) seems much more likely given the lack of detailed information about the potential for casino trips via rail and the unknown timeframe for the Midwest High-Speed Rail – especially any latent demand that the Duluth corridor may experience once High-Speed service is offered to the Twin Cities.

■ 4.5 CP: St. Paul-Minneapolis

4.5.1 Operating and Capacity Conditions

This corridor for connecting the Twin Cities (via CP, with portions of BNSF and Minnesota Commercial Railroad (MNNR)) currently serves intercity passenger rail traffic via the Amtrak Empire Builder route between Fargo/Moorhead and Minneapolis. The Empire Builder operates with once daily service between Chicago and Seattle. Red Rock commuter rail service has been studied along this corridor as part of the feasibility analysis conducted for the Red Rock Commuter Commission; it is an alternative route to the BNSF route between Minneapolis and St. Paul. Coordination with existing freight rail service and the associated cost for track and signal improvements is one challenge to implementation. In addition, the RCRRA currently is moving forward with planning for a large intermodal train station at the St. Paul Union Depot, which could potentially add significant congestion to the CP rail line at the St. Paul Union Depot. A portion of this line was previously double-tracked and could potentially be reinstalled to relieve the congestion. Previously, this line had been studied as a Central Corridor commuter rail alignment, but environmental documentation and design are proceeding on new light rail alignments along University and Washington Avenues.

Operating statistics for this corridor are shown in Table 4.4.

Table 4.4 Characteristics of CP, BNSF, and MNNR Rail Line from Minneapolis to St. Paul

Segments on Railroad	Length (Miles)	Average Train Counts	Grade Crossings
BNSF Midway Subdivision	2.5	32	1
MNNR	1.4	0	0
CP Merriam Park Subdivision	6.1	12	5
Corridor Totals/Weighted Means	9.9	25	6

Freight Train Speed	Miles of Track at Train Speed
Unknown	1.36
15	0.1
30	3.56
40	4.9

Source: CP, BNSF, and MNNR data analyzed by CS Study Team, Segments include portions of subdivision along proposed passenger route, totaled from RR segment designations. Train counts are a weighted average of number of daily trains times segment distance.

4.5.2 Central Corridor LRT

The Central Corridor LRT Ridership projects almost 15 million annual riders in 2030.[16] The analysis for this corridor will have a direct impact on the ridership of the Red Rock Corridor. The ridership methodology memoranda were not available for this corridor; however, given the recent success of the Hiawatha LRT Corridor and the travel demand that exists between Minneapolis and St. Paul, it seems likely that the ridership would reach 41,000 daily riders in 2030.

■ 4.6 BNSF: St. Paul-Minneapolis

Red Rock commuter rail service has been studied along this corridor on the BNSF (with a portion on the CP) connecting the Twin Cities, referred to as the Midway Subdivision, as part of the feasibility analysis conducted for the Red Rock Commuter Commission.

[16] AECOM. 2009. Central Corridor Ridership Forecasts Results for the Minnesota Statewide Rail Plan. Draft memorandum sent to Chuck Hymes, DMJM+Harris, April 7, 2009.

Coordination with existing freight rail and the associated cost for track and signal improvements are two challenges to implementation. One of the potential drawbacks of this 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, this line had been studied as a Central Corridor commuter rail alignment, but environmental documentation and design are proceeding on a new light rail alignment along University and Washington Avenues.

Operating statistics for this corridor are shown in Table 4.5.

Table 4.5 Characteristics of BNSF and CP Rail Line from Minneapolis to St. Paul

Segments on Railroad	Length (Miles)	Average Train Counts	Grade Crossings
Midway Subdivision	9.0	32	1
St. Paul Subdivision	0.9	0	0
CP Merriam Park Subdivision	1.2	12	0
Corridor Totals/Weighted Means	11.1	27	1

Freight Train Speed	Miles of Track at Train Speed
30	10.15
Unknown	0.90

Source: BNSF and CP data analyzed by CS Study Team, Segments include portions of subdivision along proposed passenger route, totaled from RR segment designations. Train counts are a weighted average of number of daily trains times segment distance.

■ 4.7 TCWR: Minneapolis-Norwood/Young America-Montevideo

This corridor, along the Twin Cities and Western short line railroad, is under consideration as part of the Commuter Rail System Plan completed by Mn/DOT. Coordination with existing freight rail and the associated cost are challenges to implementation, although the freight traffic is relatively light compared to other railroad lines in the Twin Cities. The rail line between Norwood/Young America to Hanley Falls would need substantial improvements to increase speeds to acceptable passenger rail levels.

Operating statistics are shown in Table 4.6.

Table 4.6 Characteristics of TCWR Rail Line from Minneapolis to Norwood/Young America and Montevideo

Segments on Railroad	Length (Miles)	Average Train Counts	Grade Crossings
Corridor Totals/Weighted Means	147.10	3	236

Freight Train Speed	Miles of Track at Train Speed
10	4
20	0.1
30	143.0

Source: TCWR data analyzed by CS Study Team, Segments include portions of subdivision along proposed passenger route, totaled from RR segment designations. Train counts are a weighted average of number of daily trains times segment distance.

■ 4.8 UP: St. Paul-Northfield-Des Moines-Kansas City

This corridor (which involves a short section on the CP railroad) has been proposed by the National Association of Rail Passengers (NARP) as part of its vision for a national passenger train network. A survey conducted by NARP in 2003 showed that this new route was the most preferred by current Amtrak riders in the Twin Cities. This route would allow connections to two existing east/west passenger rail corridors without first traveling to Chicago. The Kansas Department of Transportation in conjunction with Amtrak currently is studying an extension of the existing Ft. Worth-Oklahoma City train to Kansas City which would allow a further connection to an existing east/west passenger rail corridor in Texas. The Iowa Department of Transportation also includes this corridor in its Draft Statewide Rail Plan with a vision for operations beginning within 10 years.

Coordination with existing freight rail service is one challenge to implementation, but significant capital improvements have been made to the corridor in the last decade.

Operating statistics for this corridor are shown in Table 4.7.

Table 4.7 Characteristics of UP and CP Rail Line from Twin Cities to Northfield to Minnesota/Iowa State Line

Segments on Railroad	Length (Miles)	Average Train Counts	Grade Crossings
CP Merriam Park Subdivision	1.2	12	2
UP Albert Lea Subdivision	112.3	11	179
Corridor Totals/Weighted Means	113.5	11	181

Freight Train Speed	Miles of Track at Train Speed
20	4
25	2.8
30	4.9
40	47.4
50	55
70	0

Source: UP and CP data analyzed by CS Study Team, Segments include portions of subdivision along proposed passenger route, totaled from RR segment designations. Train counts are a weighted average of number of daily trains times segment distance.

■ 4.9 BNSF: Minneapolis-Willmar-Sioux Falls

This corridor has been proposed by the NARP as part of its vision for a national passenger train network. The section of the corridor between Minneapolis and Willmar has been named the Little Crow Transit Way. It has been proposed by two Minnesota State Representatives. In addition, the section between Minneapolis and Willmar also serves as a back-up/reliever route to the more heavily traveled Minneapolis-Coon Rapids-Big Lake-St. Cloud-Fargo/Moorhead corridor. This corridor is included in the Iowa DOT Draft Statewide Rail Plan with service continuing through Sioux City to Omaha, Nebraska from Garretson, South Dakota. One challenge to implementation is that part of the corridor between Willmar and Sioux Falls is single track and not signalized; significant upgrades would be necessary to introduce passenger rail service along this corridor.

Operating statistics for this corridor are shown in Table 4.8.

Table 4.8 Characteristics of BNSF Rail Line from Twin Cities to Willmar to Minnesota/South Dakota State Line

Segments on Railroad	Length (Miles)	Average Train Counts	Grade Crossings
Wayzata Subdivision	88.5	14	98
Morris Subdivision	4.8	13	8
Marshall Subdivision	133.9	14	194
Corridor Totals/Weighted Means	227.2	14	300

Freight Train Speed	Miles of Track at Train Speed
10	0.91
25	2.6
30	1.4
40	95.04
45	4.96
49	121.9

Source: BNSF data analyzed by CS Study Team, Segments include portions of subdivision along proposed passenger route, totaled from RR segment designations. Train counts are a weighted average of number of daily trains times segment distance.

4.10 UP: Minneapolis-Mankato-Worthington-Sioux City

A study of passenger and commuter rail service has been proposed by a Minnesota State Representative along the UP corridor (with a small portion on the BNSF railroad) between Minneapolis and Mankato under the name "Minnesota Valley Line," with continued service to Sioux City, Iowa. The Iowa DOT has included part of this corridor, between Le Mars, Iowa and Sioux City, in its Draft Statewide Rail Plan. IADOT's mapping shows the connection between the Twin Cities and Le Mars following the BNSF line through Willmar. Although coordination with existing freight service is one challenge to implementation, significant capital improvements have been made to the corridor in recent years.

Operating statistics for this corridor are shown in Table 4.9.

Table 4.9 Characteristics of UP and BNSF Rail Line from Twin Cities to Willmar to Minnesota/South Dakota State Line

Segments on Railroad	Length (Miles)	Average Train Counts	Grade Crossings
BNSF Wayzata Subdivision	3.8	14	3
Mankato Subdivision	120.9	5	156
Worthington Subdivision	67.2	5	83
Corridor Totals/Weighted Means	191.9	5	242

Freight Train Speed	Miles of Track at Train Speed
10	1.71
20	5.7
25	6.3
30	39
40	31
45	4
49	103.8

Source: UP and BNSF data analyzed by CS Study Team, Segments include portions of subdivision along proposed passenger route, totaled from RR segment designations. Train counts are a weighted average of number of daily trains times segment distance.

■ 4.11 BNSF: Minneapolis-Willmar-Fargo/Moorhead

This corridor is suggested as a back-up/reliever to the more heavily traveled Minneapolis – Coon Rapids-Big Lake-St. Cloud-Fargo/Moorhead corridor. It currently is not used for passenger rail service as demand has traditionally been higher on the corridor through St. Cloud. The section of the corridor between Minneapolis and Willmar has been named the Little Crow Transit Way. It has been proposed by two Minnesota State Representatives. In addition, the section of the corridor between Minneapolis and Willmar is part of NARP's proposed vision for a national passenger train network.

Operating statistics for this corridor are shown in Table 4.10.

Table 4.10 Characteristics of BNSF Rail Line from Twin Cities to Willmar to Fargo/Moorhead

Segments on Railroad	Length (Miles)	Average Train Counts	Grade Crossings
Wayzata Subdivision	88.5	14	98
Morris Subdivision	114.3	12	165
Moorhead Subdivisions	38.5	7	43
Prosper Subdivisions	1.4	27	8
Corridor Totals/Weighted Means	242.7	12	314

Freight Train Speed	Miles of Track at Train Speed
10	0.71
25	3.5
30	1.3
40	199.29
60	34.06

Source: BNSF data analyzed by CS Study Team, Segments include portions of subdivision along proposed passenger route, totaled from RR segment designations. Train counts are a weighted average of number of daily trains times segment distance.

4.12 CP/PGR: Minneapolis-Northfield

This corridor was under consideration for commuter rail under the name Dan Patch. A feasibility study of the Dan Patch corridor was completed in 2001 by the Dakota County Regional Railroad Authority. The Minnesota State Legislature placed a ban on any further study of the corridor in 2002.

The Dan Patch Commuter Rail Line would have passed through several of the fastest growing communities within the Minneapolis/St. Paul Region.[17] Among the commuter rail corridors, the ridership projections would have resulted in the highest annual ridership; however, there are several items within the analysis that could be reexamined based upon current projects. The effects on ridership of the Cedar Avenue BRT did not seem to have been calculated. The Cedar Avenue BRT is a direct competing route from Lakeville

[17] Parsons Brinckerhoff. 2001. Dan Patch Corridor: Commuter Rail Feasibility Study. Final report submitted to Dakota County Regional Railroad Authority, December 2001.

to Minneapolis and as such the ridership of the Dan Patch Corridor would likely be diminished. Interaction with, or feeder services from, the Hiawatha LRT were not quantified and as such any linkages are difficult to quantify. Overall, it seems that the ridership projections contained within the 2001 report would need to be reexamined with the addition of the Cedar Avenue BRT corridor.

It seems doubtful that the Dan Patch Corridor could have reached the 2.3 million annual riders forecasted in the 2001 report, considering the advent of the Cedar Avenue Transitway project and the subsequent design of BRT facilities within the Cedar Avenue Corridor. Ridership estimates for Cedar Avenue account for a tripling of current transit usage within the corridor by 2025 resulting from the implementation of BRT service, which could likely diminish the Dan Patch Ridership by as much as 1 million annual passengers.

■ 4.13 UP: St. Paul-Eau Claire

This corridor was under consideration as part of a high-speed rail route between Chicago and the Twin Cities. It was an alternative route to the one envisioned by the Midwest Regional Rail Initiative for incremental high-speed service. This route has been studied by the Minnesota, Wisconsin, and Illinois departments of transportation. It was not proposed for additional study following the 1991 Tri-State High-Speed Rail Study as the southern corridor[18] was preferred in environmental, economic, and financial terms.

This route is cited by NARP as part of the most favorable high-speed route between the Twin Cities and Chicago. There are fewer curves and less freight traffic along this corridor than on the corridor along the river between La Crosse and the Twin Cities or the route between Winona and Rochester. Expanding or replacing the railroad bridge across the St. Croix River might be expensive. This corridor in Minnesota serves a very rural population on the eastern edge of the Twin Cities, but could increase viability if MWRRI were to move its preferred alignment to Eau Claire.

Operating statistics for this corridor are shown in Table 4.11.

[18] CP: St. Paul-Red Wing-Winona-La Crosse.

Table 4.11 Characteristics of UP, CP, and BNSF Rail Line from Twin Cities to Minnesota/Wisconsin State Line

Segments on Railroad	Length (Miles)	Average Train Counts	Grade Crossings
CP Merriam Park Subdivision	1.2	12	0
BNSF St. Paul Subdivision	0.9	0	0
Altoona Subdivision	18.0	5	23
Corridor Totals/Weighted Means	20.1	5	23

Freight Train Speed	Miles of Track at Train Speed
20	0.1
25	0.7
30	18.4

Source: UP, CP and BNSF data analyzed by CS Study Team, Segments include portions of subdivision along proposed passenger route, totaled from RR segment designations. Train counts are a weighted average of number of daily trains times segment distance.

■ 4.14 Southwest Transitway LRT

The Southwest Transitway study projected almost 10 million annual riders in 2030, based upon the final alignment of the corridor and the development scenarios assumed around the station locations.[19] The ridership methodology memoranda were not available for this corridor; however, the corridor appears well suited for the implementation of LRT service. The Southwest Transitway corridor does not appear to impact any of the other Commuter Rail Corridors that have been discussed. As such, the ridership projections seem attainable by 2030.

[19]Southwest Transitway Alternatives Analysis: Technical Memorandum No. 6 – Travel Demand Forecasting Methodology and Ridership Results. Memorandum submitted to Hennepin County Regional Railroad Authority, January 2007.

5.0 Development of Synthesized Passenger Rail Forecasts

5.1 Methodology

The first step in developing a consistent forecasting process is to determine reasonable intercity demand targets. There are significant data limitations for estimating targets for travel in Midwest city pairs. Most travel surveys of individual behavior focus on a single metropolitan planning region, generally comprised of multiple counties, in which long-distance travel is collapsed into the category of external-internal (or even external-external) travel. This lack of specificity on long-distance travel limits how detailed and comprehensive any long-distance analysis can be. There is one current national-level database that includes long-distance records: the National Household Travel Survey (NHTS), which was conducted in 2001 on behalf of the Federal Highway Administration.[20] The 2001 NHTS had few long-distance travel records with one leg of the trip passing through Minnesota. More problematically, of the records associated with Minnesota, there was only a single rail trip which had been captured, which was clearly insufficient to make reasonable assessments of purpose and mode split from Minnesota to nearby states. Thus, the targets for this study had to be built up indirectly.

Since this project focuses on intercity travel, only four modes were considered: auto (with no distinction made between car driver and passenger), air travel, passenger rail and bus. While scheduled intercity bus service (Greyhound and Jefferson lines) dominates the bus mode, it might be possible going forward to include charter bus service provided there was sufficient data.

The data limitations and the limited scope of this study[21] made estimation of a full origin-destination demand matrix among all city pairs problematic, so the analysis was restricted to demand to and from the Twin Cities, which would cover all of the key corridors under study.

[20] In 1995, the long-distance travel component was surveyed separately from the 1995 NHTS. This dataset is known as the American Travel Survey (ATS).

[21] Since the study is a comprehensive look at passenger and freight rail needs, MnDOT did not contract for independent, traditional four-step modeling for passenger rail corridors for this study, which would have included origin and destination surveys between the Twin Cities and other corridor endpoints.

Auto demand to and from the Twin Cities was synthesized through the following steps. Driving directions were taken from Google maps. This source also provided typical travel time and distance information, which was used in determining auto costs. The shortest path route was plotted on a series of traffic maps, and the lowest Annual Average Daily Traffic (AADT) along the route was recorded.[22] This was assumed to set a ceiling on the number of cars that could be traveling between the Twin Cities and the city in question. An adjustment factor reduced this number to vehicles specifically associated with travel to and from the Twin Cities. This factor also accounted for occupancy rates and translated vehicles into passengers. The factor ranged from 0.75 for nearby cities (under 100 miles) to 0.5 for cities in other states and over 250 miles. The specific adjustment factors are reported in Appendix A. This approach was followed for cities in Minnesota, Wisconsin, North Dakota, South Dakota, and Iowa. For states not contiguous with Minnesota, the AADT approach was not judged suitable. The auto demand was instead factored from total demand, which in turn had been based off of air travel demand.

Air travel has the most precise measurement, since the Office of Airline Information of the Bureau of Transportation Statistics requires commercial air carriers to turn in a 10 percent sample of all tickets purchased with at least one stop at a U.S. airport.[23] This data was extracted for all four quarters of 2005.[24]

Estimating intercity rail travel was more challenging, as Amtrak releases information on total boardings and alightings at each stop, but no origin-destination information (or indeed any indication whether the boardings and alightings are in fact balanced). The Study Team asserted a factor that translated each stop into travel associated with the Twin Cities. The factor ranges from a high of 85 percent for very short trips to approximately 10 percent when the distance to the Twin Cities was over 250 miles. Milwaukee and Chicago are unique cases, in that they have extremely high boardings and alightings, but many of these are associated with a higher-frequency, corridor-type Chicago-Milwaukee service which has commuter rail demand characteristics. In addition, Chicago is Amtrak's Midwestern hub. For Milwaukee, only 2 percent of boardings and alightings were associated with the Twin Cities, whereas this study took the opposite approach and asserted that 60 percent of the St. Paul boardings and alightings were Chicago-bound passengers.

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[22] These may be accessed through the following sites:
http://www.dot.state.mn.us/traffic/data/maps/trunkhighway/2006/state_and_metro/stateflo.pdf;
http://www.dot.wisconsin.gov/travel/counts/maps.htm;
http://www.dot.nd.gov/road-map/pdf/traffic/trafficstate_2006.pdf; and
http://www.iowadotmaps.com/msp/traffic/aadtpdf.html.

[23] It is worth noting that the database does not cover international travel, so these flights will typically have the "gateway" airport recorded as the While the demand for certain city-pairs appears high or low, the data has been reported as being origin-destination based at the ticket level.

[24] The Airline Origin and Destination database can be located at the US Department of Transportation TranStats web site. Specifically, the DB1Bticket database is located at: http://www.transtats.bts.gov/DL_SelectFields.asp?Table_ID=272&DB_Short_Name=Origin%20 and%20Destination%20Survey.

Data on intercity bus travel also was difficult to obtain, though we did have information on scheduled service. We adopted the TEMS approach in asserting that buses would be run with load factors of 60 percent, which translated into 30 bus passengers for every scheduled bus to and from St. Paul.[25] The derived daily values were annualized using an adjustment factor of 330, which takes account the fact that weekend service was reduced on many of the observed routes. Fortunately, Greyhound and Jefferson Lines use a combined booking system, so service between each city pair only needed to be checked at one site.[26] It is probable that this approach will somewhat overstate bus demand when multiple stops are on the same bus route (passengers may be double counted). This was clearly the case with Kalamazoo, Michigan, so this volume was decreased by 50 percent. Other cities can be reduced on a case by case basis where appropriate.

On the other hand, the casino demand served by charter buses is not captured in this approach. This would require a data collection effort, presumably a parking lot survey, which is beyond the scope of this study. However, we did increase the bus demand at Hinckley (site of the Grand Casino Hinckley) by 500 percent, given that it is one of the top attractions in the State.[27] This still left the forecast well below the special attractions demand associated with the casino in the TEMS study, though it should be noted that the casino visitors traveling by car already are captured in the AADT measures, and casino visitors riding on scheduled bus service are few (one Greyhound bus a day in each direction). It is unclear how many visitors take chartered bus service, and a special survey would be needed to answer this question. Given the unavailability of the data, we were not comfortable increasing the bus demand to Hinckley beyond a factor of 5 as mentioned above.

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[25] Transportation Economics and Management Systems, Inc. [TEMS] with SRF Consulting Group and Krech Ojard Associates. 2007. Minneapolis-Duluth/Superior: Restoration of Intercity Passenger Rail Service Comprehensive Feasibility Study and Business Plan, page 2-13. Report submitted to St. Louis and Lake Counties Regional Railroad Authority, December 2007.

[26] Service frequency and fares were taken from the Greyhound web site: http://www.greyhound.com/home/. In 2006, Megabus, an express bus company began service between Chicago and Minneapolis, with additional stops on the route in either Milwaukee or Madison: http://www.megabus.com/us/stops/index.php. The impact of this service is not reflected in the 2005 base year demand figures, which were imputs into the forecasting tool. Additional information on these passengers, ideally including a survey, is necessary before significant changes are made to the forecasting tool. Our working assumption is that Megabus service, particularly if expanded, will draw primarily from rail mode share when rail speeds remain at 89 mph, but would draw more extensively from auto share when rail speeds reach 110 mph in the corridor.

[27] The self-reported attendance figures placing Grand Casino Hinckley as the number #3 attraction in the state of Minnesota may be accessed at http://industry.exploreminnesota.com/wp-content/uploads/2007/07/top_attractions_statewide_2005_prelim.pdf. The Study Team was unable to receive annual door count measurements for this Casino or for the Mystic Lakes or Treasure Island casinos for comparison purposes.

These four modal demand inputs were added together to generate total demand between Minneapolis/St. Paul and all other included city origins/destinations as reported in Table 5.1 (for detailed demand calculations see Appendix A, especially Table A.5).

Table 5.1 Estimated Annual Demand from/to Twin Cities for 2005

City	Total Annual Demand – 2005
Bemidji, Minnesota	525,305
Central Wisconsin (Wausau)	2,823,015
Chicago, Illinois	9,731,342
Columbus, Wisconsin	452,235
Des Moines, Iowa	2,913,580
Detroit Lakes, Minnesota	711,529
Detroit, Michigan	1,865,987
Duluth, Minnesota	4,314,250
Eau Claire, Wisconsin	5,753,730
Fargo, North Dakota	3,923,654
Grand Forks, North Dakota	2,669,011
Hinckley, Minnesota	5,770,875
Indianapolis, Indiana	637,612
International Falls Minnesota	514,100
Kansas City, Missouri	1,782,201
La Crosse, Wisconsin	2,987,809
Madison, Wisconsin	4,238,230
Mankato, Minnesota	3,742,800
Marshall, Minnesota	612,925
Milwaukee, Wisconsin	4,382,516
Northfield, Minnesota	1,672,200
Oneida/Rhinelander, Wisconsin	1,669,035
Quad Cities, Iowa	1,088,900
Red Wing, Minnesota	1,021,053
Rochester, Minnesota	4,835,215
Sioux City, Iowa	595,810
Sioux Falls, South Dakota	1,657,380
St. Cloud, Minnesota	11,007,431
St. Louis, Missouri	610,396
Thief River Falls, Minnesota	447,743
Tomah, Wisconsin	1,079,395
Willmar, Minnesota	1,580,175
Winona, Minnesota	856,262

As shown, the highest total travel demand to/from the Twin Cities is with Chicago and St. Cloud with 9 to 11 million trips respectively. These two city pairs are followed by a second cluster of city pairs in the 3-5 million trip range which includes Des Moines, Duluth, Eau Claire, Grand Forks, Hinckley, La Crosse, Madison, Mankato, Milwaukee, and Rochester. These cities encompass most of the intercity rail routes under consideration today.

Assembling the mode targets for the base year (2005) was the first step in generating new forecasts. The second step was to assemble travel costs and other inputs to the model. Most of these inputs to the costs were gathered at the same time as the targets were developed. For instance, fares were recorded along with daily frequencies to and from the Twin Cities for both the rail and bus modes. Driving times between city pairs were available from Google maps, but driving costs were calculated from distance. The Study Team assumed $0.15/mile operating cost for car travel.[28]

Given the relative lack of individual-level data, the Study Team believed the model ought to be based on generalized cost, rather than separate time and cost coefficients. The most comparable study was the Wisconsin statewide model.[29] These values of time that emerged from the model estimation are $31/hour for business travel and $12/hour for personal/leisure travel.[30] These values were used for the forecasting tool. Because the forecasting approach currently does not distinguish between business and personal travel, a single weighted value of time was calculated. The 1995 American Travel Survey (ATS) reported that approximately 50 percent of aviation travel was business-related. Personal travel dominated the non-aviation modes, at approximately a 90-10 split. Thus, in the forecasting tool, the final generalized cost term was weighted at 0.9 personal travel and 0.1 business travel for all modes other than aviation, which had equal weights applied to the business and personal generalized costs.[31] Thus, in the aviation utility calculations, the value of time is essentially $21.50/hour; and for the other modes it is $13.90/hour. All

[28] In this, we followed the general practice of TEMS in the Northern Lights study. Business travel was calculated to cost $0.485/mile (based on IRS findings) and non-business travel was asserted to cost $0.11/mile (TEMS 2007: 2-17). The 1995 American Travel Survey and 2001 National Household Travel Survey suggest that, for all non-aviation modes, 90 percent of long-distance travel (over 100 miles) in the Midwest is for non-business travel. Applying these weights to the car costs, we arrived at $0.1475/mile. Assuming no depreciation costs, $0.15/mile is within a typical range for average car costs. For instance, the 2005 TMIP peer review found that SANDAG had adopted $0.15/mile for auto cost and had accepted this as reasonable. (See http://tmip.fhwa.dot.gov/resources/clearinghouse/docs/tmip/peer_review/sandag/#iii.)

[29] Cambridge Systematics, Inc. and HNTB (Cambridge Systematics 2006).

[30] Cambridge Systematics, Inc. 2006, pages 5-17.

[31] The perceived value of time (and the relative weight between purposes) does not change between the base year and future forecasts. It is reasonable to assume that at a higher level of rail service (110+ mph), more business travel would occur and the perceived values of time would increase. The primary effect of this would be to reduce the impact of higher fares on rail share. The forecasting tool in its current form does not account for increased business travel by train.

in-vehicle times were translated into generalized costs using the appropriate value of time, then this amount was added to the fares or the calculated auto cost.

The key factors in the forecasting tool are generalized cost, university enrollment (for car and rail modes), a Grand Casino Hinckley bus factor term, and select geographic terms, such as long distance (over 300 miles) to estimate total demand between the Twin Cities and other cities in the Midwest. The primary advantage of the forecasting tool is that the same demographic information can be generated for every city (either derived from Census figures or forecasted), allowing all cities to be compared directly against each other. We deliberately tried to keep the mode-specific inputs simple – typically using only distance, in-vehicle travel time, daily frequency, and fare. For cities that do not have existing rail service, the forecasting tool will generate prospective rail demand once proposed rail fares and rail times are entered.

From this base year forecast, demand forecasts then could be developed for 2030. Three growth factors were extracted from available data from a variety of sources, primarily the State of Minnesota population forecasts;[32] the Wisconsin population forecasts;[33] Chicago Metropolitan Agency for Planning (CMAP) and Northeast Indiana Planning Commission (NIPC) for Chicago forecasts;[34] and Southeast Michigan Council of Governments (SEMCOG) for Detroit forecasts.[35] Where detailed forecasts were unavailable or central to the analysis, statewide projections were used to generate growth rates; this was

[32] Minnesota population forecasts by county are available at: http://www.demography.state.mn.us/documents/ProjectionsAgeGender2005-2035.csv

The projected increase or decrease in population at the county level between 2005 and 2030 was applied to any station within that county. In addition to allowing the Study Team to calculate population changes, we took the projected change in the age groups 15-19 and 20-24 as a proxy for changes in university enrollment. For example, St. Louis County (where Duluth is located) was projected to have a very modest population growth of 1.5 percent between 2005 and 2030. Over the same period, the population aged 15-24 was expected to decline by 21.2 percent. In contrast, Olmsted County (home to Rochester) was projected to increase by 34 percent in total population and increase its college-age population by 19 percent. While Minnesota, like Wisconsin, had reasonable employment projections available through 2016 (http://dwd.wisconsin.gov/oea/employment_projections/employment_projections.htm), they did not project employment to 2030. As a proxy, labor force supply in each county was used. The changes in labor force by county may be accessed here: http://www.lmic.state.mn.us/datanetweb/php/DemProjection/prj.html

[33] The Wisconsin population projections by county can be accessed at: http://www.doa.state.wi.us/docview.asp?docid=2014. As with the Minnesota data, age cohorts 15-19 and 20-24 were combined to project changes in university enrollment.

[34] Revised 2030 forecasts for Chicago and its surrounding counties may be found: http://www.chicagoareaplanning.org/data/forecast/2030_revised/ENDORSED_2030_forecasts_9-27-06.pdf.

[35] SEMCOG forecasts through 2035 may be accessed at: http://www.semcog.org/Data/Apps/regional.forecast.cfm.

done for North Dakota and Iowa.[36] The total population growth factor from 2005 to 2030 was available from all sources. Minnesota, Wisconsin, and Detroit all had projections that included age cohorts. By taking the most appropriate age cohort (typically 18-24) we substituted the growth (or decline) in this age cohort as a proxy for change in university enrollment. Minnesota and Chicago had projections of employment for 2030, whereas Wisconsin's detailed projections stopped short in 2016 (but the web site of the Wisconsin Office of Economic Advisors indicated that they expected a statewide workforce growth to 2030 of 12.8 percent, so this was used for all Wisconsin cities).[37] When no better information was available, the population growth factors were substituted for the employment growth factors. (See Appendix C for the individual components to the growth forecast factor.) These growth assumptions can be adjusted going forward to assess the impact of different visions for the future of the region.

■ 5.2 Findings

5.2.1 Estimating 2030 Rail Demand

To put the 2030 rail ridership forecasts into perspective, the Study Team looked at the low-end assumption that service would continue as usual, specifically one daily train in each direction, running at a top speed of 79 miles an hour and fares that averaged $0.20/mile. In the first demand projection shown in Table 5.2, no new corridors are considered. Stations on the current Empire Builder route are considered first, then locations which would require a transfer, typically in Chicago. Note that results in Tables 5.2, 5.3, and 5.4 have been rounded to the nearest 500. For full details of these projections, including the projected automobile, aviation and commercial bus shares, see Appendix D.

As shown in the table, under current operating conditions to existing cities served by rail, demand would be highest to St. Cloud followed by Chicago. The consistently high demand numbers for St. Cloud reflect its status as a hybrid market with aspects of both intercity and commuter demand, which makes it unique among all of the studied city pairs. All other cities would have much lower overall demand, although cities along the river route like Red Wing and Winona would have rail shares in excess of one percent of total demand.

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[36] North Dakota's detailed forecasts only went through 2020, so the growth rate derived from the Census statewide projections was used instead. These projections are available at http://www.city-data.com/forum/general-u-s/468856-census-bureaus-2030-population-projections-50-a.html.

[37] Again, using workforce growth rates as a proxy for employment growth is not ideal but is the data available at this time. The workforce information can be found on page 3 of http://dwd.wisconsin.gov/oea/employment_projections/wisconsin/lt_summary.pdf.

Table 5.2 Projected 2030 Rail Demand to/from Twin Cities under Current Service Conditions

	Modeled Results: 2030		
	Rail Ridership	Projected Demand	Rail Share
Chicago, Illinois	93,500	11,302,000	0.8%
Milwaukee, Wisconsin	4,000	4,663,500	0.1%
Columbus, Wisconsin	500	481,000	0.1%
Tomah, Wisconsin	2,500	1,155,500	0.2%
La Crosse, Wisconsin	13,000	3,236,000	0.4%
Winona, Minnesota	11,500	789,000	1.4%
Red Wing, Minnesota	14,500	1,113,000	1.3%
St. Cloud, Minnesota	307,000	12,952,000	2.4%
Detroit Lakes, Minnesota	7,000	796,000	0.9%
Fargo, South Dakota	21,500	3,963,000	0.5%
Grand Forks, South Dakota	7,000	2,446,500	0.3%

Table 5.3 shows the projected rail ridership in 2030 for potential rail corridors, given existing conditions of one train/day in each direction, top speed of 79 mph and low fares ($0.20/mile). As in Table 5.2, values in this table have been rounded to the nearest 500.

Table 5.3 Projected 2030 Rail Demand to/from Twin Cities with One Daily Frequency

	Modeled Results: 2030		
	Rail Ridership	Projected Demand	Rail Share
Eau Claire, Wisconsin	95,000	6,510,500	1.5%
Madison, Wisconsin	31,000	4,978,000	0.6%
Central Wisconsin (Wausau)	14,000	3,017,000	0.5%
Oneida/Rhinelander, Wisconsin	4,500	1,588,500	0.3%
Bemidji, Minnesota	1,500	622,500	0.2%
Willmar, Minnesota	20,000	1,543,000	1.3%
Duluth, Minnesota	29,500	3,909,000	0.8%
Hinckley, Minnesota	83,000	6,487,500	1.3%
Rochester, Minnesota	79,500	6,084,500	1.3%
International Falls, Minnesota	500	449,500	0.2%
Mankato, Minnesota	84,500	4,041,000	2.1%
Marshall, Minnesota	3,500	551,500	0.6%
Northfield, Minnesota	41,000	2,006,500	2.0%
Thief River Falls, Minnesota	1,000	470,500	0.2%
Des Moines, Iowa	7,000	2,993,500	0.2%
Sioux City, Iowa	500	619,000	0.1%
Sioux Falls, South Dakota	6,500	1,504,000	0.4%

As shown in the table, for cities without current rail service, the highest potential demand using current operating parameters would be to Eau Claire, Hinckley, Rochester, and Mankato, with mode shares in the one to two percent range.

The Study Team then examined the impacts of implementing a much higher standard of service, specifically high-speed rail (HSR) reaching 110 mph and eight trains per day in each direction. While potentially all corridors could eventually reach such levels, it seemed most appropriate to consider the most likely scenario where high-speed rail is implemented along the Chicago-Twin Cities (MWRRI) corridor (and extending to St. Cloud). Two MWRRI routings were tested – via Red Wing and the existing Amtrak River Route at 79 mph, and via Rochester via a new alignment at 110 mph.

With the exception of Rochester and Duluth (discussed below), all other corridors with no service currently were assumed to be served by standard rail service but with expanded frequency (four trains per day in each direction) operating at 79 mph speeds.

For Duluth, we also tested the HSR and expanded service options. The HSR option actually lowered ridership relative to the expanded service options due to the higher fare. This outcome probably reflects the demographic characteristics of Duluth combined with the relatively short travel time to the Twin Cities. According to the forecasting tool, ridership in the Duluth-Hinckley-Twin Cities corridor is quite price sensitive and conventional service at a lower price will attract more riders. However, increasing frequencies alone for Duluth from four to eight trains/day absent the speed/fare increase of HSR service did result in higher ridership, and so this service variant was included in the analysis.

For Rochester, we first considered two scenarios: where it was on the main trunk line on the MWRRI route and thus had high-speed service; and a second scenario where it had expanded service frequency but not high speed on a branch line. One key difference between the assumptions is that fares for the high-speed rail option were higher at $0.32/mile, which is consistent with the TEMS analysis. We also looked at Rochester routings via Northfield and Owatonna – making use of existing rights-of-way. The TEMS study estimated that a routing through Northfield would add 4 to 9 minutes in travel time at 150 mph. Assuming conventional speeds of 79 mph and HSR speeds of 110 mph, we estimated an increase in travel time of 15 to 20 minutes, respectively. We estimated that a routing through Owatanna would add 25 to 40 minutes in travel time respectively for conventional and 110 mph HSR service.

As shown in the Table 5.4, for the HSR option, the highest demand is from St. Cloud (again reflecting the mix of intercity and commuter demand) and Chicago. Red Wing also would have a relatively high-rail mode share (over five percent) and the third highest overall rail demand. It is interesting that the HSR option relative to the expanded service option produces a relatively small gain in ridership for Rochester, perhaps reflecting the relatively short travel distance between Rochester and the Twin Cities whereby the full travel time advantages of higher speed service cannot be realized. Routing Rochester service via Northfield would reduce Rochester ridership by between 10 and 15 percent. However, the increase in ridership at Northfield would be slightly greater. Routing

Rochester service via Owattana would reduce overall ridership by 30 percent due to the long travel time from Rochester.

The MWRRI service routing via Rochester has higher ridership (524,000) in total than the routing via Red Wing (387,000), assuming both serve Madison and Winona. This is simply because Rochester has higher demand than Red Wing, although there is some loss in Chicago and Wisconsin ridership due to the longer (albeit higher speed) routing through Rochester. Even this loss might be made up by trips destined for Rochester and the Mayo Clinic, but this model can't account for trips with intermediate destinations (i.e, other than the Twin Cities). The higher ridership of the Rochester routing needs to be measured against the relative costs, right-of-way acquisition, and general risk and uncertainty associated with the two routings.

Among cities tested with the expanded service option, the highest ridership levels are reached for Eau Claire, Hinckley, Rochester, and Mankato, all with over 200,000 annual riders and rail mode shares in the four to five percent range. Further increasing service frequencies from four to eight trains/day for Hinckley and Duluth does significantly increase ridership on that route, although as mentioned higher speeds do not increase ridership.

Table 5.4 Projected 2030 Rail Demand to/from Twin Cities with Higher Service Standards

	2030 Forecasts: Expanded Service			
	Service Level	Rail Ridership	Projected Demand	Rail Share
Chicago, Illinois	HSR[a]	299,000	11,302,000	2.6%
Milwaukee, Wisconsin	HSR[a]	16,500	4,663,500	0.4%
Columbus, Wisconsin	HSR[a]	2,500	481,000	0.5%
Tomah, Wisconsin	HSR[a]	15,000	1,155,500	1.3%
La Crosse, Wisconsin	HSR[a]	42,500	3,236,000	1.3%
Winona, Minnesota	HSR[a]	26,500	789,000	3.3%
Red Wing, Minnesota	HSR[a]	63,000	1,113,000	5.6%
St. Cloud, Minnesota	HSR[a]	712,500	12,952,000	5.5%
Detroit Lakes, Minnesota	E[b]	11,500	796,000	1.4%
Fargo, North Dakota	E[b]	36,500	3,963,000	0.9%
Grand Forks, North Dakota	E[b]	14,000	2,446,500	0.6%
Eau Claire, Wisconsin	E[b]	257,000	6,510,500	3.9%
Madison, Wisconsin	E[b]	83,000	4,978,000	1.7%
Central Wisconsin (Wausau)	E[b]	37,500	3,017,000	1.2%
Oneida/Rhinelander, Wisconsin	E[b]	12,500	1,588,500	0.8%
Bemidji, Minnesota	E[b]	4,000	622,500	0.6%
Willmar, Minnesota	E[b]	53,500	1,543,000	3.5%
Duluth, Minnesota	E[b]	66,000	3,909,000	1.7%
Hinckley, Minnesota	E[b]	224,500	6,487,500	3.5%
Duluth, Minnesota	E8[c]	101,000	3,909,000	2.6%
Hinckley, Minnesota	E8[c]	283,000	6,487,500	4.4%

Table 5.4 Projected 2030 Rail Demand to/from Twin Cities with Higher Service Standards (continued)

	2030 Forecasts: Expanded Service			
	Service Level	**Rail Ridership**	**Projected Demand**	**Rail Share**
Rochester (Branch)	E[b]	215,500	6,084,500	3.5%
Rochester (Main Line)	HSR[a]	223,500	6,084,500	3.7%
International Falls, Minnesota	E[b]	2,000	449,500	0.4%
Mankato, Minnesota	E[b]	228,000	4,041,000	5.6%
Marshall, Minnesota	E[b]	9,500	551,500	1.7%
Northfield, Minnesota	E[b]	110,500	2,006,500	5.5%
Thief River Falls, Minnesota	E[b]	2,500	470,500	0.5%
Sioux Falls, South Dakota	E[b]	18,000	1,504,000	1.2%

[a] Eight trains/day, 110 mph and fare @ $0.32/mile.

[b] Expanded service (four trains/day, 79 mph and fare @ $0.20/mile).

[c] Expanded service (eight trains/day, 79 mph and fare @ $0.20/mile).

5.2.2 Comparing Results to Other Studies

Comparing these results to previous studies discussed in Sections 3.0 and 4.0 of this Memo is not always straight-forward, given different assumptions and methodologies, not all of which are transparent.

- The TEMS study of the Northern Lights Express service to Duluth examined HSR service (110 mph and 125 mph), while this technical memorandum estimates conventional but expanded rail service to Duluth at least through 2030. At conventional speeds, TEMS expects ridership to be on the order of slightly under one million riders. Our approach generates approximately 300,000 annual riders from the Twin Cities to Duluth and Hinckley. However, our modeling approach does not directly produce Hinckley to Duluth ridership, which might be between 150 and 200,000 per year. Our modeling approach also does not estimate as large a proportion of casino-related trips by rail, as our study lacks a more complete analysis of casino customers' travel patterns. These differences in modeling inputs and methods explain part of why our modeling results do not match those in the TEMS study for the Northern Lights Express.

- Our results in the St. Cloud to Twin Cities market is closer to the previous results, though the demand is less than the total Northstar demand for the entire corridor. Demand for the Northstar commuter rail service is stronger from Big Lake into Minneapolis (this was the reason the initial system was shortened), and the Northstar demand studies were able to use much more detailed regional zone data from the MetCouncil travel demand models.

- A more dramatic difference in our modeling results from other studies is found in the Rochester studies[38] where our results indicate substantially lower ridership than forecast in the other studies. Much of the difference between the two modeling approaches and resulting forecasts are due to the underlying assumptions. The lowest speed tested in the 2003 TEMS study was 150 mph, whereas this is above the top speed of 110 mph analyzed in this technical memorandum. In addition, our treatment of special generators, particularly trips generated by the Mayo Clinic, is more conservative. In the 2000 Tri-State II and 2003 Rochester HSR studies by TEMS, both studies assumed 16 daily frequencies for higher speed rail service (110 mph and various higher speeds), which also will produce higher ridership totals. Our modeling approach, centered on individual city-pair segments from the Twin Cities, does not aggregate total travel demand on the entire MWRRI route from Chicago and Madison through Rochester. The reason for our more conservative operating assumptions was to provide an apples-apples comparison across all of the possible routes and city pairs.

Taking a broader look at the rail forecasts based on current service conditions, the majority of city pairs have a rail mode share of 0.1-0.5 percent. Cities within approximately 150 miles of the Twin Cities have a higher mode share on the order of 1-1.5 percent with St. Cloud being a bit of an outlier at 2.4 percent. This is very much in line with the current rail share observed throughout the Midwest in the 2001 National Household Travel Survey. While these mode shares are split by purpose they range from 0.87 percent for business travel, 0.36 percent for personal business travel, and 0.14 percent for pleasure travel, for an aggregate mode share across all purposes of 0.34 percent.[39] This is an overall mode share, and we would expect that within the Amtrak Empire Builder Corridor, the rail mode shares would be higher. Thus, the forecasting tool reproduces current mode shares well under current conditions.

The 1.5-5.5 percent mode shares generally predicted by the Study Team for enhanced service is slightly lower than the typical HSR mode share modeled in the report High-Speed Ground Transportation for America.[40] The different results are largely due to the much high frequencies assumed in that report – typically 15+ HSR trains a day in each direction while this Study Team took a more conservative approach and modeled 8 trains in each direction.[41] Table 5.5 looks at major city pairs in the 1997 study in which high-speed rail continues to be investigated. The base year (1993) conditions include both rail and bus, and are quite comparable to the Study Team's forecast using current Amtrak conditions: even between major cities rail mode share is one to three percent with the exception of Los Angeles to San Diego.

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[38] This study's modeling results differ from the 2003 Rochester HSR Study and the May 2009 Tri-State III results from TEMS.

[39] Cambridge Systematics, Inc. 2006, pages 5-18

[40] High-Speed Ground Transportation for America. Washington, D.C.: Federal Railroad Administration, 1997.

[41] See the Statistical Supplement of FRA 1997 for full details.

When 110 mph HSR is tested, the mode share increases by a factor of roughly 3 to 4, which is consistent with the Study Team's findings, though again the much higher frequencies contribute to mode shares well above our top value of approximately 5.5 percent. The move from 110 mph to 150 mph on electrified track does not appear to substantially increase mode share with the partial exception of the San Francisco Bay to Los Angeles route and the Texas Triangle route. Presumably the higher fares largely offset the reduced travel time.

The figures in the statistical supplement suggest that MAGLEV would capture 15-20 percent of mode share in the Northeast Corridor and 20-25 percent for SF-Los Angeles-San Diego corridor. This may be the upper limit in terms of mode share that can be expected with advanced train technology, though the specific geography and alignment will certainly impact ridership. The Midwest has a large number of mid-sized and large cities within 500 miles of each other, which will work to increase ridership while at the same time multiple stops along each potential route will work against reaching competitive speeds.

Table 5.5 Rail Mode Shares of Major City Pairs

	Rail/Bus Share in 1993	Rail Share (2030) 110 MPH Rail	Rail Share (2030) 150-Electric Rail	Rail-Bus Passenger Miles 1993 (Millions)	Rail Passenger (2030) Millions Miles 110 MPH Rail	Rail Passenger (2030) Millions Miles 150E
Bay Area-Los Angeles-San Diego	2	5.8	7.4	391	1,716	2,581
Los Angeles-San Diego	9	9.6	9.8	177	283	289
Chicago Hub	2	7.9	8.3	209	1,313	1,380
Chicago Detroit	3	7.6	7.5	127	501	498
Chicago-St. Louis	4	10.5	11.9	89	362	417
Florida	1	3.5	3.8	78	456	507
Portland-Seattle-Vancouver	1	6.3	6.6	42	482	501
Texas Triangle	2	8.5	10.3	146	982	1,208

Source: Calculated from Statistical Supplement in High-Speed Ground Transportation for America, FRA 1997.

5.2.3 Passenger Rail Corridor Demand Summary

Implementing conventional rail services to most cities within 150 miles of the Twin Cities would generate rail mode shares between 1.5-2.0 percent. The following cities appear to generate rail demand to and from the Twin Cities on the order of 50,000-100,000 annual passengers:

- Eau Claire, Wisconsin;
- Hinckley, Minnesota;
- Rochester, Minnesota; and
- Mankato, Minnesota.

The analysis of expanded and improved service offers other important insights. Increasing train frequency to four or eight trains a day results in a significant increase in rail mode share, even at conventional speeds. Implementing high-speed rail at 110 mph also increases mode share, though the expected ridership increases are somewhat offset by the assumption of higher fares. Most city pairs in the analysis of improved service have a rail mode share of 1.5-5.5 percent.

Under the expanded service plan, the following cities are expected to have annual rail ridership of 100-250,000 to and from the Twin Cities:

- Duluth, Minnesota;
- Hinckley, Minnesota;[42]
- Northfield, Minnesota;
- Rochester, Minnesota; and
- Mankato, Minnesota.

The following cities are expected to have annual rail ridership of 250,000+ to and from the Twin Cities:

- Chicago, Illinois;
- Eau Claire, Wisconsin; and
- St. Cloud, Minnesota.

[42] At eight trains a day, Hinckley will move into the next higher category.

6.0 Conclusions

Corridors that appear to be initially promising (subject to future analysis, performance metrics, integration of passenger/freight growth potential in future tasks) include:

- River route service to La Crosse, connecting to Madison and Chicago. This has relatively good track conditions, modest freight density, and good demand levels. Challenges will be increasing train speed along the river route with its curves.

- Cooperative planning with Wisconsin for the optimal route between Madison and the Twin Cities could address the strong demand in Eau Claire and Rochester and connect to the strong demand for Chicago-Twin Cities rail service. Rochester service is complicated by extensive new rights-of-way being recommended by project proponents.

- Incremental improvements to Hinckley could offer strong demand and take advantage of relatively good track and modest freight density. Extending to Duluth involves expensive infrastructure improvements and modest demand.

- Incremental improvements to bring intercity service to shorter distance city pairs (not commuter rail service) such as Mankato, Northfield, Eau Claire, and St. Cloud seem to be warranted by demand estimates and possible rail market shares. Each of these city pairs involves infrastructure challenges from heavy freight density to necessary track improvements. Extending some of these corridors to cities in other states may need to wait for corridor funding commitments from other states.

- Interstate high-speed rail service and additional intrastate passenger rail services will place strains on rail infrastructure in the Twin Cities. Ramsey County has purchased the St. Paul depot for use as an intermodal center for transit and rail services. Northstar service will be using a capacity constrained station at the Target Field ballpark in downtown Minneapolis. Additional analysis in this study and by others will be necessary for high-capacity, high-performance rail infrastructure to connect Minneapolis and St. Paul and for additional capacity at stations in both cities that offer the potential for increased train frequencies and connections to other transit services.

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Appendix A

Assumed Demand

Table A.1 Assumed Car Demand

	Max AADT To/From Twin Cities	Proportion of AADT Allocated to Twin Cities Org/Dest.	Daily Car Demand	Annual Car Demand
Bemidji	1,900	0.65	1,235	450,775
Central Wisconsin/Wausau	11,300	0.65	7,345	2,680,925
Columbus, Wisconsin	1,900	0.65	1,235	450,775
Des Moines International	14,700	0.5	7,350	2,682,750
Detroit Lakes	2,950	0.65	1,918	699,888
Duluth	14,800	0.75	11,100	4,051,500
Eau Claire	23,600	0.65	15,340	5,599,100
Fargo	13,000	0.75	9,750	3,558,750
Grand Forks	10,500	0.65	6,825	2,491,125
Hinckley	20,900	0.75	15,675	5,721,375
International Falls Minnesota	2,000	0.65	1,300	474,500
La Crosse	10,200	0.75	7,650	2,792,250
Madison	21,300	0.5	10,650	3,887,250
Mankato	13,600	0.75	10,200	3,723,000
Marshall, Minnesota	2,500	0.65	1,625	593,125
Northfield, Minnesota	6,000	0.75	4,500	1,642,500
Oneida/Rhinelander, Wisconsin	5,900	0.75	4,425	1,615,125
Red Wing, Minnesota	3,700	0.75	2,775	1,012,875
Rochester	17,100	0.75	12,825	4,681,125
St. Cloud	53,000	0.75	39,750	1,4508,750
Thief Falls, Minnesota	1,850	0.65	1,203	438,913
Willmar, Minnesota	5,700	0.75	4,275	1,560,375

Table A.2 Assumed Air Travel Demand

	Daily Paired Flights To/From Twin Cities	Annual Paired Flights
International Falls, Minnesota	132	39,600
Bemidji	182	54,730
Thief Falls, Minnesota	29	8,830
Milwaukee, General Mitchell International	1,289	386,700
Oneida County, Wisconsin	180	53,910
Dane County Regional, Madison	906	271,780
Central Wisconsin	408	122,290
Des Moines International	571	171,430
Kalamazoo/Battle Creek International	132	39,600
Detroit Metropolitan Wayne County	2,762	828,730
Gerald R. Ford International, Grand Rapids	749	224,840
Lambert-St. Louis International	802	240,450
Indianapolis International	859	257,570
Chicago	4,158	1,247,260
Quad Cities, Iowa	301	90,400
Duluth	744	223,150
Eau Claire	152	45,730
Fargo	996	298,920
Grand Forks	506	151,840
Kansas City	751	225,170
La Crosse	479	143,760
Rochester	448	134,290
Rockford, Illinois	0	30
St. Cloud	156	46,760
Sioux City, Iowa	245	73,360
Sioux Falls, South Dakota	802	240,680

Source: Airline Origin and Destination database, Bureau of Transportation Statistics.

Table A.3 Assumed Amtrak Demand
2005

		Amtrak Annual Boardings/ Alightings: 205	Share Associated with Twin Cities	Amtrak Demand: 2005
Milwaukee	Wisconsin	474,808	2	9,496
Columbus	Wisconsin	14,597	10	1,460
Portage	Wisconsin	6,318	15	948
Wisconsin Dells	Wisconsin	11,289	20	2,258
Tomah	Wisconsin	8,232	30	2,470
La Crosse	Wisconsin	24,397	50	12,199
Winona	Minnesota	20,282	75	15,212
Red Wing	Minnesota	9,621	85	8,178
St. Paul-Minneapolis[a]	Minnesota	132,528	60	79,517
St. Cloud	Minnesota	11,539	85	9,808
Staples	Minnesota	5,287	75	3,965
Detroit Lakes	Minnesota	3,482	50	1,741
Fargo	North Dakota	18,812	35	6,584
Grand Forks	North Dakota	17,847	35	6,246
Devils Lake	North Dakota	6,039	25	1,510

Source: Amtrak FY05 Fact Sheets for Minnesota, Wisconsin, and North Dakota

[a] Sixty percent of the Twin Cities boardings/Alightings is assumed to go to Chicago.

Table A.4 Assumed Bus Demand

St. Paul	Buses/Day (St. Paul Both Directions)	Daily Ridership[a]	Annual Ridership[b]
Bemidji, Minnesota	2	60	19,800
Wausau, Wisconsin	2	60	19,800
Chicago, Illinois	11	330	108,900
Davenport, Iowa	5	150	49,500
Des Moines, Iowa	6	180	59,400
Detroit, Michigan	7	210	69,300
Detroit Lake, Minnesota	1	30	9,900
Duluth, Minnesota	4	120	39,600
Eau Claire Wisconsin	11	330	108,900
Fargo, North Dakota	6	180	59,400
Grand Forks, North Dakota	2	60	19,800
Grand Rapids, Michigan	7	210	69,300
Hinckley, Minnesota	2	60	19,800
Indianapolis, Indiana	8	240	79,200
International Falls, Minnesota	-	-	-
Kansas City, Missouri	6	180	59,400
La Crosse, Wisconsin	4	120	39,600
Madison, Wisconsin	8	240	79,200
Mankato, Minnesota	2	60	19,800
Marshall, Minnesota	2	60	19,800
Milwaukee, Wisconsin	10	300	99,000
Northfield, Minnesota	3	90	29,700
Rhinelander, Wisconsin	-	-	-
Red Wing, Minnesota	-	-	-
Rochester, Minnesota	2	60	19,800
Rockford, Illinois	3	90	29,700
Sioux City, Iowa	3	90	29,700
Sioux Falls, South Dakota	3	90	29,700
St. Cloud, Minnesota	7	210	69,300
St. Louis, Missouri	9	270	89,100
Thief River Falls, Minnesota	-	-	-
Tomah, Wisconsin	12	360	118,800
Willmar, Minnesota	2	60	19,800
Winona, Minnesota	2	60	19,800

Source: Greyhound reservations web site: http://www.greyhound.com/home/.

[a] Average capacity of 50 passengers with load factor of 60 percent.

[b] Conversion factor of 330 reflects lower service on weekends.

Table A.5 All Demand Components
2005

	Annual Demand (Targets)				
	Car	Air	Rail	Bus	Total
Bemidji, Minnesota	450,775	54,730	0	19,800	525,305
Central Wisconsin/Wausau	2,680,925	122,290	0	19,800	2,823,015
Chicago, Illinois	8,295,665	1,247,260	79,517	108,900	9,731,342
Columbus, Wisconsin	450,775	0	1,460	0	452,235
Des Moines, Iowa	2,682,750	171,430	0	59,400	2,913,580
Detroit Lakes, Minnesota	699,888	0	1,741	9,900	711,529
Detroit, Michigan	967,957	828,730	0	69,300	1,865,987
Duluth, Minnesota	4,051,500	223,150	0	39,600	4,314,250
Eau Claire, Wisconsin	5,599,100	45,730	0	108,900	5,753,730
Fargo, North Dakota	3,558,750	298,920	6,584	59,400	3,923,654
Grand Forks, North Dakota	2,491,125	151,840	6,246	19,800	2,669,011
Hinckley, Minnesota	5,721,375	0	0	49,500	5,770,875
Indianapolis, Indiana	300,842	247,570	0	79,200	637,612
International Falls, Minnesota	474,500	39,600	0	0	514,100
Kansas City, Missouri	1,497,631	225,170	0	59,400	1,782,201
La Crosse, Wisconsin	2,792,250	143,760	12,199	39,600	2,987,809
Madison, Wisconsin	3,887,250	271,780	0	79,200	4,238,230
Mankato, Minnesota	3,723,000	0	0	19,800	3,742,800
Marshall, Minnesota	593,125	0	0	19,800	612,925
Milwaukee, Wisconsin	3,887,250	386,770	9,496	99,000	4,382,516
Northfield, Minnesota	1,642,500	0	0	29,700	1,672,200
Oneida/Rhinelander, Wisconsin	1,615,125	53,910	0	0	1,669,035
Quad Cities, Iowa	949,000	90,400	0	48,500	1,088,900
Red Wing, Minnesota	1,012,875	0	8,178	0	1,021,053
Rochester, Minnesota	4,681,125	134,290	0	19,800	4,835,215
Sioux City, Iowa	492,750	73,360	0	29,700	595,810
Sioux Falls, South Dakota	1,387,000	240,680	0	29,700	1,657,380
St. Cloud, Minnesota	10,881,563	46,760	9,808	69,300	11,007,431
St. Louis, Missouri	280,846	240,450	0	89,100	610,396
Thief River Falls, Minnesota	438,913	8,830	0	0	447,743
Tomah, Wisconsin	958,125	0	2,470	118,800	1,079,395
Willmar, Minnesota	1,560,375	0	0	19,800	1,580,175
Winona, Minnesota	821,250	0	15,212	19,800	856,262

Source: Tables A.1 through A.4.

Appendix B

Cost Inputs into Travel Forecast Tool

Table B.1 Car Costs

	Car Costs To/From Twin Cities					
				Generalized Cost		
	Distance (Miles)	Operating Cost[a]	Time (Minutes)	Business	Non-Work	Weighted Average
Bemidji	260	39.00	275	181.08	94.00	102.71
Duluth	151	22.65	137	93.43	50.05	54.39
Eau Claire	84	12.60	91	59.62	30.80	33.68
Fargo	245	36.75	222	151.45	81.15	88.18
Grand Forks	324	48.60	287	196.88	106.00	115.09
Hinckley	77	11.55	70	47.72	25.55	27.77
International Falls Minnesota	289	43.35	303	199.90	103.95	113.55
La Crosse	150	22.50	162	106.20	54.90	60.03
Mankato	87	13.05	109	69.37	34.85	38.30
Marshall, Minnesota	163	24.45	201	128.30	64.65	71.02
Northfield, Minnesota	44	6.60	52	33.47	17.00	18.65
Red Wing, Minnesota	45	6.75	56	35.68	17.95	19.72
Rochester	78	11.70	93	59.75	30.30	33.25
St. Cloud	76	11.40	78	51.70	27.00	29.47
Thief Falls, Minnesota	264	39.60	325	207.52	104.60	114.89
Willmar, Minnesota	103	15.45	123	79.00	40.05	43.95
Oneida/Rhinelander, Wisconsin	233	34.95	240	158.95	82.95	90.55
Central Wisconsin/Wausau	177	26.55	180	119.55	62.55	68.25
Chicago	400	60.00	395	264.08	139.00	151.51
Columbus, Wisconsin	275	41.25	270	180.75	95.25	103.80
Madison	262	39.30	262	174.67	91.70	100.00
Des Moines, Iowa	245	36.75	220	150.42	80.75	87.72
Detroit Lakes	231	34.65	220	148.32	78.65	85.62
Kansas City	438	65.70	390	267.20	143.70	156.05
Milwaukee	328	49.20	320	214.53	113.20	123.33
Quad Cities, Iowa	360	54.00	345	232.25	123.00	133.93
Rockford, Illinois	328	49.20	325	217.12	114.20	124.49
Sioux City, Iowa	306	45.90	305	203.48	106.90	116.56
Sioux Falls, South Dakota	271	40.65	240	164.65	88.65	96.25
Tomah, Wisconsin	163	24.45	161	107.63	56.65	61.75
Winona	120	18.00	141	90.85	46.20	50.67

[a] Assumes $0.15/mile.

Table B.2 Air Passenger Costs

	Direct flight time	Typical time 1+ stop flight	Cost -w/ 2 weeks advance	Cost of (connecting alternative)	Generalized cost - Business			Generalized cost - Non-work		
					Nonstop	1+stop	cost - bus	Nonstop	1+stop	cost - nonwork
Bemidji	76		418		457.27	0.00	457.27	433.20		433.20
Central Wisconsin	60		158		189.00	0.00	189.00	170.00		170.00
Chicago	73		115		152.72	0.00	152.72	129.60		129.60
Dane County Regional	64		138		171.07	0.00	171.07	150.80		150.80
Des Moines International	66		450		484.10	0.00	484.10	463.20		463.20
Detroit Metropolitan	100	210	1091	96	1,142.67	204.50	204.50	1,111.00	138.00	138.00
Duluth	47	360	418	295	442.28	481.00	442.28	427.40	367.00	367.00
Eau Claire	46		350		373.77	0.00	373.77	359.20	0.00	359.20
Fargo	57		450		479.45	0.00	479.45	461.40	0.00	461.40
Grand Forks	66		514		548.10	0.00	548.10	527.20	0.00	527.20
Indianapolis International	100	200	434	252	485.67	355.33	355.33	454.00	292.00	292.00
International Falls MN	87		457		501.95	0.00	501.95	474.40	0.00	474.40
Kalamazoo/Battle Creek		190	375			473.17	473.17		413.00	413.00
Kansas City		240	280			404.00	404.00		328.00	328.00
La Crosse	50	195	430	373	455.83	473.75	455.83	440.00	412.00	412.00
St. Louis International	90	185	316	218	362.50	313.58	313.58	334.00	255.00	255.00
General Mitchell (Milwaukee)	70		88		124.17	0.00	124.17	102.00	0.00	102.00
Oneida County, WI	66		450		484.10	0.00	484.10	463.20	0.00	463.20
Quad Cities, IA	70		291		327.17	0.00	327.17	305.00	0.00	305.00
Rochester	40	180	350	297	370.67	390.00	370.67	358.00	333.00	333.00
Rockford, IL					0.00	0.00	9,999.00	0.00	0.00	9,999.00
Sioux City, IA	59		1438		1,468.48	0.00	1,468.48	1,449.80	0.00	1,449.80
Sioux Falls , SD	57		450		479.45	0.00	479.45	461.40	0.00	461.40
St. Cloud	40		350		370.67	0.00	370.67	358.00	0.00	358.00
Thief Falls, MN		130	457			524.17	524.17		483.00	483.00

Source: Expedia website

Table B.3 Amtrak Costs

	Trains/day	Scheduled time (hrs)	Fare to Twin Cities	Fare from Twin Cities	Avg. fare	Generalized cost		
						Business	Leisure	Weighted avg.
Chicago	1	8.25	74	96	85	340.75	184.00	199.68
Milwaukee, WI	1	6.5	68	89	78.5	280.00	156.50	168.85
Columbus, WI	1	5.5	55	72	63.5	234.00	129.50	139.95
Portage	1	5	54	70	62	217.00	122.00	131.50
Tomah, WI	1	4	41	54	47.5	171.50	95.50	103.10
LaCrosse	1	3.25	31	41	36	136.75	75.00	81.18
Red Wing, MN	1	1.5	10	18	14	60.50	32.00	34.85
St. Cloud	1	1.5	11	11	11	57.50	29.00	31.85
Detroit Lakes	1	3.25	31	31	31	131.75	70.00	76.18
Fargo	1	4.25	38	38	38	169.75	89.00	97.08
Grand Forks	1	5.75	46	46	46	224.25	115.00	125.93
Winona	1	2.5	20	20	20	97.50	50.00	54.75

Source: Amtrak reservations website

Table B.4 Bus (Greyhound) Costs

	Fare		Avg.	Generalized cost		
St Paul	Inbound	Outbound	scheduled time (mins)	Business	Non-Work	Weighted avg.
Bemidji, MN	35	35	405	244.25	116.00	128.83
Wausau, WI	26	26	252.3	156.36	76.46	84.45
Chicago, IL	27	27	547.5	309.88	136.50	153.84
Des Moines, IA	35	37	368.4	226.34	109.68	121.35
Detroit Lake	29	*29*	360	200.50	86.50	97.90
Duluth, MN	19	18	172.5	107.63	53.00	58.46
Eau Claire, WI	15	15	75	53.75	30.00	32.38
Fargo, ND	24	34	438.15	255.38	116.63	130.50
Grand Forks, ND	42	42	570	336.50	156.00	174.05
Hinckley, MN	16	16	120	78.00	40.00	43.80
Kansas City, MO	55	57	639.75	386.54	183.95	204.21
La Crosse, WI	24	22	248.25	151.26	72.65	80.51
Madison, WI	31	31	325.65	199.25	96.13	106.44
Mankato, MN	17	17	150	94.50	47.00	51.75
Marshall, MN	32	29	318	194.80	94.10	104.17
Milwaukee, WI	34	34	440.25	261.46	122.05	135.99
Northfield, MN	8.5	8.5	108	64.30	30.10	33.52
Davenport, IA	42	42	756.75	432.99	193.35	217.31
Rochester, MN	16	16	96	65.60	35.20	38.24
Rockford, IL	44	44	614.25	361.36	166.85	186.30
Sioux City, IA	42	42	597	350.45	161.40	180.31
Sioux Falls, SD	37	37	380.25	233.46	113.05	125.09
St. Cloud, MN	9	13	150.15	88.58	41.03	45.78
St. Louis, MO	60	60	1025.25	589.71	265.05	297.52
Tomah	26	*26*	214.98	124.07	56.00	62.80
Willmar, MN	20	20	214.5	130.83	62.90	69.69
Winona	18	*18*	147	84.95	38.40	43.06

Source: Greyhound reservation website.
Note: fares are two-week advance fares. Missing return fares (in italics) are assumed to be the same as outbound fares.

Appendix C

Demographic Forecasting Assumptions, 2005 to 2030

Table C.1 Assumed Changes in Demographic Data

City	Population	University enrollment	Employment	Change in travel demand (equal weights)
Bemidji	30.2%	4.1%	21.1%	18.5%
Central WI/Wausau	15.3%	-7.5%	12.8%	6.9%
Chicago	14.8%	14.8%	18.8%	16.1%
Columbus, WI	16.1%	-9.9%	12.8%	6.3%
Des Moines, IA	2.7%	2.7%	2.7%	2.7%
Detroit Lakes	23.8%	-1.4%	13.3%	11.9%
Duluth	1.5%	-21.2%	-8.5%	-9.4%
Eau Claire	20.0%	6.6%	12.8%	13.2%
Fargo	8.1%	-7.4%	2.3%	1.0%
Grand Forks	-8.3%	-8.3%	-8.3%	-8.3%
Hinckley	26.6%	-11.1%	21.8%	12.4%
International Falls MN	-6.3%	-15.0%	-16.4%	-12.6%
Kansas City	8.8%	8.8%	8.8%	8.8%
La Crosse	13.9%	-1.8%	12.8%	8.3%
Madison	27.2%	12.3%	12.8%	17.5%
Mankato	16.1%	-1.5%	9.3%	8.0%
Marshall, MN	-1.9%	-18.3%	-9.9%	-10.1%
Milwaukee	7.8%	0.7%	10.8%	6.4%
Northfield, MN	33.5%	1.5%	24.9%	20.0%
Oneida/Rhinelander, WI	5.8%	-33.0%	12.8%	-4.8%
Quad Cities, IA	1.7%	1.7%	1.7%	1.7%
Red Wing, MN	19.8%	-1.4%	8.7%	9.0%
Rochester, MN	34.0%	19.1%	24.5%	25.8%
Sioux City, IA	3.9%	3.9%	3.9%	3.9%
Sioux Falls, SD	-9.2%	-9.2%	-9.2%	-9.2%
St. Cloud, MN	30.9%	0.2%	21.9%	17.7%
Thief River Falls, MN	10.7%	2.3%	2.3%	5.1%
Tomah, WI	17.6%	-9.3%	12.8%	7.0%
Willmar, MN	5.9%	-8.2%	-4.6%	-2.3%
Winona, MN	2.5%	-20.8%	-5.3%	-7.8%

Source:US Census; Minnesota State Demographic Center; Wisconsin Office of Economic Advisors; NIPC; SEMCOG

The most reasonable results came from averaging these three growth factors (population, employment, and university enrollment) and then applying this value directly to the estimated total base year demand.

Appendix D

Forecast Demand by Mode

Tables D.1 through D.3 present a more detailed look at forecasted demand across all main modes (auto, air, rail, and commercial bus) in 2030 under the main scenarios, namely if current conditions are maintained (Table D.1), if new corridors open with service comparable to existing Amtrak service (Table D.2) and if service is expanded in terms of either frequency or running speeds (Table D.3). To avoid large discrepancies in the total demand column the values have been rounded to the nearest 100 rather than to the nearest 500 in Tables 5.2 through 5.4, although this should not to be taken as an indication that the precision is any higher in these tables.[1]

Table D.1 Projected 2030 Travel
Current Conditions with No New Rail Corridors

	Automobile	Air	Rail	Bus	Total
Chicago	9,602,600	1,350,400	93,500	255,700	11,302,100
Milwaukee	4,037,600	521,200	3,900	100,700	4,663,400
Columbus, Wisconsin	480,200	0	600	0	480,800
Tomah, Wisconsin	1,135,300	0	2,700	17,500	1,155,500
La Crosse	3,050,900	128,500	13,200	43,500	3,236,100
Winona	768,100	0	11,300	9,700	789,100
Red Wing, Minnesota	1,098,600	0	14,600	0	1,113,200
St. Cloud, Minnesota	12,224,800	310,600	307,100	109,600	12,952,100
Detroit Lakes	772,300	0	6,900	16,800	796,000
Fargo	3,625,000	239,200	21,700	77,000	3,962,900
Grand Forks	2,152,300	219,800	7,100	67,400	2,446,600
Eau Claire, Wisconsin	6,274,900	173,600	0	62,000	6,510,400
Madison, Wisconsin	4,518,900	383,500	0	75,500	4,977,900
Central Wisconsin (Wausau)	2,834,300	135,200	0	47,500	3,017,000
Oneida/Rhinelander, Wisconsin	1,483,300	105,300	0	0	1,588,600
Bemidji, Minnesota	559,600	47,300	0	15,300	622,300
Willmar, Minnesota	1,525,600	0	0	17,600	1,543,200
Duluth, Minnesota	3,716,100	143,200	0	49,700	3,908,900
Hinckley, Minnesota	6,218,600	0	0	269,000	6,487,600
Rochester, Minnesota	5,860,800	165,100	0	58,800	6,084,600
International Falls, Minnesota	407,800	41,700	0	0	449,500
Mankato, Minnesota	3,999,600	0	0	41,300	4,040,800
Marshall, Minnesota	541,900	0	0	9,300	551,300
Northfield, Minnesota	1,990,600	0	0	15,700	2,006,300
Thief River Falls, Minnesota	425,800	44,600	0	0	470,400
Sioux Falls, South Dakota	1,365,100	105,000	0	34,000	1,504,100
Des Moines, Iowa	2,750,900	183,000	0	59,400	2,993,300
Sioux City, Iowa	535,200	66,300	0	17,500	619,000

[1] One issue that emerges due to the mechanistic nature of the forecasting tool when adjusting for higher train frequencies is that the resulting bus shares often look too low. Conversely, because data on passenger income was not available when doing model estimation, the value of time for aviation passengers is considerably higher than for potential rail passengers, making it difficult to move people from the aviation mode to rail, compared to the results reported in FRA 1997.

Table D.2 Projected 2030 Travel in New Rail Corridors

	Automobile	Air	Rail	Bus	Total
Eau Claire, Wisconsin	6,183,200	171,000	95,100	61,000	6,510,400
Madison, Wisconsin	4,491,000	381,100	30,800	75,000	4,977,900
Central Wisconsin (Wausau)	2,821,300	134,600	13,900	47,200	3,017,000
Oneida/Rhinelander, Wisconsin	1,479,000	105,000	4,600	0	1,588,600
Bemidji, Minnesota	558,400	47,200	1,400	15,300	622,300
Willmar, Minnesota	1,506,000	0	19,800	17,400	1,543,200
Duluth, Minnesota	3,687,900	142,100	29,600	49,300	3,908,900
Hinckley, Minnesota	6,138,800	0	83,200	265,600	6,487,600
Rochester, Minnesota	5,784,000	162,900	79,700	58,000	6,084,600
International Falls, Minnesota	407,100	41,600	700	0	449,500
Mankato, Minnesota	3,915,900	0	84,500	40,400	4,040,800
Marshall, Minnesota	538,500	0	3,500	9,300	551,300
Northfield, Minnesota	1,950,000	0	40,900	15,400	2,006,300
Thief River Falls, Minnesota	425,000	44,500	900	0	470,400
Sioux Falls, South Dakota	1,359,000	104,600	6,700	33,800	1,504,100
Des Moines, Iowa	2,744,600	182,500	6,900	59,200	2,993,300
Sioux City, Iowa	534,600	66,300	700	17,500	619,000

Table D.3 Projected 2030 Travel
Expanded Rail Service

	Service Level	Automobile	Air	Rail	Bus	Total
Chicago	HSR	9,565,100	1,329,900	298,900	108,100	11,302,100
Milwaukee	HSR	4,034,500	519,900	16,500	92,500	4,663,400
Columbus, Wisconsin	HSR	478,500	0	2,300	0	480,800
Tomah, Wisconsin	HSR	1,131,000	0	14,800	9,600	1,155,500
La Crosse	HSR	3,045,600	125,500	42,500	22,500	3,236,100
Winona	HSR	762,800	0	26,300	0	789,100
St. Cloud	HSR	11,976,900	262,700	712,500	0	12,952,100
Red Wing, Minnesota	HSR	1,050,400	0	62,800	0	1,113,200
Detroit Lakes	HSR	773,100	0	11,500	11,500	796,000
Fargo	E	3,626,700	239,700	36,600	59,900	3,962,900
Grand Forks	E	2,151,600	220,000	14,200	60,700	2,446,600
Eau Claire	E	6,082,500	171,000	256,900	0	6,510,400
Madison	E	4,477,900	381,100	83,100	35,800	4,977,900
Central Wisconsin (Wausau)	E	2,815,400	134,600	37,400	29,600	3,017,000
Oneida/Rhinelander, Wisconsin	E	1,471,300	105,000	12,300	0	1,588,600
Bemidji	E	557,800	47,200	3,800	13,500	622,300
Willmar, Minnesota	E	1,489,700	0	53,600	0	1,543,200
Duluth	E	3,675,300	142,100	80,000	11,500	3,908,900
Hinckley	E	6,103,400	0	224,700	159,400	6,487,600
Duluth	E8[a]	3,673,200	135,000	100,800	0	3,908,900
Hinckley	E8[a]	6,088,900	0	283,000	115,800	6,487,600
Rochester (Branch)	E	5,706,400	162,900	215,300	0	6,084,600
Rochester (Main Line)	HSR	5,713,500	147,500	223,600	0	6,084,600
International Falls, Minnesota	E	405,900	41,600	2,000	0	449,500
Mankato, Minnesota	E	3,812,700	0	228,100	0	4,040,800
Marshall, Minnesota	E	537,000	0	9,500	4,800	551,300
Northfield, Minnesota	E	1,895,900	0	110,400	0	2,006,300
Thief River Falls, Minnesota	E	423,300	44,500	2,600	0	470,400
Sioux Falls, South Dakota	E	1,356,200	104,600	18,000	25,300	1,504,100

[a] Expanded service (8 trains/day, 79 mph and fare @ $0.20/mile).