SECTION 3

MWRRI PROJECT NOTEBOOK FINAL
2004

Midwest Regional Rail Initiative Project Notebook

PREPARED FOR

Illinois Department of Transportation
Indiana Department of Transportation
Iowa Department of Transportation
Michigan Department of Transportation
Minnesota Department of Transportation
Missouri Department of Transportation
Nebraska Department of Roads
Ohio Rail Development Commission
Wisconsin Department of Transportation
Amtrak

MWRRI

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IN ASSOCIATION WITH
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Midwest Regional Rail Initiative Project Notebook

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1. Study Context

1.1 Vision: Midwest Regional Rail System

Since 1996, the Midwest Regional Rail Initiative (MWRRI) has advanced from a series of individual corridor service concepts into a well-defined, integrated vision to create a 21st century regional passenger rail system. This vision reflects a paradigm shift in the manner in which passenger rail service will be provided throughout the Midwest, and forges an enhanced partnership between USDOT, FRA and the Midwestern states for planning and providing passenger rail service. This system would use existing rights-of-way shared with existing freight and commuter services and would connect nine Midwestern states and their growing populations and business centers. System synergies and economies of scale, including higher equipment utilization, more efficient crew and employee utilization, and a cooperative federal and state infrastructure and rolling stock procurement, can be realized by developing an integrated regional rail system.

This vision has been transformed into a transportation plan – known as the Midwest Regional Rail System (MWRRS). The primary purpose of the MWRRS is to help meet future regional travel needs through significant improvements to the level and quality of regional passenger rail service and its integration with its own feeder bus system. The rail and bus service and the MWRRI stations also provide a stimulus for joint station development, downtown redevelopment, economic development and for a growth in travel and tourism. The Business Plan has been reviewed by the FRA, the states and Wall Street and it has been confirmed that it is indeed feasible and practical to implement and operate this 21st century regional passenger rail system.

Collectively, the key elements of the MWRRS plan will improve Midwestern travel well beyond currently available train service. These elements include:

- Upgrading existing rail rights-of-way to permit frequent, reliable, high-speed passenger train operations
- Operation of a hub-and-spoke passenger rail system providing through-service and connectivity in Chicago to locations throughout the Midwest region
- Introduction of modern train equipment with improved amenities operating at speeds up to 110-mph
- Provision of multimodal connections and feeder bus systems to improve system access
- Introduction of a contracted rail operation that will provide improvements in efficiency, reliability and on-time performance

The MWRRS encompasses a rail network of more than 3,000 route miles and serves nine states with a combined population of 60 million people. The frequent service proposed for the MWRRS (Exhibit 1-1) serves intermediate sized cities on each corridor, such as Jefferson City, Springfield, Des Moines, Indianapolis, Madison and Toledo, as well as their respective larger endpoint cities such as Kansas City, St. Louis, Omaha, Cincinnati, Twin Cities and Cleveland. Mainline service to destinations such as Detroit and Twin Cities is supplemented by branch line services to Lansing, Grand Rapids and Green Bay. The analysis demonstrated that the proposed service, with modern stations and a high level of on-board amenities, could attract significant numbers of riders and achieve a respectable modal market share for trips up to 300 miles. Since air service is increasingly focused on trips over 300 miles, the MWRRS tends to complement rather than compete with air service in the Midwest.

Exhibit 1-1
Proposed Midwest Regional Rail System[1]

The MWRRS will increase mobility choices and stimulate economic development throughout the region. The system affords the opportunity to:

- Develop attractive public/private partnerships that will enhance both rail and bus travel in the Midwest
- Achieve significant reductions in travel times and improve service reliability
- Introduce passenger rail service to Midwestern areas currently not served by passenger rail
- Introduce an alternative to auto travel to many small towns and cities of the Midwest that lack travel choices

[1] Indiana DOT is currently evaluating additional rail links to South Bend, IN and Louisville, KY.

- Introduce a regional passenger rail system designed to generate revenues that cover operating costs when it is fully implemented
- Provide major capital investments in rail infrastructure to improve passenger and freight train efficiency, safety and reliability on shared rights-of-way
- Provide impetus for station-area development

1.2 Previous Planning Studies and Findings

Since the early 1980s, a wide range of studies has been completed evaluating the potential for introducing or expanding passenger rail service in the Midwest. Individual studies have focused on the introduction of different technologies on specific corridors. Key studies include the Michigan *Back on Track Program for High-speed Transportation: The Detroit-Chicago Corridor* in 1983, Federal Reserve Bank of Chicago *High-speed Rail in the Midwest: An Economic Analysis* in 1984, Michigan *Detroit-Chicago Rail Passenger Developmental Blueprint Study* in 1991, Illinois-Wisconsin-Minnesota *Tri-State High-speed Rail Study* in 1991, Illinois *Chicago-St. Louis High-speed Rail Corridor Study* in 1996, Wisconsin-Illinois *Chicago-Milwaukee Rail Corridor Study* in 1997, and Federal Railroad Administration *High-speed Ground Transportation for America* in 1997.

The findings of these studies supported the feasibility of new passenger rail service on selected Midwest corridors. Specific findings included the following:

- A significant market for passenger rail service exists in the Midwest for travel between major cities
- The passenger rail market is comprised of business and leisure travel, with each market sensitive to different quality of service factors when making mode of travel choices
- The corridors on which intermediate and high-speed passenger rail services have been assessed appear to be able to generate sufficient revenues to cover operating costs
- The cost of developing an integrated passenger rail system appears affordable, given federal and state funding capabilities

MWRRS plan is based upon previous studies – *Milwaukee-Green Bay Rail Passenger Study*, for Wisconsin Department of Transportation, TEMS, Inc., November 2001; *Northern Indiana/Northwest Ohio Passenger Rail Routing Study*, for Indiana Department of Transportation, Ohio Rail Development Commission and Amtrak, by TEMS, Inc., November 2002; *Iowa Rail Route Alternatives Study*, for Iowa Department of Transportation, TEMS, Inc., June 1998. These studies recommended:

- The West Bend alignment to Green Bay
- The Ft. Wayne alignment to Toledo/Cleveland
- Des Moines routing to Omaha

1.3 The Planning Process for the MWRRI

The Midwest Regional Rail Initiative (MWRRI) began in 1996 under the auspices of the Mississippi Valley Conference – a regional division of the American Association of State Highway and Transportation Officials (AASHTO). Sponsors of the MWRRI include the States of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, Ohio and Wisconsin, Amtrak, and the Federal Railroad Administration.

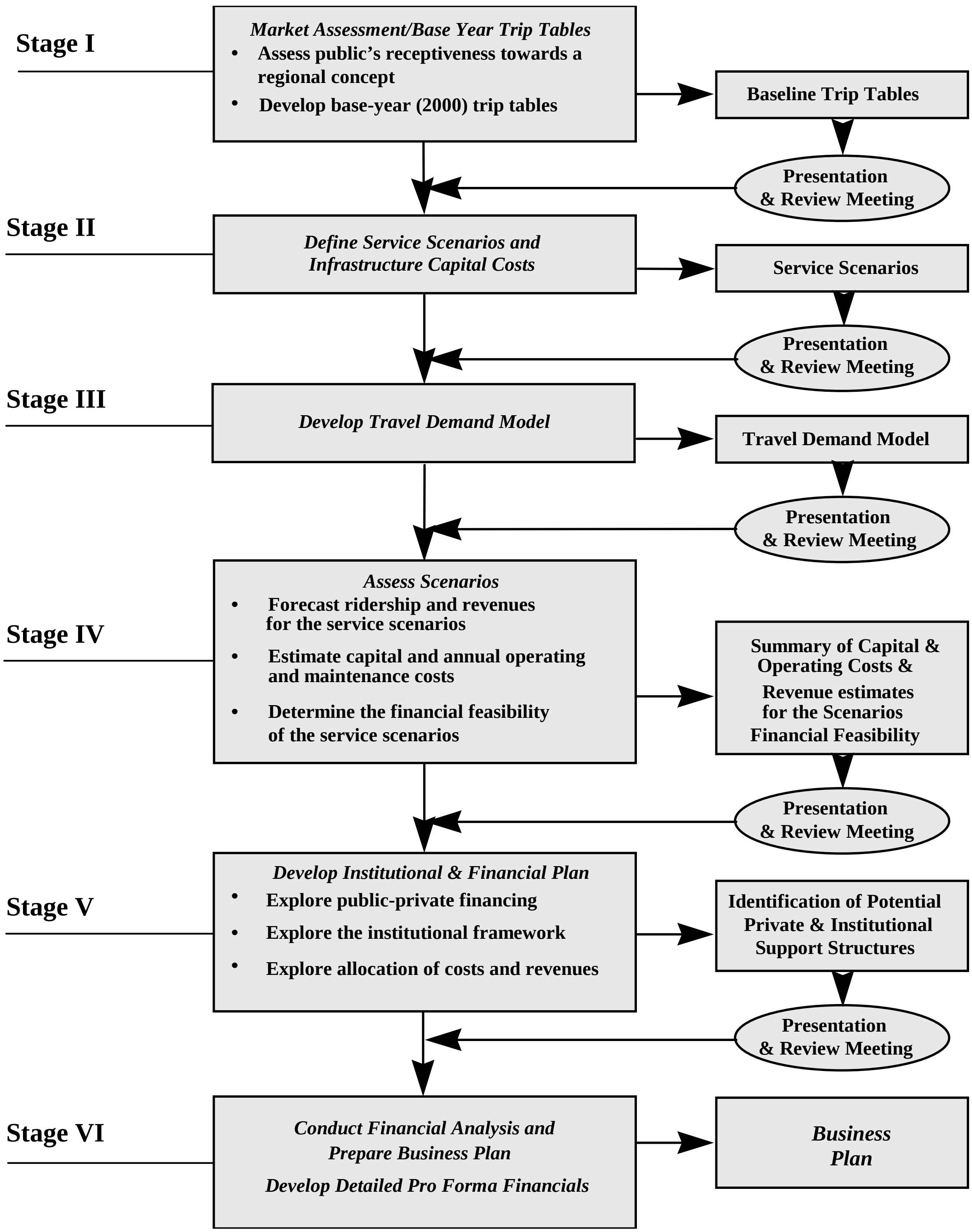
A steering committee comprised of representatives from Amtrak and the nine states was developed to provide organizational structure. The steering committee supplied oversight and direction to the consultant team, which started research into the viability of an enhanced Midwest rail system. Based on favorable results from these early 1990's corridor-specific studies, a vision emerged for developing an integrated Chicago Hub regional rail system. An integrated system would allow MWRRI to benefit from reduced costs from economies of scale and better equipment utilization, as well as increase its interconnecting passenger revenues.

- In 1998, the MWRRI consortium in cooperation with the consultant team released a draft "1998 Plan" report outlining estimated costs and detailing the potential benefits of the rail network. This analysis evaluated alternative speed options: 79-mph, 100-mph and 125-mph. The planning process involved twelve tasks grouped into six stages[2] which are shown in Exhibit 1-2. Intensive market research and stated preference surveys resulted in development of an initial demand forecast for the feasibility study. This study determined that a 110-mph system was the best fit to the Midwest region's needs, and that this "intermediate speed" option would provide an affordable and operationally and economically viable system.
- In 1999, the "2000 Plan" efforts were begun. This phase focused on 110-mph operations, resulting in considerable refinement to the operating and cost assumptions. An institutional workshop was held to develop alternatives for system financing and governance. A detailed financial plan, ramp-up plan, branch line analysis and an express parcel market assessment were also developed. An equipment vendors' workshop was held to refine vehicle life cycle costs with Talgo, Bombardier and Adtranz participating. The 2000 Plan report presented, at a feasibility level, a complete assessment of MWRRI market potential, delineated expected system operating and capital costs, outlined a strategy for funding capital needs, suggested a financing plan, and provided a cost-benefit analysis. The 2000 Plan report was delivered to the MWRRI participants in 2002.
- From 2002-2004, the current "2004 Plan" recognizes that the MWRRI will share infrastructure with freight railroads, therefore, this portion of the planning process was undertaken largely to address freight railroads' concerns. During this phase, substantial line capacity simulation work was performed[3], route-specific track maintenance costs were developed, the infrastructure capital plan was further refined, and a detailed feeder bus and express parcel operations plans were developed.

A detailed synopsis of key findings of each MWRRI planning phase is given in Chapter 2. The ideal and typical day analyses produced as part of the 2000 Plan represent the most current work available, but because of funding constraints have not been updated to reflect the latest 2004 Plan assumptions. Some assumptions may have changed since those sections were originally completed, but any such older material is clearly marked with a notation that it represents work previously performed for, and approved by, the MWRRI Steering Committee.

[2] Each time the Business Plan was updated, all six stages shown in Exhibit 1-2 would be revisited as necessary to recheck assumptions and recalculate total revenues and costs.
[3] Documented in Chapter 6, the Ideal Day and Typical Day Analyses.

Exhibit 1-2
MWRRI Planning Process



At the conclusion of each planning phase the financing plan, operating ratios and benefit/cost analysis were updated to reflect the most current assumptions. In a few situations, previous financial results were retained in the report so the reader can see how some of the planning assumptions have evolved over time. However, whenever this occurs, previous results are identified with respect to which planning report (i.e., 1998, 2000) they apply. The most up-to-date results are associated only with current planning in the 2004 Plan.

1.4 Organization of the Report

As the planning for the MWRRS continues, there is a continual need to update and revise the MWRRS documentation. To meet this need, a Project Notebook was created to support the 2000 Plan that provides the critical information associated with the concept and feasibility studies conducted to date and establishes a format for documenting project work. The Project Notebook includes the following sections, which have been updated as part of the zone plan. This layout is used to report the 2004 Plan findings of the study:

Chapter 1: Study Context

Chapter 2: Strategic Assessment

Chapter 3: Proposed Midwest Regional Rail System

Chapter 4: Market Analysis

Chapter 5: Infrastructure, Rolling Stock and Capital Investment

Chapter 6: Freight Rail Activities

Chapter 7: Operating Plan and Costs

Chapter 8: Implementation Plan

Chapter 9: Funding Alternatives

Chapter 10: Financial Analysis

Chapter 11: Economic Analysis (not updated)

Chapter 12: Institutional and Organizational Issues

Chapter 13: Conclusions and Findings

2. Strategic Assessment

2.1 Focus of the 2004 Plan Strategic Assessment and Business Plan

Planning for the MWRRS has progressed from the *concept* stage to the *feasibility* stage in the 2004 Plan. This report includes the findings resulting from additional technical study and plan refinement of major plan elements associated with further development of the 2004 Plan. These include:

- Update of ridership estimates to year 2000 socioeconomic base
- Update of revenue, capital and operating costs to year 2002 base
- Update of the operating plan
- Refinements to implementation plan phasing
- Update of the financial plan
- Update of project coordination and institutional arrangements

Starting with the 1998 Plan, the MWRRS Business Plan has been progressively refined. This Chapter presents some of the key findings of earlier stages of the MWRRS Business Plan development, and how that plan has evolved and been successively improved over the past six years.

2.2 Initial Study Approach for the 1998 Plan

As part of the 1998 Plan of the Midwest Regional Rail Initiative (MWRRI), TEMS conducted a strategic assessment of the region to determine the most beneficial and affordable service and equipment scenarios. The study focused on each scenario, and projected ridership and revenue based on travel characteristics, survey findings and demographics. In addition, TEMS evaluated the engineering, operations, financial and economic impacts of the alternative routes. The assessment of each scenario required the coordination of several key components including:

- Creation of a database comprised of base year trip tables, track conditions of the existing rail infrastructure, and current train operations data
- Conducting a stated preference survey of intercity travelers
- Utilizing the *RightTrack*© software tools to assess infrastructure, train operations, and travel demand, financial and economic returns
- Formation of three service and equipment scenarios for the MWRRS, each based on specific service and equipment attributes
- Implementation of screening criteria to be used in evaluating the performance of each scenario.

The core of the strategic assessment was an interactive analysis in which the service and equipment attributes for each scenario and the interaction between infrastructure, demand and operations were appraised simultaneously. Once the interactive analysis output was optimized for each scenario, the results were then compared using a set of screening criteria to determine the best scenario for the MWRRS.

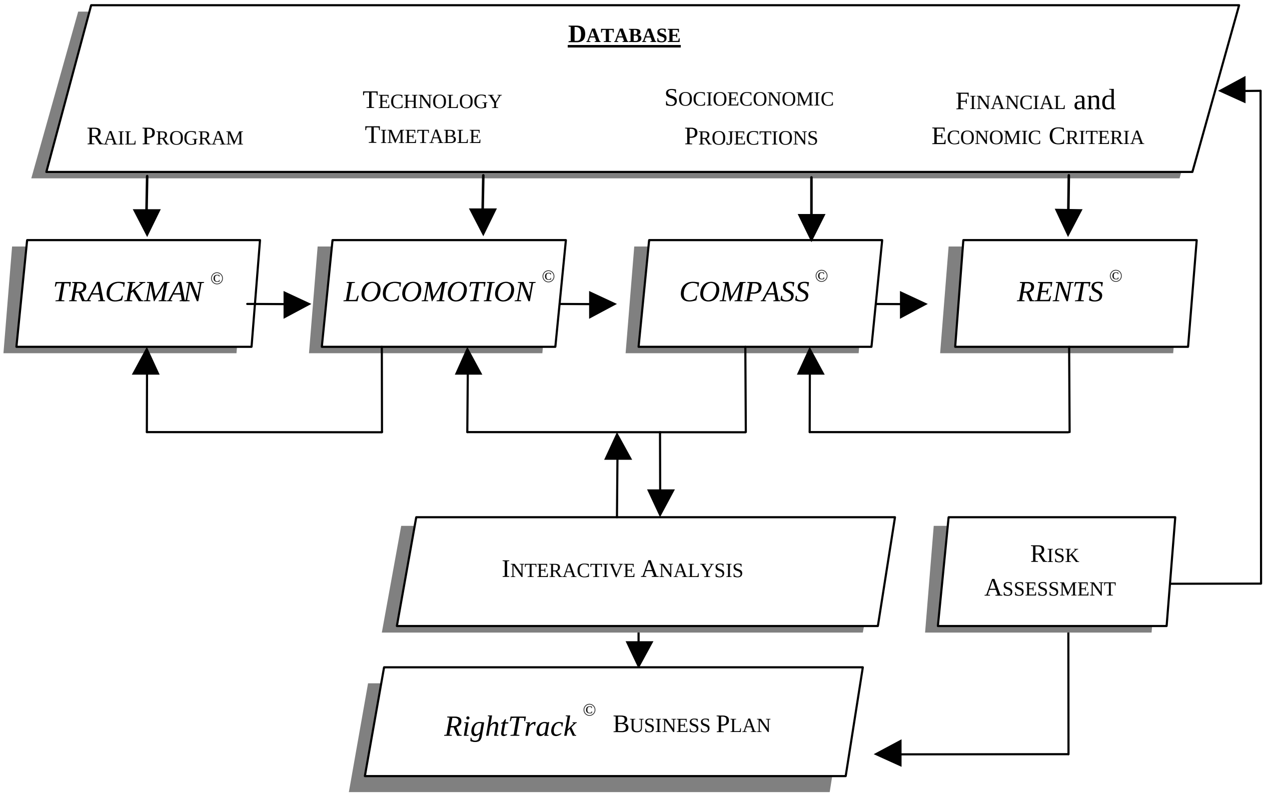
2.3 *Analysis Process*

The effective determination of appropriate infrastructure and timetables for different service and equipment scenarios depends on obtaining the optimal balance between costs and revenues. The analytical process applied in the five plans of the MWRRI is an interactive analysis in which the relationship between infrastructure costs, train technology, train operations, ridership demand and revenues, and operating costs were assessed simultaneously in transportation, financial, and economic terms, (Exhibit 2-1). In the interactive analysis, it was essential to evaluate the following for each scenario:

- Required infrastructure
- Performance of the proposed technology, particularly train speed
- Ridership, reliability, fares and frequency
- Key analyses were performed using several of TEMS' proprietary *RightTrack*© software components including:
  - *TRACKMAN*© Track Inventory and Estimating System to assess right-of-way conditions and determine appropriate track and infrastructure improvements and to calculate related costs
  - *LOCOMOTION*© Train Performance Calculator to assess travel times, establish operating plans and identify operating costs for each technology
  - *COMPASS*© Multimodal Demand Model to assess ridership and revenues generated by any given technology and level of service
  - *RENTS*© Financial and Economic Analysis Model to estimate the financial and economic benefits of a project

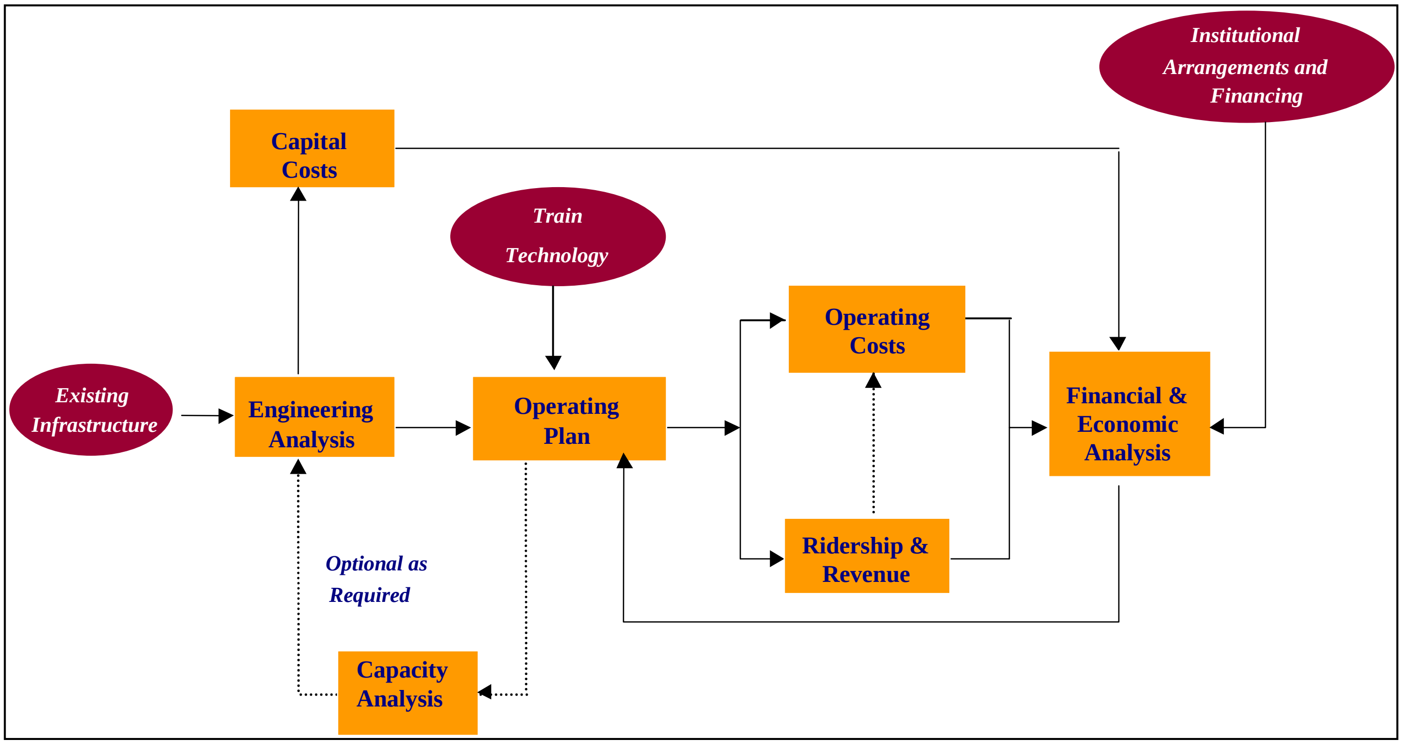
A more detailed description of each component of *RightTrack*© is given in Appendix A7.

Exhibit 2-1
The *RightTrack*© System



The interactive analysis utilized in the *RightTrack*© System is a multi-step procedure that incorporates the information on infrastructure, technology and financial strategies (Exhibit 2-2).

Exhibit 2-2
The TEMS Interactive Analysis



2.4 1998 Plan of the MWRRI - Definition of the Scenarios

Service and equipment scenarios were used as the basis for assessing an array of corridor and system-wide services. The objective was to identify scenarios that incorporated a combination of train technologies, service characteristics, amenities and financial factors to create a regional passenger rail system capable of generating high levels of ridership and recovering, at a minimum, its operating costs from fares and other revenues generated by the MWRRS.

The scenario definition task of the study was a collaborative process between the state DOT representatives, Amtrak representatives and the consultant team. A two-day workshop was convened to reach consensus on the scenarios and their definition. At the conclusion of the workshop three scenarios – Conservative, Moderate and Aggressive – were agreed upon. These scenarios formed the basis of a strategic assessment in choosing the preferred service option for the MWRRS.

In each scenario, the operating characteristics of the passenger rail service are changed to provide a different combination of capital costs, operating costs, train technology and travel times, level of infrastructure investment, frequency of service, and on-board and station amenities. Each scenario was based on a series of *drivers* that define the key attributes of the scenario. As the scenarios progressed from Conservative to Aggressive, so do the dynamics of the scenarios in terms of the type of train technology used, the level of service provided, and the capital and operating costs. The drivers used in the strategic assessment for the Conservative, Moderate and Aggressive Scenarios and the associated range of values for each is given in Exhibit 2-3.

Exhibit 2-3
Scenario Framework

Drivers	***Equipment & Service Scenarios***		
	Conservative	***Moderate***	***Aggressive***
Increase in Train Frequencies	2, 3 or 4 round trips daily	4 or 6 round trips daily	4, 6 or 8 round trips daily
Travel Time Improvement	5% to 15%	15% to 30%	20% to 50%
Fare Policy	Current to 25% increase	Current to 50% increase	Current to 50% increase
System Access/Egress Improvements	Marginal	Marginal to significant	Significant
Station-stopping Patterns	Existing	Express and/or local	Express and/or local
Network Connectivity	Limited	Integrated	Optimized
Station Amenities	Limited	Limited or significant	Significant
On-board Amenities	Limited	Significant	Significant
Track Investment	Minimal	Moderate	Significant
Rolling Stock Investment	Limited	New rolling stock	High-speed trains
Public/Private Partnerships	5% to 15%	15% to 25%	25% to 50%

2.4.1 Increase in Train Frequencies

Existing passenger rail service in the Midwest region is extremely limited with no service or only one or two trains per day on most corridors. Only on the Chicago-St. Louis, Chicago-Detroit and Chicago-Milwaukee corridors, where there are three, three and seven trains per day respectively, does any sense of a regional passenger rail service exist. Train frequencies need to be significantly increased if the MWRRS is to provide any real degree of regional connectivity.

2.4.2 Travel Time Improvement

Currently, travel times in the Midwest region are largely a product of the speed of freight train operations, which is typically well below 79-mph. The only exception is a short segment between Chicago and Detroit where the allowable speed has been increased to 90-mph. Although a segment of track on the Chicago to St. Louis corridor has been upgraded for 110-mph, the allowable speed remains 79-mph pending the installation, testing and acceptance by the FRA of a Positive Train Control safety system. For the MWRRS to provide a competitive passenger service, operating speeds need to be significantly increased and maintained for a significant proportion of any given trip. New, attractive equipment is also needed in order to obtain the full revenue benefit envisioned in the MWRRS demand forecasts.

2.4.3 Fare Policy

Historically, passenger rail fares in the Midwest, as on much of Amtrak's service elsewhere in the country, have been set at levels that are higher than intercity bus fares, but lower than airfares. If a faster, more frequent service is provided, the MWRRS can attain a larger proportion of business users, average fares can be higher and the MWRRS can thereby recapture some of the benefit given to users of the system. This can help improve the overall financial viability of passenger rail service.

2.4.4 System Access/Egress Improvements

One of the problems associated with any public travel mode is access and egress at stations and terminals. Recognition of this by the air industry has resulted in their providing a wide range of access/egress facilities and services. These facilities include parking garages, rental car outlets, taxi stands as well as multimodal and transit connections, all making the experience of getting to and from the airport easier for the traveler. To divert travelers, particularly business travelers, from other modes of travel, the MWRRS needs to provide similar facilities and services at its stations.

2.4.5 Station Stopping Patterns

Because stopping at a station adds significantly to travel time, station-stopping patterns need to be carefully considered in order to take advantage of the faster train speeds provided by modern technology. Stopping patterns need to be developed that permit the fastest train times possible between major regional centers but, at the same time, provide reasonable service to smaller urban centers. This can be achieved by including express and skip/stop trains in the MWRRS schedules.

2.4.6 Network Connectivity

One of the greatest deficiencies of existing passenger rail service in the Midwest, even when taking into account Amtrak's long-distance trains, is the lack of connectivity between regional centers and smaller urban areas in different parts of the region. To be a competitive option to other modes of travel for regional trips, *e.g.*, Madison to Detroit or Springfield, the MWRRS needs to offer connection times of less than one hour at the Chicago hub.

2.4.7 Station Amenities

Airlines have shown that terminals must be comfortable and secure facilities. Terminals must also offer a selection of personal services including voice and data phone lines, restaurants, small shops for newspapers and gifts and, at larger terminals, specialty retail shopping. To compete effectively, the MWRRS needs to offer similar facilities.

2.4.8 On-board Amenities

Travel by regional passenger rail, just as by air, needs to offer its customers on-board amenities, including audio/video entertainment facilities, 110 volt power and modem connections, as well as a food and beverage service. The railcars used for the MWRRS need to provide a level of comfort and safety that allows passengers to work and relax comfortably while on the train.

2.4.9 Track Investment

Investment in track and signaling systems is the most critical component in permitting higher train speeds. FRA rules require progressively tighter safety standards as maximum authorized speeds increase. This can result in a requirement for significant capital investment for a relatively small improvement in speed. A new signaling technology, Positive Train Control, is presently being tested in the Chicago-St. Louis corridor. An Incremental Train Control System is in revenue service under a demonstration project, on a portion of Amtrak's Chicago-Detroit corridor within the state of Michigan. The business plan assumes that FRA will approve PTC technology for normal commercial use in time for application to the MWRRS system. The most cost-effective investment in infrastructure relative to both train speeds and revenue earnings needs to be identified to ensure a realistic financial base for the MWRRS.

2.4.10 Rolling Stock Investment

In the last twenty years, rolling stock has undergone a technological revolution that has increased performance and reliability yet lowered both maintenance and operating costs. An increased focus on customer satisfaction has also led to significant improvements in the amenities on trains. The introduction of new, modern equipment for the MWRRS is in itself likely to raise ridership and increase revenues, as was seen upon the introduction of modern equipment on the Portland-Seattle corridor.

2.4.11 Public/Private Partnerships

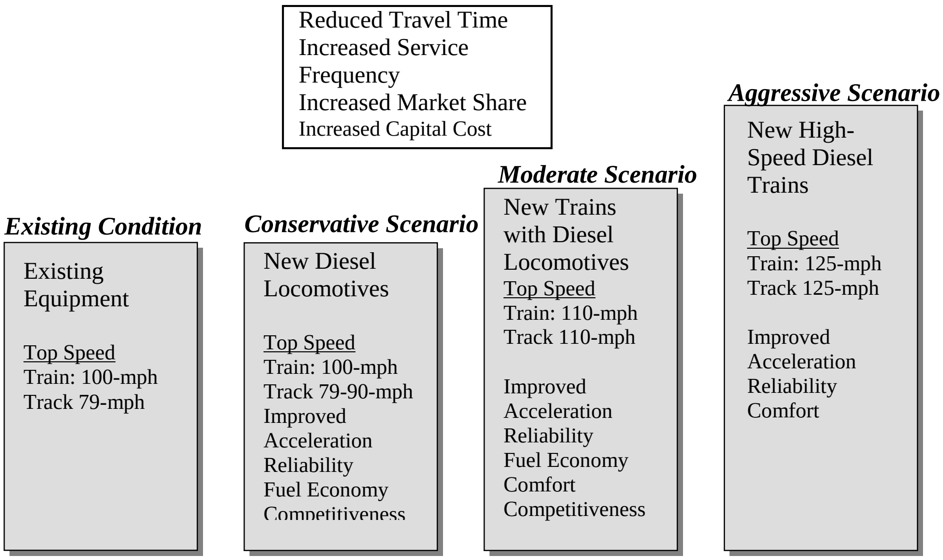
The development of an increasingly commercial attitude to providing intercity transportation systems (air, rail, and bus) is encouraging a greater degree of private sector participation in intercity transportation projects. Private sector participation projects for the MWRRS could include joint development ventures, such as that at Washington Union Station; the provision of on-board and station concessions; express parcel service; train operations and maintenance of vehicles and rights-of-way. The MWRRS needs to maximize the role of the private sector to increase its funding sources, lower its costs and thereby ensure its success. To this end, it is proposed that the MWRRS should be a contracted operation, open to the private sector as well as to Amtrak.

2.5 Scenario Analysis

While the *drivers* identified for the scenarios collectively interact to influence the level of ridership and the costs of building and operating the system, two factors – travel time and frequency of service – will have the greatest impact on the success of the MWRRS. These factors are products of the train technology selected and its operating speed. Train technology plays a significant role in developing market share, as well as improving operating performance. A train that looks new and modern is a highly visible symbol of an improved passenger rail system. Travelers typically associate such a symbol with faster travel times, more comfortable seating, improved ride quality and the provision of modern conveniences.

For the MWRRS, several different train technologies were evaluated in terms of their operating speeds, operating and maintenance costs, and capital costs. The train technologies selected as graphic examples for the three scenarios and the improvements they will generate are given in Exhibit 2-4.

Exhibit 2-4
Impact of Train Technology



2.6 The 1998 Plan of the MWRRI – Analysis of Scenarios

An interactive analysis was conducted in 1998 to measure the benefits of higher train speeds. Outputs generated were compared using a series of five screening criteria. The screening criteria reflect service and system-related factors that were identified as critical to the success of the MWRRS. Each of these factors was expressed as a ratio so that the value of each could be interpreted as a product of a specific level of investment. For example, *travel time saved* was expressed as the amount of travel time that was saved per $1 million of capital investment. This technique enabled each scenario to be compared based on specific service improvements and within the context of the level of investment required for the overall system.

The outputs from the interactive analysis and the values generated by the screening criteria were an iterative process. Values generated by the screening criteria were used as a barometer to readjust the variables used in the interactive analysis to ensure the performance of each driver and gauge the maximum overall benefit of that driver to each scenario. Once accomplished, a final comparison was made based upon the optimum results for each scenario. The screening criteria are described below.

2.6.1 Operating Cost Ratio[1] - (Expressed as Ratio of Revenues to Operating Costs)

The MWRRI has a goal for the development of a Chicago-hubbed system and related system efficiencies, whereby revenues are maximized and operating costs are minimized. This goal is designed to minimize or eliminate the requirement for state operating subsidies.

[1] The operating ratio, as defined here is revenues/costs. Note that this is the opposite of the definition typically used by freight railroads or intercity bus operators.

2.6.2 Travel Time Saved - (Expressed as Travel Time Saved per Dollar Invested or Seconds per Million Dollars)

The *travel time saved* criterion is used to assess the value of the infrastructure investment relative to the timetable improvements achieved and is used in conjunction with the *revenue generated* criteria described below to rank infrastructure improvements. The more travel time saved per dollar of capital investment for any scenario, the better the return. This criterion helps to ensure the affordability of the MWRRS.

2.6.3 Revenue Generated - (Expressed as Revenue Generated per Dollar Invested or Cents per Million Dollars)

The *revenue generated* screening criterion is similar to the *travel time saved* criterion in that it is used to prioritize infrastructure investments. It measures the response of the market to a given level of capital investment. A significant change in this criterion is an indication that a threshold in market share has been crossed or a new market has opened up to passenger rail competition. The more revenue generated per dollar of capital investment, the better the financial return is likely for the scenario. Of particular concern is that the additional infrastructure enhancement in the Aggressive Scenario generates only a minor improvement in travel time saved per dollar invested. The Moderate Scenario offers a better rate of return.

2.6.4 Connectivity through Chicago and Regional Mobility - (Expressed as Percent of Total Trips Connecting through Chicago)

A key feature of the MWRRS is the development of system connectivity through the Chicago hub. This is an important measure of the regional integration achieved and, through increased ridership, the level of payback associated with developing the Midwest hub-and-spoke network. The higher the percentage achieved for any scenario, the higher the improvement in connectivity and regional mobility.

2.6.5 Operating Cost Savings - (Expressed as Percent Reduction in Operating Costs per Train Mile)

The effects of infrastructure investment, economies of scale and improved technology are to drive down operating costs. This criterion measures the level of reduction in operating costs per train mile associated with the combination of all of the screening factors for a given scenario. The higher the percentage achieved, the better the financial return.

2.7 Results of 1998 Plan – Strategic Assessment

For the screening analysis that was performed in 1998, financial results were estimated based on Year 2010 demographics. The Moderate Scenario was selected as the most cost-effective service, infrastructure and equipment option for the MWRRS. The results of the scenario screening process are given in Exhibit 2-5 and summarized below.

Exhibit 2-5
Scenario Screening Analysis – 1998 Plan

Screening Criteria	*Scenarios*		
	Conservative	*Moderate*	*Aggressive*
Operating Ratio	0.85	1.36	0.93
Travel Time Saved per Dollar Invested (Seconds per Million Dollars)	60 seconds	9.6 seconds	1.2 seconds
Revenue Generated per Dollar Invested (Cents per Million Dollars)	31 cents	104 cents	82 cents
Percent of Total Trips Connecting through Chicago	13.5%	18.4%	17.0%
Percent Reduction over Current Amtrak Operating Costs per Train Mile	30%	36%	29%

2.7.1 Conservative Scenario

The Conservative Scenario provided a considerable improvement over the existing passenger rail service and, in fact, achieved the highest level of travel time saved per dollar invested. Because this scenario did not achieve a positive operating ratio, an annual subsidy from the states would be required to support the operation. This suggests that speeds over 79-mph are required to produce positive operating ratios. Nonetheless, because of the timetable improvements, extensive operating cost savings, and relatively modest infrastructure costs, implementation of the Conservative Scenario could serve as the initial implementation phase in the long-term development of the MWRRS.

2.7.2 Moderate Scenario

The Moderate Scenario in the 1998 Plan generated a positive operating cost ratio of 1.36, where a ratio of 1.0 was the objective. It achieved the highest level of connectivity through Chicago and the highest revenue per dollar invested – three times that of the Conservative Scenario and 25 percent greater than the Aggressive Scenario. At the same time, it generates the lowest operating costs per train mile, which represents a significant savings over the current condition and both the Conservative and Aggressive Scenarios.

2.7.3 Aggressive Scenario

Given the high cost of complete grade crossing separation for 125-mph or above speeds, this speed results in a major cost increase without enough time savings to justify the added capital expense. The analysis suggests diminishing returns associated with the level of investment required to implement the 125-mph Aggressive Scenario. Alternatives may be to drop back to a 110-mph operation that avoids the need for complete grade crossing separation, or to push towards even higher speeds of 150-mph or better. The population levels are not yet sufficient on branch lines or less-dense corridors to support the higher speed and the higher levels of frequency that are required to justify the high capital investment. However, the Chicago-St. Louis, Chicago-Detroit and Chicago-Milwaukee corridors all appear to have at least the potential to support higher-speed service.

2.8 The MWRRI 2000 Plan – Further Development of the Moderate Scenario

The most critical step in the 2000 Plan study was to further test the Moderate Scenario recommended in the 1998 study, and to develop it further by testing its feasibility. The definition of the Moderate Scenario is:

> The Moderate Scenario is based upon the use of existing train technology capable of achieving a top speed of 110-mph. The Moderate Scenario was selected because it provides the most cost-effective infrastructure and equipment option and provides the service necessary to establish and maintain a successful regional passenger rail system. The Moderate Scenario generates a strong operating ratio and provides the best value in terms of revenue generated per dollar invested.

The project areas assessed in the 2000 Plan included:

- Review of track, signaling and facilities to ensure the feasibility of the proposed plan
- Expanded definition of the operating plan to ensure maximum operating efficiency, service utility and cost efficiency
- Update and expansion of the current ridership and revenue forecasts of the nine corridors
- Analysis of multimodal connectivity and joint station development concepts
- Update to the Implementation Plan
- Additional definition of Institutional Arrangements
- Revised financial and economic results as a result of infrastructure, ridership, operations and implementation funding

A variety of additional factors were considered to guide the analyses and to assess issues that arose during the course of the overall evaluation, including:

2.8.1 Infrastructure Costs

The main goal of the infrastructure planning process was to optimize travel time saved per dollar invested. However, overriding issues sometimes arose such as the practicality of high-speed operations in urban areas, and along highly congested freight track segments. In these sections, the lowest cost infrastructure alternative that provided sufficient capacity and did not compromise safety was sought.

2.8.2 Equipment Costs

The equipment analysis included consideration of life-cycle costs for each technology. In defining the operating plan, operating costs reflective of potential MWRRS train technologies were applied in the 2000 Plan.

2.8.3 System Viability

The results of the 2000 Plan reflected the findings of earlier studies and showed that the Moderate Scenario was effective in providing the public private partnership that could support the development of the MWRRS. In economic terms, the system produced an overall cost-benefit return of 1.7 using USDOT FRA criteria. This showed that the project made a significant contribution to the performance of the American economy overall and specifically that of the Midwest.

2.9 MWRRI 2004 Plan – Update of the 2000 Plan Results

The 2004 Plan of the MWRRI consisted of an updating of the 2000 Plan from a 1996 data base year to a 2002 base year. The MWRRI states recognized the value of utilizing the latest census data to update ridership estimates and updating costs and revenues. As a result, the 2004 Plan analysis is designed to produce an updated Business Plan. Key elements revised in the 2004 Plan include:

2.9.1 Market Update

- Updated Ridership and Revenue forecasts utilizing the latest census data
- Upgraded Feeder Bus Analysis utilizing Greyhound cost data and market research
- Upgraded Express Parcel Analysis to develop cost and revenue estimates

2.9.2 Capital Cost Update

- Upgraded Capital Costs to 2002 base, by reviewing previous estimates, including new estimates generated from the latest engineering field reviews and studies
- Upgraded Capacity Analysis costs

2.9.3 Operating Plan Update

- Revised Operating Plans in line with the latest route and engineering study findings, market research, freight railroad input, and operating speed and stopping pattern revisions
- Revised Operating Costs and specifically input from Zeta-Tech on track costs and from the vehicle procurement process for equipment costs

2.9.4 Implementation Plan

- Updated Segment Phasing, with new start dates, milestones and finish dates
- Updated Construction Management and other implementation costs

2.9.5 Financial Analysis

- Calculated new cash flows
- Revised ramp up costs and revenues
- Reviewed funding approaches

Operating ratios were reassessed and were positive for each corridor by the year 2016, with the exception of the Quincy-Omaha corridor that had an operating ratio of 0.92. Quincy-Omaha becomes positive only after year 2024. MWRRS as a system results in a positive operating ratio in year 2012, which rises to 1.17 in 2014 (the first year of full operations) and to 1.36 by 2025. All corridors, including Quincy-Omaha, have a positive operating ratio by 2025.

2.9.6 Economic Analysis

Due to funding limitations, the Economic Analysis conducted in the 2000 Plan, Chapter 11 of this report, has not been updated.

3. Proposed Midwest Regional Rail System

3.1 Introduction

The proposed Midwest Regional Rail System (MWRRS) will operate in nine states, encompass approximately 3,000 route miles and operate on eight corridors. The system will largely use existing railroad rights-of-way owned by the freight railroads and Amtrak. The system has been planned to maximize the extent to which operating costs are recovered from fares and other ancillary revenues, a fundamental precept of the Business Plan.

The MWRRS is planned as a hub-and-spoke operation, with a series of primary and secondary corridors and branch lines off selected corridors. Chicago serves as the hub, with spokes connecting Twin Cities, Green Bay, Detroit/Pontiac, Grand Rapids/Holland, Port Huron, Cleveland, Cincinnati, St. Louis, Kansas City, Carbondale, Quincy and Omaha. The system also provides scheduled service to other regional centers including Milwaukee, Kalamazoo, Ft. Wayne, Toledo, Indianapolis, Springfield, Des Moines, Madison, Lansing, Jefferson City and Iowa City.

Service attributes include new rolling stock operating at significantly faster speeds than existing equipment and offering more on-board amenities designed to meet the needs of business and leisure travelers. Train stations will be renovated to provide comfortable, attractive waiting areas with customer-friendly information services. Larger stations should feature food service, retail space and connections to local transportation. There will be a feeder bus network, shown in Exhibit 3-1, to facilitate access to the stations, and its schedules and fares will be coordinated with the passenger rail schedules to provide essentially “seamless” travel throughout the Midwest region.

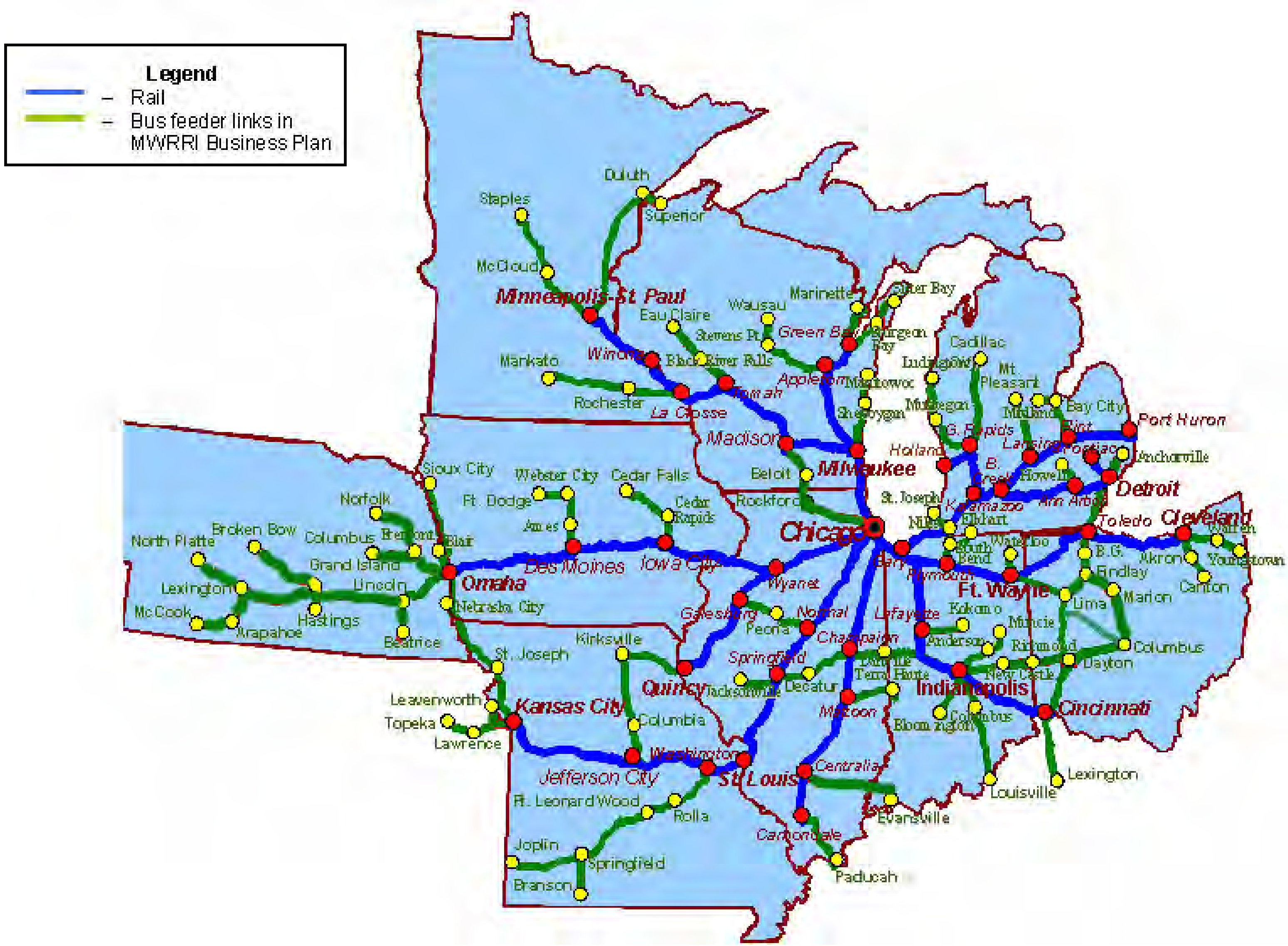
The principal service attributes of the MWRRS are:

- Use of modern equipment
- Improved travel times and frequencies
- Competitive fares that maximize revenue yields
- Improved accessibility and reliability
- On-board and station amenities

On-board food service provides the main source of ancillary revenues, but a same-day priority parcel service is an optional, ancillary business that may also be provided in conjunction with passenger rail service. To be conservative, MWRRS operating ratios and the financial plan were developed *without* inclusion of parcel service. However, a set of operating ratios *with* express parcel service has also been developed as a sensitivity.

A description of these service attributes and the benefits they provide to the passenger rail traveler is given below.

Exhibit 3-1
Feeder Bus System Map



3.1.1 Use of Modern Equipment

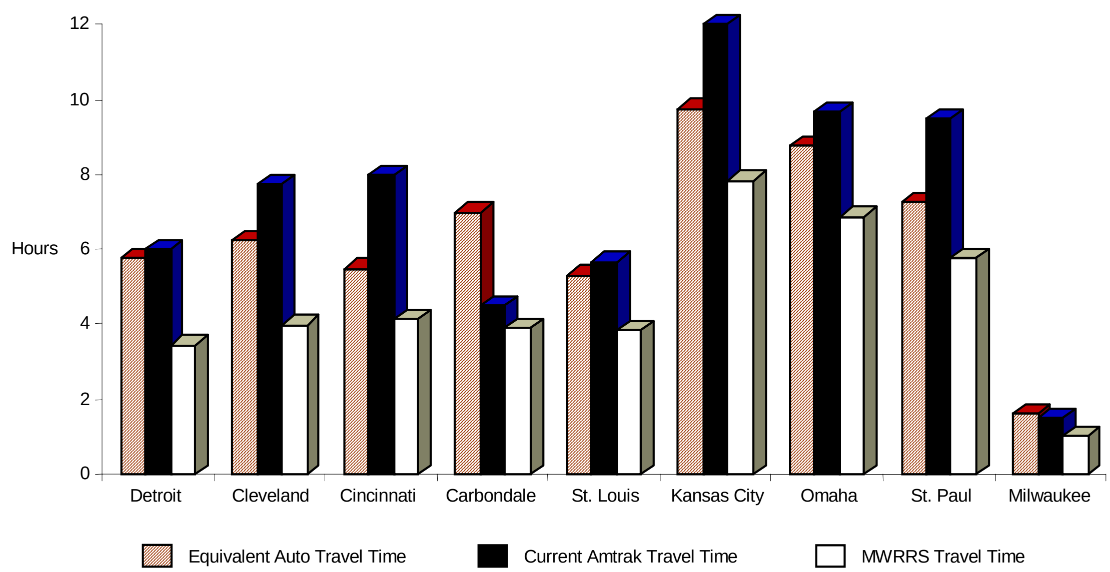
It is proposed that the MWRRS will use modern, cost-effective technology for achieving the desired speed of 110-mph. While a generic train technology has been selected for the purpose of the study, many options should be considered as the MWRRS moves towards implementation. Principal advantages of modern train technology include low operating costs, high performance levels and efficient handling characteristics. Along with anticipated economies of scale, modern technology reduces operating costs when compared to existing Amtrak practice. In the earlier 2000 Plan, European costs were measured at 40 percent of Amtrak's costs. However, in the current 2004 study, train operating costs have been significantly increased to a level that is approximately 80 percent of Amtrak's costs today. This is regarded as a conservative assumption for a modern, 63-train system. Costs assumed in this study are specific to a large operation with economies of scale and may not apply to a smaller system. The modern train provides a wide range of comfort and convenience geared to 21st century travel.

3.1.2 Improved Travel Times and Frequencies

Travel time and frequency of service are the two key factors travelers consider when selecting a mode of travel. The MWRRS will offer an attractive mix of travel times and train schedules to accommodate business as well as leisure travelers. Improved travel times and increased frequency of service will serve to foster connectivity throughout the region and strengthen the overall attractiveness and performance of the MWRRS.

When compared with the travel times of the current passenger rail service, travel time savings on the MWRRS range from 30 percent between Chicago and Milwaukee, to 50 percent between Chicago and Cincinnati. Exhibit 3-2 provides a table comparing MWRRS and existing travel times.

Exhibit 3-2
Improved MWRRS Travel Times*



As shown in Exhibit 3-3, the improvement in train frequencies, compared with the existing service, generally results in doubling or tripling the level of service currently offered along most of the corridors.

Exhibit 3-3
Improved MWRRS Train Frequencies

MWRRS Corridors	***Number of Daily Trips per Direction***	
	MWRRS	***Current Service***
Chicago-Detroit	9	3
Chicago-Cleveland	8	2*
Chicago-Cincinnati	5	1*
Chicago-Carbondale	2	2*
Chicago-St. Louis	8	3*
St. Louis-Kansas City	6	2
Chicago-Omaha	4	1*
Chicago-Twin Cities	6	1*
Chicago-Milwaukee	17	8*

* Current Service includes long-distance trains.

3.1.3 Competitive Fares that Maximize Revenue Yields

A key component in the planning of the MWRRS was the use of revenue yield techniques to maximize revenues. While these techniques are widely used by the airline industry, their application to passenger rail service is a recent development. A parametric analysis was used here to optimize fares for specific corridors, route segments and markets. Based on the use of revenue yield techniques, average fares for the MWRRS will range from 18 to 29 cents per mile.

In addition to full fares, a series of market-specific promotional and discount fares will be established to fill off-peak trains and encourage certain segments of the population, in particular students and senior citizens, to travel at off-peak times. A variety of travel cards and other promotional ticketing systems will also be developed to further promote widespread use of the system. Illustrative one-way average fares for selected city pairs on the MWRRS are given in Exhibit 3-4[1].

[1] Full fare comparisons can be misleading since Amtrak seldom is able to actually charge full fare on its current Midwest routes. The MWRRS will charge full fare a higher proportion of the time, especially to business travelers, which accounts for most of the projected increase in average fares. Sample MWRRS point-to-point fares are given in Exhibits 4-34 and 4-35.

Exhibit 3-4
Average One-way Corridor Fares for the Moderate Scenario*
(2002$)

	Average Fare			*Average Trip Length*	*Cents per Mile*
	Business	***Other***	***Overall***		
Chicago-Detroit	44.71	31.15	34.67	191	18.45
Chicago-Cleveland	59.05	48.87	51.16	203	25.20
Chicago-Cincinnati	67.96	49.55	54.37	212	25.65
Chicago-Carbondale	27.89	28.43	28.29	121	23.38
Chicago-St. Louis	54.63	38.17	43.49	197	22.08
St. Louis-Kansas City	43.05	30.72	35.18	151	23.30
Chicago-Quincy-Omaha	44.77	37.64	39.25	170	23.09
Chicago-Twin Cities	46.84	39.00	41.30	147	28.10
Milwaukee-Green Bay	32.09	23.02	25.03	86	29.10
Chicago-Grand Rapids	42.88	32.75	34.71	155	22.39
Battle Creek-Port Huron	22.50	17.26	18.58	75	24.77
Entire System	**46.71**	**35.92**	**38.84**	**167**	**23.26**

*A full range of fares including discount fares will be provided to ensure revenue optimization.

3.1.4 Improved Accessibility and Reliability

Approximately 80 percent of the region's population lives within a one-hour drive of a MWRRS rail station. Many stations will have intermodal connections to the feeder bus network. Bus and rail schedules will be coordinated to provide seamless travel for passenger rail patrons. The feeder buses will provide easy station access for travelers who are unable to or prefer not to drive to a station. In addition, taxi, rental car, limousine and transit services will be available at all major MWRRS stations.

The design of the feeder bus network was based on past studies and recommendations from the nine participating states. It is proposed that the feeder bus system will operate 4.9 million bus miles annually so that it links most of the region's smaller urban areas to the MWRRS network, and by providing easy access to the MWRRS passenger rail service raises the percentage of the region's population that is served by MWRRS to 90 percent.

The feeder bus system is expected to dramatically enhance the financial performance of the MWRRS as the bus/rail traveler utilizes an otherwise empty seat and has a longer average trip length than the typical rider, thereby paying an average fare of $50 to $75 to use the passenger rail system. Costs for the feeder bus system were estimated with the help of Greyhound Lines, Inc. (Greyhound) and were based on the size of the bus and level of ridership.

The feeder bus system for the MWRRS is discussed in more detail in Chapter 4.

3.1.5 On-board and Station Amenities

A range of amenities will be provided both on-board and at stations; station amenities will vary depending on station size and passenger volume. A food concession, newsstand, and convenience items will be available at many stations. At larger stations, a wider array of shopping will be provided, including various types of dining establishments, specialty shopping, business support services and entertainment facilities.

The design of the modern rail car offers on-board amenities that serve to make passenger rail travel superior to air travel. Seating can be bi-directional, (*i.e.*, half the seats face one way and half the other way). The interior of the train can be divided into large flexible compartments with space for wheelchairs, bicycles, strollers and play areas for children. At each seat, there are receptacles for computers and other communications equipment, amenities that are very important to the business traveler. Some modern trains have a socket for a five-channel stereo system and an informational channel. The train has an electronic information system with displays in each passenger compartment providing continuously updated information on arrival and departure times. Special vibration-absorbing mountings and soundproofing contribute to a significant reduction in the noise level, which further adds to the comfort of the passengers.

A list of the typical on-board and station amenities to be provided by the MWRRS is given in Exhibit 3-5.

Exhibit 3-5
Summary of Station and On-board Amenities

Access/Egress and Other Travel Improvements	
Internal Station Design	Passenger-oriented decor Restaurant, convenience shopping, basic business services ADA-compliant
Train-to-train and Train-to-other Mode Transfers	Improved signage at stations Improved on-board announcements On-line update status of train arrivals and departures
Station Transportation	Taxi and limousine services Rental car service Telephone link to transportation services Improved parking
Airport Connections	Intermodal links to airports (*e.g.*, Cincinnati) Stations at selected airports (*e.g.*, Cleveland, Milwaukee, Gary)
Bus Connections	Connecting feeder buses dedicated to the MWRRS Increased frequencies on existing bus networks and coordinated bus and rail schedules
Station Services	
Weather-protected Platforms	All platforms adjacent to stations or shelters
Station Aesthetics	Improved internal and external appearance of stations
Business, Food, and Retail Services	Choice of type and quality of food. Restaurants and food courts at larger stations Specialty shopping, business support services, and entertainment facilities at larger stations
On-board Amenities	
Business, Food, and Retail Services	Bistro/Trolley Service Power and modem hook-ups at each seat Business-style seating bays (two-by-two)
Seating and Entertainment	Open seating Airline-type business class seating Audio-visual monitors at seats for news, entertainment, and information programs

4. Market Analysis

4.1 Introduction

The market assessment undertaken in the 2004 plan of the Midwest Regional Rail Initiative (MWRRI) represents an analysis of the full social and business market potential for the Midwest Regional Rail System (MWRRS). The study of the passenger rail market opportunities includes an analysis of consumer preferences, market segments, competitive travel modes and the longer-term socioeconomic trends in income, employment and population that affect overall travel levels and consumer choices and mode selection behavior. An assessment of expected demand and revenue projections is critical to assuring the operational feasibility of a $7.7 billion passenger rail capital infrastructure project[1]. To develop a full understanding of the market for passenger rail service in the Midwest region, an extensive analysis was made of all travel in the Midwest region.

The following discussion presents the work performed to date on the market feasibility of the MWRRS.

4.2 Market Opportunities

With a population of just over nine million[2], Chicago is the largest metropolitan area served by the MWRRS. In addition to its renowned financial, commercial and manufacturing sectors, Chicago has long been the largest transportation hub for the Midwest region, as evidenced by its role in rail freight operations, the confluence of interstate highways and as the home of one of the busiest airports in the country – Chicago O'Hare International Airport. Chicago is also home to major arts and entertainment facilities and successful sports franchises. The city's attractions draw visitors not only from the Midwest region but also from all over the country. Nearly 30 percent of intercity trips made by air, rail and bus in the region begin or end in Chicago. Other regional centers connected by the MWRRS include Detroit (population 3.9 million), Cleveland/Akron (3.0 million), Indianapolis (1.6 million), Cincinnati (2.0 million), St. Louis (2.6 million), Kansas City (1.8 million), Omaha (0.7 million), Des Moines (0.5 million), Milwaukee (1.7 million) and Twin Cities (3.0 million). [3]

The MWRRS encompasses a rail network of more than 3,000 route miles and serves a population of nearly 60 million[4]. About 80 percent of the region's population lives within an hour drive of either an MWRRS rail station. The passenger rail market analysis confirms there is a substantial market for intercity travel between all the cities on the MWRRS network. In many markets, the MWRRS provides a faster and more cost-effective alternative to auto and bus travel. Furthermore, the MWRRS provides a more cost-effective means of travel than air in many of the smaller, urban areas on or near an MWRRS corridor.

Increased connectivity between regional centers and smaller urban areas is critical to the region's continued economic growth. In many cases, small, urban areas are today dependent on auto connections and lack competitive public modes of travel. For example, Madison, Wisconsin, the state's capital and home of the University of Wisconsin, has no passenger rail service.

[1] See Chapter 5 for a full breakdown of capital costs
[2] Figure from 2000 U.S. Census for Chicago SMSA
[3] Consolidated SMSA or urbanized area statistics provided by 2000 U.S. Census
[4] Figure from 2000 U.S. Census for nine-state region

4.3 Market Analysis Refinements

The MWRRI continues to enhance its understanding of the key market issues and opportunity for passenger rail in the Midwest region. The MWRRI study is ongoing, designed to refine the involved states' knowledge of the marketplace and to increase the reliability of ridership and revenue projections. The initial study focused on the feasibility of the MWRRS on a system-wide basis and the analysis clearly indicated financial feasibility of the proposed system. Since then, there have been further efforts to study and evaluate the MWRRS feasibility for more detailed market segments. These include:

- Branch line services
- Alternative route selection that might attract higher ridership and revenue performance
- Alternative technologies and operating plans to lower costs
- Expanding market definitions to include air connectivity
- An integrated bus plan (system of feeder buses, connecting buses, supplemental service provided by bus, etc.)

Revenue and ridership forecasts are revised through improved analysis of the attributes (*e.g.* time, fare, and frequency) of the service, better operating plans and upgraded technology. Notwithstanding these service and operating refinements, the principal characteristics of the MWRRI strategy remain unchanged. These include:

- Significant reduction in corridor travel times: up to 50 percent
- Significant increase in frequency of service: 4 to 9 round trips per day in each corridor[5]
- Improvement in train reliability
- Introduction of a new train technology offering a marked increase in comfort and amenities
- Upgrading and refurbishing of all stations and terminals
- Development of an intermodal feeder bus network to ensure access to the MWRRS
- Establishment of market-competitive fares

The following section of the report presents the market research and analysis, pricing strategies and the ridership and revenue projections for the current proposed MWRRS. The results from this section comprise key inputs into the economic and financial analyses provided in subsequent chapters of this report.

4.4 Research and Analysis

In order to evaluate and quantify the level of demand for passenger rail service in the Midwest region, an extensive market research effort was undertaken. The market research plan included both primary and secondary research. Primary research is information obtained first-hand through field survey work questioning actual and potential rail passengers about their travel behaviors, requirements and preferences. These surveys provide insight into how the travel market might respond to the MWRRS. Secondary research is information collected from published sources and provides broader-based and historical information that describes travel

[5] Except for the Champaign-Carbondale segment, where the proposed MWRRS train frequency is limited to 2 round trips each day.

behavior in the past. Both levels of market research provide critical information necessary for a comprehensive market analysis. The market analysis conducted for the MWRRS is discussed below.

4.4.1 Primary Market Research

The primary market research that was conducted included three types of surveys: stated preference surveys, general behavioral surveys and surveys relating specifically to on-board services and station amenities.

As part of the work plan conducted in the 2004 Plan, a stated preference survey was conducted in two stages. The MWRRI sponsored the first stage, which concentrated on potential station amenities and on-board services that will attract rail passengers. Greyhound Lines, Inc. sponsored the second stage, which focused on bus integration opportunities (*e.g.*, possible feeder bus routes and interlining routes). Both parts of the stated preference survey involved strategic on-board quota sampling techniques. These surveys provided data solely on the rail and bus modes, data on the air and auto modes. Data are taken from previous MWRRI survey studies.

The stated preference data collected in 2001 was compared to the previous survey data collected in prior Plans of the MWRRI. A survey was conducted in February 1997 in major cities that would be served by the MWRRS. The survey effort included stated preference surveys and specific purpose surveys to determine travelers' interest regarding on-board services (OBS) and station services along the branch lines. In October 1998, the survey effort was extended to the smaller MWRRS urban areas (branch lines). In order to obtain a broad sample of travelers from all modes, survey forms were distributed on trains, at Midwestern airports, highway rest areas and toll plazas, and at the Central Chicago (bus) Station.

The following provides a general discussion on the stated preference surveys, with respect to the approach, methodology and findings. A more detailed, technical working paper was published in March 2002 and can be found in the September 2000 Project Notebook.

4.4.2 Stated Preference Surveys

Survey Objectives

The stated preference survey was designed to elicit responses from potential MWRRS passengers identifying the passengers' *criteria* in making a travel mode choice. Using an approach designed to collect *attitudinal* data, the survey presented four specific types of choice issues:

- The tradeoff between travel time and travel costs for all modes of travel in order to derive incremental *values of time*
- The tradeoff between frequency of service (headway) and travel costs for rail, air and bus in order to derive incremental *values of frequency*
- The tradeoff between reliability (within 15 minutes of stated arrival time) and travel costs for rail and air in order to derive *values of reliability*
- The tradeoff between the level of amenities and travel costs for rail to help define the train effect (benefit) created by new technology beyond travel time alone

Survey Methodology

The surveys were conducted using a quota group sampling approach. The information collected from the respondents is extrapolated to the overall population (*e.g.*, the travelers in a particular corridor) by applying readily available census data (*e.g.*, population and income statistics) to travel information (*e.g.*, mode and purpose of travel, distance, etc.). Quota surveys, which are now widely used for commercial, political and industrial purposes have the advantage of being relatively inexpensive to conduct, while providing much greater coverage and more statistically significant results than simple random surveys.

The survey questions focused on the tradeoffs between travel times and costs for existing and proposed modes of travel (faster journey times/higher fares), measuring the impact of large changes in travel time, such as one or two hours. For an analysis of incremental improvements, tradeoff questions were focused on *specific* options being considered, (*e.g.,* for example a 30-minute improvement in the timetable). This tradeoff analysis assessed the *point* elasticities associated with changes that are more marginal and not the *arc* elasticities associated with large changes in time and costs that are typical of passenger rail improvements.

The three critical factors that determine travel behavior are trip purpose, mode of travel and length of journey. Therefore, the market was segmented into auto, bus, rail and air trips and business and non-business trip purposes. Exhibit 4-1 shows the primary quota groups covered by each of the survey studies.

Exhibit 4-1
Primary Quota Groups for the 1997, 1998 and 2001 Surveys

Trip Purpose\Mode	*Air*	*Auto*	*Bus*	*Rail*
1997 Corridor Survey				
Business	X	X	X	X
Non-Business	X	X	X	X
1998 Carbondale Survey				
Business	--	X	X	X
Non-Business	--	X	X	X
1998 Grand Rapids Survey				
Business	X	X	--	X
Non-Business	X	X	--	X
1998 Green Bay Survey				
Business	X	X	X	--
Non-Business	X	X	X	--
2001 MWWRI Travel Survey				
Business	--	--	X	X
Non-Business	--	--	X	X

Notes:
1. Modes with no existing service are indicated by dashes.
2. Because commuter traffic represented a very small portion of the survey results, they were jointly evaluated with non-business trips in the 1997 and 1998 surveys.

The surveys were either self-administered or conducted through on-location interviews. The questions were designed to represent a range of travel behavior for main lines and branch line extensions. The questionnaires collected data about each respondent's trip origin and destination and socioeconomic characteristics such as age, employment status and total household income.

To ensure that respondents were asked questions relevant to particular travel modes and categories, different questionnaires were created based on mode of travel. The surveys differentiated between business and non-business travelers and between rail, bus, air and auto travelers. The 2001 travel survey provided data on the bus and rail modes; data from air and auto was taken from previous survey studies and extrapolated to the base year. In developing specific tradeoff questions, existing rail and bus fares and schedules were used as a general guide, and an analysis was made to determine the likely ranges of value of time (VOT) and value of frequency (VOF) responses. Additional tradeoff questions regarding value of reliability (VOR) were asked of the 1997 survey respondents.

For each questionnaire, five VOT and VOF questions were formulated to ensure an appropriate range of answers. Respondents were asked to choose one of five levels of preference to indicate the degree to which they liked or disliked a given choice.

A minimum sample from each travel market segment was required to ensure statistical confidence. Using the Central Limit Theorem, it was determined that a sample size of 40 to 60 participants ensures the statistical validity of each quota sample. For the MWRRI passenger stated preference surveys, the desired quota target was set at 80-100 interviews with a minimum quota of 40 interviews per trip purpose/travel mode established. The responses from the surveys, in conjunction with the tradeoff analysis, were then used to develop the demand forecasting model.

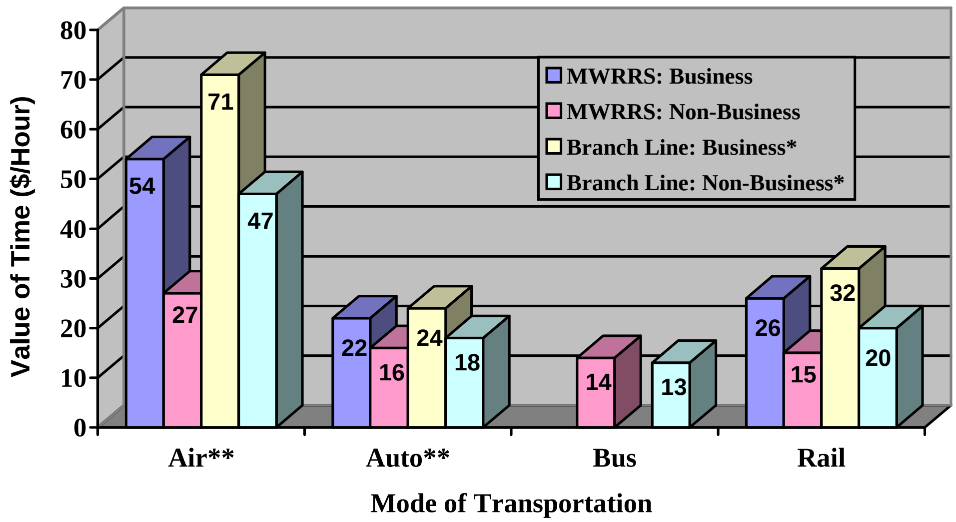
Findings

In the 2001 survey, 1,528 surveys were conducted; from the 1997 survey there were 2,038 survey responses; and from the 1998 survey, 1,028 surveys responses were collected - 419 from Grand Rapids, 317 from Green Bay and 292 from Carbondale.

Value of Time

As expected, business travelers place a higher value on their time than did non-business (pleasure or personal business) travelers. Since few business travelers use intercity buses, this group was not included in the bus survey as the sample size would have been too small to ensure validity. Exhibit 4-2 illustrates the different values of time expressed by business and non-business travelers in the various modes.

Exhibit 4-2
Value of Time by Trip Purpose and Mode (2000$)



*   Branch Line data obtained from 1998 Branch Line Surveys
** Auto and air data obtained from 1997 Corridor Survey and adjusted for the base year

A comparison among modes indicates that air travelers, particularly business travelers, place the highest premium on time. This suggests that attracting the business traveler from air to rail would require a comparable total trip time for a given city pair, in addition to other improvements discussed below.

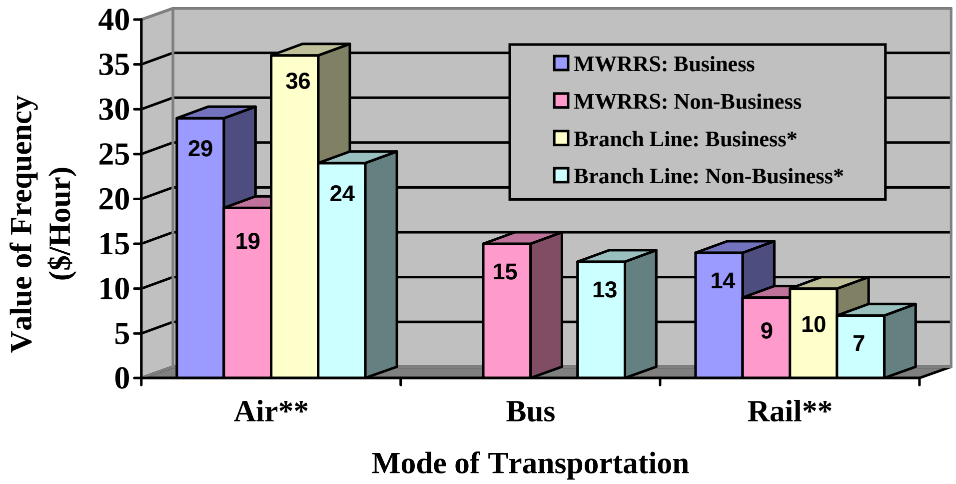
The auto traveler market is very large, representing over 97 percent of intercity passenger travel in the region[6]. Values of time for this group are similar to those of rail travelers in both the business and non-business categories - they place a high value on convenience, flexibility and reliability. Marketing rail's new ability to respond to customer needs (flexibility of schedule, costs, convenience) will attract some portion of auto passengers at current and improved speeds.

Value of Frequency

With reasonable levels of frequency, passengers are accustomed to scheduling their trips for intercity travel; those travelers who require immediate or emergency service are likely to use other modes (autos/cabs). It is worth noting that air travelers value frequency more highly than current rail travelers do, roughly proportionate to their value of time compared to rail travelers. This suggests that more frequent service may attract some current air travelers if rail travel times can also be improved. Exhibit 4-3 illustrates the travelers' values of frequency by mode.

[6] From origin-destination database developed for four modes (*i.e.* air, rail, bus and auto) as part of the MWRRI

Exhibit 4-3
Value of Frequency by Trip Purpose and Mode (2002$)

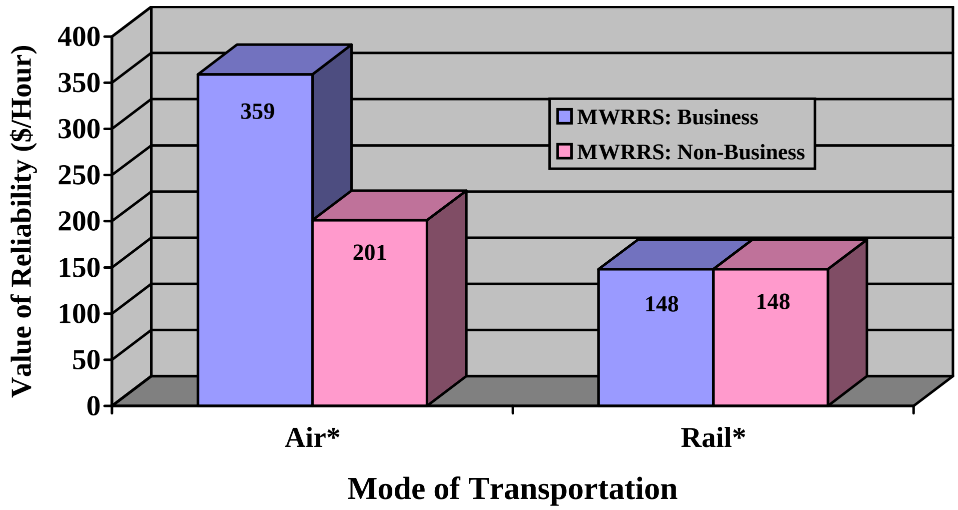


* Branch line data obtained from 1998 Branch Line Surveys
** Rail and air data obtained from 1997 Corridor Survey and adjusted for the base year

Value of Reliability by Trip Purpose and Mode

The value of reliability was calculated as part of the 1997 MWRRI Corridor Survey. Value of reliability was defined as the willingness to pay a premium to ensure arrival time within 15 minutes of the scheduled time for a percentage of time (certainty). This is the metric that the Federal Aviation Administration (FAA) uses to determine *on-time arrivals and departures* of flights by a specific carrier. These percentages ranged from 60 percent (lower fare), to 70 percent (base case), to 75 percent, 80 percent, 90 percent or 95 percent of the time. The tradeoff responses assumed there is a diminishing returns effect to increased reliability; because of this, the values of reliability cannot be compared with values of time or frequency.

Exhibit 4-4
Value of Reliability (2002$)



* Rail and air data obtained from 1997 Corridor Survey and adjusted for the base year

Rail travelers, business and non-business, place very similar values on reliability, and both categories of air travelers place a higher value on reliability than all rail travelers. By contrast, business air travelers are almost twice as concerned about arriving on time with a higher degree of certainty as air non-business travelers are.

This suggests another potential marketing opportunity: if the MWRRS can guarantee on-time performance with equal or more certainty than the airlines, particularly during poor weather conditions, then regional rail should be able to win new customers – and keep them – by providing a highly reliable service. The value of reliability is presented in Exhibit 4-4.

Comparison with Other Studies

Exhibit 4-5 shows the comparison between the values of time and frequency by mode and trip purpose from six different studies, including the MWRRI studies. Note that values of time and frequency are generally lower in the Midwest region studies than in other studies, across most categories and modes. For air in particular, it appears that the introduction of Southwest Airline's inexpensive service, with its competitive effect on other airlines, may have lowered the perceived value of airline travel time and frequency savings. In addition, the majority of the other studies represent more urban trip pairs than in the Midwest region studies. The lower incomes found in the more rural areas may have resulted in lower values of time. In addition, the majority of the other studies represent much shorter trip pairs than the Midwest region study. In particular, rail values of frequency decrease substantially with distance.

Overall, the MWRRI 2001 surveys share similar attitudinal parameters for values across all modes as the surveys taken in 1997. Furthermore, the 2001 surveys share similar time values with the 1998 branch line surveys for all but the air mode. Air travelers (both business and non-business) studied in the initial Plan survey were found to place a higher value on time, as compared the results of the 2001 survey. Similarly, air travelers' value of frequency was slightly higher in the initial Plan survey than the 2001 survey. This result can be explained by the inclusion in the 1998 survey of smaller air markets in such locations as Grand Rapids and Green Bay, which tend to have relatively higher airfares and limited service due to deregulation of the air market. Air typically provides the shortest travel time among all modes; thus, where affordable, most business travel is still by air. However, in the smaller urban communities of the Midwest region, the high cost of air sends potential rail users to the auto and other less expensive alternatives. Those who continue to use air for business travel in these more isolated locations have higher values of time. Therefore, the values of time for business air travel for the branch lines that serve Grand Rapids and Green Bay is higher than the average values in larger cities. The higher income levels found along the branch lines (*e.g.*, Grand Rapids) give travelers the option to travel by air. Interestingly, non-business air travelers also have the highest values of time for the MWRRS Branch Line as compared to all the other studies.

Exhibit 4-5

Comparison of Attitudinal Parameters: Mean Values of Time and Frequency (2002$)

Value of Time

Mode	*Trip Purpose*	*MWRRS 2001*	*MWRRS 1998 (Branch Line)*	*MWRRS 1997*	*Tri-State*	*Boston-Portland*	*Illinois*
Air	Business	54	71	54	80	62	63
	Non-Business	27	47	27	42	24	40
Auto	Business	22	24	22	53	27	35
	Non-Business	16	18	16	32	16	20
Bus	Business	-	-	-	31	18	19
	Non-Business	14	13	10	27	15	11
Rail	Business	26	32	25	50	27	29
	Non-Business	15	20	18	35	15	20

Value of Frequency

Mode	*Trip Purpose*	*MWRRS 2001*	*MWRRS 1998 (Branch Line)*	*MWRRS 1997*	*Tri-State*	*Boston-Portland*	*Illinois*
Air	Business	29	36	29	30	42	42
	Non-Business	19	24	19	27	15	30
Auto	Business	-	-	-	-	-	-
	Non-Business	-	-	-	-	-	-
Bus	Business	-	-	-	20	14	13
	Non-Business	15	13	11	16	11	8
Rail	Business	14	10	14	22	17	14
	Non-Business	9	7	10	20	12	10

In addition, rail mode has a reverse trend - the value of frequency was slightly lower in the initial plan survey than values in the 2001 survey. This may be due to the current limited service in the branch line extension; therefore, rail dependency, as well as the value of frequency, is low.

Both the earlier and later survey values are consistent with the other studies in the relationships across modes. The sometimes lower values do not change the relative pattern of responses across modes within each study (*e.g.*, air business travelers consistently place the highest values on time, and auto and rail business and non-business travelers typically present very similar patterns to one another in time values). The relative values between modes are the determining factors in demand forecasting models, rather than the absolute values.

Stated Preference Survey Conclusions

The study findings indicate that the MWRRS can attract new passengers, primarily from auto and air markets, by providing improved service and amenities. Offering high quality service (competitive in terms of time, price, frequency, and reliability), modern facilities with comfortable stations and state-of-the-art trains will divert passengers into the rail market, yielding increased ridership and revenue.

4.4.3 Specific Purpose Surveys

In addition to collecting stated preference data, the surveys included questions designed to capture user preferences for on-board and station services. The 2001 survey results were used to assess the services wanted by bus and rail passengers. The initial Plan survey results were used to determine what air and auto passengers want. For the rail and auto modes, questions regarding service, on-board amenities and station amenities were asked; air and bus travelers were asked questions regarding service and terminal amenities. Each survey questionnaire was tailored to a specific audience and restrictions on the number of questions, based on the general willingness of travelers to respond, limited the coverage. Respondents were instructed to rank the importance of each amenity with 5 being the most important and 1 being the least important (Exhibit 4-6).

Station and On-board Amenities

The 2001 survey yielded information regarding the station and on-board services expected by potential rail passengers. The results from this survey were consistent with the results of previous MWRRI surveys. The areas with the highest rankings were:

- Infrastructure improvements at stations (safe stations, ample parking and weather-protected platforms)
- Access to car rentals, taxis and public transit at stations
- Travel information (such as customer service representatives at stations and on trains)
- The availability of luggage carts and a variety of food service options, both at stations and on-board trains

Comparing Traveler Values on Different Modes

All three surveys asked respondents to rate features related to the rail service. The surveys were used to gauge the values that travelers assign to different service attributes, (e.g., station amenities, on-board services, planning and scheduling services and other miscellaneous services). The results for the analysis are shown in Exhibit 4-6; results from the 1997 and 1998 surveys are shown in parenthesis.

Exhibit 4-6
Ranking of Service Features by Modal Travelers

Importance Ratings	*Average Importance Rating 5=Highest, 1=Lowest ( ) indicates values from 1997 and 1998 surveys, others are from the 2001 survey*			
	Rail Survey	*Auto Survey*	*Air Survey*	*Bus Survey*
Miscellaneous				
Cost of the rail service		(3.52)		
Convenient schedules		(4.19)		
Accessibility to stations (home)		(4.08)		
Accessibility to stations (destination)		(4.10)		
Accessibility to public transit		(3.63)	(3.16)	(4.00)
Reliability of train service		(4.13)		
Staffed rental car booths			(3.86)	
Staff for baggage handling				(3.31)
Station Amenities				
Rail service to suburban Chicago locations	3.06 (3.09)	3.15 (3.07)	1.93	
Convenient and ample parking at stations	3.97 (3.60)	3.67 (3.74)	3.92 (4.01)	3.58 (3.08)
Car rental, taxi, shuttle, limousine services	3.89 (3.63)	3.18 (3.37)	4.11 (3.63)	3.81 (3.76)
Availability of luggage carts	3.39 (3.32)		3.05 (2.82)	3.52 (3.33)
Office and meeting facilities	2.07			2.71
Weather protected passenger platforms	4.04			4.06
Travelers' lounges	2.67 (3.38)		3.01 (3.00)	3.39 (3.04)
Food court	3.37			4.03
Restaurant with table service	3.08			3.44
Wide variety of high-quality food selections	3.45 (3.26)		3.37 (2.90)	3.78
On-board Service				
First class seating with food, beverage service	2.75 (2.63)	2.62		
Restaurant car with table service	3.01 (3.01)		(2.75)	(3.13)
Fast-food cafeteria/snack bar	3.37 (3.23)		(3.24)	(3.27)
Coffee cart services	2.77 (2.87)			
Telephone at seat	1.86 (1.81)	2.65		
Electrical outlets at seat	2.55 (2.32)			
Business service area	1.97 (1.93)		(2.58)	(2.63)
Personal TV/Video movie display	2.53 (2.40)			
Music headsets	2.54 (2.63)			
Child care services	2.04 (2.06)	2.42		
Connecting train information	3.69 (3.75)		(3.58)	
Wider seats	4.16			
More legroom	4.32			
Planning and Scheduling Services				
Phone reservation number (toll-free) number	3.92			4.01
Internet reservation/info	3.56			3.52
Destination Information	3.61		(3.64)	3.92(4.15)
Discounted fares for advance purchase	4.33			4.36
Discounted fares for seniors/students/children	3.87			4.23
Frequent traveler credits	3.52			3.68
Guarantee of a reserved seat	4.02			4.10
Not needing a reservation	3.30			3.43

Convenient schedules, accessibility to stations and reliability of service receive consistently higher rankings than other items, indicating their relative value to customers. For auto travelers, accessibility may be key to attracting portions of this very large market to rail service. For food service, travelers consistently placed the highest value on convenient access.

Specific Purpose Survey Conclusion

Attracting travelers from all types of modes to the MWRRS will require a mix of marketing strategies and enhanced service attributes such as comparable trip times and more frequent service. While air service is one of the most expensive travel modes, air travelers place a high value on total trip time and frequency of service. Primary market research concluded that it is important to dramatically improve current on-board and rail station services and continue making improvements. Marketing rail service to auto travelers must also include highlighting service reliability in addition to convenience and reduced travel time. The greatest failures of the current rail system are lack of reliability, infrequent service and travel times equal to or greater than the auto mode.

4.4.4 Travel Market Research

Data was collected on travel behavior and socioeconomic factors to develop a detailed and comprehensive zone system. These data were later used in the *COMPASS*© demand model as the primary source of information for demand and revenue forecasting.

Data Sources

Information was collected from existing sources in the travel and transportation industries including maps, government databases and socioeconomic forecasts, published schedules for the existing travel network and travel data from Amtrak, Greyhound and the airlines. Auto origin-destination (O-D) travel data was difficult to obtain and was available only for certain states and regional centers; estimates on O-D travel for zones that were lacking data were made using the travel characteristics of existing and available data, modified by population, income, employment and trip length. A summary of origin-destination sources garnered from travel industry sources is shown in Exhibit 4-7 and information collected from state government sources is shown in Exhibit 4-8. The base year for the data collected was 2000.

Exhibit 4-7
Sources of Overall Travel and Origin-Destination Data by Mode (Year 2000 Data)

Mode	*Origin-Destination Data Sources*
Rail	Amtrak Ticketing Data
	Station-to-Station Passenger Volume
	Access/Egress Simulation
Air	Federal Aviation Administration (FAA) 10 Percent Sample
	Airport-to-Airport Passenger Volume
	Access/Egress Simulation
Bus	Greyhound Station-to-Station Passenger Volumes
	Access/Egress Simulation
Auto	Statewide and Urban O-D Studies
	Trip Simulation for Door-to-Door Movement

Exhibit 4-8
Sources of Auto Origin-Destination Data by State

States	*Sources*
Illinois	Illinois Rail Study (1995)
	Illinois Statewide Highway Model (1987)
	Illinois Rail Passenger Survey (1993)
Indiana	Statewide Auto Trip Tables (Estimated from AADT)
Iowa	Highway Traffic Volumes
Michigan	Statewide Travel Demand Model
	Intercity Passenger Rail Surveys (1995)
Minnesota	Highway Traffic Volumes
	Travel Survey for Twin Cities Metro Area
	Tri-State High-Speed Rail Study (1991)
Missouri	Highway Traffic Volumes (2000)
Nebraska	Statewide Transportation Model
Ohio	High-Speed Rail Ridership Study (1988)
	Pittsburgh-Cleveland Rail Corridor Study (1995)
Wisconsin	Chicago-Milwaukee Rail Corridor Study (1995)
	Statewide Travel Demand Model

Base year socioeconomic data was provided by the U.S. Census Bureau. Socioeconomic growth rates in population, employment and income are provided by Woods & Poole Economics, Inc. Exhibit 4-9 presents the underlying data assumptions on population, per capita income and employment growth that were used in the models.

Exhibit 4-9
Socioeconomic Growth by State

	Illinois	***Indiana***	***Iowa***	***Michigan***	***Minnesota***	***Missouri***	***Nebraska***	***Ohio***	***Wisconsin***
Population									
2000 – 2010	0.67%	0.63%	0.41%	0.42%	0.81%	0.70%	0.59%	0.46%	0.71%
2010 – 2020	0.68%	0.69%	0.54%	0.55%	0.74%	0.72%	0.61%	0.58%	0.73%
2020 – 2040	0.58%	0.61%	0.49%	0.53%	0.60%	0.60%	0.52%	0.53%	0.62%
Employment									
2000 – 2010	0.99%	0.94%	0.66%	0.75%	1.05%	0.96%	0.92%	0.83%	0.97%
2010 – 2020	0.41%	0.40%	0.16%	0.29%	0.42%	0.38%	0.30%	0.31%	0.41%
2020 – 2040	0.42%	0.44%	0.27%	0.38%	0.42%	0.40%	0.33%	0.38%	0.43%
Per Capita Income									
2000 – 2010	1.03%	1.13%	1.15%	1.07%	1.04%	1.07%	1.16%	1.11%	1.10%
2010 – 2020	0.72%	0.79%	0.78%	0.77%	0.71%	0.78%	0.77%	0.78%	0.77%
2020 – 2040	0.81%	0.85%	0.85%	0.84%	0.80%	0.84%	0.84%	0.84%	0.84%

Base Travel Results: 2000 Travel between City Pairs

The summary table, Exhibit 4-10, presents total estimated rail, bus, air and auto travel in the key MWRRS corridors. These estimates include trips that would constitute a potential market for rail. Exhibits 4-11 through 4-14 disaggregate the trips by mode for these same city pairs by trip purpose, (*i.e.*, business and non-business). Exhibits 4.15 and 4.16 present the detailed data for all the cities included in the analysis, and the current estimated modal shares for each.

Exhibit 4-10
Summary of Total Trips in Selected Corridors – Year 2000

Corridor	*Trips/ Mode Share*	*Mode*				
		Air	*Bus*	*Auto*	*Rail*	*Total*
Chicago-Quincy-Omaha	Trips	1,134,675	194,147	80,245,776	285,033	81,859,631
	Mode Share	1.39%	0.24%	98.03%	0.35%	100%
Chicago-St. Louis	Trips	1,528,747	268,820	47,418,580	233,076	49,449,223
	Mode Share	3.09%	0.54%	95.89%	0.47%	100%
Chicago-Milwaukee-Minneapolis	Trips	1,810,910	677,974	138,446,848	282,324	141,218,056
	Mode Share	1.28%	0.48%	98.04%	0.20%	100%
Chicago-Carbondale	Trips[7]	298,339	232,179	47,772,320	101,235	48,404,073
	Mode Share	0.62%	0.48%	98.69%	0.21%	100%
Chicago-Michigan	Trips	1,885,901	710,720	166,087,536	398,858	169,083,015
	Mode Share	1.12%	0.42%	98.23%	0.24%	100%
Chicago-Cincinnati	Trips	1,161,538	200,304	36,812,032	44,062	38,217,936
	Mode Share	3.04%	0.52%	96.32%	0.12%	100%
Chicago-Cleveland	Trips[8]	946,727	530,155	99,780,816	104,792	101,362,490
	Mode Share	0.93%	0.52%	98.44%	0.10%	100%
St. Louis - Kansas City	Trips	775,195	65,862	24,288,942	189,375	25,319,374
	Mode Share	3.06%	0.26%	95.93%	0.75%	100%
Milwaukee-Green Bay	Trips	121,484	128,890	19,218,692	0	19,469,066
	Mode Share	0.62%	0.66%	98.71%	0%	100%
Total	**Trips**	**9,663,516**	**3,009,051**	**660,071,542**	**1,638,755**	**674,382,864**
	Mode Share	**1.43%**	**0.45%**	**97.88%**	**0.24%**	**100.00%**

[7] The Ohio and Illinois networks have many more detailed zones compared to the Indiana network. This difference generates more short-distance auto trips that account for higher auto trips on Chicago-Cleveland as compared to Chicago-Cincinnati. This inconsistency has no practical effect on rail ridership but appears to affect the modal share calculation.
[8] See footnote 6.

Exhibit 4-11
Rail Trips by Trip Purpose within Selected Corridors – Year 2000

Corridor	Trips within Corridor			
	Business	Non-business	Total	Percent of Total
Chicago-Quincy-Omaha	50,987	234,046	285,033	17.39%
Chicago-St. Louis	78,092	154,984	233,076	14.22%
Chicago-Milwaukee-Minneapolis	49,869	232,455	282,324	17.23%
Chicago-Carbondale	20,070	81,165	101,235	6.18%
Chicago-Michigan	49,545	349,313	398,858	24.34%
Chicago-Cincinnati	6,119	37,943	44,062	2.69%
Chicago-Cleveland	14,754	90,038	104,792	6.39%
St. Louis - Kansas City	66,248	123,127	189,375	11.56%
Total	335,684	1,303,071	1,638,755	100.00%

Exhibit 4-12
Bus Trips by Trip Purpose within Selected Corridors – Year 2000

Corridor	Trips within Corridor			
	Business	Non-business	Total	Percent of Total
Chicago-Quincy-Omaha	8,217	185,930	194,147	6.45%
Chicago-St. Louis	6,727	262,093	268,820	8.93%
Chicago-Milwaukee-Minneapolis	35,374	642,600	677,974	22.53%
Chicago-Carbondale	13,916	218,263	232,179	7.72%
Chicago-Michigan	20,824	689,896	710,720	23.62%
Chicago-Cincinnati	8,414	191,890	200,304	6.66%
Chicago-Cleveland	18,100	512,055	530,155	17.62%
St. Louis - Kansas City	1,584	64,278	65,862	2.19%
Milwaukee-Green Bay	4,047	124,843	128,890	4.28%
Total	**117,203**	**2,891,848**	**3,009,051**	**100.00%**

Exhibit 4-13
Air Trips by Trip Purpose within Selected Corridors – Year 2000

Corridor	*Trips within Corridor*			
	Business	*Non-business*	*Total*	*Percent of Total*
Chicago-Quincy-Omaha	424,749	709,926	1,134,675	11.74%
Chicago-St. Louis	643,645	885,102	1,528,747	15.82%
Chicago-Milwaukee-Minneapolis	812,352	998,558	1,810,910	18.74%
Chicago-Carbondale	106,450	191,889	298,339	3.09%
Chicago-Michigan	775,186	1,110,715	1,885,901	19.52%
Chicago-Cincinnati	466,011	695,527	1,161,538	12.02%
Chicago-Cleveland	353,424	593,303	946,727	9.80%
St. Louis - Kansas City	402,196	372,999	775,195	8.02%
Milwaukee-Green Bay	46,587	74,897	121,484	1.26%
Total	**4,030,600**	**5,632,916**	**9,663,516**	**100.00%**

Exhibit 4-14
Auto Trips by Trip Purpose within Selected Corridors – Year 2000

Corridor	*Trips within Corridor*			
	Business	*Non-business*	*Total*	*Percent of Total*
Chicago-Quincy-Omaha	19,367,660	60,878,116	80,245,776	12.16%
Chicago-St. Louis	10,571,812	36,846,768	47,418,580	7.18%
Chicago-Milwaukee-Minneapolis	29,855,214	108,591,640	138,446,848	20.97%
Chicago-Carbondale	11,358,557	36,413,764	47,772,320	7.24%
Chicago-Michigan	32,700,170	133,387,362	166,087,536	25.16%
Chicago-Cincinnati	7,556,624	29,255,406	36,812,032	5.58%
Chicago-Cleveland	19,075,096	80,705,720	99,780,816	15.12%
St. Louis - Kansas City	7,032,668	17,256,274	24,288,942	3.68%
Milwaukee-Green Bay	4,974,274	14,244,419	19,218,692	2.91%
Total	**142,492,075**	**517,579,469**	**660,071,542**	**100.00%**

Exhibit 4-15
2000 Base Year Person-Trips between Major Cities

City Pair	Air		Auto		Bus		Rail	
	Business	***Non-Business***	***Business***	***Non-Business***	***Business***	***Non-Business***	***Business***	***Non-Business***
Chicago-Cincinnati	60,598	68,540	222,325	707,658	811	8,291	919	4,804
Chicago-Cleveland	197,364	172,437	317,834	1,029,436	2,283	21,174	847	5,678
Chicago-Des Moines	27,496	21,609	169,982	452,624	547	5,741	983	3,306
Chicago-Detroit	308,179	240,186	994,835	3,186,965	3,383	32,467	11,805	61,166
Chicago-Indianapolis	79,127	50,042	885,731	2,530,507	3,014	28,614	2,135	12,478
Chicago-Kalamazoo	6,001	4,340	550,626	1,774,724	947	21,252	10,469	61,774
Chicago-Kansas City	127,525	136,357	89,485	272,690	287	3,085	2,199	3,594
Chicago-Lansing	22,668	23,290	288,049	921,606	512	13,822	560	5,075
Chicago-Madison	3,280	3,597	217,417	448,207	307	2,243	1,464	10,140
Chicago-Milwaukee	16,980	10,796	4,016,391	10,205,003	11,397	90,281	20,956	53,696
Chicago-Omaha	93,041	93,389	89,084	257,067	566	4,877	1,237	5,965
Chicago-Springfield IL	3,182	1,809	403,530	1,025,807	328	7,396	28,565	44,738
Chicago-St. Louis	267,709	139,356	514,330	1,487,517	1,496	20,167	31,560	43,705
Chicago-Toledo	30,522	33,810	276,178	851,531	729	11,082	2,389	15,152
Chicago-Twin Cities	291,567	186,756	272,799	727,307	1,662	12,102	8,350	41,287
Cincinnati-Cleveland	167,733	86,922	294,280	772,707	3,515	27,959	1,136	2,900
Cincinnati-Des Moines	2,425	1,290	8,156	16,429	67	1,050	-	1
Cincinnati-Detroit	35,264	22,989	328,785	941,340	2,418	30,429	-	21
Cincinnati-Indianapolis	479	934	236,393	1,214,907	309	6,674	1	16
Cincinnati-Kalamazoo	656	385	26,224	61,189	183	3,204	-	6
Cincinnati-Kansas City	18,919	19,382	18,446	39,768	385	4,222	2	22
Cincinnati-Lansing	509	1,134	36,750	89,880	239	6,963	-	-
Cincinnati-Madison	2,461	1,086	13,043	28,253	232	2,975	-	1
Cincinnati-Milwaukee	17,884	16,401	40,609	138,771	189	2,224	35	109
Cincinnati-Omaha	4,558	2,778	7,587	16,483	88	1,258	-	3
Cincinnati-Springfield IL	119	266	20,090	82,002	23	716	5	54
Cincinnati-St. Louis	4,760	14,884	33,450	225,629	150	4,133	8	94
Cincinnati-Toledo	307	248	142,224	369,973	690	13,041	-	-
Cincinnati-Twin Cities	54,425	37,550	22,574	52,489	415	4,638	-	7
Cleveland-Des Moines	1,606	1,888	5,136	11,223	90	1,061	-	1
Cleveland-Detroit	24,935	13,831	524,246	1,634,792	5,243	47,636	-	31
Cleveland-Indianapolis	19,213	11,883	73,935	187,651	630	5,411	-	-
Cleveland-Kalamazoo	952	766	30,375	76,822	235	3,341	-	11
Cleveland-Kansas City	37,643	17,586	10,351	24,254	261	2,223	-	4
Cleveland-Lansing	1,165	1,631	48,335	125,262	241	6,110	-	-
Cleveland-Madison	2,068	1,725	9,841	23,118	212	2,363	-	1
Cleveland-Milwaukee	766	17,625	2,870	190,760	19	5,690	3	607
Cleveland-Omaha	8,515	463	4,993	11,783	117	1,271	-	3
Cleveland-Springfield IL	429	115	6,115	13,523	42	736	-	21
Cleveland-St. Louis	70,248	32,015	31,885	82,885	669	8,064	-	26
Cleveland-Toledo	1,010	1,083	649,607	2,230,982	593	12,965	70	664
Cleveland-Twin Cities	40,552	23,055	17,419	44,006	858	6,326	-	22
Des Moines-Detroit	3,463	6,185	14,688	33,353	192	2,666	-	6
Des Moines-Indianapolis	5,551	1,907	11,403	22,227	61	830	-	1
Des Moines-Kansas City	17,072	5,356	95,762	184,929	223	4,606	-	-
Des Moines-Lansing	337	626	3,445	6,988	36	1,249	-	-
Des Moines-Madison	972	226	12,747	23,840	40	750	-	-
Des Moines-Milwaukee	46	657	16,256	108,017	51	1,865	27	190
Des Moines-Omaha	11	26	189,665	373,527	236	5,318	30	148
Des Moines-Springfield IL	5	22	817	15,663	-	307	-	28
Des Moines-St. Louis	14,168	4,483	23,263	47,292	60	1,729	-	-
Des Moines-Toledo	167	203	3,371	7,046	38	743	-	1
Des Moines-Kansas City	17,072	5,356	95,762	184,929	223	4,606	-	-
Des Moines-Twin Cities	34,653	9,610	112,839	229,562	186	3,416	-	-
Detroit-Indianapolis	64,027	46,290	163,598	432,106	998	10,310	-	27
Detroit-Kalamazoo	3,269	2,426	609,611	1,631,315	582	16,121	660	5,467
Detroit-Kansas City	58,158	67,777	28,681	69,735	502	4,845	-	22
Detroit-Lansing	545	624	335,459	959,655	24	1,227	81	634
Detroit-Madison	11,903	10,763	30,562	74,864	393	5,214	-	-

Exhibit 4-15 (Continued)
2000 Base Year Person-Trips between Major Cities

City Pair	Air		Auto		Bus		Rail	
	Business	*Non-Business*	*Business*	*Non-Business*	*Business*	*Non-Business*	*Business*	*Non-Business*
Detroit-Milwaukee	28,929	31,391	163,061	456,573	794	8,066	169	2,770
Detroit-Omaha	15,337	10,716	13,621	33,313	247	3,175	-	28
Detroit-Springfield IL	845	905	33,646	106,544	113	2,477	20	308
Detroit-St. Louis	55,354	58,337	63,329	243,799	511	8,359	14	204
Detroit-Toledo	228	1,930	954,396	5,535,567	1,510	35,683	48	509
Detroit-Twin Cities	128,712	72,088	47,926	125,506	1,517	13,334	-	-
Indianapolis-Kalamazoo	382	210	34,752	77,945	180	3,438	-	7
Indianapolis-Kansas City	866	7,963	3,316	33,238	6	357	2	27
Indianapolis-Lansing	2,052	3,555	42,492	101,166	197	4,680	-	-
Indianapolis-Madison	3,333	647	19,780	41,385	231	2,953	-	1
Indianapolis-Milwaukee	1,192	808	113,010	304,353	631	5,708	51	145
Indianapolis-Omaha	12,464	4,049	9,433	19,783	77	950	-	5
Indianapolis-Springfield IL	37	38	62,075	207,172	34	1,346	6	78
Indianapolis-St. Louis	13,442	16,730	126,635	621,781	351	8,687	22	202
Indianapolis-Toledo	176	626	53,562	129,863	249	3,825	-	-
Indianapolis-Twin Cities	39,559	26,715	26,933	60,365	331	3,608	-	14
Kalamazoo-Kansas City	1,346	585	6,396	13,329	65	1,170	-	6
Kalamazoo-Lansing	188	145	211,685	603,802	112	11,975	28	430
Kalamazoo-Madison	9	24	4,233	9,042	-	-	6	42
Kalamazoo-Omaha	1,602	364	2,901	6,064	31	704	-	13
Kalamazoo-Springfield IL	65	25	15,098	31,328	22	940	12	154
Kalamazoo-St. Louis	289	354	16,528	62,902	85	3,302	5	88
Kalamazoo-Toledo	99	260	15,354	303,922	-	1,412	23	300
Kalamazoo-Twin Cities	5,703	5,103	10,472	23,423	227	3,589	-	-
Kansas City-Lansing	1,888	1,920	6,586	14,280	94	2,127	-	-
Kansas City-Madison	1,233	3,812	10,027	19,830	70	1,006	-	2
Kansas City-Milwaukee	8,213	11,697	26,621	76,985	81	1,156	45	613
Kansas City-Omaha	1,473	405	120,438	248,877	203	4,494	1	4
Kansas City-Springfield IL	502	420	30,914	63,040	16	498	331	1,219
Kansas City-St. Louis	140,935	75,974	307,235	732,879	390	8,655	14,919	42,338
Kansas City-Toledo	1,222	1,292	6,407	14,348	102	1,423	-	4
Kansas City-Twin Cities	87,775	53,549	69,852	150,681	293	3,941	-	20
Lansing-Madison	471	1,222	7,586	16,685	73	2,334	-	-
Lansing-Milwaukee	2,223	2,532	47,272	126,523	104	2,947	34	535
Lansing-Omaha	502	993	3,095	6,742	45	1,404	-	-
Lansing-Springfield IL	45	56	5,398	15,296	4	364	8	64
Lansing-St. Louis	6,113	6,673	17,762	42,685	244	8,388	-	-
Lansing-Toledo	2	3	61,188	157,124	129	6,087	-	2
Lansing-Twin Cities	4,713	8,485	10,957	25,542	243	5,162	-	-
Madison-Milwaukee	67	51	574,414	1,373,962	30	1,062	1,305	5,704
Madison-Omaha	1,678	677	8,278	16,540	49	845	-	-
Madison-Springfield IL	7	79	2,894	25,436	-	145	3	93
Madison-St. Louis	3,647	2,206	39,544	87,125	285	5,421	-	5
Madison-Toledo	329	228	7,538	16,984	95	1,793	-	1
Madison-Twin Cities	5,212	8,708	45,406	148,768	25	825	292	3,672
Milwaukee-Omaha	7,678	5,373	21,765	48,859	161	2,012	-	47
Milwaukee-Springfield IL	358	189	71,909	158,359	81	1,883	27	387
Milwaukee-St. Louis	17,451	13,441	140,289	366,889	432	6,380	303	2,666
Milwaukee-Toledo	870	564	29,523	75,025	522	6,460	-	379
Milwaukee-Twin Cities	46,888	37,439	161,317	384,960	456	4,438	420	3,223
Omaha-Springfield IL	358	58	4,362	8,184	22	563	-	-
Omaha-St. Louis	71,010	24,655	27,611	59,974	189	4,448	-	-
Omaha-Toledo	92	57	3,004	6,762	47	851	-	2
Omaha-Twin Cities	62,879	16,732	61,081	132,788	208	3,423	-	-
Springfield IL-St. Louis	577	436	526,494	1,215,141	305	13,002	2,742	7,494
Springfield IL-Toledo	37	102	2,738	28,689	5	772	5	85
Springfield IL-Twin Cities	2,315	468	12,146	24,330	49	1,029	-	121
St. Louis-Toledo	912	6,333	1,653	76,218	15	2,969	1	51
St. Louis-Twin Cities	120,110	40,115	51,703	121,161	3,299	5,490	-	106
Toledo-Twin Cities	2,390	1,646	10,646	25,653	356	4,336	-	15

Exhibit 4-16
2000 Base Year Market Share by Mode

City Pair	Air		Auto		Bus		Rail	
	Business	*Non-Business*	*Business*	*Non-Business*	*Business*	*Non-Business*	*Business*	*Non-Business*
Chicago-Cincinnati	21.3%	8.7%	78.1%	89.7%	0.3%	1.1%	0.3%	0.6%
Chicago-Cleveland	38.1%	14.0%	61.3%	83.8%	0.4%	1.7%	0.2%	0.5%
Chicago-Des Moines	13.8%	4.5%	85.4%	93.7%	0.3%	1.2%	0.5%	0.7%
Chicago-Detroit	23.4%	6.8%	75.5%	90.5%	0.3%	0.9%	0.9%	1.7%
Chicago-Indianapolis	8.2%	1.9%	91.3%	96.5%	0.3%	1.1%	0.2%	0.5%
Chicago-Kalamazoo	1.1%	0.2%	96.9%	95.3%	0.2%	1.1%	1.8%	3.3%
Chicago-Kansas City	58.1%	32.8%	40.8%	65.6%	0.1%	0.7%	1.0%	0.9%
Chicago-Lansing	7.3%	2.4%	92.4%	95.6%	0.2%	1.4%	0.2%	0.5%
Chicago-Madison	1.5%	0.8%	97.7%	96.6%	0.1%	0.5%	0.7%	2.2%
Chicago-Milwaukee	0.4%	0.1%	98.8%	98.5%	0.3%	0.9%	0.5%	0.5%
Chicago-Omaha	50.6%	25.8%	48.4%	71.2%	0.3%	1.3%	0.7%	1.7%
Chicago-Springfield IL	0.7%	0.2%	92.6%	95.0%	0.1%	0.7%	6.6%	4.1%
Chicago-St. Louis	32.8%	8.2%	63.1%	88.0%	0.2%	1.2%	3.9%	2.6%
Chicago-Toledo	9.9%	3.7%	89.1%	93.4%	0.2%	1.2%	0.8%	1.7%
Chicago-Twin Cities	50.8%	19.3%	47.5%	75.2%	0.3%	1.3%	1.5%	4.3%
Cincinnati-Cleveland	35.9%	9.8%	63.1%	86.8%	0.8%	3.1%	0.2%	0.3%
Cincinnati-Des Moines	22.8%	6.9%	76.6%	87.5%	0.6%	5.6%	0.0%	0.0%
Cincinnati-Detroit	9.6%	2.3%	89.7%	94.6%	0.7%	3.1%	0.0%	0.0%
Cincinnati-Indianapolis	0.2%	0.1%	99.7%	99.4%	0.1%	0.5%	0.0%	0.0%
Cincinnati-Kalamazoo	2.4%	0.6%	96.9%	94.5%	0.7%	4.9%	0.0%	0.0%
Cincinnati-Kansas City	50.1%	30.6%	48.9%	62.7%	1.0%	6.7%	0.0%	0.0%
Cincinnati-Lansing	1.4%	1.2%	98.0%	91.7%	0.6%	7.1%	0.0%	0.0%
Cincinnati-Madison	15.6%	3.4%	82.9%	87.4%	1.5%	9.2%	0.0%	0.0%
Cincinnati-Milwaukee	30.5%	10.4%	69.2%	88.1%	0.3%	1.4%	0.1%	0.1%
Cincinnati-Omaha	37.3%	13.5%	62.0%	80.3%	0.7%	6.1%	0.0%	0.0%
Cincinnati-Springfield IL	0.6%	0.3%	99.3%	98.8%	0.1%	0.9%	0.0%	0.1%
Cincinnati-St. Louis	12.4%	6.1%	87.2%	92.2%	0.4%	1.7%	0.0%	0.0%
Cincinnati-Toledo	0.2%	0.1%	99.3%	96.5%	0.5%	3.4%	0.0%	0.0%
Cincinnati-Twin Cities	70.3%	39.7%	29.2%	55.4%	0.5%	4.9%	0.0%	0.0%
Cleveland-Des Moines	23.5%	13.3%	75.2%	79.2%	1.3%	7.5%	0.0%	0.0%
Cleveland-Detroit	4.5%	0.8%	94.6%	96.4%	0.9%	2.8%	0.0%	0.0%
Cleveland-Indianapolis	20.5%	5.8%	78.8%	91.6%	0.7%	2.6%	0.0%	0.0%
Cleveland-Kalamazoo	3.0%	0.9%	96.2%	94.9%	0.7%	4.1%	0.0%	0.0%
Cleveland-Kansas City	78.0%	39.9%	21.5%	55.0%	0.5%	5.0%	0.0%	0.0%
Cleveland-Lansing	2.3%	1.2%	97.2%	94.2%	0.5%	4.6%	0.0%	0.0%
Cleveland-Madison	17.1%	6.3%	81.2%	85.0%	1.8%	8.7%	0.0%	0.0%
Cleveland-Milwaukee	20.9%	8.2%	78.5%	88.9%	0.5%	2.7%	0.1%	0.3%
Cleveland-Omaha	62.5%	3.4%	36.6%	87.2%	0.9%	9.4%	0.0%	0.0%
Cleveland-Springfield IL	6.5%	0.8%	92.8%	93.9%	0.6%	5.1%	0.0%	0.1%
Cleveland-St. Louis	68.3%	26.0%	31.0%	67.4%	0.7%	6.6%	0.0%	0.0%
Cleveland-Toledo	0.2%	0.0%	99.7%	99.3%	0.1%	0.6%	0.0%	0.0%
Cleveland-Twin Cities	68.9%	31.4%	29.6%	59.9%	1.5%	8.6%	0.0%	0.0%
Des Moines-Detroit	18.9%	14.7%	80.1%	79.0%	1.0%	6.3%	0.0%	0.0%
Des Moines-Indianapolis	32.6%	7.6%	67.0%	89.0%	0.4%	3.3%	0.0%	0.0%
Des Moines-Kalamazoo	14.9%	1.3%	84.5%	90.5%	0.6%	8.1%	0.0%	0.0%
Cleveland-Detroit	4.5%	0.8%	94.6%	96.4%	0.9%	2.8%	0.0%	0.0%
Cleveland-Indianapolis	20.5%	5.8%	78.8%	91.6%	0.7%	2.6%	0.0%	0.0%
Des Moines-Kansas City	15.1%	2.7%	84.7%	94.9%	0.2%	2.4%	0.0%	0.0%
Des Moines-Lansing	8.8%	7.1%	90.2%	78.8%	0.9%	14.1%	0.0%	0.0%
Des Moines-Madison	7.1%	0.9%	92.6%	96.1%	0.3%	3.0%	0.0%	0.0%
Des Moines-Milwaukee	0.3%	0.6%	99.2%	97.6%	0.3%	1.7%	0.2%	0.2%
Des Moines-Omaha	0.0%	0.0%	99.9%	98.6%	0.1%	1.4%	0.0%	0.0%
Des Moines-Springfield IL	0.6%	0.1%	99.4%	97.8%	0.0%	1.9%	0.0%	0.2%
Des Moines-St. Louis	37.8%	8.4%	62.1%	88.4%	0.2%	3.2%	0.0%	0.0%
Des Moines-Toledo	4.7%	2.5%	94.3%	88.2%	1.1%	9.3%	0.0%	0.0%
Des Moines-Twin Cities	23.5%	4.0%	76.4%	94.6%	0.1%	1.4%	0.0%	0.0%
Detroit-Indianapolis	28.0%	9.5%	71.6%	88.4%	0.4%	2.1%	0.0%	0.0%
Detroit-Kalamazoo	0.5%	0.1%	99.3%	98.5%	0.1%	1.0%	0.1%	0.3%
Detroit-Kansas City	66.6%	47.6%	32.8%	49.0%	0.6%	3.4%	0.0%	0.0%
Detroit-Lansing	0.2%	0.1%	99.8%	99.7%	0.0%	0.1%	0.0%	0.1%
Detroit-Madison	27.8%	11.8%	71.3%	82.4%	0.9%	5.7%	0.0%	0.0%

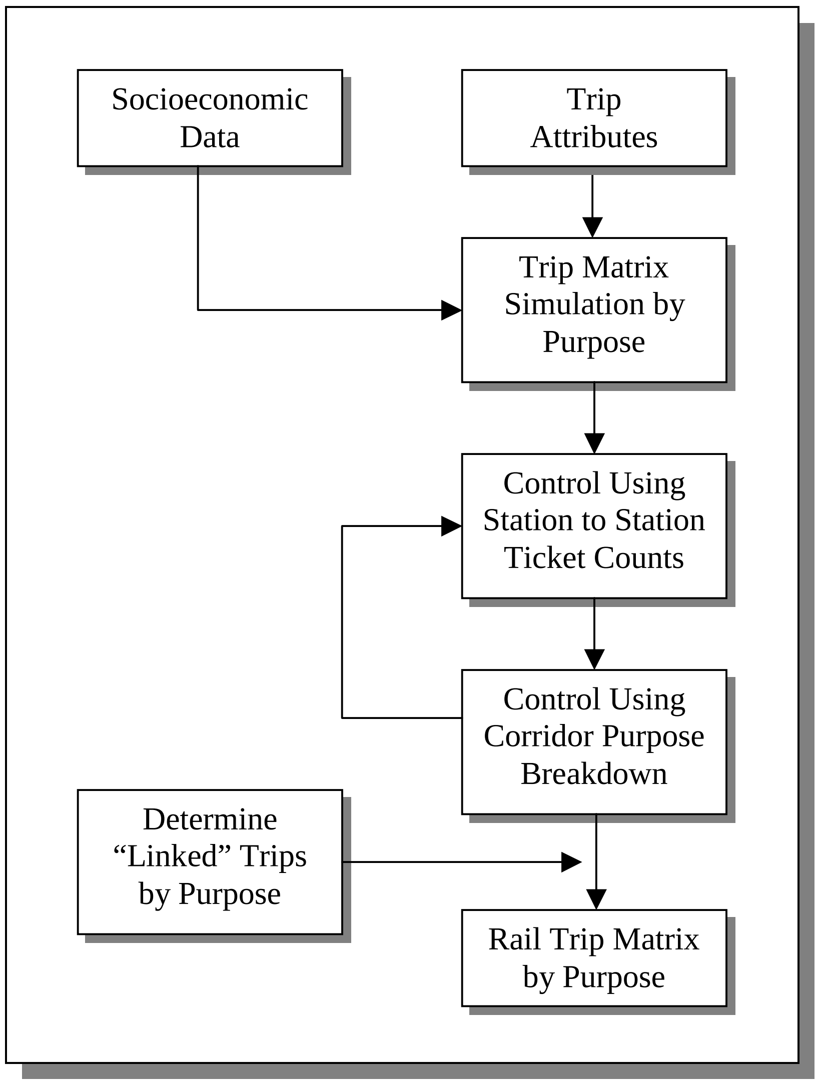
Exhibit 4-16 (Continued)
2000 Base Year Market Share by Mode

City Pair	Air		Auto		Bus		Rail	
	Business	Non-Business	Business	Non-Business	Business	Non-Business	Business	Non-Business
Detroit-Milwaukee	15.0%	6.3%	84.5%	91.5%	0.4%	1.6%	0.1%	0.6%
Detroit-Omaha	52.5%	22.7%	46.6%	70.5%	0.8%	6.7%	0.0%	0.1%
Detroit-Springfield IL	2.4%	0.8%	97.2%	96.7%	0.3%	2.2%	0.1%	0.3%
Detroit-St. Louis	46.4%	18.8%	53.1%	78.5%	0.4%	2.7%	0.0%	0.1%
Detroit-Toledo	0.0%	0.0%	99.8%	99.3%	0.2%	0.6%	0.0%	0.0%
Detroit-Twin Cities	72.2%	34.2%	26.9%	59.5%	0.9%	6.3%	0.0%	0.0%
Indianapolis-Kalamazoo	1.1%	0.3%	98.4%	95.5%	0.5%	4.2%	0.0%	0.0%
Indianapolis-Kansas City	20.7%	19.1%	79.1%	79.9%	0.1%	0.9%	0.0%	0.1%
Indianapolis-Lansing	4.6%	3.2%	95.0%	92.5%	0.4%	4.3%	0.0%	0.0%
Indianapolis-Madison	14.3%	1.4%	84.7%	92.0%	1.0%	6.6%	0.0%	0.0%
Indianapolis-Milwaukee	1.0%	0.3%	98.4%	97.9%	0.5%	1.8%	0.0%	0.0%
Indianapolis-Omaha	56.7%	16.3%	42.9%	79.8%	0.3%	3.8%	0.0%	0.0%
Indianapolis-Springfield IL	0.1%	0.0%	99.9%	99.3%	0.1%	0.6%	0.0%	0.0%
Indianapolis-St. Louis	9.6%	2.6%	90.2%	96.0%	0.2%	1.3%	0.0%	0.0%
Indianapolis-Toledo	0.3%	0.5%	99.2%	96.7%	0.5%	2.8%	0.0%	0.0%
Indianapolis-Twin Cities	59.2%	29.5%	40.3%	66.6%	0.5%	4.0%	0.0%	0.0%
Kalamazoo-Kansas City	17.2%	3.9%	81.9%	88.3%	0.8%	7.8%	0.0%	0.0%
Kalamazoo-Lansing	0.1%	0.0%	99.8%	98.0%	0.1%	1.9%	0.0%	0.1%
Kalamazoo-Madison	0.2%	0.3%	99.6%	99.3%	0.0%	0.0%	0.1%	0.5%
Kalamazoo-Milwaukee	0.3%	0.2%	99.3%	96.9%	0.3%	2.7%	0.0%	0.2%
Kalamazoo-Omaha	35.3%	5.1%	64.0%	84.9%	0.7%	9.8%	0.0%	0.2%
Kalamazoo-Springfield IL	0.4%	0.1%	99.3%	96.6%	0.1%	2.9%	0.1%	0.5%
Kalamazoo-St. Louis	1.7%	0.5%	97.8%	94.4%	0.5%	5.0%	0.0%	0.1%
Kalamazoo-Toledo	0.6%	0.1%	99.2%	99.4%	0.0%	0.5%	0.1%	0.1%
Kalamazoo-Twin Cities	34.8%	15.9%	63.8%	72.9%	1.4%	11.2%	0.0%	0.0%
Kansas City-Lansing	22.0%	10.5%	76.9%	77.9%	1.1%	11.6%	0.0%	0.0%
Kansas City-Madison	10.9%	15.5%	88.5%	80.4%	0.6%	4.1%	0.0%	0.0%
Kansas City-Milwaukee	23.5%	12.9%	76.1%	85.1%	0.2%	1.3%	0.1%	0.7%
Kansas City-Omaha	1.2%	0.2%	98.6%	98.1%	0.2%	1.8%	0.0%	0.0%
Kansas City-Springfield IL	1.6%	0.6%	97.3%	96.7%	0.1%	0.8%	1.0%	1.9%
Kansas City-St. Louis	30.4%	8.8%	66.3%	85.2%	0.1%	1.0%	3.2%	4.9%
Kansas City-Toledo	15.8%	7.6%	82.9%	84.1%	1.3%	8.3%	0.0%	0.0%
Kansas City-Twin Cities	55.6%	25.7%	44.2%	72.4%	0.2%	1.9%	0.0%	0.0%
Lansing-Madison	5.8%	6.0%	93.3%	82.4%	0.9%	11.5%	0.0%	0.0%
Lansing-Milwaukee	4.5%	1.9%	95.2%	95.5%	0.2%	2.2%	0.1%	0.4%
Lansing-Omaha	13.8%	10.9%	85.0%	73.8%	1.2%	15.4%	0.0%	0.0%
Lansing-Springfield IL	0.8%	0.4%	99.0%	96.9%	0.1%	2.3%	0.1%	0.4%
Lansing-St. Louis	25.3%	11.6%	73.6%	73.9%	1.0%	14.5%	0.0%	0.0%
Lansing-Toledo	0.0%	0.0%	99.8%	96.3%	0.2%	3.7%	0.0%	0.0%
Lansing-Twin Cities	29.6%	21.7%	68.9%	65.2%	1.5%	13.2%	0.0%	0.0%
Madison-Milwaukee	0.0%	0.0%	99.8%	99.5%	0.0%	0.1%	0.2%	0.4%
Madison-Omaha	16.8%	3.8%	82.7%	91.6%	0.5%	4.7%	0.0%	0.0%
Madison-Springfield IL	0.2%	0.3%	99.7%	98.8%	0.0%	0.6%	0.1%	0.4%
Madison-St. Louis	8.4%	2.3%	91.0%	91.9%	0.7%	5.7%	0.0%	0.0%
Madison-Toledo	4.1%	1.2%	94.7%	89.4%	1.2%	9.4%	0.0%	0.0%
Madison-Twin Cities	10.2%	5.4%	89.1%	91.8%	0.0%	0.5%	0.6%	2.3%
Milwaukee-Omaha	25.9%	9.5%	73.5%	86.8%	0.5%	3.6%	0.0%	0.1%
Milwaukee-Springfield IL	0.5%	0.1%	99.4%	98.5%	0.1%	1.2%	0.0%	0.2%
Milwaukee-St. Louis	11.0%	3.5%	88.5%	94.2%	0.3%	1.6%	0.2%	0.7%
Milwaukee-Toledo	2.8%	0.7%	95.5%	91.0%	1.7%	7.8%	0.0%	0.5%
Milwaukee-Twin Cities	22.4%	8.7%	77.2%	89.5%	0.2%	1.0%	0.2%	0.7%
Omaha-Springfield IL	7.5%	0.7%	92.0%	93.0%	0.5%	6.4%	0.0%	0.0%
Omaha-St. Louis	71.9%	27.7%	27.9%	67.3%	0.2%	5.0%	0.0%	0.0%
Omaha-Toledo	2.9%	0.7%	95.6%	88.1%	1.5%	11.1%	0.0%	0.0%
Omaha-Twin Cities	50.6%	10.9%	49.2%	86.8%	0.2%	2.2%	0.0%	0.0%
Springfield IL-St. Louis	0.1%	0.0%	99.3%	98.3%	0.1%	1.1%	0.5%	0.6%
Springfield IL-Toledo	1.3%	0.3%	98.3%	96.8%	0.2%	2.6%	0.2%	0.3%
Springfield-Twin Cities	16.0%	1.8%	83.7%	93.8%	0.3%	4.0%	0.0%	0.5%
St. Louis-Toledo	35.3%	7.4%	64.0%	89.1%	0.6%	3.5%	0.0%	0.1%
St. Louis-Twin Cities	68.6%	24.0%	29.5%	72.6%	1.9%	3.3%	0.0%	0.1%
Toledo-Twin Cities	17.8%	5.2%	79.5%	81.1%	2.7%	13.7%	0.0%	0.0%

Data Validation Process

Data, particularly data from disparate sources that are collected for a multitude of purposes, cannot simply be treated as equal units and summed, multiplied or divided. Data must be *cleaned up* and compared with actual counts, or surrogates of counts. Exhibit 4-17 depicts the steps that were undertaken to generate rail mode trips between each city pair.

Exhibit 4-17
Rail Trip Matrix Generation and Validation



Similar processes were used for other modes, chiefly differing in the source of the control totals. Air travel control totals are based on the *airline ten percent sample* data provided by the Federal Aviation Administration (FAA). Control totals for highways are based on each state's highway model origin-destination matrix and on highway traffic volumes. Bus control totals are based on station pair data provided by Greyhound.

4.5 System Zones

A 385-zone system was developed to represent the Midwest region using the data collected for each zone, integrating the information from the following sources:

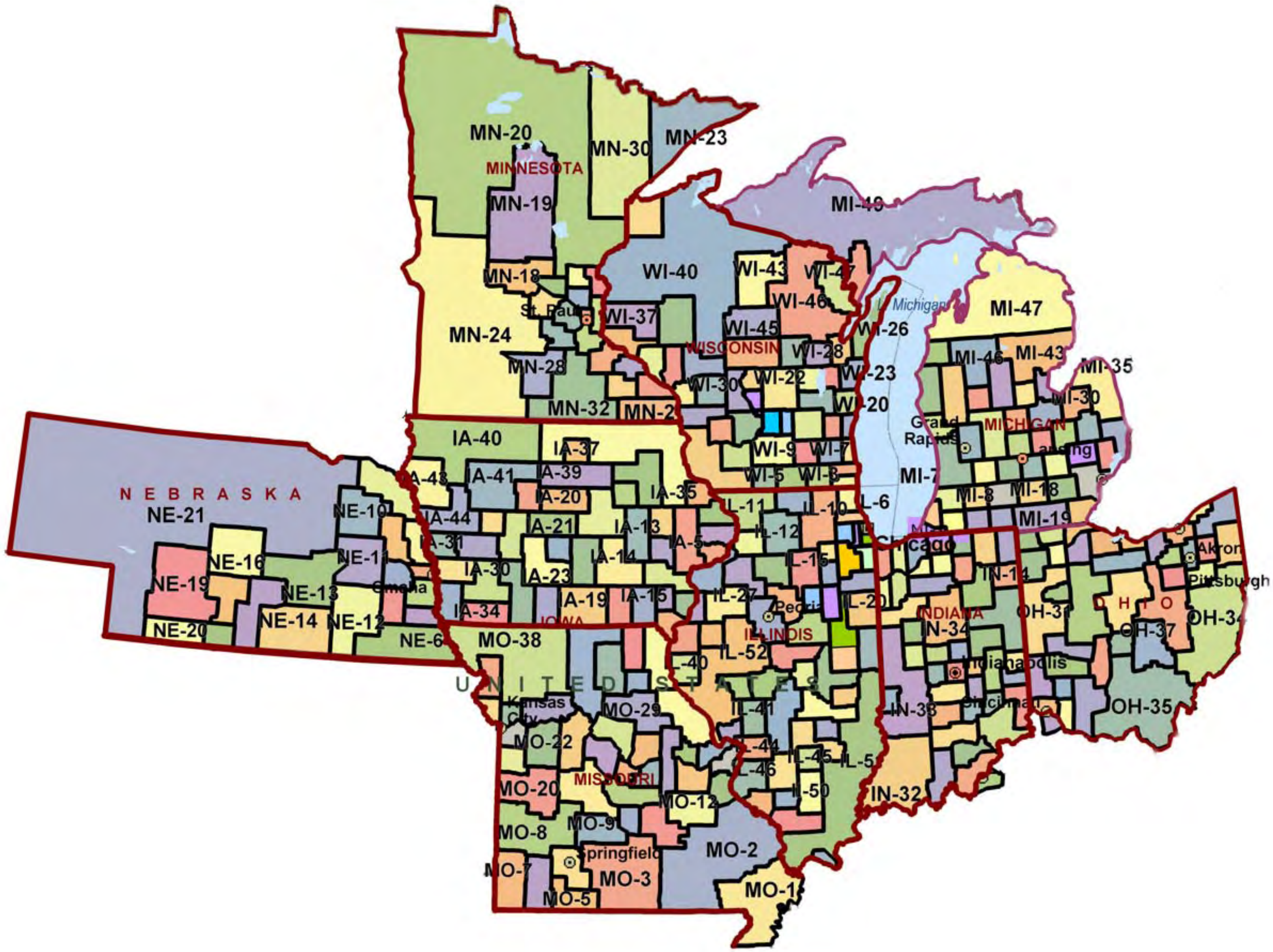
- U.S. Census Bureau and Woods & Poole socioeconomic data on population, employment and income
- Network data on all existing travel modes (auto, air, rail, bus)
- Traveler origin and destination data by mode and trip purpose
- Attitudinal data on the preferences and priorities of travelers

An early step in the development of the forecasting tool for modeling public responses to various levels of service, costs and amenities was the establishment of a zone system that would give a reasonable representation of travel between the origins and destinations in the region. The zone system used is mostly county-based, with urban areas subdivided (Exhibits 4-18 and 4-19). Individual state zone maps may be found in Appendix A3. County-based zones provide compatibility with the socioeconomic baseline and forecast data (discussed below) that are derived from the U.S. Census Bureau and Woods & Poole data and are county-based. Zones are defined relative to the rail network, such that small zones are defined for areas close to stations and larger zones for areas farther away. Network links are defined from the centroid of each zone to the nearest MWRRS station representing the cost of system access/egress. Airport-specific zones are introduced to aid in the measurement of MWRRS use for airport access.

Exhibit 4-18
Number of Zones by State

States	***Number of Zones***		
	Statewide Zones	***Airport Zones***	***Total***
Illinois	57	5	62
Indiana	43	2	45
Iowa	42	2	44
Michigan	48	1	49
Minnesota	23	1	24
Missouri	45	2	47
Nebraska	21	1	22
Ohio	36	3	39
Wisconsin	47	2	49
Other	4	-	4
Total	**366**	**19**	**385**

Exhibit 4-19
Zone System Map



The following table shows the number of zones allocated for the major cities to be served by the MWRRS (Exhibit 4-20). Large cities have more zones because of the impact of station accessibility on ridership and revenue.

Exhibit 4-20
Number of Zones by Major City

City	*State*	*Number of Zones*
Chicago	Illinois	8
Cincinnati	Ohio	3
Cleveland	Ohio	3
Columbus	Ohio	2
Des Moines	Iowa	2
Detroit	Michigan	5
Indianapolis	Indiana	4
Kalamazoo	Michigan	1
Kansas City	Missouri	6
Lansing	Michigan	2
Madison	Wisconsin	2
Milwaukee	Wisconsin	4
Omaha	Nebraska	4
Springfield	Illinois	2
St. Louis	Illinois	2
St. Louis	Missouri	4
Toledo	Ohio	2
Twin Cities	Minnesota	6

4.6 Network Attributes

The variables modeled for the MWRRI are shown in Exhibit 4-21. For all four modes of intercity travel (air, auto, bus, and rail), the data for the base year have been assembled into *COMPASS*© databases. The assumptions on the changes in the modes from the base year conditions determine the modal shifts in travel patterns.

Exhibit 4-21
Modal Attributes Used in the *COMPASS*© Demand Model

	Public Modes	*Auto*
Time	• In-vehicle time • Access/egress times • Number of interchanges • Connection wait times	• Travel time
Cost	• Fare • Access/egress costs	• Operating cost • Tolls • Parking (all divided by occupancy)
Reliability	• On-time performance	
Schedule	• Frequency of service • Convenience of times	

4.7 Market Analysis and Forecasting

This data collection effort provided the underlying basis for MWRRS market analysis and demand revenue forecasts. The following sections present the findings on the current travel market in the Midwest region under study.

4.7.1 Background – The Midwest Region

The agricultural and industrial heartland of the U.S., the Midwest region experienced rapid growth in the late 1800s and early 1900s, as it became the nation's center for heavy manufacturing. In recent years, the region's manufacturing base has been supplemented and, in some cases, supplanted by a growing and highly diverse service industry. Smaller urban and rural areas are very dependent upon effective transportation connections, more so than the large urban areas with their extensive transit networks. Their connectivity with the larger metropolitan areas is critical to the region's continued economic growth.

The MWRRS encompasses a rail network of more than 3,000 route miles and serves a nine-state population of nearly 60 million[9]. More than 80 percent of the region's population lives within a one-hour drive of either an MWRRS rail station or feeder bus connection. Various socioeconomic trends will impact the current travel market, the longer-term travel market and the target markets for passenger rail in the Midwest region.

Socioeconomic Trends

The projections for long-term growth in intercity travel were based on an analysis of socioeconomic trends. As shown in Exhibits 4.22 through 4.24 that are based on Woods & Poole data, annual growth rates for population, employment and per capita income are uniform for all of the nine states and are projected to grow almost linearly over the next thirty years. Average annual growth rates are 0.6 percent for population, 0.5 percent for employment and nearly 0.9

[9] Figure from 2000 U.S. Census for the 9-state region

percent for per capita income. The net effect of this growth will be to expand the market for intercity travel in the region by 13 percent between 2010 and 2020 and an additional 28 percent by 2040.

Exhibit 4-22
Population Trends

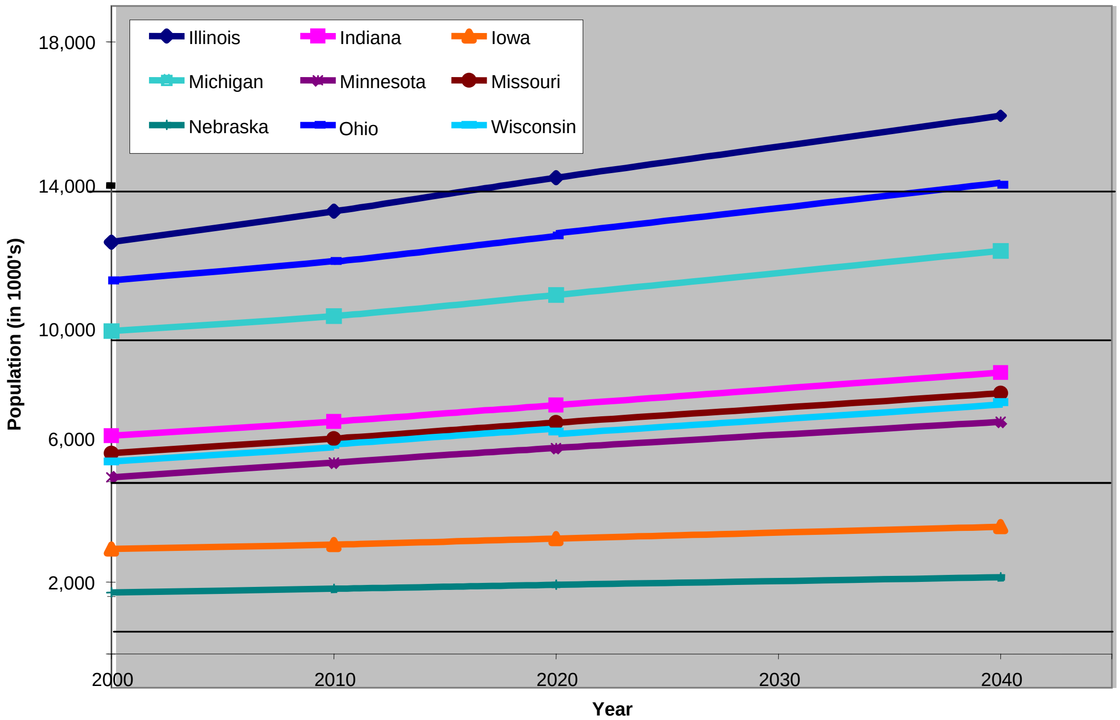


Exhibit 4-23
Employment Trends

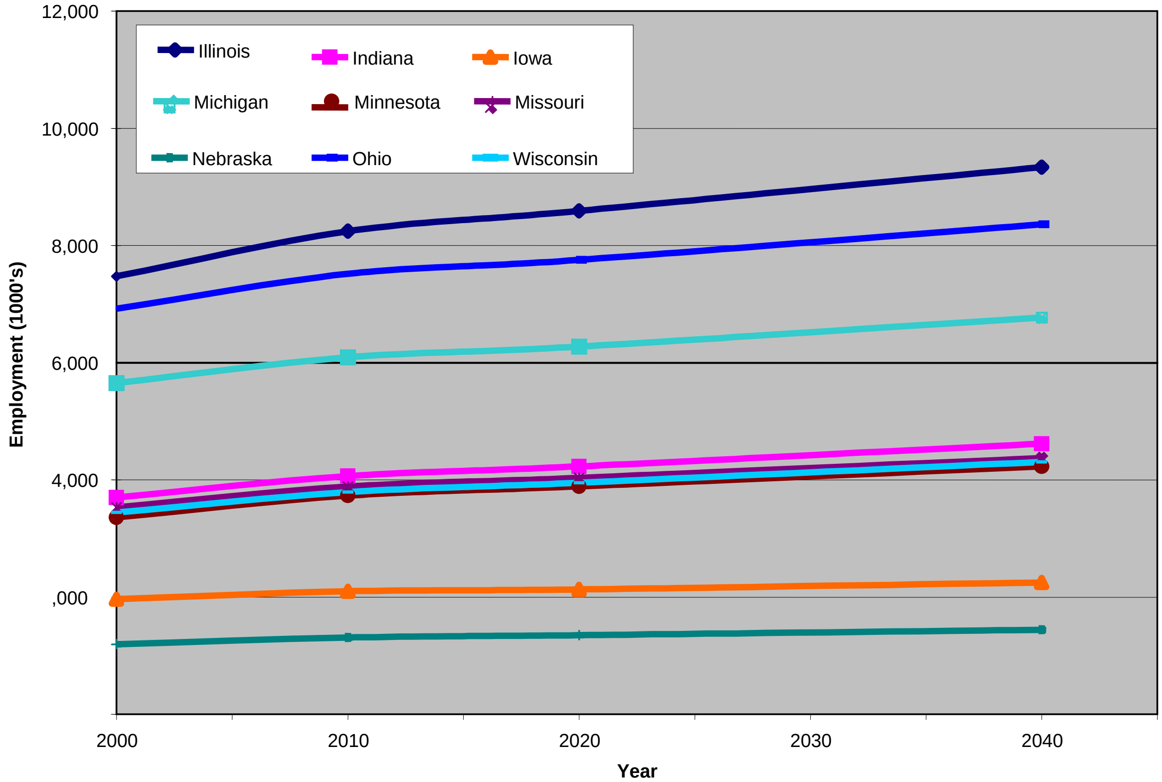
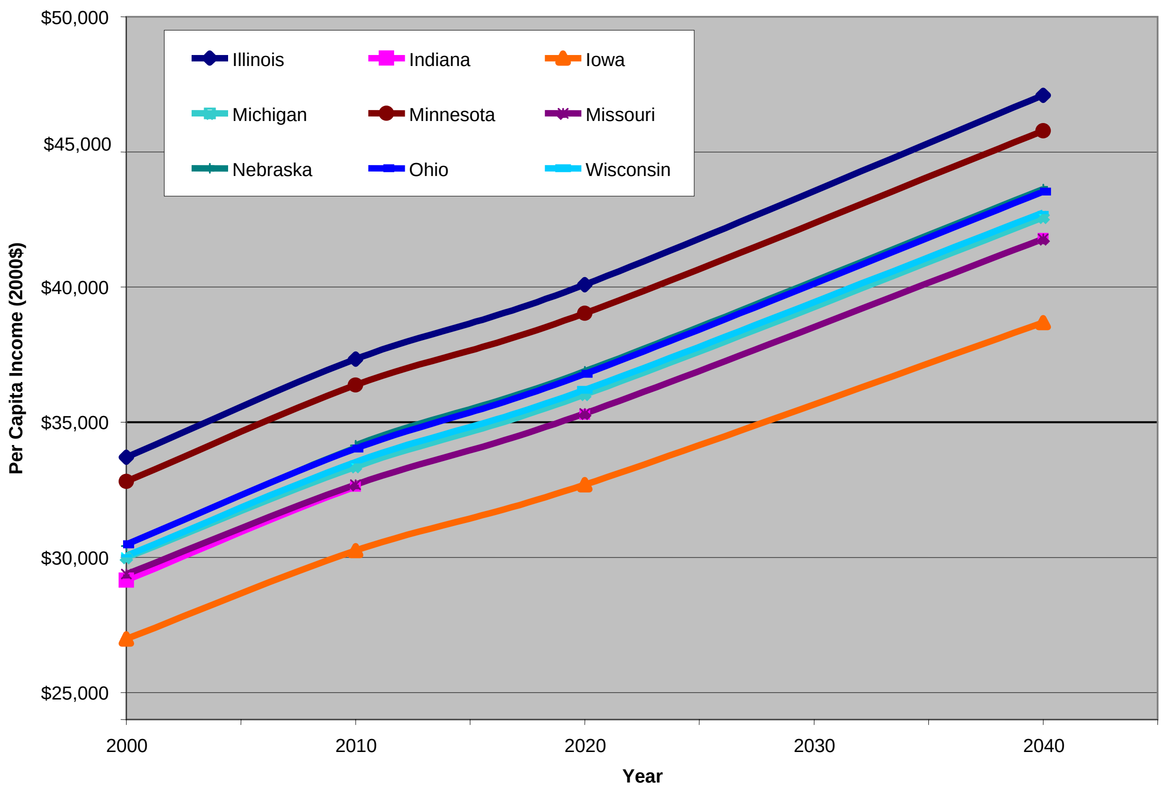


Exhibit 4-24
Per Capita Income Trends



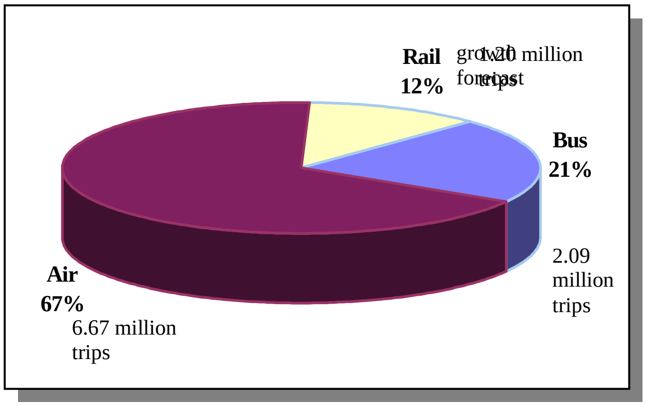
4.7.2 Midwest Region Travel Market Characteristics

The travel market can be characterized by travel mode and trip purpose. A discussion of each follows.

Travel Modes and Modal Share

Of the 2000 base year 498 million trips within the Midwest region, 98 percent are made by auto; 1.3 percent by air; 0.4 percent by bus and 0.3 percent by rail. The auto trips include a large number of relatively short trips (100 to 150 miles), while the public modes generally include longer trip lengths, typically 150 to 250 miles for bus and rail and 250 to 500 miles for air. In other words, while the market share of the public modes is small (2.0 percent for air, rail and bus), the public modes have a larger share of the total vehicle or passenger miles, and therefore account for a much larger proportion of the miles traveled. Of the public modes, of the existing market, 67 percent of the trips are made by air, 21 percent by bus and 12 percent by rail (Exhibit 4-25).

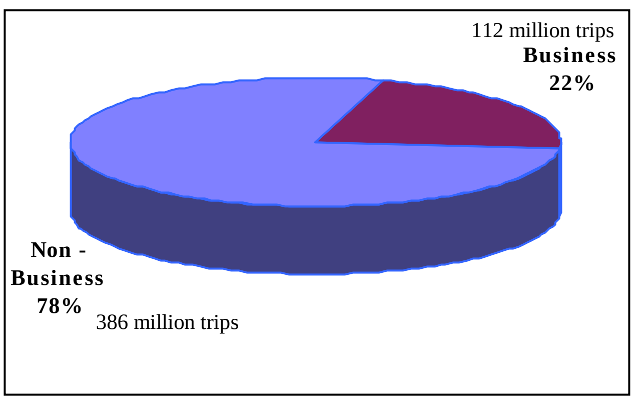
Exhibit 4-25
Intercity Public Mode Market Shares for the Base Year



Trip Purpose

Trip purposes are segmented into business (non-commuter) and non-business (leisure/commuter). Exhibit 4-26 illustrates the breakdown by trip purpose of the current travel market in the Midwest region for the base year. Of the 498 million intercity trips in the region, approximately 22 percent or 112 million are for business travel; and 78 percent or 386 million are for commuter and leisure travel. Air modal shares are for intercity trips only within the study network. For example, a Chicago-Cleveland air trip would be counted in this total, but a Chicago-New York trip would not be. Exhibits 4-25 and 4-26 do not add up to the same values, since 4-25 gives travel only by public transport modes; whereas 4-26 gives travel by *all* modes.

Exhibit 4-26
Intercity Travel Market by Trip Purpose



Leisure/Commuter Travel Market

The Midwest region abounds with tourist attractions, so the market for leisure travel is very large. Because trip length for leisure travel is often long and highway congestion can add significantly to travel time, travel by rail would be an attractive alternative. In addition, trains offer a unique travel experience with special appeal to families with children. Special fares and promotions should be utilized to attract this market sector.

Two other potentially important markets for the MWRRI are students and senior citizens. These target populations often do not own, or have only limited access to, an auto and they typically have schedules that are more flexible. Discount ticketing and special promotions can – and should – be used to encourage them to use the train during off-peak hours.

Business Travel Market
The MWRRS will be a strong contender with the airlines for the business travel market, which accounts for approximately 22 percent of all intercity trips. For business travelers, travel time, frequency of service and reliability are the primary factors that determine choice of mode. Passenger rail systems offer a high degree of reliability (because congestion and severe weather conditions rarely cause delays), and minimal waiting time at stations. In addition, trains typically provide a comfortable and work-friendly environment with economical fares.

4.7.3 Target Market Segments

The MWRRS market can be segmented into base passenger rail service and air connect service. Both of these markets contribute to the overall, long-term viability of a quality, passenger rail service. A brief description of each is presented below.

Base-level Passenger Market
The socioeconomic characteristics of the Midwest region, combined with increased traffic congestion and travel times, support the development of quality, passenger rail as a competitive alternative to air and auto travel over the medium-distance travel range. The initial MWRRI survey focused on passenger rail service in four corridors (Chicago-Detroit, Chicago-Milwaukee, Chicago-St. Louis and St. Louis-Kansas City). An initial assumption was made that travelers in the smaller, surrounding markets would exhibit the same characteristics as travelers in these larger markets. Subsequently, studies identified the characteristics of lower density routes and special population groups (*e.g.*, students, government employees, routes without current rail service). Stated preference surveys were conducted in Carbondale, Grand Rapids and Green Bay and targeted specific markets to determine whether *branch line* patrons would have different travel characteristics and preferences than *main line* patrons. Government employees in Missouri were also surveyed to identify the potential impact of encouraging or requiring them to use passenger rail for trips between St. Louis, Jefferson City and Kansas City. The results of these surveys were used to develop a branch line demand model, which complemented the established main line model, and provided a finer level of market segmentation. In general, since smaller branch line cities often lack competitive air service, they have a stronger per-capita utilization of rail than major urban centers. The finer level of market segmentation provided stronger and more reliable demand projections.

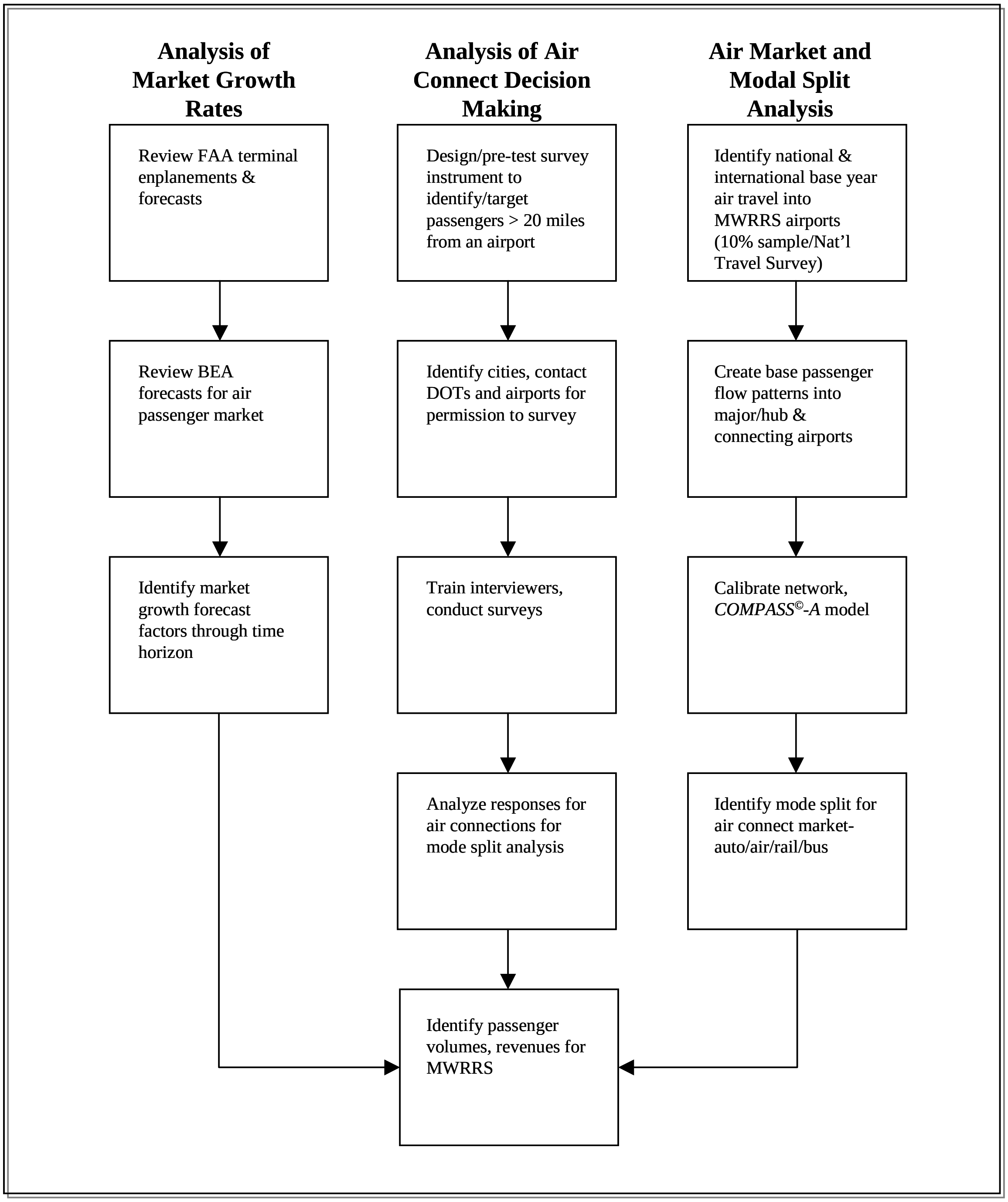
Air Connect Market
This market represents demand that results from the proximity of airports to rail stations and the convenience of multimodal transit. This is a relatively small market, and one that is particularly useful for those traveling to an airport for a trip outside the Midwest region. The initial study focused on travel within the Midwest region, currently served by intercity train, auto or plane. Since many of the current and proposed rail lines operate in close proximity to airports, providing an effective intermodal connection could increase MWRRS revenues at little or no

incremental cost. In this study, to help forecast air-connect ridership and revenue, airport-specific zones were created. An air connection was not modeled at Indianapolis.

The analysis methodology for the air connect market is presented in Exhibit 4-27.

Stated preference data used for this analysis was obtained from surveys conducted in St. Louis, Cleveland and Madison focusing on mode of access to the airports. Regional air traffic patterns and connections between the rail stations and airports were analyzed. The catchment area for an airport can extend 50 to 100 miles or more depending on population density, size of the airport, and frequency and cost of flights. It was found that the MWRRS could attract a portion of these trips, if it offers easy intermodal connections. Since travelers are already accustomed to satellite parking lots and shuttles to rental cars, the MWRRS could offer a competitive service in many communities, one that would pick travelers up at the terminal and transport them to a station close to their home or business.

Exhibit 4-27
Air Connect Analysis Methodology



Feeder Bus Integration Plan

Introduction

An MWRRI Feeder Bus network has been defined for providing connectivity and enhancing mobility in some of the smaller cities, at which MWRRI train service cannot be made directly available. An in-depth bus integration analysis was undertaken in the earlier MWRRI study that was conducted in 2000. The survey work undertaken as part of the 2000 Plan examined the unique travel characteristics and preferences of potential feeder bus routes and stations. Additionally, Greyhound Lines, Inc. was a study partner during the 2000 Plan, and as such, provided inputs on the entire integration plan. More specifically, Greyhound provided inputs on bus operating costs, fare levels and possible operating strategies. The analysis performed used an iterative process to optimize the relationship between the benefit of the feeder bus system and its operating costs. The full feeder bus system is shown in Exhibit 3-1.

Potential Benefits of Bus Integration

One of the fundamental assumptions in the early design of the MWRRS was that there would be a feeder bus network to facilitate access to stations, and its schedules would coordinate with the passenger rail schedules to provide essentially *seamless* travel throughout the Midwest region. Coordinated feeder bus services could introduce the MWRRS to new cities and markets. There are many markets within the region that would generate ridership and revenue for the MWRRS, but are not connected to the MWRRS network.

Rail stations will have intermodal connections providing easy access for travelers who are unable or prefer not to drive to stations. The feeder bus operation would be privately owned and operated, and operating hours and schedules would be coordinated with train schedules to maximize the system's utility and minimize transfer times. Taxis, rental cars and limousine services will also be available at all major MWRRS stations.

MWRRS Bus System Design

The buses used in the integration plan are intended to be co-branded with the MWRRS identity, livery, ticketing and standards. Additionally, the bus stations will offer through ticketing under the MWRRS network brand. Buses would operate to and from MWRRS rail terminals. Lastly, feeder bus passengers would be guaranteed a rail connection. The feeder bus fare is set at 12.5 cents per bus mile. The bus fares are set lower than rail rates, and lower than the charges applied to many auto travelers to entice people to use the feeder bus system and the associated rail network..

The design of the feeder bus network was based on past studies and recommendations from the nine participating states and Greyhound. The system of feeder bus routes that was included in the MWRRS Business Plan is shown in Technical Appendix A2. Exhibit 4-28 provides details on the routes including a description of the route, the frequency of service offered, the route lengths and travel time. Routes shown in red were originally proposed by the MWRRS states, but failed the MWRRS profitability criteria and were subsequently dropped from the network. Likewise, bus routes and frequencies in Exhibit 4-28 have been optimized for the rail network. However, the scope of our effort has been to develop a *rail* feeder bus network that could operate profitably, not to develop a statewide bus strategy for each of the MWRRS states.

If buses can generate enough local traffic, it is quite possible that the "outside of MWRRI" bus routes will be able to operate profitably. For example, Van Galder today operates a very successful bus service from Madison, WI, via Rockford and O'Hare airport to Chicago. In the Greyhound Analysis, it was assumed that such services would continue to operate independently of the MWRRI. As a result, it is not anticipated that MWRRS will assume financial responsibility for providing this bus service. Although Van Galder may continue to bring passenger train riders, the MWRRS business plan simply assumes that this service will continue to operate independently. Hence, the Madison-Rockford-Chicago bus system is shown in Appendix A2 as "outside of MWRRI."

It is quite possible that many of the links shown as "outside of MWRRI" can be justified as stand alone bus operations, however, our analysis showed that they generate insufficient MWRRS feeder traffic to be sustained and supported by the rail system alone. However, detailed state assessment of short-haul bus route potential is beyond the scope of our current study, which focuses more on forecasting longer-haul rail trips.

Bus frequencies were adjusted based on the projected level of demand, to produce a reasonable load factor. In general buses were not scheduled to meet every train, but only those morning and evening trains having peak demand. A minimum frequency would be one round trip per day, where a bus meets the first inbound train in the morning and last outbound train at night. It was seldom the case that a bus could be scheduled to meet every train.

Exhibit 4-28
Feeder Bus System Detail

Corridor	*From/To*	*To/From*	*Dist. mile*	*Time min.*	*Speed mph*	*Freq (rt/wk)*	*Annual Bus Miles*	*Corridor Subtotal*	*Percentage*
CA	CHARLESTON (BUS-IL)	MATTOON (IL)	11	25	26	7	8008		
CA	DANVILLE (BUS-IL)	CHAMPAIGN-URBANA (IL)	36	52	41	7	26208		
CA	DECATUR (BUS-IL)	CHAMPAIGN-URBANA (IL)	46	63	44	7	33488		
CA	MARION (BUS-IL)	CARBONDALE (IL)	16	31	31	7	11648		
CA	PADUCAH (BUS-IL)	MARION (BUS-IL)	56	74	45	14	81536		
CA	TERRE HAUTE (BUS-IN)	CHARLESTON (BUS-IL)	48	65	44	7	34944	195832	4.02%
CI	ANDERSON (BUS-IN)	INDIANAPOLIS (IN)	43	60	43	14	62608		
CI	BLOOMINGTON (BUS-IN)	INDIANAPOLIS (IN)	53	71	45	35	192920		
CI	COLUMBUS (BUS-IN)	INDIANAPOLIS (IN)	42	59	43	14	61152		
CI	COLUMBUS (BUS-IN)	LOUISVILLE (BUS-KY)	68	87	47	14	99008		
CI	COLUMBUS (BUS-OH)	DAYTON (BUS-OH)	71	91	47	14	103376		
CI	COLUMBUS1 (BUS-OH)	LIMA (BUS-OH)	126	151	50	7	91728		
CI	DANVILLE (BUS-IL)	INDIANAPOLIS (IN)	90	111	49	7	65520		
CI	DAYTON (BUS-OH)	CINCINNATI (OH)	54	72	45	14	78624		
CI	DAYTON (BUS-OH)	RICHMOND (BUS-IN)	40	57	42	7	29120		
CI	LEXINGTON (BUS-KY)	CINCINNATI (OH)	76	96	48	14	110656		
CI	NEW CASTLE (BUS-IN)	INDIANAPOLIS (IN)	49	67	44	14	71344		
CI	RICHMOND (BUS-IN)	NEW CASTLE (BUS-IN)	37	53	42	14	53872	1019928	20.92%
CL	AKRON (BUS-OH)	CLEVELAND (OH)	38	55	42	21	82992		
CL	CANTON (BUS-OH)	AKRON (BUS-OH)	23	38	36	21	50232		
CL	FT. WAYNE (IN)	WATERLOO (BUS-IN)	29	45	39	14	42224		
CL	LIMA (BUS-OH)	FT. WAYNE (IN)	61	80	46	7	44408		
CL	WARREN (BUS-OH)	CLEVELAND (OH)	55	73	45	21	120120		
CL	YOUNGSTOWN (BUS-OH)	WARREN (BUS-OH)	13	27	29	21	28392	368368	7.56%
MI	ANCHORVILLE (BUS-MI)	DETROIT (MI)	35	51	41	7	25480		
MI	BRIGHTON (BUS-MI)	ANN ARBOR (MI)	19	34	34	7	13832		
MI	CADILLAC (BUS-MI)	GRAND RAPIDS (MI)	97	125	47	7	70616		
MI	MOUNT PLEASANT (BUS-MI)	LANSING (MI)	73	96	46	7	53144		
MI	BAY CITY (BUS-MI)	FLINT (MI)	64	75	51	7	46592		
MI	DETROIT (MI)	TOLEDO (OH)	57	70	49	7	41496		

Exhibit 4-28 (continued)
Feedber Bus System Detail

Corridor	*From/To*	*To/From*	*Dist. mile*	*Time min.*	*Speed mph*	*Freq (rt/wk)*	*Annual Bus Miles*	*Corridor Subtotal*	*Percentage*
MI	HOWELL (BUS-MI)	BRIGHTON (BUS-MI)	12	26	28	7	8736		
MI	LUDINGTON (BUS-MI)	MUSKEGON (BUS-MI)	56	74	45	7	40768		
MI	MUSKEGON (BUS-MI)	GRAND RAPIDS (MI)	40	57	42	21	87360	388024	7.96%
MO	COLUMBIA (BUS-MO)	JEFFERSON (MO)	31	47	40	21	67704		
MO	FT. LEONARD WOOD (BUS-MO)	ROLLA (BUS-MO)	30	46	39	14	43680		
MO	KIRKSVILLE (BUS-MO)	COLUMBIA (BUS-MO)	92	113	49	7	66976		
MO	LAWRENCE (BUS-KS)	KANSAS CITY (MO)	38	55	42	28	110656		
MO	ROLLA (BUS-MO)	WASHINGTON (MO)	71	91	47	14	103376		
MO	SPRINGFIELD (BUS-MO)	BRANSON (BUS-MO)	42	59	43	14	61152		
MO	SPRINGFIELD (BUS-MO)	FT. LEONARD WOOD (BUS-MO)	72	92	47	14	104832		
MO	SPRINGFIELD (BUS-MO)	JOPLIN (BUS-MO)	73	93	47	7	53144		
MO	ST. JOSEPH (BUS-MO)	KANSAS CITY (MO)	56	74	45	21	122304		
MO	TOPEKA (BUS-KS)	LAWRENCE (BUS-KS)	27	43	38	28	78624	812448	16.66%
QU	AMES (BUS-IA)	DES MOINES (IA)	34	50	41	7	24752		
QU	BLAIR (BUS-NE)	OMAHA (NE)	31	47	40	7	22568		
QU	CEDAR FALLS (BUS-IA)	CEDAR RAPIDS (BUS-IA)	61	80	46	7	44408		
QU	CEDAR RAPIDS (BUS-IA)	IOWA CITY (IA)	28	44	39	7	20384		
QU	FT. DODGE (BUS-IA)	WEBSTER CITY (BUS-IA)	18	33	33	7	13104		
QU	KIRKSVILLE (BUS-MO)	QUINCY (IL)	71	91	47	7	51688		
QU	LINCOLN (BUS-NE)	OMAHA (NE)	58	76	46	21	126672		
QU	NEBRASKA CITY (BUS-NE)	OMAHA (NE)	50	68	44	7	36400		
QU	NEBRASKA CITY (BUS-NE)	ST. JOSEPH (BUS-MO)	90	111	49	7	65520		
QU	PEORIA (BUS-IL)	GALESBURG (IL)	45	62	43	14	65520		
QU	SIOUX CITY (BUS-IA)	BLAIR (BUS-NE)	85	106	48	7	61880		
QU	WEBSTER CITY (BUS-IA)	AMES (BUS-IA)	48	65	44	7	34944	567840	11.65%
SL	DECATUR (BUS-IL)	SPRINGFIELD (IL)	38	55	42	7	27664		
SL	JACKSONVILLE (BUS-IL)	SPRINGFIELD (IL)	36	52	41	7	26208		

Exhibit 4-28 (continued)
Feeder Bus System Detail

Corridor	*From/To*	*To/From*	*Dist. mile*	*Time min.*	*Speed mph*	*Freq (rt/wk)*	*Annual Bus Miles*	*Corridor Subtotal*	*Percentage*
SL	PEORIA (BUS-IL)	BTN-NORMAL (IL)	44	61	43	14	64064	117936	2.42%
TC	BLACK RIVER FALLS (BUS-WI)	TOMAH (WI)	30	46	39	21	65520		
TC	DULUTH (BUS-MN)	MPLS/ST.PAUL (MN)	150	177	51	21	327600		
TC	EAU CLAIRE (BUS-WI)	BLACK RIVER FALLS (BUS-WI)	49	67	44	21	107016		
TC	MANKATO (BUS-MN)	ROCHESTER (BUS-MN)	79	99	48	7	57512		
TC	MARINETTE (BUS-WI)	GREEN BAY (WI)	53	71	45	7	38584		
TC	ROCHESTER (BUS-MN)	LA CROSSE (WI)	70	89	47	21	152880		
TC	SHEBOYGAN (BUS-WI)	MANITOWOC (BUS-WI)	29	45	39	21	63336		
TC	SHEBOYGAN (BUS-WI)	MILWAUKEE (WI)	50	68	44	21	109200		
TC	ST. CLOUD (BUS-MN)	MPLS/ST.PAUL (MN)	75	95	47	28	218400		
TC	STAPLES (BUS-MN)	ST. CLOUD (BUS-MN)	67	86	47	7	48776		
TC	STEVENS POINT (BUS-WI)	APPLETON (WI)	59	77	46	21	128856		
TC	STURGEON BAY (BUS-WI)	GREEN BAY (WI)	18	33	33	7	13104		
TC	WAUSAU (BUS-WI)	STEVENS POINT (BUS-WI)	34	50	41	21	74256	1405040	28.81%
TOTAL								4875416	100.00%

Corridor abbreviations: CA- Carbondale, CI- Cincinnati, CL- Cleveland, MI- Michigan, MO- Kansas City, QU- Quincy/Omaha, SL- St. Louis, TC- Twin Cities

Bus Operating Costs

Base operating costs for the bus service were obtained from the American Bus Association (ABA) via their 2001 Industry Survey and from recommendations provided by Greyhound. The ABA survey set included 161 bus companies, both charter/tour and regular route service providers. The average cost per mile for a 40-foot bus was $1.90 in 2001. The cost figure provided by the ABA includes bus ownership (purchase or lease), fuel cost including tax, labor (driver and mechanic salaries/benefits), supplies (equipment and maintenance), insurance, tolls and driving expenses, and purchase of transportation. The items not included in this cost estimate were overhead and profit margin, which, in consultation with Greyhound, were assumed to be an additional 15 percent. The costs provided in the ABA survey were for 40-feet or larger buses. It was determined by Greyhound that smaller buses, as would be used for much of the MWRRS service, would have costs 20 percent less than exhibited by the larger buses. It was therefore estimated that the per-mile bus operating cost would be $2.15 for a large bus and $1.72 for a small bus.

Feeder Bus System Iterative Process

An iterative process was used to outline the feeder bus system. Operating characteristics and market analysis drove the selection of large or small buses on each route. Large buses were assumed to carry between 39 and 47 passengers, while small buses can carry 22 passengers. Smaller buses are less expensive to operate, but are not efficient over longer routes, while larger buses, although more expensive to operate, are more efficient on longer routes.

The study team worked with Greyhound to optimize the frequency of service provided on each route (*i.e.*, 1, 2, 3, or 4 daily) and the most efficient size of bus for the route. The optimization was intended to balance the supply and demand on the given routes. The frequency of service was varied based on the incremental net benefit that was added. The size of the bus was used in the measurement of passenger capacity.

Summary of Key Findings on Bus Integration

The feeder bus system described here shows that feeder buses have the ability to generate additional MWRRS rail ridership and revenue. Riders who would not otherwise use the rail system are connected by virtue of the feeder bus system, greatly enhancing transportation access. Although bus-specific costs exceed bus-specific revenue the additional rail revenue from bus passengers fed into rail trips justifies the costs of the buses. Another finding is that feeder bus/rail travelers will pay an average rail fare of $50 to $75 per trip, so rail revenues compensate for the bus cross-subsidy. Average bus loadings, with as few as seven riders paying up to 80 cents per mile on trips 200 miles from a rail station, are sufficient to make an extensive feeder bus system financially viable. However, bus routes that were projected to be unprofitable, even including connecting rail revenues, were eliminated from the plan.

The feeder bus system can generate an additional $48 million dollars in rail revenue. Exhibit 4-29 shows the results of the operating revenues and costs associated with the feeder bus system.

Exhibit 4-29
Summary of Feeder Bus System

Revenue Source	***2015 Revenue ($2002)***
Forecast Rail Fare Revenue Generated from Feeder Bus System	$47,767,000
Forecast Bus Fare Revenue Generated from Feeder Bus System	$6,218,430
Minus Total Cost of Feeder Bus System	($7,461,932)
Contribution of Feeder Bus System to Rail Revenue	**$46,523,498**

4.7.4 Competitive Issues

Intercity travel in the region is growing rapidly, and the increasing demand for travel cannot be easily met by existing modes. Regulatory, environmental and budgetary constraints are making it increasingly difficult to expand highway capacity and, in particular, to build new or expand existing highways. An analysis of the impact of congestion suggests that MWRRS demand in 2020 could be as much as ten percent higher if current congestion trends continue.

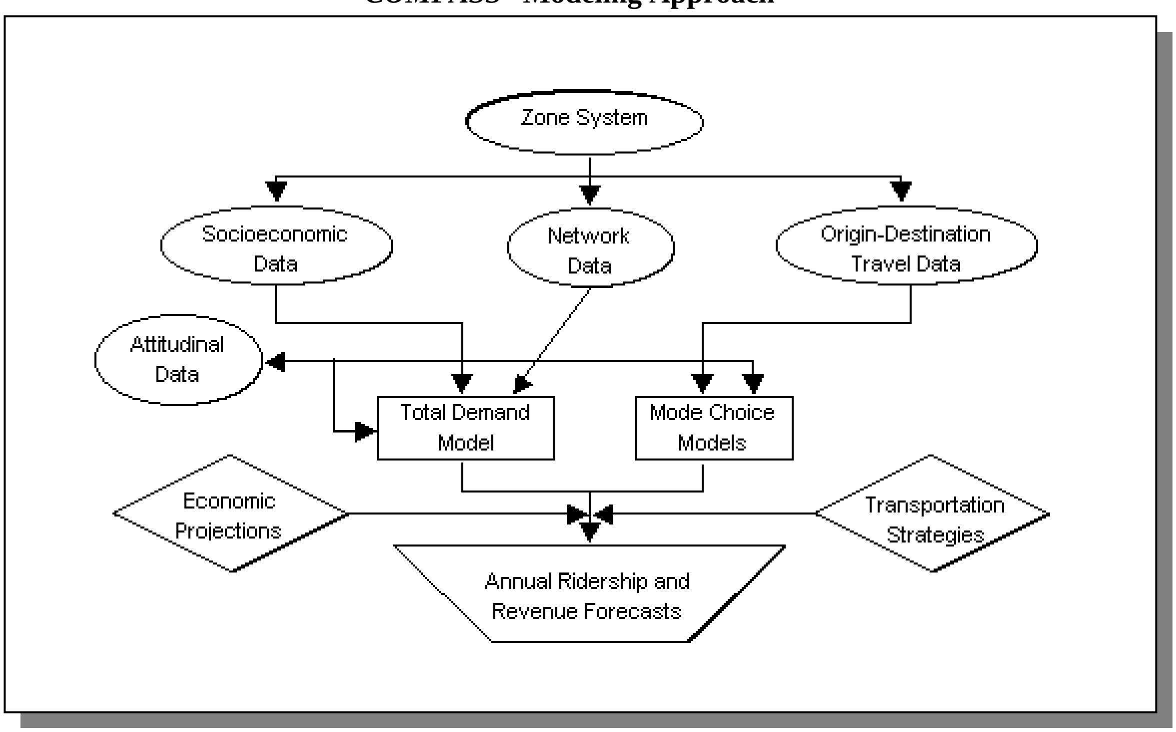
In the case of air travel, deregulation has resulted in the reduction of service on shorter routes and significant fare increases. The four major carriers in the region – United, American, Northwest and Delta – have increased their average flight length to more than 900 miles and find that flights of less than 300 miles are costlier and less efficient to operate, usually requiring cross-subsidy from longer flights. Southwest Airlines, the other important carrier in the region, serves just seven of the cities on the MWRRS. An analysis was undertaken to test the potential impact on a competitive response by the airlines to the MWRRS. The analysis showed that if all the airlines, except Southwest, reduced their fares by 25 percent on all routes except those also served by Southwest, then MWRRS ridership and revenue would fall by only two to three percent.

Because the air and highway modes (auto and bus) are finding it increasingly difficult to meet the regional demand for travel, the MWRRS will not be a replacement for existing travel modes but rather an enhancement and necessary alternative.

4.8 Model Development – COMPASS© *Interactive Process*

The *COMPASS©* Demand Modeling System is a powerful yet flexible demand forecasting tool that forecasts long-term intercity travel demand and assesses the relationships among all competitive modes of travel (rail, auto, air, and bus). *COMPASS©* uses local socioeconomic forecasts for each area to determine the growth of long-term total travel demand. *COMPASS©* computes competitive mode market shares based on the levels of service, fares or costs, and attractiveness or bias for each mode. *COMPASS©* is structured on three principal models: Total Demand Model, Induced Demand Model and Hierarchical Modal Split Model. For the MWRRS,

Exhibit 4-30
***COMPASS©* Modeling Approach**



each model was calibrated separately for each of the two trip purposes (business and other). *Other* included commuter, tourist, social, personal business, school, recreation, etc. The modeling approach and critical data flow are shown in Exhibit 4-30.

The core of the ridership estimation approach incorporates the *COMPASS*© model working interactively with the technology and operations plans. An interactive analysis in the strategic demand forecast process allows a wide range of demand, fare levels, revenue, technology, service levels, capital improvements, and right-of-way (guideway) issues to be assessed by a *what if* evaluation of possible options. For example, annual average daily traffic at a station, for a given fare and frequency scenario, determines parking requirements. Similarly, average passengers on board for any given segment can be calculated and factored to estimate peak requirements for rail car capacity and associated power usage estimates. Through the interactive analysis, *fatal flaws* can also be identified, such as a low service frequency that does not generate enough riders to cover costs, so that other options that are more favorable can then be developed.

Once the model was calibrated, forecasts were used to identify ridership and revenues associated with the passenger rail operating strategy. Standard *COMPASS*© outputs included the following:

- Total corridor travel demand by trip purpose
- Total demand by mode
- Natural growth, induced growth and diverted trips by trip purpose and mode
- Market share by trip purpose and mode
- Consumer surplus by trip purpose and mode
- Passenger revenue by trip purpose and mode
- Passenger miles by trip purpose and mode
- Station volumes by trip purpose

4.9 Pricing Strategy

The development of a competitive, market-driven pricing strategy for the MWRRS considered both the willingness of travelers to pay for service and the character of the demand for service on a daily, weekly and annual basis. The willingness to pay for service is captured by the stated preference attitudinal surveys. These surveys contained a series of questions designed to identify how individuals value different travel attributes – travel time, frequency, reliability and quality of service. These preference factors were then used in the calibration of the *COMPASS*© demand model to describe how travelers choose among modes and their responsiveness to different travel options.

4.9.1 Assumptions

The development of a fare structure for the MWRRS is based on a number of strategic objectives and pricing policies, including the following:

- Passenger rail prices will be based on what the market can bear.
- Fares will be established that maximize revenue yields. Since this approach can produce lower ridership levels, consideration will be given to balancing the loss in ridership while maintaining positive operating performance.

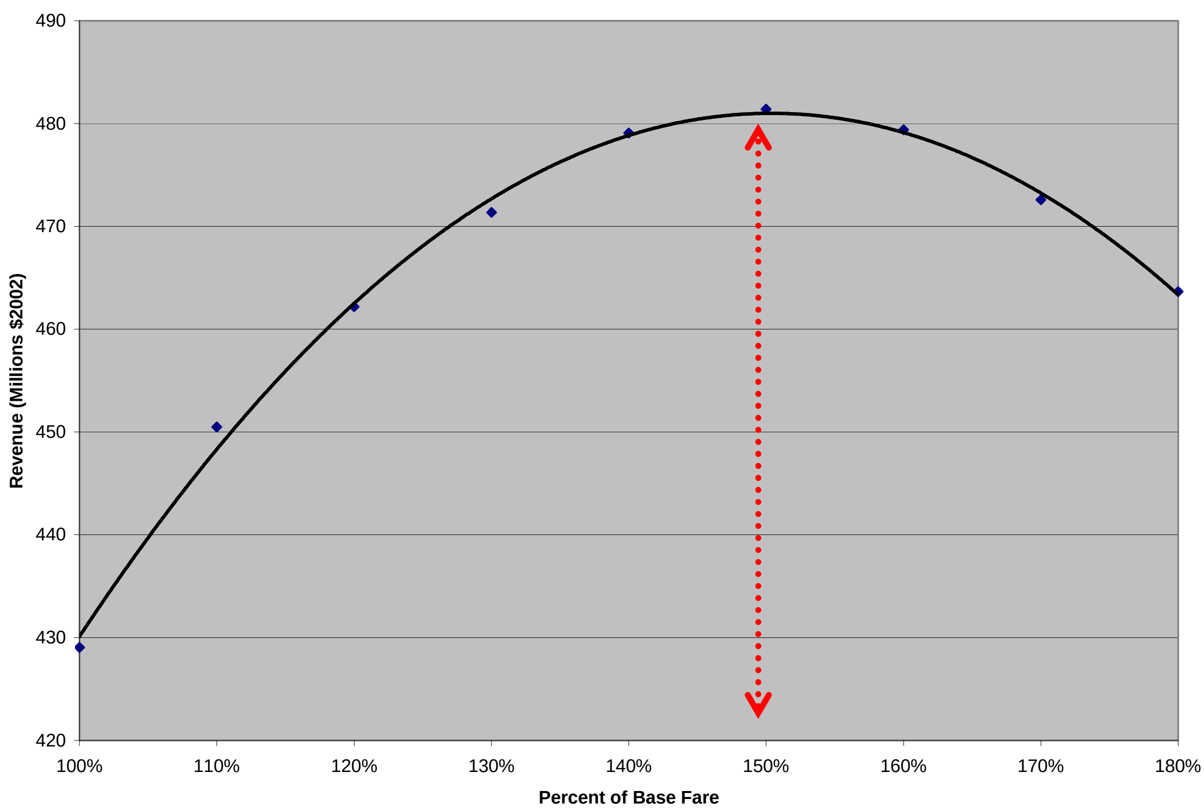
- There will be a two-tier fare structure to reflect the composition of the MWRRS market with a business class fare and a 25 percent lower, non-business class fare. Price elasticity estimates were derived on a trip-purpose basis. The analysis assumed that the selected technology could encompass first and economy class fares.

4.9.2 Competitive Fares that Maximize Revenue Yields

The use of revenue yield techniques to maximize revenues was a key component in the planning of the MWRRS. The MWRRS fares were initially set to existing intercity passenger rail fares. MWRRS fares were then determined from an analysis of the revenue potential as forecasted by *COMPASS*© under different fare scenarios. The fares were set on a segment-by-segment basis in an attempt to maximize revenues while maintaining fares within a competitive range.

In the revenue optimization process, these fares were increased incrementally by as much as 80 percent to test the impact of fares on ridership levels for the MWRRS. It was also verified that each corridor was not optimal at a point below the base fare level. The analysis showed that, generally, fares were maximized, with respect to revenue, at approximately 150 percent of current fare levels (Exhibit 4-31).

Exhibit 4-31
Revenue Maximization for the Overall MWRRS System (2015)

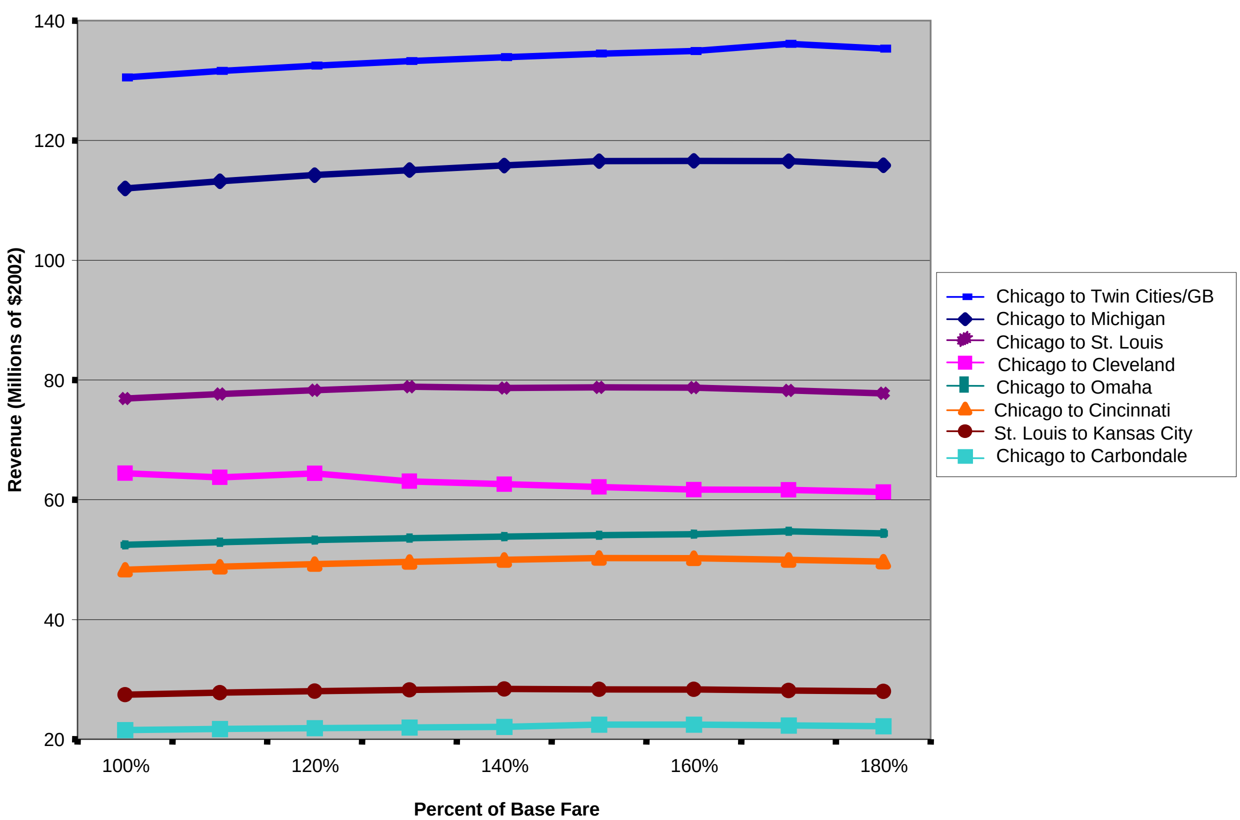


The revenue curve shows that the level of fares that maximize revenues for the entire system is about 50 percent above base year fare levels (*i.e.*, Amtrak fares in the year 2000). Above the optimal point, additional increases in fares *lower* system revenue. This is because the declines in ridership levels offsets, or negates the impact of increasing the fare. Therefore, since revenue-maximizing fare policies result in lower ridership and often by significant amounts, the fares actually used in the MWRRS feasibility analysis were restricted to a range of 25 percent to 50 percent above base year fare levels.

The revenue maximization analysis also showed that the fare levels at which revenues are maximized on different MWRRS corridors vary significantly (Exhibit 4-32). The curves in the exhibit show that these corridors that are most effective with fare optimization are Chicago-Omaha, Chicago-St. Paul, Chicago-Michigan and St. Louis-Kansas City. In other words, the lack of alternative modes of travel in the corridor allows the MWRRS rail network to charge higher fares for the service being offered. Adopting discount fares for all markets on these corridors would possibly generate additional ridership and revenues.

The fares adopted for the MWRRS forecasts are considered reasonably optimal at an aggregate level. The revenue maximization graph shows the 50 percent increase over current fares is close to the optimal fare level for most corridors. Nonetheless, further adjustments could well improve both ridership and revenues. For example, market-specific fares could be developed to attract certain population segments – students, senior citizens and families with children – and to encourage travel during off-peak hours.

Exhibit 4-32
Revenue Maximization by Corridor



A comparison of base year city-pair full fares with those in the MWRRS system is shown in Exhibit 4-33. The full fares cited here ignore any discounts that are available to various groups (*e.g.*, senior citizens, students, etc.).

Exhibit 4-33
Comparison of Full Fares
Base Year and MWRRS System (2000$)

Corridor/Branch Line and City-Pair	*Base Year Full Fare*	*MWRRS Optimized Full Fare*	*Percent Change*
Chicago-Detroit	$52.15	$77.92	49.4%
Chicago-Port Huron	$65.31	$95.18	45.7%
Chicago-Grand Rapids	$48.27	$67.03	38.9%
Chicago-Cleveland	$94.37	$114.73	21.6%
Chicago-Cincinnati	$70.78	$102.20	44.4%
Chicago-Carbondale	$68.32	$102.08	49.4%
Chicago-St. Louis	$59.58	$89.02	49.4%
St. Louis-Kansas City	$63.38	$95.61	50.9%
Chicago-Quincy	$55.99	$99.79	78.2%
Chicago-Omaha	$115.53	$150.65	30.4%
Chicago-St. Paul	$107.22	$180.78	68.6%
Chicago-Green Bay*	---	$109.86	---

* No existing rail service

The difference in the fare increases between segments can be partly attributed to the differences in the current fare levels. Fares on a per-mile basis vary substantially across the Midwest region with base year full fares ranging from approximately 19 cents per mile (Chicago-Detroit) to 28 cents per mile (Chicago-Cleveland). In general, segments with relatively higher fares tend to have lower rates of increase. The exception is the Chicago-Twin Cities corridor, which has a significant change in corridor-level service due to the introduction of service to Madison, Wisconsin.

As stated previously, the demand forecasts are disaggregated by business and non-business travel. The fares shown in the exhibit above relate to the full business travel fares. An average fare is obtained by taking the weighted average of the two fare and passenger levels. Under the proposed MWRRS system, average fares rise to a range of $0.23 to almost $0.36 per mile. These average fares-per-mile are shown on a city-pair basis in Exhibit 4-34.

Exhibit 4-34
Comparison of Base Year and MWRRS Fares per Mile

Corridor/Branch Line and City-Pairs	*Base Year Fares per Mile*	*MWRRS Optimized Fares per Mile*	*Percent Change*	*Base Year Miles*	*MWRRS Miles*
Chicago-Detroit	$0.19	$0.28	47.3%	283	283
Chicago-Port Huron	$0.20	$0.30	46.2%	319	319
Chicago-Pontiac	$0.18	$0.28	49.8%	305	305
Chicago-Grand Rapids	$0.27	$0.36	31.4%	177	191
Chicago-Cleveland	$0.28	$0.34	21.6%	341	354
Chicago-Cincinnati	$0.22	$0.32	49.9%	327	315
Chicago-Carbondale	$0.22	$0.33	49.4%	308	308
Chicago-St. Louis	$0.21	$0.32	49.9%	282	282
St. Louis-Kansas City	$0.23	$0.34	49.8%	281	281
Chicago-Quincy	$0.22	$0.39	77.5%	258	258
Chicago-Omaha	$0.23	$0.32	37.0%	501	477
Chicago-St. Paul	$0.26	$0.42	62.4%	418	434
Chicago-Green Bay	---	$0.51	---	---	214

4.9.3 Conclusions

The analysis shows that additional revenue can be generated by the use of fare optimization techniques. In the analysis of fares, the potential for increasing business fares on specific routes or for an improved service that offers some or all of the facilities typically offered by the airlines (*e.g.*, business clubs at terminals, frequent flyer points and business facilities on board the train) have not been considered. In addition to full fares, a series of market-specific, promotional and discount fares should be established to fill off-peak trains and encourage certain segments of the population, (*e.g.*, seniors and students), to travel at off-peak times. A range of travel cards and other promotional ticketing systems should also be developed to further promote widespread use of the system. Later refinements might include developing, where appropriate; discount fares for special consumer market segments (*e.g.,* seniors, students, and commuters). In addition, specific *spot* fares should be used to solve specific problems such as suburban station overload, peak-hour overload and airline competition for *end* cities.

4.10 Ridership Projections

4.10.1 Introduction

The 1998 Plan of the MWRRI Study produced preliminary ridership and revenue demand estimates. It was recognized that certain areas of the analysis could be strengthened, and the overall study enhanced by additional analysis that focused on specific goals and objectives of the MWRRI states. In particular, additional corridor-level information was required to improve the overall understanding of the feasibility issues on a corridor and state basis as well as to gain an improved understanding of the full ridership potential and revenue sources for the states. This provided the context for the 2000 Plan of the MWRRI study.

The 2000 Plan, which represented an on-going effort to ensure the viability of a passenger rail service in the Midwest region, focused on three major areas. The scope of the analysis aimed at refining market demand estimates by developing finer segmentation within some of the corridor segments and by evaluating additional consumer and business market segments. These areas are summarized below and are presented in detail later in this chapter.

- Ridership model enhancements were made to increase the level of corridor segmentation in the *COMPASS*© demand model by developing 'branch line' models to capture the smaller, less populated regional markets within a corridor. In addition, the model was used to assess the sensitivity of the impact of strategic and policy assumptions about these markets.
- Additional gains in passenger rail ridership and revenue due to modal connectivity with airports were assessed

Additionally, further refinements in implementation plans and operating schedules (discussed later in this report) impacted the demand and revenue projections. Changes on the operational side of the analysis impact travel times, frequency of service, accessibility, reliability and the overall general quality of service. Since these are the key elements in determining the choice of travel mode, the MWRRS ridership and revenue projections needed to be updated to reflect operating refinements, as well.

4.10.2 New Developments in Ridership Analysis

A brief description of the new developments in the ridership analysis is provided below. A more detailed discussion is included in the September 2000 Project Notebook.

Branch Line Analysis

The purpose of the branch line analysis was to identify characteristics of lower density routes. Stated preference surveys were conducted in three cities (Carbondale, Grand Rapids and Green Bay) targeting specific markets to determine whether branch line patrons have different travel characteristics and preferences from main line patrons. As a special case, government employees in Missouri were also surveyed to identify the potential impact of encouraging or requiring Missouri state employees to use passenger rail for trips between St. Louis, Jefferson City and Kansas City. Survey results were used to develop a distinct branch line demand model, complementing the established main line model.

- Green Bay was included in the survey because it is a city with no current rail service. Air, bus and auto travelers were surveyed. The characteristics identified in the area (values of time and frequency) are essentially the same as those in other corridors and did not result in a change to forecast parameters.
- Grand Rapids was included in order to analyze the business market for a relatively small community experiencing high airfares. Air, rail and auto travelers were surveyed. Surveys revealed values of time for air that were higher than general values in the rest of the region. However, because the air market is a small part of the Grand Rapids total travel market, the change in values of time had a negligible impact on model results.

- Carbondale was included because it has a large student population. Rail, bus and auto travelers were surveyed. The survey revealed that students in the Carbondale corridor had lower value of time than the average regional travelers in the main model. This result illustrates that students were more sensitive to cost such that substantially lower revenue and ridership estimates were obtained, compared to the main line model.
- The Missouri analysis focused on state government employees. Total state government travel to the respective cities was estimated from the surveys. The proportion and number of state government employee business trips that would be made on passenger rail was projected, assuming a policy requiring the use of rail whenever feasible. This ridership and revenue increment was then factored into the demand forecasts for the Missouri corridor.

A more detailed technical discussion on the branch line analysis and the Missouri Department of Transportation travel study are given in the September 2000 Project Notebook.

Air Connect Analysis

The air connect survey and analysis conducted in the 2000 Plan evaluated the market niche that could capitalize on good multimodal connections between airports and MWRRS passenger rail stations. Air connect trips are shorter than the average intercity trip, as they represent *local* connections to airports. However, the MWRRS can attract a portion of these trips if it offers near-seamless connections between rail stations and airports. This assessment included:

- Analyzing national and regional air traffic growth rates and national air travel patterns connecting within the region
- Analyzing the accessibility of specific Midwest airports to relevant rail stations
- Conducting and analyzing stated preference surveys at representative airports
- Estimating the mode split for air connect base and forecast years for auto, air, rail and bus using existing and proposed airport accessibility to the rail system

Federal Aviation Administration (FAA) base enplanement data and forecasts were evaluated for each major airport. In addition, the study reviewed travel patterns into and out of the region for the MWRRS cities included in the American Travel Survey. Profiles were examined for Chicago, Cleveland, Cincinnati, Indianapolis, St. Louis, Kansas City, Twin Cities and Milwaukee; profiles included detailed demographics, top ten destinations, distance traveled, etc.

For each city, the proximity of major airports to the rail corridors and stations was examined. The potential for direct access availability, (*e.g.,* a shuttle bus) was considered to connect a rail station to an airport, if the two were not contiguous. Stated preference survey findings were modeled to identify the likely mode split for air travelers from outside the region into regional auto, air, rail and bus services. Air volume forecasts, airport accessibility, and survey findings were then used to estimate rail ridership related to air connections, as well as to revise ridership and revenue by corridor and for the system as a whole. The air connect ridership is added to the base level ridership forecast. Additional discussion of the air connect analysis can be found in the September 2000 Project Notebook.

4.10.3 Ridership Projections

The *COMPASS*© demand model was used to produce ridership forecasts on a system, main line and branch line basis. The multimodal forecasting model incorporates the comprehensive database developed for the market analysis (origin-destination, network, socioeconomic and stated preference attitudinal data), the fare structure and analysis described earlier, long-term rail and other modal strategies, and the operating service and equipment selected for the MWRRS and the branch lines.

Corridor Ridership and Market Shares

The ridership results by corridor are provided in Exhibit 4-35. The revenue impact will be proportionally smaller than the ridership impact because the air connect passenger trips are much shorter than the average MWRRS intercity trip. This is demonstrated in the shorter-than-average trip length and lower-than-average fares identified for air connect passengers.

Exhibit 4-35
Base System Passenger Trips and
Passenger Miles for Full MWRRS Operation in 2025

Corridor	*Passenger Trips*	*Passenger Miles (Millions)*	*Average Trip Length (Miles)*
Michigan	3,674,940	603.14	164.1
Cleveland	1,120,108	252.14	225.1
Cincinnati	894,669	213.79	239.0
Carbondale	769,911	87.08	113.1
St. Louis	1,757,123	336.91	191.7
Kansas City	804,498	116.28	144.5
Quincy – Omaha	1,440,132	238.04	165.3
Green Bay – St. Paul	4,362,404	540.23	123.8
Cross Chicago	(2,187,778)	--	--
Total	**14,823,786**	**2387.62**	**161.1**

The ridership and revenue forecasts for the eight principal corridors used in the financial analysis of the MWRRS are given in Exhibit 4-36. It is estimated that, by 2025, the MWRRS will attract an annual ridership of 14.8 million. (Eliminating double-counting of riders who transfer in Chicago, ridership would be 12.6 million.) There are significant differences between the corridors. Not surprisingly, the forecasts show that Chicago-Michigan, Chicago-St. Louis, Chicago-Cincinnati and Chicago-Twin Cities are the corridors with the largest ridership and market shares in rail. Although the corridors with the lowest market shares are Chicago-Cleveland, Chicago-Carbondale and Chicago-Quincy-Omaha, the analysis shows they are significant components of the MWRRS network.

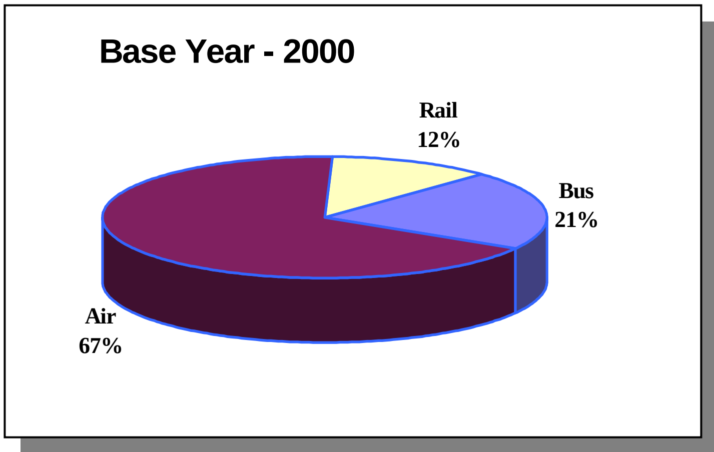
Exhibit 4-36
2025 Passenger Rail Forecasts and
Corridor Market Shares for the Intercity Modes

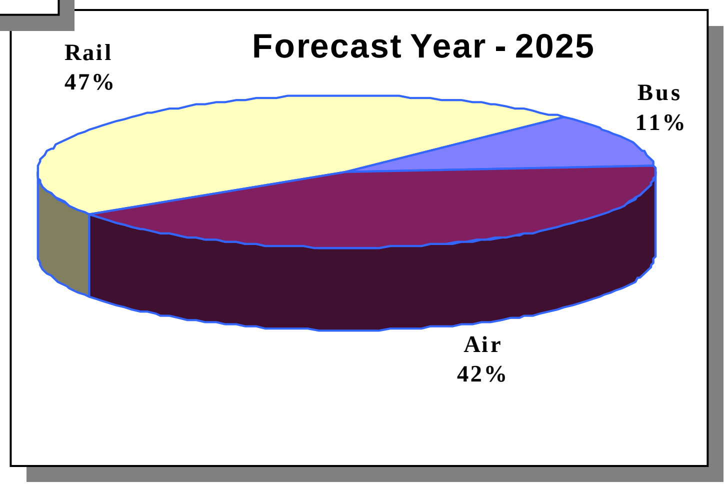
Corridor	***Rail Demand***	***Corridor Market Share (%)***			
		Air	***Bus***	***Auto***	***Rail***
Michigan	3,674,940	0.94%	0.34%	97.29%	1.43%
Cleveland	1,120,108	1.15%	0.51%	97.31%	1.03%
Cincinnati	894,669	3.48%	0.45%	93.74%	2.33%
Carbondale	769,911	0.48%	0.42%	98.10%	1.00%
St. Louis	1,757,123	2.77%	0.43%	94.61%	2.19%
Kansas City	804,498	2.95%	0.22%	95.35%	1.48%
Quincy – Omaha	1,440,132	1.25%	0.17%	97.45%	1.13%
Green Bay – St. Paul	4,362,404	1.07%	0.29%	96.97%	1.67%
Cross Chicago	(2,187,778)	2.75%	0.58%	94.36%	2.31%
Total	**14,823,786**	**1.15%**	**0.29%**	**96.41%**	**2.15%**

Of the total rail ridership forecast for 2025, 6 percent is a result of the natural growth of travel demand in the region, 10 percent is due to increased mobility or induced demand, and 84 percent is due to diverted demand. Induced demand is defined as those trips that would not have been made without the introduction of the overall MWRRS, while diverted demand is the result of travelers changing travel mode. Of the diverted demand for the MWRRS, 58 percent is from auto, 23 percent from bus and 20 percent from air.

By 2025, rail's market share will increase to 47 percent of the intercity public modes, making rail travel as popular as air travel (Exhibit 4-37). The market share for air travel falls by 23 percent because most of the diverted demand for rail is from the air mode.

Exhibit 4-37
Market Shares for the Public Modes





Average annual station-to-station ridership by corridor and city pair in 2025 is shown in Exhibit 4-38. While these traffic volumes are not additive along the corridor, they do represent the shifts (ons, offs and through-ridership) in activity levels throughout the region.

Exhibit 4-38
Station-to-Station Ridership in 2025

City Pair	*Number of Riders*
Milwaukee- Green Bay	
Milwaukee-Granville	510,040
Granville-West Bend	446,375
West Bend-Fond du Lac	423,827
Fond du Lac-Oshkosh	389,991
Oshkosh-Neenah	295,782
Neenah-Appleton	288,367
Appleton-Green Bay	99,243
Chicago-Milwaukee-Minneapolis	
Chicago-Glenview	1,823,621
Glenview-Sturtevant	1,740,675
Sturtevant-GMIA	1,538,850
GMIA-Milwaukee	1,436,260
Milwaukee-Brookfield	1,358,915
Brookfield-Oconomowoc	962,052
Oconomowoc-Watertown	1,016,597
Watertown-Madison	903,617
Madison-Portage	530,983
Portage-Wisconsin Dells	517,035
Wisconsin Dells-Tomah	497,560
Tomah-La Crosse	482,059
La Crosse-Winona	397,234
Winona-Red Wing	357,088
Red Wing-Minneapolis/St. Paul	337,306
Chicago-Cincinnati	
Chicago-Gary Airport	789,350
Gary Airport-Lafayette	794,381
Lafayette-Indianapolis Airport	711,678
Indianapolis Airport-Indianapolis	696,407
Indianapolis-Shelbyville	304,061
Shelbyville-Greensburg	300,061
Greensburg-Cincinnati	295,061

Exhibit 4-38 (continued)
Station-to-Station Ridership in 2025

City Pair	*Number of Riders*
Chicago-Quincy-Omaha	
Chicago-La Grange	1,064,746
La Grange-Naperville	1,130,123
Naperville-Plano	879,195
Plano-Mendota	865,916
Mendota-Princeton	833,048
Princeton-Kewanee	314,381
Kewanee-Galesburg	299,489
Galesburg-Macomb	132,436
Macomb-Quincy	62,957
Rock Island-Princeton	530,081
Rock Island-Iowa City	305,979
Iowa City-Newton	151,472
Newton-Des Moines	133,761
Des Moines-Atlantic	66,617
Atlantic-Omaha	66,249
St. Louis-Kansas City	
St. Louis-Kirkwood	450,247
Kirkwood-Washington	481,569
Washington-Hermann	447,572
Hermann-Jefferson	435,171
Jefferson-Sedalia	288,977
Sedalia-Warrensburg	268,456
Warrensburg-Lees Summit	252,361
Lees Summit-Independence	202,475
Independence-Kansas City	186,349
Chicago-St. Louis	
Chicago-Joliet	1,304,621
Joliet-Dwight	1,242,250
Dwight-Pontiac	1,220,536
Pontiac-Normal	1,206,642
Normal-Lincoln	987,083
Lincoln-Springfield	969,551
Springfield-Carlinville	775,826
Carlinville-Upper Alton	755,455
Upper Alton-St. Louis	622,638

Exhibit 4-38 (continued)
Station-to-Station Ridership in 2025

City Pair	***Number of Riders***
Chicago-Cleveland	
Chicago-Gary Airport	971,635
Gary Airport-Plymouth	979,560
Plymouth-Warsaw	928,853
Warsaw-Ft. Wayne	900,611
Ft. Wayne-Defiance	727,361
Defiance-Toledo	679,888
Toledo-Sandusky	425,048
Sandusky-Elyria	385,152
Elyria-Cleveland	326,676
Chicago-Detroit	
Chicago-Gary Airport	2,086,818
Gary Airport-Michigan City	2,025,731
Michigan City-Niles	1,991,194
Niles-Dowagiac	1,991,317
Dowagiac-Kalamazoo	1,976,870
Kalamazoo-Battle Creek	1,673,988
Battle Creek-Albion	1,118,142
Albion-Jackson	1,101,538
Jackson-Ann Arbor	1,028,678
Ann Arbor-Dearborn	802,942
Dearborn-Detroit	564,955
Detroit-Royal Oak	236,306
Royal Oak-Birmingham	118,707
Birmingham-Pontiac	95,305
Battle Creek-Port Huron	
Battle Creek-East Lansing	485,987
East Lansing-Durand	315,279
Durand-Flint	296,878
Flint-Lapeer	83,649
Lapeer-Port Huron	50,390
Kalamazoo-Grand Rapids	
Kalamazoo-Plainwell	437,281
Plainwell-Grand Rapids	403,066
Grand Rapids-Holland	112,494

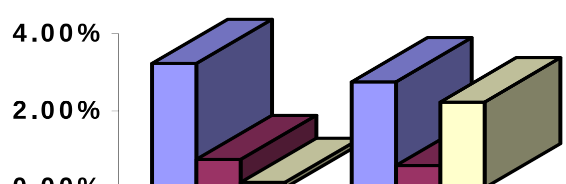
Exhibit 4-38 (continued)
Station-to-Station Ridership in 2025

City Pair	*Number of Riders*
Chicago-Carbondale	
Chicago-Homewood	608,385
Homewood-Kankakee	503,138
Kankakee-Rantoul	430,705
Rantoul-Champaign/Urbana	410,270
Champaign/Urbana - Mattoon	267,957
Mattoon-Effingham	231,879
Effingham-Centralia	210,705
Centralia-Du Quoin	202,655
Du Quoin-Carbondale	198,639

Cross-Chicago

A cross-Chicago connection is an important factor associated with the MWRRS ridership and revenue. As shown in Exhibit 4-39, most MWRRS cross-Chicago ridership is diverted from the auto and air modes, with a relatively small impact on bus traffic. The effect of improved Chicago connectivity is to raise the level of Chicago connecting trips to an airline-comparable level. Since airline trips are limited here to only those within the MWRRS service area, the overall reduction in competing air traffic is negligible. Bus traffic is not significantly affected since it consists mainly of a small number of non-business trips.

Exhibit 4-39
Cross-Chicago Connectivity



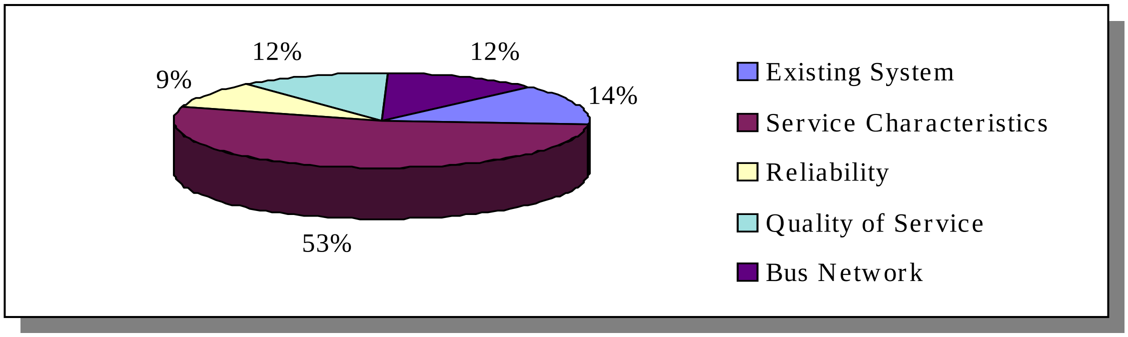
	Existing	2020
Air	3.23%	2.75%
Bus	0.74%	0.58%
Rail	0.14%	2.23%

4.11 Revenue Projections

The MWRRS seeks to provide a modern transportation system that would be comparable to air travel, with modern stations, new train equipment and a high level of on-board and station amenities. This type of service will greatly improve the image of passenger rail travel in the

Midwest region and increase passenger confidence in the usefulness and value of the rail mode. To understand the importance of the different elements of the MWRRS service strategy, each element was assessed for its contribution to total revenue. As shown in Exhibit 4-40, 12 percent of the trips are due to the quality of the service, (*i.e.*, comfort, convenience and attractiveness of the system) and 9 percent is due to the reliability of the service.

Exhibit 4-40
Impact of Service Attributes on Moderate Scenario Revenue Forecasts



The projections for system and corridor-level revenues from passenger fares are presented in Exhibit 4-41.

Exhibit 4-41
Base System and Air Connect Revenues for Full MWRRS Operation in 2025

Corridor	*Ticket Revenue (millions of 2002$)*			
	Base	*Air Connect*	*Total*	*Air Connect Percent of Base*
Michigan	118.10	0.92	119.02	0.78%
Cleveland	59.77	0.57	60.34	0.96%
Cincinnati	55.42	0.00	55.42	0.00%
Carbondale	22.48	0.06	22.54	0.30%
St. Louis	65.70	0.06	65.76	0.10%
Kansas City	41.37	0.53	41.90	1.30%
Quincy-Omaha	54.73	0.76	55.49	1.40%
Green Bay-St. Paul	156.43	1.60	158.03	1.00%
Total	**574.00**	**4.50**	**578.50**	**---**

Revenue streams are not static. Each grows at its own pace. Fare and air connect revenues increase with the growth in ridership associated with the changing socioeconomic characteristics of the region. On-board service (OBS) revenue is estimated at 8 percent of base revenue. This is a higher percentage than Amtrak's current OBS sales percentage; however, it reflects an anticipated increase due to the introduction of trolley carts along with Bistro services. Revenue for the express parcel service is based on forecasts of demand for same-day and overnight services, which are increasing much faster than the growth of freight in general. Exhibit 4-42 summarizes the system-wide increase in revenue of each service category over time.

Exhibit 4-42
System Operating Revenues
for 2015 and 2025 (Millions of 2002$)

Revenue Source	***2015***	***2025***
Base Revenue	$501.27	$573.97
Air Connect	$3.92	$4.50
On-Board Services	$40.10	$45.92
Bus-Feeder	$6.22	$7.38
Total Passenger Revenue	**$551.51**	**$631.77**
Net Express Parcel Service	$27.04	$40.40
Total Revenue	**$578.55**	**$672.16**

Summary of Findings

The study findings to date conclude that rail service in the Midwest region can attract new passengers, primarily from the auto and air markets, by providing improved service and facilities. High quality service that is competitive in terms of time, price, frequency and reliability in conjunction with modern, comfortable stations and state-of-the-art equipment will attract new passengers into the rail market. The analysis of branch lines demonstrates that passengers in smaller communities exhibit travel characteristics very similar to those in large communities, but that special populations, such as students, should be considered independently. The air connect analysis quantifies the small yet important niche market that can be developed through good multimodal connections. On-board food service making use of trolley carts along with bistro service can cover its own cost and provide an attractive amenity for passengers. Ancillary services such as express parcel can increase the profitability of the system with a very low incremental cost based on agreements with existing courier and expedited transportation services.

The passenger rail market analysis confirms there is a substantial market for intercity travel between all the cities on the MWRRS network. In many markets, the MWRRS provides a faster and more cost-effective alternative to auto and bus travel. The MWRRS also provides a more cost-effective alternative to air for urban and rural regions that are accessible to the MWRRS rail service. Furthermore, deregulation has made short-distance air travel more expensive and inconvenient due to additional travel time requirements as flights are often routed through major hubs.

The MWRRS forecasts are considered conservative in that they exclude the impact of land use and travel habit changes that may occur as a result of implementing the MWRRS. Prior experience with the implementation of high-quality passenger rail systems suggests that ridership can potentially increase by a further 20 to 30 percent or more because of such changes. For example, firms with operation centers in lower-cost locations may increase their level of trip making and begin using the MWRRS system to move their staff back and forth to their corporate headquarters in major metropolitan areas. Another example is the potential for increased leisure trips, *e.g.,* basketball, football and hockey games and tourist attractions such as casinos, theme parks, museums and other cultural and entertainment facilities.

One of the primary benefits of the MWRRS is the increased linkages and connectivity it provides throughout the region. An important finding is that 2.2 million trips or 14 percent of total rail ridership is generated from through-Chicago connections. Although 14 percent is much less than the 50 percent and 40 percent share of bus and air ridership that makes a connection in Chicago, it is much greater than rail's current share of regional traffic.

Additional detailed information on the demand and revenue forecasts can be found in Appendix A11.

4.12 Express Parcel Service

4.12.1 Introduction and Background

In 1999, the transport of small parcels and other time-sensitive goods generated $55 billion in revenue in the U.S.[10] Of particular note is a sub-category of time-sensitive delivery services called *express parcel traffic*.

The rapid growth in this market may offer an opportunity for the MWRRS to supplement passenger revenues by participating in the movement of these shipments. Such delivery services have been growing 10 percent annually[11] and have become a routine way of transmitting materials by business and personal users. Same-day delivery is estimated to be 5 percent of the total market revenue. The parcel market is growing rapidly – its explosive growth rate was confirmed by direct interviews with both UPS and FedEx officials. Since the market for express parcel delivery continues to double every 6 years, the industry now struggles to develop sufficient capacity to keep pace with the growth.

To be successful in today's express parcel market, a transportation mode must be able to specify a transit time and meet delivery commitments[12]. As shown in Exhibit 4-43, air and highway are the dominant modes for shipping time-sensitive goods within the U.S. However, a recent trend among shippers has shown that the particular mode used to transport these express packages is becoming increasingly unimportant[13]. Therefore, if a rail system could provide similar service to that offered by alternate modes, rail could develop market share in this rapidly expanding market.

[10] Figure is from 1999.
[11] Growth rate calculation is discussed further in "Analysis of National and Regional Express Parcel Growth Rates" elsewhere in this paper.
[12] Cottrill, Ken. "All in Good Time." In *Traffic World*, December 21/28 1998 (pp 51-52).
[13] Kilcarr, Sean S. "Gaining Ground." In *Air Cargo World*, February 1999 (pp 38-42).

Exhibit 4-43
1999 Estimate of the U.S. Domestic Market
for Time Sensitive Shipments

Type of Parcels	*Quantity of Parcels*	*%*
Air	1.5 billion	36.3%
Ground Parcel	2.5 billion	60.7%
Less than Truckload (LTL)	0.1 billion	2.9%
Total	4.1 billion	100%

Source: The Colography Group, Inc.

4.12.2 Opportunities and Pitfalls

The delivery of time-sensitive materials is an intensely competitive business controlled by a handful of large companies with a national and international presence. These companies have local collection, distribution and package-tracking systems in place. They provide line-haul transportation directly through their own planes and trucks or through contracts with other carriers, including railroads.

However, the way in which the large overnight carriers organize their pickups and deliveries is not conducive to the requirements for same-day service, thereby creating a niche opportunity for a new market entrant such as the MWRRS. A courier for an overnight carrier such as FedEx or Airborne may deliver a large number of packages in a morning delivery run. The more that can be delivered on a single trip, the lower the carriers' unit cost. The incentive is to deliver as many packages on a single trip as possible without returning to the terminal.

In contrast, same-day service requires customized pickup and delivery that moves individual packages directly from point-to-point. There is not enough time to go through the usual sorting or *break bulk* operations. Same-day couriers do not adhere to fixed routes. While some couriers concentrate their operations around airports, many other firms specialize in intra-city delivery and will go between any two addresses in the same city, including rail stations. Local courier firms, which are potential business partners to an MWRRS express parcel service, already exist in all of the major MWRRS cities.

Small local courier firms pay lower wages and are more flexible in their utilization of labor than the large national carriers. These flexible firms could perform pickups and deliveries at a lower cost than the large national firms could. A partnership with the MWRRS would give local couriers an additional premium service to offer at little additional cost, since their own local distribution system and infrastructure are already in place. As such, this partnership represents a value-added service to them since it would not likely displace their existing services, but would enhance their volume and revenue. Nonetheless, individualized pickup and package delivery are very labor intensive, comprising up to 70 percent of the cost of providing same-day, door-to-door service.

However, the ability to offer a door-to-door, not just station-to-station, service is vital to competitive success in this market. A centralized call center is needed to serve as a single point of contact for the customer, to proactively manage service delivery, and to ensure consistently high quality. Wholesale marketing based on price discounting is not an effective sales strategy for this type of operation. *Retail* sales directly to end-users would allow a rail-based service to compete on the quality of its service rather than on its price. Parcel service could be provided by the passenger service operators themselves or by a separate entity under an exclusive licensing arrangement that guarantees the MWRRS a fair share of the revenues.

Rail can compete best in those markets where it has a natural advantage, primarily the central business districts of cities with a MWRRS rail station – in fact, anywhere the rail station is closer to the customer than the airport would be advantageous. Most European rail parcel business originates and terminates within a 15-mile radius of a rail station. Since the cost of providing courier service is largely distance-based, a downtown station provides both a cost and time advantage for using rail to many customers. Shorter distances to the rail station allow faster and cheaper courier service than if packages have to be driven all the way to the airport. Additionally, an MWRRS express parcel service may create new markets for shippers like mail order houses who could offer same-day service to customers at a reasonable cost.

Airlines have long been players in the same-day parcel market; however, airlines by their nature specialize in longer hauls compared to the trip lengths that will be offered by MWRRS. Many smaller MWRRS cities have limited air service. To initiate an air shipment, it may be necessary to drive a package the full distance to the nearest major airport (*e.g.*, Chicago). The need for long courier trips makes same-day delivery cost-prohibitive for many potential users today.

The MWRRS can fill the void left by the decline of regional air service, providing a cost-effective alternative to long courier trips. An MWRRS parcel service could serve many intermediate markets that are not well served by air today. The ability to cost effectively reach these markets would open up new same-day business potential, and not diminish existing business. For the same reasons that many small airports are losing air service, MWRRS parcel service would enjoy a measure of protection from air competition on the short-haul routes served by the MWRRS.

The MWRRS could even complement, rather than compete with, air cargo services by bringing long-haul parcels from outlying areas into the major air shipment hubs. For example, it would be less expensive to ship a parcel from Bloomington, IL to Chicago O'Hare via the MWRRS, than to pay a courier to hand-carry that same package to Chicago. With a MWRRS service, it is envisioned that a highway shuttle would accomplish the last leg of the trip from Union Station to O'Hare. *Air connect* cargo was not included in the MWRRS express parcel forecast, but the potential for developing air cargo feeder traffic should not be neglected.

To summarize, the MWRRS can be attractive to same-day express parcels for exactly the same reasons it is attractive to passengers

- In corridors 300-500 miles in length, rail is faster than auto and just as fast as air. If post 9/11 air security requirements are taken into account, rail is both faster and less expensive than air.
- Rail offers convenient access to downtown and intermediate markets, giving both a cost and speed advantage over air.

- Rail competes with highway and air on speed, reliability and convenience rather than on price.

Because the market requirements for providing express parcel and passenger services are so similar, an express parcel component can be added to MWRRS without fear of degrading passenger service, or introducing conflicting management objectives. To ensure that passenger service is not degraded, the parcel business plan provides dedicated personnel at each station who would handle the loading and unloading of trains. This activity can be accomplished without involving the train crew and within the constraint of the normal station dwell times.

4.12.3 Proposed MWRRS Conceptual Model

An MWRRS express parcel service could function in two different ways:

- *The system could provide station-to-station service*. An individual would drop off a parcel directly at an MWRRS station, and the receiver of the parcel would pick up the package at the destination stations. Station-to-station service is much less costly than door-to-door service. For example, to move a package from downtown Detroit to downtown Chicago, same-day door-to-door air service costs $175. Airport-to-airport service costs only $65. The downtown location of many MWRRS stations would be convenient to many customers, and could allow many of them to take advantage of lower-cost station-to-station service.
- *The MWRRS operator could enter into partner agreements* with local courier services to provide door-to-door pickup and delivery services. Rail stations' downtown locations would provide a competitive advantage in the cost of courier service in central business districts. Local couriers may be a valuable source of marketing leads, but cannot be relied upon to market or sell an intercity express parcel service for the MWRRS. The MWRRS needs to control its own sales and marketing function; couriers would be relied upon solely for package pickup and delivery.

For example, couriers bring nearly all the business to and from Eurostar's *Esprit* package service. They bring 60 percent of packages to the Swedish firm *Expressgods*. While UPS does ship a few packages, UPS regards *Expressgods*' service as too expensive for regular use. Accordingly, financial projections are based on providing door-to-door retail service. However, if customers choose station-to-station service instead, the parcel operator saves both courier and call-center costs. These savings can be passed through to the customer with no net effect on the bottom-line profitability of the MWRRS parcel service.

The MWRRS business plan is revenue neutral with regard to the choice of door-to-door versus station-to-station service. Because door-to-door service requires more investment, competitive airline pricing suggests that station-to-station service may be more profitable. Door-to-door service would be provided as a necessary accommodation to customer needs rather than as a profit center in itself. For example, if couriers absorb 70 percent of the $175 cost of Detroit-Chicago door-to-door service, that leaves only $53 for the airline, compared to $65 they charge for airport-to-airport service.

Therefore, the MWRRS analysis was based on the conservative assumption of a door-to-door pricing structure, with courier costs immediately absorbing 70 percent of the revenue. Any shift towards station-to-station shipping should only increase the profitability of MWRRS parcel service.

With regard to the offering of corporate accounts, the MWRRS express parcel business plan assumes same-day packages are picked up and delivered individually. Customers who make routine use of same-day service may gain some economies of scale by tendering multiple packages at the same time, which immediately reduces the cost of the courier's service. By scheduling pickups and deliveries on a regular basis, call center costs can be reduced. Accordingly, we believe corporate account arrangements should be revenue neutral since a significant cost savings is possible to offset any price reductions.

The proposed MWRRS same-day delivery service is intended for *time-sensitive* but not *time-critical* shipments. An example of a time-critical movement (which is unlikely for MWRRS) would be the delivery of a replacement part needed to restore a factory assembly line that had shut down – at a cost of thousands of dollars per hour. For such emergencies, a shipper might charter a plane for long distances, or a truck when distances are shorter. FedEx's *Custom Critical* division provides this kind of express freight service – its shipments tend to be larger and heavier than those envisioned for the MWRRS parcel service.

Examples of time-sensitive materials that *could* be candidates for MWRRS same-day service include pharmaceuticals, high-value mail order items, computer parts and discs, auto and machine parts to retail users, letters, legal documents, and cancelled checks.

Greyhound Lines, Inc. already offers shippers a variety of services similar to those envisioned for MWRRS (*i.e.*, an independent service and partnership service). Greyhound's Freight Distribution Division earned roughly $80 million in 1999, which represented approximately 7 percent of Greyhound's revenue for that year[14].

4.13 Express Parcel Market Analysis

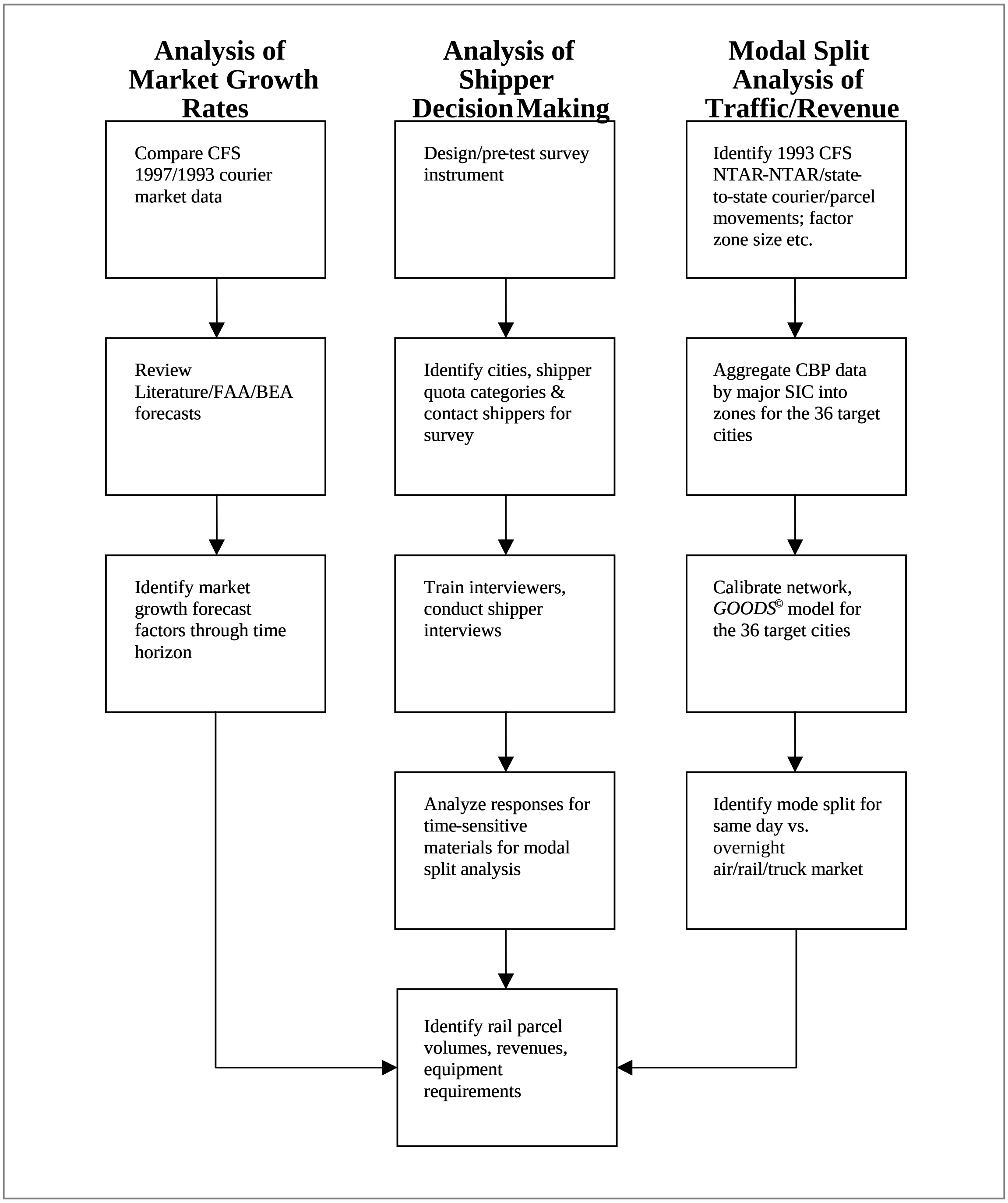
The goal of this market analysis was to thoroughly assess the Midwest express parcel market, in order to provide realistic MWRRS traffic and revenue estimates. A five-step approach was used:

- Interviews with Midwestern shippers to identify the importance of time-sensitive goods movement to business, relative volumes of same-day vs. next-day and second-day shipments, and decision-making criteria
- Interviews with expedited goods movement carriers to identify likely market strategies and potential synergies with local and national couriers and carriers
- Analysis of the growth rates of regional express parcel activity
- Detailed analysis of total parcel movement within the region using the General Optimization of Distribution System© (*GOODS*©) to perform a modal split analysis of base year volume and value of goods
- Identifying the proportion of national time-sensitive goods movement that comprises the same-day market

An overview of the methodology used is depicted in Exhibit 4-44.

[14] Allen, Margaret. "Greyhound Hopes to Team with Package Delivery Company." In *Dallas Business Journal*, January 14, 2000.

Exhibit 4-44
Express Parcel Analysis Methodology



List of acronyms used in the above exhibit:

CFS	=	Commodity Flow Survey
NTAR	=	National Transportation Analysis Region
FAA	=	Federal Aviation Administration
BEA	=	Bureau of Economic Analysis
SIC	=	Standard Industrial Classification
CBP	=	County Business Pattern

4.13.1 Interviews with Shippers in the Midwest Region

Interviews were conducted with shippers to identify the importance of time-sensitive goods movements, relative volumes of same-day vs. next-day and second-day shipments and decision-making criteria. Eighty-eight interviews were completed representing manufacturing, service and wholesale/retail sectors. These businesses account for about 200,000 annual shipments. The survey questions asked are given in the September 2000 Project Notebook.

Interviewees indicated considerable interest in the concept of an express parcel service on the MWRRS and provided statistical information for determining demand. An important finding of the survey is that same-day shipments represent about 5 percent of total time-sensitive shipments.

This finding excludes the anomaly of the Federal Reserve Bank of Chicago's check-processing center (known as the Clearinghouse). The volume this single customer generates, all of which is handled on a same-day basis, represents 1,000 inbound and 500 to 600 outbound shipments per week, ranging in weight from 1 to 100 pounds. If the Federal Reserve Bank had been included in the survey, the same-day portion of the total expedited parcel market would increase to 45 percent. The business plan did not assume that the MWRRS captured any of the Clearinghouse's business.

4.13.2 Interviews with Expedited Goods Movement Carriers

Interviews with expedited goods movement carriers identified likely market strategies and potential synergies with local and national carriers. A telephone survey of fifteen expedited service providers was conducted to determine their thoughts on how their company could potentially interface with the MWRRS. Additionally, direct meetings were held with officials from both FedEx and UPS. Overall, there was strong support for the concept of a MWRRS express parcel service.

Since 1999, there has been an increase in the electronic transmission of documents. However, cyber-security on the Internet is still perceived as a problem, which is driving a portion of the demand for same-day courier services. There are many circumstances where a paper document is still preferred or required, as in the delivery of business proposals. Interviews with FedEx in 2003 confirmed that the express parcel market is continuing to grow at 10 percent per year, in spite of Internet use and the current recession.

Market Opportunities

Through interviews with carriers, it was made clear that many saw the MWRRS service as a possible substitute for same-day air but not as a substitute for next-day truck movements. Reliability was seen as a key issue, as was the time required for getting the shipments to the express courier upon arrival at the station. A major problem with using an air service is the time required to get the shipment from the air carrier at its destination. Infrequent departures and high airline pricing were other issues. Recently, security concerns have hampered some air carriers. Lastly, the carriers determined that the MWRRS level of scheduled service is more than sufficient to attract users.

Pricing

Respondents believe that line-haul costs would need to be about 75 percent of air costs to break into the station-to-station parcel market. Carriers indicated that their local pick-up and delivery networks represent a significant portion of the cost of operation. For this type of service, the line-haul portion of revenue should represent no more than 40 percent of the total, and possibly less, depending on the distance and other options available. For the MWRRS, a same-day parcel movement price of $50, nearly $15 less than airline prices for airport-to-airport service, appears to meet the need of the market.

Location

Carriers indicated that most express parcel movements originate in suburban areas; therefore, a suburban rail station would be of value in larger cities. However, carriers also indicated there is a niche downtown business market where rail could excel with short pick-up and delivery times to downtown customers. In cities with a population of less than 1 million, a single downtown rail station is clearly satisfactory.

4.13.3 Analysis of National and Regional Express Parcel Growth Rates

A literature review was conducted to assess issues and trends in the express parcel market. Sources included the ENO Foundation, *Air Cargo World*, *Traffic World* and other trade publications, as well as the American Trucking Association. This was supplemented by information directly gathered from courier companies and through user interviews. It was determined that a 10 percent annual growth rate was reasonable through 2010, based on the assumption that overnight shipments have been increasing at more than 10 percent annually and that same-day shipments are perceived as the next growth threshold for time-sensitive shipments. Discussions in 2003 with expedited goods carriers have confirmed the continuance, even in the current recession, of a greater than 10 percent annual growth rate.

4.13.4 **GOODS©** *Analysis of Same-Day Parcel Movement Potential*

GOODS© (General Optimization of Distribution Systems) is a modeling framework designed to support the analysis of parcel traffic flows at the regional level. *GOODS©* is structured on two principal models: Total Demand Model and Hierarchical Modal Split Model.

To determine what portion of the national parcel is accessible to the MWRRS, the 1993 Commodity Flow Survey (CFS) data were used. The Bureau of Transportation Statistics, a division of the U.S. Department of Transportation, administers the CFS. The survey consists of a sample of 200,000 domestic establishments (randomly selected from roughly 800,000) engaged in mining, manufacturing, wholesale, auxiliary establishments (warehouses) and selected establishments in retail and service. The database offers detailed information concerning the origin and destination of the shipment (*i.e.*, zip code), the 5-digit Standard Classification of Transported Goods (SCTG) code, weight, value and mode(s) of transport.

The 1993 CFS was the most up-to-date information available at the time of the analysis. CFS data was used to estimate the underlying origin-destination demand pattern, not to determine the overall size of the market. Clearly not all parcel shipments included in the CFS can be considered candidates for the MWRRS same-day parcel service. Because of this, the data was segmented in order to identify the components of the parcel market that could be considered for MWRRS same-day parcel service.

The first step was to segment the market on a geographical and commodity basis. CFS data reports the shipment origin and destination based on the National Transportation Analysis Region, or NTAR. Only Midwest region NTARs served by the MWRRS (in which nearly one-fourth of the entire U.S. population lives) were considered part of the MWRRS market. The 17 NTARs in the MWRRS market area include:

Cleveland	Chicago
Cincinnati	Milwaukee/Madison
Columbus	Appleton/Green Bay
Toledo	Minneapolis/St. Paul
Detroit	Des Moines/Cedar Rapids
Grand Rapids	Kansas City, MO
Lansing/Kalamazoo	Springfield, MO
Fort Wayne	St. Louis/Quincy/Springfield, IL
Indianapolis/Champaign	

Five filters were then applied to the CFS origin-destination data to estimate the parcel traffic that might be accessible to the MWRRS:

- Traffic to, from or between non-MWRRS NTARs was excluded. This filter excludes most air-competitive, long haul traffic that the MWRRS might nonetheless handle in a feeder air connect service.
- Parcel movements whose origin and destination were within the same NTAR were eliminated as potential candidates for the MWRRS express parcel service; local couriers would dominate in this market segment.
- NTAR city pairs that are too far apart to allow for same-day service on the MWRRS were excluded, (*e.g.*, Cleveland to Omaha with a travel time of 10 hours) whereas NTAR pairs 3-4 hours apart were considered excellent candidates.
- The analysis compared MWRRS station locations with NTARs to determine the area in which express parcel service may be feasible (*i.e.*, some NTARs are geographically very large). Since not all parts of the region could be reached in time for the same-day service, a "shrinkage" factor was applied to each NTAR pair based on the zone size, distance between city pairs, population density and limited access from some parts of each NTAR to the MWRRS.
- Unsuitable types of goods not appropriate for transport on the MWRRS were eliminated. Excluded commodities include mining, construction, agriculture, forestry and fishing, and chemicals. The major commodity groups allowed to remain in the sample include light manufacturing, heavy manufacturing, food and beverage, wholesale, retail, and finance, insurance, real estate services and public administration.

Geographic and commodity filters, when applied to the CFS data, eliminated 88.58 percent of the market from further consideration, such that only 11.42 percent of U.S. parcel movements were identified as suitable for a MWRRS service.

The CFS gives the total value of goods carried in the parcel market, not the amount of freight revenue earned through transport of those goods. As previously noted, the U.S. market for time-sensitive freight was estimated at $55 billion for 1999. The total amount of parcel revenues potentially available to the MWRRS is equal to 11.42 percent of $55 billion, or $6.3 billion. This was considered reasonable given the 25 percent population share of the Midwest region.

However, as discovered in the stated preference survey, only 5 percent of the total market for express parcel service is for same-day service. The total size of the 1999 MWRRS express parcel market was therefore estimated at $314 million in 1999 dollars.

Given this market demand, a modal split model was used to estimate what percentage of shippers would benefit from this improved mode of travel, and therefore might utilize this mode. Because air service is weak in many MWRRS intermediate markets, much of the market potential for same-day service remains unexploited today. In major markets where MWRRS must compete with air, the modal split model took into account the characteristics of the different modes along with the stated preferences of customers.

Considering line-haul and access/egress travel times and the costs of various alternatives, *GOODS*® estimated that MWRRS passenger service could attain an 18.5 percent share of the MWRRS-accessible market or an annual revenue of $58.1 million in 1999 dollars[15].

Express parcel operators indicated that local courier services would consume 70 percent of origin-destination revenue, or $117 per package. At taxicab rates, $117 would be sufficient to cover the cost of a 70-mile delivery, giving a 35-mile range around both origin and destination rail stations. However, since most packages originate and terminate within a 15-mile radius, courier cost will most likely be less. The business plan conservatively assumes that MWRRS passes courier cost savings back to customers, keeping only $50 for itself. By comparison, the line-haul air price (Chicago to Detroit) is $65 per shipment.

Of the $58.1 million in door-to-door revenue, the MWRRS is expected to retain only about 30 percent of the total, or $17.4 million (based on in 1999 shipping volumes) with the remaining 70 percent going to pickup and delivery couriers. These calculations are summarized in Exhibit 4-45.

[15] The General Optimization of Distribution Systems (*GOODS*®) freight demand model was designed to support the analysis of freight traffic flows at the regional or urban level. The model uses a generalized cost approach to distribute shipments among the various modes. The model uses a nested logit structure, calibrated to model intercity modal choices available in a given study area. It predicts shippers' decisions based on the assumption that the shippers will act in a manner that minimizes their costs.

Exhibit 4-45
1999 MWRRS Market for Express Parcel Service

	CFS 1993 Parcel Value (Millions)	***Time-Sensitive Carrier Revenue (Millions)***	***Percent of Total***
Total U.S. Market	$563,603	$55,000	100.00%
Geographic Distribution: MWRRS-Accessible Origin and Destination	$64,352	$6,281	11.42%
5% of Time-Sensitive is Same-Day	-	$314	0.571%
18.5% Forecasted Share of MWRRS-accessible Traffic	-	$58.1	0.106%
30% MWRRS Revenue split with Couriers	-	$17.4	0.0316%

Source: 1993 Commodity Flow Survey from U.S. Department of Transportation, Shipper and Carrier Interviews in 1999.

4.14 Forecasts

Growth rates were applied to the 1999 revenues to forecast the future growth of the system. During the analysis, it was assumed that current double-digit growth rates of the parcel market would gradually slow. The growth rates used in the forecast years of 2010, 2020 and 2030 are 10 percent, 8 percent and 6 percent, respectively. By applying these growth rates, 1999 base year revenue would grows to $49.6 million in 2010, $107.2 million in 2020, $191.9 million in 2030 and $343.7 million in 2040, as seen in Exhibit 4-46.

Exhibit 4-46
Forecasted Revenue for MWRRS Express Parcel Service

	Revenue (Millions)	***Comment***
Control Year 1999	$17.4	
Growth to 2010	$49.6	Growth Rate from 1999 – 2010 = 10%
Growth to 2020	$107.2	Growth Rate from 2010 – 2020 = 8%
Growth to 2030	$191.9	Growth Rate from 2020 – 2030 = 6%
Growth to 2040	$343.7	Growth Rate from 2030 – 2040 = 6%

4.14.1 Discussion of Results

This study suggests that there is high revenue potential for a same-day MWRRS parcel service. Next-day and other express parcel services could add even more revenue. The key to a successful express parcel service will be not only to allow direct station-to-station movements by individuals and businesses, but also to provide door-to-door service through partnership agreements with courier services.

The analysis indicates that the MWRRS can carry express parcels profitably and add significant revenues to the rail system, while capturing no more than a 0.106 percent share of the U.S.

market for express parcels, even though 25 percent of the U.S. population lives within the MWRRS service area. Projected package counts are given in Exhibit 4-47.

Exhibit 4-47
Projected Daily MWRRS Package Counts in 2014

NTAR Zone	*Shipped*	*Received*	*Transfer*	*Total Pkgs*
Chicago-Peoria, IL-Davenport, IA	1,247	2,008	1,001	4,256
Milwaukee-Madison, WI-Dubuque, IA	552	603	173	1,327
St Louis-Springfield, IL	562	210	0	772
Detroit, MI	424	340	0	764
Cleveland-Youngstown, OH	388	295	0	683
Indianapolis, IN- Champaign, IL	350	329	0	679
Minneapolis/St Paul, La Crosse, WI	325	347	0	672
Kansas City, MO- Topeka, KS	148	261	0	409
Fort Wayne-South Bend, IN	205	201	0	406
Appleton-Green Bay-Wausau, WI	262	84	0	346
Grand Rapids-Saginaw, MI	222	112	0	334
Cincinnati, OH	146	138	0	284
Lansing-Kalamazoo, MI	164	116	0	279
Toledo, OH	93	59	114	266
Des Moines-Cedar Rapids-Waterloo, IA	120	105	0	225
Total Volume Forecast	**5,208**	**5,208**	**1,288**	**11,702**

5. Infrastructure Capital Costs

5.1 Background

During the initial stages of the MWRRI study, the infrastructure analysis involved developing corridor right-of-way improvements for all of the MWRRS corridors, paired with advances in train technology. For the first stage, infrastructure requirements were developed for each of the three scenarios (Conservative, Moderate and Aggressive) through discussions with the engineering staffs from the states and Amtrak along with a detailed review of previous engineering studies. Critical data for this analysis included existing condensed profile track data for each corridor. This data was entered into the *TRACKMAN*© Track Inventory Model and subsequently evaluated with each state and Amtrak at a series of review meetings. The data was then updated; in most corridors, the updates were based on recent hi-rail trip data, reports by engineers implementing track upgrades, and data from engineering reviews of the rights-of-way.

Using an interactive process with the states and Amtrak, improvements for each corridor were recommended. Comparisons were made between train technology performance at given levels of infrastructure improvement and the time saved per dollar spent. The extent of the infrastructure improvements was then estimated based on existing studies and interviews conducted with state and Amtrak representatives, and were then categorized by major component (track, bridges, etc.). Physical quantities for each category were estimated for each route. Unit costs were developed and applied to the quantities developed for each corridor to estimate the corridor and system infrastructure costs.

For the initial stage of the study, infrastructure improvements were staged to first provide improvements to all corridors to the Conservative Scenario level, and then to improve the most profitable corridors to the Moderate Scenario level. The technology and infrastructure improvements for the Conservative Scenario were defined as follows:

- Conventional locomotive-hauled rolling stock
- Top speed of 79- or 90-mph (via ROW improvements)
- New locomotives
- Implementation of up to 5" unbalance operation
- Improved track alignments and connections
- Installation of ITCS or similar technology (*i.e.*, ATCS Phase I) on segments above 79-mph
- Grade crossing upgrade and elimination program (3 percent per year)
- Upgrade of stations at appropriate locations

Technology and infrastructure improvements for the Moderate Scenario included the elements for the Conservative Scenario, such as advanced signaling, and were further defined as follows:

- Top speed of 110-mph (via equipment and ROW improvements)
- Either DMU rolling stock (*e.g.*, IC3 Flexliner with steerable trucks) or new locomotives with cars
- Implementation of up to 6" unbalance operation
- Major bypass program
- New line between Cleveland and Chicago via Ft. Wayne
- Grade crossing upgrade and elimination program (5-7 percent per year)

- Station upgrade program

The initial study also investigated an Aggressive Scenario for infrastructure and technology that was determined to be not cost-effective for implementation prior to 2010. However, this higher speed scenario might be warranted for future improvements to specific corridors beyond 2010.

In the 2000 MWRRS Study, a review of the original implementation process revealed that while the conservative to moderate staging reduced the rate of capital expenditure for infrastructure, it increased the level of operating losses. Since each state held as a key objective the reduction or avoidance of operating losses, it was decided to revise the Implementation Plan. The states therefore requested that a revised Moderate Implementation Plan be investigated as an alternative to the Conservative to Moderate staging approach outlined in the Executive Summary and Final Report of the 1998 MWRRS Study. The implementation of infrastructure and train technology improvements was accelerated to a more ambitious program that would take the most profitable corridors directly and as quickly as possible to 110-mph, rather than improving these lines in a two-stage process. Under the revised Moderate Implementation Plan, significant schedule improvements and new rolling stock could be simultaneously introduced to maximize ridership impact and minimize operating losses.

The principles underlying the revised phasing of segment construction are as follows:

- Maximize the geographic coverage of the improvements
- Generate maximum and immediate improvements in corridors of greatest ridership and revenue potential relative to the investment required
- Delay full-scale improvements to segments (*e.g.*, Chicago-Milwaukee), branch lines (*e.g.*, Green Bay, Quincy, Grand Rapids, Port Huron) or corridors (*e.g.*, St. Louis-Kansas City) with high cost or lesser potential
- Maintain construction funding requirements at reasonable levels throughout the project

Revised timing and costs for planning, preliminary engineering, EIS, design and construction, and rolling stock acquisition were developed for each of six implementation phases. An update of segment design and construction costs for each route was developed. The intent of the revised Moderate Implementation Plan was to provide incremental, yet significant, improvements in service as early as possible, in as many corridors as possible. Note that not all segments for the fully completed MWRRS are improved to 110-mph; the 79-mph and 90-mph segments are generally consistent with those developed for the first implementation phase of the MWRRS.

5.2 Infrastructure Assessment

The infrastructure analysis completed in 2000 for the MWRRS involved a more detailed assessment of the rail rights-of-way and capacity, as well as a refinement and validation of the unit infrastructure costs used in the preliminary plan. This analysis accomplished the following objectives:

- Identify track capacity and engineering design parameters that are compatible with freight and other railroad operations
- Assess train capacity at Chicago Union Station with respect to the proposed MWRRS operations

- Conduct a more detailed engineering assessment of the nine corridor rights-of-way comprising the MWRRS
- Identify potential environmental issues on the corridors that might require remediation under the National Environmental Policy Act (NEPA)
- Perform a more detailed assessment of the unit costs for each category of infrastructure improvements (*e.g*., track, bridges/under and over, etc.)
- Revise estimates of the physical quantities needed for each route for each category, as appropriate
- Apply unit costs to these quantities to estimate corridor and system infrastructure costs
- Employ infrastructure costs as part of the Business Plan to evaluate the revenue and ridership potential of the nine rail corridors that comprise the MWRRS

The infrastructure assumptions were further refined in 2004, which generally resulted in an increase in capital costs and the imposition of minor speed restrictions. It should be noted that these speed restrictions were not severe enough to affect the planned train schedules or demand forecasts that had been developed previously.

5.2.1 Track Capacity Issues

For the initial MWRRI study, aside from maximum allowable track speed, the most critical factor associated with determining the infrastructure needs was available line capacity. The lines proposed for use in the MWRRS are mainly owned by private freight railroads that use them essentially for their own trains. In addition, in the Chicago area, there is an extensive commuter rail system operated by Metra, as well as Amtrak long-distance trains using many of the same lines.

While Amtrak has a legislated right to provide train service on these lines, an agreement is required from the private railroad operators regarding other conditions for Amtrak's use of their rights-of-way. The key issue is not only the level of capacity required to handle the current traffic, but the future levels of freight and passenger traffic on these lines as well. Where capacity is readily available, Amtrak can obtain access at incremental cost. Where capacity is unavailable or upgrading is required, the private rail lines will require an additional infrastructure investment. That level of investment is subject to negotiation and can be substantial.

To evaluate the potential requirements and investments for the MWRRS, an assessment was made of the potential improvements to line capacity that might be required. The freight railroads and Amtrak provided information on the existing traffic on each route. The different routes were assessed and three types of track mitigation measures were developed.

Chicago-Area Routes

The Chicago rail hub is heavily used by both freight and passenger rail services. On many routes, Metra runs very dense commuter services and, indicative of the intense freight activity in the Chicago area, freight rail traffic builds up at approaches to yards and manufacturing facilities. Significant route and capacity enhancements including a new *South-of-the-Lake* access route are already planned for this area, particularly for routes running south and east of Lake Michigan (*e.g.*, Chicago-Detroit, Chicago-Cleveland, Chicago-Cincinnati and Chicago-Carbondale). To the north of Chicago, significant route restructuring and/or capacity development is planned to provide a route to Milwaukee, Green Bay and Twin Cities. Additionally, four flyovers are planned on the Metra Heritage Corridor. The Metra Heritage Corridor extends from Union Station to Joliet Union Station along tracks owned predominantly by the CN Railroad. The line is crossed at grade by other railroads at four locations between Bridgeport (MP 3.5) and Argo (MP 13.1) resulting in frequent train delays for the Metra commuter trains and Amtrak service. The crossings are Panhandle Crossing (MP 5.1) crossed by NS and CSX; Corwith Junction (MP 6.6) crossed by BNSF; LeMoyne (MP 7.9) crossed by BRC; and Argo-CP Canal (MP 13.1) crossed by IHB.

The Chicago Regional Environmental and Transportation Efficiency program (CREATE) a public/private partnership, will improve passenger rail service, reduce motorist delay, ease traffic congestion, increase safety, and provide economic, environmental and energy benefits for the Chicago region. Because Chicago is the nation's transportation hub, the CREATE program will increase the efficiency and reliability of the nation's rail service. In addition, the project will preserve the footprint for the region's proposed high speed rail network.

Heavily Used Freight Routes

On heavily used freight routes such as Chicago-Cleveland, additional and significant route infrastructure is proposed. This new infrastructure can take the form of a new dedicated passenger track alongside existing track (as proposed for the Toledo-Cleveland segment), or the use of a lightly used parallel line (such as the Iowa Interstate route between Chicago and Omaha instead of the heavily used Union Pacific and Burlington Northern-Santa Fe routes).

Lightly Used Freight Routes

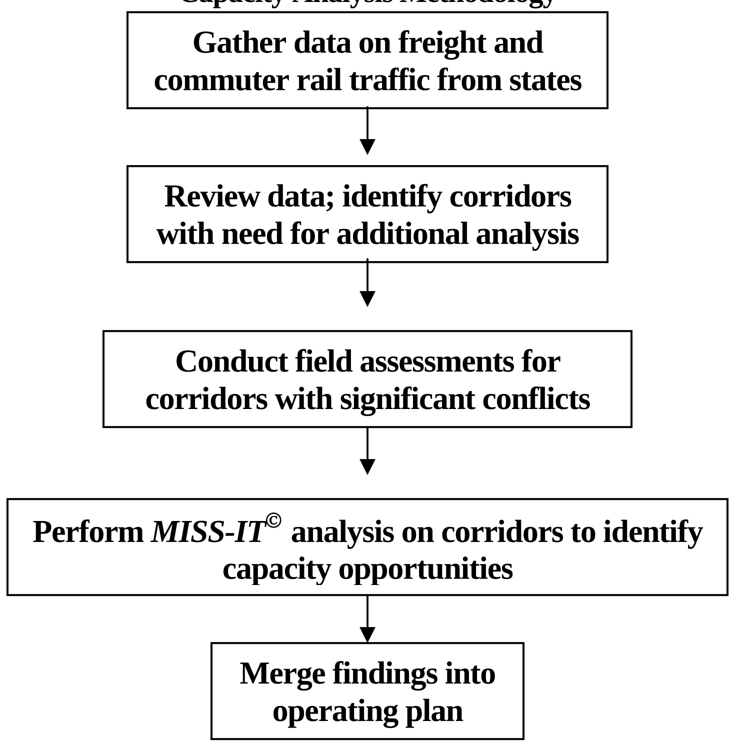
On many routes, recent consolidations or mergers of the railroads have resulted in a concentration of traffic onto a few routes leaving several only lightly used by local freight traffic. As a result, some of the MWRRS routes could encounter declining freight traffic or even abandonment. For example, the Big 4 route selected for the Indianapolis-Cincinnati segment carries only local freight traffic today. Where routes have fallen into disrepair or are lightly used, the lines will be improved to FRA Class 4 and 6 standards needed for 79- and 110-mph operations, respectively. In addition, a design standard of 10-mile long sidings every 50 miles on the lightly used routes was assumed.

Although these track, signaling and grade crossing mitigation measures provide a reasonable basis for developing infrastructure costs for the MWRRS, it should be noted that the track requirements of private railroad operations are heavily influenced by the level of consolidation in the industry. While the overall growth of freight traffic is significant, the increasing degree of freight railroad integration can have a significant impact on any line. In the next ten years, the freight railroads could consolidate further, concentrating traffic onto even fewer lines.

At this time, the industry view is that certain key freight lines into Chicago, which is a national freight traffic hub, will be increasingly used. As a result, the requirement for passenger-only access routes to Chicago is likely to become essential and is proposed by this study. However, away from Chicago and other Midwest regional centers, the investment assumptions are more conservative depending on the freight and passenger traffic density expected to operate over each line segment.

More in-depth analysis of these issues is being undertaken, as certain freight railroads have become actively involved in the planning process for the MWRRS. The MWRRI Steering Committee is committed to working cooperatively with the freight railroads towards achieving solutions and building effective working relationships. Signals, sidings and the use of computer software can serve to increase capacity, perhaps more effectively than an entirely new line, and certainly at far less cost. Freight productivity can increase while permitting increased passenger access to the lines. The methodology used in the Capacity Analysis is depicted in Exhibit 5-1. Further discussion on freight and commuter railroads and shared access is discussed in Chapter 12, Institutional and Organizational Issues.

Exhibit 5-1
Capacity Analysis Methodology



5.2.2 Detailed Engineering Assessment

The engineering assessment was performed at a feasibility level, and was designed to provide an accurate database of the basic information needed to move the project forward and ensure that no fatal flaws exist that would nullify the conceptual analysis and findings. Exhibit 5-2 provides an order-of-magnitude estimate of the accuracy of capital estimates by project segment.

Exhibit 5-2
Typical Tasks of Transportation Project Development

Typical Project Task	*Approximate Engineering Design Level*	*Approximate Cost Estimating Level of Accuracy*
Feasibility Study	0%	+ /- 30% or worse
Project Definition/ Advanced Planning	1-2%	+ / – 25%
Conceptual Engineering	10%	+ / – 20%
Preliminary Engineering	30%	+ / – 15%
Pre-Final	65%	+ / – 15%
Final Design/ Construction Documents	100%	+ / - 10% or better

5.2.3 Infrastructure Assessment by Element

A systematic engineering planning process was used to conduct an engineering assessment of the rail corridor and estimate the capital investments required to support a given passenger rail technology. The initial step in this process was to divide each route into logical segments and quantify the major infrastructure cost elements either present or required in each segment. The cost elements include:

- Track work
- Stations, terminals, and maintenance facilities
- Bridges/under
- Bridges/over
- Crossings
- Train control (signals and communications)

An engineering assessment of each corridor was accomplished by conducting field inspections of each segment. The field inspections were used to verify conditions at readily accessible points along the route and at the site of major structures and stations. The field inspections did not attempt to assess FRA track safety standards or the condition of structural elements, (*e.g.*, bridges, overpasses). At each location, engineering notes were compiled and the physical track conditions were compared with the latest available track charts and other data provided by the railroads. These field inspections were coordinated with the appropriate state, host railroad and Amtrak.

Track Work

During the field inspections, the condition of the track was noted and a determination made relative to the improvements required to accommodate a specific passenger train technology. These "limited" field inspections involved walking short segments of the track at several locations. The purpose was to assess the existing track's suitability to accommodate joint freight and passenger operations based on current usage and FRA track safety standards, and to gather sufficient data to identify needed infrastructure improvements.

Equally important to the physical condition of the track structure is each route's alignment. Curves may restrict speed and increase travel time. For passenger rail operations, it is essential to minimize the effect of the curvature of the route on passenger train speed. This can be accomplished by reducing the curvature or increasing the super-elevation. The curvature data contained within the *TRACKMAN*© files was reviewed to determine the most appropriate treatment.

Modification of Curves
While allowable super-elevations and cant deficiencies must ultimately be negotiated with the freight railroads, this study assumed a consistent MWRRS design standard of 6 inches super-elevation plus 3 inches cant deficiency for qualified equipment, leading to a maximum unbalance of 9 inches. The overall track standard defined for the MWRRS was to increase super-elevation to a maximum of 6 inches on dedicated passenger segments where possible. For lines without any freight operations, additional super-elevation might be possible, however, super-elevation on freight tracks is calculated so that a freight train traveling at 60-mph is in equilibrium. A number of curves may need to be modified to accommodate 110-mph operations. It is not envisioned that curves will be realigned due to the reconstruction cost and environmental considerations associated with this type of improvement. However, limited geometric modifications necessary to accommodate increased super-elevation and spiral lengths may be possible.

Stations, Terminals, and Maintenance Facilities
Existing stations and terminals were inspected and their general condition was noted for confirming capital cost allocation for each route. Based on the selected technology, station platforms may require lengthening. Additionally, substantial improvements in amenities within the stations are needed. The need for parking was also assessed.

Utilization of highly reliable train equipment is critical to achieving the financial goals inherent in the MWRRS plan. In particular, rolling stock must be readily available for revenue service on a daily basis; its propulsion components must provide routine high performance and rolling stock subsystems, such as HVAC, door and on-board passenger conveniences must be reliable and of high quality.

A proposed system maintenance facility concept plan was prepared. Specific locations for these facilities have not yet been identified. Conceptually, proposed locations by type of facility are as follows:

- Backshop Facility
  - Pontiac/Waterford, Michigan
- Service and Inspection Maintenance Facilities
  - Cleveland, Ohio
  - Cincinnati, Ohio
  - St. Louis, Missouri
  - Omaha, Nebraska
  - Madison, Wisconsin
  - Minneapolis, Minnesota
- Layover Facilities

- Chicago, Illinois
- Port Huron, Michigan
- Holland, Michigan
- Carbondale, Illinois
- Kansas City, Missouri
- Quincy, Illinois
- Quad Cities, Illinois/Iowa
- Milwaukee, Wisconsin
- Green Bay, Wisconsin
- Battle Creek/Kalamazoo, Michigan
- Indianapolis, Indiana
- Des Moines, Iowa

Chapter 7 provides further conceptual analysis of maintenance base siting options. HNTB's capital cost includes $110 million for up to six service and inspection facilities, $47 million for layover facilities and $45 million for the Pontiac/Waterford system maintenance facility. This capital cost estimate was accepted without prejudice for developing the MWRRS business and financial plan.

Train Service Access to Stations

Train access to current and proposed stations is critical to on-time service. Several routes will require track reconstruction to reach downtown stations. This study did not include a planning analysis of access to each station in the Midwest region. However, access to Detroit, Toledo and Cincinnati were considered in separate studies authorized by Michigan, Ohio and Indiana, respectively. A planning level assumption was approved by Iowa for access to the Omaha, Nebraska station. Station access is described below.

Detroit Station

The Chicago-Detroit route requires the installation of a new connection track in west Detroit to accommodate access to both the existing and the proposed New Center Station in Detroit.

Currently, Amtrak does not operate directly from the NS tracks to the Amtrak Detroit station at Woodward Avenue, but connects through Bay City Junction. The proposed route of the MWRRS will operate more directly, connecting from NS tracks to CN tracks at West Detroit with a new northwest quadrant-connecting track. The connecting track will include a new #20 turnout on the NS No. 1 main near MP 4.0 and a new #20 turnout at Vinewood on the CN. Additionally, crossovers are required north of Vinewood to allow the MWRRS to cross from the westernmost CN track to the easternmost Conrail Shared Assets track to serve the proposed New Center Station on the east side of the embankment.

A crossover will be required west of NS MP 4.0 to allow passenger trains to utilize the NS No. 2 main on the south side. Two crossovers will be required north of the New Center Station to allow passenger trains to cross to the CN tracks to travel on to Pontiac. This new service requires the construction of two miles of connecting track and the rehabilitation of two CN/CSAO tracks from Vinewood to Woodward Avenue, a distance of 2.5 miles. In addition, the CN bridges that are presently not in service must be inspected and repaired before the introduction of new passenger service.

Toledo Station
In order to ensure passenger train access to the Toledo Station, the western entrance will be reconstructed to accommodate four tracks. This reconstruction is necessary to alleviate freight congestion between the Airline Yard and the station. Additionally, east of the Toledo Station, the existing two-track swing bridge over the Maumee River would be replaced with a new three-track bridge, and the at-grade crossing with CSX at Vickers would be grade separated.

Cincinnati Station
The proposed reconstruction of the 110-mph rail segment between Shelbyville, Indiana and Cincinnati, Ohio requires access into a new terminal proposed for relocation in the western section of downtown Cincinnati.

Iowa Stations
Since service does not currently exist between Wyanet and Omaha on the Iowa Interstate right-of-way, access through Council Bluffs, Iowa across the Missouri River into Omaha is necessary. It is assumed that the entrance to the Omaha Station will utilize the Union Pacific Bridge over the Missouri River.

Stations/Terminals
For this study, a placeholder capital cost of stations and terminals was used depending on whether the station or terminal was constructed new or renovated. The capital cost spreadsheets in Appendix A9 contain the names of the stations and the placeholder assumption used.

Railroad Bridges
A field inspection was conducted on a representative sampling of bridges along the routes. No attempt was made to determine the physical condition of the bridges or their suitability for current usage. An estimate was made of the cost to upgrade or widen the bridges to accommodate passenger rail operations. In many cases, new "flyover" bridges that grade separate rail/rail crossings and interlockings are needed to improve passenger train reliability. The cost to upgrade bridges along the routes was extrapolated from the estimated costs of the representative bridges. A complete inventory of existing bridges was developed for each route and each technology. The cost of new bridges required for new routes or bridge replacements were estimated only at a conceptual level.

Major railroad bridge construction is required on some routes, whereas other routes will require minimal upgrade of the bridges. On the Chicago-Detroit route, it is envisioned that there will be new bridges at Englewood, Illinois and Porter, Indiana as part of the construction of the *South-of-the-Lake* Corridor (SOLC). If the northern alignment of the SOLC is selected, a flyover will be needed near Buffington Harbor (MP 501.8) to transition from the north side to the south side of the NS mainline ending at MP 500.7, west of the EJ&E grade separation. A 5.5 mile elevated structure is required beginning 3 miles east of Buffington Harbor to the western edge of the Indiana Dunes National Lakeshore. If the southern alignment of the SOLC is selected, a flyover near Buffington Harbor is required to transition from the north side of the NS mainline onto a two track main on the property of CSX (old PRR right of way).

On the Chicago-Cleveland route, in addition to the bridges between Chicago and Buffington Harbor, two major flyover structures are needed in the Ft. Wayne-New Haven area. The proposed passenger service through Ft. Wayne will be on new, dedicated track. One flyover is required to transition from the north side of the NS tracks east of the proposed Ft. Wayne station to the south side. The second flyover is needed on the east end of New Haven to transition from the south side of the NS track onto the NS Maumee Woodburn Branch line. Another flyover structure is needed at Defiance to cross the CSX railroad. Between Delta and Cleveland, Ohio undergrade bridges will have to be expanded to accommodate the installation of a third track. Additionally, several bridges will require rehabilitation on the abutments and superstructure. This type of work includes pointing of stone abutment walls, painting of bridges, and replacement of some bearings. A new bridge across the Maumee River in Toledo; a flyover of the NS mainline over the CSX railroad east of Toledo; and a new bridge at the Cuyahoga River are required.

On the Chicago-Cincinnati route, undergrade bridges will be required to carry the Wanatah-Monon segment over several railroad structures and Route 421. Bridges on the segment between Shelbyville and Cincinnati will require either substantial rehabilitation or complete rebuilding, including the bridges located within the Ohio River Valley.

Future bridgework on the Chicago-St. Louis route will be minimal north of Springfield since the track structure and bridges have been upgraded or reconstructed under the on-going construction improvement program sponsored by the Illinois Department of Transportation. Bridgework between Springfield and Q Tower will be required when this segment of track is upgraded for 110-mph operations. Similarly, the Chicago-Carbondale and the Chicago-Quincy routes through Illinois require minimal bridgework since both routes are well maintained.

The level of bridge investment in the St. Louis-Kansas City line will depend on the capacity remediation strategy that is ultimately selected, as well as Union Pacific Railroad’s participation in the cost of double-tracking the Osage and Gasconade River bridges.

The Chicago-Des Moines-Omaha route between Wyanet and Omaha requires major bridge upgrade or replacement, minor bridge upgrades, and replacement of culverts. Based on a 1997 field view, it was estimated, at that time, that four major upgrades or bridge replacements were needed between Omaha and Des Moines and three major upgrades or bridge replacements were needed between Des Moines and the Quad Cities. The locations of these bridges are reported in the *Iowa Rail Route Alternative Analysis* prepared by TEMS in June 1998.

The Chicago-Twin Cities route will require the construction of fourteen undergrade bridges between Watertown and Madison, Wisconsin. In addition, seven land bridge structures will be constructed across sensitive wetlands with soft subsoil. Minor bridge rehabilitation will be required throughout the remainder of the route. The branch line to Green Bay will require the rebuilding of several over bridges to accommodate 110-mph operations.

Highway/Railroad Crossing Eliminations

In the initial segment of the MWRRI study, grade crossings were assessed for each scenario (conservative, moderate and aggressive). The focus was the increased level of train safety associated with reducing the number of grade crossings. In the Midwest region, a 300-mile corridor could easily have 350 public and private crossings. The philosophy to be adopted by the states on public/private crossings was reviewed and agreement was reached as to the level of investment to be allocated for closures and improvements. The allocation was determined by the minimum investment required to meet FRA standards and the level of investment acceptable to the states.

As agreed in the initial segment of the study, an important element of the MWRRS is the closure of five percent of the grade crossings in each corridor per year over a six-year period. Because of this program, approximately 30 percent of crossings would be closed by 2010 (subject to public approval), significantly improving safety in the MWRRS corridors.

Highway/Railroad Grade Crossing Improvements

The treatment of grade crossings to accommodate 110-mph operations is key to the success of passenger rail in the Midwest. Accordingly, the MWRRS adopted a policy to eliminate redundant or unnecessary crossings and to install the most sophisticated traffic control/warning devices compatible with the location of the crossing. Numerous grade crossings exist through downtown business areas and residential communities where 110-mph operations are essential to the success of the MWRRS. Additionally, in many rural areas of the Midwest, secondary roads parallel the railroad right-of-way. The treatment of crossings in close proximity to parallel roadways may include the installation of acceleration and deceleration lanes and/or the installation of traffic signals on the secondary roadway. This highway work has not been included in the capital cost estimates. Humped crossings that minimize sight distance for both train and passenger vehicles are another challenge that will require specific engineering solutions.

The recommended treatment of a grade crossing is a function of average daily traffic through the crossing, proximity of parallel roadways, width of roadway, and presence of pedestrian crossings. Proposed treatments include vehicle-arresting systems (a new technology now in demonstration stages), quad gates with and without median barriers, and extended gate arms with or without median barriers.

Private crossings are numerous throughout the Midwest region. The MWRRI Steering Committee has accepted the guideline of closing five percent of private crossings per year, subject to public approval as required. Where private crossings cannot be closed, electronic gated crossings (when approved by the host railroad) or single gates and flashers are recommended.

Four-quadrant gates may be installed in areas where warranted by the level of the average daily traffic. Extended gate arms with a counterweight and chain link fencing may be used in rural areas where average daily traffic is low. The gate arm of the existing flashers and gates may be extended to meet a 50-foot section of chain link fence that would be constructed at each quadrant of the crossing. For train operations of less than 80-mph, current technology – using flashers and gates – may be relied upon.

In 2000, an inventory of crossings was prepared for each route. Representative crossings were inspected in several segments of each route and treatments recommended. Conceptual estimates were applied to all the crossings within each route so that capital costs could be developed.

Signals and Communications (Train Control)

Implementation of a state-of-the-art signal and communications system is integral to the successful implementation of the MWRRS. Improved signaling will increase track throughput and raise the efficiency, productivity and safety of the track. On 110-mph rail, overlay of state-of-the-art signal and communications system on the existing signal system along a given route are required. A state-of-the-art system is necessary to coordinate freight and passenger operations and permit joint service to share the same track. Subject to acceptance by the FRA and freight railroads, it is assumed that Positive Train Control (PTC) system technology will be applied to all routes with speeds over 80-mph.

There are several studies currently underway within the Midwest region evaluating different technologies. The Illinois Department of Transportation, in cooperation with FRA and the Association of American Railroads (AAR), is currently developing a Positive Train Control System on a 120-mile segment of the Union Pacific corridor between Chicago and St. Louis. Additionally, the FRA, the Michigan Department of Transportation and Amtrak instituted a $39 million project in 1995 to upgrade tracks and to implement a 110-mph PTC System on a 65-mile portion of the Chicago-Detroit corridor between Kalamazoo and New Buffalo, Michigan. Wisconsin is working with Canadian Pacific Railway on a federally funded project to evaluate technical issues related to adapting PTC applications to “dark” un-signaled territory. These systems must be carefully evaluated to determine their compatibility with the needs of the MWRRS. Conservative per-mile unit cost estimates have been developed based on discussions with representatives of the various state departments of transportation, Amtrak and equipment manufacturers.

Fencing

The need for the fencing of passenger rail routes within the MWRRS will be determined by each state during the preliminary engineering assessment. For planning purposes, three types of fencing were assumed. Farm fencing at 4 feet high was assumed for rural areas; chain link fence at six feet high, was assumed for use near grade crossings in rural areas and along the routes through residential and commercial areas; and decorative aluminum or steel fencing was assumed for historic areas and in downtown business districts.

5.2.4 Infrastructure Assessment by Corridor

The track structure on the nine routes in the MWRRS varies by FRA designated class of track. The Chicago-Detroit, Chicago-Cleveland, Chicago-Carbondale, Chicago-St. Louis, Chicago-Quincy, St. Louis-Kansas City and Chicago-Twin Cities routes are generally FRA Class 4 track capable of maintaining freight service at the maximum allowable speed of 60-mph and passenger service at the maximum allowable speed of 80-mph. Speed restrictions exist on each route depending on infrastructure conditions. In order to increase the passenger train speed from 80-mph (FRA Class 4 track) to 110-mph (FRA Class 6 track), upgrading of the track structure, installation of active warning systems at all grade crossings, fencing the route as necessary, and installation of PTC systems will be required. It should be noted that 49 CFR Part 213.9 (a) states that the maximum allowable speed for FRA Class 4 track is 60-mph for freight trains and 80-mph for passenger trains. However 49 CFR Part 236.0 (d) states that where any train is operated at a speed of 80-mph or more, an automatic cab signal, automatic train stop, or automatic train control system must be installed. For this reason most railroads operate their Class 4 track at a maximum authorized speed of 79-mph. However, this report uses the maximum allowable speed of 80-mph as presented in 49 CFR Part 213.9(a).

The MWRRS consists of more than 3,371 route miles and 5,584 total track miles ranging from FRA Track class 2 through Class 6 after full build-out. A summary of the MWRRS by route is shown in Exhibit 5-3.

Exhibit 5-3
Summary of Track Mileage throughout the MWRRS

From	*To*	*Through*	*Total Mileage*	*FRA Track Class*					*Total Track Mileage*
				2	*3*	*4*	*5*	*6*	
Chicago	Pontiac	Detroit	301.7	0.4	56.5	99.7	3.0	298.6	458.2
Chicago	St. Louis	Springfield	283.5	5.0	25.2	96.2	0.0	206.5	332.9
Chicago	St. Paul	Madison	443.0	3.8	28.6	71.8	187.0	598.6	889.8
Port Huron	Battle Creek	Flint	158.4	0.8	36.8	187.7	0.0	0.0	225.3
Holland	Kalamazoo	Grand Rapids	74.1	0.5	5.3	78.6	0.0	0.0	84.4
Chicago	Cleveland	Fort Wayne	346.5	0.0	34.5	149.6	0.0	303.8	487.9
Chicago	Quincy	Galesburg	258.6	0.0	48.5	17.2	404.4	0.0	470.1
Chicago	Omaha	Quad Cities	475.1	0.0	77.5	514.2	204.0	0.0	795.7
Chicago	Cincinnati	Indianapolis	309.9	4.6	60.8	202.7	0.0	181.1	449.2
Milwaukee	Green Bay	West Bend	128.6	0.7	30.0	72.1	0.0	84.2	187.0
St. Louis	Kansas City	Jefferson City	283.0	3.8	33.6	28.4	500.2	0.0	566.0
Chicago	Carbondale	Champaign	308.4	2.4	43.3	103.2	488.6	0.0	637.5
Totals			**3,370.7**	**22.0**	**480.6**	**1,621.4**	**1,787.2**	**1,672.8**	**5,584.0**

The highest proposed speed in the route is summarized in Exhibit 5-4.

Exhibit 5-4
Typical Segments of Transportation Project Development

From	*To*	*Through*	*Highest Proposed Passenger Train Speed (mph)*
Chicago	Pontiac	Detroit	110
Chicago	St. Louis	Springfield	110
Chicago	St. Paul	Madison	110
Port Huron	Battle Creek	Flint	79
Holland	Kalamazoo	Grand Rapids	79
Chicago	Cleveland	Fort Wayne	110
Chicago	Quincy	Galesburg	90

Chicago	Omaha	Quad Cities	79/90[1]
Chicago	Cincinnati	Indianapolis	110
Milwaukee	Green Bay	West Bend	110
St. Louis	Kansas City	Jefferson City	90
Chicago	Carbondale	Champaign	90

The final step in assessing the potential for 110-mph operations on MWRRS routes is determining if passenger service can be integrated with existing and projected freight service. This final integration of passenger and freight service will be a determining factor for the Chicago-Cleveland, Kansas City-St. Louis and Chicago-Twin Cities routes. To ensure proper integration, a detailed capacity and risk sensitivity analysis was completed. These analyses serve as a starting point for negotiations between the states and freight railroads. The planning assumptions presented here will continue to be refined based on the results of these railroad negotiations, and based on additional findings that may develop as this project progresses through the environmental impact assessment.

Shared Use of Track on Detroit, Cleveland, Cincinnati Routes

"Shared use" is defined as a joint use of common tracks by freight and passenger equipment. For planning purposes, the southern alignment of the *South-of-the-Lake* Corridor as presented in the *Northern Indiana/Northwestern Ohio Rerouting Study* was used. As such, the Chicago-Cincinnati and the Chicago-Cleveland routes will have shared trackage east of Buffington Harbor. The Chicago-Buffington Harbor segment for the Detroit, Cincinnati and Cleveland routes and the Buffington Harbor-Porter segment for the Detroit route will be dedicated for passenger trains. The southern alignment of the *South-of-the-Lake* Corridor will minimize service reliability problems that exist for the Chicago-Detroit and Chicago-Cleveland routes between Chicago and Porter, Indiana. Improvements, including the construction of a flyover structure, are proposed to eliminate reliability issues at Englewood. The proposed improvements will permit up to 110-mph operations between Chicago and Porter with minimal reliability issues.

Chicago-Detroit and Michigan Branch Lines

The Chicago-Detroit route proceeds on the existing alignment along the *South-of-the-Lake* Corridor to Porter. The corridor continues through Kalamazoo, Battle Creek, Detroit to Pontiac, Michigan. The branch lines serve Lansing, Flint and Port Huron on the existing Amtrak *Blue Water* route and Grand Rapids and Holland as an extension of the Kalamazoo service.

Amtrak and the Michigan Department of Transportation have invested considerable resources to upgrade the track structure from FRA Class 4 to Class 6 and have installed a Positive Train Control system between New Buffalo and Kalamazoo in order to permit 110-mph operations. Amtrak is currently operating at 90-mph in commercial service. Michigan DOT's goal is to increase speeds to 110-mph by 2006. Continued upgrading of track infrastructure between Kalamazoo and Pontiac is planned. Individual infrastructure improvement projects in Battle Creek and West Detroit will reduce current reliability problems.

[1] From Chicago to Wyanet on BNSF trackage the speed would be 90-mph; from Wyanet to Omaha on IAIS trackage the speed limit would be 79-mph.

The track structure for the Michigan branch lines is generally FRA Class 4 track. It is envisioned that only minimal improvements, such as selected tie replacement and selected signal upgrades, will be necessary for continued operation and incorporation into the MWRRS. The Michigan branch lines consist of Battle Creek to Port Huron (157 miles) and Kalamazoo to Grand Rapids (78 miles).

Chicago-Cleveland

The Chicago-Cleveland route via Ft. Wayne uses the same route as the Chicago-Cincinnati route to Wanatah, Indiana. The route follows a CSX alignment to Ft. Wayne and then proceeds northeast following the Maumee & Western alignment to Liberty Center, Ohio. The route then proceeds north along the Indiana & Ohio right-of-way to Delta, which is approximately 25 miles west of Toledo. From Delta to Toledo, passenger trains will operate on the north side of the NS mainline.

Between Toledo and Cleveland, there are segments where 110-mph operation cannot be attained. Wherever possible, a dedicated 110-mph passenger track is to be constructed 28 feet from the centerline of the existing freight track. Junctions with major railroads along the alignment with restrictions, and major structures such as the causeway between Sandusky and Port Clinton, the bridge over the Huron River, and Vermillion Bridge will not be expanded to accommodate a third track. Speed restrictions in these areas will continue and passenger and freight trains will co-mingle. The third track will end at Berea.

The Berea-Cleveland segment has a maximum proposed speed of 79-mph due to the high volume of freight traffic. Here it is proposed that passenger trains would co-mingle with freight trains. The right-of-way is adjacent to rapid transit operations in this segment, so improvements would need to include mitigation for any conflict with these operations as well. The proposed improvements include the addition of a third track for passenger use and a fourth track that would provide additional freight capacity. Placeholder costs for improvements at Brookpark near the Ford plant and Rockport Yard, as well as a new river bridge crossing over the Cuyahoga River in Cleveland, were included in the cost estimates.

Chicago-Indianapolis-Cincinnati

The Chicago-Cincinnati route follows the *South-of-the-Lake* Corridor alignment via Tolleston, Indiana. From Tolleston to Wanatah, the alignment follows existing track owned and operated by CSX (as of the date of this report). South of Wanatah, the alignment proceeds south along abandoned right-of-way to Medaryville, then to an existing branch line track that requires a complete rebuild to Monon. Between Monon and Indianapolis, the alignment follows the existing Amtrak route. Sections of this segment will be upgraded to FRA Class 6 track to permit 110-mph operations. A segment of the track structure between Indianapolis and Shelbyville will also be upgraded to FRA Class 6 to permit 110-mph operations. The segment between Shelbyville, Indiana and Cincinnati, Ohio requires a major rebuild to FRA Class 6 for 110-mph operations. The entrance into Cincinnati will require substantial upgrade of the existing track to accommodate service to the downtown area. A crossover movement with the existing CSX track near Highway 50 is required. The selected alignment affects existing floodwall protection that would require closure across the passenger rail right-of-way. The entrance to the downtown area also proceeds through a waste facility to an area near the former Baltimore & Ohio Warehouse.

Chicago-Carbondale

The Chicago-Carbondale route is mainly FRA Class 4 and is owned and operated by CN. The previously mentioned CREATE project will move the Carbondale passenger trains onto an alignment that follows the NS mainline to Grand Crossing, a distance of 9.6 miles from Chicago Union Station. At Grand Crossing, the Carbondale trains transition from the NS alignment onto the CN alignment. When the MWRRS is constructed, this transition from the MWRRS dedicated tracks along the north side will cross under the NS mainline onto the CN alignment. Grand Crossing will be reconstructed as part of the MWRRS program to permit a direct movement from the NS/Amtrak alignment onto the CN alignment.

The track structure immediately south of University Park to Kankakee will be upgraded from FRA Class 4 to Class 5 to permit 90-mph operations in this segment. The track structure is in good condition and mostly tangent track south of Kankakee. The route will be upgraded to FRA Class 5 by appropriate track improvements and the installation of PTC systems.

Speed restrictions will continue in Gilman, Rantoul, Champaign-Urbana, Mattoon, Effingham, Centralia and Du Quoin. The NS crossing at Tolono and CSX crossing north of Centralia will require speed restrictions of 60-mph. Except for these speed restrictions, passenger rail operations at 90-mph are possible.

Chicago-St. Louis

The Illinois Department of Transportation (IDOT) has completed several studies of the corridor including the *Chicago-St. Louis High-Speed Rail Study* as well as subsequent preliminary engineering and environmental impact studies. The Chicago-St. Louis route is currently FRA Class 4. The 120-mile mixed passenger/freight line between Mazonia and Springfield was upgraded to FRA Class 6, to accommodate 110-mph operations. Additionally, IDOT is proceeding with a project to design, develop and test a Positive Train Control system on this 120-mile segment.

St. Louis-Kansas City

The St. Louis-Kansas City route is an FRA Class 4 structure that is owned by Union Pacific (UP) and currently accommodates freight and passenger service. The passenger service can operate at speeds up to 75-mph between St. Louis and Jefferson City. Between Jefferson City and Kansas City, the maximum speed is 70-mph. As a result of the existing and projected freight service, it is envisioned that speeds, if increased, will only be increased to 90-mph following a detailed capacity analysis designed to ensure that Union Pacific Railroad can concur that freight operations are not impeded by the MWRRS service. Improvements are needed to the track structure in several segments to ensure reliability of passenger train operations.

Chicago-Quincy

The Chicago-Quincy route is currently an FRA Class 4 structure. Current speed restrictions will continue in this segment. Between Aurora and Quincy, the track structure will be upgraded to an FRA Class 5 to accommodate 90-mph operations. Speed restrictions will continue in Mendota, Princeton, Kewanee, Galesburg and Macomb. At the Buda and Bushnell junctions, 60-mph speeds will be required. There are reliability issues that require consideration at the Burlington Northern-Santa Fe (BNSF) yards near Galesburg.

Chicago-Des Moines-Omaha
The Chicago-Des Moines-Omaha route shares track with the Chicago-Quincy route to Wyanet, Illinois. The track structure between Wyanet and Iowa will need substantial upgrading to FRA Class 4 to accommodate 80-mph operations. In addition, a connecting track will have to be installed at Wyanet to connect the BNSF and the Iowa Interstate System (IAIS). The IAIS currently uses the track between Wyanet, Illinois and Council Bluffs, Iowa for freight operations. Access into Omaha requires use of the right-of-way owned and operated by UP.

The track structure will be upgraded to accommodate passenger trains operating at 80-mph. Most bridges are timber trestles and require replacement. In some segments, the track structure requires complete rebuilding, whereas in other segments the track structure requires replacement of most ties and full resurfacing with ballast. Since speeds will not exceed 80-mph, moderate improvements, based on average daily traffic, to grade crossing protection is anticipated. Installation of signal and communications compatible with 80-mph operations is required.

Chicago-Milwaukee-Twin Cities
On the Chicago-Twin Cities route, a major rebuilding of the Chicago-Milwaukee segment is envisioned as presented in the *Chicago-Milwaukee High-Speed Rail Study* of 1995. The segment between Milwaukee and Watertown, Wisconsin is FRA Class 4 track that will require upgrading, installation of a second track between Pewaukee and Watertown and installation of a Positive Train Control System to accommodate operation of speeds up to 110-mph. The segment between Watertown and Madison requires a complete rebuilding since the track structure is FRA Class 1. The rebuilding will include the installation of Positive Train Control System to allow 110-mph operations. The segment between Madison and Portage, Wisconsin, will require a substantial upgrade from FRA Class 2 to FRA Class 6 to accommodate 110-mph operations. Between Portage, Wisconsin, and St. Paul, Minnesota, installation of a second track in selected areas and installation of passing sidings are required. A Positive Train Control System will also be required to accommodate 110-mph operations along most of the route and 90-mph operations between LaCrosse and Red Wing. The train speed is reduced between LaCrosse and Red Wing since the curvature of the alignment does not permit efficient operation above 90-mph.

Milwaukee-Green Bay
Green Bay does not currently have passenger rail service. In order to determine the most feasible route for providing service to Green Bay, the Wisconsin Department of Transportation commissioned TEMS to conduct an Alternative Analysis. The *Milwaukee-Green Bay Passenger Rail Alternatives Analysis* dated November 2001 concluded that the West Bend option was feasible, and was used for this planning level study. The right-of-way from Milwaukee to West Bend to Fond du Lac will be constructed to permit 110-mph operations. Between Fond du Lac and Appleton, improvements will be made to permit operations to 110-mph, and between Appleton and Green Bay, improvements will be made to permit operations to 80-mph. The density of freight traffic in this segment will not permit higher passenger speeds.

5.2.5 General Environmental Issues

An environmental review was performed to identify fatal flaw environmental issues relating to the MWRRS passenger rail routes. The review studied issues that could impact implementation of the proposed passenger rail service and included a broad-scale evaluation of potential impacts on the MWRRS. This environmental review did not provide the level of analysis consistent with an Environmental Assessment or an Environmental Impact Statement (EIS). Previous passenger rail reports were reviewed to identify applicable environmental issues:

- Chicago-Minneapolis/St. Paul: "South Route Modified (Study Route No. 4)" in the Technical Report 3, Tri-State Study of High-Speed Rail Service, TMS/Benesch, November 1990.
- Chicago-Milwaukee: *Chicago-Milwaukee Rail Corridor Study - Task Six Phase II - Environmental Evaluation presented to WisDOT and IDOT*, Envirodyne Engineers, Inc., March 1994.

Information from these reports was used to develop the environmental impact topology shown in Exhibit 5-5.

Exhibit 5-5
Environmental Conditions

Type of Impact	***Environmental Effect***		
Physical	Water quality	Air quality	Wetlands
	Noise and vibration	Energy	Visual impacts
	Historical and archeological resources		
Biological	Shrinking biological diversity and fragmentation of natural habitats		Endangered species
Socioeconomic	Land use	Transportation and traffic impact	
Construction	Air quality	Construction noise	Water quality
	Temporary access		

The anticipated impact, identified by a review of previous studies, generally depends on the type of condition and the route. The following is a brief overview highlighting items that might have environmental significance for the MWRRS:

- Reduced automobile use for intercity trips will improve air quality and energy consumption. Rail operations will also affect air quality and energy consumption.
- Noise impacts are likely to be minimal. As rail frequencies increase on existing corridors, noise from passing trains will increase. However, as speeds increase the duration of the noise impact will be brief. As at-grade crossings are eliminated (where possible), the noise impact from whistle blowing at crossings will be reduced. New alignments will experience increased noise, but that noise is likely to be less than a comparable volume of auto traffic.
- Land use impacts will be most noticeable in station vicinities, attracting additional investment and development for a positive impact on the community. A 110-mph passenger rail service will result in more productive use of travel time and will improve access to important markets and suppliers.
- Construction impacts are generally temporary and can be mitigated and include run-off and water-borne silt.
- Impacts on endangered and threatened species can only be identified through additional investigation.

- Land near the historic trade and travel routes may harbor historical and archeological treasures. These are not likely to be encountered or impacted, except where additional right-of-way is needed for grade separation structures or for cross-country routes. Site-specific mitigation measures are typically developed when the location and size of such finds are known.

Programmatic Environmental Impact Statement for the MWRRI

Pursuant to the National Environmental Policy Act (NEPA), if a proposed project requires a federal permit or has federal funding, a series of environmental analyses must be performed to identify probable environmental and community impacts. As the MWRRS will be funded by federal money, an environmental document is required. It is recommended that a Tier 1 EIS or a Programmatic EIS (PEIS) be undertaken to enhance the efficiency of conducting environmental reviews of large-scale projects. The PEIS serves as an initial screen by which various levels of environmental review, as defined by the National Environmental Policy Act (NEPA) are identified. For instance, PEIS screening identifies areas which are categorical exclusions, and provides the justification for this recommendation. This programmatic process also identifies those project areas that might require environmental assessments as well as components of the project that might necessitate full environmental impact review.

Aside from these purposes, the PEIS would also provide the federal review agencies and each MWRRI state with a composite picture of sensitive, moderately sensitive, and not sensitive project segments. This level of analysis lays the groundwork for further environmental review and report preparation.

An important aspect of the PEIS for the MWRRS would be the Purpose and Need Statement, particularly the MWRRI's background and legislative history. The Purpose and Need Statement will tie together the evolution of the project by citing all its completed technical reports, policies and related governmental efforts. The Purpose and Need Statement will be the basis of future Tier 2 documents resulting from the PEIS.

Public Involvement for the PEIS

The public involvement process will communicate the history of the MWRRI, the future segments of the study process, and the findings of the PEIS. The basis of the public involvement approach begins with the preparation of a PEIS for the MWRRS. Specific tasks during the public involvement segment of the study should include a community advisory committee (CAC) with responsibility to develop an effective community involvement program and a technical advisory committee (TAC) representing federal, state and local agencies. Community information activities need to be developed to include presentation graphics, a study newsletter, study area displays, question logs and media liaisons. Finally, a web portal should be used for efficiently educating the public about the project and notification of on-call public meetings and hearings.

5.2.6 Infrastructure Capital Costs

Infrastructure Cost Assumptions

Estimates of the capital investment needed for each route were developed by applying unit costs to civil engineering quantities based on the conceptual planning of each route option for a given technology. The quantities were developed, without detailed surveys, from initial engineering analyses, existing large-scale mapping and limited site verification.

The unit costs are detailed herein by infrastructure element. These unit costs include 7 percent for engineering and 15 percent for contingencies on infrastructure costs. In addition, the following items were included in the unit costs:

- 3 percent for a program manager and/or a general engineering consultant
- 4 percent for construction inspection/management during construction
- 2 percent for owner's management costs such as alternative analyses and environmental studies

A conceptual planning process was used to estimate the capital investment required for each route. The initial step was to identify the elements of the existing route infrastructure, (*i.e.*, track structures, stations, terminals and maintenance facilities, turnouts, bridges-under, bridges-over, crossings, signals and curves.)

Each infrastructure element includes several items requiring upgrading or construction to meet the route requirements of the selected passenger rail technology. The specific unit costs for each element of work are identified in Exhibit 5-6.

Infrastructure Cost Estimates

The infrastructure cost analysis was performed by applying the unit cost for an item of work to the physical quantity associated with each item of work. The estimated infrastructure cost by corridor and major system-wide facilities are given in Exhibit 5-7. The breakdown of these costs by segments within each route and the detail on the items of work are shown in Appendix A9.

St Louis-Kansas City segment costs have been subject to ongoing engineering analysis. The original estimate of $314 million was for the St Louis-Kansas City track condition and signalling system upgrades only. After completing a line capacity analysis, TEMS recommended further improvements and added a placeholder cost of $578 million for line capacity upgrades. This total placeholder cost of $893 million was used in development of the Financial Plan, subject to field verification.

Exhibit 5-6
Unit Capital Costs by Infrastructure Element

Item No.	*Description*	*Unit*	*2002 Unit Cost (Thousands $)*
Trackwork			
1.1	110-mph on Existing Roadbed	per mile	$ 993
1.2a	110-mph on New Roadbed	per mile	$ 1,059
1.2b	110-mph on New Roadbed and New Embankment	per mile	$ 1,492
1.2c	110-mph on New Roadbed and New Embankment (Double Track)	per mile	$ 2,674
1.3	Timber and Surface w/ 33% Tie replacement	per mile	$ 222
1.4	Timber and Surface w/ 66% Tie Replacement	per mile	$ 331
1.5	Relay Track w/ 136# CWR	per mile	$ 354
1.6	Freight Siding	per mile	$ 912
1.65	Passenger Siding	per mile	$ 1,376
1.71	Fencing, 4 ft Woven Wire (both sides)	per mile	$ 51
1.72	Fencing, 6 ft Chain Link (both sides)	per mile	$ 153
1.73	Fencing, 10 ft Chain Link (both sides)	per mile	$ 175
1.74	Decorative Fencing (both sides)	per mile	$ 394
1.8	Drainage Improvements	per mile	$ 66
1.9a	Land Acquisition – Urban	per mile	$ 327
1.9b	Land Acquisition – Rural	per mile	$ 109
Curves			
9.1	Elevate and Surface Curves	per mile	$ 58
9.2	Curvature Reduction	per mile	$ 393
9.3	Elastic Fasteners	per mile	$ 82
9.5	Realign Track for Curves	lump sum	
Signals			
8.1	Signals for Siding w/ High-Speed Turnout	each	$ 1,268
8.2	Install CTC System (Single Track)	per mile	$ 183
8.21	Install CTC System (Double Track)	per mile	$ 300
8.3	Install PTC System	per mile	$ 197
8.4	Electric Lock for Industry Turnout	each	$ 103
8.5	Signals for Crossover	each	$ 700
8.6	Signals for Turnout	each	$ 400
Stations / Facilities			
2.1	Full Service – New	each	$ 1,000
2.2	Full Service – Renovated	each	$ 500
2.3	Terminal – New	each	$ 2,000
2.4	Terminal – Renovated	each	$ 1,000
2.5a	Maintenance (110-mph technology)	each	$ 10,000
2.5b	Maintenance (150-mph technology)	each	$ 86,000
2.5c	Maintenance (185-mph technology)	each	$ 162,000
2.5	Maintenance Facility	each	$ 45,351
2.6	Layover Facility	lump sum	varies
2.7	Service and Inspection Facility	lump sum	**varies**

Turnouts			
4.1	#24 High-Speed Turnout	each	$ 450
4.2	#20 Turnout Timber	each	$ 124
4.3	#10 Turnout Timber	each	$ 69
4.4	#20 Turnout Concrete	each	$ 249
4.5	#10 Turnout Concrete	each	$ 118
4.6	#33 Crossover	each	$ 1,136
4.7	#20 Crossover	each	$ 710
Bridges-Under			
5.1	Four Lane Urban Expressway	each	$ 4,835
5.2	Four Lane Rural Expressway	each	$ 4,025
5.3	Two Lane Highway	each	$ 3,054
5.4	Rail	each	$ 3,054
5.5	Minor river	each	$ 810
5.6	Major River	each	$ 8,098
5.65	Double Track High (50') Level Bridge	per LF	$ -
5.70	Rehab for 110	per LF	$ 14
5.71	Convert Open Deck Bridge To Ballast Deck (Single Track)	per LF	$ 4.7
5.72	Convert Open Deck Bridge To Ballast Deck (Double Track)	per LF	$ 9.4
5.73	Single Track on Flyover Structure	per LF	$ 6
5.8	Single Track on Approach Embankment w/ Retaining Wall	per LF	$ 3
	Ballasted Concrete Deck Replacement Bridge	per LF	$ 2.1
	Land Bridges	per LF	$ 1.5
Bridges-Over			
6.1	Four Lane Urban Expressway	each	$ 2,087
6.2	Four Lane Rural Expressway	each	$ 2,929
6.3	Two Lane Highway	each	$ 1,903
6.4	Rail	each	$ 6,110
Crossings			
7.1	Private Closure	each	$ 83
7.2	Four Quadrant Gates w/ Trapped Vehicle Detector	each	$ 492
7.3	Four Quadrant Gates	each	$ 288
7.31	Convert Dual Gates to Quad Gates	each	$ 150
7.4a	Conventional Gates Single Mainline Track	each	$ 166
7.4b	Conventional Gates Double Mainline Track	each	$ 205
7.41	Convert Flashers Only to Dual Gate	each	$ 50
7.5a	Single Gate with Median Barrier	each	$ 180
7.5b	Convert Single Gate to Extended Arm	each	$ 15
7.71	Pre-cast Panels without Roadway Improvements	each	$ 80
7.72	Pre-cast Panels with Roadway Improvements	each	$ 150
7.8	Michigan Type Grade Crossing Surface	each	$ 15

5.2.7 *Conclusion*

Based on this engineering review and refinement process, the infrastructure improvements required to implement the MWRRS are estimated to cost $6.6 billion. The infrastructure cost estimate shown in Exhibit 5-7 was increased in the latest analysis due largely to changes in routes, increases in operating speeds, and improvements to accommodate freight rail capacity needs. Major capital improvements include right-of-way modifications to track and track alignments to support 110-mph train speeds and to accommodate freight and commuter rail activity, plus upgrades to stations, highway/railroad grade crossings and signaling and communication systems.

Exhibit 5-7
Summary of Infrastructure Capital Costs by Route[2]

No.	*Route*	*Cost Estimate $2002 (thousands)*	
a	Chicago Terminal Area	$	1,152,115
b	System Maintenance Facility	$	45,351
c	Chicago Union Station	$	15,000
1	Porter-Detroit / Pontiac	$	329,771
2	Battle Creek-Port Huron	$	67,029
3	Kalamazoo-Grand Rapids / Holland	$	27,178
4	Tolleston-Cleveland	$	1,087,640
5	Tolleston-Cincinnati	$	507,468
6	Grand Crossing-Carbondale	$	219,878
7	Joliet-St. Louis	$	243,256
8	St. Louis-Kansas City[3]	$	893,110
9	Aurora-Quincy	$	257,362
10	Wyanet-Omaha	$	360,207
11	Rondout-St. Paul	$	1,049,791
12	Milwaukee-Green Bay	$	311,717
13	Ticket Machines[4]	$	5,300
Total		**$**	**6,572,171**

[2] Cost estimates in Exhibit 5-7 match the HNTB detail cost spreadsheets. Infrastructure costs in Exhibits 8-4 and 8-5 allocate the costs of Chicago Terminal Area improvements to each route, thereby giving higher costs than are shown in for each route in Exhibit 5-7

[3] The original estimate of $314 million was for St. Louis-Kansas City track condition and signalling upgrades; a placeholder cost of $578 million was added for line capacity upgrades based on a unit-costing approach. This total cost of $893 million in the current MWRRS Financial Plan is subject to revision as additional engineering work is completed on the proposed improvements.

[4] An additional $5.3 million Placeholder Cost was added to this capital cost estimate to provide for the cost of adding a ticket machine at each of the 101 MWRRS stations, plus 5 machines at CUS, at $50,000 per machine.

6. Freight Capacity Methodology and Results

6.1 Introduction

The development of the Midwest Regional Rail System (MWRRS) as a 3,000-mile, high-frequency passenger service throughout the Midwest raises important questions concerning track capacity for the states within the Midwest region and for the freight railroads, which own the tracks and right-of-way. The MWRRS uses freight rail lines that range from lightly used to very heavily used, high-volume lines. It is critical to the development of the project to understand the impact that additional passenger trains will have on existing and future railroad capacity.

Three lines, Chicago-Twin Cities, Toledo-Cleveland and St. Louis-Kansas City, are heavily used railroad corridors and the introduction of MWRRS passenger trains would place significant strain on existing infrastructure resources. The MWRRS capital costs include considerable investments to augment railroad capacity on these lines. Even on corridors with light or moderate traffic, passenger operations could still require additional improvements at critical locations.

The need for infrastructure improvements must be carefully assessed in order to develop a plan that will not compromise freight operations. At a minimum, freight railroads must be able to operate their trains as effectively as they could if the MWRRS did not exist. Beyond this, it is desirable to actually create benefits for freight railroads while developing the infrastructure necessary to support passenger services. Freight railroads must retain their ability to expand their own franchises for future traffic growth.

The Midwest Regional Rail Initiative (MWRRI) Steering Committee asked Transportation Economics & Management Systems, Inc. (TEMS) to carry out a comprehensive capacity analysis for the three most heavily used freight rail lines on the MWRRS. The goal of the analysis was to confirm the feasibility of planned MWRRS operations, and to verify the required capacity improvements and capital costs for these corridors.

The two primary objectives of the capacity analysis were to assess the feasibility of the proposed improvements :

- To measure the delay impact of running passenger trains along with freight trains on the corridors; and
- To estimate the operational and infrastructure improvements needed to achieve an acceptable level of freight and passenger service

The process for evaluating rail infrastructure investment needs involved:

- The development of an accurate and reliable operations and track infrastructure database. This required a cooperative partnership with the railroads that protected the confidentiality of proprietary business information. Freight tonnage data and growth rates were derived from state, federal and freight railroad data sources at the time the analysis was prepared. Updated line tonnage and traffic density information received later was used for development of track maintenance costs, but the line capacity results are reported here are based on the simulation results at the time the analysis was prepared.

- Ideal Day simulations represented peak day traffic, not average day traffic and used growth rates of 2 to 3 percent, well above the national average growth rate, in order to be conservative.
- Typical Day simulations, because they incorporate variability, used average day traffic but in some cases even higher growth rates that were furnished by the freight railroads.
- An assessment of the need for future freight railroad capacity. This included the future level of freight train operations, requirements for regular and programmed capital maintenance, and the ability to deal with extraordinary events such as "hot" and "cold" orders, emergency conditions due to train breakdowns (*e.g.*, due to hot boxes), and signal outages.
- A comprehensive assessment of the impact passenger train operations have on the freight railroad. This provided the input needed to support future discussions and negotiations between the freight railroad, passenger train operator and sponsoring states. The finished assessment should be able to be used to evaluate both freight and passenger rail concerns, and to provide objective input to the negotiating process, thus helping to consummate the business and commercial arrangements needed to implement the system.

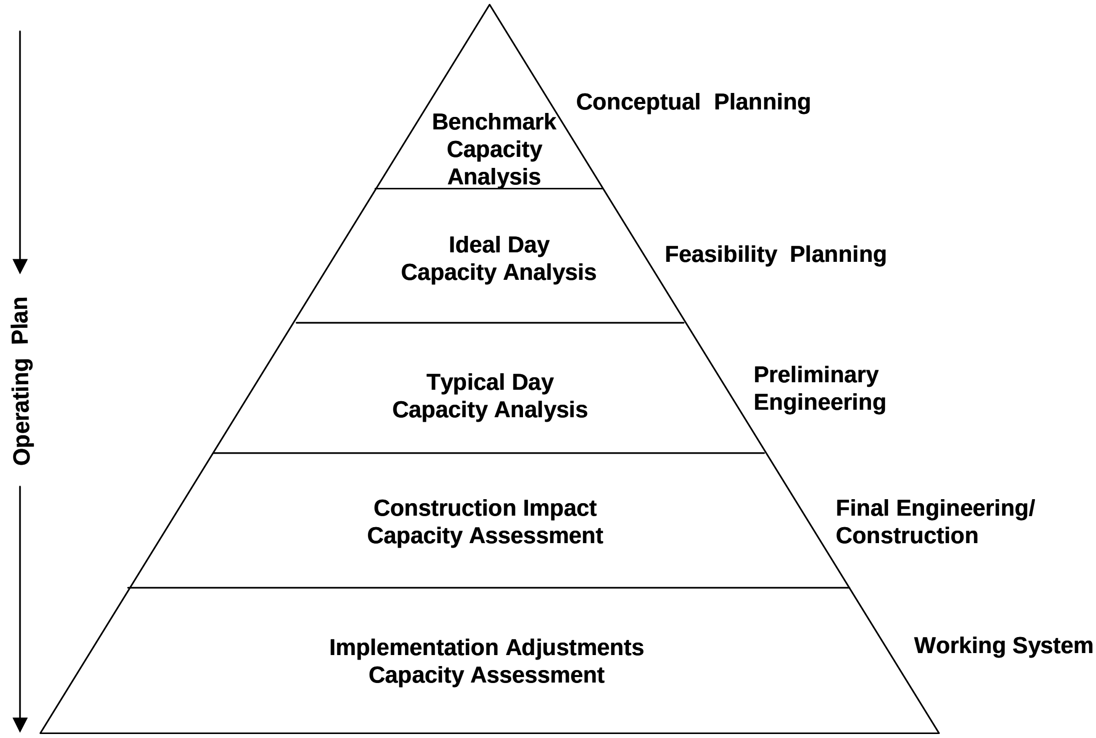
The analysis focused on mainline corridor capacity issues. For both the freight and passenger operations, separate off-line terminal issues will exist, such as the ability of the freight railroad to effectively manage its yard operations, or the ability of the passenger operator to service the passenger trains in the Chicago Union Station. These issues are outside the scope of the analysis except and unless they impact line capacity itself. For example the need to store freight trains on the mainline would be in scope, whereas yard switching operations were out of scope.

Future capacity analysis and engineering assessments will require more discussion to ensure railroad concurrence. Final design concepts and recommended capital plans will depend on detailed operations analysis, design coordination, and in-depth discussions with the freight railroads. As the MWRRS project moves beyond the feasibility phase, railroad involvement and coordination will become increasingly important.

6.1.1 Capacity Analysis Theory and Methodology

Capacity analysis provides an important interface between the engineering design of a railroad and the operations planning process. It is designed to ensure the effective integration of passenger and freight train operations with sufficient physical plant capacity. As the planning work for a project moves from conceptual to feasibility planning, and then into the preliminary and final engineering stages, the requirements for capacity analysis also change. At each step, capacity analysis becomes more detailed and reflects operating practice in an increasingly realistic manner. Exhibit 6-1 provides a diagram of this process.

Exhibit 6-1
Levels of Capacity Analysis Required in the Planning and Engineering Process



In conceptual planning, analysis consists of a manual review of potential conflicts and train "meets" and preliminary recommendations for additional infrastructure. This preliminary estimate requires further refinement as the project planning process continues. At the feasibility analysis level, an *Ideal Day Capacity Analysis* is performed. This type of analysis considers the meets and conflicts on the system and provides recommendations for additional infrastructure requirements based on train-meets, as well as providing estimates of the level of delay to freight operations that must be mitigated in order to ensure the continued effective operation of freight trains on the route.

This Ideal Day Analysis uses existing information about departure and arrival times and replicates travel times by using each train's acceleration and deceleration rates and stopping patterns, along with detailed information about the track infrastructure along the corridor, incorporating any recovery time necessary to accommodate unexpected delays. The Ideal Day Analysis is a "static" process in that it assumes that the conditions under which the trains operate are identical from day to day, producing identical travel times each day. Because there is no variation in travel times, these trains are assumed to operate under "ideal" conditions. The Ideal Day Analysis is particularly effective for inexpensively developing the preliminary estimates of the cost of implementation before more detailed cost estimates can be developed.

In the preliminary engineering phase, a *Typical Day Analysis* is required for heavily trafficked segments and for those approaching full capacity. The Typical Day Analysis produces a more detailed evaluation of train operations than the Ideal Day Analysis. It considers all forms of variation in train performance, particularly actual departure times. Instead of an "ideal" picture of train travel times, the Typical Day Analysis simulates a variation in departure times for trains in order to more realistically replicate day-to-day departure and arrival patterns. This dynamic element provides more "typical" travel time estimates for trains passing through a corridor and thus a more accurate measure of delay and conflict.

In the implementation phase, final operating plans are produced to show how the construction phasing and implementation process will affect operating plans. The Typical Day Analysis allows for the evaluation of the impact of the full range of operating, track and signaling issues. The Typical Day Analysis can be used during construction to measure constraints on freight operations and to plan the construction process in order to minimize the impact on freight service during the construction period. The analysis can also be used to show how the phasing of passenger train operations affects existing freight operations and what might be done to mitigate concerns and issues for the operating freight railroads.

Each of these levels of capacity planning can be completed using TEMS' software systems, including the Major Interlocking Signaling System Interactive Train Planner (*MISS-IT*©) program. The decision concerning which level of analysis is required depends on the quality of the estimate required, budget available and the level of traffic on any given route or corridor. As such, it may be appropriate to carry out a Typical Day Analysis for a feasibility study, if it is felt that the track is heavily used and that an Ideal Day Analysis could underestimate infrastructure needs.

6.1.2 MISS-IT© *Capacity Analysis Evaluation Framework*

The evaluation structure for any capacity analysis study is critical as it provides the framework for assessing mitigation measures and determining investment needs. The *MISS-IT*© Evaluation Framework establishes a *base case* and sets a standard against which to measure the impact of additional trains and the effectiveness of proposed infrastructure improvements. *MISS-IT*© consists of a series of evaluations to ensure that existing railroad performance standards are maintained following the introduction or expansion of passenger service. This analysis is particularly important when freight operations are nearing full capacity, in order to target infrastructure improvements to enable successful coexistence of passenger and freight operations, as well as to provide expandability for growth.

The *MISS-IT*© capacity analysis consists of a series of cases:

Case I – Base Case: This case estimates the corridor's freight and passenger traffic so that the existing delay for freight trains can be measured. These estimates are part of the basic dispatch model calibration of the capacity analysis system and are used to judge and adjust the performance of the model.

Case II – Do Nothing: This case measures the delay for freight traffic in selected forecast years (*e.g.,* 2010 and 2020) without the addition of new MWRRS passenger trains. It is this level of freight and passenger traffic delay that sets the standard for train delay, which must be maintained for the freight railroad to be mitigated.

Case III – Do Something: MWRRS trains are introduced, and the increased train delay associated with freight and passenger trains is measured. In heavily congested corridors, the introduction of MWRRS trains has a significant impact on freight train operations, and thus requires mitigation.

Cases IV– X – Mitigation: In these cases, various mitigation strategies (infrastructure, signaling, and operations) are tested for their ability to alleviate the increase in freight and passenger train delay measured in Case III, and to reduce it to the level previously identified in Case II. The number of mitigation cases developed depends on the number of infrastructure and operating strategies that can be devised to reduce freight and passenger delays. If a large number of infrastructure strategies exist, multiple cases must be assessed.

In carrying out a *MISS-IT*© capacity analysis, the average travel times, standard error, and associated train delay will be calculated for each train and reported. The results can be given by individual train, type of train (*e.g.*, intermodal freight trains) or category of train (passenger intercity, passenger commuter). Exhibit 6-2 is a matrix that shows how trains are disaggregated by type and how the delay for each train type (*e.g.*, bulk, intermodal, commuter, passenger, local, and freight) changes (increases) from the Base Case, to the Do Nothing and Do Something cases. In developing the Mitigation Analysis, results are typically classified by train priority group. High-priority trains include passenger and intermodal trains, while bulk and local freight trains are typically low-priority trains.

Exhibit 6-2
Mitigation Analysis Evaluation Framework

	Case I Base Case	Case II Do Nothing	Case III Do Something	Cases IV-X Mitigation	Result
Priority Group	Existing Freight Delay	Forecasted Freight 2010 Delay	Additional Delay Caused by MWRRS Trains	Resolved by Operations Infrastructure Signaling	Net Forecasted Delay
1					
2					
3					
4					
5					
6					

Mitigation by train group is achieved in Cases IV through X using a variety of mitigating strategies that increase and improve capacity. The results of the remaining net delay after mitigation will be shown in the last column of the above Exhibit. Ideally, mitigation is achieved when the net delay in the last column is the same or less than the delay in the Do Nothing case, Case II. With this result, a railroad can be said to be "mitigated" because its trains will experience only the delay that would have occurred had the MWRRS trains not been added.

One point worth noting is that a freight railroad may be less concerned about delay in certain types of trains, such as locals and bulks, and may be prepared during the mitigation process to trade off additional improvements for high-priority trains (*e.g.,* intermodal trains), against additional delays for local or bulk trains. The process therefore depends on the objectives and needs of the freight railroad and its preference for different types of mitigation measures under different circumstances.

Mitigation

The mitigation process considers:

- Infrastructure analysis mitigation – This includes the addition of extra crossovers, track (double, triple, quadruple), expansion of station and yard capacities, track speed improvements, elimination of crossings and scheduling drawbridge openings.
- Signaling analysis mitigation – This includes the upgrading of signaling systems to include Automatic Block Signaling (ABS), Centralized Train Control (CTC) or Positive Train Control (PTC), depending on the speed of trains proposed.
- Operations analysis mitigation – This includes the development of an integrated passenger and freight operating plan through the resolution of conflicting start and end times, etc., as well as assessments of train stops, yards, diamonds, drawbridges, and maintenance plans.

In practice, this process is disaggregated by train type, *i.e.,* freight intermodal, bulk, passenger intercity, commuter, or by specific train, so that the direct effect of mitigation can be measured on an individual train and train-type basis. This may lead to additional mitigation needs if some trains have unacceptable delay times within overall (average) satisfactory results.

6.1.3 Capacity Analysis Planning Process

The *MISS-IT*© capacity analysis planning process begins with the development of two databases that are initial inputs of the evaluation of capacity for a rail corridor. These two databases are the corridor track infrastructure for which the capacity is being measured, and the train schedule stringlines that reflect the train operations in the corridor.

TEMS develops the corridor track infrastructure database using its *TRACKMAN*© program. The *TRACKMAN*© program is designed to build an infrastructure inventory database and provide graphic review capabilities for a given railroad route. Using railroad condensed profiles, engineering information, railroad track inspection and survey data, TEMS builds a milepost-by-milepost inventory database within *TRACKMAN*© that contains the physical infrastructure of the route including gradients, sidings, crossovers, curves, bridges, tunnels, yards, and signaling systems. This data is displayed along with the maximum permissible train speed to provide the engineer with a clear definition of the track conditions and capability.

The *TRACKMAN*© database shows which track sections will limit train performance, and the program's upgrade facilities make it possible to develop a list of track improvements that will raise maximum permissible speeds and train capacity on a given route. Using either specific engineering cost data or default unit costs, the proposed list of improvements can be costed and a cost-per-minute-saved priority ranking can be generated for each of the potential track improvements. In this way, *TRACKMAN*© provides a mechanism for identifying the base track condition as well as possible strategies for alternative capacity and speed options. These strategies can then be tested in the *MISS-IT*© capacity analysis evaluation.

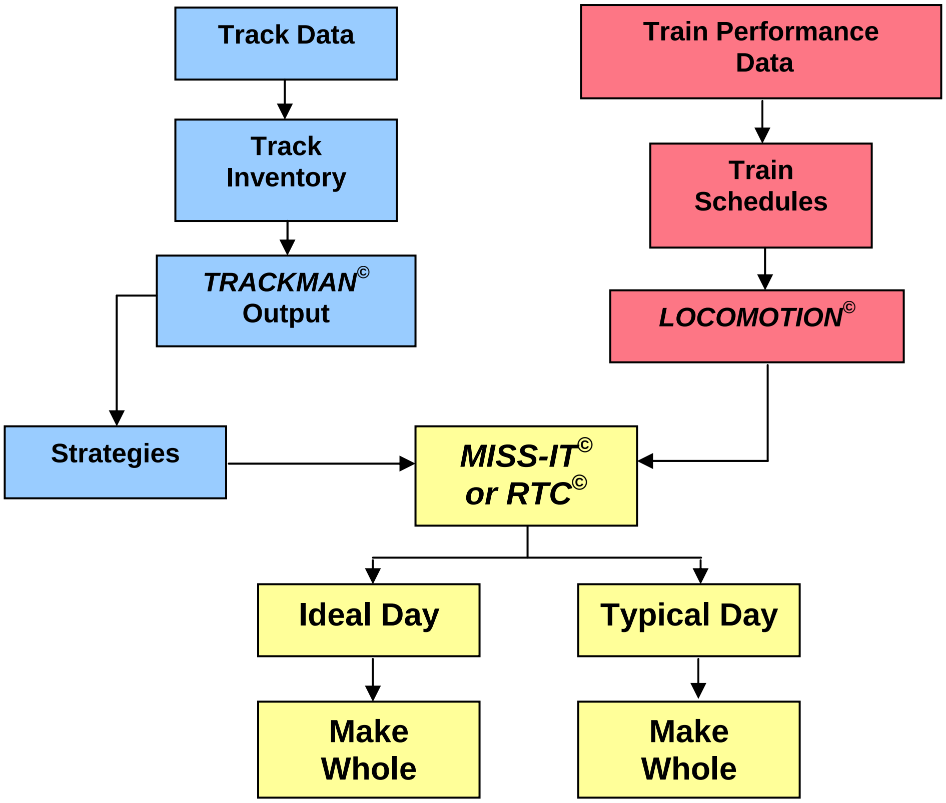
The second key input is the *LOCOMOTION*© program, which estimates train schedules for different passenger and freight train technologies using train performance, engineering track geometry, and train control input data. *LOCOMOTION*© also provides both tabular and graphic output of train performance milepost-by-milepost, based on the characteristics of both the train technology and the track. The system identifies train interaction, provides stringline output for new and existing freight and passenger services and identifies the location of train "meets." The *LOCOMOTION*© program also provides a full understanding of train schedules for any base or forecast year by including the growth of freight or passenger trains over time.

The outputs of the *TRACKMAN*© and *LOCOMOTION*© software systems are combined in the *MISS-IT*© program to perform capacity analysis and to assess the risks of train delay for any given route. In using the *MISS-IT*© program, a decision can be made either to carry out Ideal Day or Typical Day Analysis. As noted above, the Ideal Day Analysis is usually suitable for feasibility studies, while a Typical Day Analysis is required for preliminary and final engineering on heavily used rail routes. A Typical Day Analysis is sometimes needed in a feasibility study, if the corridor has heavy freight traffic and an Ideal Day Analysis would underestimate infrastructure needs.

In both cases, a Mitigation Analysis is used to evaluate the appropriate track, signaling and operating improvements necessary to mitigate delays to acceptable levels and to ensure that the freight railroad is mitigated. Exhibit 6-3 provides a diagram of the capacity analysis process using the planning methodology that was approved by the MWRRS Steering Committee.

It should be noted that the Mitigation Analysis framework is designed to identify the minimum infrastructure requirement that is needed to make a freight railroad "whole" for the cost of added freight train delays. Practically, since capacity comes in increments or step functions, it is seldom possible to satisfy the mitigation criteria exactly. To reduce freight train delays below their target level, it is usually necessary to "overshoot" the mark, so the resulting investment strategy actually does produce a net operating benefit to the freight railroad.

Exhibit 6-3
Capacity Analysis Planning Process



6.1.4 Delay Measurement

A key issue in measuring delay is its cause. Only with a full understanding of the cause of delay can effective corrective action be taken. To meet this need, a train delay management system has been developed in the *MISS-IT*© model. This feature provides comprehensive documentation of the causes of delay.

The *MISS-IT*© Action Log Report reveals the most common types of delay and how they might be mitigated. Specific action log outputs include:

- Tailgating delays
- Meet-point delays
- Signal delays (i.e., time train spends waiting for signal to change)
- Interlocking delays
- Train performance delays (acceleration/deceleration)

6.1.5 Summary

TEMS' *MISS-IT*© capacity analysis system provides a powerful approach to evaluating capacity needs when passenger train operations are imposed on existing freight operations. The system provides a mechanism for assessing all the critical issues of capacity including:

- The level of delay that exists in an existing freight operation
- The effect of increased freight train operations on train delay
- The levels of delay imposed by the introduction of new passenger train service
- The character and level of delay in train operations and how it can be most effectively reduced or managed to maximize train capacity
- The impact of different operating, engineering and signaling mitigation measures. This can be measured at the train type, group or specific train level and ensures effective mitigation of new passenger operations.

6.2 Inputs to the Capacity Analysis Process

The capacity analysis process requires the development of a definitive and detailed data set for infrastructure and train operations, and includes track infrastructure and train data specific to each specific corridor to be analyzed. These data are typically assembled by TEMS with input, assistance and oversight by railroads, state departments of transportation (DOTs) and the study engineers. For both the Ideal Day and Typical Day analyses, the databases will contain the following information on track infrastructure and train data.

6.2.1 Track Infrastructure

A key database for the capacity analysis is the available track infrastructure that trains can use in moving along the corridor. The TEMS *TRACKMAN*© program records on a milepost basis the number and location of:

- Tracks
- Curves
- Super elevations
- Sidings
- Civil speed restrictions
- Stations
- Gradients
- Crossovers
- Bridges
- Tunnels
- Turnouts
- Yards
- Junctions
- Interlockings
- Towers
- Signals
- Interconnections
- Subdivision names and lengths
- Federal Railroad Administration (FRA) track classes
- Diamonds
- Road crossings

In addition to the physical track data, the *TRACKMAN*© data set includes information on types of signal systems and signal placements.

6.2.2 Train Data

Data on existing and future freight and passenger operations for each route must be gathered from the freight and passenger carriers involved, as well as from the MWRRI study team. The train database consists of four data sets:

- Train schedules
- Train types
- Train priority
- Train departure and arrival statistics

Train Schedules

The number of trains, their scheduled departure and arrival times, and their stopping patterns form the basis of traffic analysis on the corridor. Information on the locations and duration of scheduled stops are gathered from the freight railroads, Amtrak and commuter operators, which was then entered into TEMS' *LOCOMOTION*© model.

Train Types

Each passenger and freight train operates with a different performance profile that reflects the train's performance capabilities. These include acceleration and deceleration curves, as well as tilt capability and allowable cant deficiency. The model uses information on how quickly trains can reach maximum attainable speed and the distances and speeds throughout the acceleration. Braking information is used to estimate train deceleration and thus stopping distance.

Train Priority

In order to accurately resolve conflicts between trains, the relative importance of each train, as ranked by the railroad, is input to TEMS' *MISS-IT*© model. In *MISS-IT*©, all trains are prioritized individually, as well as by technology grouping.

Departure and Arrival Statistics

The Typical Day Analysis includes not only estimated departure time but also potential variations in that time. Actual departure and arrival times for freight trains often deviate from scheduled times. In order to model this variation, a distribution of the estimated variance in departure time is input to the model to indicate whether individual trains will depart or arrive early or late and to what extent.

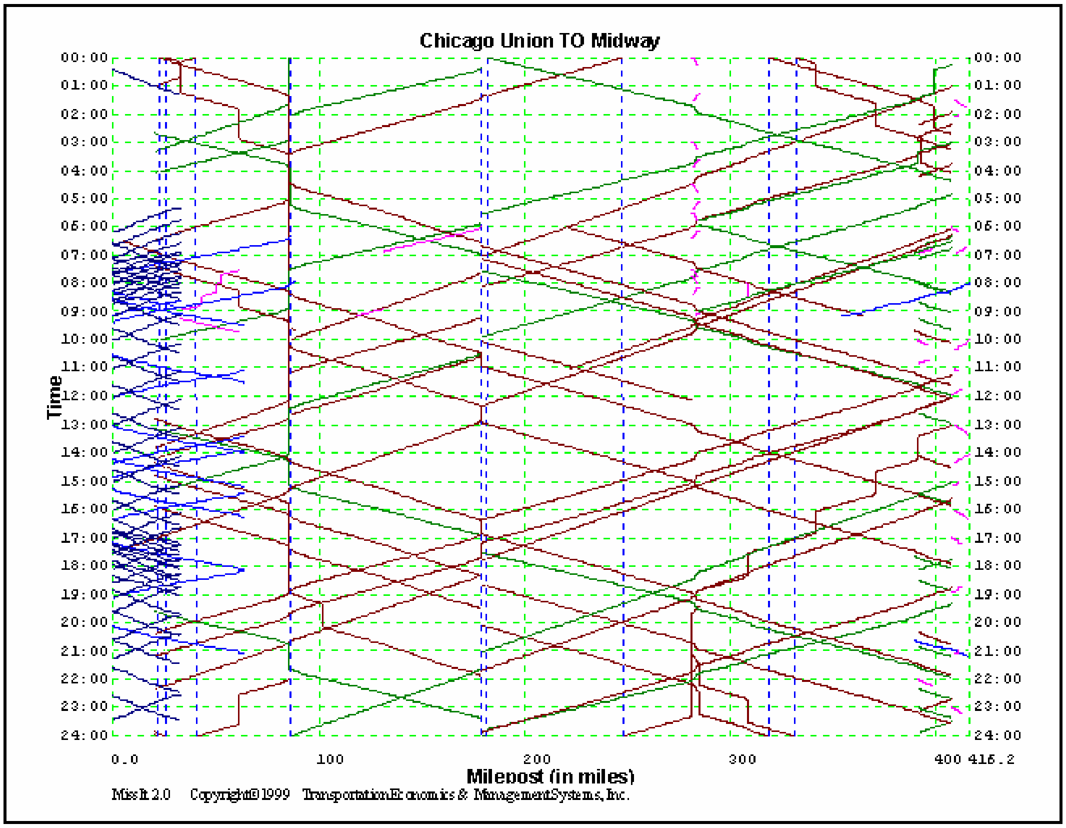
Traffic Growth Rates

Capacity analysis requires a full understanding of both freight and passenger traffic growth so that the impact of increasing traffic over time can be estimated. Any long-term traffic forecasts (or range of forecasts) developed by the railroads can be adopted and tested in the analysis. Annual growth rates are developed for each type of train and forecasts are made for the study years. A set of forecast timetables will be constructed for each train type.

Pre-Dispatch Stringlines

A base travel time for each train is produced. Each train's base travel time is the fastest achievable time given its speed capabilities, the track infrastructure but excluding any delays from meets with other trains along the track. Exhibit 6-4 presents the resulting 'ideal' stringline diagram as a visual representation of the travel times and illustrates the path of the train. It also shows the locations or meets where two trains could potentially converge or conflict.

Exhibit 6-4
Corridor Stringlines for Future Freight and Passenger Traffic Levels



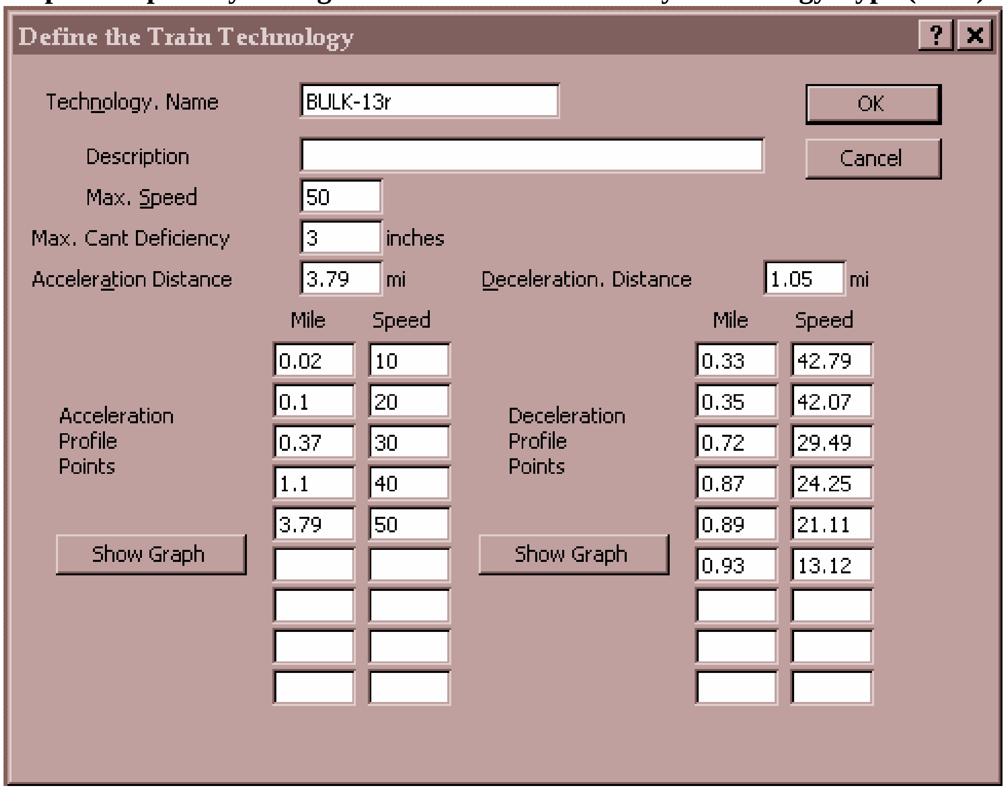
6.3 Base Case Calibration

The first step in the analysis of any rail corridor is the creation of the database for the base year, which is generated by TEMS and reviewed, as appropriate, by the freight railroads, Amtrak and the study engineers.

The second step in the analysis is to document the characteristics of the trains traveling along the corridor. In all cases, the name, scheduled departure time, ranking, probability statistics, and speed capability of each train must be provided by the railroads.

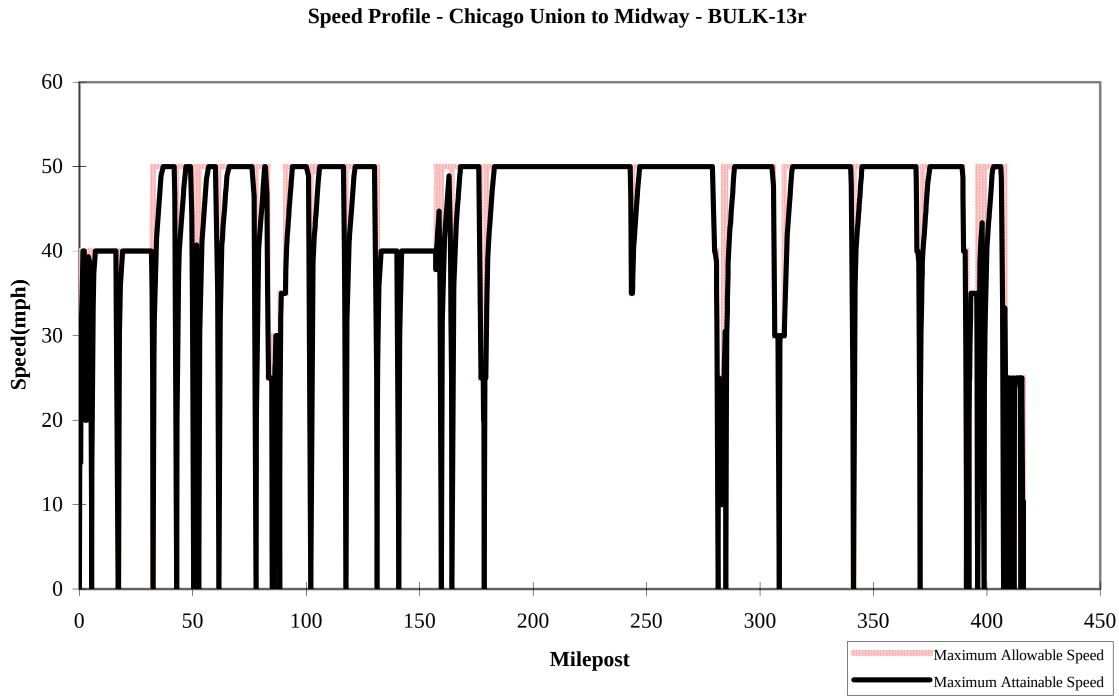
The speed capability of each train type is determined by its horsepower-to-tonnage ratio. As this ratio changes, so does the speed capability of the train, *i.e.*, train performance changes when pulling 100 tons versus 1,000 tons. To effectively describe the speed capabilities of each train, different speed capability profiles are constructed for both bulk and intermodal freight trains. Exhibit 6-5 is an example of the *LOCOMOTION©* program dialog box where the speed capability information is stored.

Exhibit 6-5
Speed Capability Dialog Box in *LOCOMOTION*© by Technology Type (Bulk)



After all of the individual train information and the track infrastructure information are collected, *LOCOMOTION*© model runs are performed to establish the base travel time. The travel times computed by *LOCOMOTION*© assume that there is no congestion along the corridor and no need for any additional time to accommodate unexpected delays. The maximum attainable speed, given the capability of the train and the speed restrictions, is illustrated in the train's speed profile (Exhibit 6-6). This ideal travel time and the train's scheduled departure time are used to replicate an operating schedule without any delays. Operating schedules are then used to calculate each train's stringline. These stringlines are imported into the *MISS-IT*© system, where train delays are calculated, and either Ideal Day or Typical Day Analysis is conducted.

Exhibit 6-6
Speed Profile Typical Bulk Train



6.4 Introduction: Ideal Day Analysis

The Ideal Day Analysis uses existing information to replicate a train's movement along a particular corridor. Travel times are modeled using detailed information about track infrastructure, train acceleration and deceleration rates, stopping patterns and built-in recovery time to accommodate unexpected delays. The Ideal Day is a valuable starting point in the planning process, even though it does not always reflect actual practice.

In an ideal situation, all trains will perform as planned. They will:

- Depart at their scheduled times
- Travel at pre-determined speeds
- Adhere to required restrictions
- Make required stops
- Be subject to expected delays
- Arrive at their destinations at scheduled times

A knowledgeable rail operator will not assume that all trains can travel without delay through a corridor; but rather will build sufficient slack time into the schedules of those trains that can accept the extra travel time without severely disrupting the rest of the system. Using this approach, what we call the Ideal Day is not *idealistic*, but is a fairly realistic assessment of train operations where traffic levels are light to moderate. As a result, the operating plan will reasonably balance a complex set of competing requirements for limited available resources, *e.g.*, track infrastructure and train technology. This balance is achieved in such a manner that maximum schedule stability, with acceptable levels of delay and variation, is achieved. For modest deviation in scheduled departures (5 to 10 minutes), the integrity of the overall schedule should remain largely intact.

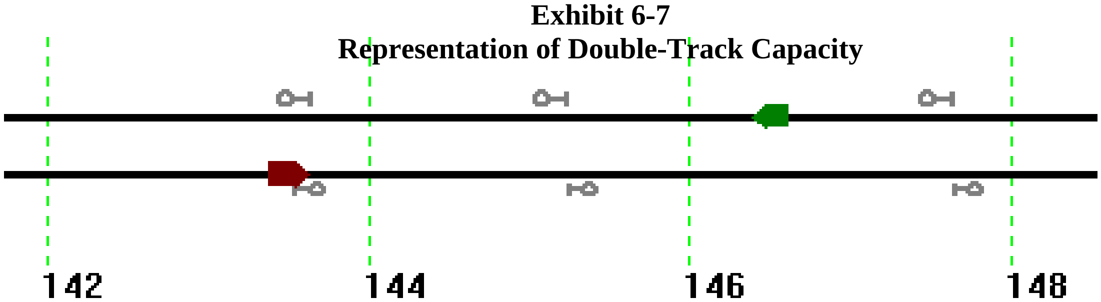
The extent to which such a plan can be constructed depends on how reliably trains can be scheduled. For passenger trains, published timetables provide sufficient guarantee that the scheduled times are realistic. Bulk trains, on the other hand, are not as time sensitive as are passenger trains. Thus, a scheduled departure time may be replaced with a scheduled departure *window*. For corridors running at or near capacity, due to the inherent unpredictability of unscheduled or semi-scheduled trains, planning becomes much more complex, and more detailed Typical Day Analysis is needed.

6.4.1 Calculating Train Travel Time and Delay

For the purposes of the Ideal Day Analysis, regardless of whether or not a train has a published departure time, a specific (most likely) departure time is assigned to each train. These departure times serve as starting points for the construction of a complete operating diagram. Three types of delay may be added to the stringline so that a more realistic replication can be achieved. These are: scheduled stops, slack and recovery time and unplanned delays due to conflict resolution.

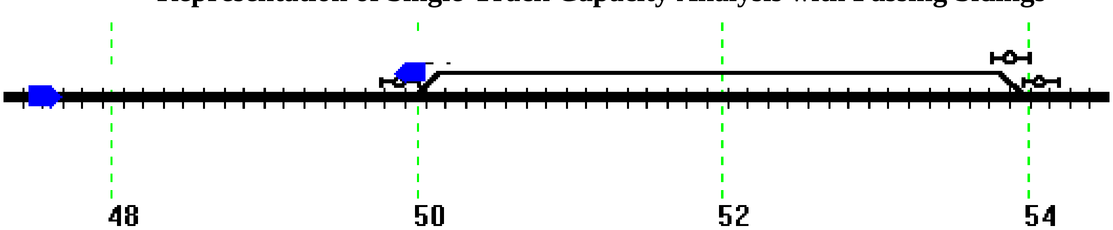
Trains that meet with sufficient infrastructure can pass with no delay to either train (e.g., two trains meeting on double track), as shown in Exhibit 6-7.

Exhibit 6-7
Representation of Double-Track Capacity



However, when there is insufficient infrastructure to accommodate all traffic in both directions, one or more trains must incur some delay to allow another train to pass, as shown in Exhibit 6-8.

Exhibit 6-8
Representation of Single-Track Capacity Analysis with Passing Sidings



Thus, the overall travel time for a train is dependent on the number of delays it encounters on the path to its destination. Whenever a train meets another train, for which there is insufficient infrastructure to allow both trains to pass freely, the lower-priority train is subject to a delay. The sum total of all delays determines the total travel time, according to the following formula.

By measuring each of the components of delay for a given set of trains, train travel time and level of delay can be estimated.

Time Penalties

Once the travel times for all of the trains operating along a given corridor are reproduced in the model, a review of the track infrastructure is conducted to determine if there is sufficient track capacity to accommodate the traffic. If the review determines that sufficient capacity does not exist, time penalties are assessed to trains with lower-priority ranking. Time penalties are based on the actions that dispatchers would likely take to avoid conflicts with other trains. If, for example, a passenger and freight train meet on a segment of single-track, and there is a siding nearby, the model assesses a time penalty on the freight train to approximate the length of time needed for the freight train to pull into the siding and wait for the passenger train to pass, thus avoiding the conflict. The time penalty in the Ideal Day Analysis is a technology-based assessment that depends upon the train type (local, bulk, or intermodal freight; commuter or intercity passenger), and is used in all cases where the review has determined that insufficient track capacity exists to accommodate trains as they meet each other along the corridor.

6.4.2 Ideal Day Outputs

In the Ideal Day Analysis, a travel profile for each train is produced. This profile is based on the fastest achievable trip time, given its technology, speed capabilities, and the constraints unique to the particular corridor. Some additional time is built into each train's base travel time to accommodate unexpected delays so that the train can still arrive at its destination by its scheduled arrival time.

6.4.3 Conclusion

Using this Ideal Day Analysis data, a feasibility estimate of train delay by train, train group and train type can be derived. The output is then used in the Mitigation Analysis to identify the infrastructure, signaling and operations changes needed to effect capacity mitigation.

6.5 Introduction: Typical Day Analysis

As previously noted, the Typical Day Analysis is designed to provide a more comprehensive and detailed evaluation of train operations than the Ideal Day Analysis. Further realism is added to the operations analysis, and the level of complexity in the analytical calculations is raised by an order of magnitude. In the *Ideal Day Analysis,* train departure times are assumed fixed. The Typical Day Analysis allows these times to vary in order to replicate realistic day-to-day departure patterns. To simulate this variation in departure times, the analysis uses a Monte Carlo statistical technique. This technique uses random numbers and probability statistics to estimate multiple randomized dispatch variations that are in turn applied to the scheduled departure times. As departure times are varied, a dynamic element is introduced into the analysis that was not available in the Ideal Day Analysis. Instead of a "snapshot" of a single point in time as shown on the Ideal Day, the Typical Day Analysis is able to take multiple snapshots and to capture how traffic in a varied, real-world environment affects train times and thus provides more "typical" estimates and more accurate measurement of delay.

6.5.1 Dispatch Logic

The Typical Day Analysis provides a detailed analysis of train delay, focused on the individual train and its performance across the route. The analysis, which uses the TEMS *MISS-IT*© capacity analysis system, is a dynamic analysis of train movements and the potential variation in those movements. It uses calibrated, railroad-specific, dispatch logic to model train performance. The analysis begins with the development of "perfect" stringline diagrams that reflect the geometry and engineering of a route and omit limitations due to train-meets and inadequate track capacity. The process then simulates the dispatching of trains according to the selected dispatch logic and calculates new stringlines that include delay times associated with train-meets, signal delays, tailgating, scheduled stops, and a variety of factors that affect dispatch decisions.

The train-meet dispatch logic uses train priority data to determine which trains proceed at each meet, which trains wait, and where they wait, and how much trains are delayed. This priority-based dispatching and conflict resolution process is an event-based logic that determines the interaction of trains as they move down the track. The dispatch logic typically resolves 99.9 percent of all conflicts. When the dispatch model cannot resolve conflicts, a manual override is available to finalize the dispatch decisions.

The advantage of event-based dispatch logic is that it measures the train delays at every train-meet throughout each schedule. Each decision is recorded and can be reviewed. If for any reason a decision needs to be changed, *e.g.*, because of a need for an "illogical" decision such as dispatching a local train ahead of an intermodal train, this can also be done using the manual override.

In carrying out the Typical Day Analysis, a risk analysis can be conducted to determine how train delay will vary as train departure times change. The analysis of risk is performed using a Monte Carlo simulation of train departure times. This model provides a dynamic assessment of train movements and changes in train delay based on empirical factors such as crew work practice, train priority, and special events, etc. The output of the analysis is not only the train delay for the entire train trip, as well as delays at any particular point in the journey, but also the distribution of delay (standard deviation) for the trip on any typical day.

To ensure that the Typical Day Analysis effectively models a "peak" traffic day for the railroad and meets the capacity needs of both freight and passenger traffic on a peak day, the analysis is iterated through a 2- to 30-day cycle. This process ensures that overnight trains are properly modeled and are not excluded from the analysis, which could give a false impression of capacity needs and that weekly and monthly peaks are properly represented. The model runs until all traffic has completed *at least* one trip on a fully loaded corridor.

6.5.2 *Typical Day Analysis Issues*

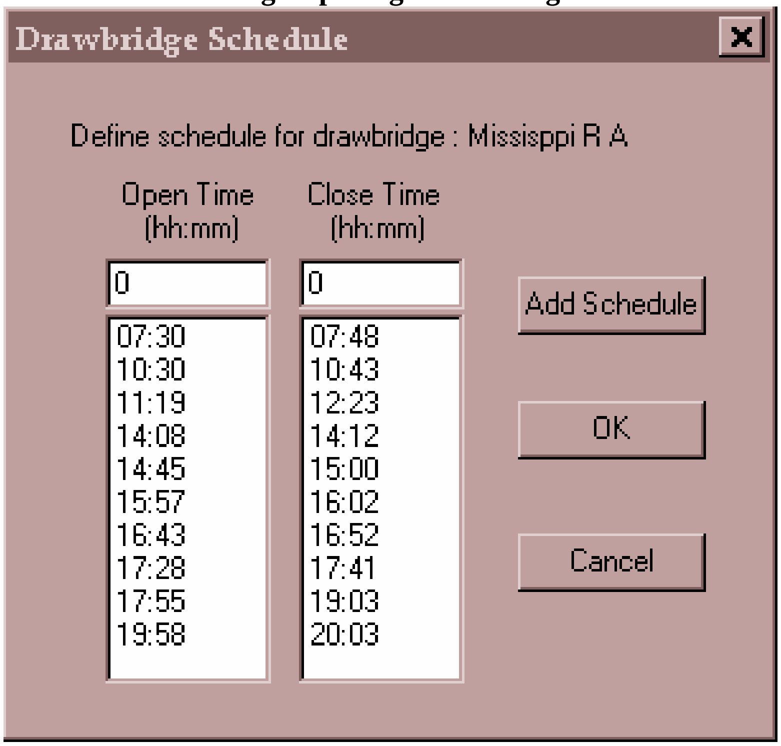
In addition to allowing departure times to vary from their set scheduled times the Typical Day Analysis provides better estimates of train travel times than the Ideal Day Analysis. The reason estimates are improved is that the *MISS-IT*© model uses an event-based conflict resolution process to estimate travel times and the resulting delays. The estimates reflect the speeds of the trains and how quickly they can progress to a point where the conflict can be resolved. In effect, as the model simulates the trains traveling through the system, it also identifies trains traveling in the opposite direction. If the train traveling in the opposite direction is on the same line, the model recognizes the conflict and determines the best way to handle it. If the train is of lower rank, the model will select a place to sidetrack the train to let the other train pass and estimate the wait-time needed for the other train to pass. Since these estimates are determined on a case-by-case basis and are reflective of the attainable train speed and the distance traveled to avoid the conflict, these estimates are more precise than the feasibility delay estimates used in the Ideal Day Analysis.

In order to conduct the Typical Day Analysis, a variety of information is collected from the railroad. The information required includes:

- Scheduled departure times for all trains operating within the corridor
- Statistical information on the probability and degree of variation in the departure and arrival times
- Information on the capabilities of various types of trains
- Detailed information on the track infrastructure
- Expected infrastructure upgrades

Another important component of the Typical Day Analysis is the development and integration of schedules for the diamond crossings and drawbridge openings. Working with the railroads, a database of diamond crossing and drawbridge occupancy and availability is generated for the Typical Day Analysis. CP Rail furnished a dataset of drawbridge opening and closing times, shown in Exhibit 6-9, based on observation of current operations of the drawbridges. The model determines when a train can and cannot pass through a diamond crossing and when a train would be expected to be traveling through the diamond from the crossing corridor. In the same manner, the model identifies scheduled drawbridge openings and when trains can occupy that space. In each case, the Typical Day Analysis considers the effect of the track availability and verifies that the trains operated within the bounds of these schedules.

Exhibit 6-9
Drawbridge Opening and Closing Times



6.5.3 Model Calibration

Comparing known travel times for "scheduled" trains with the post dispatch stringlines generated by the model validates the performance of the dispatch model. This can be completed for Metra commuter trains, Amtrak long distance trains and intermodal and bulk trains. The results of the comparison are used to adjust the dispatch logic and ensure effective representation of trains. In adjusting the dispatch logic, the results of any particular movement can be followed using the Action Log. This shows at what locations interactions occur, what happens to each train in the interaction, which train is delayed, and by how much it is delayed. The Action Log allows the totality of movements of each train to be identified as it moves along its stringline from origin to destination. Exhibit 6-10 shows comparative data for each train category. The results show that the calibrated model's post-dispatch stringlines effectively represent train performance on the corridor. It can be seen that the differences between the freight railroad and *MISS-IT*© train times are well within the allowable variance for each type of train.

Exhibit 6-10
Average Travel Times for Amtrak, Metra, and Freight Trains

Train Classification	Average Travel Times				Allowable Variance
	TEMS *MISS-IT*©	Freight Railroad Estimates	Difference		
			Faster	Slower	
Freight Bulk	12:58	12:30	+0:27		
Amtrak *Hiawatha*	1:26	1:17	-0:09		
Freight Intermodal	8:12	8:34		0:22	
Freight Local	5:30	4:35	0:54		3:00
Metra	0:48	0:50		0:02	0:04

6.5.4 Performance Upgrades/Mitigation Measures

Depending on the elements of the corridor under analysis, various improvements to the infrastructure can reduce travel times. If the railroad has an objective to mitigate or reduce travel times, the following upgrades or a mixture thereof can be added as an input to the analysis to meet these objectives. These include improvements to the signaling system, infrastructure and operations.

Signaling

In highly congested areas, upgrades to the signaling system can provide great time savings to traffic in a corridor because they increase the density of trains and permit higher speeds at signal blocks. Investment in Positive Train Control (PTC) can be especially beneficial when mixing together trains having different speeds and stopping distance profiles. In all areas where passenger train speeds are planned to exceed 79-mph, the MWRRS capital cost already includes an allowance for equipping the line with PTC technology. The amount of delay reduction depends on the exact capabilities of the PTC system that is ultimately deployed, and whether all trains are ultimately equipped with PTC capability. Our proposed remediation for the Chicago-Cleveland and St. Louis-Kansas City lines did not rely on any PTC savings. Rather the remediation consisted of enough infrastructure additions to reduce freight delay to the level they would be without passenger trains. Any PTC savings would be in addition to this.

Infrastructure

By adding segments of track along the corridor, trains are given additional choices to resolve conflicts that they did not have previously. The train can advance further down the track, clearing the way for other trains. The result is a smoother flow of traffic through the corridor and less incurred delay.

Another enhancement that results in performance improvements along the corridor is upgrades to the track to support higher speeds. These improvements help the traffic to move through the system more quickly, preventing potential conflicts with other trains later in the day.

Operations

Another measure that improves the performance of the trains along the corridor is to make changes to the operating schedules. If the analysis indicates that several trains are conflicting, changing their schedules to provide some additional spacing between the trains will smooth the flow of the trains along their journeys with the agreement of the railroads, even minor modifications to the schedules of local and lower priority bulk trains can produce significant operational improvements. This will in turn reduce the delays that these trains were incurring because they were traveling too close together.

6.5.5 Risk Analysis

For a Typical Day Analysis, a risk analysis is performed. This involves running the dispatch model to obtain randomized departure times, which vary from the scheduled departure times for each train. The risk analysis replicates the delay for each train under a series of changes in departure times. In effect, the model attempts to determine the range of delay for each train under several different conditions.

6.5.6 Typical Day Outputs

MISS-IT© is an event-based conflict-resolution model. This means that, once a train is dispatched, the model makes decisions based on oncoming traffic and the track available to avoid conflicts with the oncoming traffic.

Action Log

The action log reports any delays that a train incurs over its pre-dispatch travel time. The action log identifies the dock-to-dock trip times of the different train types and helps in providing origin-to-destination travel plans for the systems trains. It provides a key assessment of effective train movement planning, helping to ensure that the "right car is on the right train on the right day."

The summary format of the action logs reports the total journey time, percent of allowable delay, the amount of delay over the normal operation of the train, and the delays that occur when the train is moving down the track. The percent of allowable delay reported in the action log for each train is determined by the expectations of the railroad. If the railroad determines that it is acceptable for a train's delay to be 10 percent of its journey time for each train type, the percentage of allowable delay recorded in the action log is the accumulated delay time in relation to the allowable delay.

Initially the percentage of allowable delay was designed to indicate if a train was delayed within an allowable range. This meant that if a train incurred a delay, it would rise in rank relative to other trains so that it would still operate within this range of delay. In some cases, this resulted in some of the freight trains taking precedence over passenger trains. Since this was occurring, trains were restricted in rank so that they were allowed to "float" only within their own super-group, *e.g.,* bulk trains.

The delays that result from a train's movements along the track are recorded in the action log. These delays include: acceleration/deceleration, tailgating, non-signal and track switch delays. All of these delays are specific to train type and the type of infrastructure, signaling system, and dispatch policy of the railroad.

The acceleration/deceleration delays are incurred if a train needs to accelerate or decelerate to get out of the way or slow down for another train. Tailgating penalties occur in the model if a train approaches another and cannot immediately pass. The train must then wait until the other train is far enough ahead before it can proceed.

If a train enters an area where there are no signals or if the signals face the opposite direction, a train sustains a non-signal time penalty. In some cases, a railroad may determine that a penalty is not warranted in a non-signaled section, in which case this penalty is set to zero in the model.

A track switch penalty occurs when a train goes through a point where it must change tracks. This penalty is designed to replicate the amount of time a train needs to slow down to travel through a track connection. If the track is straight at this point, the train may not need to slow down. If a train diverges through a crossover or to a side track, the train may have to slow down substantially.

The detailed format of the action log reports the same information as the summary action log, but includes more information about location and time of the delay. In addition, if a train has reacted to another, the detailed action log reports the name of the causing train and its rank. In order to check if a lower-ranked train is waiting for a higher-ranked train, the rank of the current train is reported.

Comparison of Pre-Dispatch and Post-Dispatch Travel Times

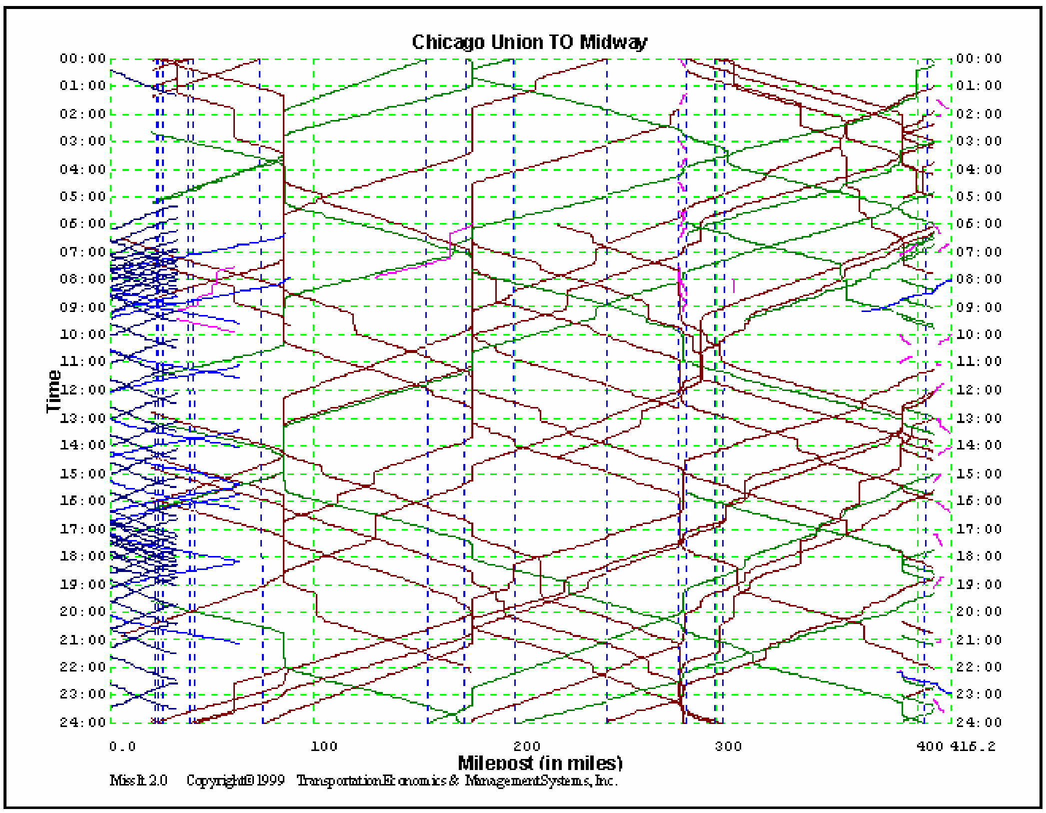
To complete this analysis, a comparison of pre- and post-dispatch travel times is generated. The term "pre-dispatch" refers to travel times or stringlines that exclude any delay associated with passenger and/or freight interaction. "Post-dispatch" refers to times/stringlines that include delay times associated with passenger and/or freight interactions. These results can be used to calculate average delay per train and the standard deviation of the trip duration.

In order to evaluate the comparison of pre- and post-dispatch times, the results can be considered on a sample train or on a train-group basis. If trains are grouped together by similar characteristics, it is easier to see how changes in track infrastructure will impact a particular group.

Post-Dispatch Stringlines

A useful instrument employed during the analysis is the post-dispatch stringline diagram. This diagram illustrates the path of each train as it travels through the system. Comparison of the post-dispatch and pre-dispatch stringline diagrams shows the delays that have been added during the conflict-resolution process as 'kinks" in the lines. This diagram can be useful in identifying potential problem areas along the corridor. This information is extremely useful in determining the necessary infrastructure to be added during the mitigation process. This is shown in Exhibit 6-11.

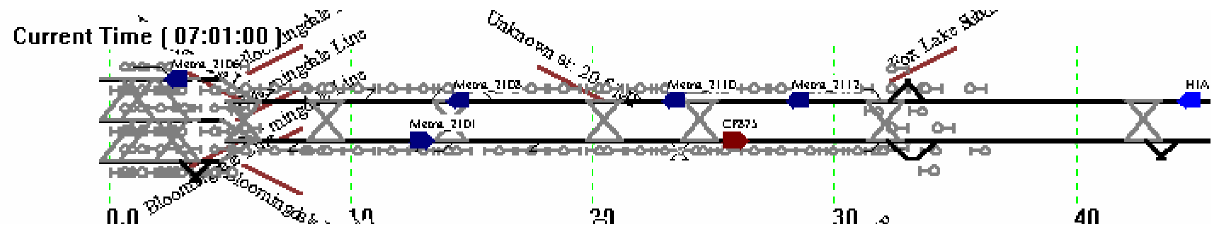
Exhibit 6-11
Post-Dispatch Stringline Diagram



Animation

The animation feature of *MISS-IT*© augments and complements the post-dispatch stringline diagram by introducing a temporal dimension to the software. It takes all the information from the stringline diagram (Exhibit 6-12) and puts it into motion, showing trains' movements over the track infrastructure. Each train is labeled for easy identification and color-coded to match the group to which it is assigned. These colors are also the same as in the stringline diagram. This animation feature is helpful in understanding the interaction between trains as well as how the trains utilize the track. Another element that the animation brings to light is the departure and arrival patterns of the trains. It also shows trains entering and departing from the track at yards, junctions and stations.

Exhibit 6-12
Example of *MISS-IT*© Animation Graphics



Risk Analysis Outputs

Exhibits 6-13, 14 and 15 provide samples of the reports that are generated in the risk analysis. In this example, the model was run three times, changing the departure times for every train each time, to determine how the trains interacted on three different days. The first part of the report details the probability statistics for each train type operating along the corridor. The second part details the departure, arrival, duration and percentage of allowable delay for each train. Three lines of information are reported for each train because the model was run three times.

The times reported in the summary report for the risk analysis are averages for the journey time, standard deviation, percentage of allowable delay and the standard deviation in the percentage of allowable delay. This Exhibit shows the average result for three runs completed in the risk analysis.

Exhibit 6-13
Risk Analysis Output (Detailed)

Train Risk Analysis Report (Journey Time)					
Model Run Name:					
Dispatch Type: MULTIPLE					
Num of Variations: 3					
Technology Statistics:		**Probability**		**Standard Deviation (min)**	
		Early	**Late**	**Early**	**Late**
BULK-Type 1	:	0.25	0.75	15	30
INT-Type 1	:	0.50	0.50	15	15
BULK-Type 2	:	0.25	0.75	15	30
BULK-Type 3	:	0.25	0.75	15	30
BULK-Type 4	:	0.50	0.50	15	15
BULK-Type 5	:	0.25	0.75	15	30
BULK-Type 6	:	0.25	0.75	15	30
BULK-Type 7	:	0.25	0.75	15	30
BULK-Type 8	:	0.25	0.75	30	60
BULK-Type 9	:	0.25	0.75	30	60
INT-Type 2	:	0.50	0.50	15	15
INT-Type 3	:	0.50	0.50	15	15
INT-Type 4	:	0.50	0.50	15	15
INT-Type 5	:	0.50	0.50	15	15

Exhibit 6-14
Risk Analysis Output (Detailed) (continued)

						Percent of
Train Number	**Departure**	**Arrival**	**Duration**	**Arrival**	**Status**	**Allowable Delay**
1 (Bulk)	0:15	12:12	11:57			45
	0:34	12:50	12:16			18
	0:30	10:50	10:20			31
						Percent of
Train Number	**Departure**	**Arrival**	**Duration**	**Arrival**	**Status**	**Allowable Delay**
4 (Commuter)	0:25	1:16	0:51			0
	1:09	2:00	0:51			0
	1:36	2:27	0:51			0
						Percent of
Train Number	**Departure**	**Arrival**	**Duration**	**Arrival**	**Status**	**Allowable Delay**
3 (Intermodal)	1:00	14:27	13:27			60
	1:18	14:45	13:27			112
	2:08	15:58	13:50			23

Exhibit 6-15
Risk Analysis Output (Summary)

Train Number	Mean Journey Time	Standard Deviation	Mean Percent of Allowable Delay	Standard Deviation
9 (Local)	0:18	0:00	193	273
1 (Bulk)	11:31	0:50	31	11
4 (Commuter)	0:51	0:00	0	0
3 (Intermodal)	13:35	0:10	65	36
73	0:21	0:00	0	0
74	0:20	0:00	0	0
75	0:29	0:00	0	0
76	0:08	0:00	0	0
77	0:29	0:00	0	0
78	10:51	0:16	83	41
79	0:27	0:00	44	62
80	12:42	0:16	48	24
81	0:18	0:00	0	0
82	3:09	0:01	32	1
83	0:21	0:00	0	0

6.5.7 *Ideal Day vs. Typical Day Analysis*

The Ideal Day Analysis provides a good estimate of delay under the assumption of a stable timetable and high or moderate traffic levels. The reality of unpredictable timetables on a corridor that is heavily used requires the broader analytic framework offered by the Typical Day Analysis. Exhibit 6-16 shows the difference between these two complementary approaches.

Exhibit 6-16
Comparison of Ideal Day Analysis and Typical Day Analysis

Ideal Day	Typical Day
Preliminary estimates	Final estimate
Static	Dynamic
Fixed schedule	Variable departure times

6.6 *Berkeley Simulation Software* RTC©

Berkeley Simulation Software's Rail Traffic Controller (RTC©) is a modeling package designed to realistically simulate freight and passenger rail operations in either a planning environment or an online control situation. The study team uses RTC© as a freestanding analysis tool in addition to TEMS' *MISS-IT*© software.

RTC© defines data as "nodes" on the rail infrastructure, including switches, signals, detectors and speed change points. Track between locations is defined as directional "links" and include characteristics such as speed limits, grade, curvature and operating rules. Rolling stock is customized for locomotive types to evaluate locomotive suitability for a particular territory.

Train lengths and costs, types of trains and train schedules are depicted providing a high level of detail needed to make planning decisions for each rail line in the network. RTC©'s logic considers shared-use corridors where decisions must be made regarding train meets, passes, overtaking and routing issues. The RTC© model allows the study team to investigate the shared use of existing facilities and infrastructure, the effect on train delay by the addition of new trains to the current network, the effect of capital improvement to existing levels of infrastructure, the need for and efficient usage of passing sidings, diagnose bottlenecks and simulate recommended schedule or routing changes.

For the MWRRS analysis, the RTC© model was used only for the St. Louis-Kansas City line, at Union Pacific's request. TEMS' *MISS-IT*© software was used to evaluate all the other line segments.

6.7 *MWRRI Ideal Day Analysis Application*

By definition, a corridor at capacity requires additional infrastructure in order to add trains. A corridor operating below capacity should theoretically have the ability to take on additional trains without needing additional infrastructure. However, additional trains may increase delays and overall transit times to all trains now operating on the route, particularly when there is a large difference in the operating speeds of the trains on the corridor. When adding new trains, it is important to understand how the additions affect existing operations, as well as how corridor improvements can mitigate these effects.

In March 2002, an *Ideal Day Analysis* was completed of eight corridors under consideration for the MWRRS. The aim of the analysis was to assess the impact of adding MWRRS passenger trains on these corridors, and to provide an initial estimate of the infrastructure improvements necessary to maintain the current level of performance with the addition of MWRRS trains. The map in Exhibit 6-17 shows the corridors that were included in the 2002 study.

This section summarizes key findings of the *Ideal Day Analysis* report, which was delivered to the MWRRI Steering Committee in March 2002 plus an analysis of the Milwaukee to Green Bay corridor that was originally incorporated into the Green Bay route alternative study. Additional detail is available in the *Ideal Day Report* that is not presented here. Freight tonnage data and growth rates used in Ideal Day Analysis were derived from state, federal, and freight railroad data sources at the time the analysis was prepared. The data represents peak day traffic and used conservative growth rates significantly higher than national average growth rates. The Ideal Day Analysis performed for the Chicago-Carbondale line did not include the recent impacts of the CN purchase of the Illinois Central Railroad.

This analysis is strictly a planning-level study that will review potential conflicts and train meet-points on each corridor. A meet-point location is the point at which two trains will *ideally* pass each other, assuming that both are operating on or close to schedule. Examining these meet-points and the level of delay experienced by all trains moving through the corridor provides a basis for determining the infrastructure improvements required once MWRRS passenger trains are added to the system.

The nine corridors that were examined are:

- Milwaukee to Green Bay, Wisconsin
- Chicago, Illinois, to Quincy, Illinois
- The Omaha Branch from the Quincy main at Wyanet, Illinois, to Omaha, Nebraska
- Chicago to Carbondale, Illinois
- Chicago to Cincinnati, Ohio
- Chicago to Pontiac, Michigan, via Detroit, Michigan
- The Holland Branch from Kalamazoo, Michigan, to Holland, Michigan
- The Port Huron Branch from Battle Creek, Michigan, to Port Huron, Michigan
- Chicago to St. Louis, Missouri

Exhibit 6-17
Ideal Day/Typical Day Corridors

These corridors were chosen based upon the key assumption that each is operating below capacity. With the possible exception of parts of the Chicago-Quincy and Carbondale corridors, traffic levels were generally low enough and existing infrastructure levels were high enough to justify this assumption, except in the urban approaches to large terminal cities. Therefore, the analysis of each route focused on the potential for bottlenecks on the corridor itself and did not address the potential congestion and delays in the terminal areas. Improvements in the Chicago region (defined as the region within the lines of the Elgin, Joliet and Eastern Railroad, but extending east to Porter, Indiana) were specifically *not addressed* due to a highly complex, local operating environment and the existing congestion on many of the routes within the region. The unique complexity of this area made it unsuitable for this type of analysis. The CREATE project, described in Chapter 5, has established an effective model for a process that could be used for identifying and resolving these complex Chicago terminal-area issues.

6.8 Methodology

The first step in the Ideal Day analysis was to model the corridor. Detailed track files were assembled in *MISS-IT*© to replicate the current track configurations over the eight corridors in question. The track configuration of many of the corridors has changed over the past few years, so it was imperative to update these files to reflect current conditions. Next, existing train operations were modeled as discussed below. This allows for the examination of existing delays on the corridor. The existing traffic was then forecast to a future year (2010), and the delays associated with that forecast year level were identified. In this report, this is referred to as the *forecast base*. MWRRS passenger trains were then added to this system without any infrastructure additions to determine the level of additional delay. In the final step, the increase in delay was mitigated as infrastructure improvements were identified that potentially reduced corridor delay times to the forecast base level. The corridor was re-analyzed with these improvements in place to determine the adequacy of the additional infrastructure. If the delay had not been reduced to an acceptable level, additional mitigation options were examined, including additional infrastructure upgrades.

6.9 Current Train Operations Analysis

The goal of this initial analysis was not to eliminate train delays, but rather to ensure the effective calibration of the Ideal Day model. In many cases, delays were unavoidable, particularly on single-track railroads. These were already indirectly recognized in that they were built into existing train schedules and operating plans.

The train movements on the corridor or on a segment of the corridor were modeled based on train counts, operations and schedules. The origins and destinations, schedules and stopping patterns, and speed limits were established first. Actual train performance, including acceleration and deceleration rates, was modeled based on train types. The trains included in this analysis were the local and through freight trains that operated on the corridor and on each corridor segment, and the intercity or non state-supported Amtrak passenger trains *outside of the Chicago region*. While Chicago-area line segments (e.g. Chicago to Joliet) were included in the model, those segments were not modeled in detail since many train operations, including Metra commuter operations (both current and planned or proposed) and Chicago local and transfer freight service, were not included in the *Ideal Day* simulation scope[1].

In addition, yard jobs that might have entered onto the main tracks in and around yards and traffic moving through very short stretches of the corridor (as on the CN lines in Battle Creek, MI) were not included in the stringline diagrams. Proposed commuter operations in Cleveland, Minneapolis, Cincinnati and Detroit and additional passenger train service (like the 3C in Ohio) were also not included in this analysis based on the assumption that these services will begin operation with additional infrastructure for their own requirements. Additional train operations stemming from new freight terminals such as Joliet Arsenal were considered only if traffic patterns and train routings are already established. Proposed or planned terminals, like the

[1] Chicago-area operations including METRA commuter trains were, however included in the scope of the Chicago-Twin Cities study that was conducted using the more detailed *Typical Day* analysis approach.

Detroit Intermodal Freight Terminal, were not considered because the traffic patterns and routings are underdetermined to date.

The performance characteristics of these trains were used in conjunction with the track files to create individual train stringlines. The stringlines shown are simply a graphical representation of each train's movement over the corridor from the time and location where it arrives until its trip is complete. The slope and shape of the stringline was dependent on the train's performance characteristics, including its maximum operating speed and its schedule.

This analysis was a *static* process in that it assumes that the conditions under which each train operates were the same from day to day, creating identical travel times each day. Because there were no variations in travel times, the trains were assumed to be operating under *ideal* conditions. In this ideal situation, all trains will operate as planned in that they will:

- Depart on schedule
- Maintain the maximum speed permitted on each segment of track after allowing for acceleration and deceleration
- Make all required stops with consistent dwell times
- Be subject only to expected delays
- Arrive at their destinations on schedule

Individual idealized stringlines were then applied based on the current corridor operations to model the train operations and develop the daily operating plan. This plan was the schedule for a single day of operation on the corridor. The extent to which an operating plan can be constructed depends a great deal on how reliably trains can be scheduled. For intercity Amtrak passenger trains, published timetables provided the arrival times onto the corridor. High priority intermodal freight trains had similar departure schedules, defined both by the cutoff time when the inbound highway equipment has to be processed through the terminal gate and by the actual train departure time. Lower priority freight trains, on the other hand, were not as time sensitive and subsequently could operate more irregularly with a scheduled departure *window* rather than a fixed departure *time*.

Given that this analysis was applied to corridors that generally have *excess* capacity, normal day-to-day variations in departure times and operations can be absorbed. As a result, the operating plan will reasonably balance the competition for the available capacity. This balance is achieved with some tolerance for schedule deviations (typically 5 to 10 minutes). For corridors running at or near capacity, planning becomes much more complex due to this uncertainty and thus requires, as noted above, a more detailed level of analysis, including a risk assessment.

6.10 Calculating Train Travel Time and Planned Delays

A train's idealized stringline shows the fastest possible travel times from origin to destination. Such idealized stringlines will not reflect train delays where meets take place. These delays were accounted for in the analysis with three types of delay – scheduled stops, slack and recovery time, and unplanned delays due to conflict resolution – added as necessary to achieve a more realistic model of the corridor's operations.

6.11 Calculating Unplanned Train Delays

Trains that meet with sufficient infrastructure can pass with no delay to either train (*e.g.,* two trains meeting on double track). However, when there is insufficient infrastructure to accommodate the traffic in both directions, one or more trains must incur some delay to allow another train to pass. Thus, the overall travel time for a train is dependent on the number of delays it encounters on the path to its destination. Whenever a train meets another train for which there is insufficient infrastructure to allow both trains to pass freely, the lower-priority train is subject to a delay. By measuring each of the components of delay for a given set of trains, train travel time and level of delay can be estimated.

Once the travel times for all of the trains operating along a given corridor were reproduced in the model, track infrastructure was reviewed to determine if there was sufficient track capacity to accommodate the traffic. This was done by analyzing train movements along the corridor and assessing time penalties when the review determined that sufficient capacity did not exist for train meets or overtakes. The time penalties were based on the delays that a train would incur in the event of a meet. For example, if a passenger and a low priority freight train meet on a segment of single track, and there is a siding nearby, the model assesses a time penalty on the freight train to approximate the length of time needed for the freight train to pull into the siding, wait for the passenger train to pass and then accelerate to track speed. The time penalty was used in all cases where the review determined that insufficient track capacity existed to accommodate trains as they met each other along the corridor.

These unplanned delays were the key measurements used for comparing train operations with and without the addition of MWRRS traffic on the corridor and the effects of the suggested infrastructure improvements.

6.12 Forecast and MWWRS Traffic

Traffic levels were forecast to the year 2010 using an annual growth rate of up to two percent per year for through freight traffic[2]. The base traffic year is 2000. Traffic growth was largely focused on through freight traffic with zero growth for intercity Amtrak passenger trains. The through freight traffic in many of the corridors in this analysis has multiple origins and destinations with trains on the same corridor running on different line segments. In these cases, the traffic growth was assumed constant for all groups of trains. In other words, the growth rate was applied equally to trains operating between Chicago and Kankakee and between Chicago and Champaign. Current state-supported Amtrak trains were not included in this analysis on the assumption that MWRRS trains will replace them.

[2] In the *Ideal Day* analyses, traffic was estimated based on a “peak” rather than average day assumption. *Typical Day* corridors and Chicago’s CREATE rail plan generally assumed higher growth rates, for example 5% per year on UP’s St. Louis to Kansas City line. In spite of this, it is not clear that the *Ideal Day* analysis understates traffic due to its use of a peak day as the starting point. 2% is the traffic growth rate assumption that was approved by the MWRRI Steering Committee at the time when the *Ideal Day* analysis was performed and represents a growth rate well above national freight traffic growth.

6.13 Infrastructure Improvements

In developing the types of infrastructure improvements to analyze, the best course of action is to keep trains moving wherever possible by avoiding situations where trains slow or stop for meets. By keeping trains moving during meets, fewer delays are incurred.

6.13.1 Types of Infrastructure Improvements

Improvements in alignments and local track geometry were not considered. The levels of infrastructure improvement considered in this analysis are listed below.

- Adding *passenger* sidings located primarily for passenger-to-passenger train meets. These sidings are ideally six miles long for a 79-mph area and 10 miles long for a 110-mph area. The length of the sidings allows for passenger train meets without stopping either train, with a total tolerance in the actual running time of about 5 minutes. In all cases, the sidings were assumed to have 60-mph premium turnouts on each end. Some sidings also have a pair of 30-mph crossovers in the middle to allow for 3-way train meets and overtakes. In many cases, these types of improvements can be achieved by simply extending existing sidings. While these sidings are primarily located for passenger train meets, their use is by no means limited or restricted to passenger train operations. The addition of crossovers in the middle of some of these sidings specifically adds additional flexibility for freight train operations.
- The addition of *freight* sidings for holding freight trains for meets. Typically, these sidings are 10,000 feet or 2 miles in length. On corridors such as Chicago to Quincy, these were used to stage trains into or out of potential choke points such as regions affected by commuter windows or outside major classification yards. On lower density routes such as the Omaha branch, these sidings provided room for freight traffic to clear the main for oncoming traffic or for overtaking priority traffic. The reasoning was that the additional cost of a longer siding is not justified on a low-density freight route.
- Extending sections of multiple tracks for increased capacity, particularly on both sides of single-track bottlenecks. These extensions not only create, in effect, longer sidings, but with the addition of 60-mph premium turnouts, they also allow all trains, including freight traffic, to accelerate and maintain that speed prior to hitting the bottleneck section. This helps minimize the time spent on the bottleneck by each train, increasing the capacity or number of trains that can use the line.
- Adding crossovers in bi-directional multiple-track territory. Additional crossovers allow for much greater flexibility in handling traffic on multiple-track territories. With the improvement of only one track to full MWRRS speed in multiple-track territory, the addition of crossovers was necessary to keep traffic fluid while minimizing delay. Unless otherwise noted, the speed limit on the additional crossovers is 45-mph.

6.13.2 Infrastructure Improvement Assumptions

Several assumptions were made with regard to the infrastructure improvements used in this analysis. First and foremost, no field inspections were conducted and it was assumed that all proposed improvements were feasible in the field. Important track and environmental constraints such as track curvature and the location of fixed structures such as bridges were considered in locating sidings. Because there were no field inspections, all the milepost locations given for various improvements must be considered approximate.

The second key assumption was that a train control system was in place on all of the corridors. This is a critical assumption because a train control system can significantly improve rail capacity by allowing trains to safely operate with reduced headways. However, it must be noted that several different train control products are being developed by several Class I railroads. The interoperability of these systems has not been developed or even contemplated. However, for purposes of this study it is assumed that the MWRRI system is equipped with a completely interoperable and seamless train control system. The train control system to be deployed is assumed to be RF communications based.[3]

The speed limit through turnouts was assumed to be a minimum specific speed. The reason speed limits were used rather than specifying turnout type or geometry was because the local conditions can play a significant role in determining what will and will not work at a particular location. As noted above, it was assumed that where a 60-mph turnout was specified, it would be feasible to install at this particular location. Turnouts with speed limits in excess of 60-mph would likely further improve operations and enhance capacity, but given their considerable space requirements, they were not considered based on the assumption that they may not be practical to install in all locations.

The remaining assumption was that all stations have two platforms in multiple track territories with no need to route the MWRRS passenger trains onto a specific track into the station.

Note that the speed limits used for MWRRS passenger trains were either 79-mph or 110-mph, as noted in the description of each corridor in their respective chapters below. These speed limits were all based on the business plan, as it existed in late 2001 and early 2002. Subsequent to completion of this analysis, some speed limits were reduced from 110-mph to 90-mph or even 79-mph. This change in planning assumptions has not been reflected in the results presented here, which summarize the findings as of early 2002, when the Ideal Day Analysis was completed.

6.14 Calculating Train Travel Time and Delay with Infrastructure Improvements

The meet-points and delays were re-analyzed after infrastructure upgrades were added on each corridor. In areas where new *passenger* sidings were installed, the new siding was found to eliminate all the delays associated with opposing train meets (including freight train meets), with the exception of three-train meets and overtaking situations. In the case of three-train meets, the delays on the second and third trains were maintained. Likewise, delays were kept in place in overtaking situations for the train being overtaken. Delays were also eliminated for train meets on multiple track unless there were meets with three trains or there were overtake situations, in which case the delays were handled as described above. In some cases, delays were reduced but not eliminated for freight train and passenger train meets on single track with siding and turnout improvements due to faster entry or exit speeds into and out of the sidings. Finally, minor

[3] Under FRA regulations, either a conventional cab-signaling system or a train control system deployment will be required to support passenger train speeds exceeding 79 MPH. While the NAJPTC territory in Illinois supports the implementation of moving block as an overlay to the existing signal system, development efforts are underway, but deployment in revenue service is several years in the future.

schedule adjustments were made to eliminate meets just outside of sidings or end terminals. The resulting reductions in delays were then applied to the total delay time to determine if the improvements were sufficient. Exhibit 6-18 summarizes the results of the analysis presented.

Exhibit 6-18
Ideal Day Delay Summary by Corridor

Corridor Analysis Summary - Year 2010				
Total Delays (in minutes)	***Base Forecast***	***MWRRS***	***MWRRS w/ improvements***	***% Change vs. Base***
Quincy	3,100	5,700	3,200	3.2%
Omaha	160	820	190	18.8%
Carbondale	3,260	4,580	3,340	2.5%
Cincinnati	660	1,360	620	-6.1%
Detroit	980	3,500	1,010	3.1%
Holland	60	240	80	33.3%
Port Huron	980	1,580	960	-2.0%
St. Louis	560	2,440	590	5.4%
Totals	**9,760**	**20,220**	**9,990**	**2.4%**

6.15 Milwaukee-Green Bay Corridor Assessment

In July 1999, WisDOT asked Transportation Economics & Management Systems, Inc. (TEMS) to assess the feasibility of providing 110-mph rather than 79-mph passenger train service on the Milwaukee-to-Green Bay route and to determine whether there will be sufficient capacity to accommodate the addition of passenger rail service as well as the anticipated growth in freight service. The initially proposed alignment connected Milwaukee and Green Bay via Duplainville through Brookfield, Allenton, Fond du Lac, Oshkosh and Appleton, and was referred to as the *Duplainville Route Option.*

The preliminary results of that analysis led to a second study request by WisDOT in January 2000 to evaluate an alternative alignment from Milwaukee to Green Bay via West Bend. Canadian Pacific Railway (CPR) had asked WisDOT to consider an alternative alignment that would redirect passenger trains away from CPR's mainline route. The second possible alignment connects Milwaukee and Green Bay via West Bend to Fond du Lac and is referred to as the *West Bend Route Option*. The route rejoins the WCL mainline at Fond du Lac and continues on the WCL's mainline to Neenah. From Neenah to Green Bay, the route uses the alignment of the FVWR. From Fond du Lac to Green Bay, the *Duplainville* and *West Bend* route options are identical.

TEMS conducted an *Ideal Day* analysis for the *Duplainville Route Option*. Because of the low volume of freight operations on the *West Bend Route Option*, a track capacity analysis of that segment of the route was not required. In the event the *West Bend Route Option* is selected, the improvements proposed between Duplainville and Fond du Lac would not be needed. Those funds would be invested in the parallel *West Bend* corridor instead.

As a first step in the track capacity analysis, TEMS staff conducted an operations inspection of the *Duplainville Route Option*. The operations inspection identified both the high volume of freight trains on the route and the number of industrial sidings at key locations along the route. The inspection revealed that Neenah is a critical crossroads for WCL's freight train movements from northern and western Wisconsin to Chicago and for the movement of CN freight trains from Canada through Superior and to Chicago.

The track capacity analysis conducted for this study identified train delays based on the number of train-meets derived from combining the assumed operating schedules of both passenger and freight trains. The location and amount of additional infrastructure that would be required to eliminate conflicts between passenger and freight trains were then estimated. The three types of train meets that would occur on a rail corridor that has both freight and passenger trains operating over it are *passenger-to-passenger, passenger-to-freight* and *freight-to-freight.*

As part of the track capacity analysis, TEMS considered mitigation results from both infrastructure and operating improvements. In terms of mitigation through operating changes, passenger train departure times were adjusted to minimize the impact on freight operations. For both the 79-mph and 110-mph passenger train options, operating schedules were adjusted so that *passenger-to-passenger* and *passenger-to-freight* train-meets occurred at a limited number of specific locations. This reduced the number of additional sidings required and limited the number of passenger-to-freight meets.

The analysis methodology used the operating schedules for both 79-mph and 110-mph passenger rail service and identified the number of *passenger-to-passenger* meets in each case. From this information, TEMS determined the total number and lengths of sidings needed to eliminate these meets and subsequent delays.

To estimate the *passenger-to-freight* meets, the analysis used the projected WCL freight schedules for 2020, which were then combined with the proposed passenger train schedules. The conflict analysis identified the additional infrastructure required to eliminate *passenger-to-freight* meets.

The analysis also identified that even without passenger train operations, additional infrastructure would be needed just to meet the needs of the route's growing freight traffic.

A basic assumption embedded in the MWRRI and therefore carried forward in this study is that the track and signaling system will be upgraded to FRA Class 4 track for 79-mph passenger rail operations and to FRA Class 6 for 110-mph operations. The 79-mph operations can use various forms of wayside signaling, but 110-mph operations must use an in-cab signaling system. For both cases, it was assumed that *passenger-to-passenger* meets will require 10-mile passing sidings to allow passenger trains to pass at speed. For both cases, it was also assumed that *passenger-to-freight* meets and *freight-to-freight* meets can be resolved by using 5-mile passing sidings and that the freight train taking the siding will stop to allow the other passenger or freight train to pass.

The results of the capacity analysis described above are presented in Exhibits 6-19 and 6-20. The results are shown as additional miles of sidings required to resolve the three types of train meets that can occur on a rail corridor that has both freight and passenger trains operating over it.

Exhibit 6-19
Total Miles of Sidings Required to Mitigate Train Conflicts for Duplainville Route Option

Types of Train Conflicts Mitigated	Passenger Train Operating Scenario	
	79-mph 5 Round-trips Daily	**110-mph 7 Round-trips Daily**
Passenger-to-passenger	20	40
Passenger-to-freight	26	21
Total	**46**	**61**

Exhibit 6-20
Freight-to-Freight Capacity Needs

Type of Passenger Rail Service	Miles of Siding Needed
None	26
79-mph	15
110-mph	10

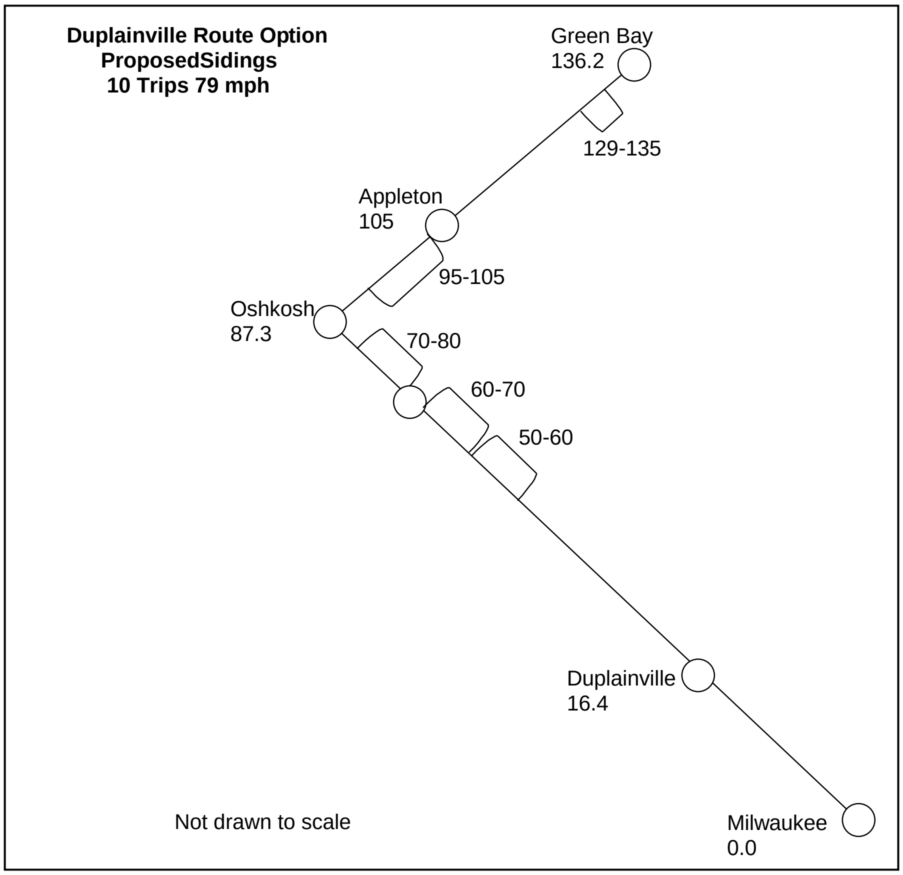
As shown in Exhibit 6-20, in the absence of the implementation of passenger rail service in the Duplainville corridor, WCL would need to build 26 miles of sidings in order to accommodate the projected growth of its own freight train traffic. However, implementing passenger rail service would add infrastructure that would reduce these *freight-to-freight* siding requirements. The 26 miles of siding that the WCL is projected to need would be reduced to 15 miles under the 79-mph passenger rail option and to 10 miles under the 110-mph option because of the mitigation of *passenger-to-passenger* and *passenger-to-freight* train conflicts. The addition of these extra sidings would increase the amount of track capacity available for freight train traffic at the times when passenger rail does not operate, providing the WCL with increased operational flexibility. Thus, the infrastructure improvements required for passenger rail service would provide additional capacity that the WCL could use for its freight train operations and thereby reduce the amount of additional track capacity required by the WCL to meet its projected growth in freight train operations.

As also shown in Exhibit 6-19, the addition of 79-mph passenger train service on the Duplainville Route would require the construction of 46 miles of new sidings to eliminate the train meets caused by the passenger rail service. Exhibit 6-21 shows the location and length of each siding. Exhibit 6-22 provides a schematic representation of the proposed siding locations.

Exhibit 6-21
Location of Proposed Sidings to Mitigate Train Conflicts for Duplainville Route Option for 79-mph Passenger Train Speed Option

Type of Train Meet	Begin @ Milepost	End @ Milepost	Length of Siding (Miles)
Passenger-to-passenger	50	60	10
Passenger-to-passenger	95	105	10
Passenger-to-freight	60	70	10
Passenger-to-freight	70	80	10
Passenger-to-freight	129	135	6
Total Miles of Sidings			**46**

Exhibit 6-22
Schematic Representation of Proposed Sidings to Mitigate Train Meets on the Duplainville Route Caused by 79-mph Passenger Train Service



As shown in Exhibit 6-19, the addition of 110-mph passenger train service on the Duplainville Route would require the construction of 61 miles of new sidings to eliminate the train meets caused by the passenger rail service. The location and length of each siding is presented in Exhibit 6-23.

Exhibit 6-23
Location and Length of Proposed Sidings to Mitigate Train Meets on the Duplainville Route Caused by 110-mph Passenger Train Service

Type of Train Meet	Begin @ Milepost	End @ Milepost	Length of Siding (Miles)
Passenger-to-passenger	25	35	10
Passenger-to-passenger	45	55	10
Passenger-to-passenger	60	70	10
Passenger-to-passenger	90	100	10
Passenger-to-freight	16	21	5
Passenger-to freight	37	42	5
Passenger-to-passenger	75	80	5
Passenger-to-freight	129	135	6
Total Miles of Sidings			**61**

Exhibit 6-24 shows that seven new passing sidings are proposed between Duplainville and Appleton. Because these proposed sidings are so numerous and close to each other, the construction of a dedicated[4] passenger track from Duplainville to Appleton was assumed for purposes of this feasibility study. The dedicated passenger track would begin approximately at WCL's Chicago Subdivision Milepost 102.3 and end at Fox River Subdivision 213, a subdivision distance of 90 miles. The proposed dedicated passenger track allows the WCL to maintain its current freight train communications and control system between Duplainville and Appleton.

Exhibit 6-25 schematically depicts the location of the dedicated passenger track recommended for passenger trains operating at speeds up to 110-mph on the Duplainville Route between Duplainville and Green Bay. A dedicated passenger track was not proposed for the Appleton to Green Bay segment of this route. In this segment, passenger train speeds would be limited to 79-mph. However, a 6-mile passing siding would be required to accommodate passenger-to-freight train meets.

The capacity analysis for the Duplainville Route Option shows that significant additional track capacity is required for both the 79-mph and the 110-mph passenger train speed alternatives. In the case of the 79-mph option, 46 miles of new siding will be required to mitigate forecast train-meets caused by the introduction of passenger rail service. For the 110-mph option, 61 miles of new passing sidings would be required to mitigate forecast train meets caused by the introduction of passenger rail service. Because the proposed passing sidings are so numerous and close

[4]It was assumed that freight trains would be able to make use of this track for passing purposes.

together between Duplainville and Appleton, the construction of a new 90-mile track dedicated to passenger rail is a more effective solution.

For the section of track between Appleton and Green Bay, both the 79-mph and 110-mph passenger train speed options will require a 6-mile siding immediately south of Green Bay to accommodate freight train movements on the industrial spurs in the area.

Finally, with respect to freight operations on the Duplainville route option, WCL will need to build additional sidings to accommodate projected growth in freight train traffic. By accommodating passenger rail service, WCL's need for additional sidings is reduced from 26 miles to 15 miles, if the passenger trains operate at speeds up to 79-mph and to only 10 miles if the passenger trains operate at speeds up to 110-mph.

Exhibit 6-24
Schematic Representation of Proposed Sidings to Mitigate Train Meets on the Duplainville Route Caused by 110-mph Passenger Train Service

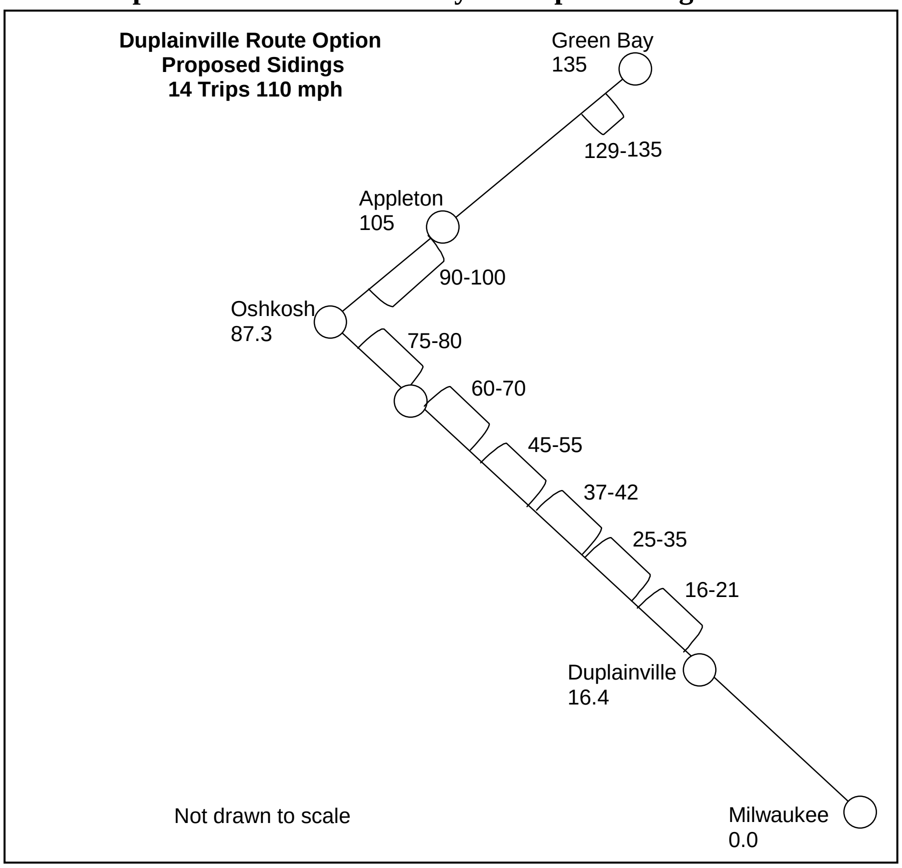
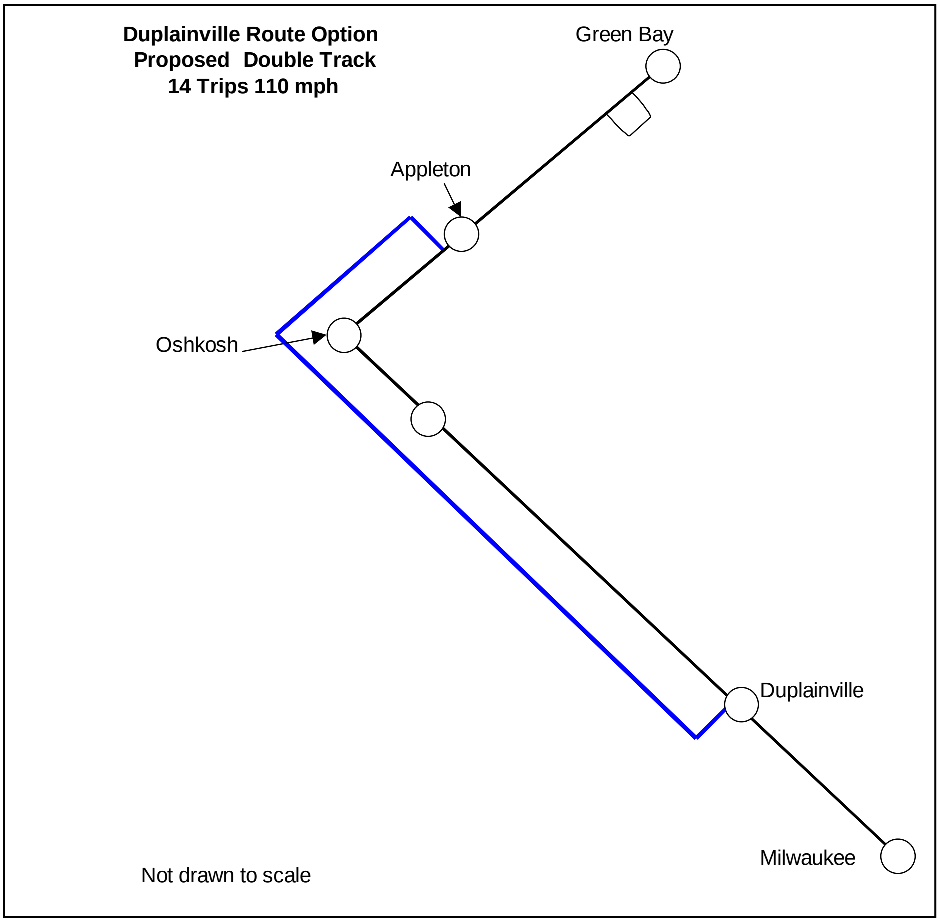


Exhibit 6-25
Schematic Representation of Proposed Double Track for the Duplainville Route to Accommodate 110-mph Passenger Train Service



6.16 Chicago-Quincy Corridor Assessment

From Chicago Union Station, this route traverses three BNSF Subdivisions. From east to west, they are the Chicago, Mendota and Brookfield Subdivisions. The Chicago Subdivision has two to four tracks, with multiple crossovers typically every two to four miles, and two major terminals: Cicero Intermodal yard and Eola classification yard. Mendota Subdivision is double-track with crossovers typically every 11 to 12 miles; the Galesburg classification yard is at its west end. Brookfield is single-track with nine passing sidings that are longer on the east end to allow for holding trains awaiting access to Galesburg yard. Siding spacing is from six to 12 miles, averaging nine miles apart.

The current traffic control system in use on all three of these Subdivisions is Centralized Traffic Control (CTC) and current freight speed limits are 50-mph between Chicago and Aurora and then 60-mph between Aurora and Quincy, except for loaded coal trains, which are limited to 50-mph and empty coal trains that are limited to 55-mph.

Chicago region traffic currently originates in Eola and Cicero and will originate in Joliet Arsenal, possibly joining this route in either Eola (off the EJ&E) or Galesburg (off the Chillicothe Subdivision). Traffic density is highest in the Chicago region, with 150 train movements a day up to Aurora. Aurora is both the terminus of Metra commuter trains and where Twin Cities and Pacific Northwest traffic split off, including most of the intermodal traffic from Cicero. The line from Aurora to Galesburg has 20 trains per day, including Powder River Basin coal traffic, Amtrak's *Illinois Zephyr* and two long distance trains – the *California Zephyr* and *Southwest Chief* – which split off at Galesburg. Between Galesburg and Quincy, 12 trains per day operate, including the *Illinois Zephyr* to Galesburg. This corridor was modeled with 27 freight trains (total includes both eastbound and westbound trains) per day between Eola and Galesburg and 21 freights between Quincy and Galesburg.

The Chicago-Quincy Ideal Day analysis assumed that MWRRS traffic operates at 110-mph, with four roundtrips daily between Chicago Union Station and Quincy and five daily round trips on the Omaha branch that splits off this line at Wyanet, IL. MWRRS trains operate intermixed with freight traffic along the full length of the corridor. In multiple-track territory, only one track will be upgraded to 110-mph. *Subsequent to completion of this study, the planning speed was reduced from 110-mph to 90-mph from Chicago to Quincy.* However since the capacity needs were based on a passenger design-speed of 110-mph, they are conservative from a freight perspective.

Chicago-Quincy is, in general, a high capacity, well-engineered route with a long and ongoing history of handling passenger and other priority traffic. There is also a long history of moving trains on a multiple bi-directional railroad. In addition, this route is operated by a single railroad, which significantly increases the likelihood of smooth operations. As noted, commuter windows are a concern for some trains, but in general, the proposed MWRRS schedule has many trains operating outside the windows and avoiding the resulting delays. Cicero Yard is a very important terminal on this route. Since it has been redeveloped recently, it will continue to play a major role in years to come even as new terminals such as Joliet Arsenal develop. The intermodal train departures typically create local fleeting problems, especially in the early evening with multiple westbound trains having similar cutoff and departure times. While this is a concern in the Chicago region, the majority of this traffic moves off the corridor at Aurora bound for Pacific Northwest and Twin Cities destinations.

Base level (2010) delays were calculated at 3,100 minutes for the corridor. The addition of the MWRRS brought the total delay to 5,700 minutes, an 84 percent increase over the forecast base.

The increase in delays with the addition of the MWRRS passenger traffic was attributable to the following:

- Passenger Traffic: Heavy commuter traffic from Aurora to Chicago Union Station (CUS), including express trains operating on the middle main.
- Freight Traffic: the limited hours of freight operation in the commuter district (commuter windows) and the resulting congestion west of Eola. The commuter windows typically created situations where the freight trains bunch up as these trains attempt to make it through the window. Eastbound passenger trains that operated when the window was closed can overtake significant traffic, especially eastbound freight trains waiting just

west of Eola for the window to open. The MWRRS passenger trains typically encountered these trains east of Galesburg, particularly around Mendota.

- Galesburg Yard: The yard leads at the north end of Galesburg yard are short, forcing yard jobs to pull out onto the main when switching the leads.
- Brookfield Subdivision: The sidings west of Galesburg on the Brookfield Subdivision are restrictive. The sidings near Galesburg were lengthened to hold trains awaiting room in Galesburg yard while the sidings to the west are generally short, some far too short, for long coal trains.

Potential Mitigation Options (all mileposts are from CUS and are the same as local railroad mileposts):

- Passenger Traffic: the Chicago area was included in this study
- Freight Traffic: Fleeting trains will have a particular impact on the Mendota Subdivision between Aurora and Galesburg. To accommodate this, add a 10-mile passenger siding plus two pairs of 45-mph crossovers between the original two mains between milepost (mp) 82 and 92 for multiple meets and overtakes between passengers and freights. For additional flexibility on this section of double track, add 45-mph double crossovers at mp 66 and mp 105 and a second set of 30-mph crossovers at mp 80 and mp 129. In addition, add a two-mile long freight siding around mp 62-63 mainly for holding eastbound traffic waiting to get into Eola.
- Galesburg Yard: To keep Galesburg yard jobs off the main, extend the yard lead east past the station for approximately ½ to 1 mile.
- Brookfield Subdivision: Extend the Abingdon siding (mp 173) west by about 2.4 miles and add a pair of 30-mph crossovers in the middle (near current west turnout). This would allow for westbound freights to depart and hold clear of Galesburg while simultaneously allowing eastbound trains to wait for clearance into Galesburg with room for a passenger train to pass both. Extend the Colchester siding (mp 210) to 10 miles long, east to mp 207 and west to mp 217, for passenger-to-passenger meets. Include a pair of 45-mph crossovers in the middle at the current west turnout for additional flexibility.

The total level of infrastructure improvement is as follows (not including Chicago Union Station to Eola):

- Capacity improvements addressing passenger needs: 18 miles of new trackage, plus four premium turnouts (60-mph) for new *passenger* sidings and sixteen 45-mph turnouts for higher-speed crossovers
- Capacity improvements addressing freight needs: three miles of new trackage, plus 12 turnouts (30-mph) for use in *freight* sidings and lower-speed crossovers

The results of this analysis show that these improvements should be sufficient to accommodate the MWRRS trains operating over some or all of this route (including the Omaha branch trains). Overall, delays with improvements were 3.2 percent above the total delays experienced in the forecast base case scenario.

Freight train delays were virtually unchanged from the pre-MWRRS conditions, with a one percent increase over existing delays, well within the margin of error in this analysis.

All passenger trains, including the 18 MWRRS trains, using this corridor ended with, on average, about three additional minutes in delay with all of the improvements in place, well within the planned recovery time. Average delays for freight trains increased by less than a minute.

Exhibit 6-26 shows that all passenger trains, including the 18 MWRRS trains, using this corridor ended with, on average, about three additional minutes in delay with all of the improvements in place, well within the planned recovery time. Average delays for freight trains increased by less than a minute.

Exhibit 6-26
Additional Average Delays per Train, Chicago-Quincy Corridor
(With Infrastructure Improvements)

	# Trains Modeled	*Additional Delays*
Passenger	22	3.2 Minutes
Freight	48	0.6 Minutes
Total	70	1.4 Minutes

6.17 Wyanet-Omaha Corridor Assessment

The Omaha branch diverges from the Chicago-Quincy line at Wyanet, IL. From there to Omaha, NE, trains operate over the Iowa Interstate Railroad. On-line yards exist in Des Moines, Iowa City and the Quad Cities area, mainly for local traffic. The entire route is single-track, with 25 passing sidings. The sidings tend to be relatively short, typically 4,000 to 6,000 feet in length. Siding spacing is in the order of eight to 18 miles on the eastern two-thirds of the route and higher (up to 28 miles apart) on the west end. The current traffic control system on the entire route is Track Warrant Control (TWC). Current freight speed limits are 40-mph.

Current freight traffic is light with a mix of local, mainly agricultural carload freight and through traffic, including intermodal. Omaha freight traffic generally terminates offline in the Union Pacific yard in Council Bluffs. No passenger service currently exists on this route. This corridor was modeled with three through freights each way per day along the full length of the route.

MWRRS traffic operates at 79-mph on this corridor co-mingled with freight traffic along the full length of the corridor. There are four roundtrips daily between Chicago Union Station and Omaha and one daily round trip between Chicago and Des Moines.

Two other factors to consider on this route are that this corridor is a relatively low volume freight route, and operation over the entire route is on one railroad, simplifying traffic control and dispatching.

Base level delays for the corridor were calculated at 160 minutes in the year 2010. The addition of the MWRRS brought the total delay to 820 minutes, a 412 percent increase over the forecast base.

The increase in delays with the addition of the MWRRS passenger traffic was attributable to the following:

- Passenger Sidings: The line is long (365 miles) without infrastructure necessary for train meets. There is currently no way for passenger trains to meet without incurring significant delays.
- Freight Sidings: Many of the sidings are short with only hand-thrown turnouts.
- Omaha Terminal: Potential congestion problems exist in the Omaha terminal area, particularly if freight traffic volumes increase subsequent to MWRRS track upgrades.

Potential Mitigation Options (Iowa Interstate Railroad mileposts/corridor mileposts from CUS):

- Passenger Sidings: Passenger-to-passenger sidings need to be built by extending existing freight sidings to 6 miles in length (5 for Durant) at Atkinson (mp 151/135), Durant (mp 203/188), Marengo (mp 267/251), Ascalon (mp 297/281) and Earlham (mp 387/372). In all cases, add 60-mph turnouts and switch machines. In addition, extend the siding at Rock Island (mp 181/165) through the station area and add 45-mph powered turnouts.
- Freight Sidings: Add switch machines and upgrade turnouts and sidings for freights at Atlantic (mp 440/424). Extend Colfax (mp 334/319) and Casey (mp 410/394) sidings to 2 miles in length for freight meets.
- Omaha Terminal: The Omaha terminal issues are not addressed in this study but need to be further addressed. A preliminary analysis shows that the addition of a 1-mile long freight siding around mp 484/464 will provide the ability to stage traffic into and out of Council Bluffs.

The total level of infrastructure improvement is as follows:

- Capacity improvements addressing passenger needs: 28 miles of new trackage, ten 60-mph premium turnouts and two 45-mph turnouts for new sidings.
- Capacity improvements addressing freight needs: 3 miles of new trackage, plus eight turnouts (30-mph) for use in *freight* sidings and lower-speed crossovers. The results of the analysis show that the improvements will cut delays from an unimproved MWRRS by almost 96 percent, but they were not reduced completely to within the margin of error of the forecast base level. This is due to the long length of the corridor and the insufficient number of sidings.

The freight trains that are projected to be in operation on this corridor actually see a reduction in total delays of around 30 percent on the corridor with infrastructure improvements (see Exhibit 6-27).

Exhibit 6-27
Omaha Branch Additional Average Delays per Train
(With Infrastructure Improvements)

	# Trains Modeled	*Additional Delays*
Passenger	10	8.0 Minutes
Freight	6	-8.3 Minutes
Total	16	1.9 Minutes

The 10 MWRRS passenger trains on this corridor ended with, on average, eight additional minutes in delay with all of the improvements in place. This total was in addition to the three minutes of average delay gained on the Wyanet to Chicago segment of the line. On average, the six modeled freight trains lost over eight minutes in delays.

6.18 Chicago-Carbondale Corridor Assessment

This study assessed the planned future MWRRI route, not the current Amtrak route that uses the St. Charles Air Line. From Chicago Union Station, this route first operates over Amtrak trackage to 21st Street, interlocking then on the Norfolk Southern Chicago Line to *Grand Crossing*, where the line crosses over Canadian National track on the south side of Chicago. There are two major intermodal terminals on the NS – 55th Street and Park Manor.

The connection to the CN line at Grand Crossing would be new. From this new connection, the route follows the CN all the way to Carbondale, operating over three districts. From the north, the route is on the Chicago, Champaign and Centralia districts. The Chicago District is four tracks on the first 14 miles on the north end, narrowing to three tracks for 3.5 miles, double-track for the next five miles and then single-track with seven passing sidings (including six miles of double track in Gilman, IL). The sidings are typically about two miles in length and spaced eight to 10 miles apart.

There are major freight and intermodal yards in the Homewood/Harvey area. The Champaign District is mainly single-track with nine passing sidings that are typically two to three miles long and spaced every nine to 12 miles (spacing increases to 14 and 19 miles for the last two sidings north of Centralia). There are six miles of double-track through Centralia. The only terminal of any significance on this district is a freight yard in Champaign. The Centralia District is single track south of Centralia, with three passing sidings going into Carbondale. The sidings range in length from 4,000 feet to 4-½ miles and are spaced from six to 15 miles apart. The last five miles into Carbondale are double-tracked. The current traffic control system throughout this route is CTC, with the exception of some diamonds that are locally controlled. Current freight train speed limit is 60-mph.

Much of the current freight traffic on this route originates in the Chicago area, though recently there has been a significant change to more through traffic from Canada with the acquisition of Wisconsin Central by Canadian National. A fair amount of traffic enters the line at crossings in central Illinois. Traffic also leaves the route at various local yards or at junctions. Consequently, traffic density varies along the route. Each day there are 35 freight trains from the Chicago area to Kankakee, 30 trains between Kankakee and Gillman, 24 freights between Gillman and Champaign, 18 freights between Champaign and Effingham, and 26 freights between Effingham and Carbondale. Freight train traffic includes intermodal trains originating in Harvey. In addition, Amtrak currently operates two trains per day on this route, the *Illini* to Carbondale and the long distance *City of New Orleans* running the length of this corridor on its way to New Orleans.

Freight traffic was modeled as follows: 39 freights between Chicago and Kankakee, 33 between Kankakee and Gilman, 28 between Gillman and Champaign, 20 between Champaign and Effingham and 30 from Effingham to Carbondale.

In this analysis, MWRRS traffic was assumed to operate at 110-mph, with two roundtrips daily between Chicago Union Station and Carbondale, plus three round trips per day between Chicago and Champaign. MWRRS trains operate intermixed with freight traffic. In multiple track territory, only one track will be upgraded to 110-mph. *Subsequent to completion of this study, the planning speed was reduced from 110-mph to 90-mph from Chicago to Carbondale.* However since the capacity needs were based on a passenger design-speed of 110-mph, they are conservative from a freight perspective.

The Chicago-Carbondale route is, in general, a highly efficient corridor with current passenger service on the route. Outside of Chicago, this route is also on a single railroad that already has scheduled freight operations (unlike most other freight operations), which significantly increases the likelihood of smooth operations. As noted below, commuter congestion in the Chicago area is a concern, but in general, the Metra and South Shore commuter trains operate on dedicated trackage from University Park to Chicago (the South Shore trains operate only as far as Kensington).

At-grade railroad crossings are a definite concern. This route has multiple at-grade mainline railroad crossings (at Kensington, Kankakee, Tolono, Tuscola, Effingham, Odin, Ashley and Tamaroa). Cross traffic can be heavy in places, placing restrictions and even operating windows for traffic on the CN. Kensington Junction in particular sees a significant number of train movements with crossing South Shore commuter traffic. The management of crossing slots where used will be key for consistent operation. Contingency slots will need to be built into critical junctions as necessary.

Base level delays were calculated at 3,260 minutes for the corridor. The addition of the MWRRS brought the total delay to 4,580 minutes, a 40 percent increase over the forecast base.

The increase in delays with the addition of the MWRRS passenger traffic was attributable to the following:

- Sidings: The route was single-tracked south of the commuter district when Illinois Central (IC) operated it. Siding lengths were designed primarily with freight traffic in mind, and as a result, siding lengths are typically inadequate for unobstructed MWRRS passenger service.
- CN Operations: After Canadian National merged with IC, this line became a key route in the new, integrated system. Recent projects have seen intermodal terminal upgrades at Harvey and improved connections with CN lines into Michigan and Canada. These improvements have resulted in a growth in freight traffic with more likely to follow.

Potential Mitigation Options (all mileposts are from CUS and are the same as local railroad mileposts):

- Sidings: The majority of passenger meets occur in multiple track territory. Consequently, only a few freight sidings need to be upgraded. For passenger-to-passenger meets, extend the Kankakee siding (mp 54) south into the station area connecting to Otto siding (two miles total). In addition, install a pair of crossovers north of the NS Streator line crossing. This will enable meets and overtakes during station stops. Extend Ashkum siding (mp 72) eight miles south to the Gillman double-track. Add a pair of crossovers around mp 75, primarily for passenger-to-passenger passing. In addition, extend the Paxton siding (mp 100) by three miles and add premium turnouts.
- CN Operations: The additional sidings noted above should allow for the expected freight traffic growth. The intermodal trains departing Chicago are fleeted to a degree, but not to the extent of other corridors, as travel times to certain cities (like New Orleans) generally allow for later cutoff times.

The total level of infrastructure improvement is as follows:

- Capacity improvements addressing passenger needs: 13 miles of new trackage, plus six premium turnouts (60-mph) for new sidings and four 45-mph turnouts for higher-speed crossovers.
- Capacity improvements addressing freight needs: four 30-mph turnouts for lower-speed crossovers.

In addition to the above changes to the infrastructure, MWRRS train number 400 from Carbondale-Chicago was moved back by 10 minutes for improved meets. The departure time from Carbondale changed to 6:38 a.m. with arrival at 10:50 a.m. at CUS.

The results of this analysis show that these improvements should be sufficient to accommodate the MWRRS trains operating over this route. Overall, delays with improvements were 2.5 percent above total delays experienced in the forecast base case scenario. Freight train delays were virtually unchanged from the pre-MWRRS conditions, coming in at less than 1 percent of existing delays, lower than the margin of error in this analysis.

As indicated by Exhibit 6-28, all passenger trains using this corridor, including the 10 MWRRS trains, ended with, on average, five additional minutes in delay with all of the improvements in place, which was within the planned recovery time. Freight train delays were essentially unchanged from the base forecast level.

Exhibit 6-28
Additional Average Delays per Train, Chicago-Carbondale Corridor
(With Infrastructure Improvements)

	# Trains Modeled	***Additional Delays***
Passenger	12	5.0 Minutes
Freight	150	0.1 Minutes
Total	162	0.5 Minutes

6.19 Chicago-Cincinnati Corridor Assessment

This route is one of the most complicated of the eight routes examined in this report. Initially, it was proposed that MWRRS trains would operate on Amtrak trackage to 21st Street, followed by the NS Chicago Line, the *South-of-the-Lake* improvement, CSX Garrett Subdivision, the Alida connection, CSX Medaryville Spur, CSX Monon Subdivision, CSX Lafayette Subdivision, CSX Crawfordsville Branch, CSX St. Louis Line, CSX Shelbyville Secondary and the Central Railroad of Indiana (CIND) for the final run from Shelbyville, IN, to Cincinnati, OH.

Subsequent to completion of this analysis, the routing from Chicago was changed. Instead of using the busy CSX Garrett Subdivision from Gary, IN to Alida, IN a distance of about 25 miles, the former PRR Fort Wayne line to Wanatah was proposed. In this option trains would turn south at Wanatah, which is just 6 miles south of Alida, onto their originally planned route towards Medaryville and Indianapolis. The advantage of using the Fort Wayne line is that it not only avoids the busy CSX Garrett Subdivision, but is also the route for the Chicago-Fort Wayne-Toledo-Cleveland MWRRI trains, so some capital and maintenance costs can be shared.

While this analysis of the northernmost part of the route from Chicago to Alida no longer reflects current planning assumptions, the vast majority of the analysis is still relevant to the MWRRS capital plan south of Wanatah. Funding limitations have not permitted the previous study to be updated. This section summarizes capacity planning work as it was originally completed in 2002, however to reduce possible confusion, references to the CSX Garrett Subdivision (that will no longer be used) and Alida improvements have been removed to footnotes.

The Chicago Line and the St. Louis Line are all double-track with multiple crossovers and CTC traffic control. The South of the Lake improvement is assumed double-track throughout. The remaining lines are single-track in general, with relatively few passing sidings.

There are no passing sidings on the Medaryville Spur. The CSX Monon, Lafayette and Crawfordsville lines combined have five passing sidings plus a stretch of double-track through Lafayette yard, which is used primarily as a yard lead. There are intermodal yards at 55th Street and Park Manor on the NS Chicago Line, and there is a freight yard on the CSX in Lafayette. The Medaryville spur is unsignaled and operates as a single block for its entire length.

Direct Traffic Control (DTC) is used on the Monon and Lafayette subs, while Form D Control System (DCS) traffic control is used on the Crawfordsville branch and Shelbyville secondary. Current freight train speed limits are 70-mph for the Garrett Subdivision; 60-mph for the Monon and Lafayette Subdivisions, the Crawfordsville branch and the St. Louis Line; 40-mph on the Shelbyville Secondary; and 25-mph on the Central Railroad of Indiana extending from Shelbyville to Cincinnati.

Traffic on this line is almost as varied as the route. The line from Wanatah south to Monon sees at most one local train a day between Monon and Medaryville. Between Monon and Crawfordsville, CSX operates up to 10 trains per day. There are also three to four freight trains a day operating between Lafayette and Indianapolis. South of Indianapolis, traffic thins to four freight trains per day to Shelbyville and approximately two per day between Shelbyville and Cincinnati on the CIND. Amtrak's *Cardinal*, operates between Monon and Indianapolis.

Train operations on this corridor were modeled as follows: 12 freight trains per day between Monon and Crawfordsville, five freight trains per day between Lafayette and Indianapolis, seven trains per day between Indianapolis and Shelbyville and five trains between Shelbyville and Cincinnati[5]. Traffic on the St. Louis Line was not modeled due to the very short length in which MWRRS trains will operate on this route.

MWRRS traffic operates at 110-mph, with five round trips daily between Chicago Union Station and Indianapolis, plus one round trip per day between Chicago and Indianapolis and one round trip per day between Indianapolis and Cincinnati. Both tracks on the *South-of-the-Lake* improvement were assumed to be 110-mph. MWRRS trains are co-mingled with freight traffic along most of this route except on the South of the Lake line and from Wanatah to Medaryville.

This is a complicated route operating over multiple railroads and divisions, making centralized passenger train control a key to success on this corridor. Ensuring that every railroad and division know when to expect MWRRS trains will be critical to minimizing the delays when transitioning from one line to another. The main strength of this corridor is that the majority of the route is on low freight volume or dedicated passenger trackage, which should help to minimize delays.

The base level delays were calculated at 660 minutes for the corridor. The addition of the MWRRS brought the total delay to 1,360 minutes, a 106 percent increase over the forecast base.

The increase in delays with the addition of the MWRRS passenger traffic was attributable to the following[6]:

- Northern Sidings: Going south from Alida, there are only 2 short sidings until Lafayette, and those are between Monon and Lafayette. The lack of passing points on the north end of this route can seriously hamper consistent operations.
- Lafayette: Once in the Lafayette area, there can be significant freight train congestion around the yard and station. CSX often fleets freight trains, especially northbound trains, which results in trains blocking the main while waiting for access to the yard.
- Central Sidings: There are no sidings between Crawfordsville (Ames) and Indianapolis (33 miles).
- Indianapolis: The CSX St. Louis Line is another high volume route with potential congestion in Indianapolis.
- Southern Sidings: There are no sidings from Indianapolis to Shelbyville and only a few short sidings known to exist on the line south to Cincinnati.

[5] 57 trains per day were modeled on the Garrett Subdivision
[6] CSX Traffic: The CSX Garrett Subdivision was double-tracked subsequent to the Conrail acquisition to handle expected major traffic increases. Traffic has increased significantly on the line, resulting in a greater potential for delays, especially because the passenger routes on both sides are single-track lines without passing sidings.

Potential Mitigation Options[7] (local railroad mileposts/corridor mileposts from CUS):

- Northern Sidings: Extend the Brookston siding (mp 105/114) north through Chalmers and into Reynolds (mp 97/104), creating 10-mile long siding primarily for passenger-to-passenger meets. Include 60-mph turnouts on each end plus two sets of single 45-mph crossovers at Brookston and Reynolds for local freights and multiple meets. Add a two-mile long freight siding roughly halfway between Monon and Alida, as both extra insurance for passenger meets and for local freight traffic meets.
- Lafayette: Extend the double track north of Lafayette yard (mp 117/125) by approximately 2 miles to just south of the Wabash River Bridge to provide for additional freight staging room clear of the mainline. Upgrade the siding south of Lafayette at mp 122/130, adding 45-mph turnouts and switch machines to provide both staging room south of Lafayette yard and the ability to pass passenger trains if necessary. Extend the Linden siding (mp 137/146) to five miles long, with a pair of crossovers in the middle to allow for both passenger-to-passenger meets, freight train meets and overtakes.
- Central Sidings: Add a four-mile long siding at Jamestown at mp 31/173.
- Indianapolis: No change is needed on this line as well due to the minimal distance running on the St. Louis line (including station stop at Indianapolis). The line already has multiple crossovers for flexibility.
- Southern Sidings: Extend the Shelbyville siding (mp 82/232) to about 9.5 miles in length (three miles north and two miles south) to allow for passenger-to-passenger meets. Include a pair of freight crossovers in the middle to turn CSX and Central of Indiana freight trains. In addition, improve the existing siding at mp 64/250 with new powered turnouts (45-mph). Add a two-mile freight siding around mp 30/285 to provide the ability to stage traffic into and out of Cincinnati.

The total level of infrastructure improvement is as follows:

- Capacity improvements addressing passenger needs: 21 miles of new trackage, plus eight premium turnouts (60-mph) for new sidings and 16 higher speed turnouts (45-mph) for crossovers and one passing siding
- Capacity improvements addressing freight needs: seven miles of new trackage, plus seven turnouts (30-mph) for use in *freight* sidings and lower-speed crossovers

The results of the analysis show that these improvements should be sufficient to accommodate the 14 daily MWRRS trains operating over this route with additional room for even more growth. Overall, delays with improvements were 6.1 percent less than the total delays experienced in the forecast base case scenario. Freight train delays were nine percent less than the pre-MWRRS conditions.

Exhibit 6-29 shows that all of the passenger trains on this corridor, including the 14 MWRRS passenger trains using this corridor, ended with, on average, less than two additional minutes of delay with all the improvements in place, well within the planned recovery time. Freight train delays were, on average, slightly less than the base forecast.

[7] CSX Traffic: To increase flexibility on the Garrett Subdivision, 45-mph crossovers were also added at Alida mp 221/52.3 to allow for passenger trains to operate on either track.

Exhibit 6-29
Additional Average Delays per Train, Chicago-Cincinnati Corridor
(With Infrastructure Improvements)

	# Trains Modeled	*Additional Delays*
Passenger	12	1.7 Minutes
Freight	86	-0.7 Minutes
Total	98	-0.4 Minutes

6.20 Chicago-Pontiac via Detroit

While not quite as complicated as the Chicago-Cincinnati route, the Chicago-Detroit corridor comes close. Leaving Chicago Union Station, the route follows Amtrak to 21st Street, the NS Chicago Line to Porter, Amtrak's Michigan Line to Kalamazoo, the NS Michigan Line to just outside Detroit (with a short stretch in Battle Creek on the CN South Bend Subdivision), followed by a trip on the Conrail Shared Assets Michigan Line and then their North Yard Branch, with the final leg into Pontiac on the CN Holly Subdivision.

The NS Chicago Line, the CN line in Battle Creek and the Conrail and NS lines in the Detroit region are all double-track with crossovers. Crossovers are situated every two to three miles near Chicago to every four to seven miles near Porter on the Chicago Line. Furthermore, the Detroit region has multiple crossovers. The remaining route is single-track with passing sidings.

The Amtrak line has eight sidings roughly 10 to 12 miles apart. While the line between Battle Creek and Kalamazoo is double-track on both ends, there are no sidings on the 16 miles of single track in between. East of Battle Creek has five sidings between three to 17 miles apart. There are intermodal yards on the NS Chicago Line at 55th Street and Park Manor and Livernois freight yard in Detroit. Traffic control is CTC throughout with Incremental Positive Train Control currently in revenue service as part of an FRA demonstration project on the Amtrak Michigan line.

Outside of the Chicago and Detroit regions, the traffic on this route is largely passenger. Even before ConRail was formed in the late 1970's, the Penn Central hds shifted most of its freight south between Detroit and Chicago via Toledo. Since ConRail didn't want to include this line segment in their network, Amtrak acquired ownership of the Porter to Kalamazoo line. Amtrak currently operates four round trips per day on this route, including the *Blue Water*[8] between Chicago and Battle Creek. Amtrak service changes however, have no effect on the line capacity simulation that was performed since future MWRRS schedules and not current Amtrak schedules are what was simulated.

Freight train operations on this corridor were modeled as follows: five total trains per day between Porter and Kalamazoo, 15 per day between Kalamazoo and West Detroit, 32 per day between West Detroit and Milwaukee Junction and 16 per day between Milwaukee Junction and Pontiac. This is intended to reflect a peak day freight operation. The only Amtrak train modeled

[8] The *Blue Water* replaced a longer-distance international train to Toronto, the *International*.

was the *International*. CN traffic in Battle Creek was not modeled due to the short length of the route shared with the MWRRS.

MWRRS traffic operates at 110-mph, with four roundtrips daily between Chicago Union Station and Pontiac, plus 5 round trips per day between Chicago and Detroit and 1 daily round trip between Chicago and Battle Creek. Mainline trains were assumed either to operate between Kalamazoo and Chicago with the branch line trains coupled. This operating scenario is currently under evaluation. MWRRS trains operate intermixed with freight traffic. In multiple track territory, only one track will be upgraded to 110-mph.

Another factor to consider here is that the entire route is the same as the current Amtrak route to Detroit and Pontiac. This has led to well-established procedures for operating passenger trains despite the multiple railroads involved. The Amtrak ownership of the Porter-Kalamazoo line and height restrictions help to keep freight traffic relatively low, with the exception of the areas around Chicago, Battle Creek and Detroit. The Detroit area has several improvements already in the planning stages, including the New Center Station and the addition of a new connecting track between Conrail and the CN at West Detroit.

Base level delays were calculated at 980 minutes for the corridor. The addition of the MWRRS brought the total delay to 3,500 minutes, a 350 percent increase over the forecast base.

The increase in delays with the addition of the MWRRS passenger traffic was attributable to the following:

- Chicago: Congestion on the Chicago line and in the Chicago terminal area. Intermodal trains are particularly important on this route and tend to operate in fleets both eastbound and westbound to meet tight cutoff and departure times.
- Passenger Meets: Relatively short sidings between Kalamazoo and Porter for passenger-to-passenger train meets create the potential for delays in waiting for opposing traffic.
- Kalamazoo: There are no sidings between Battle Creek and Kalamazoo. With Port Huron branch line trains operating between Battle Creek and Kalamazoo, the result is 28 passenger trains per day (plus the Amtrak International) on this line. In addition, splitting the trains results in a 20-minute gap on eastbound trains, creating a significant potential bottleneck, particularly for any freight traffic operating during the day. The limited windows available for freight operations, except for the hours between 1 and 5 a.m., result in little time for on-line local switching. The lack of slots will lead to fleeting of the few freight trains operating on the line, which may compound delays.
- Battle Creek: Potential freight and passenger train congestion through Battle Creek.
- Sidings: East of Battle Creek towards Detroit, there are relatively long distances between sidings.
- Detroit: Though perhaps not as severe as Chicago, the Detroit area also faces congestion delays, especially at major interlockings.

Potential Mitigation Options (local railroad mileposts/corridor mileposts from CUS):

- Chicago: Chicago west of Porter is not included in detail in this study due to the complexity of the operations. Additional trackage is likely needed in this area, and fleeting concerns will likely have to be addressed through the development and management of detailed freight and passenger train operating schedules.

- Passenger Meets: Extend Three Oaks siding (mp 214/68) to connect with Dayton siding (10 miles) to create 13.5 miles of double track for unobstructed passenger-to-passenger train meets. Include a pair of 45-mph crossovers in the middle of the siding and extend the Dowagiac siding (mp180/102) east five miles to the siding at mp 173/109.
- Kalamazoo and Battle Creek: Extend the double track west from Battle Creek by about 1 mile and upgrade turnouts to 60-mph on both the Battle Creek and the Kalamazoo end. This provides about 22,000 feet (vs. 16,600 ft.) of unrestricted double track at Battle Creek to enable eastbound freights to accelerate up to 60-mph and keep this speed through the turnout and onto the single-track section. Even with these changes, freight trains will have to be carefully slotted on this line to avoid major delays.
- Sidings: Extend the Chelsea siding (mp 56/226) two miles west to mp 58/224 and add a pair of crossovers in the middle of the siding. Add a single set of crossovers in the Jackson siding (mp 78/203). Both of these upgrades would allow for three-way meets. Add a freight siding at mp 34/247 (about 10,000 feet long), mainly for staging local traffic.
- Detroit: The Detroit terminal was not analyzed in detail for this study due to its complexity.

The total level of infrastructure improvement is as follows:

- Capacity improvements addressing passenger needs: 18 miles of new trackage, plus eight premium turnouts (60-mph) for new sidings and four 45-mph turnouts for higher-speed crossovers.
- Capacity improvements addressing freight needs: two miles of new trackage and eight turnouts (30-mph) for use in *freight* sidings and lower-speed crossovers.

The results of this analysis show that these improvements should be sufficient to accommodate the MWRRS trains operating over this route. Overall, delays with improvements were 3.1 percent above the total delays in the forecast base case scenario. As noted above, freight trains will still need to be carefully slotted between Battle Creek and Kalamazoo, as will passenger trains coming into and out of Chicago.

Freight train delays were about 2 percent more than the pre-MWRRS conditions without any significant schedule adjustments. This value is well within the margin of error for this analysis.

The 28 MWRRS passenger train movements on this corridor ended with, on average, less than one additional minute in delay with all of the improvements in place (Exhibit 6-30), well within the planned recovery time. Freight traffic likewise saw an increase in average delay of less than one minute per train.

Exhibit 6-30
Additional Average Delays per Train, Chicago-Pontiac Corridor
(With Infrastructure Improvements)

	# Trains Modeled	***Additional Delays***
Passenger	28	0.4 Minutes
Freight	68	0.3 Minutes
Total	96	0.3 Minutes

6.21 Holland-Kalamazoo

From Holland going east, this route follows the CSX Grand Rapids Subdivision, followed by the CSX Grand Rapids Terminal Subdivision and then the NS BO Secondary from Grand Rapids to Kalamazoo. With the exception of double track in Grand Rapids and Holland, this entire route is single track with passing sidings. There is one passing siding between Holland and Grand Rapids and 4 short passing sidings south to Kalamazoo. There is a local freight yard on line in Grand Rapids. The traffic control systems currently in use are: CTC on the CSX Grand Rapids Subdivision, Automatic Block Signals (with tracks signaled for one direction) on the CSX Grand Rapids Terminal Subdivision, and DCS on the NS BO Secondary. Current freight train speeds are 25-mph on the Grand Rapids Terminal Subdivision and 40-mph on the NS BO Secondary.

This line has light freight traffic throughout, particularly on the NS BO Secondary. Amtrak currently operates an established service between Holland and Grand Rapids. Freight traffic was estimated for this analysis at four trains per day each way between Holland and Kalamazoo, plus 6 total trains per day between Holland and Grand Rapids.

MWRRS traffic operates at 79-mph, with four roundtrips daily between Holland and Kalamazoo. MWRRS trains operate intermixed with freight traffic.

Base level delays were calculated at 60 minutes for the corridor. The addition of the MWRRS brought the total delay to 240 minutes, 300 percent over the forecast base.

Due to the very light level of traffic, there are essentially no concerns on this route, with the exception of the lack of sidings between Grand Rapids and Kalamazoo. This poses a problem with two passenger-to-passenger train meets on this line segment with the current schedule. These two meets are responsible for the increase in delays with the addition of the MWRRS passenger traffic:

- Sidings: there are few sidings for meets between two passenger trains and between a passenger train and a local freight switching industries between Kalamazoo and Grand Rapids.

Potential Mitigation Options (local railroad mileposts/corridor mileposts from Holland):

- Sidings: add a 1-mile siding between mileposts 90/38 and 91/37 for local freights for both passenger-to-passenger and freight meets. A siding of this length will impose a delay on one of the passenger trains in a two-train meet, but a short siding is justified in this case given the low volume on this route. In addition, upgrade the existing passing siding at Plainwell (mp 66/62) with powered 45-mph turnouts for passenger train meets.

The total level of infrastructure improvement is as follows:

- Capacity improvements addressing passenger needs: one mile of new trackage and four turnouts (45-mph) for passing sidings.
- Capacity improvements addressing freight needs: none.

The results of this analysis show that these improvements should be sufficient to accommodate the MWRRS trains operating over this route

While overall delays with improvements were 33 percent above the total delays experienced in the forecast base case scenario, and freight train delays were about 17 percent over the pre-MWRRS conditions, delays per train were actually only slightly higher than the base forecast case.

The eight MWRRS passenger train movements on this corridor ended with, on average, just over one additional minute in delay with the one improvement in place, well within the planned recovery time. Freight traffic delays saw an increase of, on average, less than one minute per train, as shown in Exhibit 6-31.

Exhibit 6-31
Additional Average Delays per Train, Holland Branch
(With Infrastructure Improvements)

	# Trains Modeled	*Additional Delays*
Passenger	8	1.3 Minutes
Freight	20	0.5 Minutes
Total	28	0.7 Minutes

6.22 Battle Creek-Port Huron Corridor Assessment

Splitting off the Detroit-Pontiac line in Battle Creek, this route is on Canadian National's Flint Subdivision to Port Huron. The route has been reconfigured very recently with the single tracking of sections of what was once a double-track line. Double track sections remain in place in Port Huron (five miles), Flint (13 miles), Durand (six miles), Lansing (19 miles) and Battle Creek (20 miles). The remaining route is now single track, with four passing sidings. The single-track sections, between double-track segments and between sidings, are typically 10-12 miles in length; sidings are 2- to 2-½ miles long. In addition, service tracks at the Flint and Lansing yards are often used as sidings. There are numerous local freight yards along the route plus a major classification yard in Battle Creek. CTC is the traffic control system on the entire route. The maximum freight train speed limit is 60-mph.

This route is CN's primary route between Chicago and Canada, with heavy overhead traffic, both carload and intermodal. In addition, considerable traffic originates or terminates on line. Current traffic levels are as follows: 22 trains per day between Battle Creek and Durand, 19 between

Durand and Flint and 16 per day between Flint and Port Huron, which are typically through trains between Canada and Chicago. In addition, Amtrak's *International* operates on this route between Battle Creek and Port Huron.

Freight train operations on this corridor were modeled as follows: 26 total freight trains per day between Battle Creek and Durand, 22 per day between Durand and Flint and 20 per day between Flint and Port Huron. The only Amtrak train modeled was the *International*.

MWRRS traffic operates at 79-mph, with four roundtrips daily between Chicago Union Station and Port Huron. MWRRS trains operate intermixed with freight traffic.

As with the Chicago-Quincy route, this corridor runs along the same railroad, but in this case, operations are all on the same division, greatly simplifying train operations. Amtrak currently operates on this route with their train the *International*, helping to establish procedures for handling passenger trains. The recent track reconfiguration program has been relatively sophisticated with long sidings, extensive use of 45-mph turnouts on sidings and crossovers and several crossovers on double track sections.

Base level delays were calculated at 980 minutes for the corridor. The addition of the MWRRS brought the total delay to 1,580 minutes, a 65 percent increase over the forecast base.

The increase in delays with the addition of the MWRRS passenger traffic was attributable to the following:

- Track Reconfiguration: Despite the relatively advanced track redesign, the line was reconfigured predominantly to handle the expected local and through freight traffic, not passenger traffic. The east end of the line in particular has the potential for creating delays for passenger traffic as it consists of a series of 10-12 mile long single track sections separated by two-mile long sidings.
- Freight Traffic: This line serves as CN's primary bridge route between Canada and Chicago via the Sarnia tunnel. Consequently, there is heavy freight traffic all along the length of the line, including a number of priority intermodal trains. The track design also lends itself to fleeting, creating fewer opportunities for passenger trains to overtake freights.
- Local Congestion: There are potential congestion problems through many of the major cities due to local freight trains running on and working off the mainline.

Potential Mitigation Options (local railroad corridor/corridor mileposts from Port Huron):

- Track Reconfiguration: With the current MWRRS schedule, many of the passenger-to-passenger meets are scheduled at stations, but there is a need to create 6-mile long passenger sidings by extending the existing sidings at Emmett (mp 318/16) and Lapeer (mp 289/45). In addition, extend the Shaftsburg (mp 236/98) and Charlotte sidings (mp 203/131) by two miles each to bring them to eight miles and three miles long, respectively. These longer sidings will provide for more efficient meets for both freight and passenger traffic.

- Freight Traffic: Add pairs of 45-mph crossovers in Flint at mp 266/68 and at Battle Creek mp 184/150. These will provide more options for passing and overtake situations on congested double track sections.
- Local Congestion: Add crossovers in Flint mp 269/65 (one set), two single sets at Lansing at mp 217/117 and mp 221/113, and two single sets in Battle Creek at mp 177/157 and mp 181/153. These upgrades allow for greater flexibility for through trains to pass as locals enter or exit the yards.

The total level of infrastructure improvement is as follows:

- Capacity improvements addressing passenger needs: 12 miles of new trackage, plus eight premium turnouts (60-mph) for new sidings and eight 45-mph turnouts for higher-speed crossovers.
- Capacity improvements addressing freight needs: 10 turnouts (30-mph) for lower-speed crossovers.

The results of this analysis show that these improvements should be sufficient to accommodate the MWRRS trains operating over this route. Overall, delays with improvements were lower than the forecast base case scenario by 2 percent. Freight train delays were 2 percent less than the pre-MWRRS conditions. Passenger trains using this corridor, including the eight MWRRS passenger trains, ended with no additional delays with the improvements in place; freight trains saw a slight decrease in average delays per train (Exhibit 6-32).

Exhibit 6-32
Additional Average Delays per Train, Port Huron Branch
(with Infrastructure Improvements)

	# Trains Modeled	***Additional Delays***
Passenger	10	0.0 Minutes
Freight	68	-0.3 Minutes
Total	78	-0.3 Minutes

6.23 Chicago-St. Louis

The St. Louis route begins on Amtrak trackage from Chicago Union Station to 21st Street. From there, the Canadian National Bridgeport and then Joliet Districts are used to reach Joliet. At Joliet, trains switch to the Union Pacific's Joliet and Springfield Subdivisions that are used all the way to just outside St. Louis. The last few miles from East St. Louis to the terminal are on the trackage of the Terminal Railroad Association of St. Louis (TRRA). The trackage from Chicago to Mazonia (about 5 miles south of Braidwood, IL) is double track with few crossovers. From Joliet to Mazonia there are two paired single tracked lines that together act as double track. The CN Joliet District has a number of manual crossovers used primarily for locally switching while the paired single track lines from Joliet south are widely separated, and thus have no crossovers.

South of Mazonia, the line is single track with 15 passing sidings. The passing sidings are typically 1¾ to 2 miles long, spaced about 10 to 12 miles apart. In addition, there are two sections of double track in Bloomington/Normal and Granite City. The final few miles into St.

Louis on the TRRA are double track. The only freight yards of significance on this route are the CN Glenn Yard in Chicago and the UP yard in Springfield. The route is currently controlled with CTC traffic control, with local sections of ABS and TWC traffic control in the Chicago area. The on going Chicago-St. Louis High-Speed Rail project will alter this route, bringing PTC (through the North American Joint PTC project) and capacity improvements, as noted below. A maximum freight train speed limit is 60-mph throughout (with many local exceptions particularly at crossings in the Chicago area).

The traffic on this route, representing a peak day, was modeled with 10 freight trains per day between Joliet and Bloomington, 12 per day between Springfield and Bloomington and 15 per day between Bloomington and St. Louis. The only Amtrak train modeled in this analysis is the *Texas Eagle* since MWRRS replaces existing Amtrak corridor service.

MWRRS traffic would operate at 110-mph, with nine roundtrips daily between Chicago Union Station and St. Louis. MWRRS trains operate intermixed with freight traffic.

This route has several additional factors to consider. Despite the fact that this route connects two major Midwestern cities, freight traffic is relatively light. However, several major at-grade crossings on this route in the Chicago area create the potential for delays. The key crossings are in Brighton Park, Corwith, Argo and Joliet. The management of crossing slots, where used, will be a key to consistent operation. Contingency slots need to be built into critical junctions as necessary. The archaic non-interlocked crossing at Brighton Park will need to be upgraded to minimize delays currently experienced at this location.

Base level delays were calculated at 560 minutes for the corridor. The addition of the MWRRS brought the total delay to 2,440 minutes, a 335 percent increase over the forecast base. The increase in delays with the addition of the MWRRS passenger traffic was attributable to the following:

- Chicago Congestion: Chicago area congestion, including commuter and local freight traffic into Joliet. This section of the corridor operates through a highly industrialized region with numerous freight shippers located on line.
- Joliet: The Joliet area itself presently offers key challenges with several projects under study or development, including the Joliet Arsenal terminal.
- Passenger Meets: While there are numerous meet-points on this corridor, few are sufficient for unobstructed passenger-to-passenger train meets.
- St. Louis Congestion: Freight train congestion is also a concern in the St. Louis area, particularly on the approaches to the McArthur Bridge across the Mississippi River.

Potential Mitigation Options (all mileposts are from CUS and are the same as local railroad mileposts):

- Chicago Congestion: Metra commuter operations consist of three roundtrips per day only at peak hours. The current MWRRS schedule calls for minimal conflict with the commuter operations, as there is only one early evening, westbound MWRRS train that potentially could overtake westbound commuter trains. Three MWRRS trains will potentially meet opposing commuter trains en route but with double track operation, there should be no delays. Additional upgrades to eliminate or improve rail grade crossings northeast of Joliet were not within the scope of this analysis.

- Joliet: Add a pair of 45-mph crossovers at mp 39 just south of Joliet to increase flexibility in the station area. As noted above, increased traffic through this crossing may require the creation and management of crossing slots to minimize delays.
- Passenger Meets: Create passenger-to-passenger sidings at Dwight – mp 72 (extend north by five miles), Odell – mp 82 (extend south 6.5 miles), Bloomington/Normal – mp 122 (extend double track north two miles), Ballard – mp 107 (extend north two miles and south one mile), McLean – mp 139 (extend north 1.5 miles and south 2.5 miles), Elkhart Siding – mp 169 (extend north by four miles), Girard – mp 211 (extend north 3.5 miles) and Carlinville – mp 224 (extend north 7 miles). On the Odell, McLean, Elkhart and Carlinville sidings, add a set of 30-mph crossovers in the middle. Add 30-mph double crossovers on the Granite City double track at mp 269. All other passenger train meets take place at stations or on existing double track sections.
- St. Louis Congestion: While the St. Louis area is not addressed in detail in this report, the creation and management of train slots is key to keeping passenger service consistent through this point. In addition, a second connecting track with additional crossovers from the bridge to the UP line may need to be considered, depending on the constraints of the current junction area.

The total level of infrastructure improvement is as follows:

- Capacity improvements addressing passenger needs: 35 miles of new trackage, plus 16 premium turnouts (60-mph) for new sidings and four 45-mph turnouts for higher speed crossovers.
- Capacity improvements addressing freight needs: 20 turnouts (30-mph) for use in *freight* sidings and lower-speed crossovers.

As noted, this corridor has improvements planned as part of the Chicago-St. Louis High-Speed Rail project. Phase 2 of this project will see the addition of double track on the south end between mileposts 204 and 218 and an improved freight siding at Elkhart at mp 169. The Phase 2 improvements were not considered to be in place when proposing potential infrastructure improvements. If added, the new double track will eliminate the need to upgrade the Carlinville siding. The siding at Elkhart will still need to be extended, but by only two miles in place of the four miles noted.

The results of this analysis indicate that these improvements should be sufficient to accommodate the 18 daily MWRRS trains operating over this route. Overall, delays with improvements were 5.4 percent above the total delays experienced in the forecast base case scenario, but freight train delays were about 10 percent less than the pre-MWRRS conditions.

All of the passenger trains, including the 18 MWRRS passenger train movements on this corridor ended with, on average, about four additional minutes in delay (Exhibit 6-33), well within the planned recovery time. Freight traffic lost, on average, over one minute in delay time.

Exhibit 6-33
Additional Average Delays per Train, Chicago–St. Louis Corridor
(With Infrastructure Improvements)

	# Trains Modeled	***Additional Delays***
Passenger	20	4.5 Minutes
Freight	37	-1.6 Minutes
Total	57	0.5 Minutes

6.24 *Chicago-Twin Cities Corridor Assessment*

The MWRRS sets out a 10-year implementation program that will provide daily passenger rail service from Chicago to Milwaukee, Madison, Green Bay, and Twin Cities. The first step in this process, Phase I, is to extend service from Milwaukee to Madison and increase frequencies between Chicago and Milwaukee

A key requirement of the MWRRS is the use of right-of-way that is currently owned by the freight railroads. In order to facilitate that use, the MWRRS states will need to develop a cooperative agreement with the freight railroads that includes additional capacity to ensure that the freight railroads can maintain their own train service. As part of the *Milwaukee-Madison Passenger Rail Corridor Study – Environmental Assessment*, WisDOT and Canadian Pacific Railway (CPR) agreed to carry out a track capacity analysis study. The goal of the study is to identify the short- and long-term capacity needs of the Chicago-Milwaukee-Twin Cities corridor in terms of both freight and passenger train operations. However, this simulation contains preliminary data that is subject to review, verification and approval by Canadian Pacific Railway. As of the date of this report, this review process has not taken place. Findings are not to be construed as a commitment on the part of Canadian Pacific to operate additional service.

The *MISS-IT*© capacity analysis system was used to conduct the analysis. *MISS-IT*© creates a Mitigation Analysis evaluation framework using existing databases of both the track infrastructure and the current train operations in order to measure existing train delay and establish a benchmark against which future freight and passenger train delay can be compared. These data files are developed using railroad, state, and survey data collected explicitly for the purpose and stored in *TRACKMAN*© (infrastructure) and *LOCOMOTION*© (train profiles) systems.

For this study, the capacity analysis process was designed to:

- Measure the impact of running MWRRS passenger trains on the Chicago-Milwaukee-Twin Cities corridor. It should be noted that this corridor is not identical to the study corridor of Chicago-Milwaukee-Madison as the rail line between Watertown and Madison diverges from the CPR right-of-way, and will use a revitalized track to access Madison. Since the purpose of this analysis was to mitigate freight train delays, the direct freight line from Watertown to Portage via Columbus is the route that was simulated. In the future after leaving Madison, MWRRS trains will rejoin the CPR line at Portage and then use the CPR line to Twin Cities.
- Identify the potential operational and infrastructure mitigation measures (track and signals) needed to achieve an acceptable level of service in terms of train delay and travel time and to ensure effective mitigation of the impact of adding MWRRS trains.
- Evaluate the necessary Mitigation Analysis measures needed for both the short term (2003) and the long term (2020).

6.24.1 Typical Day Mitigation Analysis

As part of the Mitigation Analysis, the *MISS-IT*© model evaluates a range of strategies for mitigating capacity delays and maintaining train delay at the appropriate level or benchmark in a given base or forecast-year. In the case of the Chicago-Milwaukee-Twin Cities corridor, the evaluation years selected for analysis were:

- 2000: base year
- 2003: first year of MWRRS implementation
- 2020: a year near the end of the MWRRS life cycle and investment period

For the forecast-years 2003 and 2020, a benchmark file was constructed that incorporated the proposed infrastructure improvements for that year, as well as the growth in freight and passenger (Metra, Amtrak) train traffic. Once this file was constructed, a second file that incorporated the MWRRS trains proposed for that year was also developed. The travel times generated by these two files were then evaluated in the *MISS-IT*© model to determine the impact of the MWRRS trains had on overall train delay.

The goal of the Mitigation Analysis was to identify where bottlenecks occurred with the addition of MWRRS trains and to add infrastructure to bring travel times back to previous levels (prior to the addition of the MWRRS trains). Canadian Pacific Railroad (CPR), Amtrak, WisDOT and study team engineers held a workshop to identify appropriate mitigation strategies. Mitigation measures included: changes in train operations to accommodate higher-ranked trains, upgrades to the signaling system to improve train throughput, and the addition of track to add capacity at bottleneck locations. The group then structured mitigation strategies in a unit form to allow for incremental application of any single strategy or combination of strategies.

Mitigation Measures

- Infrastructure: By adding segments of track (sidings, double or triple track) along the corridor, trains are given additional choices to resolve conflicts. Additional track provides for a smoother flow of traffic through the corridor and less incurred delay because trains can advance more quickly down the track and clear the way for following trains.
    - Increasing track capacity at targeted locations can ease bottlenecks and increase the free-flow of traffic in heavily traveled areas. Increasing capacity in these sections can be accomplished with the addition of new track, or when possible, utilizing existing infrastructure such as sidings and converting switches to crossovers.
    - Track upgrades that support higher speeds provide another enhancement that results in performance improvements along the corridor. Track upgrades help the traffic to exit the system more quickly, preventing potential conflicts with other trains later in the day. If overall train speeds are increased on a network, capacity is increased. However, greater disparities in speeds between passenger trains and bulk freight trains can also reduce capacity because of the degree of overtaking.

- Signaling: In highly congested areas, upgrades to the signaling system can provide significant time savings to traffic along a corridor, through the ability to increase traffic density and maintain higher speeds at signal blocks. The choices of signaling systems currently available include: Dark Territory or Non-Signaled (NS), ABS, Color Aspect Signaling (CAS), CTC, and PTC. Advancing to a PTC environment offers the advantage of reduced “block lengths” and even “moving blocks.” By reducing block space, the railroad has effectively increased the capacity of the same track.

  - The real differences become apparent when evaluating existing signaling systems such as ABS and more recent systems such as PTC. The older systems permit trains to enter a block only when cleared by the dispatcher after the previous train has exited the block. While highly effective for lightly used lines, fixed block systems impede heavily used systems as trains must slow and even stop when following slower or inadequately spaced trains. With moving block systems, a train is not slowed until following a preceding train at a minimally safe distance. As a result, a moving block system obtains the maximum length capacity.
  - It is proposed that with PTC moving block, trains carry their own block (safety zone) with them and therefore on heavily used lines will both maximize the available capacity and minimize the delays waiting or stopping for slower trains. The *MISS-IT*© model evaluates these options by measuring delays due to tailgating and stopping when distances and capacity become inadequate. This means that the trains can be concentrated as much as possible within safety constraints. In fixed block signaling, there can only be a less dense flow of trains with much greater delays, as trains must respond to fixed block limitations and controls.
- Operations: Changes to operating schedules provide another measure that improves the performance of the trains along the corridor. The preliminary operating plans for 2003 and 2020 are the result of a range of hypothetical decisions and plans developed independently by rail organizations and other authorities. Therefore, an “integration” analysis is needed to make the best use of the track, bearing in mind market and operating requirements. If the analysis indicates that there is overlap in dispatch times of passenger and freight trains, so that several trains are traveling too closely together, changing their schedules to provide some additional spacing between the trains will smooth the flow of the trains along their journeys. This will reduce the delays incurred by these trains.

For this analysis, restrictions were developed as to the degree of flexibility possible for each train type as it was recognized that any changes in real working schedules would need to be negotiated between all the railroads involved.

Growth Rates

The growth rates of train frequencies for each year in the analysis were necessary to determine the volumes at each stage of the analysis. Based on these growth rates, trains were added to replicate the appropriate level of traffic during the analysis year. A growth rate of 1.5 percent per year was assumed for Metra commuter trains and bulk freight trains. Intermodal grew at a faster rate of 4.0 percent per year. No growth was assumed in Amtrak or local trains.

Freight tonnage data and growth rates used in this analysis were derived from state, federal, and freight railroad data sources at the time the analysis was prepared. Since that time, more refined freight tonnage and growth forecast information has been made available from freight railroads and has been incorporated into subsequent analyses.

6.24.2 Capacity Analysis Results

The capacity analysis was used to assess the need for mitigation for CPR, Metra, Amtrak and BNSF train operations in both the short and long term. The year 2003 was selected to represent the short term, and the year 2020 was selected to represent the long term.

Year 2003 Analysis Results

For the year 2003, the volume of freight and passenger trains that was projected to use the Chicago-Milwaukee-Twin Cities corridor is shown in Exhibit 6-34. The first 32.5 miles from Chicago Union Station are the busiest, with 116 trains (62 Metra trains and 20 MWRRS trains). There are 17 CPR bulk trains and nine CPR intermodal trains. Amtrak has six trains including the *Empire Builder*, planned new *Fond du Lac*, and planned *Janesville* trains (Fond du Lac service was never started, and the Janesville train has since been discontinued.) The next busiest section is between mileposts 370.6-415, which has 78 trains, including 23 BNSF trains. Elsewhere, train volumes are in the 30-50 range.

As multiple commuter lines merge together on the final approaches to Chicago Union Station and St. Paul Union Depot, a detailed simulation of these terminals was not included in the scope of the line capacity simulation analysis. It is assumed that these highly localized commuter issues will be resolved by the respective metropolitan authorities. North of milepost 415, the analysis does not include all the trains that are operating in the section because this area is beyond the Twin Cities (St. Paul Union Depot) station to which MWRRS trains will operate.

Exhibit 6-34
2003 Train Volume by Track Segment*

Train	***Milepost***										
	0-32.5	***32.5-85.9***	***85.9-131.6***	***131.6-178.5***	***178.5-240***	***240-285.01***	***285.01-295***	***295-310.1***	***310.1-370.6***	***370.6-415***	***415-416.19***
Amtrak	6	4	4	2	2	2	2	2	2	2	2
BNSF	0	0	0	0	0	0	0	0	0	23	0
Bulk	17	17	17	15	19	21	21	21	19	19	0
Intermodal	9	9	9	9	9	9	14	14	14	14	0
Local	2	2	2	2	0	20	0	0	2	2	0
Merriam Park	0	0	0	0	0	0	0	6	0	18	6
Metra	**62	0	0	0	0	0	0	0	0	0	0
MWRRS	20	20	12	0	0	0	0	0	0	0	0
Total	**116**	**52**	**44**	**28**	**30**	**52**	**37**	**43**	**37**	**78**	**8**

* *This includes all trains in 2003 without any routing mitigation.*
***This excludes Metra trains between Union Station and Healy Station (mp 6.3).*
**** Amtrak's current Hiawatha service of 14 trains per day is included in the Midwest Regional Rail train volume numbers*

Base track data for 2003 shows the route to be largely a double-track railroad between mileposts 0.0 and 104.2, and then a largely single-track railroad with some double-track sections totaling 70 miles north to the Twin Cities, a distance of just over 300 miles. The line is largely CTC with some short stretches of ABS (*e.g.*, from milepost 85.7 to 95.1 and 246 to 255.5).

For the year 2003, the provision of a Muskego Yard northern lead, and 11.4 miles of double track between mileposts 119.6 and 131.0, would permit the operation of the MWRRS, including the addition of four extra trains, for a total of 10, operating on the Chicago-Milwaukee-Watertown-Madison route. If PTC signaling is provided and appropriate track changes are made, the train operation could be increased to 110-mph from the 79-mph operation that is possible with CTC/ABS.

Chicago-Milwaukee-Madison Analysis

For 2003, two basic sets of infrastructure improvements were tested in the Milwaukee-Watertown segment:

- 2003A – Allows 79-mph train operations and reflects existing CTC/ABS signaling system
- 2003B – Allows 110-mph train operations and requires PTC signaling system

To each of these basic strategies a series of infrastructure options was added. In both 2003A and 2003B, an additional lead was provided to Muskego Yard. This was done because it was recognized that even at today's level of traffic, this is a bottleneck that should be eliminated and clearly with MWRRS trains on the track, this one basic improvement is necessary to permit effective train operations. As such, it was made a basic component of each strategy.

The focus of the 2003 strategies was the Milwaukee-Watertown segment (mileposts 85.6–131.6), which would need upgrading to allow for new MWRRS Phase 1 train operations on the Chicago-Milwaukee-Madison corridor. The 2003 strategy only extends service only to Madison, not beyond. It is only in later phases of the MWRRS that MWRRS trains connect to Portage (milepost 178.0) and Twin Cities (milepost 407.4). The connection to Madison uses the CPR right of way leased to WSOR. This connects with the mainline at milepost 176.75. Exhibit 6-35 summarizes the infrastructure strategies adopted. In each case the following additional infrastructure was added to the previous strategy:

- Strategy 1 – Double track for an additional 11.4 miles between Milwaukee and Watertown (mp 119.6–131.0)
- Strategy 2 – Double track for an additional 15.4 miles (mp 104.2–119.6)
- Strategy 3 – Add a Muskego Yard bypass (mp 83.5–87.2)

Exhibit 6-35
2003A Infrastructure: Overview

Infrastructure	*2003A*	*Strategy 1*	*Strategy 2*	*Strategy 3*
CPR signal improvements, 79-mph, Muskego Yard lead upgrade	✓	✓	✓	✓
Double-track from mp 119.6 to 131		✓	✓	✓
Double-track from mp 104.2 to 119.6			✓	✓
Muskego Yard freight bypass				✓

The effect of adding Strategy 2, or double tracking from mp 104.2 to 131.0, is to effectively provide a double-track rail line from Chicago (mp 0.0) to beyond Watertown to as far as milepost 157.1, given the fact that double track already exists between mileposts 131.0 and milepost 157.1.

Exhibits 6-36 through 6-39 provide the results of the capacity analysis. In the case of 2003A (Exhibit 6-37) Strategy 1 easily mitigates the CPR, BNSF, Amtrak, and Metra trains; Strategies 2 and 3 would provide huge benefits as well. In fact, the improvements are such that there would be no degradation from the amount of delay that currently exists on the line, a level well below the Base Case year 2003. For the 2003B strategy, Strategy 1 achieved a similar result with mitigation. The effect of introducing the PTC signaling system between Milwaukee and Watertown can be seen by comparing the results of Strategy 1 in Exhibits 6-38 and 6-39. Its introduction to the 46-mile stretch reduces travel time on average by 3 to 4 minutes for every train, and the CPR intermodals would get a 7-minute benefit.

Exhibit 6-36
2003A Average Delay

	Freight	*Freight + Growth (no lead)*	*Freight + Growth + MWRRS (no lead)*	*+ Capacity Improvements (with lead)*		
	2000	***2003A (with CTC)***	***2003A (with CTC)***	***Strategy 1***	***Strategy 2***	***Strategy 3 (with freight bypass)***
Metra	0:00	0:03	0:03	0:03	0:03	0:02
Intermodal	1:15	1:37	2:16	1:26	1:14	1:10
BNSF	0:02	0:03	0:02	0:02	0:02	0:02
Bulk	2:15	2:41	3:35	2:27	2:11	2:08
Local	0:15	0:16	0:23	0:21	0:18	0:16
Amtrak*	1:15	1:30	1:44	1:14	1:19	1:17
MWRRS	—	—	0:28	0:17	0:14	0:11
Average Delay Time	**0:50**	**1:01**	**1:13**	**0:50**	**0:45**	**0:43**

Shaded area used for comparison.
*Delay time for Amtrak increases under Strategies 2 & 3, whereas all others decrease.

Mitigation

Average delay time is calculated by averaging the delay time for each train group for a particular infrastructure condition (*e.g.*, Freight 2000, Freight + Growth, etc.). These times show that as infrastructure improvements are made, the overall system is benefiting, even when some group times improve while others worsen.

Exhibit 6-37
2003A Standard Deviation of Duration

	Freight	*Freight + Growth (no lead)*	*Freight + Growth + MWRRS (no lead)*	*+ Capacity Improvements (with lead)*		
	2000	*2003A (with CTC)*	*2003A (with CTC)*	*Strategy 1*	*Strategy 2*	*Strategy 3 (with freight bypass)*
Metra	0:04	0:08	0:08	0:08	0:08	0:07
Intermodal	4:01	3:51	4:26	3:46	3:55	3:53
BNSF	0:04	0:07	0:03	0:05	0:04	0:04
Bulk	4:10	4:18	5:09	4:02	3:49	3:47
Local	0:29	0:30	0:41	0:40	0:34	0:31
Amtrak	3:45	3:50	3:44	3:42	4:16	4:16
MWRRS	—	—	0:35	0:33	0:24	0:23
Average Delay Time	**2:05**	**2:07**	**2:06**	**1:50**	**1:52**	**1:51**

Shaded area used for comparison. Mitigation

Exhibit 6-38
2003B Average Delay

	Freight	*Freight + Growth (no lead)*	*Freight + Growth + MWRRS (no lead)*	*+ Capacity Improvements (with lead)*		
	2000	*2003B (with PTC)*	*2003B (with PTC)*	*Strategy 1*	*Strategy 2*	*Strategy 3 (with freight bypass)*
Metra	0:00	0:02	0:03	0:03	0:02	0:02
Intermodal	1:15	1:35	1:46	1:19	1:11	1:09
BNSF	0:02	0:03	0:02	0:03	0:02	0:02
Bulk	2:15	2:38	3:07	2:15	2:15	2:08
Local	0:15	0:16	0:20	0:19	0:16	0:10
Amtrak*	1:15	1:26	1:34	0:55	0:51	0:59
MWRRS	—	—	0:20	0:13	0:10	0:09
Average Delay Time	**0:50**	**1:00**	**1:01**	**0:43**	**0:41**	**0:39**

Shaded area used for comparison. Mitigation
*Amtrak's delay time increases between Strategies 1 & 3.

Exhibit 6-39
2003B Standard Deviation of Duration

	Freight	*Freight + Growth (no lead)*	*Freight + Growth + MWRRS (no lead)*	*+ Capacity Improvements (with lead)*		
	2000	*2003B (with PTC)*	*2003B (with PTC)*	*Strategy 1*	*Strategy 2*	*Strategy 3 (with freight bypass)*
Metra	0:04	0:08	0:08	0:08	0:08	0:07
Intermodal	4:01	3:57	4:09	3:50	3:51	3:49
BNSF	0:04	0:07	0:05	0:07	0:05	0:04
Bulk	4:10	4:27	4:47	3:55	4:01	3:59
Local	0:29	0:32	0:39	0:39	0:33	0:32
Amtrak	3:45	3:36	3:26	3:21	3:17	3:17
MWRRS	—	—	0:26	0:31	0:21	0:20
Average Delay Time	**2:05**	**2:07**	**1:57**	**1:47**	**1:45**	**1:44**
Shaded area used for comparison.					Mitigation	

Chicago-Milwaukee-Twin Cities Analysis (2020)

As shown in Exhibit 6-40, the volume of trains in the corridor by 2020 grows significantly due to the high growth rate of CPR intermodal and BNSF freight trains, and the moderate growth in CP bulk and freight trains, and Metra commuter rail trains. For the first 32.5 miles from Chicago Union Station to Rondout Station, the number of trains increases from 116 in 2003 to 156 trains in 2020. Between mileposts 370.6 and 410.5, the increase is from 78 trains to 122, of which 35 are BNSF trains. Over the rest of the corridor, train volumes approach the capacity limit of 65 to 80 trains, except between mileposts 131.6 and 240, in which they range from 40 to 55 trains. A first assessment of train volumes suggests that triple track may well be required on the first 32.5 miles of the route north of Chicago Union Station, since there are more than 120 trains in this section, and also between mileposts 370.6 and 410.5 because there are more than 40 trains on that segment. Double track may also be required from milepost 104.2 to milepost 131.6 and between mileposts 240.0 and 370.6.

For the year 2020, despite very significant forecasts of freight growth, it was found that mitigation could be achieved for the full MWRRS rail service from Chicago via Madison to Twin Cities. The mitigation proposed for 2003 in terms of track (11.4 miles) and yard capacity (lead) was enhanced by the following:

- Providing a PTC System for the Chicago-Milwaukee-Twin Cities Corridor
- Adding 20 miles of double track to complete the double-tracking of the route between Milwaukee and Watertown
- Adding a Muskego Yard Bypass
- Adding the infrastructure proposed in the *Chicago/Milwaukee Rail Corridor Study* of 1997
- Adding 121 miles of extra double track between mileposts 245.0 and 410.0

- Completing an Integration Analysis of all the 2020 train services and making modest changes to CPR local train operations at La Crosse and to the scheduled times of MWRRS trains.

Strategies

In developing strategies for 2020, a number of basic infrastructure upgrades were adopted for the route. The first upgrade is a requirement for triple track on the first 32.5 miles of the route. This requirement was set forth in by the *Chicago-Milwaukee Rail Corridor Study* of 1997, which proposed three specific mitigation measures between Chicago and Milwaukee. The results of that study were accepted without prejudice for this analysis.

The three measures were:

- Triple track from Chicago Union Station to Rondout mp 32.5
- The separating of CPR operations at Truesdell and providing a separate line for these trains to Techny, where today the CPR trains turn off for Bensenville
- Providing three 2-mile freight sidings at 10-mile intervals north of Truesdell

It was determined that joint operations of freight and passenger trains north of Truesdell would be modeled. In modeling the route south of Truesdell, since CPR trains would not be operating on the right-of-way, there was no need to consider their trains beyond the impact on the junction at Techny.

Exhibit 6-40
2020 Train Volume by Track Segment*

Train	***Milepost***										
	0-32.5	***32.5-85.9***	***85.9-131.6***	***131.6-178.5***	***178.5-240***	***240-285.01***	***285.01-295***	***295-310.1***	***310.1-370.6***	***370.6-410.5***	***410.5-416.19***
Amtrak	6	4	4	2	2	2	2	2	2	2	2
BNSF	0	0	0	0	0	0	0	0	0	35	0
Bulk	21	21	21	21	24	26	26	26	24	24	0
Intermodal	17	17	17	17	17	17	25	25	25	25	0
Local	2	4	2	2	0	20	0	7	2	4	0
Merriam Park	0	0	0	0	0	0	0	0	0	20	6
Metra**	78	0	0	0	0	0	0	0	0	0	0
MWRRS	32	32	30	0	12	12	12	12	12	12	0
Total	**156**	**78**	**74**	**42**	**55**	**77**	**65**	**72**	**65**	**122**	**8**

* This includes all trains in 2020 without any routing mitigation.
** This excludes Metra trains between Union Station and Healy Station (MP 6.3)
*** Amtrak volumes were based on the Empire Builder plus the then-planned *Fond du Lac* and *Janesville* trains.

Although it was found that 2003A Strategy 1 and 2003B Strategy 1 mitigated train delays in year 2003, given the growth in train traffic, the 2003B Strategy 3 was used as a base for the 2020 analysis as instructed by the Wisconsin Department of Transportation. This strategy, as previously described, assumes an additional lead is provided to Muskego Yard and that 26.8 miles of double track are provided between mileposts 104.2 and 131.0, that PTC is installed, and that a bypass for the Muskego Yard is developed. This incorporates the already proposed improvements for 2003 into the basic 2020 track infrastructure.

Once the basic elements of the 2020 infrastructure were established (2020-Base, see Exhibit 6-41), a set of additional possible strategies was developed. In Strategy 1, the basic elements are included to ease freight movements through Milwaukee and the five 10-mile passenger sidings located strategically along the route to allow for passing of passenger trains.

Exhibit 6-41
2020 Strategies Overview

Infrastructure	*2020-Base*	*Strategy 1*	*Strategy 2*	*Strategy 3*	*Strategy 4*
2003B – Strategy 2 *Double-Track:* *MP 104.2-MP131*	✓	✓	✓	✓	✓
Freight bypass at Muskego Yard *MP 83.5-MP 87.2*	✓	✓	✓	✓	✓
Chicago / Milwaukee Rail Corridor Study *Diverting Freight Traffic to UP Line: Techny (MP 20.45) to Truesdell (MP 52.6)* *Three freight sidings:* *MP 59-61* *MP 70-MP 72,* *MP 81.5-83.5*	✓	✓	✓	✓	✓
Ideal Day Analysis: Five 10-mile sidings *MP 236-MP 246,* *MP 269-MP 277,* *MP 320-MP330,* *MP 348-MP 363,* *MP 398-MP 408 (416)*		✓	✓	✓	✓
Southern Relief: Two sections of improvements *MP 157-MP 174,* *MP 288-MP 294*			✓		
River Junction Relief: Two sections of double-track *MP 260-MP 282,* *MP 288-MP320*				✓	
Northern End Relief: Six sections of double-track *MP 236-MP 246,* *MP 260-MP 282,* *MP 288-MP 340,* *MP 348-MP 385,* *MP 411-MP 416*					✓

6.24.3 Infrastructure Definitions for 2020

Strategy 1: Ideal Day Analysis-Five Sidings

In Strategy 1, five 10-mile sidings identified as part of the Ideal Day Analysis for the route conducted as part of the MWRRI Phase 3B. The locations of these Ideal Day sidings are as follows:

- Mileposts 236 to 246
- Mileposts 269 to 277
- Mileposts 320 to 330
- Mileposts 348 to 363
- Mileposts 398 to 408 (416)

In order to increase train performance, the lengths of sidings 4 and 5 were increased as it considerably increased train performance. In addition, the fifth siding was further extended to milepost 416 to accommodate future commuter rail operations in the Twin Cities.

Strategy 2: Southern Relief Option

In Strategy 2, the option, the effect of double tracking an additional 90 miles of track on the southern end of the route (between mileposts 157 and 174 and 288 and 294), was evaluated. Including existing sidings, this effectively extends double track from Chicago to milepost 180, a segment of the route with extensive passenger train operations.

Strategy 3: River Junction Relief Option

In Strategy 3, the option, 121 miles of double track are added to minimize the impact of the La Crosse Mississippi River crossing at milepost 283. The route is effectively double tracked on either side of this bridge from mileposts 260 to 330, with the exception of the Mississippi River Bridge itself.

Strategy 4: Northern End Relief Option

In Strategy 4, the Northern End Relief option, 163 miles of double track were assessed between mileposts 236 and 416 with only three short breaks. Two of the breaks are for the two Mississippi crossings at mileposts 283 and 385, while the third break is between mileposts 340 and 348. The aim of this strategy was to minimize the impact of the Mississippi bridges on the performance of the long-distance corridor trains.

6.24.4 Mitigation Results

The evaluation of these strategies is shown in Exhibits 6-42 and 6-43. Mitigation of train delay is achieved by the Strategy 3 infrastructure. The average delay for all trains is 45 minutes, while average delay for the benchmark is 1 hour and 3 minutes. The time-critical trains, as well as the passenger and intermodal freight trains, all have delays less than the benchmark delay times.

Exhibit 6-42
2020 Average Delay by Train Type

	Freight	*Freight + Growth*	*Freight + Growth + MWRRS*	*+ Capacity Improvements*			
	2000	***2020***	***2020-Base***	***Strategy 1***	***Strategy 2***	***Strategy 3***	***Strategy 4***
Metra	0:00	0:01	0:05	0:02	0:03	0:03	0:08
Intermodal	1:15	1:37	2:22	2:05	2:05	1:25	1:23
BNSF	0:02	0:04	0:01	0:00	0:00	0:00	0:00
Bulk	2:15	3:18	3:42	4:10	3:18	2:02	1:55
Local	0:15	0:17	0:21	0:24	0:21	0:16	0:09
Amtrak	1:15	1:40	1:45	1:50	1:41	1:31	1:27
MWRRS	—	—	1:21	1:06	0:57	0:28	0:27
Average Delay Time	**0:50**	**1:09**	**1:22**	**1:22**	**1:12**	**0:49**	**0:47**

Shaded area used for comparison. Mitigation

Exhibit 6-43
2020 Standard Deviation of Duration by Train Type

	Freight	*Freight + Growth*	*Freight + Growth + MWRRS*	*+ Capacity Improvements*			
	2000	***2020***	***2020-Base***	***Strategy 1***	***Strategy 2***	***Strategy 3***	***Strategy 4***
Metra	0:04	0:04	0:01	0:05	0:05	0:07	0:10
Intermodal	4:01	3:34	3:57	3:33	3:42	3:30	3:56
BNSF	0:04	0:12	0:12	0:04	0:05	0:06	0:06
Bulk	4:10	4:33	4:41	4:54	4:29	4:11	4:05
Local	0:29	0:30	0:25	0:44	0:37	0:38	0:30
Amtrak	3:45	3:47	3:50	3:55	3:50	3:44	3:45
MWRRS	—	—	1:24	1:22	1:20	1:11	1:09
Average Delay Time	**2:05**	**2:06**	**2:04**	**2:05**	**2:01**	**1:55**	**1:57**

Shaded area used for comparison. Mitigation

Operations Integration

While the investment in track and signaling meets the overall delay requirements, further adjustment is required to meet the needs of passenger trains – and specifically MWRRS trains – to improve the flexibility and effectiveness of the overall operating plans of all trains using the corridor.

In evaluating the capacity analysis strategies for the Chicago-Milwaukee-Twin Cities corridor, considerable delay was identified at the following five locations, which have been prioritized in terms of severity of delay:

- River Junction (mileposts 282-283.7): The Mississippi River Bridge is itself a major bottleneck, but this problem is exacerbated by the local La Crosse trains that operate all day, including peak operating hours, across the bridge.
- Muskego Yard (mileposts 83.5-87): This is potentially the most difficult area of the route given the importance of the yard for freight operations and the level of passenger train operations in the section. However, the extra lead and the bypass infrastructure for the yard effectively resolve the problems.
- Hastings River Crossing (mileposts 391.2-392): This bridge is a problem given the volume of freight traffic and the projected level of MWRRS operations. However, the capacity issue can be resolved by measures of effective train scheduling and the scheduling of bridge operations. In the future (beyond 2020), the potential increases in both passenger and intermodal operations is likely to encourage further consideration of the potential doubling of bridge track.
- Union Station (milepost 32.5): The growth of Metra, MWRRS, Amtrak and CPR trains on this section of track could present some of the most complex capacity problems if proposed changes in CPR train routing are not achieved. Considerable attention should be paid to developing a full understanding of infrastructure and train plans for the principal rail operations in the segment.
- Mileposts 240 to 410: The level of train operations on this segment needs to be carefully monitored to ensure that capacity is sufficient. Capacity is being approached, and although the Risk Analysis currently shows no major problems, as few as 10 additional trains could dramatically affect delays. Full double track may be needed between mileposts 240 and 410. Beyond that, the two Mississippi single-track bridges form a critical bottleneck.

Following the review of capacity-constrained areas, the train schedules were reviewed for efficiency. No changes or adjustments to the schedules of CPR intermodal trains or bulk trains were included in the analysis (local train schedules, on the other hand, were adjusted within a reasonable range). As a result, the integration analysis proposed the following adjustments:

- Metra trains – no change
- MWRRS trains – departure time adjustments less than 1 hour from original schedule
- Amtrak – no change
- CPR intermodal – no change
- CPR bulk – no change
- BNSF – no change
- CPR locals – significant change to River Junction operation. Trains were moved up to 3-4 hours.

Exhibit 6-44 shows the adjustments to the operating schedules of MWRRS and CPR local trains.

Exhibit 6-44
Adjustments to Operating Schedules of MWRRS and CPR Local Trains

Train Name	***Old Departure Time***	***New Departure Time***	***Difference***
	2020-3	***2020-3A***	
***MWRRS*:**			
MWTCPTL-1	7:52	7:02	0:50
MWMDCHL-1	11:47	11:25	0:22
MWTCPTE-2	8:21	8:06	0:15
MWMDCHE-4	12:00	12:14	0:14
MWMDCHL-2	17:31	18:21	0:50
MWTCPTE-3	16:20	15:50	0:30
MWMDCHE-5	19:59	19:29	0:30
MWMDE-3	13:00	12:30	0:30
MWPTTCL-1	10:42	11:22	0:40
MWMDE-2	10:40	10:10	0:30
MWPTTCE-2	13:30	13:00	0:30
MWTCPTE-1	6:47	6:13	0:34
MWMDE-1	5:50	5:30	0:20
MWPTTCE-1	8:13	7:53	0:20
MWTCPTE-1	6:47	5:47	1:00
La Crosse (locals):			
CPLacW1	3:00	2:00	1:00
CPLacW2	4:30	0:30	4:00
CPLacW3	5:30	2:30	3:00
CPLacW6	12:30	11:30	1:00
CPLacW7	14:30	11:45	2:45
CPLacE2	3:49	2:49	1:00
CPLacE3	5:06	1:06	4:00
CPLacE4	6:07	3:07	3:00
CPLacE7	13:29	12:29	1:00
CPLacE8	15:34	12:49	2:45

6.24.5 Chicago-Twin Cities Infrastructure Needs

The capacity analysis for the Chicago-Milwaukee-Twin Cities corridor has identified the critical infrastructure and operating strategies for mitigating the freight railroad. In developing the Capacity Analysis model for the study, the results of the 1997 *Chicago/Milwaukee Rail Corridor Study*, a base-year comparison was made of the study's results and those of the *MISS-IT*© model. It was found that the *MISS-IT*© model assessment of train performance closely matched the study's estimates in terms of the average travel times for base-year trains.

This study accepted without prejudice the 1997 *Chicago/Milwaukee Rail Corridor Study* such that the evaluation of capacity needs of the Chicago-Milwaukee-Twin Cities corridor were based on specific assumptions that need to be reviewed and verified. The assumptions included:

- A triple-track rail system from Chicago to mp 32.5 as proposed in the 1997 study. The validity of this assumption has been questioned and needs to be reevaluated.
- The adoption of the assumption that CPR will use the UP line from Truesdell to Bensenville. This assumption needs to be agreed to by CPR and UP railroads, given the land use development at Truesdell.
- The assumption that the CPR and UP connection can be made at Truesdell needs to be assessed, given recent land use developments that may have impacted the availability of the proposed right-of-way for the connection between the existing UP right-of-way and the CPR right-of-way.
- The acceptability of PTC to CPR. This assumption appears very reasonable for 2020, but PTC may not be reasonable in the near future.
- The adoption of drawbridge schedules by the Coast Guard. This assumption needs to be validated by detailed discussions with the relevant authorities.
- The study findings need to be reviewed with CPR to ensure that maintenance needs can be effectively completed in forecast years.

For the year 2020, despite forecasts of very significant freight growth, it was found that mitigation could be achieved for the full MWRRI rail service from Chicago via Madison to Twin Cities. The mitigation proposed for 2020 is the following:

- Add a PTC System to the Chicago-Milwaukee-Twin Cities Corridor
- Add 20 miles of double track to complete the double-tracking of the route between Milwaukee and Watertown. The Wisconsin rail plan has advanced the full double tracking of Watertown-Milwaukee to occur when the Madison passenger service is implemented.
- Add a Muskego Yard Bypass
- Add the infrastructure proposed in the *Chicago/Milwaukee Rail Corridor Study* of 1997
- If capacity constraints at the Mississippi River bridges cannot be directly addressed, then add 121 miles of extra double track between mileposts 245.0 and 410.0
- Complete an Integration Analysis of all the 2020 train services and make modest changes to CPR local train operations at La Crosse and to the scheduled times of Midwest trains to avoid passenger conflicts with scheduled freight operations.

6.25 St. Louis-Kansas City Corridor Assessment

Joining Union Pacific's (UP's) transcontinental routes to eastern rail connections at the St. Louis gateway, UP's St. Louis-Kansas City line is literally at the heart of the U.S. rail network. As shown in Exhibit 6-45, in 2002 the line handled over 100 million gross tons, making it one of UP's highest-density lanes. It carries high volume Powder River coal mixed with intermodal and merchandise freight trains. As Powder River coal continues to penetrate farther east, Union Pacific projects nearly a doubling of freight traffic by 2020. Additional traffic will come from UP's newly-acquired Golden State route to El Paso, TX which forms part of a southern transcontinental route to Los Angeles, CA.

Exhibit 6-45
UP Tonnage Density Map[9]

9 UP 2002 Analyst Factbook: Railroad Overview, .pdf document downloaded from UP web site.

NOTICE:
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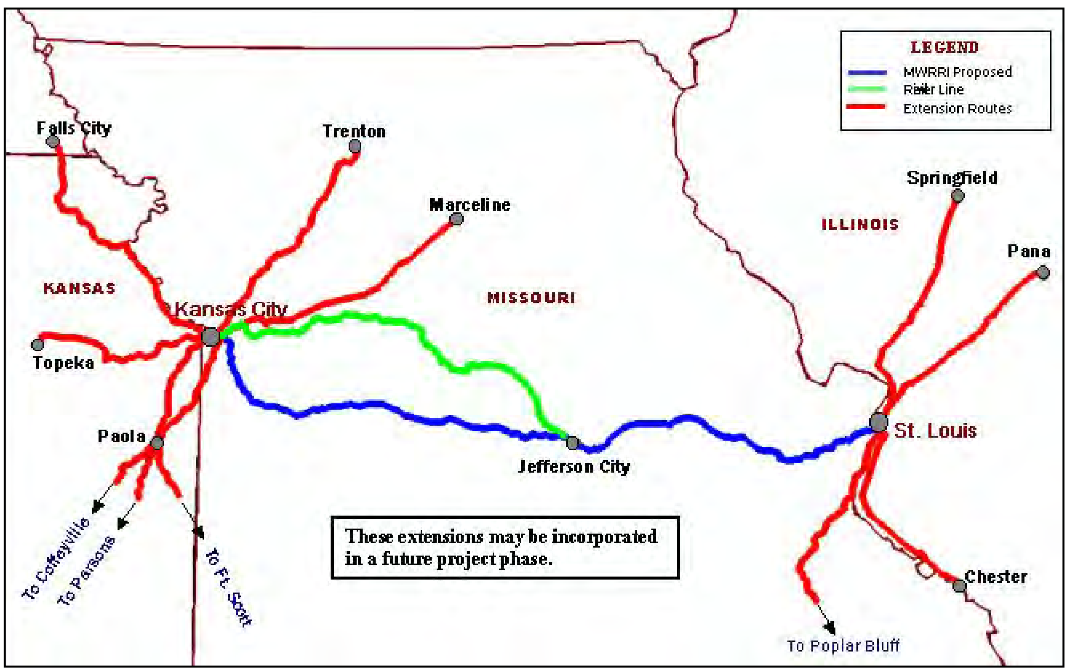
In addition to all this freight traffic, Amtrak operates two round-trip passenger trains between St. Louis and Kansas City on a daily 5:40 schedule. The Midwest Regional Rail Initiative (MWRRI) proposes to introduce tilting train technology to increase speeds to 90-mph by 2013. The number of trains is slated to grow to four round-trips by 2011 and to 6 round-trips with a 4:42 running time by 2013. This service would extend Illinois'110-mph Chicago-St. Louis corridor all the way to Kansas City.

To nearly double freight volume and triple passenger traffic on this congested corridor will require significant investment. An important part of this investment is the capacity of freight yards in St. Louis and Kansas City, as well as that of rail lines radiating in all directions from both terminals. Exhibit 6-46 shows the St. Louis to Kansas City line in blue and green; route extensions used by UP around both endpoints are shown in red. This exhibit does not show *all* rail lines – it only shows lines operated by Union Pacific.

A study of the St. Louis and Kansas City terminals and their feeder lines is essential to understanding the long-term needs for rail infrastructure in the region. The simulation effort is still incomplete since it does not include an analysis of the impact on St. Louis and Kansas City terminals. It is anticipated that funding to complete the scope of the simulation effort will be sought in a future project phase.

Exhibit 6-46
UP Route Extensions around the Endpoint Terminals



Note: This exhibit shows only those rail lines operated by Union Pacific.

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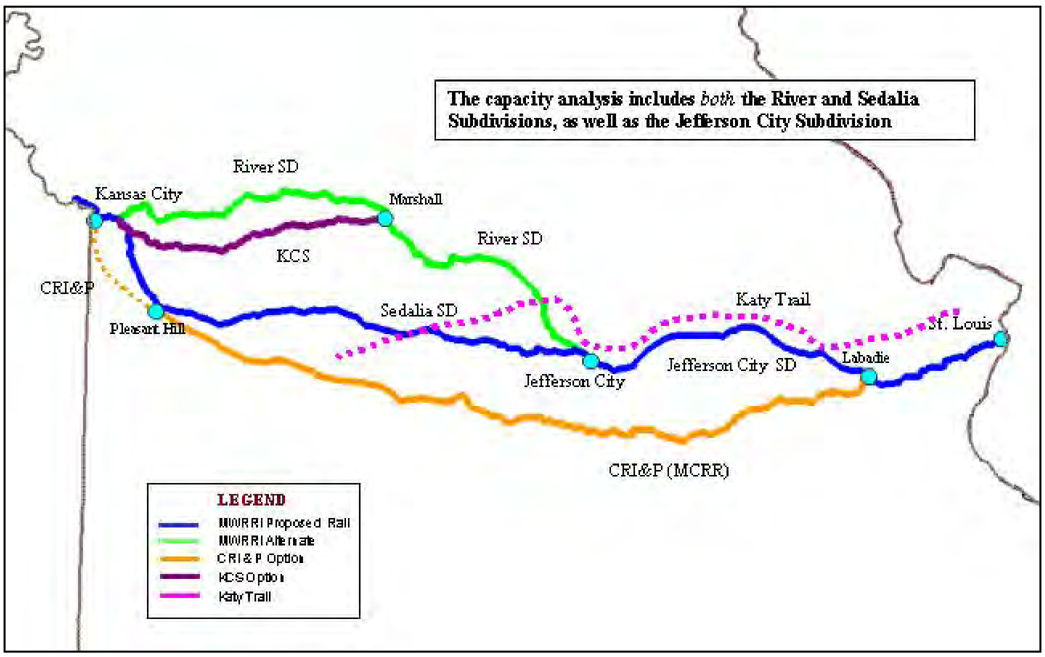
This reports the results of a simulation of the St. Louis-Kansas City line, not including the endpoint terminals, that was undertaken by the study team during the summer of 2003. TEMS and Missouri Department of Transportation sincerely appreciate the excellent cooperation received from Union Pacific who supplied data needed for the analysis. When the simulation work is accomplished, (including Kansas City and St. Louis terminals and radiating lines out 75 miles) it will be subject to review, verification and approval by Union Pacific Railroad. As of the date of this report, this simulation work has not been accomplished and consequently the review process has not taken place. Findings are not to be construed as a commitment on the part of Union Pacific to operate additional service.

6.25.1 Route Alternatives within the Corridor

As previously discussed, Union Pacific and the Missouri Department of Transportation required that Berkeley Simulations Software's RTC model be used for the capacity analysis of the St. Louis-Kansas City corridor (Exhibit 6-47). As such, it was not possible to simulate the use of a Positive Train Control (PTC) system. On other MWRRS corridors, PTC use typically resulted in more than a 10 percent savings in train delays. In addition, because of other limitations of the RTC model, scenario development was performed with MWRRS trains at current 2002 freight levels instead of projected 2020 freight levels.

Exhibit 6-47
St. Louis to Kansas City Route Alternatives



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Katy Alternative

As shown above, the Missouri-Kansas-Texas railroad formerly operated a parallel route on the north side of the Missouri River, from St. Louis to Sedalia via Jefferson City. After the rail line was abandoned in 1986, the right-of-way was converted as part of the *Rails to Trails* project into the highly popular, recreational use *Katy Trail.* In spite of the obvious cost advantage for reusing an existing right of way, that corridor is no longer available for rail operations between St. Louis and Sedalia.

Rock Island Alternative

Another possibility is to reactivate the former Rock Island line across Missouri. Except for the eastern 107 miles from St. Louis to Belle, MO, this track has remained unused since 1980. From Union to Belle, however, the track is in poor shape and impassible. West of Belle, the right-of-way is completely overgrown. Trees are growing between the rails and ties have rotted completely away. Washouts, landslides and urbanization have compromised the right-of-way. Bridges have been demolished for highway and road expansion, and some farmers along the line have even pulled up rails and sold them for scrap.

For freight service, directional use of the Rock Island for westbound trains between Labadie and Pleasant Hill may be a possibility. However, to traverse the large rivers and rugged hills of the northern Ozarks mountain country, many tunnels and high trestles would need to be restored. The line was known as Rock Island's *mountain railroad* because of its grades and curves. All these factors make the line unattractive for through freight service.

The Rock Island alignment is better known for its grand scenery than for its on-line traffic base. It bypasses Missouri's state capitol of Jefferson City and so is not an attractive route for providing MWRRS passenger service.

Union Pacific has examined, however, the possibility of reactivating the west end of the Rock Island line between Pleasant Hill and Kansas City, for reducing delays on the Sedalia line. However, diverting freight trains from the Sedalia to the River line, as proposed here, would minimize the need for adding freight capacity between Pleasant Hill and Kansas City.

UP River Line Alternative

Union Pacific's River subdivision is currently used for eastbound freight trains from Kansas City to Jefferson City, MO. It is eight miles longer and a little slower than the Sedalia subdivision, but offers easier grades and lower fuel consumption. Subject to completion of a detailed line simulation analysis incorporating the terminal areas (which has not been completed) double-tracking the River line should be investigated as a possible means for separating freight from MWRRS passenger operations west of Jefferson City.

One disadvantage of relying on the River line is its tendency to flood. Most flooding problems have occurred west of Jefferson City. During floods, Union Pacific runs trains bi-directionally over the Sedalia subdivision. After the MWRRS start-up, UP could still use the Sedalia line for emergency rerouting. Capacity upgrades to support MWRRS passenger service would in fact facilitate this. Several computer simulation runs will be presented to evaluate use of the Sedalia line for freight under emergency conditions.

KCS Variant of the River Line Alternative

Kansas City Southern (KCS), Norfolk Southern (NS) and Burlington Northern Santa Fe (BNSF) all have active lines between St. Louis and Kansas City. All three railroads run north of UP's alignment through Jefferson City, so UP trains could not use any of those routes without significantly disrupting UP crew and terminal operations. Both BNSF and NS have line capacity problems of their own. However, the KCS line, formerly part of Illinois Central, remains underutilized.

A portion of the KCS route – from Kansas City to Marshall, MO – could be used without affecting operations at either UP endpoint terminal. At Kansas City, the KCS line joins the Sedalia line just east of Rock Creek Junction. At Marshall, a new connection track would probably need to be built where the two lines cross. Between Marshall and Jefferson City, both east and westbound trains would operate over the River line, which would be double-tracked between those points.

The main benefit of using the KCS line is that it avoids the need for double-tracking 82 miles of the River line. With the KCS variant, only 74 miles of River Line would have to be double-tracked, rather than 156 miles. It appears that the KCS variant is operationally equivalent to double-tracking the River line. Further study is recommended of this cost savings opportunity, but an engineering analysis is needed first to confirm the feasibility of incorporating this route segment into Union Pacific's River line.

6.25.2 Needed Improvements on UP Infrastructure

A *partial* estimate of improvement costs was developed. The $314 million for improvements to the St. Louis-Kansas City line does not include costs for the capacity upgrades or River line improvements recommended here. The estimate includes:

- $170.7 million for track condition upgrades – timber and surface with 66 percent tie replacement, new switches and curve improvements on the Jefferson City and Sedalia lines
- $64.4 million for installing a Positive Train Control (PTC) system and other signaling upgrades
- $58.6 million for grade crossing improvements

An engineering cost estimate for needed capacity improvements has not yet been completed. An additional $578 million[10] Placeholder Cost for St. Louis-Kansas City capacity improvements has been included in the MWRRS business plan.

[10] This $578 million placeholder was estimated based on unit costs from other passenger rail corridor studies. It assumes infrastructure improvements recommended in this report east of Jefferson City and a full double tracking of

A capacity improvement plan has been developed for each subdivision. In the RTC model simulations, each subdivision's improvements were treated as a group. Improvements to all three subdivisions are needed to satisfy the delay mitigation criteria for the MWRRS.

6.25.3 Sedalia Subdivision - Capacity and Speed Improvements

The Sedalia subdivision extends from Jefferson City, MO to Kansas City, MO (Rock Creek Junction) via Sedalia. Long passing sidings on the Sedalia line would allow "running meets" between MWRRS passenger trains but would also significantly boost capacity of the Sedalia line for emergency freight use. Assuming westbound freights are diverted to the River line, the MWRRS guideline of a 10-mile siding every 50-miles, or 20 percent double-track, was used for developing an initial plan to upgrade the Sedalia line for passenger use. Since the total length of the Sedalia line is 150 miles, 20 percent double-track would allow 30 miles of new construction. These miles were distributed as follows:

- MP 248 to 260 - Connect Pleasant Hill to Lee's Summit siding
- MP 217 to 224 - Extend Centerview siding east, past Warrensburg
- MP 189 to 197 - Extend Dresden siding east to Sedalia
- MP 150 to 160 - Extend California siding west to MP 160

While these four sidings total 37 miles long, this total includes existing sidetrack mileage incorporated into new extended *passenger* sidings. Four sidings are spaced at 25-30 mile intervals. The proposed siding placement takes into account local conditions, including gradients for restarting freight trains, grade crossings and local industrial service.

The proposed layout of the Sedalia line represents a compromise between conflicting passenger and freight requirements. Such a compromise adds four long sidings instead of just two. By lengthening existing sidings, two sidings can be 10-miles long, while the other two sidings would be only slightly shorter. This distributes more sidings at uniform spacing along the length of the line. It provides much more freight capacity than would a two-siding solution and eliminates conflict with local industry switching at Sedalia

An alternative to double-tracking the River line would be to double-track the Sedalia line instead. This alternative has double-track with universal crossovers every 8-12 miles. The advantages of double-tracking the Sedalia subdivision instead of the River line include:

- Double-tracking the Sedalia avoids problem areas for flooding on the River line
- The Sedalia line is eight miles shorter and is faster than the River line

However, double-tracking the Sedalia line would keep freight and passenger operations mixed. The advantages of double-tracking the River line instead of the Sedalia are:

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the Sedalia subdivision. This placeholder has been estimated in advance of field inspections or detailed discussions with Union Pacific Railroad.

- Double-tracking the River line would provide a completely separate, low-grade route for freight trains west of Jefferson City
- Separating freight and passenger lines would offer reliability gains, particularly for MWRRS passenger service
- The current plan is to operate MWRRS trains at 90-mph with tilting equipment. Curves on the Sedalia line are not as severe as those on the River or Jefferson City subdivisions. If the line were dedicated to passenger trains, super-elevations (the amount of banking in the curves) could be raised to permit higher speeds. The design standard for MWRRS-dedicated tracks is a curve balancing speed of 60-mph, up to a maximum super-elevation of 6 inches.

Increasing super-elevations on the Sedalia line for 110-mph passenger trains would also allow speed limits of 70-mph for intermodal trains. However, increasing Sedalia super-elevations may also limit UP's ability to utilize the line for heavy bulk trains should the Missouri River flood. Any decision to upgrade the Sedalia line above a 90-mph standard would have to be undertaken based on the mutual consent of both UP and the MWRRI.

Jefferson City Subdivision – Capacity Improvements

The Jefferson City subdivision, between Jefferson City and St. Louis, handles UP freight in both directions, as well as two Amtrak trains each way. The line operates today with top freight train speeds of 60-mph. A *LOCOMOTION*® analysis determined this is the maximum freight speed possible for existing curve super-elevations. Curves on the Jefferson City line allow 90-mph with tilting equipment, but are too sharp for 110-mph operation. Since curvature restricts passenger train speed to 90-mph and this speed can be accommodated in mixed freight and passenger operations, the study assumed that there is no need to separate freight and passenger tracks over this line segment.

This segment needs to be upgraded to handle a doubling of freight volume and a tripling of passenger volume by 2020. Although there is currently no design standard for upgrading double-track lines for the MWRRS, a 20 percent target was used for determining the mileage of new passing siding capacity to be added. This mileage was distributed as follows:

- Double-track across Osage River Bridge and eliminate single-track bottleneck
- Double-track across Gasconade River Bridge and eliminate single-track bottleneck
- Center Siding at Dozier MP 28 to 37
- Center Siding at Berger MP 71 to 79.5

By 2020, triple-track will also be needed from Osage River (MP 117.4) to River Junction (MP 129.4.) This additional 12 miles of triple-track would be installed as part of the proposed support yard project at Jefferson City.

Subsequent to completion of this phase of the simulation effort, Union Pacific indicated they were planning to double-track the Osage and Gasconade River bridges, as well as to address yard capacity needs for crew changing at Jefferson City. The timing of this investment would be

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based on UP's own traffic growth and need for added capacity. Adding these bridge improvements into the base infrastructure would lower the amount of freight train delay in the base. While the MWRRS would avoid the cost of the bridge improvements, additional triple-track may be required to mitigate the impact of passenger delays on freight operations.

River Subdivision - Capacity and Speed Improvements

The River line would be upgraded by double-tracking its entire length from River Junction to Rock Creek Junction. Universal crossovers should be provided every 8-12 miles mainly to provide flexibility during track maintenance, although this was not explicitly simulated. A third track should be added along the shared BNSF section.

The distance from River Junction to Marshall, MO is 74 miles. Beyond Marshall, it is another 82 miles to Kansas City. If the parallel KCS line could be used between Marshall and Kansas City, the cost of double-tracking 82 miles of the River line can be avoided. If KCS cannot be used, double-tracking the Sedalia line might be less expensive. We recommend that the possibility of using the KCS alignment for westbound directional freight trains be formally evaluated in a future study.

The possibility of raising the River line speed limits to 60-mph was studied on stretches over 10 miles in length totaling 60.6 miles in length. Eastbound trains that are able to exceed 50-mph[11] would save 10 minutes. For westbound trains, the Sedalia line is still a little faster, but this improvement could reduce the time difference. Overall, since River line speeds would be improved in both directions, freight trains diverted to the River line may experience little adverse effect on total running times. The exact time savings or cost cannot be determined until the infrastructure upgrade plan is determined in more detail.

6.25.4 Yard and Terminal Issues

The line capacity simulation revealed problem areas at Jefferson City and at Sedalia. At Jefferson City, there is a need for additional yard tracks for crew changes and train staging. This is needed to keep the main tracks clear for passenger operations. In Sedalia, where a local train serves industries on the single-track main, this switching conflicts with both MWRRS passenger trains and with through freight trains.

Locating the End-of-Double-Track at Sedalia

At Sedalia, local industries are generally located west of the Amtrak station. Double-tracking MP 189-197 would allow through trains to pass around switching activities, but if the siding ends at MP 189, eastbound trains would have to restart against an ascending 1.35 percent gradient. If double-track were extended farther east through the Sedalia yard to MP 186.5, the starting gradient would be reduced to 0.15 percent ascending. However, unless new double-track could be added on the south side, the Sedalia yard lead would have to be replaced. The details of the infrastructure required to serve local industry at Sedalia have not yet been finalized.

[11] Coal loads are today limited to 50-mph, as are many manifest freight trains.

Jefferson City Support Yard

By 2020, additional yard capacity will be needed at Jefferson City for changing crews on freight trains, while keeping both main tracks clear. While some crew changes can take place on the main tracks at the Amtrak station, MWRRS passenger trains limit how much those tracks can be used. Some MWRRS trains are scheduled to meet at Jefferson City. When this occurs, MWRRS requires the use of both main tracks.

Use of yard tracks for crew changing would displace yard capacity at Jefferson City that is now used for switching purposes. There appear to be a few acres of land between the yard and the Missouri River where short half-mile mile tracks could be squeezed in to expand the existing switching yard.

A better option may be to construct an entirely new support yard west of town, at the mouth of Grays Creek. Trains headed to or from the Sedalia line would be limited to about 1½ miles in length. Even though westbound trains would normally use the River line, access to the Sedalia line is still needed for emergency use and during maintenance on the River line. If the yard needs to be longer than this, a 100-foot cut through a bluff or a tunnel would be needed to provide a head-on movement to the Sedalia line farther west.

An alternative plan would be to site the yard entirely west of River Junction, where tracks could be as long as desired. By installing a connecting Wye track at River Junction, westbound trains could reach the Sedalia line by reversing direction, or crews could change on the main line at Jefferson City when MWRRS trains do not need it. Since the Sedalia line would see only occasional use, this site may prove satisfactory. An engineering field survey and further discussion are needed before definitive plans are made.

An aerial survey suggests that the land needed for yard expansion might be available alongside the Missouri River west of Jefferson City; however the area is in a flood plain. Constructing a yard there may require moving existing levees. A detailed engineering assessment is needed to determine the feasibility and optimal site(s) for yard expansion near Jefferson City.

By 2020, a full-fledged, six-track support yard will be needed to provide for changing crews on freight trains. This yard must have direct access from the River Route to prevent conflicts with MWRRS passenger trains. Triple-track should also be provided on the east end of the yard to the Osage River, so freight trains can arrive and depart the yard simultaneously even if a MWRRS passenger train is coming.

Given the high cost of land in St. Louis and Kansas City, coal-staging yards might be built *outside* these major metropolitan areas at a lower cost. The goal for coal trains should be to get them *through* St. Louis and Kansas City as quickly as possible, not to hold or store them there. It would be more cost-effective to build new support yards at Jefferson City and Marysville, rather than trying to squeeze more yard capacity into the already-congested St. Louis and Kansas City terminals.

Kansas City Terminal

The Kansas City Terminal (KCT) between Rock Creek Junction and Kansas City Union Station was included in the RTC simulation. However, freight train data was not received from either KCT or BNSF. Currently KCT handles well over one hundred freight trains per day on a double-tracked railroad, with some triple-track. Amtrak operates four trains a day, projected to grow to 12 with implementation of MWRRS. MWRRS would represent a very small percentage of the total train movements over KCT track. Line congestion remains an issue, but KCT capacity issues will be driven more by projected increases in freight traffic than by MWRRS needs.

The most serious operational problem between Rock Creek Junction and Union Station is a level crossing at Sheffield with both KCS and the UP Coffeyville rail line. The Sheffield flyover recently bridged that crossing. A new connection track at Rock Creek Junction is needed to allow MWRRS passenger trains to access the flyover and avoid conflicts with freight trains crossing at Sheffield.

6.25.5 St. Louis-Kansas City Simulation Analysis

This study develops an infrastructure plan to accommodate MWRRS passenger trains at forecast 2020 freight traffic levels. The evaluation was conducted following the mitigation framework described earlier in this report. The MWRRS mitigation determines the investment needed to reduce freight delays to the level they would be without the addition of MWRRS passenger trains, on current infrastructure in 2020. Current infrastructure was assumed as the base line. Subsequent to completion of the simulation modeling, Union Pacific indicated they were planning to double track the Osage and Gasconade River bridges. This changed assumption is not reflected in this report, but will be addressed in a future project phase.

The proposed rerouting of westbound freight trains from the Sedalia to the River line raises a question whether *train delay* or *transit time* should be equalized. Since the River line is slightly longer and slower than the Sedalia, Union Pacific suggested that transit time mitigation be used. Anticipated locomotive and fuel savings associated with the use of the River route should at least partially compensate Union Pacific for any added free-running time. Nonetheless, Union Pacific's requested criterion of transit time equalization was used in this analysis.

Union Pacific also requested that a *freight-only* base case be developed. This request was also accommodated. If freight traffic doubles without adding infrastructure, the performance of the system by 2020 will be very weak. Without investment, it will not even be possible to continue operating Amtrak trains on any acceptable schedule. The RTC simulation locked up when a 2020 *Do Nothing* simulation was attempted, keeping the Amtrak trains on the tracks. Accordingly, the Amtrak trains were removed from the simulation and a 2020 *Do Nothing* scenario was developed without Amtrak trains, which allowed the RTC simulation to run successfully.

The cost estimate prepared includes $64.4 million for a Positive Train Control (PTC) or Communications-Based Train Control (CBTC) system and other signaling improvements between St. Louis and Kansas City. However, Berkeley's RTC model is not able to simulate a PTC-overlay signal system with moving block. We had to assume conventional TCS signaling. Presumably, a PTC system could reduce delays – in addition to the delay savings generated by the proposed infrastructure improvements. It was not possible to quantify the magnitude of the savings here since, at the request of Union Pacific, the RTC model was used for the simulation runs. Accordingly, the mitigation option of using PTC on the routes was not studied.

Of the three mitigation options discussed earlier in this report, only the option of adding infrastructure could be pursued here; signaling improvement could not be simulated by the RTC model and there were no obvious opportunities for any operations-based mitigation.

6.25.6 Scenario Development

Even with new infrastructure added, the RTC model took four days to complete one 30-day simulation at 2020 volumes. The size and complexity of this analysis creates a challenge for the timely completion of computer simulation runs. At 2020 traffic volumes, the simulation performs adequately only if the full package of proposed infrastructure investments are included. With any fewer investments, the simulation bogs down and often terminates short of completion. This reflects the physical reality of conducting complex, high-volume rail operations. However, to obtain comparative delay statistics, there is often still a desire to obtain a completed simulation of a hypothetical "Do Nothing" alternative. Because of this difficulty in getting the RTC model to run with less than full infrastructure at 2020 traffic levels, scenario development was performed with MWRRS passenger trains at current 2002 freight traffic levels.

Exhibit 6-48 shows the complete set of scenario development simulations. All were performed at 2002 freight levels. Of particular interest was determining whether mitigation could be attained *without* making all the improvements proposed on each subdivision. *If the mitigation criteria could not be satisfied even at 2002 traffic levels, the plan clearly would not work for 2020.* The Sedalia, Jefferson City and River lines were *individually* reverted – one subdivision at a time – back to their unimproved condition. This produced a measure of the incremental benefit of investment on each subdivision without overloading the RTC model. Scenario development runs included:

- A 2002 Base Case both with and without Amtrak trains, over current infrastructure
- A Future Railroad scenario including the complete set of improvements proposed for MWRRS
- In the Jefferson Base scenario, the Jefferson City subdivision was not improved. This measures the benefit of improvements east of Jefferson City.
- In the River Base scenario, the River line remains single-tracked and empty trains return via the Sedalia line, with improved passing sidings. This measures the incremental benefit of double-tracking the River line.
- In the Sedalia Base scenario, the Sedalia Subdivision was not improved. This run measures the incremental benefit of improvements to the Sedalia Subdivision.
- A Sedalia Double scenario explores the possibility of double-tracking the Sedalia instead of the River line. Sedalia double-track would replace both River line double-track and long Sedalia passenger passing sidings.
- Two special simulations explored reroute options using the Sedalia line during flood conditions on the River line.

Exhibit 6-48
St. Louis to Kansas City Scenario Development

Investments Included	***Base Case***	***Future RR***	***Jefferson Base***	***River Base***	***Sedalia Base***	***Sedalia Double***	***River Flooded w/Single***	***River Flooded w/Double***
Years Run	**2002**	**2002**	**2002**	**2002**	**2002**	**2002**	**2002**	**2002**
Jefferson City Sub Improvements	Freight Only and with Amtrak	✓		✓	✓	✓	✓	✓
River Sub Double-track		✓	✓		✓		Out of Service	Out of Service
Sedalia Sub Passenger Sidings		✓	✓	✓			✓	
Sedalia Sub Double-track						✓		✓

Freight train running time was longer in both the Jefferson Base and River Base simulations than it was in the current Base Case with Amtrak. *Therefore, the freight mitigation criteria for the MWRRS cannot be satisfied without the full set of improvements to both the Jefferson City and River lines*. This establishes the need for both the Jefferson City and River line investment packages even at 2002 freight traffic levels, so further analysis of these partial investment packages in 2020 is not needed.

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The Sedalia Base alternative shows that freight mitigation can be achieved without extending the passing sidings on the Sedalia line. Due to freight trains being diverted off the Sedalia onto the River line, the ability to do so without Sedalia siding improvements is not unexpected. However, long passing sidings on the Sedalia line are still needed for passenger use and they would provide significant added capacity for overflow freight or for emergency reroutes.

Clearly, there is a need to maintain at least some operations during flood conditions on the River line. The most severe flooding tends to occur west of Jefferson City, on the portion of the River line proposed to be double-tracked. During flooding, freight trains can operate bi-directionally via the Sedalia line. Extra locomotive power is required on eastbound coal trains to do this.

The existing Sedalia line does not offer enough capacity to handle even today's traffic in both directions, so operations have to be restricted. However, the improvements advocated for the MWRRS would extend or connect several Sedalia passing sidings to provide about 20 percent double-track. Another strategy would completely double-track the were examined for emergency freight operations on the Sedalia line:

- First, as shown in the River Base simulation, an improved Sedalia line can accommodate a *directional* (westbound) freight operation, along with MWRRS passenger trains. It was expected that this would routinely occur anytime maintenance on the River line takes a track out of service.
- The Sedalia line, even with planned improvements, does not have enough capacity to handle freight in both directions along with MWRRS passenger trains. However, bi-directional freight (at 2002 levels) could be accommodated on an improved single-track Sedalia by temporarily suspending MWRRS passenger service. The River Flooded w/ Single scenario simulates this.
- The Sedalia Double scenario double-tracks the Sedalia line instead of the River line. It continues directional operation, routing westbound freight trains over the Sedalia while loaded coal trains continue to use the River line.

While the Sedalia Double scenario shows satisfactory performance at 2002 traffic levels, it continues to mix freight and passenger operations rather than separating them. In the long term, this may lead to a cost and reliability penalty for both freight and passenger services. It may be better to take advantage now of the opportunity to completely separate freight from passenger operations west of Jefferson City.

The Sedalia Double option does offer one significant advantage: it provides enough capacity to support bi-directional freight along with full MWRRS passenger schedules, if the River line is flooded. However, this benefit would only accrue perhaps one week a year. To obtain it, passenger and freight operations would have to remain mixed for the remaining 51 weeks a year, even when the river is not flooded. Improved flood protection for the River line may be a better option than double-tracking the Sedalia line.

Base Case Calibration

Two variants of the 2002 Base Case were created: *freight only* and *with Amtrak trains*. These Base Case simulations identified three significant sources of delay:

- Eastbound Amtrak trains oppose westbound freight trains on the Sedalia line
- Delays occur around Jefferson City as freight trains wait for crew changes
- LSJ69 serves industry along the Sedalia line. If LSJ69 is released to serve industries along the single-track portion, through trains catch up taking significant delay, or else LSJ69 must be held in a siding waiting for a work window. In the post-MWRRS scenario, it actually becomes easier to avoid interference, since through freights would be diverted to the River line and the locals could operate at night when passenger trains are not running.

In data supplied by UP, average freight train speed from Kansas City to St. Louis was 18.6-mph and 24.1-mph in the westbound direction. This includes all delays and crew changing time. Faster westbound speeds result from the improved weight-to-power ratio of empty trains and from higher speed limits on the Sedalia line.

Union Pacific also furnished data on temporary slow orders and track outages. Although slow orders are a normal part of any rail operation, planned track condition upgrades and raising the FRA Track Class will reduce the frequency of slow orders that affect freight operations. For example instead of having a slow order that reduces speed from 50-mph down to 25-mph, a "slow" order in Class 5 territory may instead reduce speed from 90-mph down to 60-mph. Such a restriction would affect passenger trains but would have minimal effect on freight. On upgraded infrastructure, slow orders of such severity that they affect freight operations should be rare.

By including slow orders in the base case simulation, simulated running times could have been brought closer to real-world results. However, since the MWRRS plan allocates $170.7 million for track condition upgrades, slow orders were not simulated in the base case. Any train delay savings from elimination of slow orders would be *in addition to* savings from MWRRS line capacity improvements. This omission of slow orders from the base case tends to *understate* the delay mitigation benefit of the proposed MWRRS investment, which would clearly benefit freight as well as passenger trains.

MWRRS Mitigation Simulations

For establishing mitigation, RTC model simulations were developed at 2002, 2012 and 2020 traffic levels.

- 2002 Base Case and 2012 Do Nothing scenarios were developed with and without current Amtrak trains. These were compared to a Future Railroad simulation for each forecast year.
- For 2020 volume, a freight-only Do Nothing simulation of the existing infrastructure was simulated. The RTC model aborted immediately when Amtrak trains were turned on. This freight-only Do Nothing result was compared to a 2020 Future Railroad simulation.

Proposed Future Railroad capacity enhancements are shown in Exhibit 6-49. At first, even with all improvements, freight train delays were too high. Further simulation was used to help fine-

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tune interlocking configurations, crossover locations and the configuration of the crew-changing yard at Jefferson City – until 2020 freight delays were reduced below the level that would have occurred if the MWRRS did not exist.

Diverting through freights onto the River line would give passenger trains their own dedicated track west of Jefferson City to Kansas City. Long sidings on the Sedalia line would facilitate running meets between MWRRS passenger trains, and would increase freight capacity for emergency use. In the future case simulation, two single-track bottlenecks on the Jefferson City line were eliminated and three sections of triple-track were added along with a new support yard at Jefferson City. This complete set of upgrades was introduced at the same time as MWRRS passenger service.

Exhibit 6-50 shows forecasted total elapsed time in each of three simulated years – 2002, 2012 and 2020. Three curves are shown – the current railroad with and without Amtrak, and the proposed MWRRS mitigation solution. In 2002, adding the proposed MWRRS infrastructure would reduce train-running time substantially below its current value. *As traffic levels increase in the future, proposed MWRRS infrastructure additions become even more valuable.* By 2012, the MWRRS mitigation outperforms the current railroad even *without* Amtrak. Because the RTC model was unable to operate at 2020 traffic levels on the current railroad with Amtrak trains, a value for the result of that run was estimated.

The 2002 Base Case generates 11 days of freight train delay; by 2020, without double-tracking the Osage and Gasconade River bridges, this would rise to 121 days in the Do Nothing scenario even if Amtrak trains were discontinued. Freight delays grow by a factor of 12 when volume less than doubles. This disproportionate increase in train delays clearly shows that the system will be reaching its capacity limit by 2020. If Union Pacific proceeds with double-tracking the two river bridges, then additional triple-tracking between Jefferson City and St. Louis (beyond what is included in the current infrastructure plan for the MWRRS) will be needed to reduce 2020 freight delays below the level that would have occurred, if MWRRS did not exist. Development of such a strategy will require an engineering field assessment to determine the areas where triple-tracking may be feasible, along with additional simulation modeling effort to ensure the delay mitigation criteria for the MWRRS are fully satisfied. A likely scenario is full triple tracking except for the tunnels at Gray’s Summit and the Osage and Gasconade River bridges, which may remain only double tracked. It is anticipated this expanded modeling effort will be funded in a future project phase.

Exhibit 6-49
Proposed Future Railroad Capacity Additions

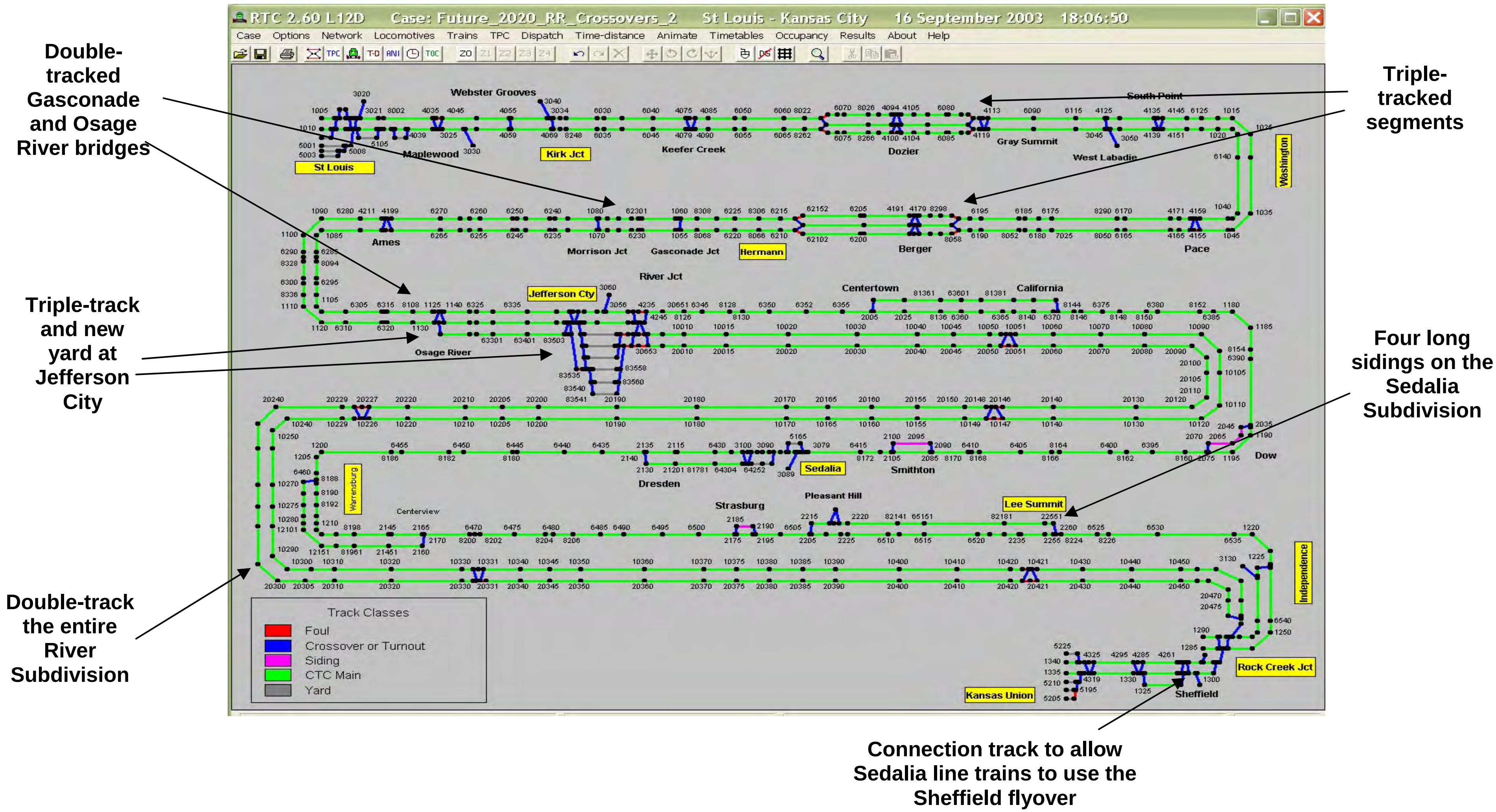

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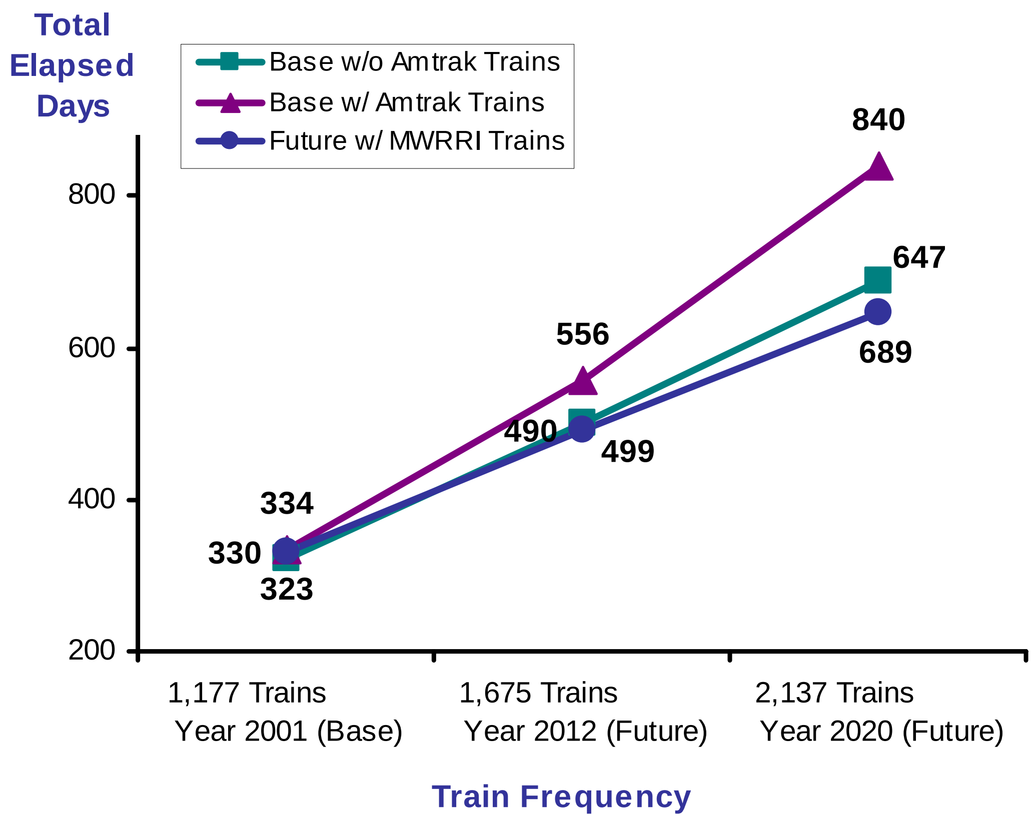
Exhibit 6-50
St. Louis-Kansas City Mitigation Statistics
30-day Simulation – Summary Statistics for Freight Trains Only
Total Running + Delay Time of All Freight Trains



6.25.7 Conclusions and Recommendations

The St. Louis to Kansas City line is one of Union Pacific's highest density freight corridors. Already carrying more than 100 million gross tons per year, freight traffic is forecast to almost double by 2020. In addition, the line carries two round trip Amtrak trains each day. The goal of the MWRRI is to increase passenger service to six round trips by 2013 and to shorten the schedule by one hour by introducing new tilting trains (that can go faster around curves) and a Positive Train Control (PTC) signaling system.

Increase in freight train delays occur because of projected freight traffic growth and would happen even without the addition of MWRRS passenger trains. To partially offset these delays, Union Pacific has indicated it is planning to double-track the Osage and Gasconade River bridges, and to make whatever yard investments are needed at Jefferson City to support its own operations. This report develops an infrastructure plan for returning 2020 freight delays to a

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level *lower* than they would be without any passenger trains on existing infrastructure. Specifically:

- Capacity needs west of Jefferson City would be fully addressed by double-tracking the River line and by upgrading the Sedalia line to serve as a dedicated high-speed passenger and freight route and as a relief route for high-speed freight or emergencies. Since westbound traffic consists mostly of empty trains, these could be diverted as needed to the Sedalia line without damaging MWRRS passenger tracks.
- Infrastructure improvements for the MWRRS would eliminate the two remaining single-track bottlenecks and install three sections of triple-track to allow MWRRS and intermodal trains to overtake slower coal trains. Since this line segment is already double-tracked, infrastructure improvements for the MWRRS would be selectively targeted to address the most urgent capacity needs. These include major construction to double-track bridges across the Osage and Gasconade Rivers, and providing triple track at critical meet points.

The proposed infrastructure improvements for the MWRRS would provide enough capacity west of Jefferson City not only for day-to-day operations but also to meet emergency and maintenance needs. By making an upgraded Sedalia line available during flood conditions or to relieve freight congestion on the River line, the need for building more than two tracks on the River line can be avoided.

Some benefits to Union Pacific of the infrastructure improvements for the MWRRS would include:

- An investment of $64.4 million to install a Positive Train Control system and other signaling upgrades. The RTC model simulation does not reflect the benefits of this PTC investment, which has reduced train delays in other MWRRS corridors by more than 10 percent.
- An investment of $170.7 million for general track condition upgrades, *over and above* the cost of line capacity additions and River line improvements. This would dramatically reduce freight train delays due to slow orders. These train delay savings have been neither quantified nor included in the RTC model mitigation.
- An investment of $58.6 million for grade crossing improvements. In addition to saving lives and reducing property damage, this investment would reduce the frequency of severe operational disruptions caused by grade crossing accidents.
- The capacity enhancements suggested here would offer significant *benefits* to yard and terminal operations. With directional running, if either line is shut down it is difficult to divert trains to the other track. With a double-tracked River line, one track could be closed for maintenance while full operations continue using the other track. With the added line capacity west of Jefferson City provided by MWRRS, the need for holding or staging trains in Kansas City and St. Louis yards for track maintenance curfews should be dramatically reduced.

A projected increase in freight delays on current infrastructure by 2020 remains a serious concern. To maintain freight delays near their current level along with MWRRS operations, it will be necessary to fully triple-track the Jefferson City line except perhaps for a few short stretches at tunnels and bridges. To reduce costs, MWRRS trains should possibly switch to the BNSF alignment east of Pacific (MP 35). Some other joint-running or capacity-sharing arrangement with BNSF from Pacific into St. Louis might also be possible. For perspective, Union Pacific today operates an average of 45 trains-per-day (including passenger trains) on its double-tracked line between St. Louis and Kansas City. This is forecast to grow to 88 trains-per-day by 2020, an average of 44 trains-per-track per-day on a double-tracked line.

By comparison, between O'Fallons and North Platte, NE, Union Pacific operates 125-150 freight trains per day on a triple-tracked rail line or, 42-50 trains per track per day. This volume was formerly handled on a double-track line, but not without significant problems. Union Pacific's own operating experience, therefore, confirms the possibility of operating as many as 88 trains-per-day over a double-tracked Jefferson City line, although that would clearly be reaching the upper limits of line capacity. The three sections of triple track provided in the current simulation would be intensively used to allow overtaking not only by passenger trains, but also by higher-priority automotive and intermodal freight trains.

While the simulation suggests this partial triple-tracking solution may be adequate for handling MWRRS trains along with today's freight traffic volume, without full triple tracking by 2020, the proposed MWRRS service could be expected to suffer reliability problems. Union Pacific's St. Louis to Kansas City corridor is one of the densest bulk and manifest freight routes in the United States. The challenge of overlaying a high-speed passenger network on this route is further complicated by the curvature and gradient profile of the line. At projected 2020 traffic levels, assuming Union Pacific funds the cost of double-tracking the Osage and Gasconade River bridges, the capacity needed to support proposed MWRRS service would be equivalent to providing one additional track all the way from St. Louis to Kansas City. However in the context of the MWRRS project, this is no greater investment than has been proposed for other corridors, such as from Cleveland to Toledo where a dedicated third track would be constructed alongside nearly the entire length of the Norfolk Southern line.

With its own dedicated track from St. Louis to Kansas City, the proposed MWRRS service could operate with minimal interaction with existing freight service. However to optimize the freight benefit of making the investment, this plan instead envisions adding a third *shared* track from St. Louis to Jefferson City rather than a dedicated passenger line. West of Jefferson City, using the River route for freight would completely separate freight from passenger operations. Given a nearly $1 billion investment that would effectively separate freight from passenger trains all the way from St. Louis to Kansas City, TEMS believes these two kinds of services should be able to coexist without difficulty.

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6.26 *Chicago–Toledo-Cleveland Rail Corridor*

The aim of this analysis was to:

1) Assess the impact of MWRRS high-speed 110-mph passenger train operations on the Toledo-Cleveland railroad corridor, and
2) Confirm the initial estimate of the infrastructure improvements needed to maintain freight operations at current levels of performance. This study is strictly a feasibility-level analysis that identifies line capacity issues and evaluates potential operational conflicts on the corridor.

Norfolk Southern owns the Toledo-Cleveland line. This analysis has been advanced prior to the initiation of detailed operational discussions or negotiations with the railroads, or the identification of specific project funding sources. Future engineering assessments will require considerably more discussion to ensure railroad concurrence. Final design concepts and recommended capital plans will depend on detailed operations analysis, design coordination, and in-depth discussions with the freight railroads. As the MWRRS project moves beyond the feasibility phase, railroad involvement and coordination will become increasingly important.

Chicago-Toledo Route Alternatives

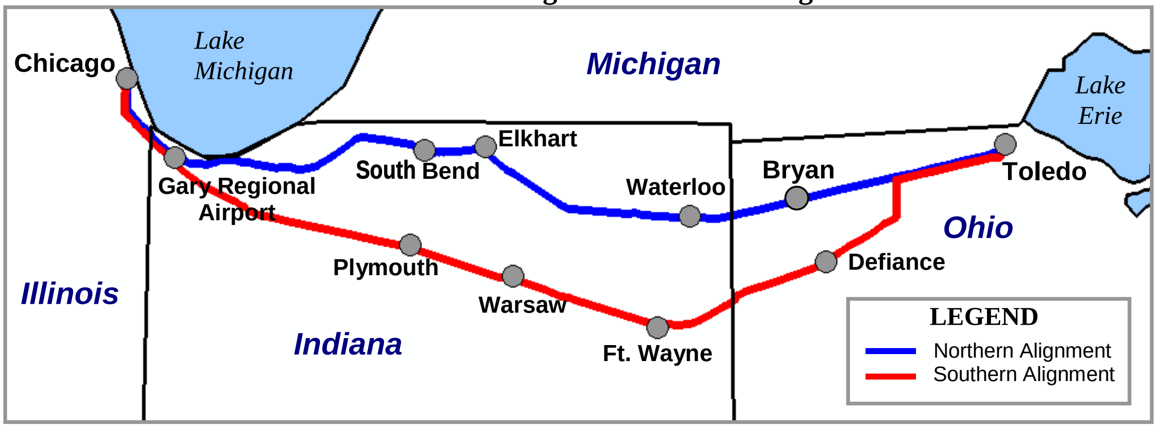
Originally, the MWRRS had considered only Norfolk Southern's Chicago Line, also called the "Northern Alignment" as the route between Chicago, Toledo and Cleveland. However, in 2002, the Indiana Department of Transportation requested a comparative analysis of an alternative "Southern Alignment"[12] from Buffington Harbor, near the Gary Airport in northwest Indiana, to Delta, Ohio, west of Toledo. This alternative route, which passes through Gary, Plymouth, Warsaw, Ft. Wayne and Defiance, has relatively light freight traffic.

As shown in Exhibit 6-51, the MWRRS alternative routes between Chicago and Toledo consist of several route segments, each of which has distinct ownership and operational characteristics. Amtrak currently operates the daily *Capitol Limited* (Washington-Pittsburgh-Chicago) and the daily *Lake Shore Limited* (New York-Albany-Chicago) over Norfolk Southern's "Chicago Line" (the northern alignment) with stops in Hammond, South Bend, Elkhart, Waterloo, Bryan, and Toledo.

Despite being approximately 13 miles longer, because of the lower density of traffic and upgraded track, the Southern route is up to nine minutes faster than the Northern route. In financial and economic terms, the Southern Alignment was shown to be more beneficial than the Northern route. This is because the Southern Alignment serves Fort Wayne, and allows higher train speeds at a lower cost by redeveloping a light-density freight rail line for passenger use.

[12] See the *Northern Indiana/Northwestern Ohio Routing Study*, TEMS, Inc., November 2002.

Exhibit 6-51
Northern and Southern Alignments from Chicago to Toledo



Several factors led to this finding. Higher infrastructure capital costs were found for the northern route. Because freight traffic levels on the existing northern corridor are particularly high, a new dedicated track would be required along the entire length of the corridor. In areas where there is not enough room to construct the adjacent passenger track at the required minimum distance from the freight line, speeds would be reduced to 90 mph. This slower speed on portions of the northern route increased the overall travel time and subsequently lowered the projected ridership for the corridor. Competitive commuter rail service between South Bend and Chicago had a further negative impact on the overall projections for the northern route. Given the selection of the southern route, Indiana DOT proposed to enhance the NICTD system by providing additional express train service between South Bend and Chicago. This provides an effective connection with the MWRRS at Gary.

The substantially lower freight density on the southern corridor reduced the cost of that route since it allowed for plans to rebuild the existing tracks without a need to build an entirely new set of adjacent tracks. Because of the lighter freight density on the Ft. Wayne line, it is anticipated that opportunities will exist for cooperative freight and passenger shared use of the line.

By 2012, MWRRS plans to introduce new high-speed (110-mph) train operations and a Positive Train Control (PTC) signaling system. Nine daytime MWRRS round-trips would operate between Cleveland and Toledo (eight of which would continue to Chicago), in addition to the two Amtrak long-distance trains that operate today[13]. By raising Chicago-Toledo-Cleveland train speeds from 79 to 110-mph, running times would be shortened from the current 7:15 to 4:48 (HH:MM). New trains would use tilting technology to allow faster speeds through curves, while maintaining passenger comfort and ride quality.

[13] In addition, Ohio's proposed high speed "Cleveland Hub" service would use the Cleveland-Toledo portion of the corridor. Cleveland Hub would operate an additional eight round-trips from Cleveland to Detroit on a 2:47 (HH:MM) schedule. We assume that the single MWRRS Toledo-Cleveland round trip will eventually be replaced by Cleveland Hub service, reducing the number of daily MWRRS round-trips from nine to eight.

On the Southern Alignment between Buffington Harbor (Gary Airport) and Delta, Ohio, long high-speed sidings for passenger train meets would be added according to the MWRRS standard of 20% double track. Sidings would be located at Valparaiso, Hanna, Plymouth, Warsaw, Van Dale, Fort Wayne, Antwerp and Defiance. Freight train interference on the Fort Wayne line should not be an issue since Conrail downgraded its Fort Wayne line to secondary status in 1990 only local freight service remains. Track configuration details for local industry switching remain to be defined during the preliminary engineering phase of this project.

At Delta, the passenger alignment would use the Indiana & Ohio railroad bridge, crossing over the NS Chicago Line and would then turn right to parallel the NS freight tracks.

In Toledo, representatives from Norfolk Southern, Amtrak and the State of Ohio conducted a joint field investigation of the Toledo terminal operations. Engineering plans for running the passenger alignment around Airline Yard remain to be finalized, but a $40 million capital placeholder has been designated for that purpose.

Toledo-Cleveland

From Toledo to Cleveland, the MWRRS passenger alignment would follow the Norfolk Southern right-of-way on the north side of the existing Chicago Line. Amtrak operates the *Capitol Limited* and the *Lake Shore Limited* over this route with stops in Sandusky, Elyria, and Cleveland.

As requested by both CSX and NS, wherever 110-mph FRA Class 6 operations are planned, a new high-speed track would be added with 28-foot centerline offset from the existing freight tracks. MWRRS train speeds would be restricted to 90-mph or less whenever a 28-foot separation cannot be maintained.

The MWRRS capital plan assumes that the Toledo-Cleveland passenger rail alignment would be mostly separated from the freight mainline operation. However, the MWRRS proposes to share the existing NS double track in several places where it would not be economically feasible to widen the right-of-way. The shared track segments, where freight and passenger trains would co-mingle include locations in Toledo, the Sandusky Bay Causeway and the bridge crossings over the Huron and Vermilion Rivers. Because of these short co-mingled track segments and the need for passenger trains to meet each other, MWRRS passenger trains *would not be completely separated* from freight between Toledo and Cleveland.

6.26.1 Toledo-Cleveland: Past and Present Freight Flows

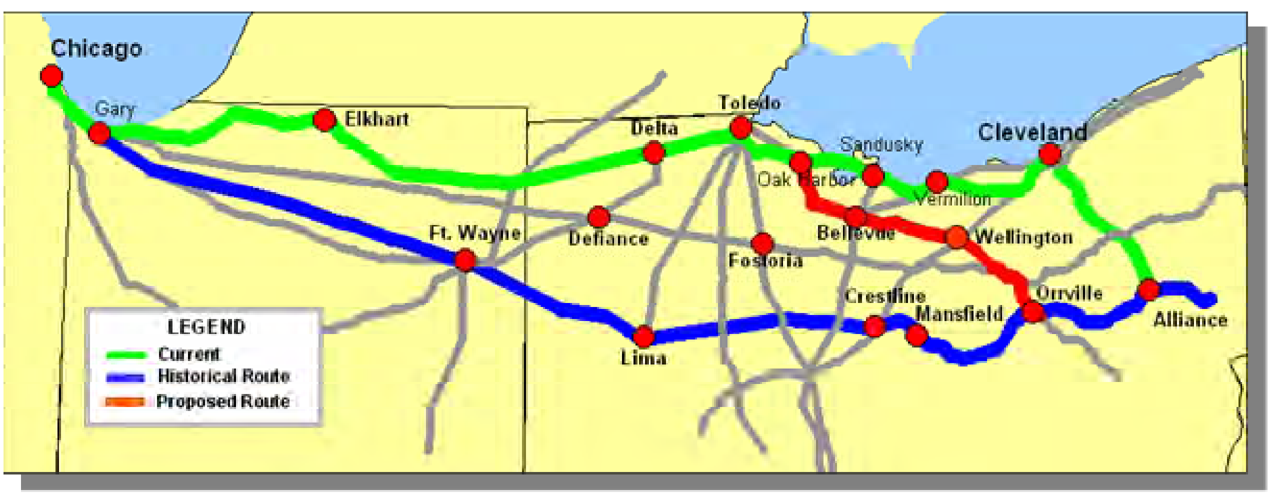
In examining railroad capacity on the Toledo-Cleveland freight corridor, it is helpful to highlight recent changes in freight railroad traffic flows. Freight railroad operations in the Toledo–Cleveland corridor changed dramatically in 1999 with the acquisition of Conrail by NS and CSX. As a result of the acquisition, the major flow of rail traffic has changed considerably.

Prior to 1999, the traffic was accommodated over two railroad corridors running through Fort Wayne. Today, the major flows of freight traffic use the NS Toledo–Cleveland line along with a parallel CSX route.

- As shown in Exhibit 6-52[14], NS Chicago traffic from Pennsylvania and Maryland, which before 1999 used Conrail's direct line west through Crestline and Fort Wayne (blue route), is now routed from Alliance to Cleveland instead (green route). A possible future routing for this traffic via Orrville and Bellevue is shown in red. This route alternative will be discussed in more detail in section 6.26.6.
- As shown in Exhibit 6-53, prior to 1999, NS Chicago traffic originating on the former Nickel Plate (NKP) east of Cleveland was handled on the line via Bellevue and Fort Wayne (blue route). Rerouting this former NS traffic on the new route via Toledo alleviated capacity constraints on NS' Chicago–Fort Wayne line. However, the old NS line from Cleveland via Toledo still remains an alternative for this traffic, or a new routing via Wellington and Bellevue (red route) may also be a possibility for it. This route alternative will also be discussed in more detail in section 6.26.6.

Currently, the east and west ends of the NS Cleveland-Toledo line have heavier volumes of freight traffic than the middle portion of the route. This is due to the NS Bellevue Yard which collects merchandise carload traffic and operates as a major classification point for north-south shipments heading into traditional NS territory in the south. To allow trains to reach Bellevue from the acquired Conrail (NYC) line, NS installed connection tracks shown in 6-54, 6-55 and 6-56, at Vermilion and Oak Harbor.

Exhibit 6-52
Pennsylvania and Maryland to Chicago (Former Conrail Traffic)



[14] In Exhibits 6-50 and 6-51, a "proposed route" option is also shown in red. See section 6.33.

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Most NS bulk and intermodal trains continue to operate over the direct Cleveland-Toledo line through Sandusky. However, freight trains often use the connection tracks at Oak Harbor and Vermilion to stop at Bellevue yard. This freight diversion via Bellevue reduces the number of trains crossing the Sandusky Bay causeway, which is a critical capacity bottleneck on the line. So, the east and west ends of the Cleveland-Toledo line have heavier freight traffic than the middle portion.

Exhibit 6-53
Buffalo to Chicago (Former NS Traffic)

Exhibit 6-54
Norfolk Southern Toledo–Cleveland: Two Routes

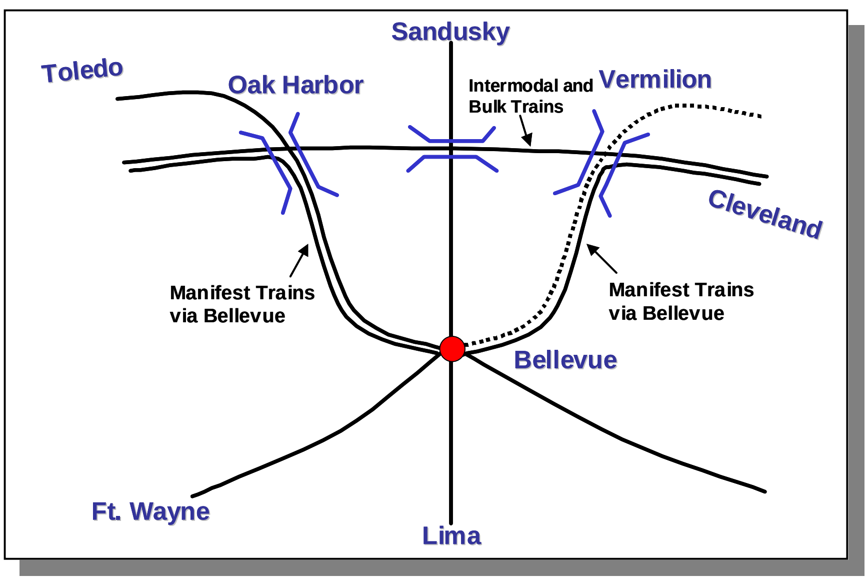


Exhibit 6-55
NS Oak Harbor Connector

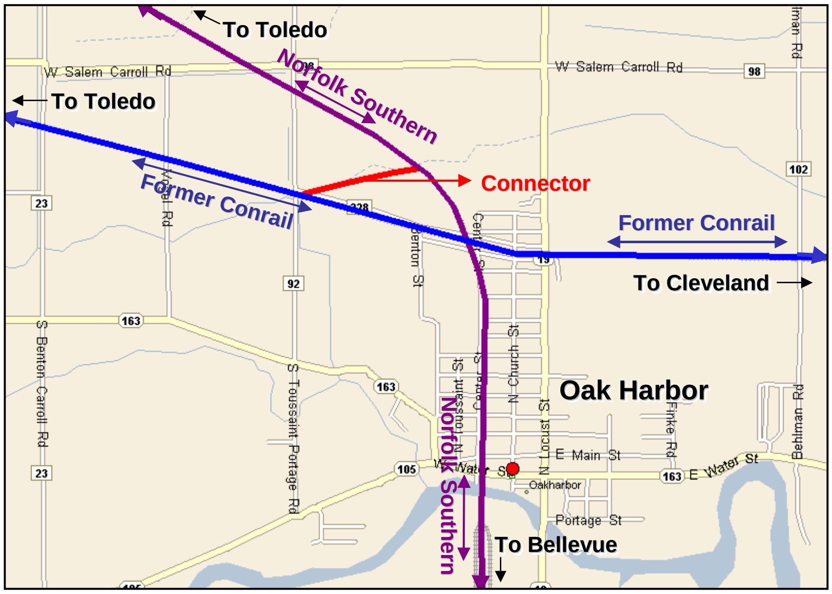
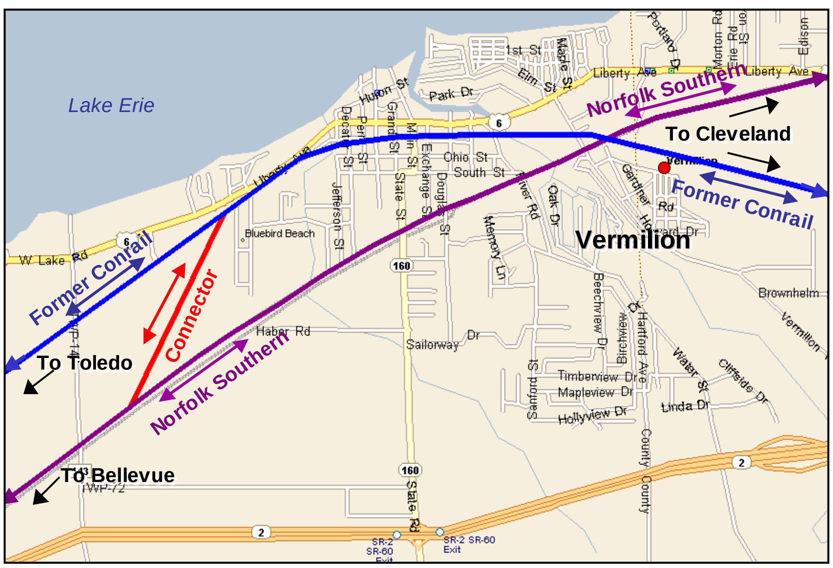


Exhibit 6-56
NS Vermilion Connector



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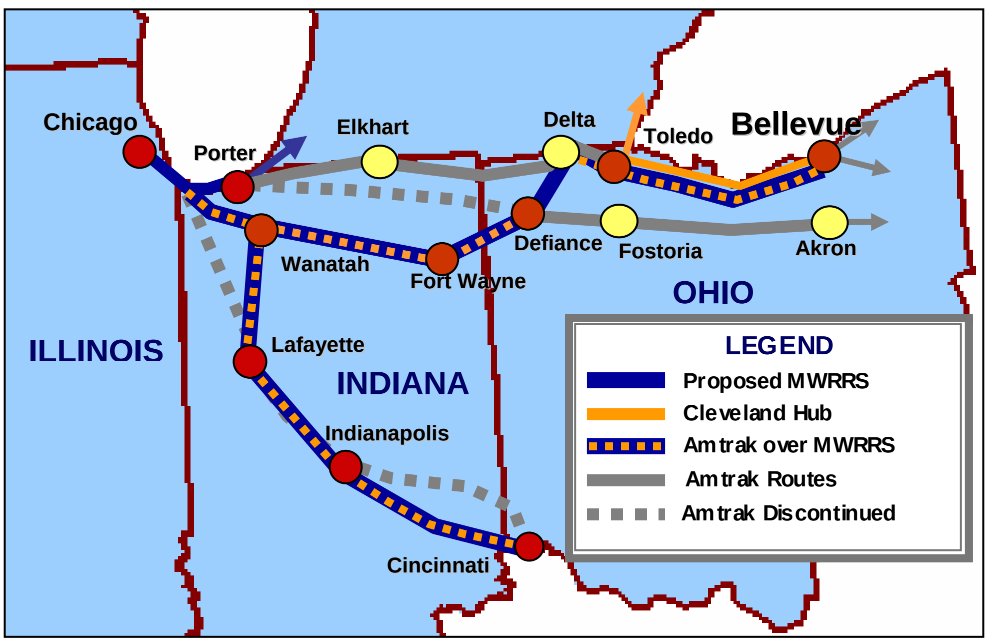
6.26.2 Possible Benefits to Amtrak Long-Distance Trains

Assuming existing Amtrak long-distance trains remain in operation, Exhibit 6-57 illustrates the potential rerouting of Amtrak's trains in northern Indiana and Ohio. By removing two daily Amtrak passenger trains in each direction from CSX's Chicago-Defiance line segment, and by taking advantage of the MWRRS high-speed track between Delta and Cleveland, MWRRS investments should positively impact both Amtrak service and freight railroad capacity. For example:

- Only two trains serve the Chicago–Cleveland passenger market today: Amtrak's Chicago–New York *Lake Shore Limited* and Chicago–Washington *Capitol Limited*. Both trains can take advantage of capacity improvements made by MWRRS between Delta and Cleveland.
- Amtrak's *Three Rivers* operates today on a CSX routing through Akron and Fostoria, OH. With restoration of the Fort Wayne line for high-speed passenger service, the *Three Rivers* could be rerouted into Fort Wayne by adding a connection track at Defiance, OH.
- Amtrak's *Cardinal* operates today on a daily basis to Indianapolis and tri-weekly through to Cincinnati and Washington, D.C. While daily Amtrak service to Indianapolis will be replaced by MWRRS, tri-weekly long-distance service through to Washington may continue. Presently, the *Cardinal* is routed over congested freight tracks through the Chicago terminal, but MWRRS would offer an even better option. The *Cardinal* could operate over the MWRRS corridor from Chicago to Wanatah, then turn south on MWRRS' Cincinnati line.

Exhibit 6-57
Proposed Passenger Service in Northern Indiana and Ohio



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6.26.3 Simulation of the Chicago–Toledo-Cleveland Corridor

NS freight train volumes shown in Exhibit 58 were estimated based on a peak-day extracted from NS defect detector data. An annual growth rate of 2% was assumed for carload and bulk freight, and 5% for intermodal. No growth was assumed for local trains. The same growth rates were applied to every line segment.

Exhibit 6-58
NS Cleveland-Toledo Projected Train Counts

Train Group	2002			2010			2020		
	Toledo-Oak Hbr	Oak Hbr-Vermilion	Vermilion-Cleveland	Toledo-Oak Hbr	Oak Hbr-Vermilion	Vermilion-Cleveland	Toledo-Oak Hbr	Oak Hbr-Vermilion	Vermilion-Cleveland
Amtrak	4	4	4	4	4	4	4	4	4
Freight	36	36	36	41	41	41	47	47	47
Short Frt	8	0	12	9	0	14	11	0	17
Intermodal	12	12	12	18	18	18	31	31	31
Local	3	3	3	3	3	3	3	3	3
MWRRS	N/A	N/A	N/A	18	18	18	18	18	18
Total	**63**	**55**	**67**	**93**	**84**	**98**	**114**	**103**	**120**

When MWRRS passenger service was introduced in the simulation, investments were simultaneously added to restore freight delays to the level they would be without the addition of passenger trains to the line(s). Several simulations were run to evaluate the impact of different combinations of improvements at projected traffic levels for 2010 and 2020. Nine 30-day scenarios were run as a *Typical Day* analysis. The simulations showed four main freight benefits:

- **Installation of a Positive Train Control system by MWRRS** can improve performance by allowing closer train spacing and raising line capacity.
- **Planned Track Condition Upgrades** from FRA Class 4 to Class 5 and signal upgrades would allow raising freight speed from 50- to 60-mph and increasing intermodal speed from 60- to 70-mph, should NS choose to take advantage of this capability[15]. The engineering costs provide for upgrading 83 miles of existing track, with 33% tie replacement plus surfacing.
- **Additional line capacity provided by MWRRS** would add more than 20 miles of new Class 5 "passenger sidings" – fully accessible to freight trains. In the simulation, the Class 6

[15] Although FRA Class 5 track allows freight operation at up to 80-mph, most freight equipment is unable to operate at that speed without special modifications to stabilize the suspension system. If only a single car on a train is speed restricted, the entire train must be speed restricted. In addition, the design of signal systems must permit adequate stopping distance within the braking capabilities of the train. For this reason, U.S. freight train speeds are likely to remain in the 60- to 70-mph range for the foreseeable future – although higher speeds might be possible for specially equipped trains.

dedicated passenger track was also made accessible for occasional freight use with a 30-mph speed limit. Track capacity added by MWRRS would allow NS to expedite premium intermodal and automotive trains, whereas today it may not be feasible to do so.

- Amtrak long-distance trains would be accommodated on new MWRRS infrastructure which would mitigate any Amtrak-caused delays that exist in the Base Case.

6.26.4 Current Cleveland-Toledo Capital Plan

- Although NS freight would be completely separated from MWRRS passenger operations west of Delta, OH, the current MWRRS plan calls for sharing the NS right-of-way between Delta and Cleveland. The study team, Amtrak and, to some extent, Norfolk Southern developed the concept for improving the railroad infrastructure for shared freight and passenger operations over this route segment: The plan would add 94 miles of dedicated Class 6 110-mph track between Delta and Berea, with 28' off-set from the existing freight tracks. This is required by the freight railroads to allow 110-mph passenger train operations.
- The engineering cost estimate *also* provides for upgrading 83 miles of existing track with 33% tie replacement, along with 20 miles of discretionary "passenger siding" but does not specify exactly where this additional mileage will be located. This track can be placed where it can do the most good, and would be constructed to Class 5 90-mph standards.

The current plan does *not* completely separate passenger trains from freight operations. Had it been possible to construct new track along the *entire* length of the Toledo–Cleveland corridor, complete separation of passenger from freight operations might have been achieved. Then freight interference would not have been a concern. With shared line segments however, the problem is how best to add infrastructure to mitigate freight delays. This led to development of two different strategies for deploying discretionary mileage: a "uniform-spacing" and "freight-optimized" configuration:

- **A configuration based on uniform spacing of passing sidings** locates high-speed passenger sidings primarily to facilitate meets between passenger trains. This design was developed as if the Toledo-Cleveland route were a single-tracked line built for exclusive use of MWRRS passenger trains. It assumes MWRRS trains will meet or pass each other using only the passenger sidings provided, and not use freight tracks at all except on the shared segments. A basic design principle for single-tracked lines is to space passing sidings equally. This has been shown to minimize train delay[16].

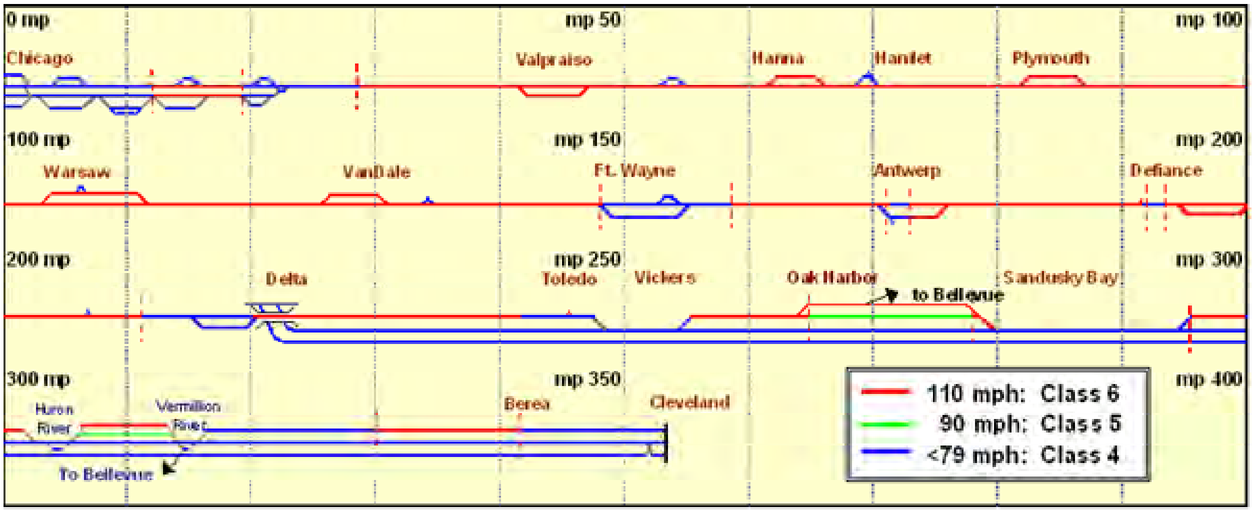
[16] Kraft, E. R. (1988) Analytical Models for Rail Line Capacity Analysis, *Journal of the Transportation Research Forum* **29** (1) 153-162.

- **A freight-optimized configuration** places added capacity where freight trains need it most: east of Vermillion, or west of Oak Harbor. This plan assumes MWRRS passenger trains use any available track to meet and pass one another. Therefore, passing siding location imposes no practical constraints on scheduling of passenger trains. Conversely, placement of the siding mileage can be improved to produce greater benefit to freight operations. The uniform-spacing design adds capacity *between* Vermilion and Oak Harbor, where freight volumes are lower. A freight-optimized design corrects this by shifting more capacity west of Oak Harbor, and by shortening the length of the critical bottleneck at the Sandusky Bay Causeway.

Design of the Uniform-Spacing Configuration

Although the ideal placement for passing sidings is to space them equally, it may be necessary to adjust locations to account for local engineering constraints. In this case, the Sandusky Bay crossing, and Huron and Vermilion River bridges constrain where passenger sidings may be located. The assumption that passenger train meets and passes can be limited only to "passenger sidings" is not very practical. Current MWRRS train schedules were built around customer-preferred departure times and for efficient equipment utilization, not to optimize meet/pass performance. Secondly, even if schedules were built around a need to avoid using freight tracks, small delays -- inevitable in daily operations -- would still require freight tracks to be occasionally used to avoid further compounding those delays. See Exhibit 6-59 for a graphic depiction.

Exhibit 6-59
Proposed MWRRS Chicago–Cleveland Line: With Uniformly Spaced Sidings



110-mph passenger tracks are shown in red; 90-mph "passenger siding" miles are shown in green. Crossovers or interlocking details are not shown in these schematics.

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Design of the Freight-Optimized Configuration

An option to reduce freight train delays would be to allow freight trains to use the new MWRRS infrastructure. However, high-speed track is difficult to maintain under heavy tonnage. Without any restrictions on axle loads or freight train speeds using high-speed tracks, this could prove to be a very expensive solution. A compromise, therefore, would allow shared use of 90-mph MWRRS "passenger sidings" [17] but restrict the speed of freight trains on the 110-mph passenger tracks to perhaps 30-mph. To adjust the uniform-spacing proposal to better meet freight needs, the location of the passenger siding mileage was changed as follows:

- Construct a single dedicated passenger track at FRA Class 6 standards to support 110-mph passenger operations. In our *MISS-IT*© simulation, freight trains were allowed to use these high-speed tracks, but a 30-mph speed limit was imposed.
- Construct additional "passenger siding" mileage at FRA Class 5 standards so freight trains may use these tracks without speed restriction. Class 5 tracks allow up to 90-mph passenger speeds and are the standard for high-speed freight track in the US.[18]
- For further running time improvements, existing freight tracks between Cleveland and Toledo may be upgraded from FRA Class 4 to Class 5 standards[19]. Upgrading the freight tracks would allow flexible use of any track for meeting and passing passenger trains, improve ride quality, reduce fuel consumption of freight trains, and raise the speed limit for intermodal service.

The freight-optimized configuration deploys the two passenger sidings farther west than they are if sidings are uniformly spaced, as shown in Exhibit 6-60:

- The proposed siding in the uniform spacing configuration from Vermilion to Huron is located west of the Vermilion connection track – therefore it cannot be used by many freight trains. However, the MWRRS plan provides another section of third track just east of the Vermilion river bridge that can be used for holding NS freight trains awaiting clearance to move onto the connection.

  Therefore, this siding mileage was moved farther west to create a seven-mile passenger siding from MP 233.0 to MP 240.6, Huron to Sandusky. This appears as four-track territory in Exhibit 6-60. The passenger siding should be constructed as a third freight track immediately adjacent to the existing line, with 28' separation between the passenger siding and the proposed Class 6 high-speed main line.

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[17] Restricting the speed of freight trains reduces the dynamic loading on the infrastructure and therefore reduces the track damage they cause.

[18] Class 5 track allows up to 80 mph freight speeds, but most freight equipment cannot go that fast. Practically, Class 5 allows 70-mph intermodal trains. For a more complete description of the FRA Track Classification system, see: http://www.trains.com/Content/Dynamic/Articles/000/000/003/010pwhmw.asp

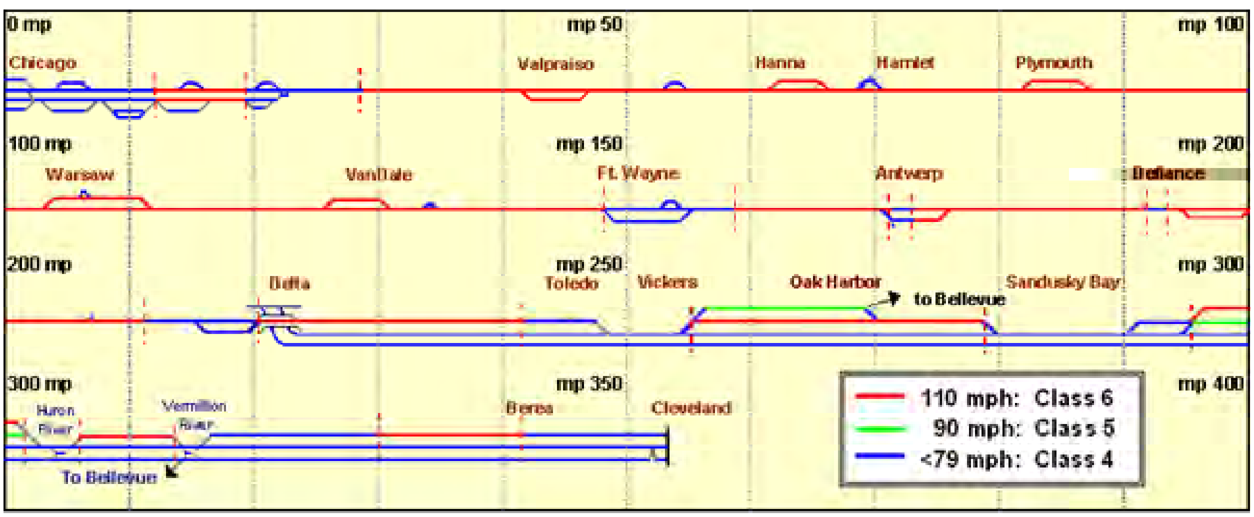
[19] Subject to negotiation of an appropriate cost-sharing agreement with the freight railroad for the added cost of maintaining higher-quality Class 5 track.

Even though 110-mph territory ends at MP 240.6, it appears there is room to extend a third-track at conventional speed further west another four miles to MP 244.8. The third track at Sandusky should be extended as far west as possible, to minimize the length of the Sandusky Bay causeway double-track section. This extension is shown as a blue track in Exhibit 6-60.

- The NKP connection track at Oak Harbor enters the NS mainline on the north side. Entering and exiting freight trains at Oak Harbor would conflict with high-speed passenger operations planned for the north side. To deal with the awkward freight connection at Oak Harbor, the freight-optimized configuration proposes to construct a freight track on the *north* side of the proposed MWRRS track to eliminate freight interference at Oak Harbor. This track would extend from the Oak Harbor connection at MP 265.7 all the way to the west end of the 110-mph section at Millbury, MP 280.7. With this design, the proposed 110-mph track must be placed in the *middle* of the right-of-way between two freight tracks or else a flyover bridge must be constructed to move passenger trains back to the outside track. MWRRS might ask NS to waive the usual 28' separation requirement in this area.

Another solution for addressing the Oak Harbor connection problem may be to restore the abandoned rail line from Fremont direct to Millbury. Freight trains would enter Millbury on the south side, eliminating conflicts with MWRRS passenger trains. Some portions of this right-of-way have been converted to trail use as the North Coast Inland Trail[20], so restoration of rail service over this alignment may no longer be feasible.

Exhibit 6-60
Proposed MWRRS Chicago–Cleveland Line: With Siding Mileage Optimized for Freight Needs



110-mph passenger tracks are shown in red; 90-mph "passenger siding" miles are shown in green. Crossovers or interlocking details are not shown in these schematics.

[20] See: http://home.earthlink.net/~bikeohio/elmore.html

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6.26.5 Simulation Results

- A 2002 Base Case simulated current operations at traffic levels, *with* Amtrak but *without* MWRRS passenger trains. The 2002 Base Case assumed a conventional signaling system. The 2010 and 2020 "Base + Growth" scenarios were simulated *twice*: once with conventional signaling and again with a PTC signaling system. Addition of the PTC system reduced freight delays even as additional freight traffic was added.
- A "Do Something" scenario that would operate MWRRI trains over existing freight tracks was not simulated, since it would have contradicted Norfolk Southern's requirement that new tracks be built alongside their existing line to support passenger operations at 110-mph. Neither 90-mph or 79-mph operation were part of the current project scope. Neither engineering costs nor a demand forecast had been developed for them, so these reduced-speed scenarios over the existing NS trackage were not evaluated.
- MWRRS trains were added to expanded infrastructure with dedicated 110-mph tracks to develop three scenarios. These were:
  - "Uniform spacing"
  - Freight-optimized" and
  - "Freight-optimized" with freight tracks upgraded to FRA Class 5.

The simulations show an improved ability to expedite intermodal and other time-sensitive freight trains over the expanded infrastructure. While bulk train delays increase slightly, these delays are more than offset by the improvement to intermodal trains so the overall level of freight delay is reduced. The simulations show that freight operations would significantly benefit from the proposed line capacity improvements, higher track speeds and installation of a PTC signaling system, all funded by MWRRS. Beyond this, freight transit times could be substantially reduced should NS choose to take advantage of the ability to run its intermodal trains at a higher speed on upgraded Class V tracks.

All three scenarios improve freight train performance over the Base Case, however the freight-optimized configuration performs best. Compared to 2010 and 2020 "Base + Growth with PTC" runs that *include PTC in the Base*, it can be seen that the proposed mitigation does *not* rely on either PTC benefits or on freight speed improvements. Exhibit 6-61 details the results of a 30-day simulation of freight trains on the NS Cleveland-Toledo line.

Exhibit 6-61
NS Cleveland-Toledo 30-day Simulation -- Summary Statistics for Freight Trains Only*
Times in DDD:HH:MM format

Statistic	2002	2010 Frequencies					2020 Frequencies				
					Fast Freight					Fast Freight	
	Base	Base + Growth	Base + Growth w / PTC	Freight Optim	Uniform Spacing	Freight Optim	Base + Growth	Base + Growth w / PTC	Freight Optim	Uniform Spacing	Freight Optim
For All Freight Trains:											
# of Run Time Trains	71	85	85	85	85	85	109	109	109	109	109
Elapsed Time	07:05:04	08:18:10	08:00:29	07:22:04	07:10:32	07:09:59	11:15:04	10:13:07	10:04:07	09:13:04	09:09:49
True Delay	01:01:58	01:12:17	00:18:36	00:16:38	00:08:35	00:08:03	02:10:22	01:08:26	00:23:48	00:14:16	00:11:06
Delay per Train (minutes)	21.9	25.6	13.1	11.7	6.1	5.7	32.1	17.9	13.1	7.9	6.1
Delay as % of Elapsed Time	15%	17%	10%	9%	5%	5%	21%	13%	10%	6%	5%
For Expedited Freight Trains: (Intermodal)											
# of Run Time Trains	12	18	18	18	18	18	31	31	31	31	31
Elapsed Time	01:05:24	01:21:23	01:16:39	01:12:57	01:11:26	01:11:46	03:08:58	03:00:28	02:17:02	02:14:10	02:13:51
True Delay	5:13	9:03	4:19	0:46	1:26	1:48	18:20	9:49	2:13	3:37	3:18
Delay per Train (minutes)	26.1	30.2	14.4	2.6	4.8	6.0	35.5	19.0	4.3	7.0	6.4
Delay As % of Elapsed Time	18%	20%	11%	2%	4%	5%	23%	14%	3%	6%	5%
Average Speed Including Dwell	43.6	42.4	47.3	51.9	54.1	53.6	41.0	45.7	53.4	53.1	53.4
For Regular Freight Trains:											
# of Run Time Trains	59	67	67	67	67	67	78	78	78	78	78
Elapsed Time	05:23:39	06:20:46	06:07:50	06:09:06	05:23:06	05:22:12	08:06:05	07:12:39	07:11:04	06:22:54	06:19:57
True Delay	20:44	01:03:14	14:17	15:51	7:08	6:15	01:16:02	22:37	21:34	10:39	7:48
Delay per Train (minutes)	21.1	24.4	12.8	14.2	6.4	5.6	30.8	17.4	16.6	8.2	6.0
Delay As % of Elapsed Time	14%	18%	9%	10%	5%	4%	20%	13%	12%	6%	5%
Average Speed Including Dwell	31.3	31.2	33.8	33.6	35.9	36.2	29.6	32.5	36.0	35.2	36.0
		← *2010 Base* →		← *MITIGATION* →			← *2020 Base* →		← *MITIGATION* →		

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6.26.6 Alternative Corridor Concepts

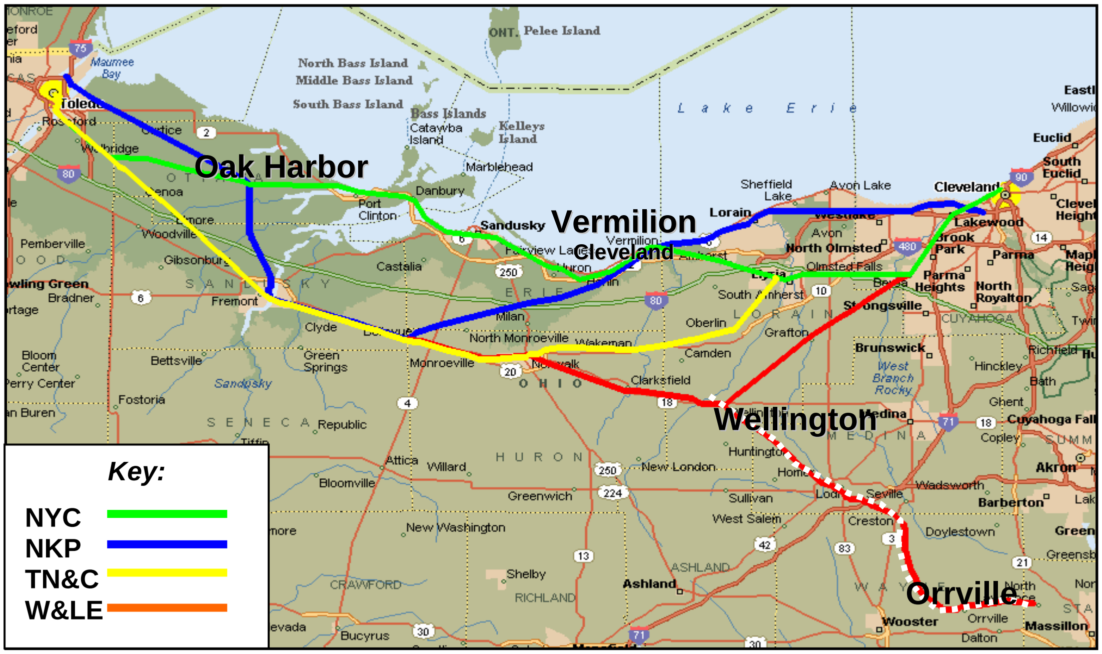
The current MWRRS infrastructure plans do not result in a complete separation of high-density freight from passenger operations between Cleveland and Toledo. Additional study is warranted to identify a dedicated alignment for MWRRS that accomplishes this separation. This would likely identify lower cost solutions that have a greater public benefit than the current MWRRS proposal.

Currently, Norfolk Southern maintains two parallel lines between Cleveland and Toledo. Perhaps one of these routes could be dedicated to MWRRS and high-speed intermodal freight service, allowing bulk traffic to be concentrated on the other line. Concentrating its traffic on only one line would free Norfolk Southern from the expense of maintaining two parallel lines, while the other route would still remain available to NS for intermodal trains, emergency use or during track maintenance. Completely separating freight from passenger operations may also facilitate the eventual introduction of passenger trains even faster than the 110-mph trains currently under consideration.

Exhibit 6-62 on the following page shows some of the route alternatives that could be considered between Cleveland and Toledo. These are further discussed in the following subsections:

- The proposed MWRRS alignment now serves as the Norfolk Southern main freight line, utilizing the former Conrail (NYC) route shown in green.
- The abandoned Toledo, Norwalk and Cleveland line is shown in yellow. Portions of this route have been converted to trail use (the North Coast Inland Trail.)
- NS' traditional NKP line between Cleveland and Toledo, shown in blue parallels the NYC route. This line serves a major freight yard at Bellevue, OH.
- Reactivating the Bellevue to Orrville route for NS Pittsburgh–Chicago freight could implement a *Cleveland Bypass* for NS traffic originating in former Conrail territory in Pennsylvania and Maryland.

Exhibit 6-62
Cleveland to Toledo Rail Options



Passenger Re-route Concepts

Any of the corridors in Exhibit 6-62 could be considered as a possible MWRRS passenger route. However, the location of Bellevue yard favors selection of the former NKP line as the primary freight route. By process of elimination, this leaves the former NYC route as the most practical alternative for MWRRS passenger service. Upgrading the existing double track mainline to FRA Class 6, could probably accommodate the proposed passenger service if heavy bulk freight trains were diverted to another route. New investments in the significant expansion of freight capacity could be focused on upgrading the parallel freight routes instead. With the exception of local trains and high-speed intermodal service, the freight traffic could be diverted to the parallel lines. This reroute concept is presented as a point of discussion to be studied in additional detail as the project develops.

However, one option that should be considered for passenger service is to utilize the parallel NKP Lakeshore line instead of the NYC route between Vermilion and Cleveland. NS has already diverted nearly all its freight traffic off this segment. Although the Lakeshore line bypasses Cleveland Hopkins Airport, it does pass through a more heavily populated area than does the NS Chicago Line via Elyria. Directly serving added population along the lake shore could generate additional traffic for the MWRRS.

Freight Re-route Concepts

The Conrail split in 1999 enhanced the possibility for establishment of a dedicated MWRRS passenger route between Cleveland and Toledo. This transaction left NS with two parallel lines, and diverted a major portion of the traffic that historically operated this way to a parallel CSX route. The exhibits on the next page show historical, current and possible new routings for freight traffic to establish a corridor that can be dedicated to MWRRS passenger service (though not exclusively) from Toledo to Cleveland:

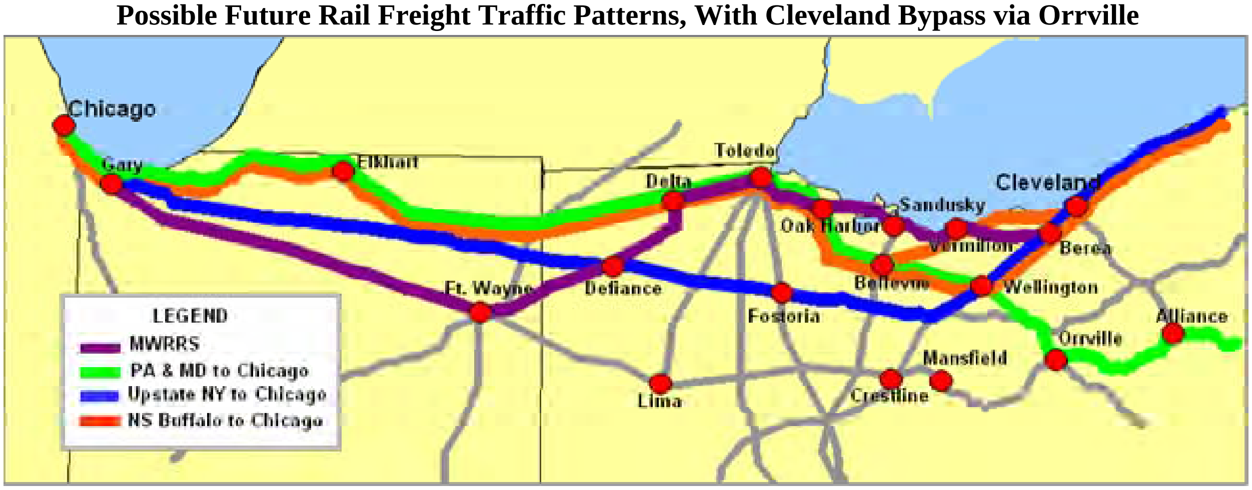
- Before 1990, Conrail's Pittsburgh–Chicago traffic (in green) was routed directly west through Fort Wayne, while traffic from upstate New York (in blue) moved via Cleveland and Toledo. NS Buffalo–Chicago traffic (in red) was routed through Bellevue and Fort Wayne. This historical traffic pattern is shown in Exhibit 6-63.
- After NS and CSX absorbed Conrail in 1999, routings changed. Conrail's Pittsburgh–Chicago traffic (in green) was allocated to NS and continued moving via Cleveland, a routing that Conrail had established in 1990 when the Fort Wayne line was downgraded. Traffic from upstate New York (in blue) was allocated to CSX and diverted to a B&O routing via Willard. NS Buffalo–Chicago traffic (in red) was diverted to the NYC line through Toledo and Elkhart. This traffic pattern, which remains in effect today, is shown in Exhibit 6-64.
- A potential new freight routing uses Wheeling and Lake Erie's line from Bellevue to Orrville, shown in red in Exhibit 6-65. At Orrville, OH, the W&LE line connects to the former PRR Fort Wayne route to Alliance. NS freight would move directly from Pittsburgh to Bellevue instead of being routed through Cleveland. Toledo to Cleveland freight could also benefit from the W&LE alternative. Freight trains could either follow their historical NKP routing to Bellevue, or use the CSX mainline south from Berea to Wellington, OH, then head west to Bellevue over the W&LE line.

A Cleveland freight bypass via Orrville could give NS a shorter route for Pittsburgh to Chicago freight; reduce the number of freight trains competing with passenger trains for line capacity between Cleveland and Toledo; and would reduce the number of freight trains and hazardous materials shipments passing through the highly populated Cleveland area. This would also remove many freight trains from the Cleveland to Alliance line segment, possibly allowing reconsideration of that route for implementing high-speed passenger service between Cleveland and Pittsburgh. Clearly broadening the scope of the planning study to consider more alternatives offers a possibility for reducing the cost, as well as improving the public benefits of the investment in MWRRS infrastructure. Again, this reroute concept is presented as a point of further discussion, to be studied in additional detail as the project develops.

Exhibit 6-63
Rail Freight Traffic Patterns before 1990

Exhibit 6-64
2003 Rail Freight Traffic Patterns

Exhibit 6-65
Possible Future Rail Freight Traffic Patterns, With Cleveland Bypass via Orrville



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6.26.7 Conclusions and Recommendations

The capacity analysis confirmed the feasibility of shared passenger and freight operations on the NS Cleveland to Toledo line. Our results suggest that the proposed MWRRS line capacity, track condition and signaling system upgrades will mitigate passenger-caused delays to freight. By allowing NS to better expedite its own high-priority intermodal and automotive freight trains, the proposed improvements may in addition offer substantial improvement to freight train operations.

All three future-case scenarios considered:

- “Uniform spacing”
- “Freight-optimized” and
- “Freight-optimized” with freight tracks upgraded to FRA Class 5.

are consistent with current Engineering cost estimates, provided that the 33% tie replacement with resurfacing would be sufficient to upgrade the track condition to FRA Class 5.

Higher freight train speeds allowable with Class V track – particularly the ability to increase intermodal train speeds to 70 mph – would amplify the improvement to freight operations resulting from this investment, but are not required to satisfy the MWRRS delay mitigation criteria. This evaluation therefore confirms, at least for planning purposes, the sufficiency of the infrastructure now proposed to be added to the Toledo-Cleveland line segment.

While this analysis does suggest the feasibility of the current plan for adding MWRRS trains to Norfolk Southern’s Cleveland-Toledo line, it is possible that the cost might be reduced and benefits increased through the consideration of additional alternatives. Therefore, TEMS recommends that the scope of the current planning process be broadened, to comprehensively assess freight as well as passenger route needs, with the goal of separating freight from passenger operations on separate line from Toledo to Cleveland. We also recommend expanding the scope of the MWRRS simulation also to consider the requirements of Ohio’s own rail initiative, the Cleveland Hub system, as well as the capacity needs of any potential commuter rail operation in the Cleveland area.

7. Operating Plan and Operating Costs

7.1 Introduction

A railroad's operating plan must balance market needs with operating costs and with the capabilities of trains and infrastructure. Fare policies and train schedules are key variables under control of the service planner. Train frequency and operating speeds can be improved by making infrastructure investment. Through an iterative analysis, an optimal combination of fares and level of service can be developed for each corridor. The strength of market demand in each corridor and the availability of a suitable railroad right-of-way determine the level of capital investment that is needed and justified.

In developing an operating plan, consideration must be given to proposed ramp-up from existing service. For the MWRRS, an implementation plan will be developed through six transitional stages, until the final operating plan is realized in Phase 7. At each stage, rolling stock, manpower needs and operating costs can be identified. This chapter discusses operating plan issues as they relate to the completed MWRRS rail system in Implementation Phase 7. Transitional or implementation plans are presented in Chapter 8. This chapter addresses the following topics:

- This chapter reports the results of a train technology assessment that was conducted as part of the 2000 planning effort
- As a result of a collaborative effort between the study team and state DOT's, a set of proposed MWRRS train schedules have been developed. These schedules have implications for facility requirements at stations, including possible locations for equipment maintenance bases, and the need to develop feasible equipment maintenance cycling plans to ensure the train fleet is adequately sized. A key recommendation of this study is to allow prospective equipment vendors the prerogative of recommending and establishing an optimal maintenance strategy for their own train sets, subject to state consideration and approval. For the best performance, the final locations and sizing of needed equipment maintenance bases should be competitively determined by the contract maintenance operators during the equipment procurement process and not mandated by the states or Amtrak.
- A particular concern is the ability of Chicago Union Station (CUS) to support the projected level of MWRRS operations. Several prior studies were reviewed to determine their findings on CUS' ability to support proposed MWRRS operations. While it now appears that CUS can support the MWRRS, prior studies are either too short-term or too long-term in nature. No detailed studies adequately assess CUS infrastructure needs in the intermediate 2014-2025 planning horizon that is of primary interest to the MWRRS.
- The states have expressed concern about the operations of several endpoint terminals, including Quincy, Carbondale, Port Huron, Holland and Green Bay. A short section describes operational issues and infrastructure needs at each of these terminals.
- This chapter includes a detailed evaluation of the operational requirements for providing an optional express parcel service.
- Finally, there is a detailed description of how operating costs were developed, building up to an assessment of all the costs that are included in the MWRRS business plan.

7.2 Operating Plan Approach

The proposed MWRRS operating plan optimizes the relationship between service levels, estimated ridership and generated revenue. Compared to current regional passenger rail services, the MWRRS operating plan dramatically improves reliability, increases frequency and reduces travel times. Depending upon the corridor, roundtrip frequencies are increased by two and five times compared to existing services, improving opportunities to make connecting trips through Chicago Union Station. Improvements in travel times range from 30 percent between Chicago and Milwaukee, to 50 percent between Chicago and Cincinnati. Exhibit 7-1 compares travel times by mode on selected MWRRS corridors.

Exhibit 7-1
Estimated Travel Times to Chicago by Corridor – 2020

MWRRS Corridors	***Train Travel Times***			
	MWRRS	***Current Service***	***Reduction in Travel Time***	***Percent Reduction***
Chicago-Detroit	3 hrs 46 mins	7 hrs 20 mins	3 hrs 34 mins	48.6%
Chicago-Cleveland	4 hrs 23 mins	7 hrs 16 mins	2 hrs 53 mins	39.7%
Chicago-Cincinnati	4 hrs 08 mins	9 hrs 25 mins	5 hrs 17 mins	56.1%
Chicago-Carbondale	4 hrs 22 mins	5 hrs 30 mins	1 hr 08 mins	20.6%
Chicago-St. Louis	3 hrs 50 mins	5 hrs 30 mins	1 hr 40 mins	30.3%
St. Louis-Kansas City	4 hrs 14 mins	5 hrs 40 mins	1 hr 26 mins	25.3%
Chicago-Omaha	7 hrs 02 mins	8 hrs 37 mins	1 hr 35 mins	18.4%
Chicago-Twin Cities	5 hrs 37 mins	8 hrs 15 mins	2 hrs 38 mins	31.9%
Chicago-Milwaukee	1 hr 05 mins	1hr 29 mins	0 hr 24 mins	43.8%

* Based on Express MWRRS Schedule.

Along almost every corridor, the MWRRS provides more service than is currently operated. MWRRS either replaces Amtrak's short-distance Chicago Hub trains, or adds service to new routes not presently served by Amtrak. Exceptions to this are the Omaha line through Iowa, the Indianapolis-Cincinnati line and direct service to Madison, WI and Ft. Wayne, IN using different routes than those currently utilized by Amtrak. Implementation of the MWRRS will help Amtrak's long-distance trains by improving track speed and covering the costs of many station and yard facilities. An upgraded passenger infrastructure will reduce delays currently incurred by Amtrak on busy freight tracks. Exhibit 7-2 compares current Amtrak service to the number of roundtrips planned for the fully implemented MWRRS.

Exhibit 7-2
Passenger Rail Service Comparison (Roundtrips)

City Pair	*Current Amtrak Service*	*Fully Implemented MWRRS*
Chicago - Detroit	3	9
Chicago-Kalamazoo/Niles	4	14
Kalamazoo/Niles-Ann Arbor	3	10
Ann Arbor-Detroit	3	10
Kalamazoo-Port Huron	1	4
Battle Creek-Holland	0	4
Detroit-Pontiac	3	7
Chicago - Cleveland	2*	8
Chicago-Toledo	2*	8
Toledo-Cleveland	2*	9**
Chicago - Cincinnati	1*	5
Chicago-Indianapolis	1*	6
Indianapolis-Cincinnati	1*	6**
Chicago - Carbondale	2*	2
Chicago-Champaign	2*	5
Chicago-Carbondale	2*	2
Chicago - St. Louis	3*	8
Chicago-Joliet	3*	8
Joliet-Springfield	3*	8
Springfield-St. Louis	3*	8
St. Louis - Kansas City	2	6
St. Louis-Kansas City	2	6
Chicago - Quincy	1	4
Chicago - Omaha	1	4**
Chicago-Naperville	3*	5
Naperville-Rock Island	0	5
Rock Island-Iowa City	0	5
Iowa City-Des Moines	0	5
Des Moines-Omaha	0	4
Chicago – Twin Cities	1*	6
Chicago-Milwaukee	8*	17
Milwaukee-Madison	0	10**
Madison-St. Paul	0	6
Milwaukee-Green Bay	0	7

* Includes Amtrak long-distance trains

** MWRRS route differs from current Amtrak service

Compared to the existing service, the MWRRS plan generates operating efficiencies by using new, modern trains, by maintaining equipment to maximize availability, and by running faster to maximize labor and equipment productivity.

The MWRRS will operate as a hub-and-spoke system with seven main corridors plus branch lines, all converging on Chicago Union Station. A hub-and-spoke system facilitates the sharing of trains between routes for better equipment utilization and allows convenient passenger transfers between routes. It offers an array of travel options at the hub, and fosters efficiencies in the use of equipment and in deployment of manpower.

The MWRRS plan includes the use of standardized train technology and rolling stock amenities throughout the system. Because of constraints of available land, the MWRRI Steering Committee decided that MWRRS equipment maintenance shops need to be located at route endpoints rather than in Chicago. This requirement to rotate equipment into shop facilities adds complexity to the MWRRS operating plan. Since not every route will have its own shop, standard train consists are essential to facilitate necessary equipment cycling between routes.

7.3 Train Schedule Development

MWRRS train schedules were developed using the *TRACKMAN*© and *LOCOMOTION*© software systems[1]. *TRACKMAN*© was used to identify all infrastructure characteristics, while *LOCOMOTION*© monitors train technology capabilities. Information such as acceleration and deceleration rates of different train technologies and maximum allowable speeds on curves by use of various tilt technologies were incorporated into the simulations. Train speed and running time profiles were generated for different combinations of infrastructure and equipment investments.

Three different train technologies were compared and any of the three could perform within the required operational parameters for the MWRRS. A life cycle cost analysis verified that two of the three technologies could operate within the cost parameters of the business plan. It was therefore decided that MWRRS operating and financial plans should adopt a conservative posture based on the higher-cost technology of the two that met the financial criteria – specifically by assuming use of Talgo passive tilt technology as the MWRRS generic train.

Originally, skip-stop service was proposed so some trains could bypass small stations. That concept was abandoned in favor of an express/local service pattern. Local service makes all station stops, while express service runs with limited stops throughout the day.

Extra time, (i.e., recovery time) was added to each train schedule as a contingency, so that some level of delay can be incurred without causing late train arrivals. Train delays can be extremely disruptive since late arrivals not only delay passengers, but can also upset equipment cycling, crew allocation and terminal operations. Capacity constrained corridors with heavy freight traffic need extra recovery time. Specifically, recovery time was added to schedules as follows:

[1] Both *TRACKMAN*© and *LOCOMOTION*© are proprietary software systems developed by Transportation Economics & Management Systems, Inc.

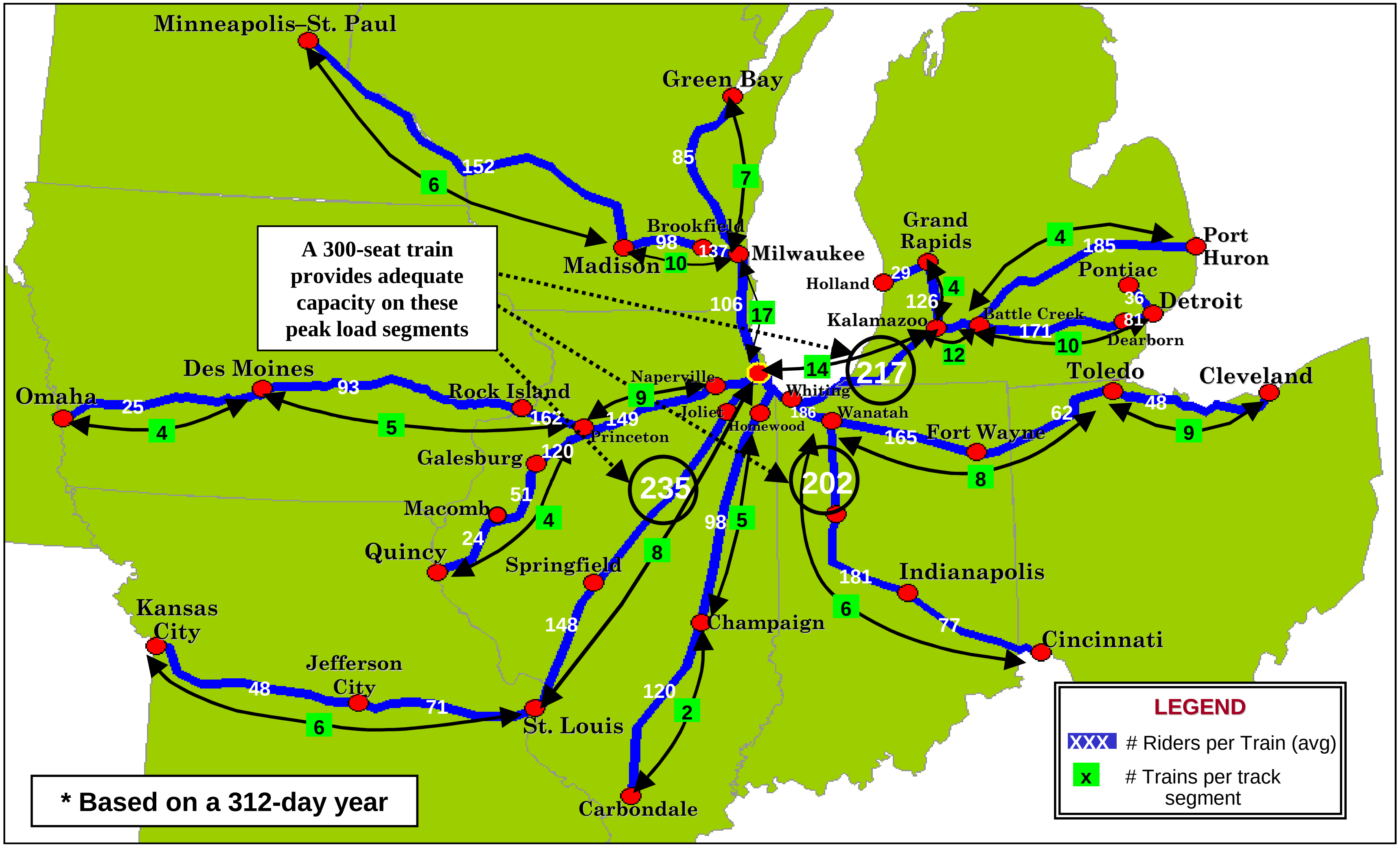
- Five percent for lines with limited freight activity:
  - Chicago-Detroit and Michigan branch lines
  - Chicago-Cincinnati
  - Chicago-St. Louis
  - Chicago-Toledo (Southern Alignment)
- Eight percent for moderate freight activity:
  - Chicago-Carbondale
  - Chicago-Quincy/Omaha
- Ten percent for very heavy freight activity:
  - Toledo-Cleveland
  - St. Louis-Kansas City
  - Chicago-Twin Cities

Once schedules were developed, they were input to the *COMPASS*© demand forecasting model[2] for estimating ridership and revenue. During MWRRS implementation, a 10 percent contingency for construction travel time was included in revenue forecasts for the implementation period. This extra time will be needed to offset likely train delays during the track construction period.

MWRRS service will operate an equivalent of 312 days per year, reflecting 5-day weekday schedules and half-day service on Saturday (largely morning) and Sunday (largely evening.) Based on the anticipated ridership on each line and by using a target load factor of 65-70 percent (on the peak segment throughout the day) a 300-seat train was determined to be most appropriate for the MWRRS. Exhibit 7-3 shows train frequency and average passengers per train by route segment.

[2] *COMPASS*© is proprietary software system developed by Transportation Economics & Management Systems, Inc.

Exhibit 7-3
Projected 2020 Daily Round Trips per Track Segment



The need to use a standardized 300-seat train results in slightly higher than desirable loadings on some lines with lower than desirable loadings on other segments. For example, the Cleveland line east of Ft. Wayne[3] and the Omaha line west of Des Moines are lightly used; but the Michigan and St. Louis routes are heavily used, and could support additional train frequency. Nonetheless, planned schedules with 300-seat trains offer enough capacity to accommodate demand through 2020.

7.4 Train Technology – Assessment Conducted in 2000

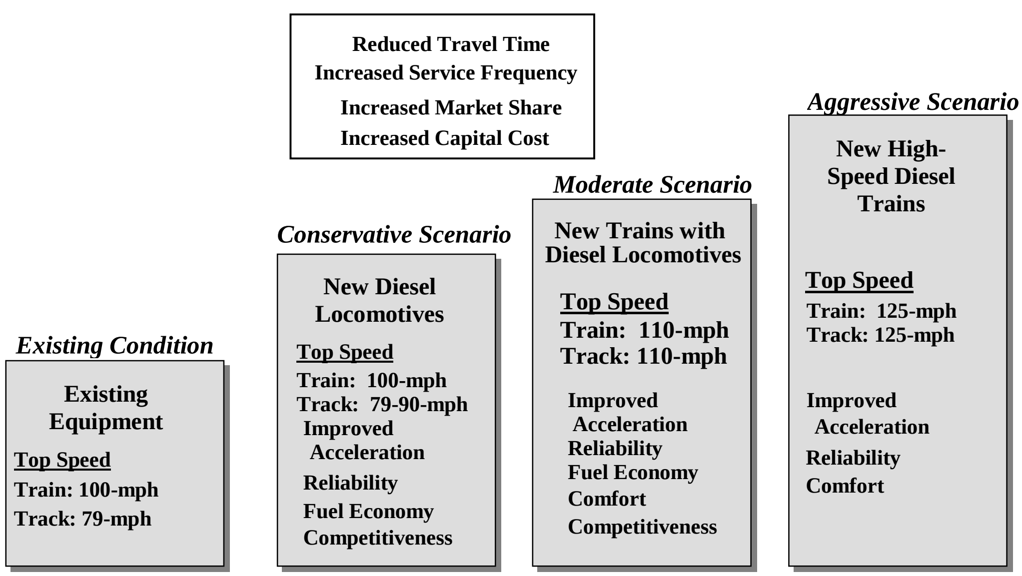
This section discusses the selection of a generic train technology, which can be used to estimate travel times in the schedules used for modeling purposes. The text documents the process by which the train technology and moderate speed option were selected during the study conducted in 2000.

As part of the MWRRI 1998 plan, four technologies were examined at the concept level for the three different speed scenarios under consideration:

- Conservative Scenario – new Amtrak F-40 locomotives pulling standard Amfleet cars
- Moderate Scenario – either Diesel Multiple Unit (DMU) integral cars or passenger cars with passive tilt pulled by locomotives, such as a Talgo T21 train
- Aggressive Scenario – a 125-mph train, such as the X2000 Flyer with tilt

Exhibit 7-4 illustrates the original train and speed concepts developed for the study conducted in 1998. The result of the concept study was that the 110-mph Moderate Scenario using a generic DMU was initially selected as the alternative for further evaluation.

Exhibit 7-4
MWRRS Technology Scenarios – 1998

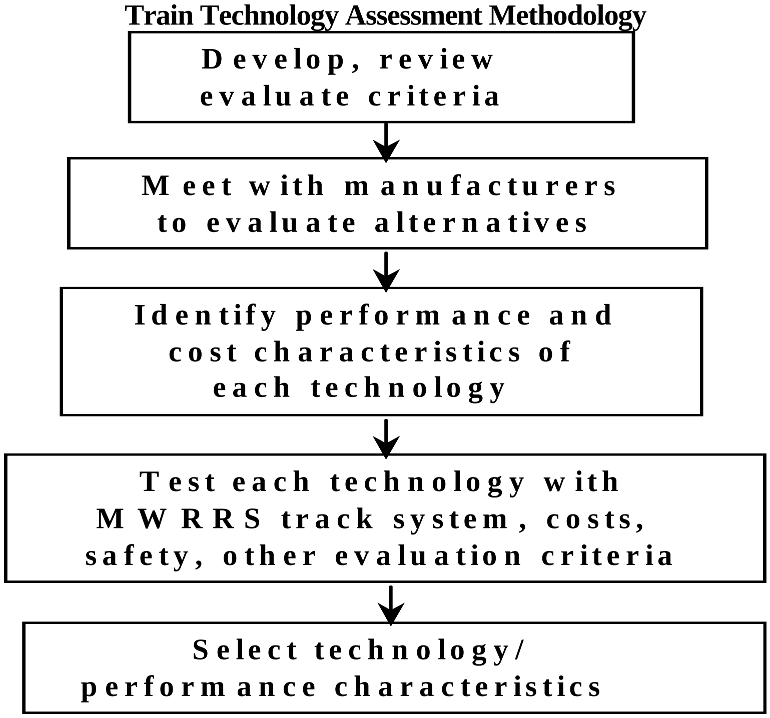


[3] However, the connectivity provided by the Cleveland Hub System rectifies forecast light ridership on the east end of the Cleveland line. Three additional destinations served by Cleveland Hub – Detroit, Columbus and Pittsburgh – would add significantly to the ridership on the MWRRS Cleveland line. Additional ridership that would result from Cleveland Hub connectivity is not included in the current MWRRS financial forecasts.

Since the initiation of the MWRRI study, the FRA has been working in partnership with Bombardier to develop a higher-powered gas turbine locomotive, capable of higher speeds and better performance than diesel locomotives and without the infrastructure requirements of an electric-powered locomotive. In addition, Talgo developed the T-21 train, which offers a full Talgo alternative (locomotive and passenger cars) capable of speeds between 110- and 135-mph. During the study conducted in 2000, a Steering Committee subcommittee was established to evaluate the potential for using gas turbine technology for the MWRRS versus the new Talgo T-21 train and an upgraded IC3 DMU technology.

The gas turbine, T-21 train and upgraded IC3 DMU technologies were reviewed to determine consistency between train technology available in the U.S. and the operating requirements defined for the MWRRS. The methodology for the assessment of the train technologies is given in Exhibit 7-5.

Exhibit 7-5
Train Technology Assessment Methodology



Three manufacturers participated in this technology feasibility assessment:

- Bombardier – Acela, and turbine-powered version of the American Flyer
- Adtranz – IC Flexliner DMU
- Talgo – T-21 integral locomotive and cars

In 2000, the MWRRI Steering Committee convened a two-day symposium that was attended by members of the MWRRI Steering Committee, additional technical representatives from the member states, representatives from Amtrak and technical experts from each of the three equipment manufacturers. Each equipment manufacturer presented the technical aspects of their trains and discussed infrastructure and servicing requirements, and life cycle cost data. Prior to the symposium, the manufacturers were provided with proposed operating plans (timetables) for all routes that included the frequency and stopping patterns (local and express) for the proposed service, as well as overnight layover points for the trains. The manufacturers were also given copies of the 1998 report and the working assumptions for the operating cost and revenue structure of the service. The manufacturers were then asked to provide cost and performance data on their trains – weight, power, acceleration, deceleration, braking, climbing, curve performance, etc.

This symposium enabled manufacturers to become more familiar with the MWRRS planned operating environment and operating requirements. Likewise, it also enabled the states to obtain information on available train technologies, equipment operating characteristics, maintenance requirements, and general cost requirements[4].

After this symposium, the MWRRI Steering committee agreed on an equipment maintenance cost of $5.42 per train mile for a 300-seat train (in $2002) that included:

- Preventive and corrective maintenance
- Inspections
- A mid-life capital refurbishment, converted to an annualized per-mile cost
- A cleaning cost of 52¢ per train mile included in the overall $5.42 per train mile rate.

This cost assumed the adoption of off-the-shelf European train technology, rather than a custom product. Adopting European best-practice maintenance methods resulted in a substantial savings compared to current U.S. costs.

7.4.1 Operating Plan Requirements for Rolling Stock

Key elements of the operating plan in the 1998 study had significant implications for the procurement of rolling stock. The operating plan is designed to accommodate the constraints imposed by the configuration of and competing requirements at Chicago Union Station, and the requirements for fast, frequent, reliable service with minimal delays for station stops and servicing.

General Rolling Stock Service Requirements

The following operating plan (1998) assumptions were provided to the train manufacturers:

- Train consists were to be reversible or push pull (able to operate in either direction without turning the equipment at end points).
- No more than forty minutes were to elapse between a train's arriving at its end point, before it is fully serviced and ready to depart.
- Trains were not to require mid-route servicing, with the exception of food and fuel top-off. Restroom attention, potable water top-off and similar requirements were to be accomplished at the overnight layover only.
- Trains were to be able to be dispatched on any corridor indiscriminately, on an as-needed basis.

[4] Assurances were made that this symposium would not serve as a marketing opportunity for equipment manufacturers. This objective was accomplished. Activities focused on technology and not on specific brands of equipment.

- Trains were to have an expandable consist capacity for seasonal fluctuations and/or could be added to one another to double capacity as required.
- Trains were to be accessible from low-level station platforms for passenger access and egress, which is required to ensure compatibility with freight operations.
- Train configurations were to include allowances for a bistro and/or roll-on/roll-off cart service for on-board food service.

Train Reliability and Availability

It is currently assumed that rolling stock suppliers will participate in on-going maintenance activities, through direct operation or through management partnerships with established organizations. It is also anticipated that any equipment award would include long-term performance and maintenance cost specifications. These provisos create additional manufacturer incentives to design equipment and facilities for long-range ease of maintenance and reliability.

In order to achieve financial goals for the MWRRS, rolling stock must have a very high reliability ratio. This includes availability for service, routine high performance of propulsion components, and reliability of HVAC, doors and all on-board passenger conveniences. This reliability must be maintained in all weather conditions, including severe Northern Plains winter weather conditions and extreme summer heat.

For this reliability to be achieved routinely, it is assumed that component change-outs will be accomplished within limited night time servicing hours (not to exceed eight hours), and only a small fraction of equipment will be out-of-service during revenue hours at any given time. Key systems, such as those governing safety, propulsion, and heat and light, will have design redundancy so that the failure of one key component while en route does not render the train totally inoperative. It is also important not to over-design the system.

Compatibility with Amtrak Operations

Each end of a trainset must be equipped with a standard North American coupler, permitting recovery of a disabled train by conventional locomotives. The brake system must be compatible with 26-C brake equipment (standard passenger brakes).

Basic Regulatory Requirements for Rolling Stock

All train technologies to be considered for the MWRRS must be capable of meeting all applicable regulatory requirements, either now or in the near future, without waivers. These requirements include:

- *Safety:* The FRA has established safety requirements for speed operations up to 125-mph, known as Tier I requirements, which were still under development at the time of this evaluation. These requirements cover end strength, rollover strength, side strength, and details such as anti-climbers and coupler loads to ensure passenger and engineer safety in the event of a collision or derailment. Other safety requirements include the American Public Transit Association (APTA) standards that are applicable to mainline passenger rail equipment.
- *Accessibility*: The Americans with Disabilities Act (ADA) establishes minimum requirements for accessibility for disabled persons. ADA requirements for passenger train

equipment include wheelchair accessibility – boarding ease, aisle widths, restroom size, seat positions, etc. The equipment must also include provisions for persons who are vision or hearing impaired.

- *Material Standards*: The Association of American Railroads (AAR) has established standards for components and materials for rail applications.
- *EPA Requirements*: The Environmental Protection Agency (EPA) has established regulations for waste disposal and power unit emissions.

7.4.2 Results of the Equipment Assessment Conducted in 2000

Three routes were chosen for the performance comparison to represent a range of operating and development conditions:

- *Chicago-Detroit*, which exemplifies a route with extensive, long-ranging state involvement with improvements on an active freight line, that is also relatively flat and straight
- *Chicago-Twin Cities*, which exemplifies a route with fairly good track at one end (Chicago-Milwaukee), heavy freight use, and extensive curves and elevations (Twin Cities)
- *Chicago-Cincinnati*, which exemplifies a fairly flat and, until now, undeveloped route that will have very limited freight activity. There are fairly significant sections limited to 79-mph, as is the case with many of the branch lines

TRACKMAN© track files for the three sample routes were provided to the manufacturers for their own comparisons of the track profiles and speed restrictions that would be in place after the proposed MWRRS infrastructure improvements. The train performance information provided by the manufacturers for each technology was entered into the Train Performance Calculator. With *LOCOMOTION©* working interactively with *TRACKMAN©*, calculations were made for train speed and to create an operating timetable for a given route, based on train performance characteristics, and input characteristics such as the location of stops and dwell time at stations. The summary travel times for each technology and route are shown in Exhibit 7-6.

Exhibit 7-6
Summary Comparison of Simulated Travel Times for Each Technology

Corridor	*Schedule Type*	*Travel Time* [5]	*DMU Active Tilt*	*Passive Tilt*	*Gas Turbine*
Detroit	Express	3:36	3:31	3:39	3:30
	Local	4:15	3:59	4:14	3:56
Twin Cities	Express	5:40	5:32	5:43	5:31
	Local	6:41	6:22	6:36	6:13
Cincinnati	Express	4:06	4:04	4:09	4:02
	Local	4:36	4:22	4:33	4:19

[5] Base times from MWRRI Phase 1 were revised due to changes in infrastructure, dwell time, recovery and other run-time assumptions.

One of the more surprising findings of the comparison was the similarity in results among three very different technologies. The passive tilt technology was consistently slower than either the active tilt or the turbine technology. The passive tilt technology did not provide as much of a speed benefit in curves as did the active tilt. However, when the passive tilt technology option was run for all routes as a base case, it showed a faster travel time than the DMU for the Omaha line, which is one of the straightest segments in the MWRRS.

One of the outputs of *LOCOMOTION©* is the speed profile which graphically illustrates the performance of the train given restrictions such as curves, station stops and other speed restrictions. The performance, safety and configuration information was reviewed and found to be consistent with MWRRS infrastructure and operating plans.

7.4.3 MWRRS Assumptions for Train Technology

The train technology assessment determined that the three technologies that were evaluated could perform within the operating constraints of the MWRRS, and could be designed and built within the MWRRI's schedule. The life cycle cost analysis verified that either the passive tilt or DMU technologies could operate within the operating cost parameters of the initial MWRRS financial plan. The analysis confirmed that the operating plan and infrastructure requirements defined for the MWRRS were consistent with available technology and therefore verified that the operating plan and associated system costs were achievable.

Pursuing a conservative costing philosophy, it was decided that the MWRRS operating and financial plans should be based on the locomotive-hauled, passive tilt technology. Whereas this is the higher cost technology of the two that met MWRRS financial criteria, and is slightly slower than the DMU technology on most corridors, the ridership and revenue forecasts are more conservative than if the generic DMU had been selected. Please note that selecting the generic passive tilt technology for the operating and financial plans does not mean that Talgo would be selected as the equipment manufacturer for the MWRRS. Rather, this selection increases the flexibility in choosing a technology, because multiple manufacturers and technologies will be able to meet the broader performance parameters provided by this more conservative approach.

7.4.4 Capital Acquisition of Train Technology and Life-cycle Costs in 2000

All three train technologies were reviewed to determine which technology provided the best fit with the operating requirements defined for the MWRRS. The equipment acquisition cost for each technology was based on the purchase of approximately 60 trainsets, each with a capacity of 190 to 200 passengers. (The recommended train size was subsequently revised upwards to a 300-seat train.) The cost was based on information received from the manufacturers; however, manufacturers' price quotes were only preliminary estimates. The final cost will be determined by a set of factors to include the degree of competition, delivery dates, level of customization, and number of trainsets ordered. However, these preliminary estimates provided a reasonable basis for this analysis. The volume discounts included in the analysis were predicated on the states collectively purchasing the rolling stock on a system-wide basis rather than individually, on a by-corridor basis.

For the Net Present Value (NPV) analysis, the full acquisition cost for each technology was assumed to occur one year before the Implementation Plan's Phase 1 operation. The analysis also assumed no residual value.

Each of the technologies evaluated included an allowance for maintenance facilities. It is likely that costs will vary depending on the length and number of trainsets, as well as on the quantity and location of the maintenance facilities required and the activities required at each facility. The train equipment maintenance cost per train mile provided in this study is based on the information received from each manufacturer, with a constant value added per train mile to accommodate cleaning the train and facility costs. Fuel costs were similarly based on the information received from each manufacturer. Both train equipment costs and fuel costs per mile were multiplied by the projected annual train miles and added to the other operating costs to generate annual operating cost.

Operating cost per train mile was based on a hypothetical mix of miles and passengers plus fixed costs that were held constant for each technology. Operating cost is subtracted from operating revenue to derive the net surplus or deficit in each year.

Costs and revenues were calculated through 2030, which includes six years of phasing the system in and 21 years of full operation. The NPV of the cash flows, including equipment acquisition and maintenance facility costs, was calculated using a 5 percent real discount rate, since all values are expressed in constant dollars.

The life cycle NPV and operating comparison results calculated during Phase 3 of the Implementation Plan for each technology are given in Exhibit 7-7. The life cycle cost excluded any differential in ridership that might be achieved through differences in operating speeds. The equipment capital and maintenance cost components were subsequently revised upwards in the 2004 update of the MWRRI study.

Exhibit 7-7
Life Cycle NPV Analysis and Operating Cost Comparison
(Millions of 2000$)

	DMU with Tilt	***Talgo***	***American Flyer***
Initial Capital Cost for Train Equipment (approximately 60 trainsets) and Maintenance Facilities	$558	$657	$1,020
Average Operating Cost per Train Mile: 2010	$20.44	$21.23	$25.94
Average Operating Cost per Train Mile: 2020	$20.36	$21.15	$25.86
Life Cycle NPV @ 5% *including* Initial Capital	$1,370.8	$1,099.6	($297.1)
Life Cycle NPV @ 5% *excluding* Initial Capital	$1,997.4	$1,811.6	$708.0

7.5 *Fleet Sizing and Equipment Rotation Methodology*

To determine the number of trains required in the MWRRS equipment fleet, train set rotations were developed to cover specific sequences of schedules. To maintain high availability, every train must return to a maintenance base every four days. A two-step process guarantees the operating plan accomplishes this. First, sets of pairings determine a sequence of daily assignments for each train set. The goal is to build shop-to-shop maintenance cycles not exceeding four days in length. Some pairings may have to be adjusted to make the plan fit when grouping daily pairings into round-trip cycles.

Exhibit 7-8 shows a daily pairing using Train Set #26 as an example. This theoretical train begins its day at 08:00 in Pontiac and runs to Chicago as train #105. An hour after arrival at 13:30, it departs for Cleveland as #208. Fifty minutes later, this same train turns back to Chicago as #215 arriving at 23:30. When developing such pairings, at least a one-hour leeway in Chicago is built into the schedule. Train schedules determine the leeway at the outlying stations.

Exhibit 7-8
Sample Pairings: Train set #26

Train #	*From*	*To*	*Depart*	*Arrive*
105	Pontiac	Chicago	8:00	12:25
208	Chicago	Cleveland	13:30	17:53
215	Cleveland	Chicago	18:43	23:30

Maintenance cycles are round-trips that both begin and end at a MWRRS maintenance base. As Exhibit 7-9 shows, a train released from the St. Paul shop departs on pairing #56 to Port Huron. On day two, the train returns to Chicago on pairing #32 and ends up in Green Bay. The third day the train works from Green Bay back into Chicago on pairing #29. Finally, pairing #4 takes the train back to the St. Louis shop, just in time for its next required progressive maintenance.

Exhibit 7-9
Four-Day Maintenance Cycle #2

Pairing #	*From*	*To*
56	St. Paul	Pt. Huron
32	Pt. Huron	Green Bay
29	Green Bay	Chicago
4	Chicago	St. Louis

The most recent MWRRS pairing analysis shows a requirement of 57 train sets to cover all schedule assignments. However, depending on the layover time allowed between equipment turns, earlier studies have produced requirements ranging between 51 and 60 trains. The 51-train solution relies on very short, 30-minute dwell times at Chicago and at some other stations. Longer layovers allow schedule recovery should an inbound train arrive late, but also require a larger train fleet. Excessively long layovers could cause congestion at the Chicago terminal, due to a lack of sufficient space to store all the trains. The current goal is to allow 40-60 minutes in Chicago for schedule recovery between trips.

With 10 percent or 6 trains in reserve, 63 trains are needed to cover the full set of planned MWRRS schedules. Exhibit 7-10 shows this number of trains allocated to each MWRRS corridor.

Exhibit 7-10
Allocation of Rolling Stock by
MWRRS Corridor – with 6 Train Reserve

Corridor	*Number of Trains Needed*
Chicago-Detroit/Michigan	15
Chicago-Cleveland	8
Chicago-Cincinnati	5
Chicago-Carbondale	3
Chicago-St. Louis	7
St. Louis-Kansas City	5
Chicago-Quincy-Omaha	9
Chicago-Twin Cities	11
Total	**63**

Individual trains usually do not return to their starting points each night. However, the total number of trains lying overnight at each location must match the number of trains needed for departure the next morning. Exhibit 7-11 shows overnight layover locations in the most recent 57-train solution. The six reserve train sets should be allocated to those locations having the largest number of trains laying overnight: that is, one each to Chicago, Pontiac, St. Louis, Kansas City, Madison and St. Paul. These large locations are the same ones that are recommended as potential sites for maintenance bases. Reserve train sets cover the possibility that critical equipment defects discovered in the shop the night before, might not in every case be able to be repaired by the next morning. For this reason it is important to have one reserve train for each major maintenance base.

Exhibit 7-11
Overnight Layovers for 57-Train Solution – Without Reserve

Station	*# Trains*	*Station*	*# Trains*
Chicago	20	Omaha	2
Pontiac	4	Green Bay	2
St. Louis	4	Kalamazoo	1
Kansas City	3	Battle Creek	1
Madison	3	Toledo	1
St. Paul	3	Cincinnati	1
Holland	2	Champaign	1
Pt. Huron	2	Carbondale	1
Cleveland	2	Quincy	1
Indianapolis	2	Des Moines	1

5 locations provide nightly access to 17 trains

7.6 Equipment Maintenance Shop Requirements

With 57 working trains generating 14.1 million train-miles per year, the average MWRRS train will run 795 miles per day. Each MWRRS train must rotate through a shop facility every four days. In theory, a minimum shop production of 57 ÷ 4, or 15 trains per night would be required to ensure that each unit could receive this level of maintenance. We have demonstrated feasible cycling solutions based on a shop capacity of 16 trains per night, which is considered the practical minimum.

During the implementation period, it will certainly be possible to purchase additional trains to allow for daytime maintenance. These extra trains could be absorbed into daytime revenue service as implementation of the service proceeds. However, by the time the system is fully built-out in 2014, all equipment maintenance must occur at night. Furthermore, to avoid the need for purchasing additional trainsets (or for non-revenue or deadhead mileage) shops must be located where – according to the schedule – equipment naturally needs to lie overnight. To serve as a starting point for future discussions, therefore, several different options were developed with respect to MWRRS shop locations.

MWRRS equipment procurement envisioned a turnkey contract, where the equipment supplier would also provide maintenance services. The initial MWRRI proposal included a central facility at Chicago, however, during the equipment procurement development stage it was suggested that there would be benefit in having three shops rather than one – a backshop in Pontiac, MI, and Service and Inspection facilities in Madison, WI, and St. Louis, MO.

However, the three-shop plan can only support the initial phase of MWRRS in 2008. These shops would have nightly access to only 11 trains but by 2014, at least a 16-train production per night is needed. In addition, the site proposed for the St. Louis shop limits its capacity to two trains, even though four trains will be available for servicing each night. Although St. Louis remains a good location for a maintenance base, TEMS recommends:

- An alternate site that can allow construction of a larger 4-train St. Louis shop should be identified.

- To obtain the most competitive bids, the final determination of the number of shops needed and the siting, sizing and equipping of shops should be left to the successful equipment provider, subject to state approval. A concern has been raised that improved efficiencies in maintenance shops may cause inefficiencies in the transportation function, e.g. through a requirement for either an increased fleet size or increased deadheading. These areas of concern should be explicitly addressed in equipment vendors' proposals, by requiring the bidders to demonstrate how their maintenance proposals support cost-effective rail operations.
- Until an equipment provider is selected, the analysis of location and equipping of shops should be treated as a Placeholder Cost in the business plan.

As shown in Exhibit 7-12, to maintain 16 trains each night, shops need to be located at Pontiac, St. Louis, Kansas City, Madison and St. Paul. If St. Louis cannot produce at least three trains per night, a sixth shop will be needed and is recommended for Cleveland, OH.

Discussions with manufacturers indicate that, for equipment running 250,000 miles per year, wheels require truing at least once a month or about every 20,000 miles. One lathe plus a backup would provide sufficient capacity to maintain the wheels of all 57 working trains. If Pontiac were the only facility equipped for wheel maintenance, there would be a requirement to return each train to Pontiac at least once a month. Pontiac processes four trains per night. With 57 working equipment sets, trains can work back to Pontiac every 16 days, nearly twice as often as required. Equipping all the shops with wheel lathes would increase costs but eliminate this need to return trains to Pontiac for truing the wheels.

While the first maintenance cycling plan was developed for five shops in 2014 at Pontiac, St. Louis, Kansas City, Madison and St. Paul, two alternative equipment cycling plans were also constructed:

- The *2014 Pontiac, Cleveland, Kansas City, Madison and St. Paul (no CUS run-through[6])* plan eliminated the St. Louis shop and substituted a three-train shop at Cleveland. In addition, trains arriving on Chicago Union Station (CUS) north or south station tracks could only depart in the same direction; north/south transfers may only precede the first or follow the last trip of the day. This eliminated daytime run-through operations at CUS. This scenario showed that a Cleveland shop could substitute for St. Louis, and provides for limitations on run-through operations at CUS along with maintenance cycling requirements.
- Because it is not certain that the Madison shop will come on-line as planned in 2008, a *2008 Pontiac only (Pontiac and St. Louis lines only)* scenario showed that a single shop at Pontiac could maintain all trains needed for both the Pontiac and St. Louis lines.

A two-train shop at St. Louis would provide insufficient capacity to meet the needs of the 2014 MWRRS system. A minimum three-train capacity is needed here to increase the system production rate to 16 trains per night. A feasible rotation could be developed for any shop-siting plan that offers capacity of at least 16 trains per night. The final choice of shop locations must largely hinge on the availability of reasonably priced real estate in reasonable proximity to the

[6] For more background on CUS operating constraints that restrict North/South run-through operations, see Section 7.7.1 of this Chapter.

endpoint stations. It is therefore recommended that further study be undertaken to find a better and larger location for the proposed St. Louis shop, and to identify specific sites for the proposed Kansas City and St. Paul shops:

- At this time, only the shops proposed at Pontiac, Cleveland and Madison have adequate sites identified.
- The proposed site for the St. Louis shop may not be large enough to service all the trains available there, or to meet the long-term needs of the MWRRS network.
- The proposed shops in Kansas City and St. Paul have not been sited yet.
- From an operational perspective, Chicago remains a logical location for an MWRRS equipment maintenance facility, if a suitable site could be identified.

At this early planning stage of the MWRRS project, the important thing is not the detailed rotation plan but rather the most critical findings:

- A purchase of 63 trains would be sufficient to operate the proposed MWRRS 2014 schedule. With intensive progressive maintenance to keep trains in service, based on Talgo's experience with its Pacific Northwest fleet, a 10 percent reserve[7] should be sufficient to protect the reliability of the MWRRS network.
- A network of shops that provide a minimum capacity of 16 trains per night is needed in any of the following locations: Pontiac, Cleveland, Kansas City, Madison, St. Paul, St. Louis or Chicago. Any five of these seven locations can be chosen as progressive maintenance bases, based on availability of suitable real estate. With five shops, all operations could be conducted at night, avoiding the need for additional trains. The planned schedules could then be operated with a fleet of 63 trainsets.
- However, it may be more cost-effective to purchase a few additional trainsets beyond the minimum requirement of 63 trains. A few extra trains would allow daytime as well as overnight maintenance. By running maintenance facilities during the day as well as at night, fewer bases would be needed to support the system. A detailed optimization of this fleet size vs. maintenance base trade-off is beyond the scope of this analysis. It is recommended that the equipment manufacturers address this issue as part of a future procurement.

7.7 Chicago Union Station Issues

A critical issue for the MWRRS operating plan is the ability of Chicago Union Station (CUS) to provide sufficient capacity. CUS has been the subject of several different planning studies -- none of which has offered a definitive solution to the problem of how to accommodate the need for growth in Metra commuter and MWRRS corridor services:

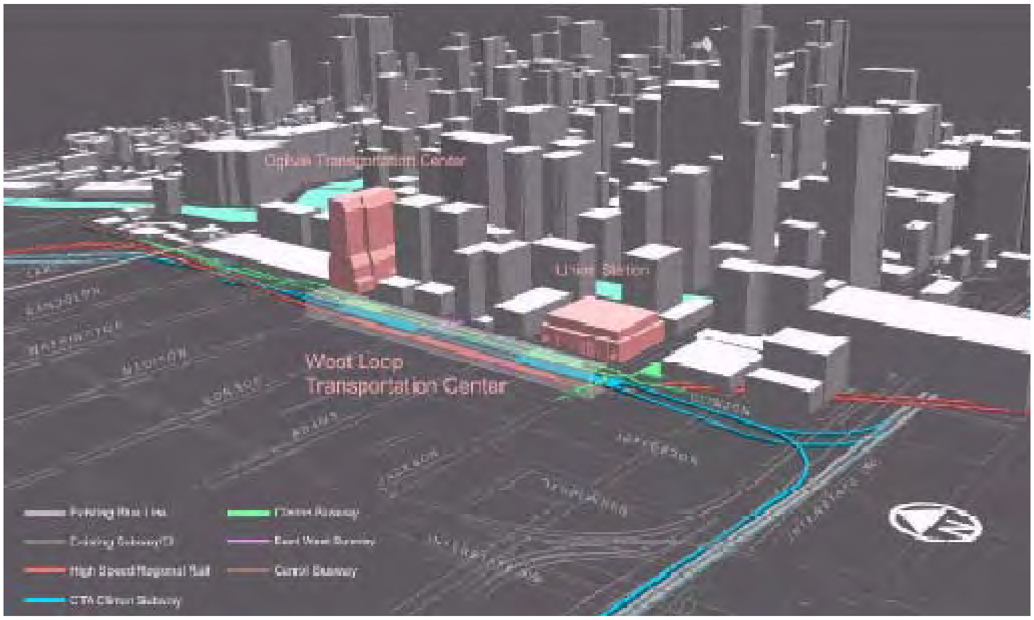
- Amtrak and Metra jointly sponsored a June 2002 study by HDR/CANAC that focused on short-term solutions for accommodating Metra growth and Phase I MWRRS services at CUS by 2008. A longer-term study is needed that takes account of Metra's plans for shifting some operations to other downtown stations, thereby addressing the 2014-2025 planning horizon that is of primary interest to MWRRS.

[7] It may be possible to operate with less than a 10% reserve fleet. A major risk that requires reserve is the possibility that problems uncovered during the overnight progressive maintenance might not always be completely resolved by the morning. Therefore a larger number of maintenance bases might require a larger reserve fleet to cover this contingency. Conversely a more centralized maintenance strategy may need a smaller reserve fleet.

- In contrast with the short-term focus of the HDR/CANAC study, the City of Chicago's *Central Area Plan* envisions a new West Loop Transportation Center with new subway tunnels under Clinton Street, next to Union Station, as shown in Exhibit 7-13. This plan is able to address capacity needs at CUS, but its construction obviously extends well beyond the planned MWRRS implementation timeframe. A shorter-term CUS capacity strategy is needed to support MWRRS implementation.

The implementation period for MWRRS lies between these very short and very long-term extremes, putting MWRRS in an awkward position, since practical CUS infrastructure strategies for a 2014-2025 planning horizon have yet to be developed. The HDR/CANAC report does not do this, nor does the City of Chicago's long-term planning effort.

Exhibit 7-12 [8]
Chicago's Proposed West Loop Transportation Center



[8] Source: Chicago Central Area plan, see:
http://egov.cityofchicago.org/webportal/COCWebPortal/COC_ATTACH/CAPchapter4_2a.pdf

7.7.1 *Changing Assumptions on CUS Requirements*

Since the HDR/CANAC report was issued in June 2002, two key assumptions have already changed. The first change was due to a policy decision by Amtrak to withdraw from the express freight shipping business. The second change is the result of a recent re-examination of the operational feasibility of running MWRRS trains through CUS.

As background, the MWRRS operating pattern favors inbound service to Chicago in the morning, with heavier outbound service starting in the early afternoon and evening hours. Based on MWRRS schedules approved by the states, many trains are not scheduled to run through but rather require mid-day storage at CUS. To allow for schedule recovery, the goal has been to plan minimum 40-60 minute equipment turns at CUS. Maintenance cycling sometimes forces pairings with longer dwell times than this. However, the main cause of longer CUS dwell times is simply the fact that there are more morning train arrivals than departures from CUS.

Because of the need for mid-day train storage, average dwell time at CUS between assignments now averages almost two hours. In contrast, the original plan for run-through operations relied on CUS dwell times not exceeding 20 minutes. With two-hour layovers for mid-day turns, stored trains would block the platforms on either side of the run-through tracks, which would gridlock the run-through area. For this reason, it is infeasible to run MWRRS trains through CUS under the current scheduling. If MWRRS run-through operations were considered essential, then all MWRRS train schedules would have to be rebuilt to reduce CUS dwell times. This would undoubtedly entail a large increase in deadhead or low-ridership train miles, as well as force a difficult physical track reconfiguration at CUS.

Instead, it has been proposed to forego the reconfiguration of the run-through tracks as discussed in the HDR/CANAC report, thus avoiding the capital cost of reconfiguration. Instead, the equipment cycling plan is to eliminate daytime run-through schedule pairings. Accordingly, the equipment rotations have been redesigned to operate within the capabilities of the existing CUS facility. The only required use of the run-through track is for deadheading equipment between the train storage yard, assumed to be on the south side, and the north side platforms. This change has no effect on revenue or ridership forecasts, since run-through operations were never included in these forecasts.

Running trains through CUS may still be appropriate, however, for Metra commuter service. Pairing north/south routes, as done in Philadelphia, Pennsylvania would reduce Metra's demand on CUS platform capacity. However, a detailed examination of Metra operations, or how best to reconfigure CUS to support Metra needs, is beyond the scope of this study.

7.7.2 *CUS Platform Capacity Needs*

From the HDR/CANAC report, Amtrak's current allocation is seven dedicated tracks at CUS, with an additional seven tracks shared with Metra. Each platform can therefore hold only one MWRRS train. MWRRS platform requirements were combined with Amtrak's current long distance train needs to see if the total would fit within Amtrak's allocation.

As shown by Exhibits 7-14 and 7-15, MWRRS can operate within Amtrak's current seven-track allocation. The Capitol Limited that departs at 5:35 PM requires use of one Metra shared track for 30 minutes. At off-peak, the times MWRRS would use no more than one-half to one-third of the capacity of the Metra shared tracks for mid-day train storage. By shunting four trains to the yard for mid-day storage, the MWRRS can operate within the seven-track constraint during all peak hours except for 30 minutes of the evening rush.

Exhibit 7- 13
CUS Track Occupancy: MWRRS/Long Distance

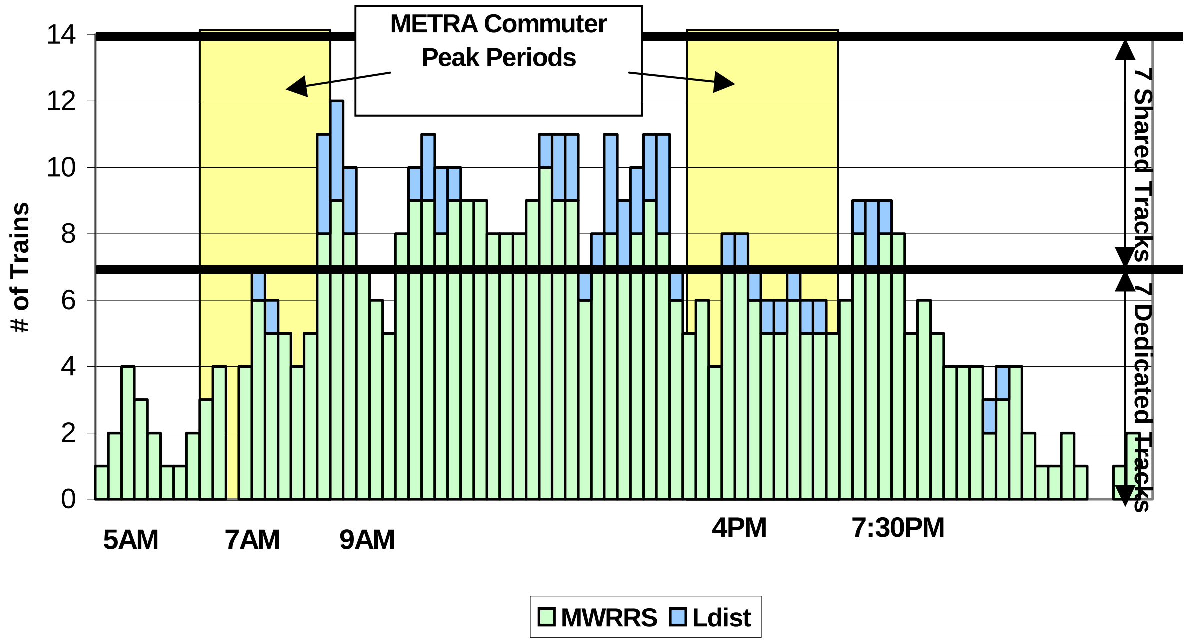
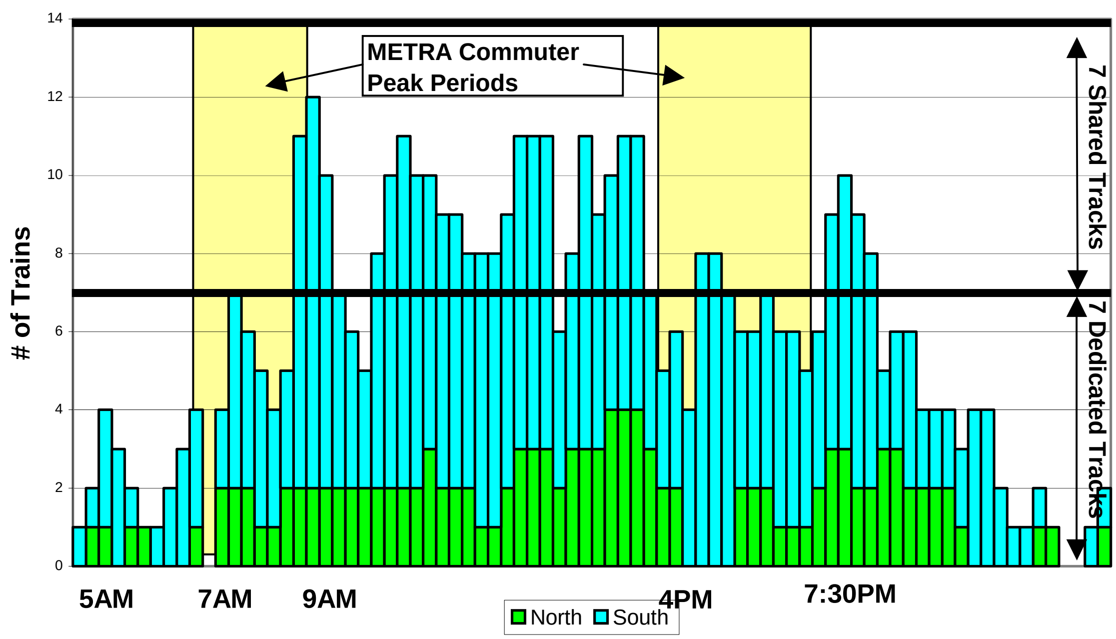


Exhibit 7- 14
CUS Track Occupancy: North/South



7.7.3 CUS Platform Reconfiguration

Chicago Union Station (CUS) was originally designed as a grand passenger rail station for long-distance intercity trains, not as a commuter station. In the past few decades, however, commuter trains have largely displaced intercity operations at CUS. To deal with heavy passenger flows generated by Metra commuter operations, a June 2002 report by HDR/CANAC suggested reconfiguring the baggage platforms for pedestrian use.

However, the current platform arrangement is adequate for MWRRS pedestrian flows and is ideal for providing MWRRS express parcel service. The current arrangement is also suitable for providing mail and checked baggage service on Amtrak’s long-distance trains. MWRRS and Amtrak trains carry fewer passengers with a lower seating density than Metra’s. Further, MWRRS arrivals and departures are spread throughout the day. The current platform configuration at CUS, with separate baggage platforms, is adequate for the needs of the MWRRS and Amtrak’s long-distance trains, despite the well-known limitations of the station’s pedestrian capacity.

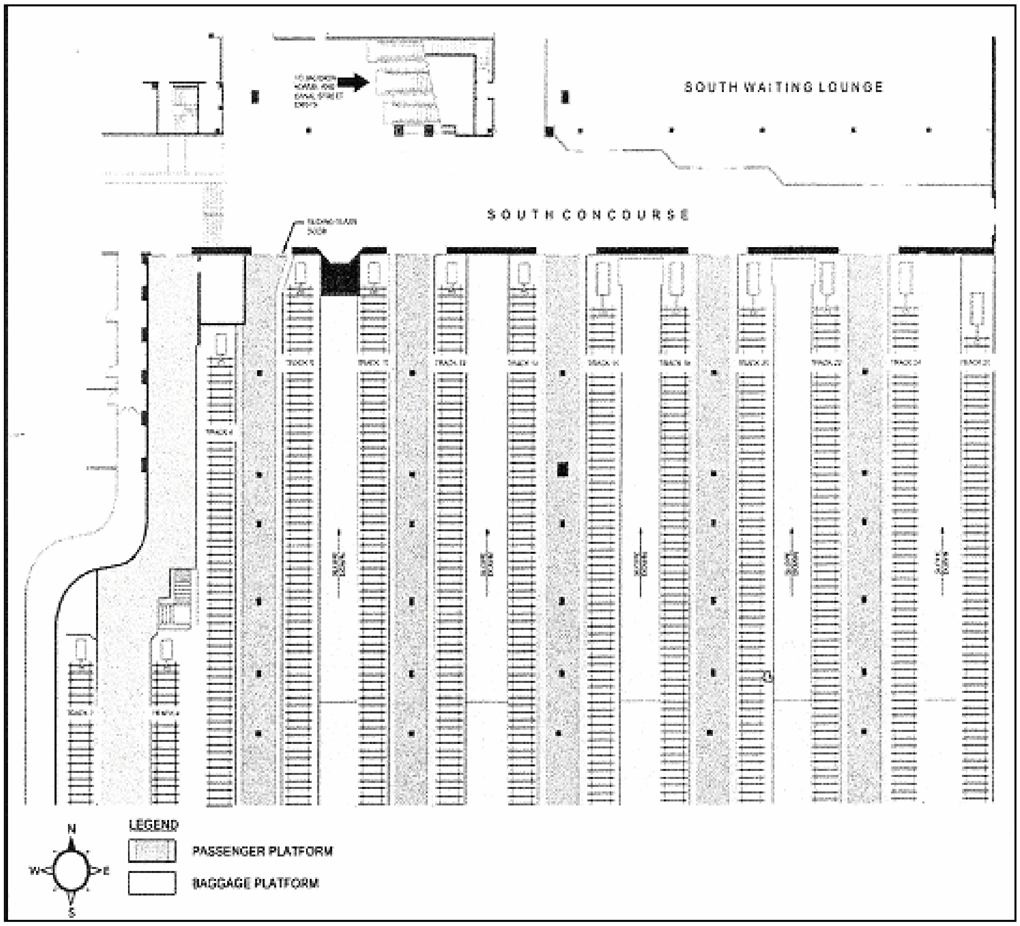
It is believed that the current CUS platform configuration will work well not only for MWRRS passengers, but also for express parcel traffic. As shown in Exhibit 7-16, separate baggage platforms were constructed between each track. A ramp descends directly from each platform to the basement, where the main baggage room is located. While express parcel operations work effectively on standard intercity train platforms, it would be even more advantageous to use CUS’ dedicated baggage platforms for express parcel tugs.

It is suggested that those baggage platforms used by MWRRS and Amtrak’s long-distance trains not be reconfigured. However, reconfiguring platforms would still allow MWRRS parcel service to be accommodated on the passenger platforms. As an intercity passenger service, MWRRS is consistent with the original design intent for Chicago Union Station. CUS, in its current configuration, is adequate, if not ideal, for the MWRRS. It would be more advantageous not to modify the platforms, since the original CUS facility design is very well suited to MWRRS operations.

It seems clear that Metra, rather than MWRRS or Amtrak’s long distance trains, will benefit from the platform changes or run-through track reconfiguration proposed by HDR/CANAC. Therefore, Metra, and not MWRRS, should bear the cost of any such improvements; any platform reconfiguration should be limited to only those platforms used exclusively by Metra commuter trains.

The June 2002 report by HDR/CANAC suggested that anticipated growth in Metra service has the potential to crowd out the Amtrak and MWRRS services. To prevent this from happening, it is essential that Amtrak maintain, at a minimum, its current allocation of seven dedicated tracks along with seven shared tracks at CUS. If Amtrak’s allocation is reduced, then it may no longer be possible for CUS to support the planned level of MWRRS operations.

Exhibit 7-15
Platform Arrangement at Chicago Union Station



7.8 Mechanical Facilities and Train Storage at CUS

In the current operating plan, 20 trains layover in Chicago, with the other 37 trains spend the night at outlying points. Since morning demand is mostly inbound to Chicago and evening demand outbound, it makes sense that more trains lay over at outlying points. In total, the fully built out system requires 57 trains for daily operations, but 63 trains are required for reserve and protect assuming all maintenance is performed at night. To support a daytime maintenance policy, even more trains would need to be purchased.

MWRRS needs capacity at CUS for mid-day train storage, as well as for parking, fueling and the cleaning of twenty trains overnight. MWRRS locomotives will have large enough fuel tanks to operate throughout the day without refueling. However, trains that lay overnight will require refueling, cleaning and turnaround mechanical inspection before beginning their next day's trip. Amtrak's recent withdrawal from boxcar express shipping operations should make it easier to find support tracks and yard storage space to accommodate MWRRS needs. Still, a specific plan is needed for the requisite mechanical and train storage facilities at CUS. Conceptually, Chicago would be an ideal location for a MWRRS maintenance base, if a suitable site could be found. At a minimum, Chicago must provide turnaround servicing, but the operating plan does not now require a maintenance shop there.

Only a few fueling tracks are needed to fuel all 20 trains overnight. However, trains must be moved off the servicing tracks back to the station as soon as fueling is complete, so that the next set of trains can move into place. Each evening, MWRRS trains can be shuttled one or two at a time from the station tracks to the fueling facility, and back again. Since up to 14 trains can be stored on the station tracks, only six MWRRS trains need to be stored overnight in the yard.

7.9 Outlying Station and Mechanical Facilities

Low-cost train layover facilities are needed at the following 13 locations:

- Omaha
- Cleveland
- Quincy
- Cincinnati
- Carbondale
- Battle Creek/Kalamazoo
- Indianapolis
- Holland
- Green Bay
- Toledo
- Des Moines
- Champaign
- Port Huron

Each layover facility must have the capability to fuel locomotives and to provide the FRA-mandated daily equipment inspection. Additionally, electrical hookups, waste disposal and potable water facilities are needed to service the passenger coaches. Layover facilities may have a small inspection pit. A canopy-type covering has been suggested for at least the inspection area, since many of these outlying facilities are in heavy snow belt areas, thus potentially rendering the inspection pits unusable. Only refueling, cleaning and FRA-required daily inspection – but no significant maintenance activities – should need to occur at any of these locations. Based on the State of Maryland's experience with similar facilities recently constructed in Frederick, MD and at Martinsburg, WV for the Maryland Rail Commuter (MARC) service, the cost for a two-train layover facility should be no more than \$2-\$3 million. However, the MWRRI cost estimate conservatively provides \$6.5 million for each layover facility. The following are the recommended mechanical shop and layover facilities:

- One system maintenance facility with eight servicing bays and two tandem lathes at Pontiac
- A satellite maintenance facility with five servicing bays at St. Louis
- Smaller satellite maintenance facilities with three servicing bays at Kansas City, St. Paul and Madison

- A three-track train fueling and inspection facility near Chicago Union Station
- Overnight layover facilities at 13 outlying locations[9]

Stations at route endpoints have significant operational requirements. Trains at the end of their runs need extra time for schedule recovery, reversing direction and for mechanical inspection before beginning the next trip. Trains must be stored overnight, fueled and inspected before their first morning departure. Trains can be stored overnight on the station tracks, or they can be moved to a separate train layover facility. Ideally, an overnight layover facility should be located close to the passenger station, and in the outbound direction so a train can continue, without reversing direction, after its final station stop.

- If the layover facility is outbound from the station, then requirements are no different than for any other station stop since the train needs to pause only for a few minutes at the station platforms.
- If a reverse move is required to reach the layover facility, separate station platform tracks are recommended. Dedicated tracks eliminate interference with freight operations while a passenger train waits at the station.

Both an inspection pit and a fueling facility are desirable for an overnight layover facility. However, these facilities may be difficult to accommodate on station platform tracks. Although an inspection pit is desirable, the FRA does not require one. This report addresses facility requirements only at a conceptual level. Detailed requirements for train layover facilities at a specific location, or the decision not to build one at all, is best left to the discretion of the individual states involved in the MWRRI.

7.9.1 Terminal Station Evaluations

TEMS evaluated terminal operational requirements at five specific MWRRS stations. Two locations, Quincy and Carbondale, serve as a terminus for Amtrak service today. Two stations, Holland and Port Huron, serve as intermediate stops for Amtrak trains, but no trains originate or terminate there. With the ending of Chicago-Toronto International service in April 2004, Port Huron will become the terminus for a new daily train, the Blue Water, which will lay overnight on the Port Huron station track. Green Bay does not have rail passenger service. The operational requirements and existing facilities at each station are different. A conceptual assessment of terminal station operations was developed for each of the following five MWRRS locations:

Quincy, IL

As shown in Exhibits 7-17 and 7-18, the un-staffed Quincy Amtrak station is located along the single-tracked BNSF main line on the northerly outskirts of town. One daily Amtrak train serves Quincy, leaving for Chicago at 6:12 AM and returning at 10:18 PM. After discharging its passengers at the Quincy station, the train crosses a Mississippi River bridge for overnight storage in the West Quincy, MO freight yards.

[9] Kalamazoo and Battle Creek may possibly be combined into a single layover facility.

Exhibit 7-16
Location of Quincy, IL Amtrak Station

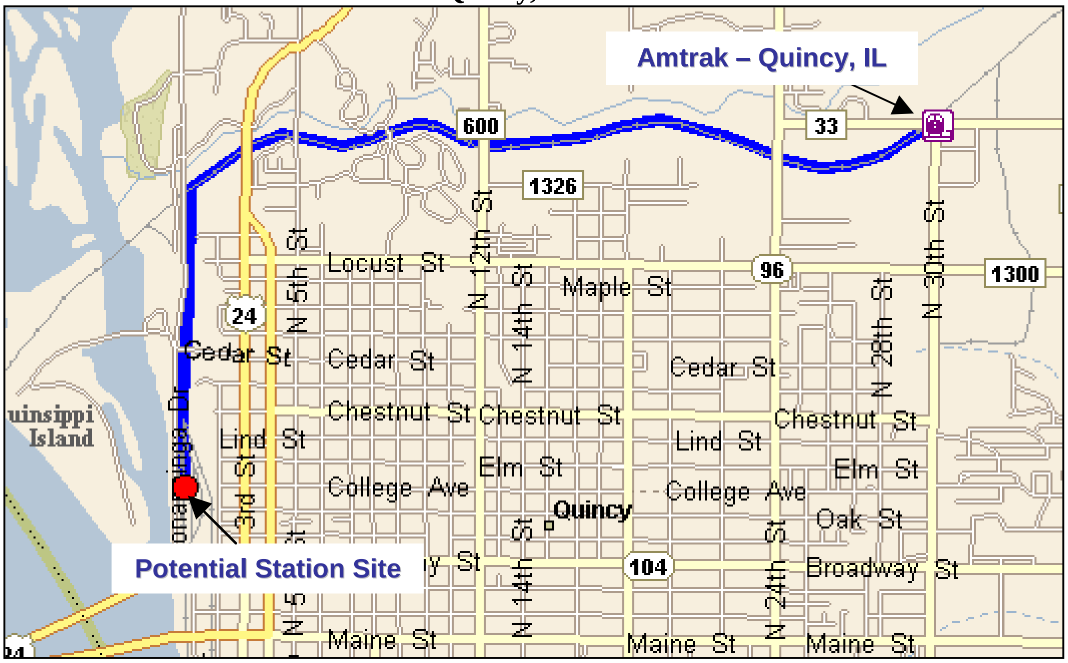
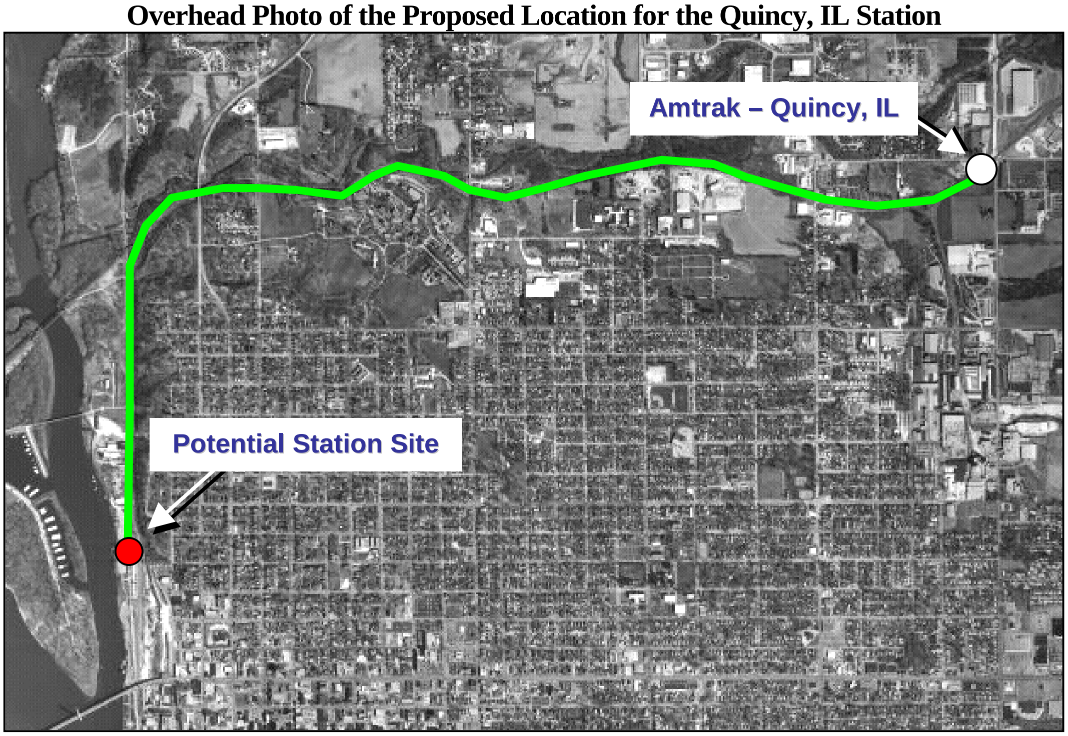


Exhibit 7-17
Overhead Photo of the Proposed Location for the Quincy, IL Station



As shown in Exhibit 7-19, the MWRRS would expand service to Quincy from one-round trip to four round-trips each day. Planned equipment turns and layover times are based on the most recent MWRRS equipment cycling analysis. Train pairing 657-650, shown in yellow, requires an overnight layover. One train will lay overnight at Quincy under the planned MWRRS schedules.

Exhibit 7-18
Planned MWRRS Quincy, IL Equipment Turns

Train #	***Station***	***Time***		***Station***	***Train #***	***Station***	***Time***		***Station***	***Layover Time***
		Dep	***Arr***				***Dep***	***Arr***		
651	Chicago	7:10	10:54	Quincy	652	Quincy	11:35	15:40	Chicago	0:40
653	Chicago	9:56	14:00	Quincy	654	Quincy	14:30	18:15	Chicago	0:29
655	Chicago	14:10	17:54	Quincy	656	Quincy	18:25	22:30	Chicago	0:30
657	Chicago	20:00	0:04	Quincy	650	Quincy	5:01	8:56	Chicago	4:56

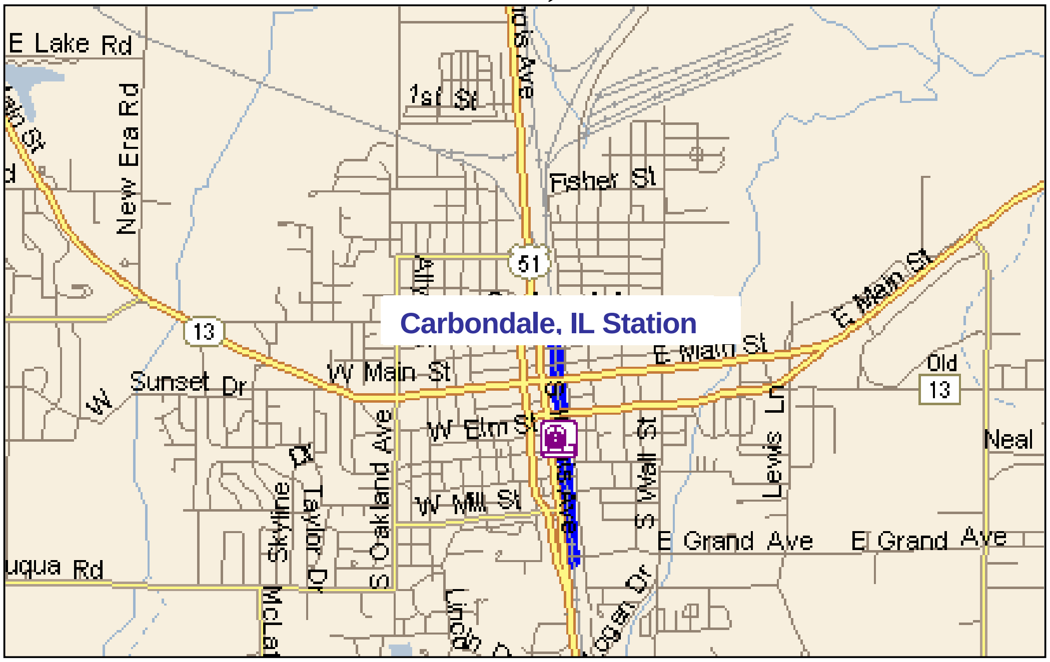
The Quincy station needs a dedicated platform track for reversing passenger trains. This is not a problem for the current Amtrak operation since the train pauses for only a few minutes before continuing to West Quincy, but extended layover times of 30-40 minutes for trains turning back to Chicago may become a problem, if trains block the busy BNSF main line. A short siding east of the station may be used for clearing passenger trains off the main line, but it would be better for trains to wait directly on the platform track and not have to back in and out of the station.

However, consideration should be given to extending rail service to a new station in downtown Quincy on the riverfront, where MWRRS could help stimulate downtown economic development. A riverfront site would clear passenger trains off the BNSF main track so freight interference with station operations would no longer be an issue. The current station could remain in service as a suburban, auto-accessible site. Since only one train must be stored overnight at Quincy, allowing the train to lie over on the station track seems to be an adequate solution.

Carbondale, IL

As shown in Exhibit 7-20, the Carbondale Amtrak station is located on the Illinois Central main line in the Carbondale central business district. Two daily Amtrak trains serve Carbondale. State-supported *Illini* service leaves for Chicago at 4:05 PM and returns at 9:35 PM. Amtrak's long-distance train, the *City of New Orleans*, leaves the station in the middle of the night, northbound at 3:16 AM and southbound at 1:21 AM. One train set needed to support *Illini* service is stored overnight on the Rock Track just south of the station. Just before train time, the equipment is moved out of the Rock Track onto the mainline for loading.

Exhibit 7-19
Location of Carbondale, IL Amtrak Station



MWRRS would double Carbondale service from one to two round-trips each day. Planned equipment turns and layover times, based on the most recent MWRRS equipment cycling analysis, are shown in Exhibit 7-21. Train pairing 403-400, shown in yellow, requires an overnight layover. Only one train needs to lay overnight at Carbondale under the planned MWRRS schedules.

Exhibit 7-20
Planned MWRRS Carbondale, IL Equipment Turns

Train #	***Station***	***Time***		***Station***	***Train #***	***Station***	***Time***		***Station***	***Layover Time***
		Dep	***Arr***				***Dep***	***Arr***		
401	Chicago	9:30	13:52	Carbondale	402	Carbondale	15:03	19:26	Chicago	1:11
403	Chicago	17:30	22:11	Carbondale	400	Carbondale	6:08	10:50	Chicago	7:56

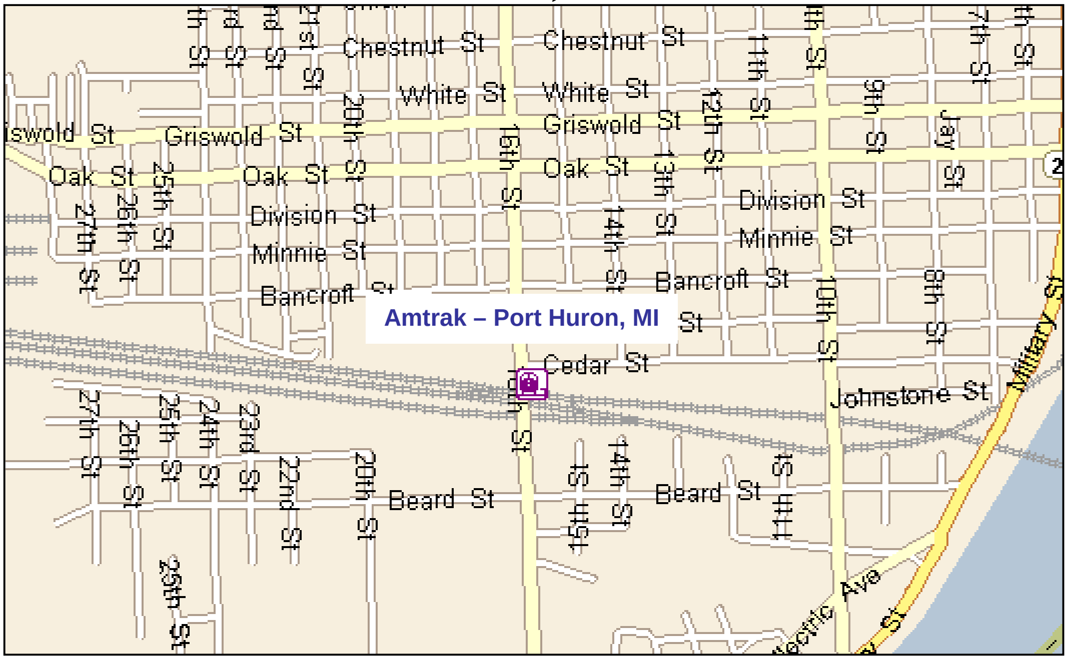
Current facilities at Carbondale seem adequate to support the proposed MWRRS operation, assuming that the Rock Track can be used for storing the mid-day equipment turn 401-402 as well as the overnight layover of 403-400. Mechanical servicing facilities on the Rock Track may not be adequate, in which case an inspection pit and a fueling capability may need to be installed, or a small layover facility can be built at the southern outskirts of Carbondale.

Port Huron, MI

As shown in Exhibit 7-22, the Port Huron Amtrak station[10] is located along the CN main line just west of the entrance to the Sarnia-Port Huron rail tunnel. The station is staffed. Only one train serves Port Huron today: Amtrak's daily Chicago-Toronto *International*, which departs eastbound to Toronto at 4:55 PM and westbound at 12:20 PM (except Sundays, when the train departs at 5:15 PM.)

[10] Photographs of Port Huron station can be found on-line at: http://www.trainwatchers.com/porthuron/

Exhibit 7-21
Location of Port Huron, MI Amtrak Station



Since Port Huron today only serves as an intermediate stop, there is no overnight Amtrak train storage there. However, in April 2004, Chicago-Toronto through service was discontinued, and replaced with a daily Port Huron-Chicago round-trip. An electrical hookup and water service are being installed on the Port Huron station track to allow the train to lay overnight there. As shown in Exhibit 7-23, MWRRS plans to institute four daily round trips to Port Huron. Two trains, shown in yellow, will need to lay overnight. The current MWRRS schedules also call for relatively long three-hour layovers before mid-day equipment turns.

Exhibit 7-22
Planned MWRRS Port Huron, MI Equipment Turns

Train #	*Station*	*Time*		*Station*	*Train #*	*Station*	*Time*		*Station*	*Layover Time*
		Dep	*Arr*				*Dep*	*Arr*		
150	Chicago	7:10	12:04	Pt. Huron	155	Pt. Huron	15:08	17:57	Battle Creek	3:03
152	Battle Creek	11:25	14:15	Pt. Huron	157	Pt. Huron	17:30	20:19	Battle Creek	3:14
154	Battle Creek	18:11	21:01	Pt. Huron	153	Pt. Huron	8:20	11:09	Battle Creek	11:18
156	Battle Creek	20:33	23:23	Pt. Huron	151	Pt. Huron	6:02	11:18	Chicago	6:38

Two solutions to the long layovers may be possible. One would be to add two dedicated platform tracks at the Port Huron station. Alternatively, a separate layover facility could be constructed, but if located west of the station, trains will have to back in and out of the station, and at least one dedicated station track will still be needed. Ideally, the MWRRS layover facility will be located east of the station to avoid the need for reverse moves, but the station's close proximity to the mouth of the Sarnia-Port Huron rail tunnel imposes constraints on where the facility can be placed.

A new intermodal facility has been proposed near the Port Huron Amtrak station. Whether this proposal conflicts with a MWRRS passenger train layover facility remains unclear.

Holland, MI

As shown in Exhibits 7-24 and 7-25, the Holland Amtrak station is located on the CSX main line in downtown Holland. In 1991, the beautifully landscaped station received a $1.7 million renovation. One daily train serves Holland: Amtrak's state-supported *Pere Marquette* that departs daily eastbound to Grand Rapids at 9:16 PM, and westbound to Chicago at 8:17 AM. Since Holland serves only as an intermediate stop, there is no overnight Amtrak train storage there today.

Exhibit 7-23
Location of the Holland, MI Amtrak Station

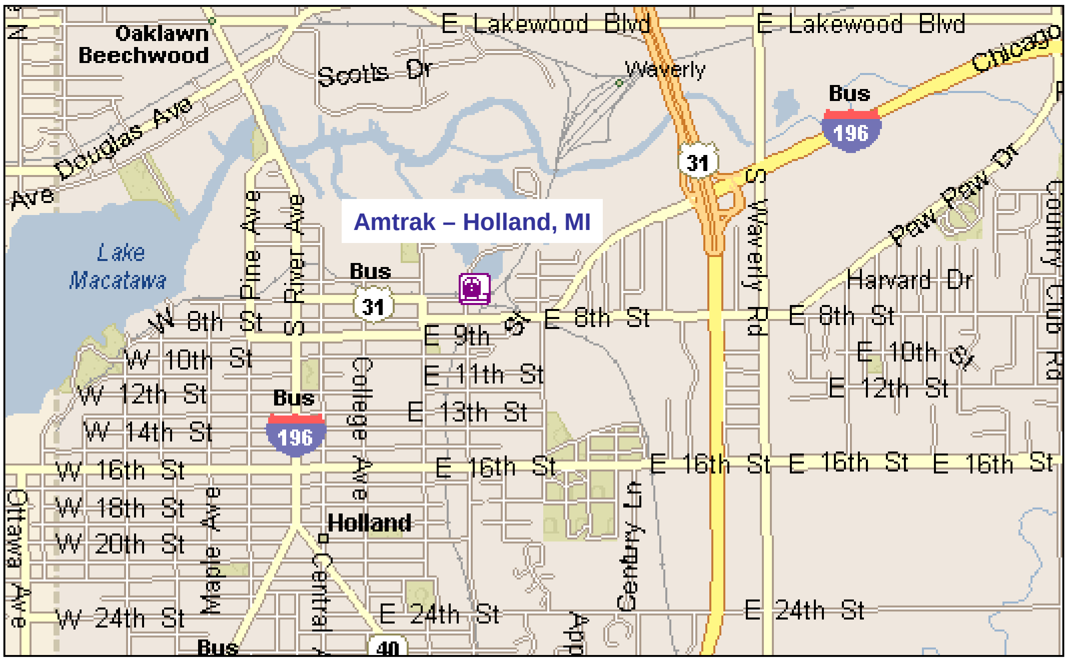


Exhibit 7-24
Photo of the Holland, MI Amtrak Station

Rail service to Holland would operate differently under MWRRS than it does today. Currently, Amtrak heads directly south to Chicago on CSX's former Pere Marquette line. Instead, MWRRS would offer Holland service as an extension of the Kalamazoo-Grand Rapids branch line. Trains from Holland would first head northeast 25 miles to Grand Rapids, then due south to Kalamazoo before turning southwest to Chicago.

Based on the latest MWRRS equipment cycling analysis (Exhibit 7-26), two trains would lay overnight at Holland, shown in yellow, and two other trains would have long mid-day layovers. Dwell times at Holland cannot be as short as desired, because trains must rotate through shops for maintenance on four-day cycles. Although train 130 arrives early enough to turn back as train 133, another equipment set from the yard must cover that schedule. Equipment arriving on train 130 departs as train 135 instead.

Exhibit 7-25
Planned MWRRS Holland, MI Equipment Turns

Train #	*Station*	*Time*		*Station*	*Train #*	*Station*	*Time*		*Station*	*Layover Time*
		Dep	*Arr*				*Dep*	*Arr*		
130	Chicago	8:18	11:16	Holland	135	Holland	15:00	18:22	Chicago	3:43
132	Kalamazoo	13:10	14:28	Holland	137	Holland	17:40	21:02	Chicago	3:11
134	Chicago	14:20	17:18	Holland	131	Holland	5:22	8:28	Chicago	12:03
136	Chicago	19:00	22:23	Holland	133	Holland	11:40	12:57	Kalamazoo	13:16

Between 14:28 and 15:00, trains 135 and 137 both need to park in the station. Currently there is only a single track through the station. However, since the line was double-tracked, there should be enough room to add at least one dedicated station track. However, two tracks, not just one are needed.

As shown in Exhibit 7-27, the best location for a Holland train storage yard would be either:

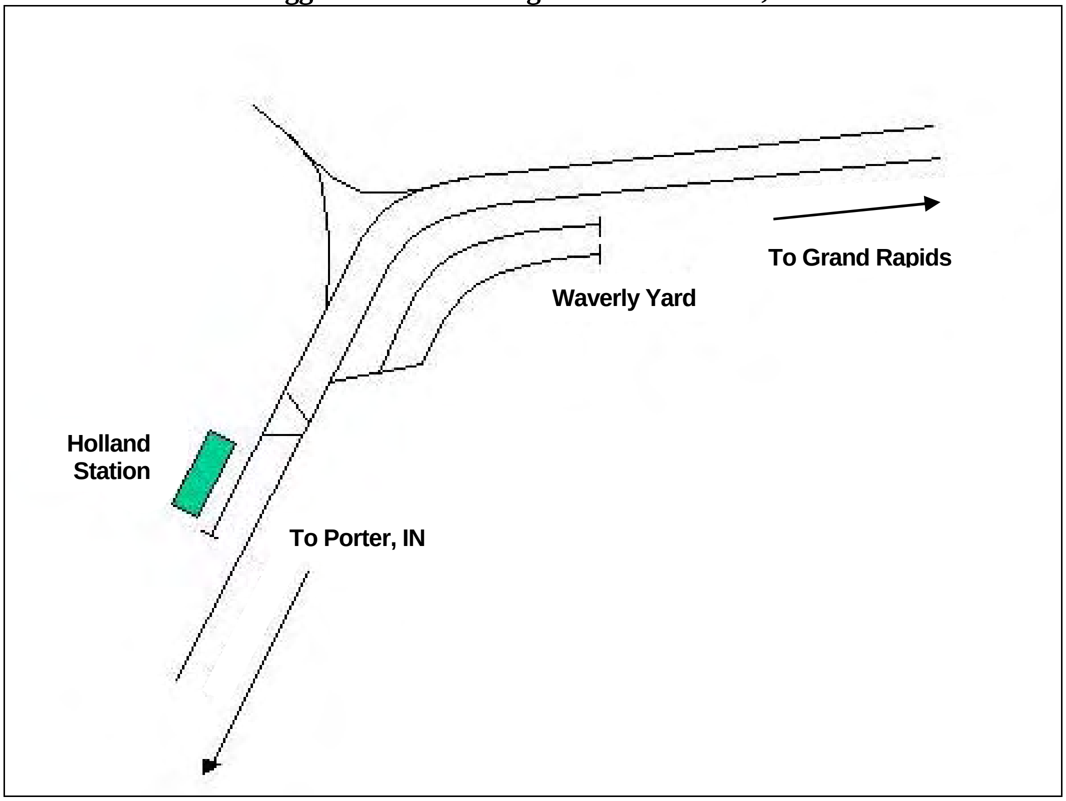
- In the immediate vicinity of the Holland station, or
- In CSX's Waverly yard – about a mile northeast of the station

Waverly yard is an attractive site even though it would require reversing direction from the station. Going south would require moving over numerous highway grade crossings in downtown Holland. If these grade crossings could be eliminated, a site south of the station may be more desirable. However, the needed additional land appears to be available at Waverly, and there do not appear to be any grade crossing conflicts between Waverly and the train station location.

For a layover facility at Waverly, a stub-end, dedicated platform track at Holland station should be installed as shown in Exhibit 7-28. This would keep passenger trains off the CSX main line while loading or unloading passengers at the Holland station. Trains would move from the Waverly storage yard to the passenger station just before train time. While passengers are loading, the operating crew would change ends and prepare for departure. This process would work in reverse for arriving trains.

Exhibit 7-26
Waverly Yard Site at Holland, MI

Exhibit 7-27
Suggested Track Configuration at Holland, MI



Green Bay, WI

Green Bay has not had passenger rail service since April 1971. Wisconsin Central acquired the former C&NW rail lines on which MWRRS would operate in 1993; Canadian National purchased Wisconsin Central in 2001.

The Titletown Brewery Company converted the former C&NW train station, at the intersection of Dousman and Broadway Street, into a restaurant. However, the owner of the restaurant seemed interested in forming a cooperative relationship with MWRRS that may enable use of at least the station platforms, or allow for the building of a new station on adjacent property. Exhibits 7-29 and 7-30 show the location of the proposed C&NW station at Green Bay.

Exhibit 7-28
Location of the Green Bay, WI MWRRS Station

Exhibit 7-29
Aerial Photograph of Proposed Green Bay Station Site

As shown in Exhibit 7-31, MWRRS would institute seven daily round trips to Green Bay. Two train sets, shown in yellow, would need to lay overnight. Current MWRRS schedules call for three-hour layovers for mid-day equipment turns; as a result, two trains need to be on hand at Green Bay most of the time.

Exhibit 7-30
Planned MWRRS Green Bay, WI Equipment Turns

Train #	*Station*	*Time*		*Station*	*Train #*	*Station*	*Time*		*Station*	*Layover Time*
		Dep	*Arr*				*Dep*	*Arr*		
751	Chicago	6:15	9:28	Green Bay	754	Green Bay	11:36	15:25	Chicago	2:07
753	Chicago	7:20	11:06	Green Bay	756	Green Bay	14:12	17:45	Chicago	3:06
755	Chicago	9:30	13:02	Green Bay	758	Green Bay	16:07	19:40	Chicago	3:04
757	Chicago	11:40	15:26	Green Bay	760	Green Bay	17:58	21:14	Chicago	2:31
759	Chicago	13:50	17:28	Green Bay	752	Green Bay	9:58	13:20	Chicago	16:29
761	Chicago	15:50	19:22	Green Bay	762	Green Bay	19:52	23:41	Chicago	0:29
763	Chicago	19:49	23:35	Green Bay	750	Green Bay	6:20	10:09	Chicago	6:44

This analysis confirms the need for a freight yard site adjacent to the passenger station, providing room to construct dedicated platform tracks and a train layover facility. Although one platform track and two layover tracks would be theoretically sufficient, because of the possibility of late arrivals or departures, our recommendation would be to construct a three-track train layover facility at Green Bay and to provide two dedicated station platform tracks.

7.10 Express Parcel Operations

Same-day parcel service is a high revenue, low volume business with exacting service requirements, even when compared to overnight delivery. While the express parcel service discussed here may bear a superficial resemblance to Amtrak's Package Express product, this new service would be targeted towards a completely different, time-sensitive market.

Amtrak has recognized the synergy between checked baggage service and light weight express package service, which Amtrak offers on its national network of long distance trains. Amtrak considers anything under 50 lbs. that can be handled without fork lifts or facilities beyond those normally used to provide checked baggage service to be "Regular Express." Such packages are small enough to be individually handled, or they can be sorted into small plastic bins or mail sacks. Rates of $60-$80 per added pound keep parcels small. For example, on Esprit's service from London to Paris or Brussels, 80 percent of shipments weigh less than two pounds. However, Amtrak's current slow, infrequent, long distance trains cannot provide a reliable and therefore marketable, same day express service.

Amtrak's has noted that its fast, frequent and reliable trains in the Northeast Corridor also did not provide for a successful parcel operation. However, express parcel traffic does not materialize automatically but requires an effective marketing effort. By relying heavily on courier firms to market its service rather than employing its own sales force, Amtrak may have doomed its earlier initiative for reasons unrelated to operational feasibility. Since express parcel service is a growing component of European passenger rail services, provision of rail parcel service is technically feasible. Clearly there is a market for same-day parcel service in the U.S. as well. For downtown-to-downtown shipping, rail has both a cost and speed advantage over competing modes, and so it should be able to garner significant market share.

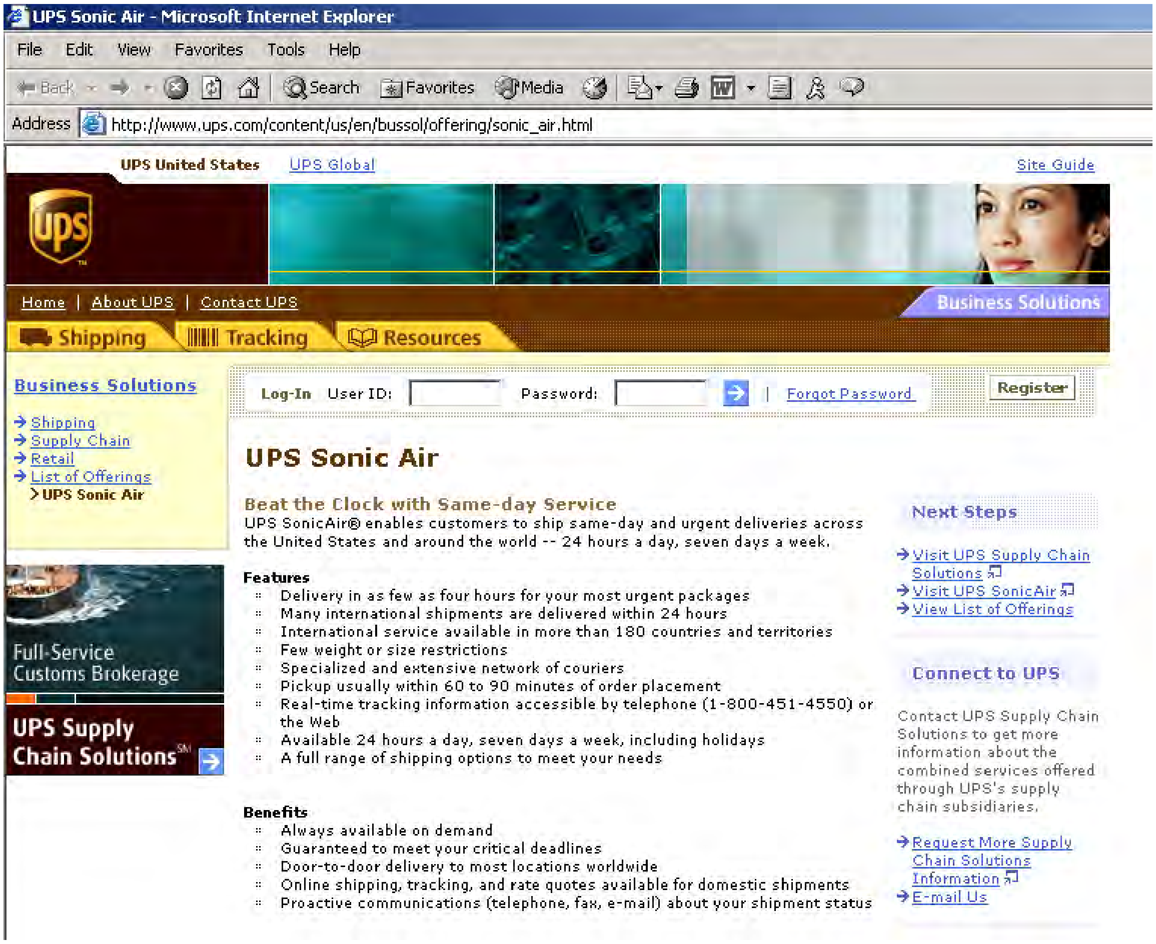
MWRRS will improve corridor frequencies and speeds enough to make rail attractive for parcels as well as passengers. To see how an MWRRS express parcel service could be organized the structuring of similar American and European services was investigated.

In the U.S., same-day parcel service is offered by UPS and FedEx, as well as by some airlines. United Parcel Services' Sonic Air subsidiary (Exhibit 7-32) offers same-day delivery of shipments up to 100 pounds. Sonic Air uses "a specialized and extensive network of couriers" and boasts "access to more than 30,000 domestic and international flights per day." It operates separately using its own courier network and regularly scheduled airlines – not UPS' own trucks and planes.

TEMS interviewed two European rail priority parcel service providers: the Swedish operator Expressgods and the British Esprit, a division of Eurostar. Expressgods offers same-day rail package service throughout Sweden, while Esprit provides a same-day package service on Eurostar's high-speed trains between London, Paris and Brussels. Esprit also contracts with passenger train franchisees to provide same-day package service anywhere in the U.K.

Sonic Air, Expressgods and Esprit all use call centers to serve as a single point of customer contact. These centers manage courier services at both ends, arrange for any special handling, track the movement of all packages and deal with any exceptions that might occur. All three companies advertise their services directly to the customer and employ their own sales force. These successful business strategies are the same ones proposed for MWRRS express parcel service.

Exhibit 7-31
UPS Sonic Air: Web Site



7.10.1 Handling Parcels on Trains

European railroads employ two main methods for handling parcels on trains – conductor-provided service and dedicated parcel compartment.

Conductor-provided service

Train conductors in Sweden and the U.K. routinely handle express parcels. Since trains run often, each conductor has to handle only a few packages, yet a large volume of packages can be shipped. If available, conductor workrooms offer a secure place to store packages but are not necessary.

At small stations and during start up, if MWRRS train conductors could handle some parcels, then business could grow incrementally without risking capital investment or prematurely adding fixed station costs. A few packages could be handed off to conductors at the platform in a matter of seconds. Conductors' responsibility in handling express parcels would differ little from the work they already do handling rail company mail. In the U.S., train conductors routinely do this while still fulfilling their other duties. Conductors generally receive a small extra payment, called an “arbitrary” for handling company mail, and could receive the same extra pay for handling parcels.

The number of packages on each train has to be kept within reasonable, agreed-upon limits to prevent overburdening or distracting the conductors from other duties. Any burden on train conductors is intended to be minimal, since the main parcel flows should be carried in the dedicated compartment. The same computerized reservations system used to manage door-to-door parcel operations could easily enforce limits on the maximum number of parcels any conductor is expected to handle. Conductors could interface directly with couriers even at stations that are not staffed. No station facilities are needed to support this kind of service.

Although conductor-provided service works well in Europe, it is not clear that Amtrak can negotiate a similar deal with its staff – or that under the current management policy of focusing on its core passenger business, that Amtrak would wish to do so. If conductors are not able to handle parcels, then an independent operator could implement MWRRS parcel service, using only the dedicated parcel compartment.

Dedicated Parcel Compartment

At major stations, station personnel could load parcels into a dedicated, secure compartment using an outside access door. This can be done quickly without delaying the train, since dedicated station personnel would transfer the packages or mailbags, and the train crew need not be involved in the loading or unloading operation. Once business grows to a point that justifies investment and added station staff, any station can be equipped to handle parcels using such a dedicated compartment. Exhibit 7-33 shows a baggage handler loading packages onto the dedicated compartment on a Eurostar train.

Exhibit 7-32
Eurostar Baggage Handler Loading Small Packages onto the Train

The MWRRI proposal recommends franchising the express parcel business separately from the passenger contract. Without the ability to use train conductors, higher station staffing is needed during ramp-up, but this has no effect on the long-term economics of the system. The express parcel financial plan provides enough dedicated personnel to handle the parcel traffic – 1 person, 2 shifts per day, at 22 stations which should be able to develop enough business to justify using the dedicated compartment. TEMS’ revenue projection is based on traffic at those 22 stations; it does not include revenue at other stations that would have to rely on conductor-provided service.

7.10.2 Station Facility Requirements

The preferred method for handling express parcel traffic depends on the size of the station, and whether conductor-provided service can be made available. Service at small stations is only feasible if train conductors can handle the packages making a dedicated station facility unnecessary. Passenger personnel or food stand operators can accept a few packages, or couriers could meet the train conductors directly. The Swedish firm Expressgods found that ticket agents are usually very busy close to train departure time and, therefore, do not have enough time to handle packages. They are also unable to leave their posts to deliver packages to a train. Therefore, Expressgods prefers to work with others, such as station restaurateurs, who are happy to receive incremental revenue associated with parcel handling. Expressgods pays its contractors at small stations on a per-package basis.

At major stations, it is worthwhile to establish a permanently staffed, secured and dedicated parcel room. Such rooms may have a small area for sorting parcels into mailbags or plastic bins.

If there are regularly more bags or bins than a person can easily carry train side, baggage carts or small tractors may be needed to haul them out to the platforms. Exhibit 7-34 shows an Esprit tractor with baggage carts.

Exhibit 7-33
Esprit Tractor and Baggage Carts

On the platform, bags and bins are manually loaded/unloaded from the compartments. Heavy roll on/roll off units that require high platforms – normally associated with heavy second and third class mail – need not be used. Instead, procedures and equipment normally used for providing checked baggage service are appropriate. Same-day parcels are normally lightweight and low volume, and can be handled using mailbags. These can be loaded or unloaded from baggage carts into the parcel compartments by hand.

In Exhibit 7-29, the baggage carts used by Esprit are extremely low-slung; packages and bags are carried close to the ground. This is to minimize the need for lifting packages and bags on and off the cart, when loading or unloading a train at a high-level platform. In contrast, a standard U.S. baggage cart that is about 36” high would approximate the train floor level when loading from a low-level platform. Thus, a parcel service can easily be provided from either a low-or-high level platform, simply by procuring a baggage cart of the appropriate height.

Clearly, the time needed for station servicing depends on the number and weight of bags to be transferred. Plenty of time is available at route endpoints such as Chicago, and often schedules allow extra time at major stops, such as St. Louis. Express parcel volume at small intermediate stations will not be heavy enough to cause any train delay. Both Esprit and Expressgods confirmed their parcels are transferred without slowing down train operations.

The station facilities needed to support a MWRRS parcel service are already in place in 13 out of the proposed 22 locations. Amtrak operates a network of long-distance trains that already serve many of the larger MWRRS stations. Since long-distance trains offer checked baggage service, all of these stations have a baggage room, tractors and baggage carts. Light express package service is also offered today at all 13 locations. MWRRS stations already with the checked baggage capability for Amtrak include:

- Chicago, IL
- Kansas City, MO
- Omaha, NE
- Bloomington-Normal, IL
- Springfield, IL
- St. Louis, MO
- Toledo, OH
- Cleveland, OH
- Indianapolis, IN
- Champaign-Urbana, IL
- Carbondale, IL
- Milwaukee, WI
- Minneapolis/St. Paul, MN

Only two major MWRRS cities lack Amtrak checked baggage service today:

- Cincinnati, OH
- Detroit, MI

Mid-sized stations where new parcel facilities are needed include:

- Madison, WI
- Jefferson City, MO
- Green Bay, WI
- Des Moines, IA
- Kalamazoo, MI
- Fort Wayne, IN
- Grand Rapids, MI

If Amtrak chooses not to participate in the express parcel market, the economies of scale associated with using existing baggage facilities may not be realized. As a result, the MWRRS business plan includes capital for adding separate express parcel rooms to all 22 stations, without relying upon Amtrak's facilities. Security measures for express parcel service are the same as those needed and currently in place for Amtrak Regular Express service.

7.10.3 Chicago Union Station Requirements for Express Parcel Service

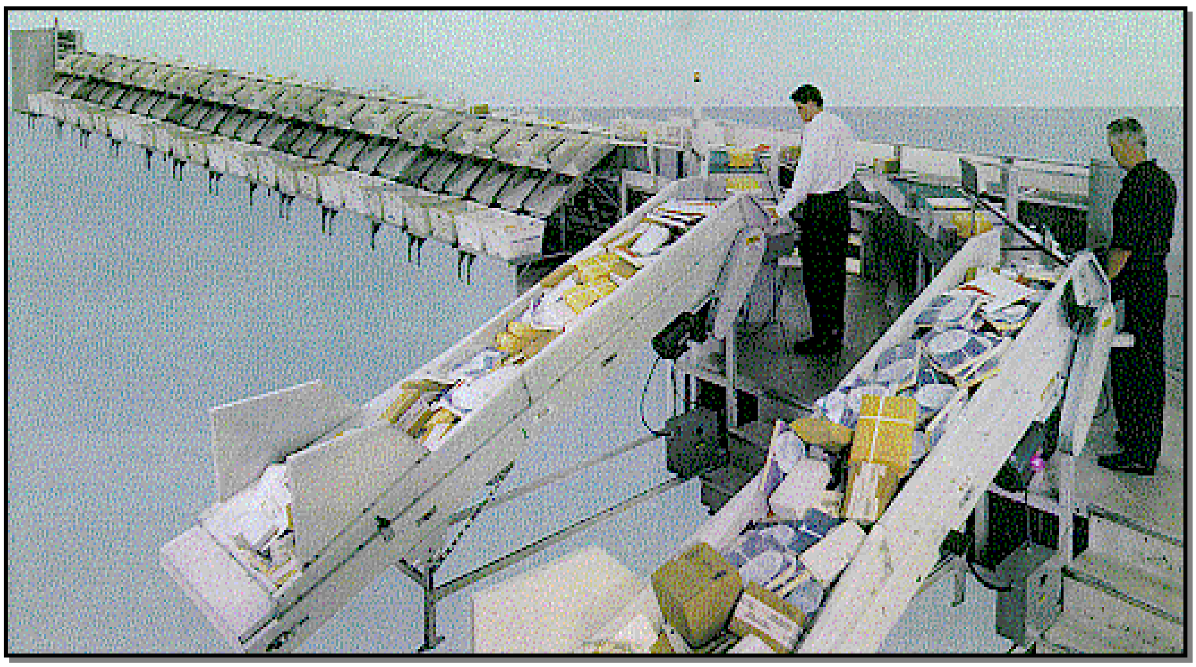
At Chicago, packages arriving from local couriers are sorted for departure on the correct outbound train. Packages from arriving trains are sorted for delivery to local couriers or further movement on outbound connecting trains. Most MWRRS parcels will originate, terminate or pass through Chicago. The Express Parcel Market Analysis projected that by 2014 volume at Chicago will be 1,247 originating, 2,008 terminating and 1,001 parcels transferred from inbound to outbound trains: a total of 4,256 packages each day that need to be sorted.

To determine the facilities needed for handling this volume, Chicago facility requirements were discussed with Esprit**,** which has a similar sorting facility at their London rail station, and with Lockheed Martin, a supplier of automated sorting equipment for the U.S. Postal Service (USPS).

A manual sorting operation has a productivity of 120 parcels per person per hour. By 2013, staffing would need to expand to eight persons, or four persons per shift. Work rules must be created to permit flexible utilization of mailroom labor, so the same person can load and unload a train, bring packages back to the mailroom and sort packages to their correct destinations, as needed.

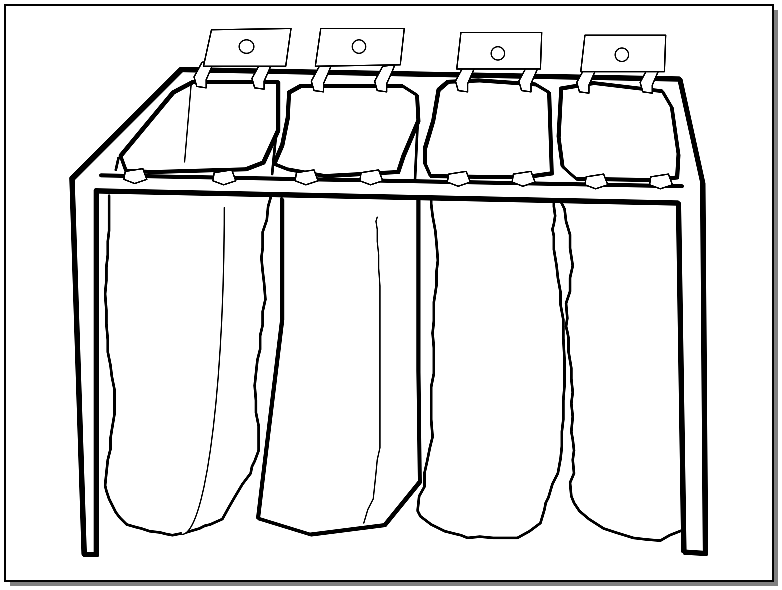
The Esprit package service uses manual sorting and Lockheed Martin recommends manual sorting as the best, lowest cost method until the cost of a machine can be justified. The capacity of even Lockheed Martin's smallest machine that sorts 2,500 packages per hour with up to 56 outputs, shown in Exhibit 7-35, substantially exceeds MWRRS requirements[11]. It appears, therefore, that simple manual sorting using mailbags and racks, as shown in Exhibit 7-36, will be the most cost-effective solution for the MWRRS.

Exhibit 7-34
Lockheed Martin Small Package Sorter



[11] TEMS' market analysis assumed a very modest market share based on excluding certain traffics, such as cancelled check packets from the Federal Reserve Bank. If the MWRRI system attracted such traffic, a far more extensive operation would be needed at Chicago Union Station, which might utilize Lockheed Martin sorting equipment. This would fit in the space defined in the financial plan.

Exhibit 7-35
Package Bag Sort Rack



A small room with dimensions of 20 x 20 feet, in the basement of Chicago Union Station, with a total staff of 2-3 persons for manual sorting should suffice for the start up period. Ideally, this room should be:

- Convenient to ramps leading to the CUS baggage platforms
- Convenient to arriving and departing couriers, and accessible to the public
- In a location that allows expansion for future growth

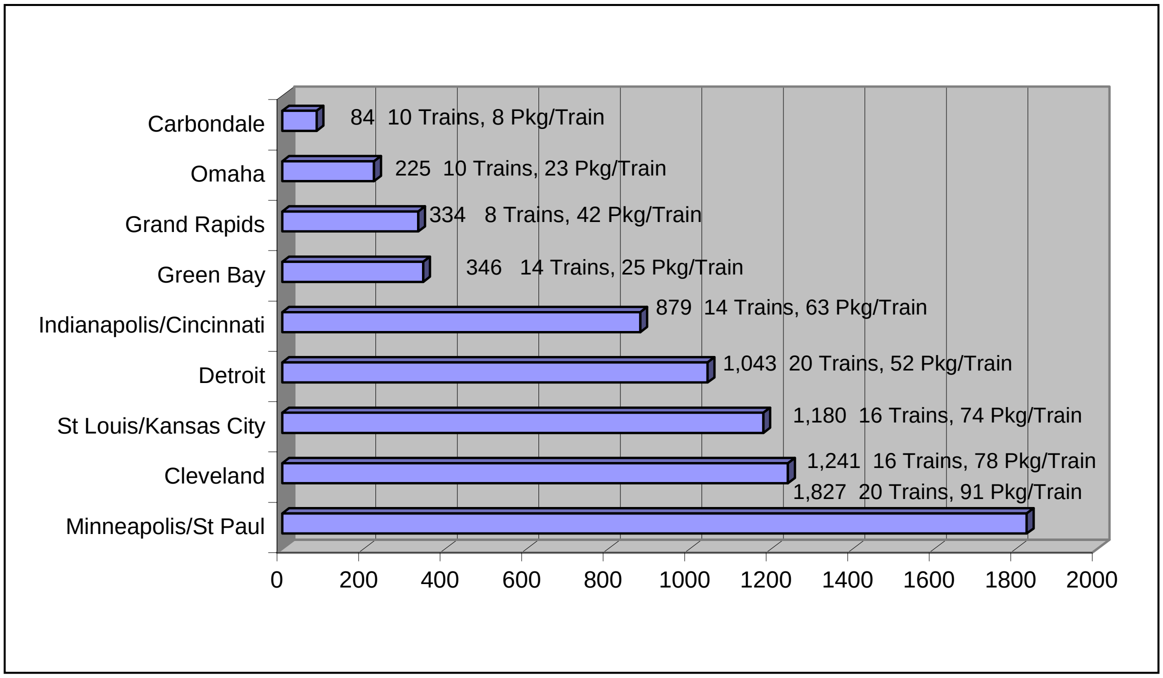
If, however, a space of sufficient size cannot be found, the amount budgeted in the express parcel business plan is sufficient to allow space to be leased at a nearby office building at commercial rates. Automated sorting can be considered a future possibility, as the cost of a new machine is $650,000. However, Lockheed Martin is beginning to replace USPS package sorters with newer models. With the permission of USPS, MWRRS could possibly acquire one or more second-hand USPS package sorters at a discount price. Such a machine would require floor space of 90 x 15 feet with additional 10 foot wide working space needed along each side of the machine.

7.10.4 Rail Equipment Requirements

As shown in Exhibit 7-37, the heaviest loading is predicted on the Twin Cities corridor with an average of 91 packages per train. On each train, a short walk-in compartment with an outside door just nine feet long, similar to those on Eurostar trains, would provide ample room to accommodate this business. The parcel compartment would be used by dedicated station parcel handling staff, not by train conductors. The requirement for a conductor workroom depends on whether conductor-provided express parcel service will be offered. To keep all options open, TEMS recommends both a dedicated parcel compartment and conductor's workroom with locking doors be included in MWRRS equipment specifications.

Most train manufacturers were comfortable that space needed for a parcel compartment could be added without displacing seating capacity. For example, space above the raised axle towers in Talgo end cars – an area that is unsuitable for revenue seating – could be used to provide an office and parts storage for a technician, a conductor's workroom, or a parcel compartment. Bombardier suggested that a parcel compartment could be added to the locomotive. As a result, it is anticipated that a parcel compartment could be added to the equipment purchase without significantly raising the cost or reducing seating capacity.

Exhibit 7-36
Daily MWRRS Parcels by Route (2014)[12]



7.11 *Express Parcel Operating Plan*

Most parcels originate or terminate in Chicago. Therefore, trains inbound to Chicago tend to load parcels, while outbound trains tend to unload them at stations along the way. In Chicago, parcels have to be sorted either for delivery to local couriers or for connecting outbound trains. There need to be only a few exceptions to this basic operating pattern:

- Packages headed outbound, for example Toledo to Cleveland, should not be sent the *wrong way* into Chicago. Toledo should separately sort packages for Cleveland and vice-versa.
- If there is a major intermediate station on the same line (*e.g.,* Indianapolis on the Cincinnati line) the outlying station could handle sorting. In other words, Cincinnati should sort Indianapolis' parcels into a separate mailbag, so they can be unloaded at Indianapolis. Those parcels should not be sent to Chicago.

[12] Projected daily package volumes in Exhibit 7-31 are based on an assumption of 260 working days per year. Usually, geographic zones in the demand forecast (based on NTAR's) are fine enough so at least the MWRRS route, if not a specific station, can be identified. However, Indianapolis/Champaign packages were allocated to routes based on the populations of those cities. The Quincy route generates negligible parcels.

- Packages bound for minor stations on the same line should also not be sent to Chicago, but if conductor-provided service is offered, they can be given to the train conductors. If conductors are not allowed to handle parcels, service cannot be offered at minor stations.
- Cleveland-Toledo-Detroit packages could use the Detroit-Toledo feeder bus. There is substantial demand for same-day shipping in this lane, so these packages should not be sorted in Chicago. Instead, Cleveland packages should be set off at Toledo and put on the bus to Detroit. Eventually it is possible that Cleveland Hub trains could handle these packages. An agreement would have to be negotiated with the Detroit-Toledo feeder bus operator to handle parcels, but hauling the parcels would seem to entail little or no additional cost to them.
- Door-to-door pickups and deliveries would be ordered through a central call center. A schedule would be proposed for the movement and, if the customer agrees, a courier would be dispatched to pick up the shipment. At stations with dedicated personnel for parcels, the package would be delivered to the station, sorted into a mailbag or container and placed in the parcel compartment. When the shipment arrives at the destination rail station, a courier would be waiting to deliver it to the consignee.

It has been Esprit's experience that priority parcel volumes are spread through the whole day and into the evening. A disadvantage of regular overnight package services – in spite of its lower cost – is a cutoff time for drop off as early as 3-4 PM. Rail express parcel service offers much later cutoffs, since it can accept packages until the last train of the evening, and still deliver early the next morning. Having missed the early afternoon cutoff for conventional overnight service, many customers are willing to pay a premium price to for a same-day delivery service. For this and other reasons, demand for rail express parcel service is not limited only to a few mid-day trains, but rather the facilities and trains are efficiently utilized throughout the day and night.

7.12 Operating Cost Development

The operating plan developed for the MWRRS not only promotes the delivery of high quality and reliable train service, but also the delivery of these services in a manner that promotes cost efficiencies. Operating costs for the MWRRS were developed based on the following premises:

- Train operating practices follow existing work rules
- Operating expenses for train operations, dispatch, management and supervision were developed through a bottom-up staffing approach, validated through independently developed operating ratios for train-mile costs and related supervision
- Maintenance of train equipment is contracted out (privatized)
- Track maintenance is provided by the host freight railroad
- The express parcel service is franchised separately from the passenger operation and its costs and revenues are developed separately from those of the passenger operation. The parcel operator's payment is calculated as a percentage share of net parcel revenue, after the cost of local courier service and a few other allowable expenses. The express parcel business plan, and proposed basis for calculating this payment are detailed in Chapter 10.

Eleven specific areas were focused upon for defining operating costs. These costs include:

- Track and right-of-way maintenance

- Train equipment maintenance
- Train and engine crew
- Fuel and energy
- On-board services crew
- Station staffing
- Service administration
- Sales and marketing
- Liability insurance
- Feeder bus
- Operator profit

Each of these costs has been categorized as mostly fixed or mostly variable. Variable costs are those that are modeled as directly dependent on ridership, passenger-miles or train-miles. Fixed costs are either predetermined or influenced by external factors, such as the level of freight railroad tonnage. Some fixed costs, such as station operations, increase as line segments open but not in direct proportion to train-miles. As a general principle, the costs identified as fixed should remain relatively stable across a broad range of service activities whereas the level of activity directly influences variable costs.

Fixed and variable cost designations were established only for categorizing the cost drivers. They are not intended as management precepts or edicts. Modern management practices, such as activity-based costing, can prove very effective in on-going efforts to increase efficiency and effectiveness.

7.12.1 Fixed Costs

Track and Right-Of-Way Maintenance Costs

When fully implemented, the MWRRS assumes an increase in both maximum authorized speed and frequency of train service. On some heavily used corridors, the MWRRS also assumes a substantial increase in capacity, all of which will require maintenance to FRA Class 4, 5, or 6 standards.

Incremental costs for track maintenance were estimated based on Zeta-Tech's January 2004 draft technical monograph Estimating Maintenance Costs for Mixed High Speed Passenger and Freight Rail Corridors. Route-specific track maintenance costs were developed for MWRRS by subdividing each line into short segments that have the same speed, freight and passenger tonnage, and number of tracks. Anywhere the speed, tonnage or number of tracks changed, a new segment was created. However, Zeta-Tech's costs are conceptual and are still subject to negotiation with the freight railroads. A spreadsheet giving costing detail by line segment is included in Appendix A10.

An important assumption in the application of Zeta-Tech's methodology is selection of the minimum or maximum cost level. Maximum costs are mentioned on page 1 of the report to "reflect maintenance practices on existing high speed railroad track such as Amtrak's Northeast Corridor (NEC)" whereas minimum costs are typical for freight railroads over which MWRRS will actually operate. Exhibit 7-38 shows the 2025 annual maintenance costs resulting from a *maximum* or "high-line" assumption.

The high line costs result not only from a higher ride quality standard, but also from difficulty of access and the difficulty of performing track maintenance, especially of rights of way with dense freight and passenger traffic. All these factors increase unit costs. The MWRRS has some routes that have relatively light traffic densities. Physical access to the track is not often an issue on these routes. MWRRS may also be able to benefit from the economies of scale realized by freight railroads. Therefore, a midpoint between the minimum and maximum costs would reflect the need for improved ride quality, without confounding costs with economic efficiency or economies of scale issues. However, the MWRRI steering committee adopted a very conservative posture that high-line costs should be used for developing the MWRRS financial plans.

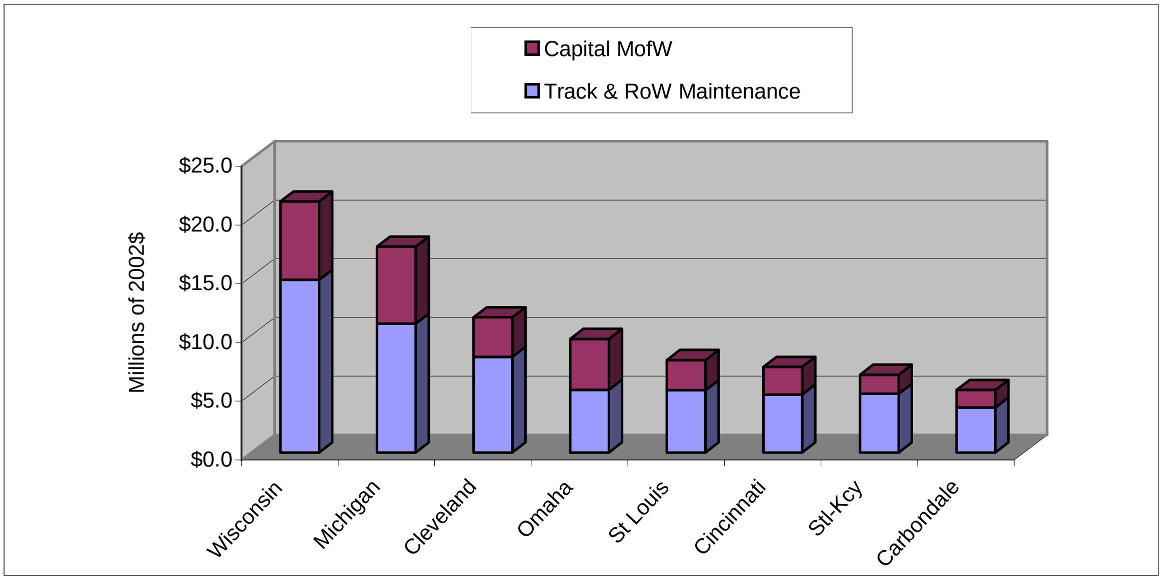
Exhibit 7-37
Cost Adjustments Following Upgrade of a Rail Line

Year	*Percent of Capital*	*Year*	*Percent of Capital*
0	0%	11	50%
1	0%	12	50%
2	0%	13	50%
3	0%	14	50%
4	20%	15	75%
5	20%	16	75%
6	20%	17	75%
7	35%	18	75%
8	35%	19	75%
9	35%	20	100%
10	50%		

Capital costs are gradually introduced in the MWRRS business plan, using a table of ramp-up factors provided by Zeta-Tech (Exhibit 7-37). In 2025, the year for which data are shown in Exhibit 7-38, capital costs have escalated only to about half their steady-state level. A normalized capital maintenance level is not reached until 20 years after completion of a major rail upgrade program. The annual MWRRS expenditure for train maintenance capital is funded out of the operating surplus generated by the system, but is not included in the Operating Ratio calculation. The annual amount of this capital cost is shown in Exhibit 10-14 "Cash Flow Analysis" for the MWRRS system.

In the MWRRS business plan, only the operating component of track maintenance cost is treated as a direct operating expense. States may have the option of directly funding capital costs using 80/20 federal matching grants. In the MWRRS business plan, however, maintenance capital costs are funded from the railway annual operating surplus and only reduce the net cash flow generated from operations. Accordingly, in the business plan, users of the MWRRS pay the full maintenance cost, although capital costs are not included in calculation of the operating ratio for each route.

Exhibit 7-38
2025 Annual MWRRS Track Maintenance Costs (Millions of 2002$)



Directly Reimbursable Freight Railroad Costs

Currently, it is industry practice for passenger train operators providing service on freight-owned rights-of-way to pay for track access and track maintenance. Passenger service must also reimburse a freight railroad's added costs for dispatching its line, providing employee efficiency tests and for performing other services on behalf of the passenger operator. Amtrak, however, enjoys statutory rights to access freight tracks at avoidable cost.

The MWRRS cost is calculated as the incremental track maintenance cost, described previously, plus an allowance of 39.5¢ per train-mile added to cover freight railroad out-of-pocket or directly reimbursable costs[13]. This 39.5¢ rate is about half the level of Amtrak's current costs, reflecting economies of scale inherent in a large regional passenger rail network. These costs are not shown as a separate category: they are included as part of Track and Right of Way Maintenance costs in the calculation of operating results.

Access fees and on-time performance incentive payments to host freight railroads are specifically excluded from this calculation. With regard to right-of-way access fees, it is felt that any such payments would have to be calculated and negotiated on a route-specific and railroad-specific basis. Such a calculation would have to consider the value of the infrastructure improvements

[13] This out-of-pocket expense includes the cost of train dispatching, freight railroad efficiency testing of passenger train crews, added police protection and freight railroad administrative overhead.

made by the MWRRS to the freight railroad as well as track maintenance payments. This type of analysis is beyond the scope of this study, and will be handled within the context of negotiations with specific railroads as the MWRRS is implemented.

In the case of incentive payments for on-time performance which are currently paid by Amtrak on a route-specific basis, similar concerns exist. The $6.6 billion in infrastructure improvements to freight corridors called for in this study are designed to provide sufficient capacity to provide superior on-time performance for both freight and passenger operations. The need for additional incentive payments will be unclear until performance data is obtained from actual post-implementation MWRRI passenger operations. Again, this subject was considered too complex to address within the context of the current study and will be handled within the context of negotiations with specific railroads as the MWRRS is implemented.

Station Operating Costs

A simplified fare structure, heavy reliance upon electronic ticketing and avoidance of a reservation system will minimize station personnel requirements. Station costs include personnel, ticket machines and station operating expense. Thirty-nine of the 101 MWRRS stations, plus Chicago Union Station, are staffed. Of these, Amtrak staffs 24 stations today, and the MWRRS would staff 15 new locations.

As shown in Exhibit 7-39, locations that are not staffed cost $45,872 per year ($2002); the incremental cost for stations currently staffed by Amtrak is $307,683, and newly staffed stations cost $538,332 per year. This is sufficient to add five additional positions at each staffed Amtrak station and eight positions for each new location. The operating cost of ticket machines adds an additional $22,936 per station, per year. For the implementation period 2008-2014, this cost was ramped-up based on line segments scheduled to begin operation each year.

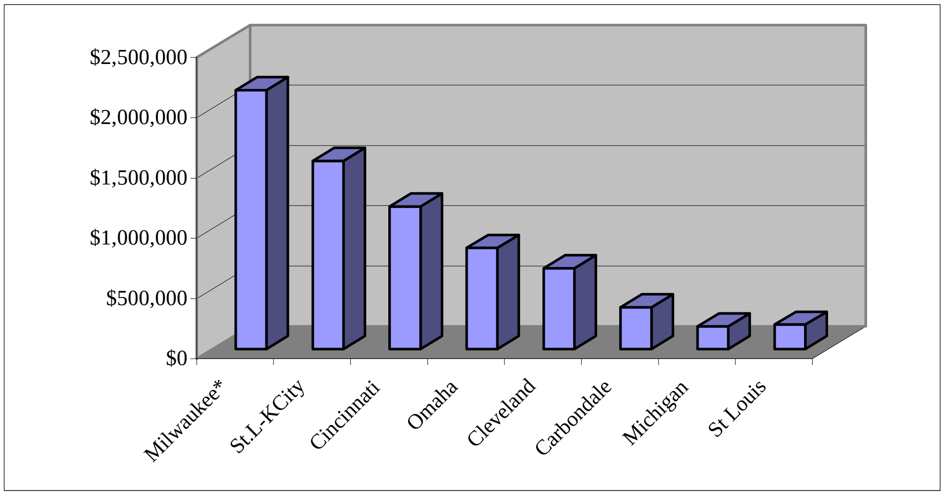
Exhibit 7-37
MWRRS Station Operating Expenses (2002$)

	Intercity Staffed	*Intercity Unstaffed*	*Stand-Alone Staffed*	*Stand-Alone Unstaffed*	*Chicago Union Station*	*Total*
# of Stations	24	35	15	27	1	102
Station Operations	$ 7,384,404	$1,605,505	$ 8,077,982	$ 1,238,532	$ 5,470,183	$ 23,776,606
Ticket Machines	$ 550,459	$ 802,752	$ 344,037	$ 619,266	--	$ 2,316,514
Total	**$ 7,934,862**	**$2,408,257**	**$ 8,422,018**	**$ 1,857,798**	**$ 5,470,183**	**$ 26,093,119**

Feeder Bus Cost

A detailed analysis of feeder bus operations determined which routes made economic sense to operate. The analysis described in Chapter 4 developed revenue and ridership forecasts for each bus route. Based on projected load factors, either a small or a large bus ($1.72 or $2.15 per mile, respectively) was chosen to operate each route. These bus costs were supplied by Greyhound for use in the MWRRS study. Feeder bus costs, shown in Exhibit 7-40, were calculated based on planned bus-miles for each rail corridor. For the implementation period 2008-2014, this cost was ramped-up based on segments scheduled to begin operation each year.

Exhibit 7-38
2014 Feeder Bus Costs (2002$)



*Green Bay is included in this corridor

For the MWRRS study, buses were modeled as an “access mode” that provide connectivity between rail stations and adjoining zone centroids. Bus frequencies but not specific schedules were developed. Bus frequencies were adjusted based on anticipated demand and did not necessarily meet every train. However to serve local travel needs, some states have suggested higher levels of bus service than that specified in the MWRRS plan. Accordingly, bus costs are assumed to represent economies of scale of a large operator like Greyhound; but no demand forecast has been developed for local bus riders that would not connect to the rail service.

Sales and Marketing Costs

A simplified ticketing methodology with unreserved service should result in substantial cost savings. While there are advantages to variable pricing based upon yield management principles, MWRRS does not require that level of sophistication in its early stages. Simplicity in fares and services will limit talk time and heighten the use of voice recognition menu-driven or internet-based systems. The primary expenses represented in this category consist of advertising: $6.8 million per year fixed cost, plus call center expenses.

Projected call center costs were built up directly from ridership, assuming 40 percent of all riders will call for information, and that the average information call will take 5 minutes for each round trip. Assuming some flexibility for assigning personnel to accommodate peaks in volume and a 20 percent staff contingency, variable cost comes to 65¢ per rider plus a fixed supervisory cost of $460,000 per year.

Credit card commissions were modeled as 1.6 percent of ticket revenue – 80 percent of ticket revenue for credit cards with a 2 percent fee – and travel agency commissions as 1 percent of ticket revenue. The cost of ticket machines is included as part of station expenses.

Service Administration Costs

A hypothetical MWRRS management organization was developed as a stand-alone structure, holding no other responsibility than operation of the MWRRS. The main purpose of the exercise was to develop an estimate of the costs, not to set up an actual management structure. Responsibilities would include liaison work with other rail and commuter lines, marketing, accounting, finance and interface with the nine state partners. Providers of equipment maintenance, on-board food service and express parcel service would have their own management structures, and their administrative costs are included within those areas. As well, call center expenses are treated separately and described as Sales and Marketing costs. The MWRRS itself would retain only a small management staff for delivery audit, quality assurance and contract administration. In 2002 dollars, costs break down as follows:

- General Admin Labor (incl. Fringe) $7.64 Million
- Engineering & Maintenance Labor (incl. Fringe) $4.44 Million
- Operations & Customer Service labor (incl. Fringe) $8.84 Million
- Additional Cost (leases, etc.) $8.07 Million
- Total Annual Cost $28.99 Million

These costs were originally calculated in 1997 dollars, but adjusted for inflation to 2002 dollars.

A detailed management organization chart was reviewed with Amtrak in 2000, who requested that a 20 percent contingency be added for items that may have been overlooked, but otherwise agreed that the overall cost level was reasonable. Administration costs were ramped up over a two-year period reflecting 70 percent of cost in year 1; 80 percent of cost in year 2 and 100 percent in year 3. Exhibits 7-41, 7-42 and 7-43 detail the proposed MWRRS management organization.

Exhibit 7-41
Proposed MWRRS General Administration Structure

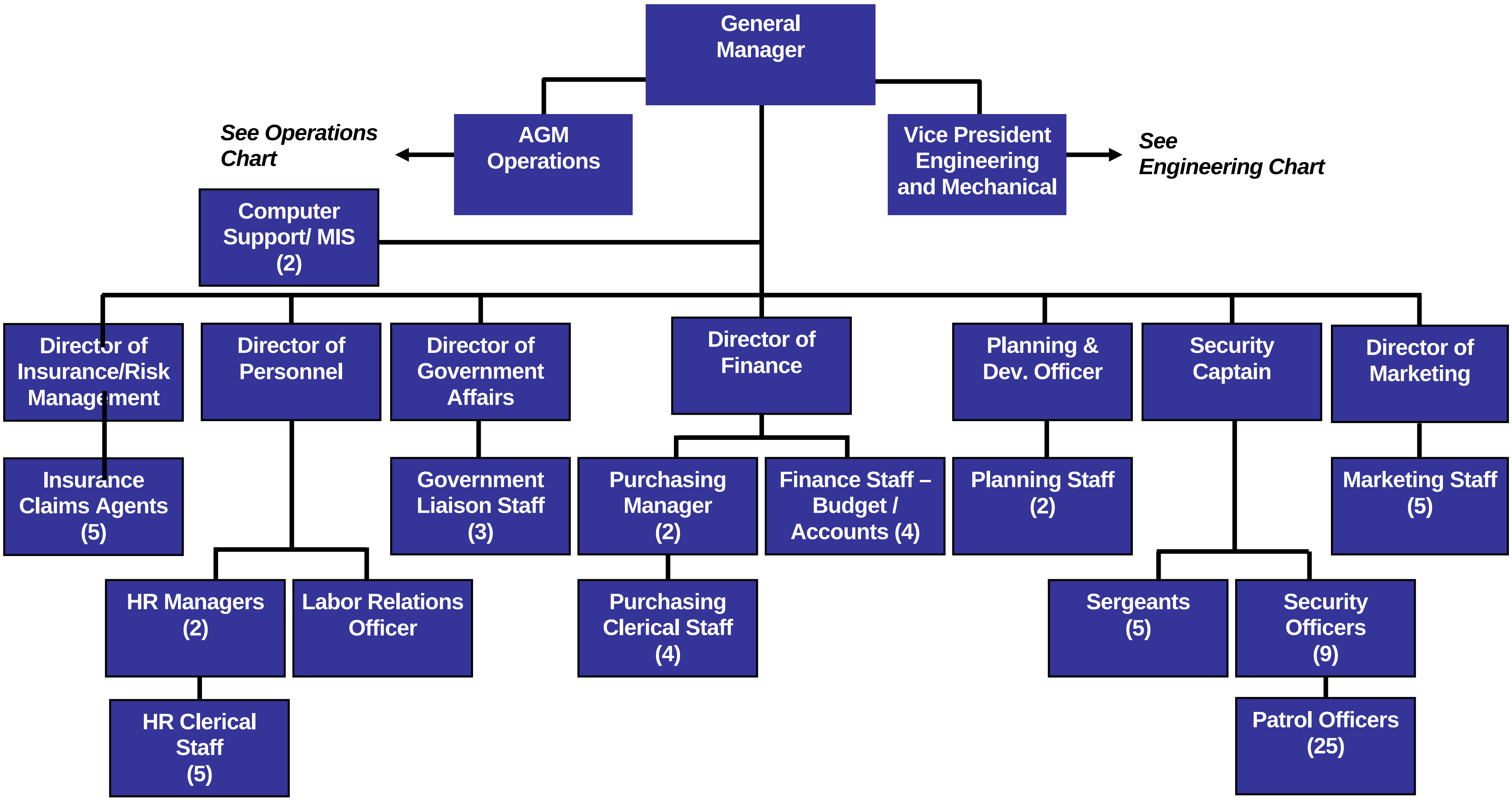


Exhibit 7-42
Proposed MWRRS Operations Structure

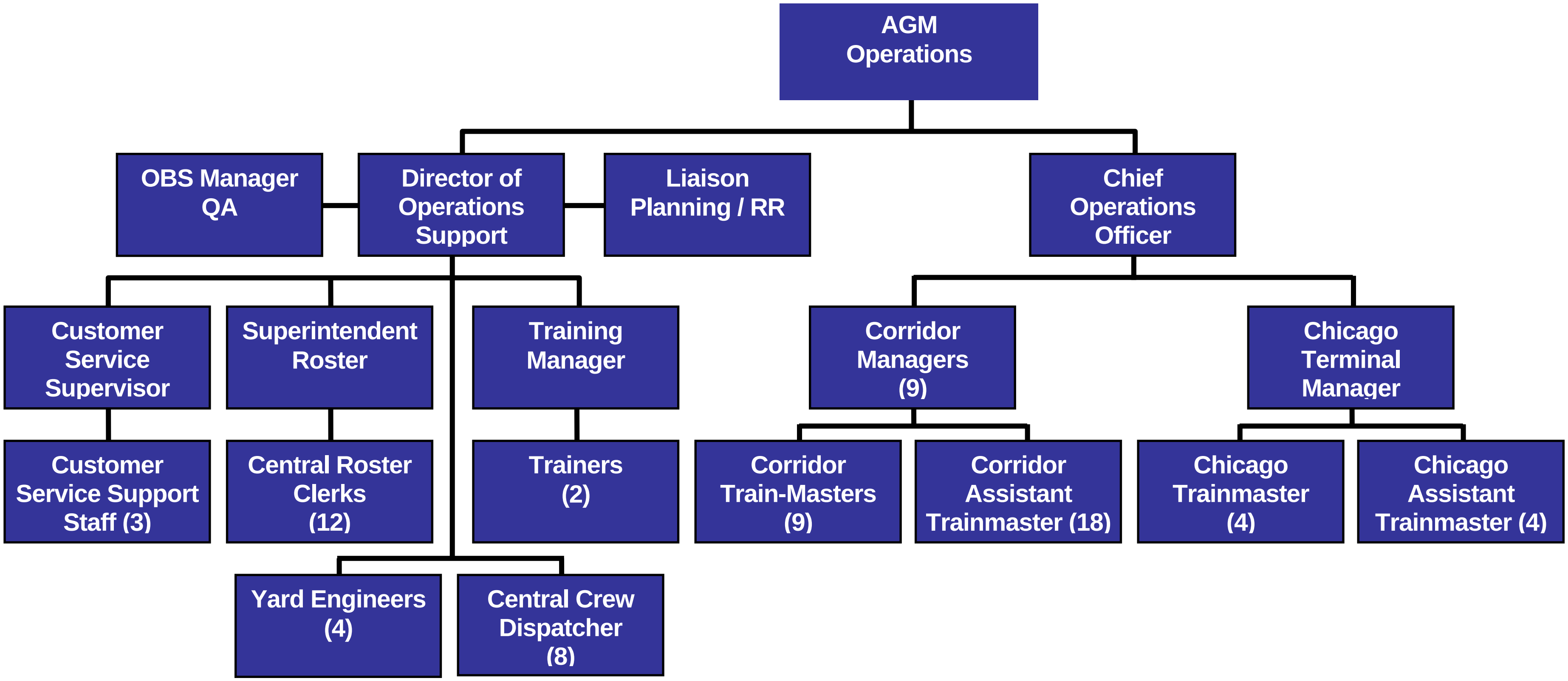
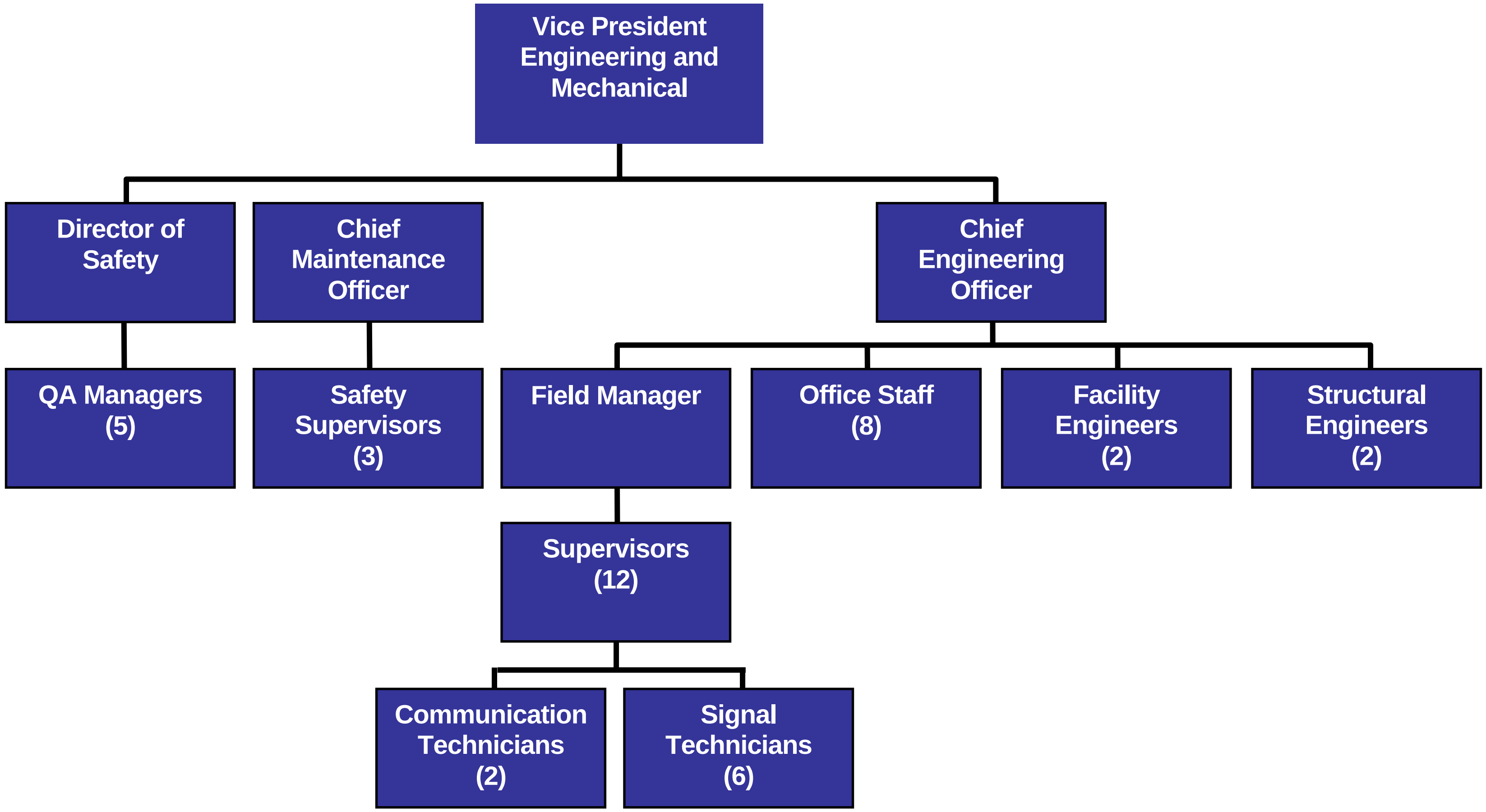


Exhibit 7-43
Proposed MWRRS Engineering/Equipment Maintenance Structure



7.12.2 Variable Costs

Liability Insurance

Liability insurance costs were estimated at 1.1¢ per passenger-mile, which is the 2000 plan cost adjusted to 2002 dollars. This cost originally included a one-third reduction on Amtrak's national average rate, which was later increased to 1¢ per mile as a result of the discussions and agreement with Amtrak in 2000. This excludes FELA expenses for employee injuries, which the MWRRS business plan treats as a part of the employees' fringe benefit rate, rather than as part of insurance costs.

Train Equipment Maintenance Costs

Equipment maintenance costs include costs for all spare parts, labor and materials needed to keep equipment safe and reliable. The costs include periodical overhauls in addition to ongoing maintenance. It also assumes that facilities for servicing and maintaining equipment are designed specifically to accommodate the selected train technology. This supports more efficient and cost-effective maintenance practices. Acquiring a large fleet of trains, with identical features and components, should allow for substantial savings in parts inventory and other economies of scale. In particular, commonality of rolling stock and other equipment will standardize maintenance training, enhance efficiencies and foster broad expertise in train and system repair.

Earlier costs developed in the 2000 plan[14] were updated by consulting with a train equipment manufacturer who had participated in the MWRRI procurement effort conducted by Illinois, Wisconsin and Amtrak. This update resulted in nearly doubling the maintenance cost from $5.42 to $9.87 per train-mile. The new cost came out very close to what was proposed in the MWRRI procurement process – for a 13-train order – and incidentally is in the same order-of-magnitude as Amtrak's current cost for corridor services. This update reflects more recent information on US and North American equipment maintenance requirements that were specified in the MWRRI procurement, as well as an attempt to address economies of scale resulting from a purchase of a full 63-train order.

Train and Engine Crew Costs

Current rates and staffing patterns were assumed for the assessment of this cost. Rates used were derived from consultant studies for passenger rail service in the Midwest and discussions with Amtrak staff (2000 Plan Report), adjusted for inflation. An overtime allowance is included as well as scheduled time-off, unscheduled absences and time required for operating, safety and passenger handling training. Fringe benefits include health and welfare, FICA and pensions. The cost of employee injury claims under FELA is also treated as a fringe benefit for this analysis. The overall fringe benefit rate was calculated as 55 percent. The costing of train crews was based on Amtrak's 1999 labor agreement, adjusted for inflation to 2002.

Crew costs depend upon the level of train crew utilization, which is largely influenced by the structure of crew bases and any prior agreements on staffing locations. Train frequency strongly influences the amount of *held-away from home* terminal time.

[14] See Section 7.4 of this report.

Since train schedules have constantly evolved throughout the lifetime of the MWRRS project, a parametric approach is needed to develop a system average per-train mile rate for crew costs. Such an average rate necessarily involves some approximation across routes, but to avoid having to reconfigure a detailed crew-staffing plan whenever the train schedules change, an average rate is necessary and appropriate for a planning-level study.

Without developing a detailed crew base plan, the total number of equipment operating hours was estimated based on a prior equipment cycling analysis. For each train set, this determined a sequence of schedule pairings[15] whereby the total duration of equipment use could be measured. The total number of hours was calculated from the start of the first daily equipment assignment, until the end of the last equipment assignment. This total operating hours for each train set was divided by an eight-hour shift, and then rounded up to the next highest whole number. The result of the parametric analysis was as follows:

- 136 shifts needed per day, including 20 percent extra board coverage
- Arbitraries: Split hours: 85; Overnights: 20; Turn limit: 6
- Base salary growth of 3 percent over 4 years was considered. With inflation, 2002 costs for Engineer $28.66/hr, Conductor $25.08/hr, Asst. Conductor: $20.30/hr
- Rates include 16 percent overtime and 55 percent fringe benefits
- Average rate is $3.95 per train mile

Once operational, the MWRRS will employ a far greater number of workers than existing passenger rail service in the Midwest region. Since operating personnel are compensated at an hourly rate, if the number of miles gained in one-hour increases, the cost per mile decreases. Consequently, the operating cost per train mile continually drops as train speed increases. In addition, further productivity improvements can be achieved because of the higher train frequencies that reduce crew layover times at away-from-home terminals.

Fuel and Energy Costs

A consumption rate of 2.42 gallons/mile was estimated based upon nominal usage rates of all three technologies considered in the 2000 Plan of the MWRRS study. Savings were assumed because of large bulk purchases at central locations and the use of modern transfer equipment at new servicing facilities. A diesel fuel cost of $0.96 per gallon leads to a train-mile rate of $2.32 per train mile.

On-Board Services Costs

On-board service (OBS) adds costs in three areas: equipment, labor and cost of goods sold. For the MWRRS financial plan, equipment capital and operating cost is built into the cost of the trains and is not attributed specifically to food catering. The cost of goods sold is estimated as 50 percent of OBS revenue, based on Amtrak's route profitability reports. Amtrak estimated labor costs, including the cost of commissary support and OBS supervision, at $1.53 per train-mile. This cost is consistent with Amtrak's level of wages and staffing approach that provides one OBS attendant for each train.

[15] As defined in Section 7.5

By increasing revenues from on-board sales, a trolley service makes it possible for the provider of on-board services to earn a reasonable profit while still maintaining a reasonable and affordable price structure for passengers. Although trolley service is standard in Europe, in the U.S. there is very little rail trolley service, although it is extensively used in air service. This may be attributed to the commercial orientation of European passenger railways where food service is often contracted out to food specialty firms that expect to make a profit. In practice, it is difficult for a bistro-only service to sell enough food to recover its costs. While Bistro cars are admittedly a very attractive amenity, their high cost has resulted in their elimination from many European trains. However it may possible to support the cost of a bistro car if the capital cost is furnished by government as part of the initial trainset acquisition, and if bistro revenues are complemented by trolley service throughout the train.

Offering a trolley cart service is a proven way to increase sales. The key to attaining OBS profitability is selling enough products to recover the train-mile related labor costs. In British Rail's experience, trolley cart service not only reduces expense, it also *doubles* the OBS revenue. While only a limited menu can be offered from a cart, the ready availability of food and beverages at the customer's seat is a proven strategy for increasing sales. Gate Gourmet, a specialist firm catering to the transportation industry (including Amtrak) also recognizes that OBS sales are increased by offering a trolley cart service. While some customers prefer stretching their legs and walking to a bistro car, other customers will not bother to make the trip. Many customers however, appreciate the convenience of a trolley cart service, and are willing to purchase food and drink items that are brought directly to their seat.

For this reason if a fixed bistro is to be operated, the ability to augment bistro sales with revenues from a trolley cart is essential to the business success of MWRRS food services. Periodically the bistro service attendant should make a trip through the train with a trolley cart. The MWRRS business plan assumes that bistro revenues are augmented by trolley cart revenues.

The MWRRS plan recommends that a vendor experienced in provision of catering service be contracted to provide the catering services. The most likely contenders are firms who already have kitchens to support air service in the principal MWRRS terminal cities. A key requirement for providing trolley service is to ensure the doors and vestibules between cars are designed to allow a cart to easily pass through. Since trolley service is a standard feature on most European railways, most European rolling stock is designed to accommodate carts. Although convenient passageways often have not been provided on U.S. equipment, the ability to accomodate trolley carts is an important design requirement for the planned MWRRS service.

Operator Profit

The gross operator profit is based upon 10 percent of directly-controlled costs, including insurance, station, sales and marketing, service administration, train crew, and energy and fuel. All other costs are out-sourced. Costs for externally contracted services are excluded and are assumed to include a 10 percent profit margin. Gross operator profit is allocated to the operator as an incentive.

Costs Summary

An overall summary of MWRRS Unit costs are shown in Exhibit 7-44. Predicted operating and financial results are reported in Chapter 10.

Exhibit 7-44
Unit Operating Costs Summary (2002 $)

Category	*Source*	*Allocation Basis*	*Type*	*Unit / Lump Sum Cost*
Train Crew	TEMS/Amtrak	Train Miles	Variable	$3.95
OBS	Amtrak/ Gate Gourmet	Train Miles plus OBS Rev	Variable	$1.53 (crew and supervision) plus 50% of OBS Revenue
Equipment Maintenance	Equipment Manufacturers	Train Miles	Variable	$9.87
Energy/Fuel	Equipment Manufacturers	Train Miles	Variable	$2.32
Track/ROW	Zeta-Tech/ HNTB	Train Miles	Both Fixed and Variable Components	Lump Sum (corridor wise - year wise) plus 39.5¢ /TM for Out-of-Pocket Expense such as Dispatching.
Station costs	TEMS/ Amtrak	Passengers	Fixed	$26,093,119 per year (full operation years)
Insurance	TEMS/Amtrak	Passenger Miles	Variable	$0.011
Sales/Marketing	TEMS/ Amtrak	Passengers plus Ticket Revenue	Both Fixed and Variable Components	$0.65 (phone support variable), 1.6% (credit card fees), 1% (travel agent fees), $7,339,450 fixed (market media and phone support)
Admin	TEMS/ Amtrak	Train Miles	Fixed	$28,993,655
Bus Feeder	Greyhound	Bus Miles	Fixed	Lump sum (corridor wise - year wise)
Operator's Profit	TEMS/ MWRRI	Percentage of Energy-Fuel, Train Crew, Service Admin, Sales-Marketing, Station Cost, Insurance Liability	Variable	10%

8. Implementation Plan

8.1 Introduction

Given the scale of the MWRRS – more than 3,000 route miles through nine states – and the level of capital funding required for the infrastructure improvements and rolling stock, implementation of the MWRRS will occur in a series of six construction phases. The MWRRS will be fully operational by the end of the tenth project year, during Implementation Phase 7 in 2014.

This timeframe takes the project through design and manufacture of rolling stock, project development, preliminary engineering, design and final construction of the rail system's infrastructure. Project development includes all environmental reviews and/or the steps necessary under the National Environmental Policy Act, including public involvement and necessary engineering to obtain a *record of decision*. This incremental approach allows the states to secure funding and to develop the infrastructure in conjunction with the freight railways, and enables the rail operator to assess the impact of various service attributes on ridership and revenue and make any necessary adjustments. The environmental assessment for the extension of 110-mph service from Milwaukee to Madison has been completed, final public hearings conducted and a FONSI (Finding of No Significant Impact) request submitted to FRA. MWRRS service at speeds of up to 110 mph using new track infrastructure and equipment is planned to begin between Chicago and St. Louis, Pontiac and Madison in 2008.

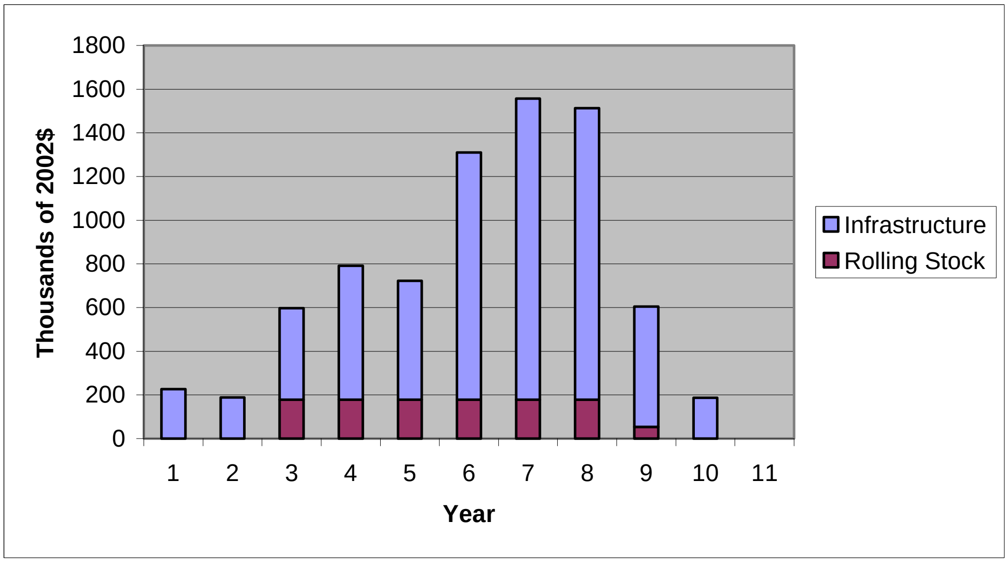
8.2 Implementation Approach

Five guiding principles characterize the implementation phases:

- Service is to be implemented as quickly as possible
- The most cost-effective corridors and services are to be implemented first
- Broad geographic coverage is to be achieved as early as possible
- Project phasing is to be consistent with the demand for service and affordability
- Passenger cars are to be assembled in the Midwest region to support the local manufacturing industry

While the MWRRS requires significant capital funding, its $7.7 billion cost is reasonable given the size and population of the Midwest region (60 million people), the lack of previous regional investment in intercity passenger rail and the fact that these costs would be shared by nine states and the federal government. The proposed split of the necessary funding is 80 percent federal and 20 percent state and other sources – a long-established statutory arrangement used for highway, transit and airport funding. As shown in Exhibit 8-1, more than $1.3 billion will be needed in each of three peak years to support construction and equipment purchases.

Exhibit 8-1
MWRRS Capital Requirements by Year



8.3 *Implementation Phase Development*

The implementation plan has been refined since the 1998 *Phase I Strategic Assessment and Business Plan* to ensure positive operating cash flows as early in the implementation schedule as possible. The corridors (routes) have been segmented and re-ordered in such a way as to optimize financial results. Thus, those corridor segments with the highest operating returns are implemented in the earlier phases of the plan. Exhibit 8-2, located at the end of this chapter, illustrates the full implementation plan by corridor and provides details on the ten-year schedule by activity – project development, preliminary engineering design and construction. Exhibits 8-3, 8-4 and 8-5 provide information on the development of each corridor and the financial costs to each state.

8.3.1 Description of Implementation Plan by Services

Implementation of the MWRRS begins with the design specifications for new rolling stock and preliminary engineering and design of the selected corridor segments. Upgrades to 110-mph are already underway on the Michigan and St. Louis corridors, where prototype Communications-Based Train Control systems are being tested. Extension of passenger service from Milwaukee to Madison via Watertown has already been environmentally cleared. MWRRS service using new trains will begin to St. Louis, Pontiac and Madison in 2008. This represents the first phase of MWRRS implementation. As construction continues and more equipment arrives, more routes will be added until the MWRRS system is fully operational in 2014.

Branch Line Services

Current state-supported passenger services (such as Chicago-Quincy, Grand Rapids, Port Huron, etc.) are presumed to continue as state-supported services during implementation, until infrastructure improvements are completed and sufficient new equipment is available to support launching the MWRRS service. Subsidies needed to maintain pre-existing Amtrak services are not included in the MWRRS business plan until after services are upgraded with improved track and equipment. Any subsidy required on a short-term, transitional basis is included in the MWRRS business plan. Over the long term, the MWRRS goal is to eliminate the need for states to provide operating subsidies since taxpayer assistance can take the form of capital grants, and stronger routes can cross-subsidize operating losses of the weaker corridors, especially during the early implementation years. Funding for infrastructure and equipment is being used to improve service to the point where revenues cover operating costs as the system is fully built out, but some direct operating subsidies may still be required during the ramp-up period. Either these subsidies can be provided by direct state support or, as proposed in Chapter 10, the start-up cost can be financed by a TIFIA loan that is later repaid from the operating surplus that will be generated in later years.

Core Service (Main Line Services)

State-supported *core* services are considered part of MWRRS from the beginning. An example is service from Chicago to Milwaukee. This segment is integral to providing Madison service, although improvements are not fully completed until 2014. Likewise, Chicago-Detroit and Chicago-St. Louis are treated as core system elements, although the Chicago-Joliet and South-of-Lake improvements will not be fully operational until 2011 and 2012 respectively.

Long-distance Services

Long-distance Amtrak services are presumed to continue during and after MWRRS implementation, and may benefit from speed and line capacity improvements created by the MWRRS. Riders, revenue, operating costs and frequencies in the MWRRS business plan include only those for the MWRRS service. Long-distance trains are assumed as a federal responsibility and are not included in the MWRRS financial results. There is a potential downside of not including long-distance service figures. Total rail frequencies in the Midwest region will be understated, which will moderately decrease total demand on the MWRRS system. This appears to be less of a risk than overstating revenues and ridership without including the attendant costs.

Implementation of MWRRS should improve long-distance services as well. Where the MWRRS improves tracks that are currently used by Amtrak, such as from Chicago-St. Louis or Toledo-Cleveland, long-distance trains will be able to operate over improved infrastructure with reduced conflicts with freight trains. In other cases, such as Chicago-Des Moines-Omaha and Chicago-Fort Wayne-Cleveland, Amtrak may have an *option* to reroute their trains to serve more populous cities than is possible over current routes. Amtrak's desire to re-route a long distance train must be balanced against the needs of the territory now served. Some possible long-distance train reroute alternatives include:

- Rerouting the *California Zephyr* via Des Moines would directly serve a greater population base, but would also leave southern Iowa bereft of passenger rail service.
- A connection between MWRRS and CSXT at Defiance, Ohio would allow restoration of direct Amtrak service to Fort Wayne, IN (the *Three Rivers*) that was lost when Conrail downgraded the line in 1990.
- Amtrak's *Cardinal* could be routed via the MWRRS from Chicago-Cincinnati. This would eliminate a difficult Chicago access route on the north end and switch Cincinnati-Indianapolis service to a different line altogether.

- Finally, there may be an opportunity to reroute the *Empire Builder* via Madison once MWRRS through-service to the Twin Cities starts.

All these re-route opportunities are business decisions that need to be considered by Amtrak and the respective states, once MWRRS passenger service starts.

8.4 Description of Implementation Phases

A description of each implementation phase, a data and cost summary and a map showing overall infrastructure improvements implemented prior to and during each phase are provided on the following pages. Additional information on travel times and frequencies by phase can be found in Appendix A8.

Acquisition of rolling stock is a critical factor in the implementation of the MWRRS due to the long lead-time required for manufacturing and assembly. There is also a desire to have the rolling stock built in the Midwest region. Consequently, vehicle procurement is the first major step in the implementation plan, with delivery of vehicles occurring throughout the implementation period. The MWRRS financial analysis anticipates the acquisition of 63 trains by 2014 with equipment received at a steady rate of 10 trains per year beginning in 2006. Given the size of this equipment order and by allowing the builder to run the production line at a steady pace for seven years, the MWRRS can be expected to receive the 25 percent volume discount assumed in the financial analysis[1].

A synergistic effect occurs as implementation of the MWRRS moves from one phase to the next. Each phase provides a strong base upon which to support the next phase by strengthening and increasing the value of the improved passenger rail service to the region. Phase 1 establishes a strong core for the new service – Chicago is established as the system hub, station improvements and on-board amenities are introduced, ridership grows and the availability of an attractive regional passenger rail service is marketed throughout the Midwest region. In later phases, additional improvements and service extensions are made throughout the region. Because of a phased approach in implementing infrastructure improvements, the system will not immediately achieve a positive operating ratio. To quickly reduce operating deficits associated with start-up, it is important to progress rapidly from phase to phase.

Operating costs and revenues of each phase were evaluated to minimize operating losses during the initial implementation period. Each of the three corridors selected for Phase 1 yields positive operating cost ratios by the time Phase 2 begins. The first year losses reflect the initial ramp-up of revenues over a one-year period assumed for each new segment as it is brought online. Despite the continuing expansion of the system, the system as a whole achieves a positive operating ratio by 2012, and maintains a positive operating ratio thereafter. However, individual corridors reach operating self-sufficiency at different times. All corridors except Quincy/Omaha reach a positive operating ratio by 2015 – the first year of full operation. The Quincy/Omaha line attains a positive operating ratio in 2024.

[1] Trains costs are set at $17.9 million each. A normal procurement process may use a less conservative payment schedule. It would probably assume 30 percent down, 35 percent during the build-out and 35 percent upon completion.

Phase 1: Chicago-Pontiac; Chicago-St. Louis; Chicago-Madison

Phase 1 is based on infrastructure completed by state initiatives presently underway and on acquisition of new rolling stock for the Michigan, Illinois and Wisconsin corridors. Introduction of new trains would help establish a positive brand-identity for MWRRS, generate increased ridership and improve passenger ride quality and comfort. Equipment maintenance shops open at Pontiac, St. Louis and Madison. During 2008, significant construction is underway on line extensions to Iowa City and St. Paul.

Phase 1 Data and Cost Summary	
Start-Up Year	2008
Infrastructure Costs	$544.2
System Operating Performance	
Revenue	$106.6
Cost	$145.0
Surplus (Subsidy)	$(38.4)
(All Costs in Millions of 2002$)	

Phase 2: Service Extension to St. Paul

In 2009, 110-mph service is extended to St. Paul. A fourth shop facility is added in St. Paul, while construction continues on the Iowa City extension; construction begins on the South-of-the-Lake project, Chicago-Joliet, 110-mph extensions to Cleveland and Cincinnati and on 90-mph upgrades for Chicago-Champaign and Wyanet-Quincy.

Phase 2 Data and Cost Summary	
Start-Up Year	2009
Infrastructure Costs	$1130.9
System Operating Performance	
Revenue	$172.2
Cost	$180.2
Surplus (Subsidy)	$(8.0)
(All Costs in Millions of 2002$)	

Phase 3: Service Extension to Iowa City

In 2010, service is extended to Iowa City. Construction continues on South-of-the-Lake, Chicago-Joliet, 110-mph corridors to Cleveland and Cincinnati and on a 90-mph upgrade between Chicago and Champaign. Construction begins on line upgrades between Milwaukee and Chicago, on capacity upgrades between St. Louis and Kansas City, on a line extension from Iowa City to Des Moines and on the Holland and Port Huron (Michigan) branch lines.

Phase 3 Data and Cost Summary	
Start-Up Year	2010
Infrastructure Costs	$1378.3
System Operating Performance	
Revenue	$ 223.5
Cost	$ 210.1
Surplus (Subsidy)	$ 13.4
(All Costs in Millions of 2002$)	

Phase 4: Service extends to Quincy, Carbondale and Kansas City

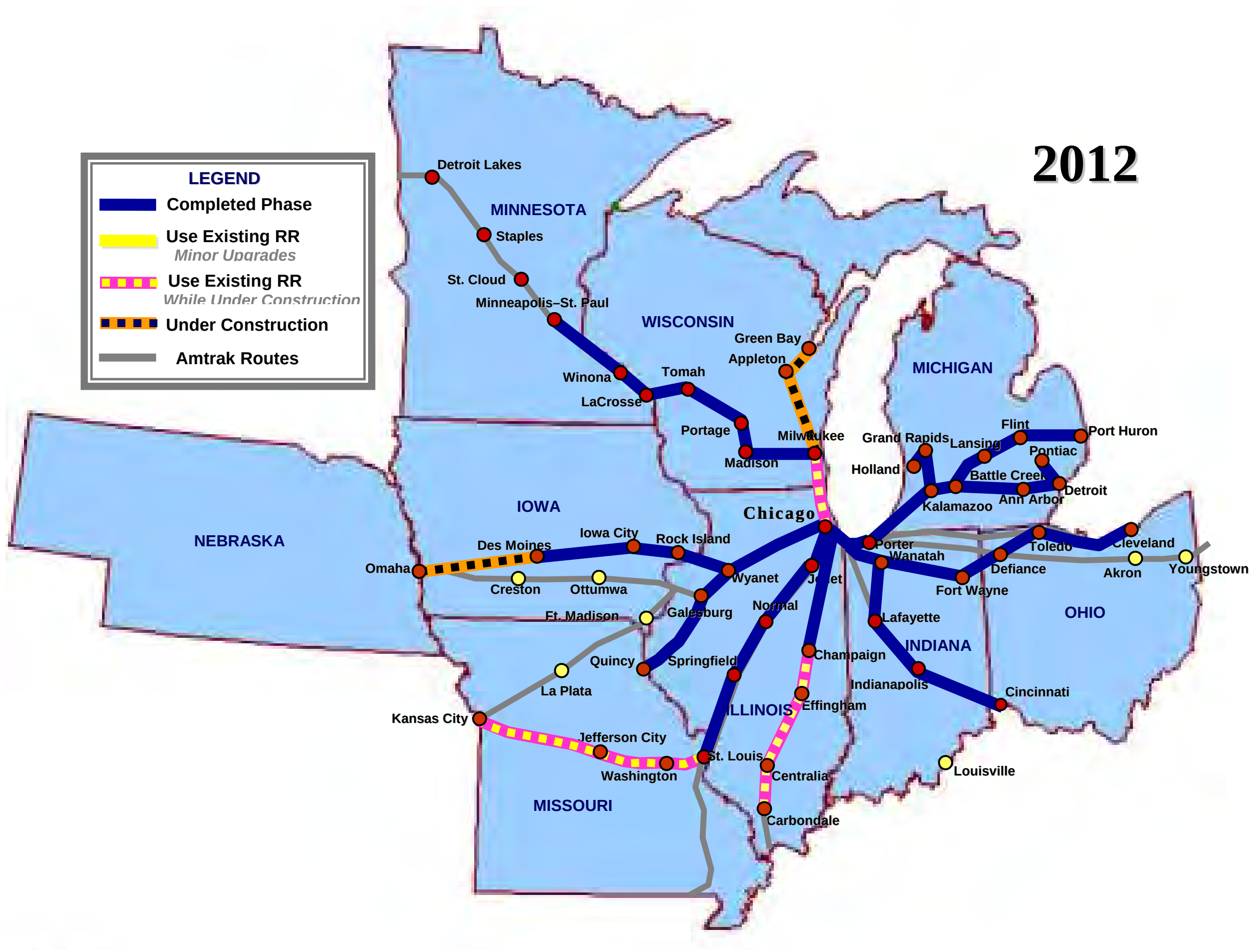
Phase 4 Data and Cost Summary		
Start-Up Year		2011
Infrastructure Costs	$	1334.5
System Operating Performance		
Revenue	$	261.4
Cost	$	264.5
Surplus (Subsidy)	$	(3.1)
(All Costs in Millions of 2002$)		

In 2011, 90-mph service for Chicago-Quincy and Chicago-Champaign begins. Two trains continue south from Champaign to Carbondale at 79-mph. Four trains operate between St. Louis and Kansas City at 79-mph. A fifth shop is added at Kansas City. The line improvement between Chicago and Joliet is completed, while construction continues on South-of-the-Lake, Chicago-Milwaukee, St. Louis-Kansas City, the Michigan branch lines, the Des Moines extension and the Cincinnati and Cleveland corridors. An upgrade of the Champaign-Carbondale line and Des Moines-Omaha to 90-mph begins, and construction begins of a 110-mph extension to Green Bay.

Phase 5: Cincinnati, Cleveland, Des Moines and Michigan Branch Lines

With completion of the South-of-the-Lake improvement, Phase 5 implements service to Cincinnati, Cleveland, Des Moines, and on the Holland and Port Huron (Michigan) branch lines. A sixth equipment maintenance shop is added at Cleveland. The speed of service to Pontiac is increased. Construction continues on the Chicago-Milwaukee, Milwaukee-Green Bay, Champaign-Carbondale, Omaha and St. Louis-Kansas City lines.

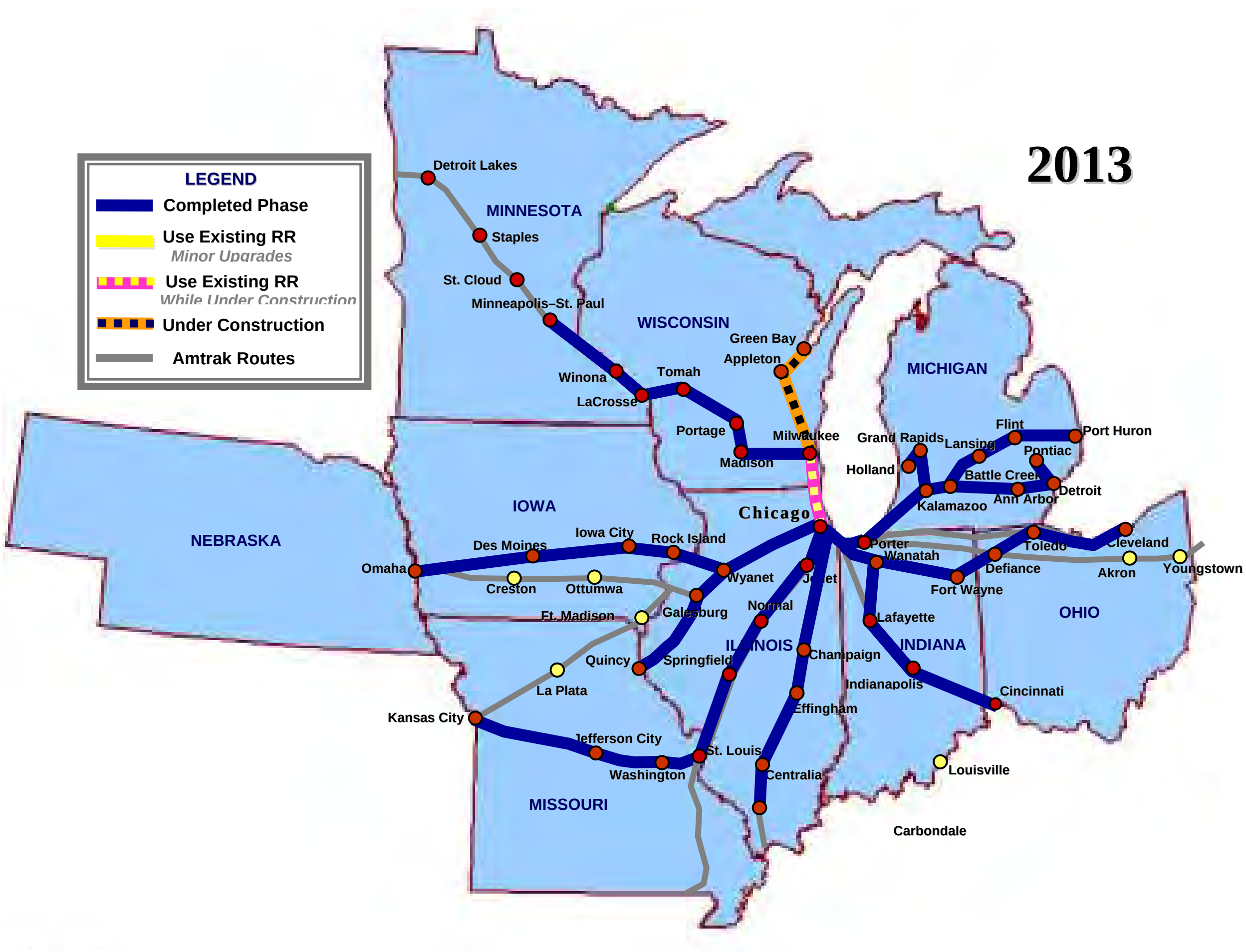
Phase 5 Data and Cost Summary		
Start-up Year		2012
Infrastructure Costs	$	550.4
System Operating Performance		
Revenue	$	414.0
Cost	$	402.6
Surplus (Subsidy)	$	11.4
(All Costs in Millions of 2002$)		



Phase 6: Omaha Service Extension, Carbondale and Kansas City Speed-ups

Service is extended from Des Moines to Omaha. With completion of the upgrades between St. Louis and Kansas City, additional frequencies can be offered at 90-mph speeds. The 90-mph upgrade between Champaign-Carbondale is also completed. Work continues on Chicago-Milwaukee and Milwaukee-Green Bay.

Phase 6 Data and Cost Summary		
Start-up Year		2013
Infrastructure Costs	$	187.8
System Operating Performance		
Revenue	$	478.3
Cost	$	426.2
Surplus (Subsidy)	$	52.1
(All Costs in Millions of 2002$)		



Phase 7: MWRRS System Complete

Completion of the capacity and speed upgrade between Chicago and Milwaukee allows a 15-minute schedule reduction on Madison and St. Paul trains. An additional seven trains are added to launch service to Green Bay in 2014. At this time, it is possible that a number of other branch lines could become viable. This could include such routes as Indianapolis-Louisville, Columbus-Cleveland and Tomah-Eau Claire, which are currently feeder bus routes on the MWRRS.

Phase 7 Data and Cost Summary		
Start-up Year		2014
Infrastructure Costs	$	0.0
System Operating Performance		
Revenue	$	528.4
Cost	$	452.8
Surplus (Subsidy)	$	75.6
(All Costs in Millions of 2002$)		

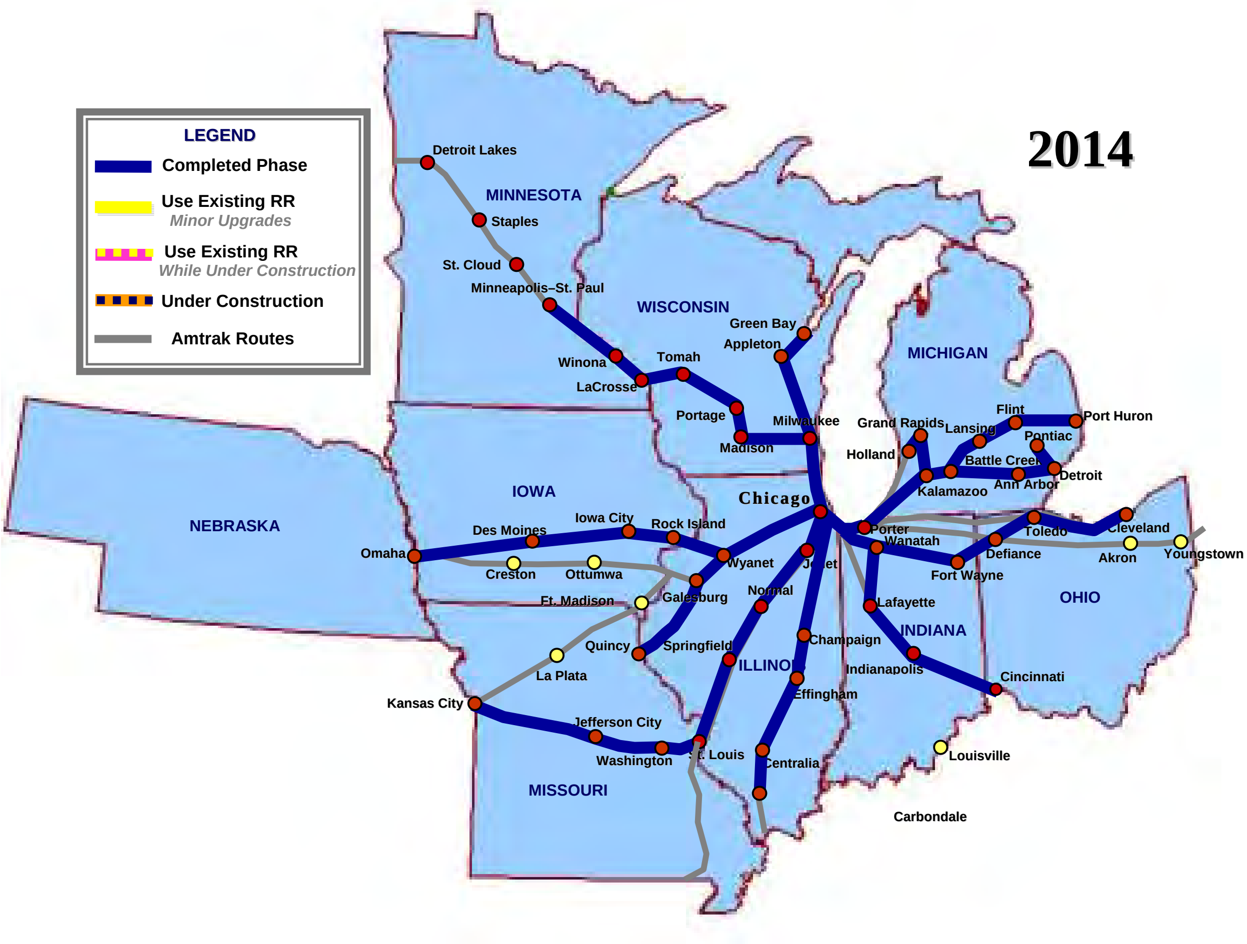
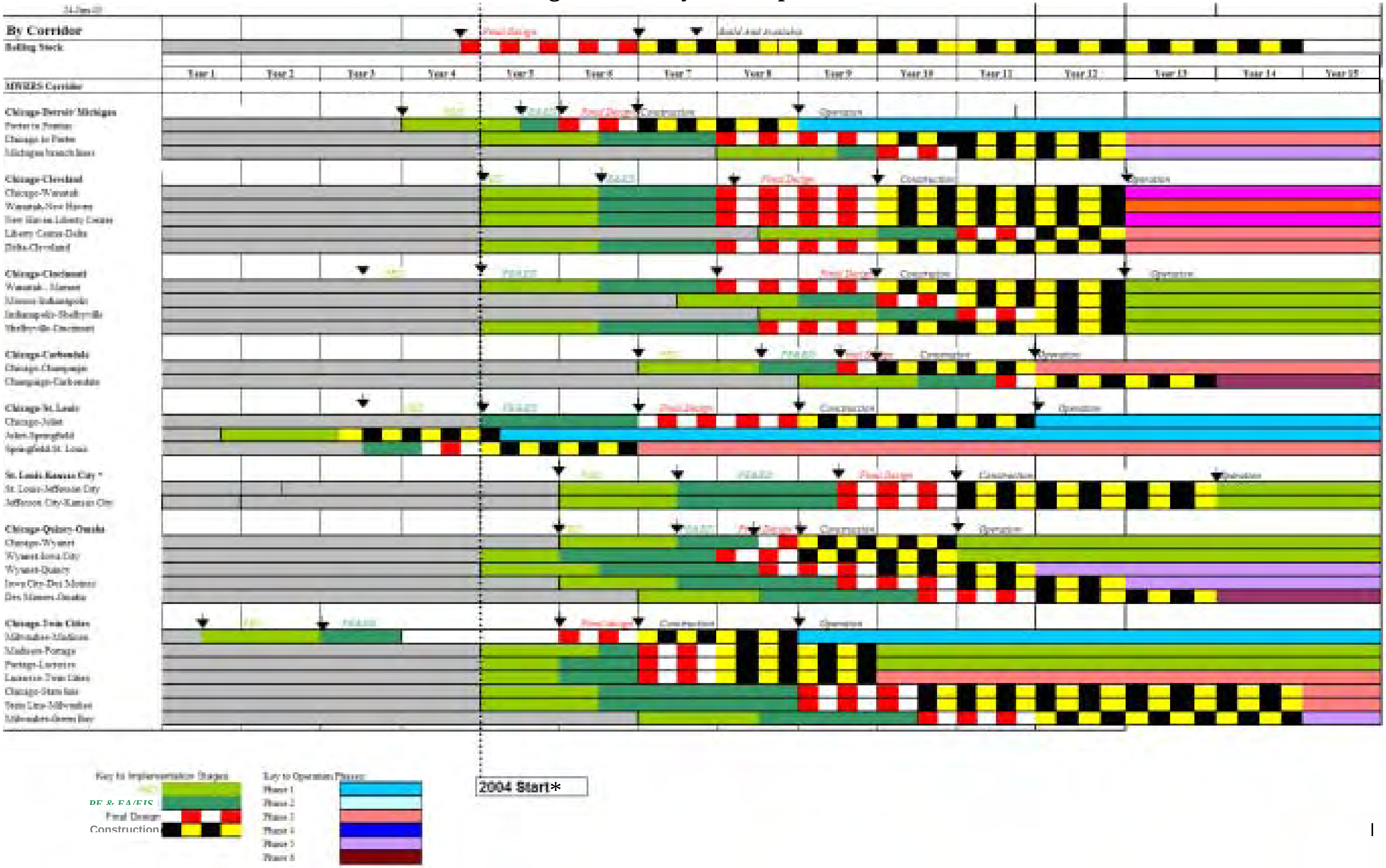


Exhibit 8-2
Midwest Regional Rail System Implementation Plan



* Dates are illustrative for planning purposes and the actual dates will be dependent upon federal funding.

Exhibit 8-3
MWRRS Train Schedule Implementation Plan

Year	*Chicago-Detroit*	*Chicago-Cleveland*	*Chicago-Cincinnati*	*Chicago-Carbondale*	*Chicago-St Louis*	*St. Louis-Kansas City*	*Chicago-Quincy / Omaha*	*Chicago–Twin Cities*
2008	6 Round Trips CHI-PNT, 5:23 running time (Old Phase 2 schedule extended to Pontiac)				8 round trips with 4:10 running (Old Phase 6 schedules)			Six round trips to Madison with 2:43 running time (Old Phase 2 but truncate St Paul back to Madison)
2009	"Same as above"				"Same as above"			Six round trips to Twin Cities at 6:44 running plus 4 to Madison (Old Phase 6 schedules without Green Bay)
2010	"Same as above"				"Same as above"		5 Round Trips to Iowa City service	"Same as above"
2011	"Same as above"			5 Round Trips CHI to Champaign at 90 mph; two trains continue to Carbondale at 79 mph.	"Same as above"	4 Round Trips on 5:34 schedule (old Phase 4 schedules)	Iowa City plus 4 Round Trips to Quincy	"Same as above"
2012	Full schedules with Branch Lines, 5:01 running time CHI-PNT. (Old Phase 6 schedules)	Full schedules with 8 round trips, 4:48 running time (Old Phase 6 schedules)	Full schedules with 5 round trips, 4:25 running time (Old Phase 6 schedules)	"Same as above"	"Same as above"	"Same as above"	Extend service to Des Moines, plus Quincy	"Same as above"
2013	"Same as above"	"Same as above"	"Same as above"	5 Round Trips CHI to Champaign at 90 mph; two trains continue to Carbondale at 90 mph.	"Same as above"	6 Round Trips on 4:42 schedule (old Phase 6 schedules)	Extend service to Omaha, plus Quincy (Old Phase 6 schedules)	"Same as above"
2014 - beyond	"Same as above"	"Same as above"	"Same as above"	"Same as above"	"Same as above"	"Same as above"	"Same as above"	Add Green Bay service; reduce Chicago-Milwaukee by 15 minutes

Exhibit 8-4
Capital Costs by Phase and Route Segment
(Millions of 2002$)

Route	*Year 1*	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Year 6*	*Year 7*	*Year 8*	*Year 9*	*Year 10*	*Total*
Michigan	$20	$24	$165	$157	$15	$165	$163	$163	$0	$0	$873
Cleveland	$0	$28	$42	$23	$23	$422	$316	$332	$0	$0	$1,187
Cincinnati	$0	$9	$15	$11	$17	$166	$177	$212	$0	$0	$606
Carbondale	$0	$0	$0	$3	$8	$53	$58	$55	$55	$0	$232
St. Louis	$188	$68	$4	$4	$72	$54	$54	$0	$0	$0	$445
St. Louis-Kansas City	$0	$0	$16	$21	$30	$21	$322	$241	$241	$0	$893
Omaha	$0	$7	$12	$22	$110	$179	$125	$116	$66	$0	$638
Wisconsin	$15	$50	$148	$354	$247	$70	$163	$216	$188	$188	$1,638
Chicago Terminal + Pontiac Shop	$4	$2	$16	$16	$22	$0	$0	$0	$0	$0	$60
Rolling Stock	$0	$0	$179	$179	$179	$179	$179	$179	$54	$0	$1,128
TOTAL	**$227**	**$189**	**$597**	**$791**	**$723**	**$1,310**	**$1,557**	**$1,514**	**$604**	**$188**	**$7,700**

Exhibit 8-5
Summary of Capital Costs by Corridor
(Millions of 2002$)

Corridor	*Infra-structure*	*Rolling Stock*	*Total*
Michigan	$873	$234	$1,106
Cleveland	$1,187	$152	$1,338
Cincinnati	$606	$101	$707
Carbondale	$232	$51	$283
St. Louis	$445	$115	$560
St. Louis-Kansas City	$893	$86	$980
Omaha	$638	$167	$806
Wisconsin	$1,638	$222	$1,860
Chicago Terminal + Pontiac Shop	$60	-	$60
TOTAL	**$6,572**	**$1,128**	**$7,700**

9. Funding Alternatives

9.1 Background

Implementation of the MWRRS will require the states to develop a financing plan to fund capital costs. There are financial resources from federal, state and local governments that are worthy of consideration. At state and local levels throughout the U.S., many innovative financing concepts for transportation projects are being proposed and accepted. These include privatization or turnkey operations such as design-build-operate projects, public/private partnerships, the incorporation of federal funds and federal credit enhancements in state and local projects, and the establishment of state infrastructure banks. In addition, bond issuance and leasing are options for increasing or leveraging funds to finance the required state contributions.

There are a number of federal programs that fund passenger rail research, planning and corridor development that are administered by the Federal Transit Administration (FTA) and the Federal Railroad Administration (FRA). The genesis for many of these programs was the Intermodal Surface Transportation and Efficiency Act (ISTEA) and the Swift Rail Development Act (particularly the Next Generation High-Speed Rail Program).

The information below is based on The Transportation Equity Act for the 21st Century, which was enacted June 9, 1998 as Public Law 105-178, since a new bill has not yet been signed by the President. Therefore, the programs described below are all based on Public Law 105-178, the 1998 Transportation Equity Act for the 21st Century. Since TEA-21 has not been renewed at the time of the writing of this section, features of the original TEA-21 will be used as the basis for discussion.

9.2 Federal Funding Programs

The FTA funds capital and operating programs of public transit services throughout the U.S. There are two major types of FTA grant programs: formula grants, which fund operations and maintenance and capital programs – predominately for system preservation; and discretionary grants, which fund larger capital projects such as new starts, system rehabilitation and system expansion. Discretionary grants, particularly for major fixed guideway projects, are limited to available funding and many transit agencies compete for these funds. Typically, the total funds requested by transit agencies for capital purposes greatly exceed the available funding. Grants are awarded partially based on relative cost-effectiveness, level of state and/or local funding contributions and other quantitative performance factors.

9.2.1 Federal Transit Administration Funding Programs

Major Capital Investment Program – Section 3009

Under TEA-21 Section 3009, funding is limited to major capital investment programs (New Starts) and will be the only discretionary capital program (renamed Capital Investment Grants and Loans Program) under TEA-21. The New Starts funding program is designated for the construction of new fixed guideway (rail and bus) projects and extensions to existing fixed guideway systems. New start funding is generally available for only transit projects and not intercity passenger rail. Exceptions might be made for shared use facilities such as passenger rail stations. Funding is reserved annually by Congress based on the authorization/reauthorization process. Grants made to states and local agencies fund up to 80 percent of the new project costs, based on negotiations between the federal, state and local agencies. Projects must compete for funding using federal criteria to justify the major investments involved. Competition for New Starts funding is intense. The potential to receive Section 3009 funds improves as the cost-effectiveness of the project and the level of state and local funding for the project increases. The latter is referred to as "overmatching." The effect of overmatching is that the level of state and local funding increases above the 20 percent minimum and federal funding levels decrease proportionately.

Flexible Funds

TEA-21 continues the 1991 ISTEA provision that provides state and local governments with the ability to transfer a portion of federal highway funds to transit use based on local needs. These funds include Surface Transportation Program (STP) and Congestion Mitigation and Air Quality Improvement Program (CMAQ).

- STP is the largest category of flexible funds and may be used for all projects eligible for funding under current FTA grant programs except the formula grant program. STP funds can be used to upgrade rail facilities that are used to support local or regional commuter rail or connecting transit services. However, the funds *cannot* be used for intercity passenger rail projects at present, so funding available for the MWRRS under this program may depend on which capital investments meet the requirements. Safety set aside funds equivalent to the funds made available for FY1991 for the Hazard Elimination and Railway-Highway Crossing Programs (23USC 130 and 152) may not however be transferred. Under TEA-21, the Surface Transportation Program increased the set aside for Railway-Highway Crossing Hazard Elimination in High-Speed Rail Corridors from $5 million per year to $5.25 million per year, adding three additional high-speed rail corridors, expanding one of the original five corridors and authorizing the Secretary of the USDOT to select up to three additional corridors (1103-c).
- CMAQ funds, which are used to support transportation projects in air quality non-attainment areas, may also have some applicability in funding the MWRRS. A CMAQ project must contribute to the attainment of the national ambient air quality standards by reducing pollutant emissions from transportation sources.

9.2.2 Federal Railroad Administration Funding Programs

TEA-21 contains provisions for two funding categories relating to passenger rail and high-speed rail programs. These programs include Section 7201: High-Speed Rail and Section 1103-c: High-Speed Rail Grade Crossings.

High-Speed Rail (Section 7201)

The high-speed rail provisions of TEA-21 extend authorizations of appropriations for the existing high-speed rail assistance program created in the Swift Rail Development Act of 1994 (49 U.S.C. 26101 et seq.). An important modification in TEA-21 Section 7201 to ISTEA is the definition of high-speed rail. In particular, high-speed rail is now defined as train units that are *reasonably expected to reach* 125-mph or more. In ISTEA, the definition of high-speed rail was more absolute in that it required train sets to achieve at least 125-mph or more. This broader definition in TEA-21 is believed to make elements of the MWRRS, which is designed to operate primarily at speeds lower than 125-mph, eligible to pursue funding under this TEA-21 provision, provided they could show a long-term potential for higher speeds.

The TEA-21 authorization covers fiscal years 1998 through 2003 and is a General Fund authorization. This means that the funds must be made available in an Appropriations Act before the program can be implemented. The U.S. Secretary of Transportation is authorized to provide financial assistance for up to 50 percent of the publicly financed costs of corridor planning activities and up to the full cost of technology improvements.

These funds are to provide financial assistance to public agencies for high-speed rail corridor planning activities and certain other pre-construction activities, including right-of-way acquisition. Authorizations in Section 7201 are subject to budget appropriations. TEA-21 authorizes planning and pre-construction funding (including right-of-way acquisition) at $10 million/year with the federal government contributing up to 50 percent of a project's cost, and the remaining 50 percent being provided by the local government. Section 7201 also provides funding to any U.S. business, educational institution, state or local government, public authority, or federal agency to support the development of high-speed rail technology improvements. Funds for technology development and demonstrations are authorized at $25 million per year. There is no local match requirement when using funds for technology development purposes.

Funding authorizations for TEA-21 Section 7201 are provided in the table below:

Exhibit 9-1
Funding Authorizations for TEA-21 Section 7201

Year	***1997***	***1998***	***1999***	***2000***	***2001***	***2002***	***2003***
Planning	$45M	$10M	$10M	$10M	$10M	0	0
Technology	$40M	$25M	$25M	$25M	$25M	0	0

Source: FHWA, TEA-21 Fact Sheet, www.fhwa.dot.gov/tea21/factsheets November 2003

High-Speed Grade Crossing Program (Section 1103-c)

Section 1103-c extends and expands the program established under Section 1010 of ISTEA relating to grade crossing hazard elimination in designated high-speed rail corridors.

The purpose of the high-speed rail grade crossing improvement program is to reduce or eliminate the hazards at highway-rail grade crossings in designated high-speed corridors as provided in Section 1103-c of TEA-21. The U.S. Secretary of Transportation is authorized to provide financial assistance to the states, or authorities designated by one or more states, to fund crossing improvements that range from improved warnings to physical closure or grade separation. It is a two-part program that first designates passenger rail corridors as eligible for funding, and subsequently provides funds for improvements at specific highway-rail grade crossings.

To be eligible for designation, a corridor must be a rail line where speeds of at least 90-mph are occurring or can reasonably be expected to occur in the future. Grade crossing improvements identified as part of the MWRRS are eligible for this funding program under this provision.

Work eligible for Section 1103-c funding may include any of the following to eliminate hazards of highway-rail grade crossings, in the selected corridors:

- Installation or improvement of warning devices
- Improvement of track circuitry which activates warning devices
- Other crossing improvements such as improved crossing surfaces, improved sight distances, crossing illumination, closure of crossings with or without attendant highway relocations, grade separation construction or reconstruction
- Combining crossing warning systems with advanced train control and/or intelligent highway traffic control systems, and
- Any combination of these project areas

The federal share of the costs of improvements funded under Section 1103-c may be up to 100 percent of the costs of engineering and construction. However, before allocating funds, the extent to which other private, state, local and federal entitlement, *e.g.*, Surface Transportation Program, funds are being committed to corridor improvements in conjunction with these funds will be considered.

Contract authority from the Highway Trust Fund, other than the Mass Transit Account, is provided for fiscal years 1998 though 2003 totaling $31.5 million. An authorization for any appropriation is provided for an additional $75 million over fiscal years 1999 to 2003. Authorizations for the High-Speed Rail Grade Crossing Improvement Program are provided in Exhibit 9-2.

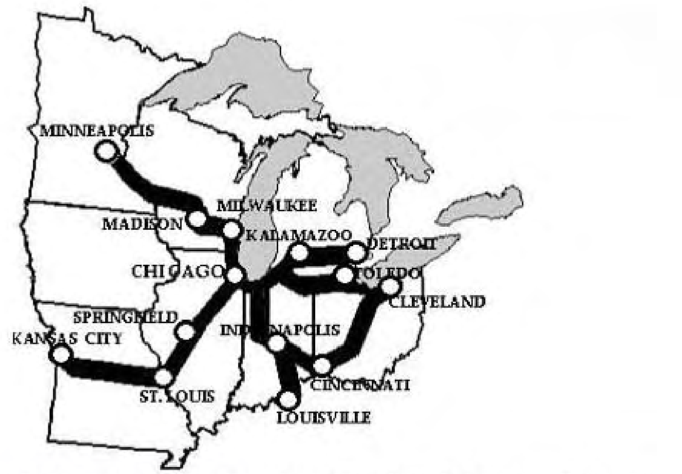
Exhibit 9-2
TEA-21 Authorizations – High-Speed Rail Grade Crossing Improvement Program

Year	***1998***	***1999***	***2000***	***2001***	***2002***	***2003***
Trust Funds	$5.25M	$5.25M	$5.25M	$5.25M	$5.25M	$5.25M
Authorized		$15M	$15M	$15M	$15M	$15M

Source: FHWA, TEA-21 Fact Sheet, www.fhwa.dot.gov/tea21/factsheets November 2003

Midwest Corridors eligible for Section 1103-c funding include the Chicago hub linking St. Louis, Twin Cities, Milwaukee and Detroit. The FRA map of designated High-Speed Rail Corridors is provided below:

Exhibit 9-3
FRA-Designated and Proposed High-Speed Rail Corridors



Source: Federal Railroad Administration Chronology of High Speed Rail Corridors Designations and Extensions, http://www.fra.dot.gov/Content3, November 2003

Federal Credit Programs

TEA-21 contains provisions for two credit programs to assist in the funding of large infrastructure projects relating to passenger rail and high-speed rail programs. These programs include Section 1503: Rail Passenger Eligibility under the Transportation Infrastructure Finance and Innovation Act (TIFIA), and Section 7203: Rail Passenger Eligibility under Railroad Rehabilitation and Improvement Financing (RRIF). The strategic goal under both programs is the use of credit rather than grants to help advance projects of national significance. As such, any funding under the programs is loans and must be repaid.

Transportation Infrastructure Finance and Innovation Act (TIFIA)

The Transportation Infrastructure and Finance Act (TIFIA) is a program under TEA-21 that provides federal assistance in the form of credit, *e.g.,* direct loans, loan guarantees and standby lines of credit, rather than grants to help fund major transportation investments of critical regional or national importance. The TIFIA credit program is designed to fill funding gaps and to leverage substantial private co-investment by providing supplemental and subordinate capital in the form of long-term loans. TIFIA could serve as a significant financing source for the MWRRS. In particular, TIFIA's ability to cover operating shortfalls during the early years of operation (ramp-up costs) might prove pivotal to obtain the multi-state decision to move forward with MWRRS implementation. The MWRRS, its market and service areas, and the transportation role that it will play in the Midwest in particular, and nationwide in general, are highly consistent with TIFIA eligibility requirements.

The TIFIA credit program consists of three different types of financial assistance designed to address projects' varying requirements throughout their life cycles:

- Secured loans are loans in a debt obligation involving the U.S.DOT as the lender and a non-federal sponsor as the borrower. The interest rate is "not less than" the yield on marketable Treasury securities of similar maturity on the date of execution of the loan agreement. A TIFIA loan matures no later than 35 years after the date of substantial completion of the project.
- Loan guarantees ensure a "federal government full-faith-and-credit guarantee" to institutional investors making a loan for a project.
- Standby lines of credit represent secondary sources of funding in the form of contingent federal loans that may be drawn upon to supplement project resources, if needed during the first ten years of project operations.

A corporation, joint venture, partnership or governmental entity may provide investment funds. The amount of federal credit assistance may not exceed 33 percent of total project costs.

Projects eligible for federal financial assistance through regular surface transportation programs (Title 23 or Chapter 53 of Title 49) are eligible for the TIFIA program. In addition, regionally or nationally significant projects such as intercity passenger rail facilities and vehicles, including Amtrak and Magnetic Levitation Systems, publicly owned intermodal freight facilities on the National Highway system, border crossing infrastructure, and other large infrastructure projects are examples of projects that could qualify under the TIFIA umbrella.

To qualify, projects must cost at least $100 million or 50 percent of a state's annual apportionment of federal-aid funds, whichever is less. In addition, the project must be supported in whole or in part from user fees or other non-federal dedicated funding sources, *e.g.*, tolls, and must be included in the state's transportation plan.

$530 million of contract authority is provided to pay the subsidy cost of supporting federal credit under TIFIA (to cover anticipated losses). The maximum amount of credit that may be provided is capped at $10.6 billion over the 6-year authorization period. Exhibit 9-4 provides annual contract authority and the maximum amount of credit available through 2003.

Exhibit 9-4
Federal Credit Authorizations under TIFIA

Year	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*Cumulative*
Contract Authority	0	$80M	$90M	$110M	$120	$130M	$530M
Maximum Amount of Credit	0	0	$1,800M	$2,200M	$2,400M	$2,600M	$9B

Source: FHWA, TEA-21 Fact Sheet, www.fhwa.dot.gov/tea21/factsheets November 2003

The U.S. Secretary of Transportation has developed selection criteria to guide the selection of TIFIA-candidate projects. These criteria include:

- The extent to which the project is nationally or regionally significant in terms of generating economic benefits, supporting international commerce or otherwise enhancing the national transportation system
- The creditworthiness of the project, including a determination by the Secretary that any financing for the project has appropriate security features, such as a rate covenant, to ensure repayment
- The extent to which the project will foster innovative public/private partnerships and attract private debt or equity investment
- The likelihood that assistance would enable the project to proceed to an earlier date than the project would otherwise be able to proceed
- The extent to which the project uses new technologies, including Intelligent Transportation System (ITS) that enhances the efficiency of the project
- The amount of budget authority required to fund the federal credit instrument made available
- The extent to which the project helps maintain or protect the environment
- The extent to which assistance would reduce the contribution of federal grant assistance to the project

The Secretary must require each project applicant to provide a preliminary rating opinion letter from at least one rating agency indicating that the project's senior obligations have the potential to achieve an investment-grade rating. Before entering into an agreement, the Secretary, in consultation with the Director of the Office of Management and Budget and each rating agency providing a preliminary rating opinion letter, must determine an appropriate capital reserve subsidy amount for each secured loan, taking into account the opinion letter.

The secured TIFIA loan must be payable, in whole or in part, from tolls, user fees, or other dedicated revenue sources; and include a rate covenant, coverage requirement, or similar security feature supporting the project obligations; and may have a lien on revenues. The Secretary establishes a repayment schedule for each secured loan based on the projected cash flow from project revenues and other repayment sources. Scheduled loan repayments of principal or interest on a TIFIA loan shall begin not later than 5 years after the date of substantial completion of the project. The final maturity date of the secured loan is no later than 35 years after the date of the substantial completion of the project.

Railroad Rehabilitation and Improvement Financing (RRIF)

The Railroad Rehabilitation and Improvement Financing Program, in Section 7203 of TEA-21, is intended to make funding available through loans and loan guarantees for railroad capital improvements. No direct federal funding is authorized in TEA-21; however, the Secretary is authorized to accept a commitment from a non-federal source to fund the required credit risk premium. The aggregate unpaid principal amounts of obligations for direct loans and loan guarantees cannot exceed $3.5 billion at any one time, of which not less than $1 billion shall be available solely for other than Class 1 carriers.

The Secretary is authorized to provide direct loans and loan guarantees to State and local governments, government sponsored authorities and corporations, railroads, and joint ventures that include at least one railroad to be used to acquire, improve, develop or rehabilitate intermodal or rail equipment or facilities, including track, bridges, yards and shops.

The Secretary is to give priority in selecting projects to those that enhance public safety and the environment, promote economic development, enable U.S. companies to be more competitive in international markets, are endorsed in state and local transportation plans, or preserve or enhance rail or intermodal service to small communities or rural areas.

The total unpaid principal amount of direct loans and loan guarantees cannot exceed $3.5 billion at any one time, of which not less than $1 billion is to be available solely for smaller (non-Class 1) carriers.

The Secretary is allowed to accept a commitment from a non-federal source to fund in whole or in part the required credit risk premium. Credit risk premiums fund the costs associated with a potential default on the loan/loan guarantee. The private commitments can be used in lieu of or in combination with any appropriations of federal funds for this purpose that might be provided in the future. The Secretary (in consultation with the Congressional Budget Office) is to determine the amount required for credit risk premiums for each loan/loan guarantee on the basis of the circumstances of the applicant, including the collateral offered, the proposed schedule for disbursing the funds, historical data on the repayment history of similar borrowers, and any other relevant factors.

No direct Federal funding is authorized in TEA-21; however, the Secretary is authorized to accept a commitment from a non-Federal source to fund the required credit risk premium[1]. The term of any loan may not exceed 25 years; the assistance must be justified by the present and probable future demand for rail services or intermodal facilities; the applicant must provide reasonable assurance that the facilities or equipment to be acquired, rehabilitated or established will be economically and efficiently utilized; and the obligation must be reasonably expected to be repaid, taking into account an appropriate combination of credit risk premiums and borrower collateral.

No direct federal funding is authorized or provided in TEA-21, however, as noted above, the Secretary is authorized to accept a commitment from a non-federal source to fund the required credit risk premium.

9.3 State and Local Financing

Federal funding under the programs described above usually requires a minimum local match of 20 percent at the state and local levels. Several provisions are included in TEA-21 that provides greater flexibility to states and local governments in satisfying the non-federal matching requirements of a project.

The states may use FTA grant funds, or assets acquired with federal assistance, to enhance the effectiveness of their capital investment program with the use of innovative financing techniques.

[1] TEA-21 Fact Sheet, see: http://www.fhwa.dot.gov/tea21/factsheets/r-rrehab.htm

Several alternative approaches to infrastructure financing that have been advocated in recent years may be of particular relevance to the MWRRS.

9.3.1 State Infrastructure Banks

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) authorized states to provide loans or other forms of credit enhancements utilizing federal funds a state has received. This program continues under TEA-21. A state can provide simple or leveraged loans through a State Infrastructure Bank (SIB), which functions as a state-level revolving loan fund. Federal funds can be used as seed capital or equity, and other non-federal funds can also be transferred directly into the bank. The bank could make loans to private project sponsors for any revenue-generating transportation project. After being repaid to the bank, the funds from the loan payments may be re-loaned to other projects. The revolving loan fund can grow in size as principal and interest payments are accumulated.

Through a SIB, a state can use its initial capital (provided by its federal-aid highway apportionment, federal transit allocations, and non-federal funds) to provide loans and for a variety of other financing arrangements. Activities by a SIB include financing arrangements to provide credit enhancements, serve as a capital reserve for bond or debt financing, subsidize interest rates, issue letters of credit, finance purchase and lease agreements, provide debt financing security, or provide other forms of financial assistance for the construction of projects qualified under the federal-aid highway program and transit capital projects. As the funds are repaid or compensation is provided, the SIB can make new financial assistance available to other projects, continually recycling and leveraging the initial funds available.

9.3.2 Leveraged Loan Fund

A leveraged loan fund increases its available resources by using the loan repayment stream and/or the initial capital base as collateral for a bond issue. The state leverages these funds by placing the seed capital into a reserve fund and then issues bonds against the fund, potentially tripling the amount of money it is able to lend. When repayments from the revenue-generating facility are repaid, these funds go into the reserve fund to be used to leverage more funds for the bank. However, leveraged funds may need to rely on the government's credit rating and backstop revenue sources to secure a bond rating high enough to permit loan offerings at affordable terms.

9.3.3 Revolving Loan Funds

Capital for revolving loan funds can be assembled from several sources, including dedicated taxes and user fees, government grants, legislative appropriations, bond proceeds, loan repayments, interest earned from loan operations, and interest on cash balances. The capital base of the revolving loan fund may be designed either to remain self-sufficient during its lifetime or to require future infusions of funds from external sources to remain operational.

The terms of repayment for the loans, including the interest rate, term of the loan, percentage of costs financed, payment schedule and grace period, may also vary to match the borrower's profile. The loan could be repaid on terms very favorable compared to those of most revenue and general obligation bonds funded from the capital markets. The loan could be structured, for example, with no interest and payments deferred until after the completion of construction or, perhaps, several years thereafter. The net savings to the implementing agency (in terms of interest cost saved) could be more than 30 percent, depending on how the loan is structured.

SIBs can provide a flexible source of financing for privately sponsored transportation projects. These mechanisms provide more capital for transportation projects with less reliance upon federal apportionment. In a turnkey or build-operate-transfer (BOT) project, the project company could receive a loan for a portion of the cost of the project and repay the loan through revenues generated by land development, lease payments, payments from operating agreements, or fare revenues.

9.3.4 Delayed or Tapered State/Local Match

The FTA permits grantees to defer payment of the state/local share of transit projects. The Secretary may allow the federal share to vary up to 100 percent on individual progress payments on a project as long as the final contribution of federal funds does not exceed the maximum federal share authorized for the project. The states may wish to delay the application of their matching funding, particularly if they are trying to maximize the use of available state/local funds. This could occur because the funds are invested in a short-term security, for example, or otherwise encumbered. However, there may also be a situation where the grantee is seeking to arrange construction period financing or some other innovative financing mechanism, which could be facilitated through an uneven expenditure of federal and matching funds. Additional benefits could be generated through innovative project financing or other means.

The FTA grants process generally is based on a level outflow for a specific project. For example, for every 20 percent expended by the state/locality, 80 percent in federal funds are expended. Little value can be added to such a cash stream through the assistance of private capital markets. However, if the federal dollars are expended first, *e.g.*, for 100 percent of the design, engineering or environmental reviews, then the construction period can be financed with some private participation. In this instance, state/local funds can be “banked,” or pledged as additional security for the construction period financing. This is all possible because there are no arbitrage concerns with state/local funds as there might be with the federal funds. The benefit of a delayed state/local match is that it may help assure the smooth progress of a major transit infrastructure project without any increase in federal outlays.

It should be clear that while FTA may allow a delayed match, FTA funding programs do not directly support intercity passenger rail. It does however establish a precedent for a delayed match provision in a new multi-year 80/20 Federal funding program for intercity passenger rail, as is recommended by this plan update.

9.3.5 Credit for Acquired Land

TEA-21 expands the law relating to donated property to also allow the fair market value of land lawfully obtained by the State or local government to be applied to the non-federal share of project costs.

9.3.6 *Using Federal Funds as Match*

For transportation enhancement projects, the states may apply funds from other federal agencies to the non-federal share of the project.

9.4 Local Funding

Financial support for the system may also come from local sources, which at present typically contribute a share of certain costs of surface transportation projects, *e.g*., freeway interchanges. In the case of the MWRRS, endorsement of local funding for station construction or improvements, *e.g.*, as part of an urban renewal or downtown development program, can be justified given the economic benefits that will accrue to new development in station areas because of the increased ridership of the MWRRS.

Frequently, local communities have encouraged businesses to enhance station facilities with such activities as travel agencies, convenience stores, restaurants and cafes. In addition, some communities have used their stations as transportation multimodal hubs with integrated bus and taxi operations. For these reasons, it is likely that funding for station facilities could be obtained from local communities. Local contributions could expand the matching capabilities of the states and could generate as much as five percent or more of the total capital costs.

9.5 Private Sector Contributions

Private sector contributions may be used to fund public works projects. The level of contribution depends on the willingness of private parties to participate. Private developers may be willing to provide cash and in-kind contributions to support transportation improvements from which they expect to benefit. Businesses and individuals may have a strong interest in promoting certain types of development, and they may be willing to contribute money, property or services to enhance the feasibility of the project. Special benefits may accrue to private contributors in the form of projects sited near property owned by the developer, the creation of access points between the developer's property and the project, zoning concessions, development rights, or public recognition.

The freight railroads will be a major recipient of benefits because of all the infrastructure investments in track, signaling and rights-of-way for the MWRRS. As a result, they will experience substantial productivity gains within their operations and significantly lower track maintenance and renewal costs. Therefore, the freight railroads may contribute to the costs of implementing the MWRRS, although the match potential and form of benefit cannot be estimated now.

9.6 Joint Private/Public Development

Joint development is similar to private sector contributions. However, joint development involves the development of adjoining facilities shared by the public and the private developer, such as a transit station adjoining office or retail space. Developers may be granted development rights for stations in exchange for contributions towards funding a transportation project. Contributions could include on-time payments towards the transit project or annual payments that can be applied to project costs or operating costs. Project viability depends on real estate market conditions and the ability of the public agency to provide necessary inducements for development. Inducements may include land, favorable zoning changes, lower financing costs or improved public access to the developer's property.

9.7 Debt Financing

The use of debt financing provides the ability to advance project implementation by borrowing against projected future revenues. Several forms of debt financing are discussed below.

9.7.1 Bond Issuance

The issuance of bonds and availability of up-front bond proceeds enables projects, such as the MWRRS, to proceed in an uninterrupted fashion since project funding is secure. Additionally, the use of bond financing allows major capital projects, which are long-lived assets, to be paid for over their useful lives rather than by current users. Tax-exempt debt represents bonds issued by a public agency or authority and backed by a specified source of revenue. The taxable debt represents bonds issued under structures in which the project costs are not eligible under the Internal Revenue Code for funding by tax-exempt bonds. Taxable debt would be issued at an interest rate approximately 1.5 to 3.0 percentage points higher than tax-exempt debt, because the interest income from these bonds would be subject to federal, state, and local income taxes which in turn affect investor returns. The basic structure of bonds is the same, whether tax-exempt or taxable.

9.7.2 Tax-exempt Bonds

There are two major categories of tax-exempt bonds - general obligation and revenue. The full faith and credit of the issuer with taxing power secures general obligation bonds. Revenue bonds are payable from specific revenue sources and do not permit bondholders to force taxation or legislative appropriation of funds not pledged for payment of debt service. Revenue bonds are non-recourse to the taxing power of the state in which the issuing authority is located. The only source of repayment and security for bondholders is the specific revenues that are pledged under the bond indenture.

Under certain conditions as defined in the Internal Revenue Code, state agencies and authorities would be able to issue tax-exempt governmental use bonds for a project. Exemption of the interest income on the bonds from federal taxes will lower the bonds' interest costs, because investors can still achieve the same effective return on tax-exempt bonds issued with a lower interest rate, as they would otherwise achieve on taxable bonds at higher rates. For the bonds to obtain tax-exempt status, certain criteria must be met. Funded assets must be publicly owned. The operating contract must be a short-term contract that satisfies certain conditions, including termination rights by the public authority, and compensation cannot be based on a percentage of gross or net revenues.

If a long-term operating contract is employed, and consequently the operating contract conditions discussed above are not met, tax-exempt governmental use bonds cannot be issued. For different reasons, again defined in the Internal Revenue Code, a second type of state-issued, federally tax-exempt bond, the private activity bond, also cannot be used. Under current law, these bonds may generally be used in private concessions for high-speed rail projects, except for the acquisition of rolling stock, for a system with operating speeds that exceed 150-mph. Thus, the MWRRS would not qualify for this type of funding, as its operating speed is not expected to exceed 110-mph.

Use of Proceeds and Source of Repayment

The revenues that are pledged to repay debt generally include portions of a state's motor fuel taxes, motor vehicle registration fees and motor vehicle license or permit fees, and sometimes a portion of the state sales tax. While net revenues from the operation of the proposed system could be pledged to repay the bonds, the interest rate for an untested entity such as the MWRRS would probably be substantially higher than those available to the individual states.

Establishment of New or Expanded Debt

States have constitutional or legislative restrictions on the issuance of debt. In addition, the enactment of a transportation bond program may require legislative action to establish the size of the program, identify existing or new revenue sources that will be pledged over a multi-year period to repay debt, and develop guidelines for the types of projects to be financed. The development of each new or expanded financing program must be tailored to meet specific legal, political and financial constraints. In this study, it has been assumed that each state will have, or will secure, the necessary bonding capability.

Structuring Considerations

Tax-exempt bonds can be structured as long-term, fixed-rate debt, where the interest rate is established at the time of sale. Potential investors and the rating agencies carefully evaluate the credit strength of a bond issue. The key credit factor is the expected strength and stability of the pledged revenues.

9.7.3 Grant Anticipation Notes

Grant Anticipation Notes (GANs) or similar instruments (such as GARVEEs) offer states an additional mechanism to raise up-front capital on the basis of receiving future federal funds. The term GAN refers to a debt-financing instrument that permits its issuer to pledge future FTA funds to repay investors. GANs are generally short term, usually less than one year to maturity but sometimes as long as two to three years to maturity, and intended only to meet short-term financial needs.

When the GAN is issued, the main form of security backing this debt-financing instrument is the state's obligation of future federal-aid apportionments based on a Letter of Intent or a Full Funding Agreement from the FTA. Short-term GANs are defined as notes that are backed by future obligations of a currently authorized Full Funding Agreement. Therefore, assuming that a state issued the GAN in the second year of a five-year authorization period, the term of the notes–or at least that portion backed by federal funds–could not exceed four years.

Federal tax law presently prohibits tax-exempt bonds from being guaranteed either directly or indirectly by the federal government (*i.e.*, Full Funding Agreement). Therefore, to enhance the credit rating of the issuance, additional security for the GANs is often required. Because of the shorter maturity and the additional security pledged, GANs usually are issued at a rate that is approximately one percent less than that for general obligation bonds. Accordingly, they could be a potential source of funding during the implementation period, when the amount of funds received from federal grants does not meet the capital requirements of the construction program.

9.7.4 Leasing

There are two potential funding mechanisms for financing rolling stock and possibly maintenance facilities. One option is offshore or cross-border leasing, and the other is the issuance of Certificates of Participation (COPs). There must be a separation of federal and state interest in the equipment or facility in order to use cross-border leases or COPs to leverage additional funds, or when using short-term lending or debt subordination where arbitrage issues could be involved. For example, the portion of a fleet or facility without federal interest could be financed and the proceeds used to earn interest or act as a credit enhancement on a bond issue supporting a major investment, thus generating savings for the state. Any legislative package proposed for the MWRRS should include the powers necessary to enter into such leases.

Off-shore or Cross-border Leasing

Off-shore or cross-border leasing is a mechanism by which the state purchases rolling stock, such as railcars, then simultaneously sells them to a non-U.S. investor who would be allowed to take investment tax credits or tax depreciation write-offs on the value of the equipment. The investor in turn leases them back to the state, and the tax benefits are shared with the state through reduced leased costs. The foreign investor pays the state an up-front consideration usually ranging from five to ten percent of the cost or value of the vehicles. The balance of the proceeds is deposited in a trust account to prepay or decease the lease payments.

Cross-border leasing is an ideal market for railcars because of their long life and "resale ability." The market has a proven advantage but it is volatile with uncertainties as to the availability and amount of savings. At a given point in time, there may be more demand than supply. While this mechanism has been used by Amtrak to privately finance equipment purchases and to obtain operating cash, it is not clear that such cost reduction measures will be available to States in conjunction with other Federal funding programs.

9.7.5 Certificates of Participation

Certificates of Participation (COPs) are a method of issuing debt, similar to bonding, secured by the value of the vehicles and/or facilities of the project. The investors become the technical owner of the vehicles/facilities and *lease* them back to the state. The lease payments become the service on the debt and, at the end of the lease period, the debt is retired and ownership reverts to the state or issuing agency.

COPs represent an interest in the payments the issuer has promised to make, but which are subject to annual appropriation by the issuer's governing body. The issuer must actually appropriate the funds each year; therefore, there is an element of risk not present in bonds. Although COPs can be insured, the interest rate is usually higher because of the increased risk.

9.8 State Funding Programs

Each state member of the MWRRI has distinct state programs where funding may be available for contributions to the MWRRS. Potential funding sources may be available through numerous state programs. The state programs may include:

- State Rail Programs
- State Highway Programs
- State Transportation Budgets

Each state in the MWRRS has its own distinct funding programs such as dedicated funding sources for public transportation including rail passenger programs; rail assistance programs; state funding and/or low interest loan programs for rail improvements or infrastructure; and state transportation budgets. These funding vehicles can be an appropriate source of financing for the MWRRI project, if the coalition deems these sources suitable.

9.9 Required Financial Thresholds

The MWRRS financial plan developed in Chapter 10 assumes a dedicated multi-year Federal funding program providing an 80/20 federal/state share. The Federal Railroad Administration (FRA) is likely to be the federal agency responsible for such a new program. The 1997 *Commercial Feasibility Study*[2] describes two conditions that are essential for receiving federal funding support for proposed intercity passenger rail projects:

1. A Benefits/Cost ratio greater than 1.0, and
2. An operating cost ratio of at least 1.0, defined as a precondition for an effective public/private partnership.

The *Feasibility Study* report also makes it clear that "Federal consideration of specific High-Speed Ground Transportation project proposals could apply additional criteria that could differ from, and be much more stringent than, this report's threshold indicators for partnership potential."

The definition of "operating ratio" used in this study is consistent with its definition by FRA in the *Commercial Feasibility Study*. It is different from the commercial "Operating Ratio" calculation that is typically presented by freight railroads and intercity bus companies. There are two key differences:

1. The "operating ratio" as calculated here includes *direct operating costs only*. Consistent with the FRA's requirement, the operating ratio calculations presented in this document do not include capital costs, depreciation or interest.
2. The "Benefit/.Cost ratio" presented here is defined as Revenues/Costs. Freight railroads and intercity bus companies typically define it as the reciprocal Costs/Revenues. Thus, they are seeking the lowest possible operating ratio while the passenger service would be seeking to maximize it.

As defined in the *Commercial Feasibility Study,* a positive operating ratio does not imply that a passenger service can attain "commercial profitability" by covering its capital costs. Since "operating ratio" as defined here does not include any capital-related costs, this report shows that

[2] U.S. Federal Railroad Administration, *High-Speed Ground Transportation for America*, pp. 3-7 and 3-8, September 1997

the proposed MWRRS network meets the requirements of the *Commercial Feasibility Study* by covering at least its direct operating costs and producing a cash operating surplus.

9.10 Conclusion

Many states are exploring opportunities to increase the private sector involvement in the implementation of rail projects. The magnitude of the capital requirements of the MWRRS, and the lack of a proven regional system of this size in the Midwest region would make the potential for full private sector participation challenging. Thus, it is currently assumed that each state will fund its portion of the capital costs separately using one or a combination of the project funding alternatives discussed above. Specific funding strategies and structures, based on the funding requirements and abilities of the individual states are outside the scope of this study. However, it has been assumed that the likely mechanisms are those presented above. These include:

- 80 percent federal funds (discretionary grant)
- 20 percent state/local funds (bonds)
- Cash flow management (TIFIA, GANs)
- Cost reduction techniques (cross-border leases, COPs)

10. Financial Analysis

10.1 Introduction

The MWRRS financial analysis was revised to incorporate the results of the updated operating plan and implementation schedule. The financial analysis incorporates many of the same financial assumptions contained in the studies conducted from 1998 through 2000. This update incorporates a sensitivity analysis with respect to federal funding levels and the application for TIFIA funds to offset ramp-up operating losses.

The financial analysis for the MWRRS was prepared at the system level and reflects the economies of scale inherent in a large regional passenger rail service. This approach maximizes the financial performance of the rail service during the ten-year start-up period and lessens the impact of short-term, ramp-up period operating revenue shortfalls on specific corridors.

The financial analysis was performed to provide insight into the viability of the proposed MWRRS and as a basis for reviewing the direct financial merit of the project and possible public bond financing alternatives. The financial analysis also provides state and federal decision-makers with sufficient information to enable them to judge the fiscal practicality of the proposed system.

The financial analysis integrates the capital, operating and maintenance costs along with the revenue projections for 2008 through 2040 and addresses financing alternatives. The analysis was based on the following components:

- Operating and implementation plans for the MWRRS passenger rail service
- Cost estimates for operations, infrastructure and acquisition of rolling stock
- Ridership and revenue estimates based on projected travel demand and assumptions regarding fare levels and other services
- Cash flow analysis that includes statements of revenues and expenses as well as sources and uses of funds, including the impact of the financing alternatives

Two measures of economic benefit were used to evaluate the alternative options. These are net present value (NPV) and cost benefit ratio. The measures are defined as follows:

Net Present Value = Present Value of Total Benefits – Present Values of Total Costs

$$\text{Cost Benefit Ratio} = \frac{\text{Present Value of Benefits}}{\text{Present Value of Costs}}$$

Where Present Value is defined as

$$PV = \sum C_t / (l + r)^t$$

Where

PV = Present value of all future cash flows

C_t = Cash flow for period *t*

r = Opportunity cost of money

t = Time

10.2 Key Assumptions

Operating costs and revenues are expressed in the financial model as base year (2002) dollars, by calendar year. The analysis projects travel demand, operating revenues[1] and operating and maintenance costs for all years from 2008 through 2040. Following GAO guidelines, the financial analysis has been conducted in real terms using constant 2002 dollars. Accordingly, no inflation factor has been included. Revenues have also been projected in constant dollars over the time frame of the financial analysis. A summary of key inputs are presented below:

10.2.1 Ridership and Revenue Forecasts

Ridership and revenue forecasts were prepared for the years of 2003, 2010, 2020 and 2040. Operating costs and revenues in intervening years are projected based on interpolations, reflecting the projected growth in ridership. Revenue includes passenger fares, air connectivity and onboard services. The economic scenario for the ridership forecasts assumes the continuation of existing socioeconomic trends for income, population and employment growth throughout the region; the competitive market analysis assumes the continuation of current trends in the auto, air and bus modes. Operating ratios were estimated both *with* and *without* supplementary express parcel service. However, at the direction of the MWRRI Steering Committee, the financial plan was conservatively based on the result *without* the express parcel service.

10.2.2 Capital Costs

Capital costs include rolling stock, track, bridges, fencing, signaling, grade crossings, maintenance facilities and station improvements. The capital costs used in the financial analysis incorporate the related start-up costs for project management and preliminary engineering and design during each of the implementation phases. The capital cost projections are based on year-by-year projections of each cost element.

10.2.3 Operating Expenses

Major operating and maintenance expenses include equipment maintenance, track and right-of-way maintenance, administration, fuel and energy, train crew and other relevant expenses. A profit factor is included for all expenses including the primary work of the system operator.

10.2.4 Implementation Period

The MWRRS has a planning and implementation period of approximately ten years. The financial analysis is based on the assumption that some planning and preliminary engineering for the project began as early as 2000. This reflects, for example the completion of the Milwaukee-Madison Environmental Assessment and corridor investments already made by Illinois and Michigan. Except for improvements to the Springfield-St. Louis segment that are already underway, construction is scheduled to begin in 2006 and operations on three corridors (Implementation Phase 1) begin in 2008. The financial analysis incorporates revenue and cost assumptions in accordance with the implementation plan described in Chapter 8. Full corridor service, with respect to revenues and costs, is assumed to begin on the first day of the year following completion of construction.

[1] Operating revenues include passenger revenue, air connect revenues, on-board services revenue, and optionally express package revenue.

10.3 Results of Operations

10.3.1 MWRRI System

Exhibit 10-1 shows MWRRI net revenue and operating expenses and the resultant cash flows. During the first two years of the implementation period, start-up operating expenses – at the system level – are below operating revenues. By the third year of implementation, net operating revenues (revenues less costs) are positive and continue to accelerate at a faster rate than operating costs. After full implementation of the system, ridership, revenues and costs continue to slowly increase because of the effect of forecast population growth and income changes. With additional ridership, costs increase at a much slower pace since train-mile costs are held essentially fixed. Since operations are held constant after Phase 7, the financial model predicts an improving operating ratio over time.

Exhibit 10-1
Net Operating Revenues and Expenses

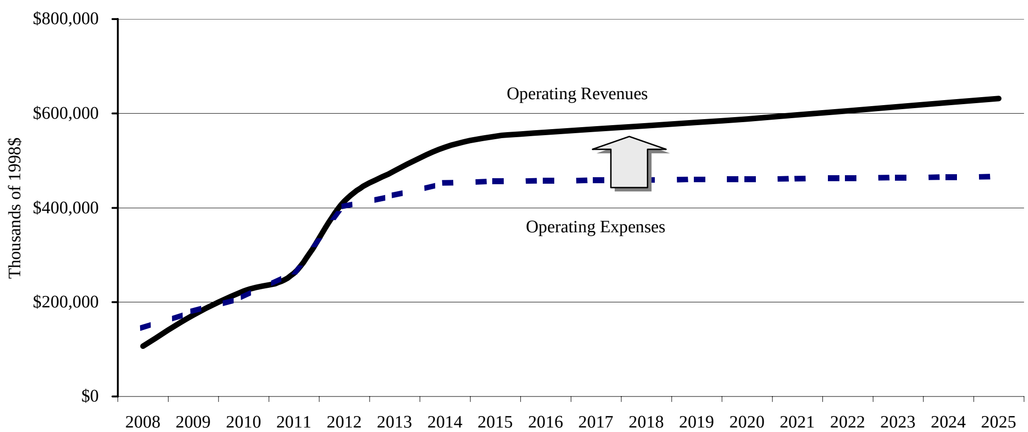


Exhibit 10-2 provides a detailed Pro Forma Statement of Operations for the thirty-three year planning period 2008 through 2040.

Exhibit 10-2
Midwest Regional Rail System
Statement of Operations, Year 2008 – 2040 (Thousands of 2002$)

	Total to 2040	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Revenues												
Fare Box Revenue	**$17,584,584**	$98,405	$158,554	$205,681	$240,453	$380,650	$438,283	$483,991	$505,191	$512,822	$519,288	$525,753
On Board Revenue	**1,395,879**	7,826	12,600	16,330	19,084	30,219	34,800	38,422	40,101	40,707	41,220	41,733
Express Parcel Svc (Net Rev)	**0**	0	0	0	0	0	0	0	0	0	0	0
Bus Feeder System	**220,722**	398	1,095	1,539	1,898	3,159	5,216	5,964	6,218	6,361	6,467	6,575
Total Revenues	**18,980,463**	106,628	172,249	223,550	261,435	414,028	478,299	528,377	551,511	559,890	566,975	574,061
Train Operating Expenses												
Energy and Fuel	**965,994**	7,827	10,026	11,625	16,204	28,172	29,773	31,940	31,940	31,940	31,940	31,940
Train Equipment Maintenance	**4,109,638**	33,300	42,652	49,458	68,938	119,851	126,663	135,881	135,881	135,881	135,881	135,881
Train Crew	**1,645,551**	13,334	17,078	19,803	27,603	47,990	50,718	54,408	54,408	54,408	54,408	54,408
On Board Services Crew	**1,334,461**	9,071	12,906	15,825	20,219	33,673	37,018	40,257	41,097	41,399	41,656	41,913
Service Administration	**942,294**	20,296	23,195	28,994	28,994	28,994	28,994	28,994	28,994	28,994	28,994	28,994
Operating Profit	**621,640**	7,202	8,654	10,220	12,070	17,131	18,102	19,183	19,412	19,483	19,542	19,600
Total Train Operating Expenses	**9,619,578**	91,029	114,511	135,926	174,028	275,811	291,268	310,662	311,731	312,105	312,420	312,735
Other Operating Expenses												
Track & ROW Maintenance	**1,802,585**	22,942	27,403	30,143	39,790	55,557	56,272	58,166	58,166	58,166	58,166	58,166
Station Costs	**818,250**	14,001	14,767	16,165	18,965	24,719	25,119	26,093	26,093	26,093	26,093	26,093
Sales & Marketing	**987,206**	11,620	13,972	15,940	17,519	23,435	25,823	27,876	28,808	29,154	29,430	29,706
Insurance Liability	**857,110**	4,943	7,503	9,676	11,415	18,004	20,596	22,523	23,880	24,243	24,553	24,863
Bus Feeder	**221,295**	482	2,124	2,241	2,815	5,055	7,105	7,462	7,462	7,462	7,462	7,462
Total Other Operating Expenses	**4,465,151**	53,988	65,769	74,165	90,504	126,771	134,914	142,120	144,410	145,118	145,704	146,290
Total Operating Expenses	**14,084,729**	145,018	180,281	210,090	264,532	402,582	426,182	452,782	456,141	457,223	458,124	459,025
Cash Flow From Operations	**4,895,734**	($38,389)	($8,031)	$13,459	($3,097)	$11,446	$52,117	$75,595	$95,370	$102,668	$108,851	$115,037
Operating Ratio	**1.35**	0.74	0.96	1.06	0.99	1.03	1.12	1.17	1.21	1.22	1.24	1.25

Exhibit 10-2 (continued)
Midwest Regional Rail System
Statement of Operations, Year 2008-2040 (Thousands of 2002$)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Revenues												
Fare Box Revenue	$532,219	$538,684	$546,641	$554,598	$562,555	$570,511	$578,468	$586,425	$594,382	$602,339	$610,295	$618,252
On Board Revenue	42,247	42,760	43,391	44,023	44,655	45,286	45,918	46,549	47,181	47,812	48,444	49,076
Express Parcel Service (Net Rev)	0	0	0	0	0	0	0	0	0	0	0	0
Bus Feeder System	6,684	6,795	6,908	7,023	7,140	7,259	7,380	7,503	7,627	7,754	7,883	8,015
Total Revenues	581,149	588,239	596,941	605,644	614,349	623,056	631,766	640,477	649,190	657,905	666,623	675,342
Train Operating Expenses												
Energy and Fuel	31,940	31,940	31,940	31,940	31,940	31,940	31,940	31,940	31,940	31,940	31,940	31,940
Train Equipment Maintenance	135,881	135,881	135,881	135,881	135,881	135,881	135,881	135,881	135,881	135,881	135,881	135,881
Train Crew	54,408	54,408	54,408	54,408	54,408	54,408	54,408	54,408	54,408	54,408	54,408	54,408
On Board Services Crew	42,169	42,426	42,742	43,057	43,373	43,689	44,005	44,321	44,636	44,952	45,268	45,584
Service Administration	28,994	28,994	28,994	28,994	28,994	28,994	28,994	28,994	28,994	28,994	28,994	28,994
Operating Profit	19,659	19,718	19,784	19,851	19,917	19,984	20,050	20,144	20,239	20,333	20,428	20,522
Total Train Operating Expenses	313,050	313,365	313,748	314,130	314,512	314,895	315,277	315,687	316,097	316,507	316,918	317,328
Other Operating Expenses												
Track & ROW Maintenance	58,166	58,166	58,166	58,166	58,166	58,166	58,166	58,166	58,166	58,166	58,166	58,166
Station Costs	26,093	26,093	26,093	26,093	26,093	26,093	26,093	26,093	26,093	26,093	26,093	26,093
Sales & Marketing	29,982	30,258	30,544	30,829	31,114	31,400	31,685	32,042	32,399	32,756	33,113	33,470
Insurance Liability	25,172	25,482	25,862	26,242	26,621	27,001	27,381	27,968	28,555	29,142	29,729	30,316
Bus Feeder	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462
Total Other Operating Expenses	146,876	147,461	148,126	148,792	149,457	150,122	150,787	151,731	152,675	153,619	154,562	155,506
Total Operating Expenses	459,926	460,827	461,874	462,921	463,969	465,016	466,064	467,418	468,772	470,126	471,480	472,834
Cash Flow From Operations	$121,224	$127,412	$135,067	$142,723	$150,380	$158,040	$165,702	$173,059	$180,418	$187,779	$195,143	$202,508
Operating Ratio	1.26	1.28	1.29	1.31	1.32	1.34	1.36	1.37	1.38	1.40	1.41	1.43

Exhibit 10-2 (continued)
Midwest Regional Rail System
Statement of Operations, Year 2008 – 2040 (Thousands of 2002$)

	2032	2033	2034	2035	2036	2037	2038	2039	2040
Revenues									
Fare Box Revenue	$634,166	$642,122	$650,079	$658,036	$665,993	$673,950	$681,906	$689,863	$697,820
On Board Revenue	50,339	50,970	51,602	52,234	52,865	53,497	54,128	54,760	55,392
Express Parcel Service (Net Rev)	0	0	0	0	0	0	0	0	0
Bus Feeder System	8,284	8,421	8,561	8,704	8,849	8,996	9,146	9,298	9,453
Total Revenues	692,788	701,514	710,243	718,974	727,707	736,443	745,181	753,921	762,664
Train Operating Expenses									
Energy and Fuel	31,940	31,940	31,940	31,940	31,940	31,940	31,940	31,940	31,940
Train Equipment Maintenance	135,881	135,881	135,881	135,881	135,881	135,881	135,881	135,881	135,881
Train Crew	54,408	54,408	54,408	54,408	54,408	54,408	54,408	54,408	54,408
On Board Services Crew	46,215	46,531	46,847	47,163	47,478	47,794	48,110	48,426	48,742
Service Administration	28,994	28,994	28,994	28,994	28,994	28,994	28,994	28,994	28,994
Operating Profit	20,711	20,805	20,900	20,994	21,088	21,183	21,277	21,372	21,466
Total Train Operating Expenses	318,148	318,558	318,969	319,379	319,789	320,199	320,609	321,019	321,430
Other Operating Expenses									
Track & ROW Maintenance	58,166	58,166	58,166	58,166	58,166	58,166	58,166	58,166	58,166
Station Costs	26,093	26,093	26,093	26,093	26,093	26,093	26,093	26,093	26,093
Sales & Marketing	34,184	34,541	34,898	35,255	35,612	35,969	36,326	36,682	37,039
Insurance Liability	31,490	32,077	32,664	33,251	33,838	34,425	35,012	35,599	36,185
Bus Feeder	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462	7,462
Total Other Operating Expenses	157,394	158,338	159,282	160,226	161,170	162,114	163,058	164,002	164,946
Total Operating Expenses	475,542	476,897	478,251	479,605	480,959	482,313	483,667	485,021	486,375
Cash Flow From Operations	$217,246	$224,618	$231,992	$239,369	$246,748	$254,129	$261,513	$268,900	$276,289
Operating Ratio	1.46	1.47	1.49	1.50	1.51	1.53	1.54	1.55	1.57

10.3.2 Corridor Level Performance

Operating performance on a corridor basis both *with* and *without* the express parcel service, showing operating revenue, costs and ratios is presented in Exhibit 10-3 and 10-4 respectively. Adding the express parcel service clearly improves the financial performance of the MWRRS, but is not critical to meeting the FRA requirement described in Chapter 9 that each route must show a positive operating ratio after the ramp-up period. O&M costs do not increase with the addition of the express parcel service, since express parcel costs are accounted for here in a separate financial statement. Only the net contribution of the express parcel service is brought forward into the operating ratio calculations of Exhibit 10-4.

Exhibit 10-3
Operating Revenues, Costs and Ratios without the Express Parcel Service

MWRRS Summary Financial Statistics	*Operating Revenue (Millions of 2002$)*		*O&M Cost (Millions of 2002$)*		*Operating Ratio*	
	2014	*2025*	*2014*	*2025*	*2014*	*2025*
Chicago-Detroit/Grand Rapids/Port Huron	$113	$129	$95	$97	1.18	1.32
Chicago-Cleveland	$50	$66	$56	$58	0.88	1.15
Chicago-Cincinnati	$53	$61	$40	$41	1.32	1.49
Chicago-Carbondale	$22	$25	$22	$22	0.99	1.11
Chicago-St. Louis	$61	$71	$47	$49	1.30	1.46
St Louis-Kansas City	$35	$47	$34	$35	1.05	1.32
Chicago-Quincy Omaha	$53	$61	$59	$60	0.90	1.02
Chicago-Minneapolis /Green Bay	$141	$172	$99	$104	1.42	1.65
Midwest Regional Rail System Total	**$528**	**$632**	**$453**	**$466**	**1.17**	**1.36**

Exhibit 10-4
Operating Revenues, Costs and Ratios with the Express Parcel Service

Corridor	*Operating Revenue including Express Parcel Service (2002$ Million)*		*Operating Cost (2002$ Million)*		*Operating Ratio*	
	2014	*2025*	*2014*	*2025*	*2014*	*2025*
Chicago-Detroit/Grand Rapids/Port Huron	$118	$137	$95	$97	1.24	1.40
Chicago-Cleveland	$54	$73	$56	$58	0.96	1.27
Chicago-Cincinnati	$57	$66	$40	$41	1.40	1.61
Chicago-Carbondale	$22	$25	$22	$22	1.00	1.13
Chicago-St. Louis	$64	$76	$47	$49	1.36	1.55
St Louis-Kansas City	$37	$49	$34	$35	1.09	1.38
Chicago-Quincy-Omaha	$54	$62	$59	$60	0.92	1.04
Chicago-Minneapolis /Green Bay	$149	$185	$99	$104	1.51	1.77
Midwest Regional Rail System Total	**$555**	**$672**	**$453**	**$466**	**1.23**	**1.44**

10.3.3 Net Operating Revenue/Losses

As shown in Exhibit 10-5, total operating losses during the seven-year implementation period amount to $206.1 million, on a corridor basis. With this approach, each corridor operates independently from the others and there is no cross-subsidy between corridors. However, on a system-wide basis, total operating losses are only $49.5 million, less than one-fourth the amount of the individual corridors. The improved *net* financial performance, when viewed on the system-wide basis, results from the stronger established corridors covering some initial start-up costs of the weaker routes that are not yet fully ramped-up. The financial analysis assumes that TIFIA assistance, rather than a direct state subsidy, will be used to cover the ramp-up operating losses. A system-wide approach dramatically reduces the level of TIFIA assistance needed.

Exhibit 10-5
Net Operating Revenue
(Thousands of 2002$)

Cash Flow (Thousands of 2002$)		*Implementation Period*						
Corridor	*Total Losses*	*Phase 1 2008*	*Phase 2 2009*	*Phase 3 2010*	*Phase 4 2011*	*Phase 5 2012*	*Phase 6 2013*	*Phase 7 2014*
Michigan	($53,395)	($21,286)	($13,256)	($10,836)	($8,018)	$2,112	$12,338	$17,506
Cleveland	($47,648)	$0	$0	$0	$0	($28,478)	($12,434)	($6,736)
Cincinnati	($10,243)	$0	$0	$0	$0	($10,243)	$7,998	$12,908
Carbondale	($11,256)	$0	$0	$0	($7,884)	($2,201)	($947)	($224)
St. Louis	($11,571)	($11,571)	$1,038	$4,986	$2,555	$11,859	$12,711	$14,234
Kansas City	($11,164)	$0	$0	$0	($9,022)	$2,927	($2,142)	$1,546
Quincy-Omaha	($55,299)	$0	$0	($5,199)	($15,167)	($13,802)	($15,430)	($5,702)
Green Bay-St. Paul	($5,533)	($5,533)	$4,187	$24,508	$34,438	$49,271	$50,023	$42,062
Total by Corridor	**($206,109)**							
Total by System	**($49,518)**	**($38,389)**	**($8,031)**	**$13,459**	**($3,097)**	**$11,446**	**$52,117**	**$75,595**

Applying the cost assumptions discussed previously in this report, the operational analysis projects that the MWRRS produces an operating surplus – on a system-wide operating basis – in 2012, the fifth year of implementation. By the end of the first four years, the performance of the corridor segments completed in Phase 1 through Phase 4 is strong enough to *carry* projected operating losses through the remainder of the implementation period.

In the operating projections, all operating costs are incurred in the first year of each corridor's operation. However, revenue levels do not achieve full potential until the third year of operations. This assumption allows for a reasonable ramp-up period and takes into account the lag in market responsiveness to this new service. Revenues are projected at 50 percent of full operations in the first year and at 90 percent in the second year. Therefore, even with increases in variable costs resulting from increased ridership levels, the overall operating cost ratio for the system improves from 0.74 in 2008 to 1.06 in 2010 and to 1.17 in 2014. Projected annualized revenues by 2014, the first full year in which all corridor segments are in operation, are expected to exceed $528 million with net operating cash flows of approximately $75 million.

Projected operating revenues and costs are incorporated into each financing alternative and are estimated over a twenty-year period. Net revenues are defined as farebox, onboard, express parcel service revenues, less operating and maintenance costs. The cash flow projections assume that five percent of any positive net cash flow from operations, on a system-wide basis, is diverted to a capital reserve account and used for system expansion, preservation or other purposes. The balance of annual net revenues would be disbursed to the participating states based on an agreed-upon allocation method.

10.3.4 Operating Cost Ratio

In terms of the objectives set by the MWRRI Steering Committee, the ratio of revenues to operating costs, the *operating cost ratio*, provides the key financial measure of the merits of the MWRRS. Specifically, the operating cost ratio measures whether the system will generate enough revenues to cover its operating costs. Thus, the operating cost ratio measures the MWRRS' ability to be self-supporting, if the capital costs of the system are provided as grants. The operating cost ratio for the MWRRS achieves a ratio above 1.0 (revenues greater than costs) by 2006 and is projected to achieve a ratio of 1.17 by 2014 when the system is fully operational.

With the exception of the Chicago-Omaha/Quincy route, each corridor achieves a positive operating cost ratio (greater than 1.0) by 2015, the year after full system implementation. The Chicago-Omaha segment, which is not completed until Phase 6, does not reach self-sufficiency until 2024. Exhibit 10-6 presents the forecasted operating cost ratio for each corridor in 2014 and 2025.

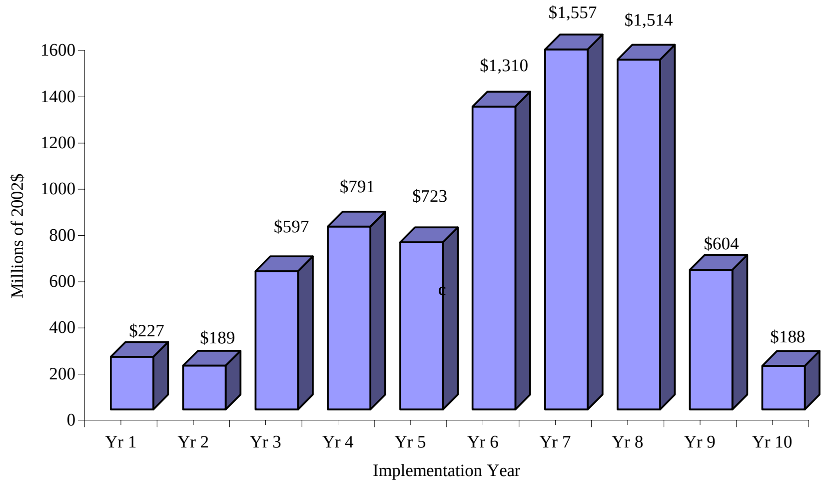
Exhibit 10-6
Operating Cost Ratios in 2014 and 2025

MWRRS Summary Financial Statistics	*2014*	*2025*
Chicago Detroit/Grand Rapids/ Port Huron	1.18	1.32
Chicago Cleveland	0.88	1.15
Chicago Cincinnati	1.32	1.49
Chicago Carbondale	0.99	1.11
Chicago St. Louis	1.30	1.46
St Louis Kansas City	1.05	1.32
Chicago Quincy Omaha	0.90	1.02
Chicago Minneapolis /Green Bay	1.42	1.65
Midwest Regional Rail System Total	**1.17**	**1.36**

10.4 Capital Funding Requirements

The capital funding requirements are derived from the implementation plan and are assessed on a corridor basis by implementation phase. The annual capital requirement for the years 2004-2013 is shown in Exhibit 10-7. The three peak years of capital requirements are years six, seven and eight, during which time an average of over $1.4 billion dollars are needed each year.

Exhibit 10-7
Capital Funding Requirements



10.5 Finance Plan Analysis

The following section describes the key assumptions related to financing alternatives, the analysis methodology and the results of the financial analysis.

10.5.1 Financing Alternative Assumptions

Funding Sources

Either direct state grants or General Obligation Bonds are the principal source of financing for the state matching funds considered in this analysis. Interest rates vary depending on the type of bond issued (general obligation, tax-exempt revenue bonds, taxable revenue bonds) and total investment costs are affected by the choice of debt instruments. Previous MWRRI studies analyzed the impact that various bond structures had on the financial results to support investment strategies for the MWRRS.

The MWRRS funding plan is based upon the assumption of 80 percent federal and 20 percent state funding. However, since federal appropriations fluctuate annually, the level of federal funds required to support the project's cash flow might fall below the 80 percent level even with a full funding agreement. Consequently, additional funding mechanisms will be required to maintain the funding level necessary to support the project, including short-term credit options. Short-term debt instruments include Grant Anticipation Notes (GANs) and other revenue anticipation notes along with TIFIA assistance. By project closeout, the federal contribution is required to equal 80 percent of eligible project costs.

The financial plan assumes that federal funds will be allocated based on capital costs for each year of the implementation period. It was also assumed that TIFIA assistance would be used to obtain loans that will be applied to operating revenue deficits in the early phases of the implementation plan. The MWRRI states will be responsible for repayment of debt service and principal on any bonds issued to fund their matching shares. Cash flow from operations would be the source of repayment for short-term debt as well as any longer-term TIFIA assistance. During the construction period, GANs can be repaid with unused federal funding.

This analysis continues the two cash management techniques applied in earlier studies – delayed state match and the use of GANs. GANs, or other similar short-term debt instruments, offer the states an ability to raise up-front capital based on receiving future federal funds. The benefit of issuing GANs is that implementation could proceed as scheduled, even though the flow of federal funding does not follow the contract obligation or project cash flow requirements. GANs are used to make up the difference between funds available and funds required. For example, GANs may be used in 2010 to allow the construction of $1.56 billion of infrastructure and rolling stock even though only $400 million is available from federal sources. These debt instruments are incorporated into the financial projections to provide for any cash shortfalls that may occur.

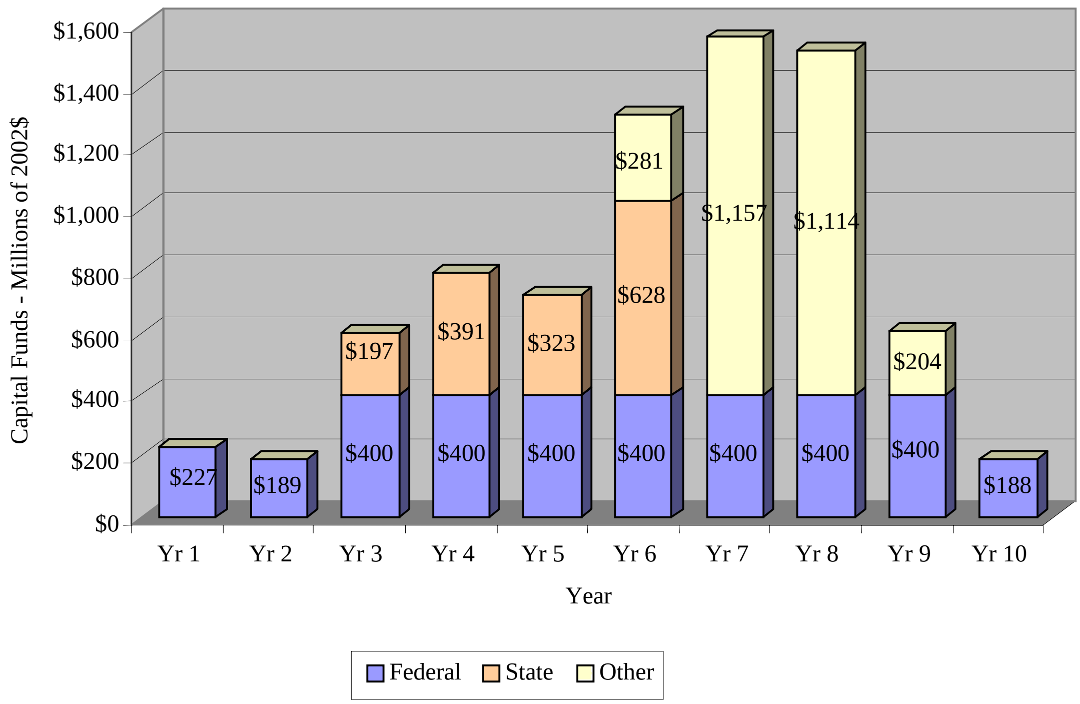
Estimated Level of Debt

The amount of debt is based on the projected capital requirements for infrastructure and rolling stock. The financial plan assumes that 80 percent of projected capital requirements is contributed by federal funding sources and 20 percent by the participating states. Additional factors include issuance costs, debt service reserve fund requirements and interest earned on the reserve funds.

Federal and state funding is combined with TIFIA assistance and GANs to meet the annual capital cost and financial requirements during the project's implementation phases. At this time, it is considered that the MWRRS might attract approximately $400 million per year in federal funding. This would be consistent with federal support for major infrastructure projects of this type.

Exhibit 10-8 is an example of projected cash flow requirements and the resulting mix of funding sources when federal funds granted to the project are capped at $400 million per year. This exhibit is only a construct of the funding strategy whose state funds are spent prior to any GANs being used. This construct has been approved by a major Wall Street firm.

Exhibit 10-8
Cash Flow Requirements Utilizing GANs and Delayed State Match
(Millions of 2002$)



Year	*Total Capital Cost*	*Federal Grant 80%*	*State Funds 20%*	*Actual Federal Outlay*	*Actual State Funds*	*Other Funds (GANS)*	*Total Funds Available*
Yr 1	227.1	181.7	45.4	227.1	0.0	0.0	227.1
Yr 2	188.5	150.8	37.7	188.5	0.0	0.0	188.5
Yr 3	597.2	477.7	119.4	400.0	197.2	0.0	597.2
Yr 4	791.2	633.0	158.2	400.0	391.2	0.0	791.2
Yr 5	723.2	578.6	144.6	400.0	323.2	0.0	723.2
Yr 6	1309.9	1047.9	262.0	400.0	628.4	281.5	1309.9
Yr 7	1557.3	1245.8	311.5	400.0	0.0	1157.3	1557.3
Yr 8	1513.5	1210.8	302.7	400.0	0.0	1113.5	1513.5
Yr 9	604.1	483.3	120.8	400.0	0.0	204.1	604.1
Yr 10	187.8	150.3	37.6	187.8	0.0	0.0	187.8
Total	7699.9	6159.9	1540.0	3403.5	1540.0	2756.4	7699.9

Investment Rates

The short-term investment rate is set at two percent. This was left unchanged from the previous analysis, as lending rates have been stable over the past two years. The long-term investment rate is also set at 2 percent.

Borrowing Term

The MWRRI states may issue bonds for their matching 20 percent contribution for federal funds. Bond maturity terms are frequently matched to the useful lives of the revenue-producing assets that are funded, in this case rolling stock. The projections assume the bonds mature in twenty years.

Borrowing Rates

Projected interest rates on the bonds were based on an analysis of the market rates for revenue bonds and their relationship to the 30-year Treasury Bond. Based on this analysis, the rate for general obligation bonds is 5.5 percent, 5.0 percent for GANs, and 5.5 percent for TIFIA. The lower rate on GANs takes into account its risk-free nature since its payback is guaranteed by federal funds.

Issuance Fees

The issuance fees for the GANs are set at 1.0 percent.

The financing assumptions are summarized in Exhibit 10-9.

Exhibit 10-9
Updated Financial Assumptions

Category	***Financial Assumptions***
Construction Period	10 years Phase 1 operations begin in 2008 Full operations - 2014 onwards
Capital Funding	$7.7 billion
Contribution to Reinvestment fund	5 percent of cash flow after TIFIA repayment
Interest income on Reinvestment fund	2 percent
Principal Deferment on GANs	2-5 years, as necessary
Issuance Cost	GANs – 1.0 percent of issuance amount
Interest Rates Grant Anticipation Notes (GANs) TIFIA Loan Assistance	 5.0 percent 5.5 percent
Annual Federal Grant Obligation	80 percent of capital cost
Annual Federal Grant Obligation	$400 million (moderate level)
Operating Losses During Ramp-Up	TIFIA assistance

10.6 Methodology

A financial model for the MWRRS was developed to evaluate alternative financial strategies. The model was used to assess projected cash flows from the service based on the implementation

– planned and projected funding requirements. The following sections describe the results of the analysis.

10.6.1 Financial Results of the Analysis of Financing Alternatives

The sources of the funds required to meet the capital costs and the implementation plan are summarized in Exhibit 10-10.

Exhibit 10-10
Sources and Amounts of Funds Required
(Millions of 2002$)

	Amount
Federal Contribution	$3,403
State Contribution	$1,540
GANs	$2,756
TIFIA Loan	$427
Total Funds contributed	$8,127

Notes:

(1) Actual federal grants used during the construction period are only $3,403 million out of the total $6,160 million (80 percent) due to the $400 million annual disbursement cap.

(2) GANs in the amount of $2,756 million are completely paid back with late federal contributions not disbursed during the construction period due to the $400 million annual cap, thus making the total Federal contribution $6,160 million.

(3) TIFIA funds are used for financing ramp-up operating losses, initial working capital contribution, and GANs interest and issuance fees

The distribution of the sources and the uses of funds by year during the implementation period are shown in Exhibit 10-11.

Exhibit 10-11
Midwest Regional Rail System - Sources and Uses of Funds
(Millions of 2002$)

	Total	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Sources of Funds:											
Financing											
State Contribution	**$1,540.0**			$197.2	$391.2	$323.2	$628.4				
Short-term loan/GANS	**$2,756.4**						$281.5	$1,157.3	$1,113.5	$204.1	
Initial Working Capital Contribution	**$30.0**					$30.0					
TIFIA Loans for Ramp-up Operating Losses	**$49.5**					$38.4	$8.0		$3.1		
TIFIA Loans for Accrued Interest/Issuance Fees on GANs	**$347.9**						$46.4	$159.8	$124.3	$17.5	
Total TIFIA Funds	**$427.5**					$68.4	$54.4	$159.8	$127.4	$17.5	
Federal Contribution	**$6,159.9**	$227.1	$188.5	$400.0	$400.0	$400.0	$400.0	$400.0	$400.0	$400.0	$400.0
Total Sources of Funds	**$10,883.8**	**$227.1**	**$188.5**	**$597.2**	**$791.2**	**$791.6**	**$1,364.3**	**$1,717.1**	**$1,640.9**	**$621.6**	**$400.0**
Uses of Funds											
Infrastructure Capital Costs	**$6,572.2**	$227.1	$188.5	$418.2	$612.2	$544.2	$1,130.9	$1,378.3	$1,334.5	$550.4	$187.8
Rolling Stock Costs	**$1,127.7**	$0.0	$0.0	$179.0	$179.0	$179.0	$179.0	$179.0	$179.0	$53.7	
Total Capital Costs	**$7,699.9**	$227.1	$188.5	$597.2	$791.2	$723.2	$1,309.9	$1,557.3	$1,513.5	$604.1	$187.8
TIFIA Uses of Funds											
Start-up Costs	**$30.0**					$30.0					
Ramp-up Operating Costs	**$49.5**					$38.4	$8.0		$3.1		
Accrued Interest on GANs	**$320.4**						$43.6	$148.2	$113.2	$15.4	
GAN Issuance Fees	**$27.6**						$2.8	$11.6	$11.1	$2.0	
Total TIFIA Funds Uses	**$427.5**					$68.4	$54.4	$159.8	$127.4	$17.5	
Repayment of GANS	**$2,756.4**										212.2
Total Uses of Funds	**$10,883.8**	**$227.1**	**$188.5**	**$597.2**	**$791.2**	**$791.6**	**$1,364.3**	**$1,717.1**	**$1,640.9**	**$621.6**	**$400.0**

Exhibit 10-11 (continued)
Midwest Regional Rail System - Sources and Uses of Funds
(Millions of 2002$)

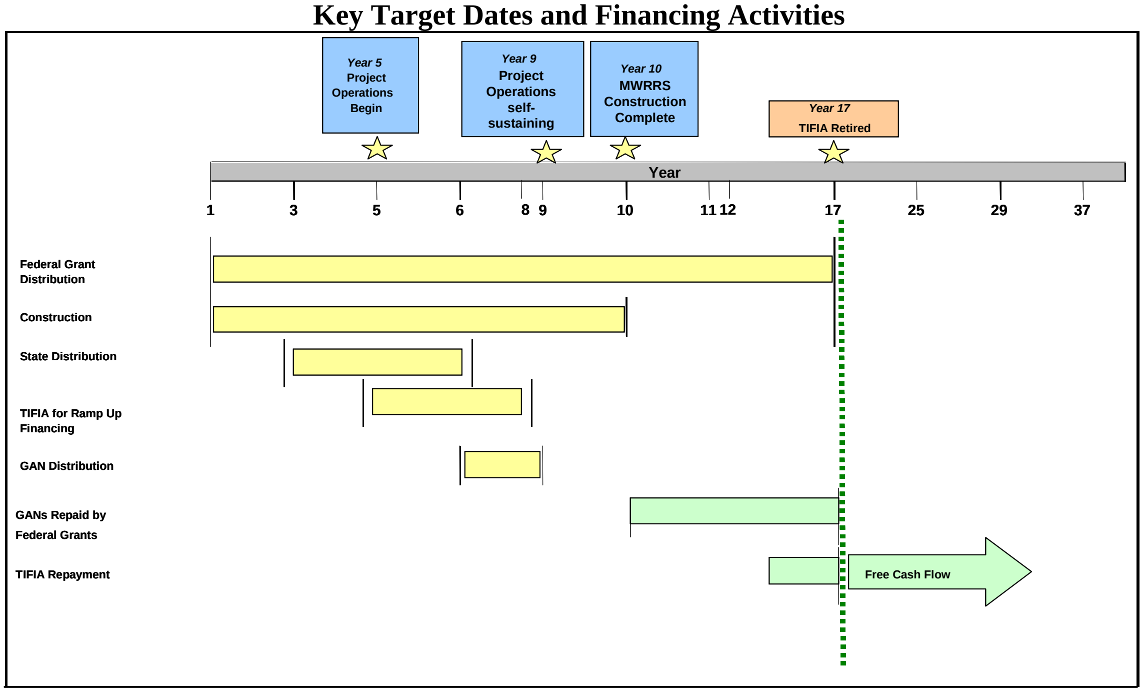
	2014	2015	2016	2017	2018	2019	2020
Sources of Funds:							
Financing							
State Contribution							
Short-term loan/GANS							
Initial Working Capital Contribution							
TIFIA Loans for Ramp-up Operating Losses							
TIFIA Loans for Accrued Interest/Issuance Fees on GANs							
Total TIFIA Funds							
Federal Contribution	$400.0	$400.0	$400.0	$400.0	$400.0	$400.0	$144.3
Total Sources of Funds	**$400.0**	**$400.0**	**$400.0**	**$400.0**	**$400.0**	**$400.0**	**$144.3**
Uses of Funds							
Infrastructure Capital Costs							
Rolling Stock Costs							
Total Capital Costs							
TIFIA Uses of Funds							
Start-up Costs							
Ramp-up Operating Costs							
Accrued Interest on GANs							
GAN Issuance Fees							
Total TIFIA Funds Uses							
Repayment of GANS	400.0	400.0	400.0	400.0	400.0	400.0	144.3
Total Uses of Funds	**$400.0**	**$400.0**	**$400.0**	**$400.0**	**$400.0**	**$400.0**	**$144.3**

Financial feasibility is demonstrated by a positive Net Present Value (NPV). The NPV analysis is presented in Exhibit 10-12. Key financial milestones are shown in Exhibit 10-13.

Exhibit 10-12
Net Present Value
$400 Million Annual Federal Obligation

	2008-2040	***2008-2025***
Sources of Cash:		
Operating Cash Flow	$2,160,987	$927,186
TIFIA Loan for Ramp-Up Operating Losses	$47,045	$47,045
Interest Income on Capital Reserve Fund (2 percent)	$1,640	$407
Gross Cash Flow	$2,209,673	$974,638
Applications of Cash:		
Capital MofW Financing by MWRRS	$368,872	$138,460
Contribution to Reinvestment Fund (5 percent)	$82,024	$20,334
Net Cash Flow	$1,758,777	$815,844
TIFIA Debt Service by MWRRS	$443,601	$443,601
Net Cash Flow After TIFIA Re-payment	**$1,315,176**	**$372,243**

Exhibit 10-13
Key Target Dates and Financing Activities



The financial plan results in a positive net cash flow by 2012 that is sufficient to retire the TIFIA obligations by 2020. A detailed presentation of the financial plan results is shown in Exhibit 10-14. The total project costs are summarized in Exhibit 10-15. Detailed system and corridor results are given in Appendix A11.

Exhibit 10-14
Cash Flow Analysis - General Obligations Bonds - $400 Million Annual Federal Obligation

(Thousands of 2002$)	Total	2008	2009	2010	2011	2012	2013	2014	2015	2016
Sources of Cash:										
Operating Cash Flow	**$4,895,162**	($38,389)	($8,031)	$13,459	($3,097)	$11,446	$52,117	$75,595	$95,370	$102,668
TIFIA Loan for Ramp-Up Operating Losses	**$49,518**	$38,389	$8,031	$0	$3,097	$0				
Interest Income on Reinvestment Fund (2 percent)	**$4,121**	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross Cash Flow	**$4,948,801**	$0	$0	$13,459	$0	$11,446	$52,117	$75,595	$95,370	$102,668
Applications of Cash:										
Capital MofW Financing by MWRRI	**$854,327**	$0	$0	$0	$0	$3,928	$3,928	$5,370	$9,782	$12,071
Contribution to Reinvestment Fund (5 percent)	**$206,075**	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Cash Flow	**$3,888,399**	$0	$0	$13,459	$0	$7,518	$48,189	$70,225	$85,588	$90,597
Change in Cash Balance (Pro forma):										
Beginning Cash Balance		$0	$0	$0	$0	$0	$0	$0	$0	$0
Increase/(Decrease) in Cash		$0	$0	$13,459	$0	$7,518	$48,189	$70,225	$85,588	$90,597
Ending Cash Balance		$0	$0	$13,459	$0	$7,518	$48,189	$70,225	$85,588	$90,597
Net Cash Flow after TIFIA Debt Service	**$3,888,399**	**$0**	**$0**	**$13,459**	**$0**	**$7,518**	**$48,189**	**$70,225**	**$85,588**	**$90,597**
TIFIA loans Outstanding:										
Beginning Balance		$0	$72,151	$133,553	$295,987	$446,670	$482,154	$460,483	$415,584	$352,854
Ramp-up Operating Loss	**$49,518**	$38,389	$8,031	$0	$3,097	$0				
Working Capital Deposit	**$30,000**	$30,000								
GANs Int./Iss Loans	**$347,944**	-	46,409	$159,761	$124,300	17,474	-	-	-	-
Total Outstanding TIFIA Loans		68,389	126,591	293,314	423,384	464,144	482,154	460,483	415,584	352,854
Accrued Interest	**$203,623**	$3,761	$6,962	$16,132	$23,286	$25,528	$26,518	$25,327	$22,857	$19,407
TIFIA payment	**($631,084)**	$0	$0	($13,459)	$0	($7,518)	($48,189)	($70,225)	($85,588)	($90,597)
Ending Balance	**$3,274,771**	72,151	133,553	295,987	446,670	482,154	460,483	415,584	352,854	281,664
Net Cash Flow After TIFIA Re-payment	**$3,257,315**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Exhibit 10-14 (continued)

(Thousands of 2002$)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Sources of Cash:										
Operating Cash Flow	$102,668	$108,851	$115,037	$121,224	$127,412	$135,067	$142,723	$150,380	$158,040	$165,702
TIFIA Loan for Ramp-Up Operating Losses										
Interest Income on Reinvestment Fund (2 percent)	$0	$0	$0	$0	$0	$135	$143	$150	$158	$166
Gross Cash Flow	$102,668	$108,851	$115,037	$121,224	$127,412	$135,202	$142,865	$150,531	$158,198	$165,868
Applications of Cash:										
Capital MofW Financing by MWRRI	$12,071	$12,936	$17,036	$18,753	$19,618	$20,555	$22,272	$27,542	$27,542	$28,984
Contribution to Reinvestment Fund (5 percent)	$0	$0	$0	$0	$0	$6,753	$7,136	$7,519	$7,902	$8,285
Net Cash Flow	$90,597	$95,915	$98,000	$102,471	$107,795	$107,893	$113,457	$115,469	$122,754	$128,599
Change in Cash Balance (Pro forma):										
Beginning Cash Balance	$0	$0	$0	$0	$0	$88,674	$107,893	$113,457	$115,469	$122,754
Increase/(Decrease) in Cash	$90,597	$95,915	$98,000	$102,471	$107,795	$107,893	$113,457	$115,469	$122,754	$128,599
Ending Cash Balance	$90,597	$95,915	$98,000	$102,471	$107,795	$196,567	$221,350	$228,927	$238,223	$251,353
Net Cash Flow after TIFIA Debt Service	**$90,597**	**$95,915**	**$98,000**	**$102,471**	**$107,795**	**$107,893**	**$113,457**	**$115,469**	**$122,754**	**$128,599**
TIFIA loans Outstanding:										
Beginning Balance	$352,854	$281,664	$201,240	$114,308	$18,124	$0	$0	$0	$0	$0
Ramp-up Operating Loss										
Working Capital Deposit										
GANs Int./Iss Loans	-	-	-	-	-	-	-	-	-	-
Total Outstanding TIFIA Loans	352,854	281,664	201,240	114,308	18,124	-	-	-	-	-
Accrued Interest	$19,407	$15,492	$11,068	$6,287	$997	$0	$0	$0	$0	$0
TIFIA payment	($90,597)	($95,915)	($98,000)	($102,471)	($19,121)	$0	$0	$0	$0	$0
Ending Balance	281,664	201,240	114,308	18,124	-	-	-	-	-	-
Net Cash Flow After TIFIA Re-payment	**$0**	**$0**	**$0**	**$0**	**$88,674**	**$107,893**	**$113,457**	**$115,469**	**$122,754**	**$128,599**

Exhibit 10-14 (continued)

(Thousands of 2002$)	2026	2027	2028	2029	2030	2031	2032
Sources of Cash:							
Operating Cash Flow	$173,059	$180,418	$187,779	$195,143	$202,508	$209,876	$217,246
TIFIA Loan for Ramp-Up Operating Losses							
Interest Income on Reinvestment Fund (2 percent)	$173	$180	$188	$195	$203	$210	$217
Gross Cash Flow	$173,232	$180,599	$187,967	$195,338	$202,711	$210,086	$217,463
Applications of Cash:							
Capital MofW Financing by MWRRI	$30,547	$33,408	$38,678	$38,678	$40,120	$41,683	$44,544
Contribution to Reinvestment Fund (5 percent)	$8,653	$9,021	$9,389	$9,757	$10,125	$10,494	$10,862
Net Cash Flow	$134,032	$138,170	$139,900	$146,902	$152,465	$157,909	$162,057
Change in Cash Balance (Pro forma):							
Beginning Cash Balance	$128,599	$134,032	$138,170	$139,900	$146,902	$152,465	$157,909
Increase/(Decrease) in Cash	$134,032	$138,170	$139,900	$146,902	$152,465	$157,909	$162,057
Ending Cash Balance	$262,631	$272,202	$278,070	$286,802	$299,368	$310,374	$319,966
Net Cash Flow after TIFIA Debt Service	**$134,032**	**$138,170**	**$139,900**	**$146,902**	**$152,465**	**$157,909**	**$162,057**
TIFIA loans Outstanding:							
Beginning Balance	$0	$0	$0	$0	$0	$0	$0
Ramp-up Operating Loss							
Working Capital Deposit							
GANs Int./Iss Loans	-	-	-	-	-	-	-
Total Outstanding TIFIA Loans	-	-	-	-	-	-	-
Accrued Interest	$0	$0	$0	$0	$0	$0	$0
TIFIA payment	$0	$0	$0	$0	$0	$0	$0
Ending Balance	-	-	-	-	-	-	-
Net Cash Flow After TIFIA Re-payment	**$134,032**	**$138,170**	**$139,900**	**$146,902**	**$152,465**	**$157,909**	**$162,057**

Exhibit 10-14 (continued)

(Thousands of 2002$)	2033	2034	2035	2036	2037	2038	2039	2040
Sources of Cash:								
Operating Cash Flow	$224,618	$231,992	$239,369	$246,748	$254,129	$261,513	$268,900	$276,289
TIFIA Loan for Ramp-Up Operating Losses								
Interest Income on Reinvestment Fund (2 percent)	$225	$232	$239	$247	$254	$262	$269	$276
Gross Cash Flow	$224,842	$232,224	$239,608	$246,995	$254,384	$261,775	$269,169	$276,565
Applications of Cash:								
Capital MofW Financing by MWRRI	$44,544	$44,544	$44,544	$44,544	$44,544	$44,544	$44,544	$44,544
Contribution to Reinvestment Fund (5 percent)	$11,231	$11,600	$11,968	$12,337	$12,706	$13,076	$13,445	$13,814
Net Cash Flow	$169,068	$176,081	$183,096	$190,113	$197,133	$204,155	$211,180	$218,207
Change in Cash Balance (Pro forma):								
Beginning Cash Balance	$162,057	$169,068	$176,081	$183,096	$190,113	$197,133	$204,155	$211,180
Increase/(Decrease) in Cash	$169,068	$176,081	$183,096	$190,113	$197,133	$204,155	$211,180	$218,207
Ending Cash Balance	$331,124	$345,148	$359,177	$373,209	$387,247	$401,289	$415,335	$429,387
Net Cash Flow after TIFIA Debt Service	**$169,068**	**$176,081**	**$183,096**	**$190,113**	**$197,133**	**$204,155**	**$211,180**	**$218,207**
TIFIA loans Outstanding:								
Beginning Balance	$0	$0	$0	$0	$0	$0	$0	$0
Ramp-up Operating Loss								
Working Capital Deposit								
GANs Int./Iss Loans	-	-	-	-	-	-	-	-
Total Outstanding TIFIA Loans	-	-	-	-	-	-	-	-
Accrued Interest	$0	$0	$0	$0	$0	$0	$0	$0
TIFIA payment	$0	$0	$0	$0	$0	$0	$0	$0
Ending Balance	-	-	-	-	-	-	-	-
Net Cash Flow After TIFIA Re-payment	**$169,068**	**$176,081**	**$183,096**	**$190,113**	**$197,133**	**$204,155**	**$211,180**	**$218,207**

Exhibit 10-15
Total Project Costs (Millions of 2002$)

Capital Costs	
Infrastructure & Rolling Stock	$7,699.9
Initial Working Capital	$30.0
Total Capital	$7,729.9
Interest Costs	
TIFIA	$203.6
GANs	$320.4
Total Interest	$524.0
Other Costs	
GANs Issuance Fees	$27.6
Total Project Costs	$8,281.4

10.7 Risks to the Financial Plan and Strategic Financing Issues

A number of risks to the financial plan were identified in conducting the financial analysis. The most significant risk factor is the availability of federal grant programs. Once federal grant funds are identified and secured, the availability of state funds, as well as the ability to obtain secondary sources of short-term financing to cover start-up operating losses need to be secured. Federal and state funding programs are discussed in Chapter 9.

Given that funding requirements are met, the actual level of annual appropriations from Federal sources will have a large impact on the need for short-term loans (GANs, TIFIA) to cover any gap in construction costs. Any additional financing will increase the total project costs. The impact of various annual federal obligation levels is shown in Exhibit 10-16. As seen in the exhibit, the increase in federal annual cap results in a decrease in the GANs requirement. If the annual federal funding cap is increased to $947 million from $400 million, assumed as moderate level in base case, GANs will not be required since federal funds disbursement would cover 80 percent of the project's cost during the construction period.

Exhibit 10-16
Alternative Federal Obligation Levels
(Million of 2002$)

Total Capital Cost		**$7,700**		
Maximum Federal Grant (80 percent)		$6,160		
Maximum State Bond (20 percent)		$1,540		
Annual Federal Obligation Level	***Total Capital Cost***	***Available Federal Grants***	***State Bonds***	***Additional Funds***
$300	$7,700	$2,703	$1,540	$3,456
$400	$7,700	$3,403	$1,540	$2,756
$500	$7,700	$4,103	$1,540	$2,056
$600	$7,700	$4,801	$1,540	$1,359
$700	$7,700	$5,305	$1,540	$855
$800	$7,700	$5,719	$1,540	$441
$900	$7,700	$6,019	$1,540	$141
$947	$7,700	$6,160	$1,540	$0

Another factor that would influence the overall financial results is the level of financial accountability with respect to a system-wide or a corridor-based financing structure. Total MWRRS net revenue losses are minimized when summed across the system. Additional risk factors are related to interest rates and other borrowing costs, unanticipated construction delays, and many other factors.

10.8 Sensitivity Analysis

Finance-related uncertainties and alternative funding strategies could affect the results of the financial analysis. These include factors beyond the control of the states such as interest rates, capital and operating costs and revenue growth. An analysis was conducted to assess the sensitivity of the financial analysis based on changes to the underlying assumptions, which were given in Exhibit 10-8.

Exhibit 10-17 presents the changes in financial results based on variations in operating cost and revenue assumptions. The analysis indicates that net cash flow is more sensitive to changes in revenues than operating costs. For example, a 10 percent decline in projected ticket revenues in base case results in a $14.9 million reduction (197 percent) in cash flow in year 2009. In comparison, a 10 percent increase in track and right-of-way maintenance costs results in a 34 percent decline in the 2009 cash flow.

Exhibit 10-17
Financial Sensitivity – Changes in Operating Assumptions
(Thousands of 2002$)

	Operating Subsidy Required								
	2008		***2009***		***2010***	***2011***	***2012***	***2013***	***2014***
Base Case:	**($38,389)**		**($8,031)**		**$13,459**	**($3,097)**	**$11,446**	**$52,117**	**$75,595**
	$ Required	***Percent***	***$ Required***	***Percent***	***$ Required***	***$ Required***	***$ Required***	***$ Required***	***$ Required***
Personnel Costs + 10 percent	($43,821)	14 percent	($14,746)	84 percent	$5,403	($12,531)	($1,963)	$37,862	$60,442
Personnel Costs – 10 percent	($32,957)	-14 percent	($1,316)	-84 percent	$21,516	$6,336	$24,855	$66,372	$90,749
Train Equipment Maintenance + 10 percent	($41,719)	9 percent	($12,296)	53 percent	$8,514	($9,991)	($539)	$39,451	$62,007
Train Equipment Maintenance – 10 percent	($35,059)	-9 percent	($3,766)	-53 percent	$18,405	$3,797	$23,431	$64,784	$89,183
Track and ROW Maintenance + 10 percent	($40,683)	6 percent	($10,772)	34 percent	$10,445	($7,076)	$5,890	$46,490	$69,779
Track and ROW Maintenance – 10 percent	($36,095)	-6 percent	($5,291)	-34 percent	$16,474	$882	$17,002	$57,744	$81,412
Operating Costs + 10 percent	($52,891)	38 percent	($26,059)	224 percent	($7,550)	($29,550)	($28,812)	$9,499	$30,317
Operating Costs – 10 percent	($23,887)	-38 percent	$9,997	-224 percent	$34,468	$23,356	$51,704	$94,735	$120,873
Ticket Revenue +10 percent	($28,549)	-26 percent	$7,824	-197 percent	$34,027	$20,948	$49,511	$95,946	$123,994
Ticket Revenue – 10 percent	($48,230)	26 percent	($23,887)	197 percent	($7,109)	($27,143)	($26,619)	$8,289	$27,196
Ticket Revenue – 20 percent	($58,070)	51 percent	($39,742)	395 percent	($27,677)	($51,188)	($64,684)	($35,539)	($21,203)
Ticket Revenue – 30 percent	($67,911)	77 percent	($55,598)	592 percent	($48,245)	($75,233)	($102,749)	($79,368)	($69,602)
Total Revenue + 10 percent	($27,726)	-28 percent	$9,194	-214 percent	$35,814	$23,046	$52,849	$99,947	$128,433
Total Revenue – 10 percent	($49,052)	28 percent	($25,256)	214 percent	($8,896)	($29,241)	($29,957)	$4,287	$22,757

Based on the projections, the operating subsidies required during 2008, 2009 and 2011, which total approximately $49.5 million, are recovered by 2013. As was shown in Exhibit 10-15, if there is a 10 percent decrease in the projected revenues, the operating subsidy would increase by 188 percent. The cumulative subsidy resulting from the decrease in revenues would be recovered beyond 2014 or by 2017. A 10 percent decrease in projected revenues would shift the year in which the MWRRS achieves a 1.0 or break-even operating revenue cost ratio on a system-wide basis.

The above results provide an indication of how the underlying assumptions affect the financial results for the MWRRS. Public sector as well as private sector contributions toward projected capital costs (*e.g.,* stations) can have a positive impact on the cash flow requirements of the financing alternative chosen. With bonds as the state financing vehicle, an increase in capital costs or interest rates or a decrease in annual federal grant obligations can have a significant impact on the level of state revenues required to be pledged for repayment on bonds.

10.9 MWRRS Internal and External Risk Analysis

10.9.1 Specific MWRRS Risks

Although the MWRRS is not an inherently risky project, it should be understood that project risk could occur anywhere during the development, implementation or the operational life cycle. Risk affects construction goals and timetables, project funding, project launch and operational performance. Risks can be internal – occurring at the MWRRS level and external – caused by forces or parties outside of the MWRRS. Risk may include event, management, technology, ridership, freight railroad, inflation and interest rate risks. Ignoring these issues early in the project can lead to delays in delivery dates and budget overages that severely undermine confidence in the project and in the project manager. While any project accepts a certain level of risk, regular and rigorous risk analysis and management techniques serve to defuse problems before they arise.

Business Risks

Management Risk: A major concern for the success of the MWRRS is the quality of the management team selected to operate the system. Potential operators must be thoroughly evaluated prior to selection. A management team that is well-respected, seasoned and has a distinguished track record of operating success as reflected by evidence of cost control, annual surpluses, support of the financial community and customer satisfaction should be selected. While Amtrak is currently considered a preferred operator of the MWRRS, the MWRRS should have a full understanding of other potential operators prior to making its selection. Operators from other transportation sectors, including airline and cruise ship, should be considered since they often have the marketing and operating infrastructure in place and a record of financial discipline to ensure that revenues are generated and costs are controlled in order to meet the financial obligations of the system. Failure to enlist a strong operator and management team could threaten the financial success of the MWRRS.

Construction Risk: With any construction project, there are numerous critical points where risk can occur. However, rail construction is a proven, low-risk endeavor with a long history of success in this country. Although not all risks will be identified here, the MWRRI should be aware of some construction risks associated with the project, which may include contractor, vendor, inclement weather, schedule, cost overrun and quality risks. Hiring a reputable general contractor to oversee construction can minimize these risks. The MWRR could also consider employing contracting vehicles that shift some of the construction risk to a general contractor. Such contracts could include *cost plus incentive fee*, *fixed price* and *incentive fee*, etc. In addition, dividing segments or corridors amongst several contractors can reduce the overall risk of the MWRRS.

Inflation Risk: Inflation can be defined as a sustained increase in the general level of prices for goods and services. It is measured as an annual percentage increase. As inflation rises, every dollar you own buys a smaller percentage of a good or service. Inflation can be measured by the Consumer Price Index and the Producer Price Index. Over time, as the cost of goods and services increase, the value of a dollar will fall because it will not be able to purchase the same amount of goods or service it once did. While the annual rate of inflation has fluctuated greatly over the last half century, ranging from nearly 0 to 23 percent, the Federal Reserve Board actively tries to maintain a specific rate of inflation. This rate is usually 2-3 percent but can vary depending upon circumstances. Inflation can have a significant impact on the MWRRS financial plan because the costs of labor and capital can rise faster than the current funding strategy has accounted for. A significant rise in inflation could negatively impact MWRRS funding; conservative inflation figures were used in the financial analyses.

Interest Rate Risk: The price that a debt security (bond) will fall due to increases in interest rates is known as *interest rate risk*. It is also called *funding risk* because changes in interest rates resulting in higher funding costs can impact a project's cash flow. Whereas this is a high cost project, interest rates could affect the progress of the MWRRS.

Technology Risk: The proposed train technologies for the MWRRS are proven; therefore, technology risk is rather low. However, when working with a vendor in equipment procurement, there can be several risk factors associated with its deployment. These include schedule and cost risks, operating risks and performance risk. When Amtrak introduced the Acela train, there were issues with excessive wheel wear and cracking of the suspension stabilization device. These issues increased maintenance costs and the out-of-service ratio. The rolling stock suggested for the MWRRS has been successfully deployed in other areas and therefore, this risk is not expected. However, MWRRS management should be aware of all risks associated with the deployment of the rolling stock.

Inclement Weather Risk: The Midwest region is prone to severe winter weather, creating disruptions to schedule and operating conditions. A blizzard could shut down the rail system for brief periods; however, rail service is more reliable than air or highway travel during inclement weather and could reap benefits from stormy weather in the region.

Ridership Risk: Revenue generated by the MWRRS is dependent upon the number of riders using the system. Some of the risk associated with ridership levels has already been mitigated by the approach taken to demand forecasting. Forecasts were developed using very conservative estimates for modal choice, demographic growth and economic growth. In addition, an error range of +/- 20 percent is associated with ridership forecasts. There is low risk associated with under-forecasting, however, risk factors that could affect ridership forecasts include a dramatic slowdown in the economic growth of the Midwest region and the level of reliability and quality of service as detailed in this plan.

Freight Railroad Risks: The MWRRS will provide for enough railroad capacity for reliable operation of both passenger and freight trains, however, since MWRRS trains will share track with freight trains, there is some risk that MWRRS operating speed and schedules could be affected by freight train operation. Agreements need to be made with the freight railroad companies giving right-of-way to MWRRS passenger trains and the freight trains moving into sidings to allow an MWRRS train to pass. MWRRS running times would be maintained, and risk minimized, through well coordinated, timely dispatch support and the mitigation of line congestion due to siding capacity issues. Risk is also a factor should agreements concerning track maintenance costs and access fees not be reached.

Event Risk

Security Risk: Security and terrorism risks must be considered in the deployment of the MWRRS. A terrorist could choose to disrupt the system at many critical points including damaging tracks, bridges, rolling stock or stations. However, unlike aviation or waterborne targets, damage to a portion of the railroad is not necessarily catastrophic. For example, track can be replaced in a matter of days; a bridge can be repaired in a matter of weeks. Terrorists often select targets where many people congregate, making the MWRRS' stations *high value* targets. Many of the MWRRS' security vulnerabilities can be mitigated by coordinating early-on with the Department of Homeland Security and the Transportation Security Administration and through the use of new technologies to *harden* the stations and therefore make them as secure as possible.

10.10 Express Parcel Financial Model

This section develops a financial model for the performance of an optional MWRRS express parcel service. A separate financial statement has been developed for the proposed express parcel service, so that the impact of this service can be easily identified, and separated, from the main results, if desired. A net profit figure has to be developed for each year from 2008 through 2040 to integrate this result into the overall MWRRS business plan.

It is recommended that the MWRRS express parcel service be franchised on an exclusive basis. This approach would allow use of the parcel compartment in return for a share of revenues developed by the parcel service. The agreement should require the parcel franchisee to commit to using the parcel compartment on a *take or pay* basis for *all* shipments they handle. There is a real risk that a parcel operator may use MWRRS service as a method of building volume, then try to switch over to a lower-cost highway provider once sufficient volume develops. The franchising structure can prevent this by requiring that MWRRS have a share of *all* revenues developed by the parcel service. In return, the parcel operator would receive:

- Exclusive use of the parcel compartment on MWRRS trains,
- The right to use station facilities provided by the MWRRI states, and
- The ability to contract for conductor-provided service to smaller stations on the MWRRS network, should the passenger operator choose to cooperate in making this service available.

The financial structure proposed for the MWRRS express parcel service, is modeled after the contractual framework that the European operator *Esprit* has already negotiated with its U.K. rail operators. The operating approach is consistent with that of the European rail operators for the *Esprit* and *Expressgods,* as well as that of Greyhound and U.S. airlines who offer a similar service.

- After deducting the cost of local courier service, *Esprit* splits its revenue 50/50 with the passenger train operator. *Esprit's* payment for the rail line haul includes all necessary station support services. However, this business plan assumes that the MWRRS parcel operator must provide its own station support services.
- This 50 percent revenue share would show as additional revenue on the MWRRS passenger operator's income statement and is associated with very little additional operating cost. This payment is treated as an operating expense to the parcel operator.

This financial plan is predicated on the following assumptions:

- The MWRRS parcel operator is responsible for the cost of its own station operations; call center operations and the CUS parcel sorting room. The capital cost of outlying station facilities is funded by the MWRRS states; however, the parcel operator must pay a market-based rental rate for any space used at CUS as its parcel sorting room.
- The MWRRS parcel operator pays the passenger train operator 50 percent of its revenue, net of cost for local courier service, outlying station operations, and purchased highway or air service. The parcel operator is responsible for covering its own costs for call center operations, the CUS parcel sorting room, sales and marketing, and corporate overhead out of its remaining 50 percent revenue share.

This MWRRS express parcel business plan is developed from the viewpoint of the *parcel franchisee* and not the MWRRS train operator. This plan shows the ability of the parcel franchisee to operate profitably, while sharing 50 percent of its revenues (net of certain costs) with the passenger train operator. With the franchising structure proposed here, parcel service would generate substantial revenue with very few added costs to the passenger train operator. The costs of providing the parcel service would be paid by the parcel operator, and covered by the parcel operator's remaining 50 percent revenue share.

10.11 Express Parcel Service Costs

Following are assumptions incorporated into the parcel franchisee's pro-forma financials. The following are considered largely fixed costs:

- Headquarters and management salaries, including office rental, are budgeted initially at $2.9 million per year.
- Sales and marketing expenses are budgeted initially at $3.1 million per year, which includes $1 million per year for advertising
- Even though traffic volumes are light enough to be handled manually, large parcel room (100 x 40 feet) is being provided at CUS. This room would be large enough to accommodate an automated package-sorting machine should the need arise. Space for the mailroom is leased from CUS at an annual cost of nearly $1 million.
- Each of the other 22 main MWRRS stations are staffed by one full-time parcel position, two

shifts a day with extra board coverage for vacancies and vacation relief.[2] Staffing these 22 stations plus 8 positions at CUS costs $3.5 million per year.

- This total of $10.5 million is considered about 30 percent variable and 70 percent fixed.

The following are considered variable costs, with totals given based on a volume of 5,200 packages per day:

- The cost of courier service consumes 70 percent of the door-to-door revenue, or $117 per package. Only $50 per package remains after paying local couriers for providing local pickup and delivery service. This price level was confirmed based on Internet real time price quotes from several airline web sites.
- Call center costs are the largest line-item expense after the cost of local courier service. At 10 minutes per package, talk-time would cost $17.1 million per year.
- An additional $2 million per year is allocated for station and shipping supplies.

The direct cost of providing the MWRRS express parcel service was modeled as $7.49 million per year fixed, plus a $16.28 per package variable. This does not include the payment to the MWRRS passenger operator for use of the parcel compartments.

Because of the high $7.49 million fixed cost, a minimum volume must be reached before the express parcel service can become profitable. Operating a profitable service requires a rail network of a reasonable size. To prevent large start-up losses, it has been assumed that parcel service would not start until 2012, the fifth year of MWRRS implementation. By this time, most of the core network will be in place.

Although all available data suggests that the express parcel business should maintain a high growth rate for the foreseeable future, it is a highly competitive business. A high growth rate has been projected for the parcel service in the early years, followed by a gradual tapering as market penetration is established. Given however a forecast growth rate of 6-8 percent per year for the industry for the foreseeable future, it is clear that the market potential for parcel service will most likely be much *larger* than the forecasts given in Exhibit 10-18.

Exhibit 10-18
Growth Rates Used for
Express Parcel Service Financial Plan

Growth Rate from 1999 – 2010	10 percent
Growth Rate from 2010 – 2020	4 percent
Growth Rate from 2020 – 2040	3 percent

The MWRRS passenger operator’s payment would be computed according to a contractual formula that calls for a 50/50 revenue split, after deducting the cost of couriers and a few other specific, allowable expenses. The financial result including the cost of payments to the MWRRS

[2] $60,000 is the full cost for parcel handling personnel employed by the parcel franchisee, including benefits. This is a reasonable cost for a private franchise operator hiring low-skilled labor at competitive market rates. Higher-skilled call center personnel are paid at a higher rate.

passenger operator[3] is given in Exhibit 10-19. This analysis shows that express parcel service is well able to contribute significant ancillary revenues to the MWRRS bottom line, while still affording a very comfortable profit margin to the parcel operator. The parcel operator's profit margin is quite reasonable, since the majority of the capital investment in trains and stations will be provided by the MWRRS. The passenger operator's share, which is much larger than the parcel operator's profit margin, can be considered an equitable payment for the right to use the capital investment and train services provided by the MWRRS.

Exhibit 10-19
Parcel Service Financial Results (2002$)

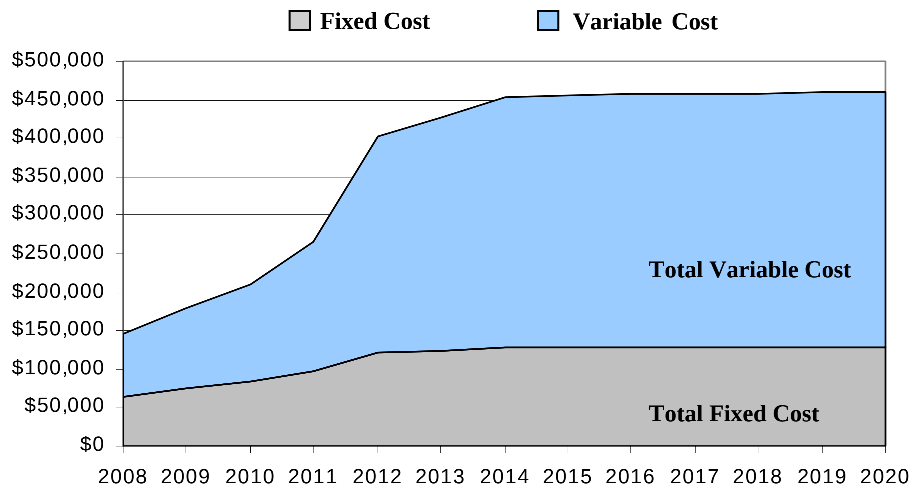
YEAR	**2012**	**2013**	**2014**	**2015**	**2025**	**2040**
REVENUE AFTER COURIER COST	**$26.85**	**$41.88**	**$58.08**	**$60.40**	**$85.19**	**$132.73**
DAILY PARCEL COUNT	2,065	3,222	4,468	4,646	6,553	10,210
PARCEL OPERATOR'S COST	**$16.23**	**$21.13**	**$26.40**	**$27.16**	**$35.23**	**$50.71**
PASSENGER OPERATOR'S SHARE	***$5.00***	***$19.07***	***$27.04***	***$28.19***	***$40.40***	***$63.81***
PARCEL OPERATOR PROFIT	**$5.62**	**$1.69**	**$4.64**	**$5.06**	**$9.57**	**$18.22**
PASSENGER OPERATOR'S SHARE						
Allocated to Routes ($Mill)						
Michigan	$0.96	$3.67	$5.20	$5.42	$7.77	$12.27
Cleveland	$0.87	$3.31	$4.69	$4.89	$7.00	$11.06
Cincinnati	$0.61	$2.34	$3.32	$3.46	$4.96	$7.83
Carbondale	$0.06	$0.22	$0.32	$0.33	$0.47	$0.75
St. Louis	$0.54	$2.05	$2.91	$3.04	$4.35	$6.87
Kansas City	$0.29	$1.09	$1.54	$1.61	$2.31	$3.65
Quincy - Omaha	$0.16	$0.60	$0.85	$0.89	$1.27	$2.01
Green Bay - St. Paul	$1.52	$5.79	$8.21	$8.56	$12.26	$19.37

10.12 Cost Implications

During the initial years of service, while ramping up to full implementation, the MWRRS will incur higher unit operating costs than in later years due to economies of scale. The system-wide MWRRS operating costs are shown in Exhibit 10-20. Total operating costs rise from $145 million in 2008, to $453 million by 2014. Fixed costs become a smaller portion of total costs as the system is expanded. In Phase 5 in 2012, total costs allocated to established corridors, such as Chicago-Twin Cities and Chicago-St. Louis *actually drop* as some fixed costs are reallocated to Michigan and new-start corridors. As the number of train-miles increases from 3.4 million to 2008 to 12.1 million in 2012, the average cost per train-mile decreases from $42.98 to $33.15, a 23 percent reduction, as shown in Exhibits 10-20 and 10-21.

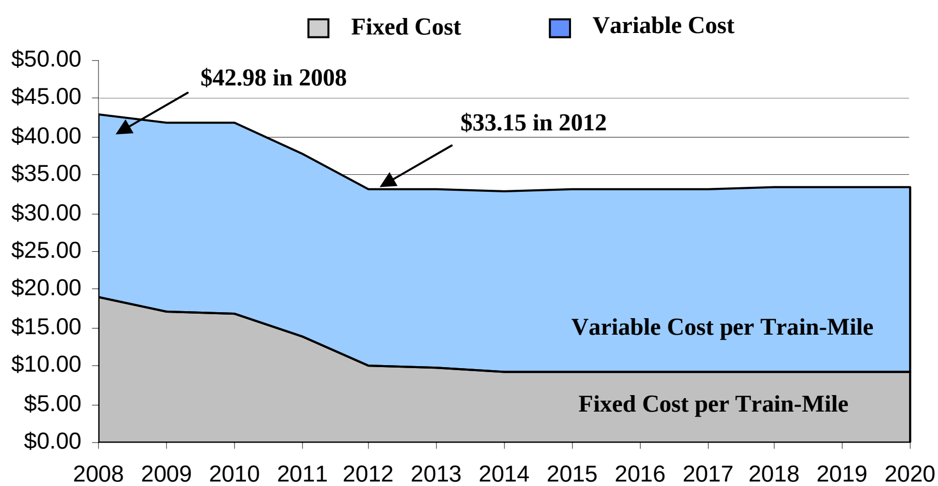
[3] To help the parcel operator overcome start-up expenses, this payment is capped at $5 million in 2012, the first year of operations. After that, a 50 percent of revenue formula is used.

Exhibit 10-20
Total Fixed and Variable Cost*



Fixed and variable operating costs do not include capital costs, interest or depreciation expense. Only direct operating expenses that are included in the Operating Ratio calculation, as defined by the FRA *Commercial Feasibility Study* are included.

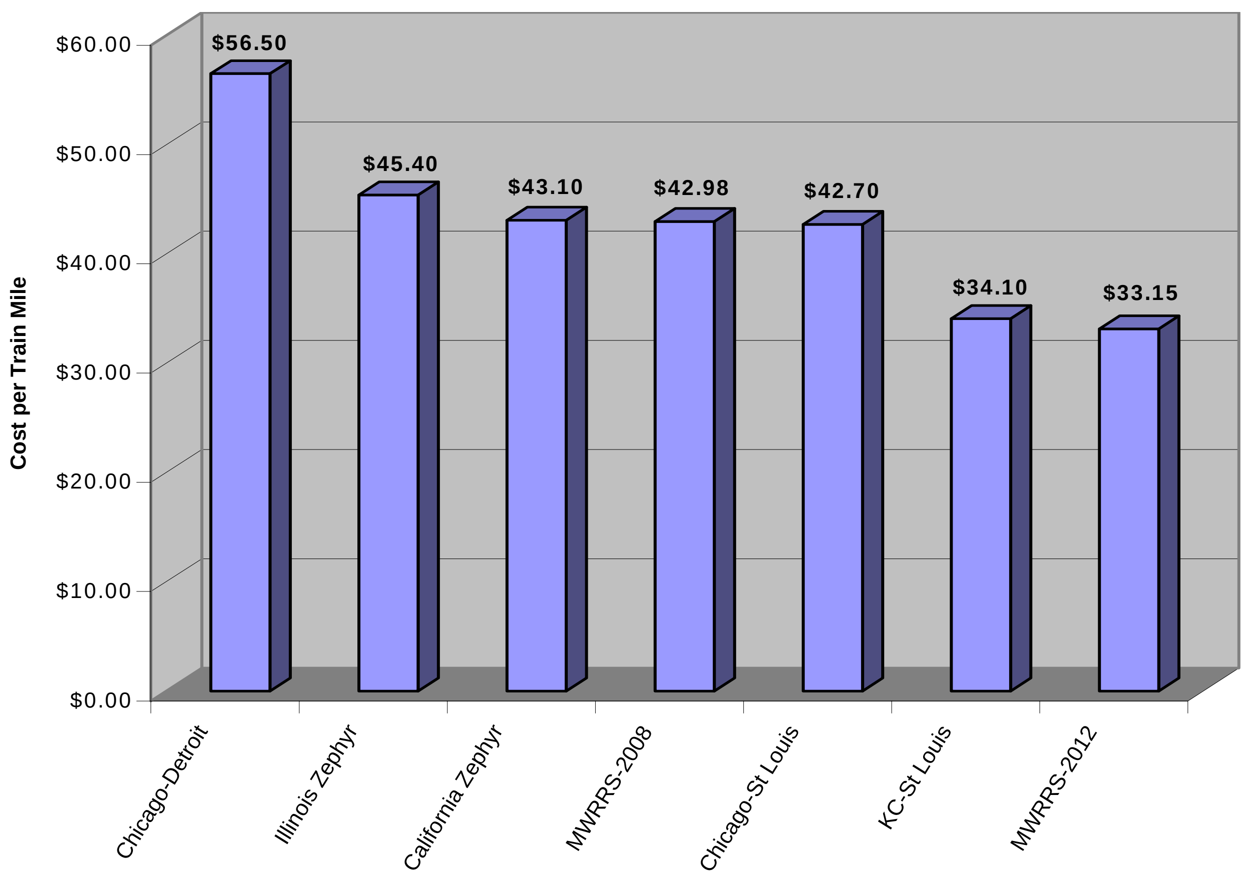
Exhibit 10-21
Fixed and Variable Costs per Train-Mile *



* Variable cost per mile changes slightly because it includes components that vary by passenger volumes and passenger miles

Comparing these projected MWRRS costs to fully-allocated Amtrak costs[4], as seen in Exhibit 10-22, it should be apparent that they are approximately in the same range – in fact, the MWRRS 2008 projected cost of $42.98 is slightly higher than Amtrak's fully-allocated RPS cost for the Chicago-St. Louis corridor. Amtrak's costs for the Chicago-Detroit corridor are higher because of the high cost of maintaining the dedicated passenger trackage, spread over a relatively few train miles operated. Spreading MWRRS' fixed cost over a larger number of train-miles reduces this average cost to $33.15 by 2014. This cost is somewhat lower than Amtrak's costs today, but is still in the range of some existing services in the Midwest region, and is roughly comparable to the level of costs now being allocated to the St. Louis-Kansas City route.

Exhibit 10-22
Comparison: Projected MWRRS vs. Amtrak RPS Costs



[4] 1997 Amtrak costs adjusted for inflation to 2002, excluding depreciation. Source*: Intercity Passenger Rail: Financial Performance of Amtrak's routes,* U.S. General Accounting Office, May 1998.

11. Economic Analysis

11.1 Introduction

The MWRRS will provide a wide range of benefits that contribute to economic growth and strengthen the region's manufacturing, service, and tourism industries. It will improve mobility and connectivity between regional centers and smaller urban areas, and create a new passenger travel alternative. The train stations will incorporate multimodal systems, connecting bus and rail networks to the MWRRS and making transportation services accessible to approximately 80 percent of the region's 60 million residents.

Economic benefits expected to be derived from the MWRRS were updated using the TEMS *RENTS*© Model. The analysis used the same criteria and structure as the 1997 Federal Railroad Administration/U.S. Department of Transportation (FRA/USDOT) study, *High-Speed Ground Transportation for America*. In that study, costs and benefits were quantified in terms of passenger rail system user benefits, other-mode user benefits, and resources benefits.

The connectivity and regional mobility provided by the MWRRS can also be expressed in terms of direct economic benefits to communities, *i.e.*, in what manner the consumer demand side impact will eventually be realized in terms of supply side benefits to communities. The *RENTS*© model measures these supply side benefits and demonstrates how each billion dollars of user benefits translates into increased jobs, incomes and property values. Note that these benefits are the supply side expression of the user benefit analysis; they are not added to the projects total benefits. This analysis will be discussed in the Section 4 of this chapter.

Benefits to be derived include the following:

- MWRRS User Benefits: The reduction in travel times and costs (consumer surplus and system revenues) that users of the MWRRS receive
- Benefits to Users of Other Modes: The reduction in travel times and costs that users of other modes receive as a result of lower congestion levels
- Resource Benefits: Savings in airline fares and reductions (savings) in emissions as a result of travelers being diverted from air, bus and auto to the MWRRS

11.2.1 MWRRS User Benefits

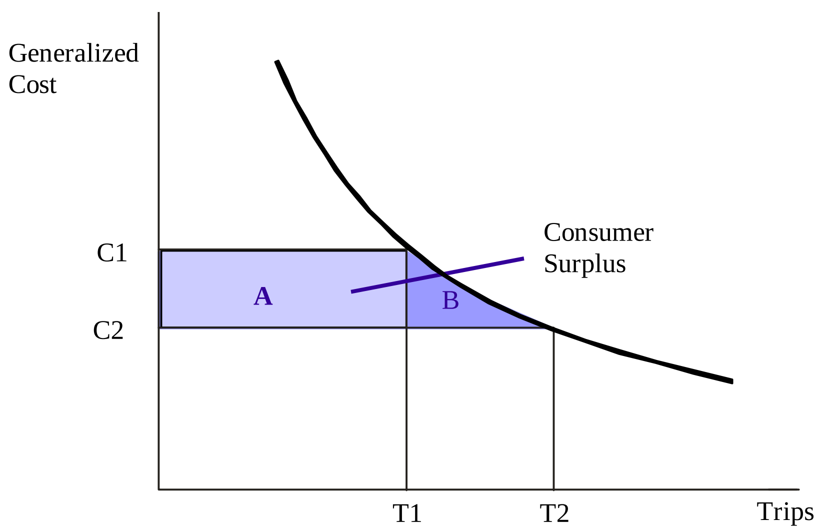
The analysis of user benefits for the MWRRS is based on the measurement of generalized cost of travel which includes both time and money. Time is converted into money by the use of Values of Time. The Values of Time (VOT) used in this study were derived from stated preference surveys conducted in this and previous study phases and used in the *COMPASS*© multimodal demand model for the ridership and revenue forecasts. These VOTs are consistent with previous academic and empirical research and other transportation studies conducted by TEMS.

Benefits to users of the MWRRS are measured by the sum of *system revenues* and *consumer surplus*. Consumer surplus is used to measure the demand side impact of a transportation improvement on users of the service. It is defined as the additional benefit consumers (users of the service) receive from the purchase of a commodity or service (travel), above the price actually paid for that commodity or service. Consumer surpluses exist because there are always consumers who are willing to pay a higher price than that actually charged for the commodity or service, *i.e.*, these consumers receive more benefit than is reflected by the system revenues alone. Revenues are included in the measure of consumer surplus as a proxy measure for the consumer surplus forgone because the price of rail service is not zero. This is an equity decision made by the FRA to compensate for the fact that highway users pay zero for use of the road system (the only exception being the use of toll roads). The benefits apply to existing rail travelers as well as new travelers who are induced those who previously did not make a trip) or diverted (those who previously used a different mode) to the new passenger rail system.

The *COMPASS*© demand model estimates consumer surplus by calculating the increase in regional mobility, traffic diverted to rail, and the reduction in travel cost measured in terms of generalized cost for existing rail users. The term generalized cost refers to the combination of time and fares paid by users to make a trip. A reduction in generalized cost generates an increase in the passenger rail user benefits. A transportation improvement that leads to improved mobility reduces the generalized cost of travel, which in turn leads to an increase in consumer surplus.

Exhibit 11.1 presents a typical demand curve in which Area A represents the increase in consumer surplus resulting from cost savings for existing rail users, and Area B represents the consumer surplus resulting from induced traffic and trips diverted to rail.

Exhibit 11.1
Consumer Surplus Concept



The formula for consumer surplus is as follows:

$$\text{Consumer Surplus} = (C_1 - C_2)*T_1 + ((C_1 - C_2)*(T_2 - T_1))/2$$

Where:

C_1 = Generalized Cost users incur before the implementation of the system

C_2 = Generalized Cost users incur after the implementation of the system

T_1 = Number of trips before operation of the system

T_2 = Number of trips during operation of the system

The passenger rail fares used in this analysis are the average optimal fares derived from the revenue-maximization analysis that was performed for each MWRRS corridor. User benefits incorporate the measured consumer surplus ($6.4 billion) and the system revenues ($6.8 billion), since these are benefits transferred from the rail user to the rail operator.

11.2.2 Benefits to Users of Other Modes

In addition to rail-user benefits, travelers using auto or air will also benefit from the MWRRS as the system will contribute to highway congestion relief and reduced travel times for users of these other modes. For purposes of this analysis, these benefits were measured by identifying the estimated number of air and auto passenger trips diverted to rail and multiplying each by the benefit levels used in the FRA/USDOT study, *High-Speed Ground Transportation in America*. Note that the FRA's study only included five Midwest states (Illinois, Indiana, Missouri, Michigan and Wisconsin) and the MWRRI study includes nine states (in addition to above five states, Iowa, Minnesota, Nebraska, and Ohio).

Airport Congestion

Using projections from the *COMPASS*© model, benefits to air travelers resulting from reduced air congestion were identified by estimating the number of passenger air trips diverted to rail in 2020 (the comparable year for the FRA study). The air-connect model, developed specifically for this study, estimates that 1.35 million air trips will be diverted to the MWRRS, slightly higher than the 1.23 million trips projected in the Phase 1 MWRRI Study. This compares to the FRA estimate of 2 million diverted air trips expected to result from the availability of 110-mph rail service. The larger number of diverted air trips in the FRA study reflects their inclusion of a rail extension to O'Hare Airport, which is not proposed for the MWRRS.

The FRA calculated travel time saved by air passengers (those not diverted to rail) due to reduced congestion, deviations from scheduled flight arrival and departure times, and additional time spent on the taxiway or en route. For each major airport, average delays were capped at 15 minutes per operation. The FRA calculated the Net Present Value (NPV) of the benefit for diverted air trips throughout the study period at $1.15 million for its 110-mph scenario, or the equivalent of $43.64 per diverted passenger air trip. This value, multiplied by the estimated 1.35 million air trips diverted to the MWRRS, yields a 30-year discounted benefit of $0.7 billion.

Highway Congestion

There will be reduced congestion and delays on highways due to auto travelers diverting to the MWRRS. It is estimated that 4.4 million auto trips will be diverted, up from the 4.1 million projected in the Phase 1 MWRRI Study. The FRA projected 2.65 million diverted auto trips in its five-state study. The increased level of diverted auto trips in the MWRRI study can be explained by the different analysis areas used by TEMS and the FRA.

The FRA calculated the travel time saved when traffic volumes are reduced on major highways between city pairs. The NPV of the benefit of all diverted auto trips throughout the study period was estimated at $692 million, or the equivalent of $23.48 per diverted passenger auto trip. This value, multiplied by the estimated 4.4 million auto trips diverted by the MWRRS and discounted over a 30-year period, yields a benefit of $1.3 billion.

11.2.3 Resources Benefits

The implementation of any transportation project has an impact on the resources used by travelers. MWRRS service and the consequent reduction in airport congestion will result in resource savings to airline operators and reduced emissions of air pollutants for all non-rail modes.

Air-Carrier Operating Costs

Benefits to air carriers in terms of operating costs savings resulting from reduced congestion at airports are calculated in much the same way as the time savings benefits to air travelers. For its study corridors, the FRA study estimated the benefits to air carriers by multiplying the projected reduction in the number of aircraft hours of delay by the average cost to the airlines for each hour of delay. As noted above, average delays were capped at 15 minutes per operation. The NPV of air carrier benefits was estimated at $623 million for the 110-mph scenario, or the equivalent of $23.46 per diverted passenger air trip. This value, multiplied by the 1.35 million air trips diverted to the MWRRS, yielded a discounted 30-year benefit of approximately $0.4 billion.

Emissions

The diversion of travelers to rail from the auto and air modes generates emissions savings. The FRA calculated emissions savings based on changes in energy use with and without the proposed rail service. Their methodology took into account the region of the country, air quality regulation compliance of the counties served by the proposed rail service, the projection year, and the modes of travel used for access/egress as well as the line-haul portion of the trip. For the MWRRS, it was assumed that emissions savings would be proportional to the number of diverted auto vehicle miles. For both the FRA and MWRRI analyses, the number of vehicle-miles saved was calculated by multiplying the number of diverted auto trips times and the average trip length divided by an average vehicle occupancy factor. The resulting auto vehicle miles saved was divided by the estimate of emissions benefit, yielding a FRA estimated benefit of $0.02 per vehicle mile. This value, multiplied by the number of vehicle miles saved by implementation of the MWRRS, yields a benefit of $0.3 billion.

11.3 Costs

In the economic analysis, costs were separated into three primary components - infrastructure and rolling stock capital costs, financing costs associated with the capital costs, and operating and maintenance costs. An additional cost of equipment replacement is considered; however, because of the uncertainty of the actual implementation year, this cost was not included in the economic analysis.

Capital Costs

Capital costs were based on infrastructure improvements and the rolling stock required for the proposed MWRRS implementation plan. It was assumed that 80 percent of the capital costs would be funded by the federal government or other sources beginning in the year 2000. These funds would be used on an as-needed basis in accordance with the implementation schedule. The total infrastructure and rolling stock capital costs for the MWRRS are calculated to be approximately $4.1 billion[1].

Financing Costs

The preliminary estimate of the financing costs was based on the assumption that 20 percent of the capital costs would be provided by the states and financed over 30 years. For study purposes, the total financing costs for the MWRRS are assumed to be $0.2 billion.

Operating Costs

Operating and maintenance costs were compiled for the years 2004 through 2030, and they include the effect of the implementation period, 2004-2009. The NPV of the operating and maintenance costs over the 30 years lifespan of the project is estimated to be $5.0 billion.

11.4 Total User Benefits

As shown in Exhibit 11.2, the total user benefits generated by the MWRRS, including rail user benefits, other mode user benefits, and resources benefits are $15.9 billion. The ratio of the total user benefits to total costs is 1.7.

[1] This is an old capital costs number which is no longer valid.

Exhibit 11.2
Midwest Regional Rail System
User Benefits and Costs to 2030 (Billions of 1998$)

Cost Benefit Parameters	30-Year Net Present Value
Benefits	
MWRRS User Benefits	
Consumer Surplus	$ 6.4
System Revenues	6.8
Other Mode User Benefits	
Airport Congestion	0.7
Highway Congestion	1.3
Resources Benefits	
Airlines	0.4
Emissions	0.3
Total Benefits	**$ 15.9**
Costs	
Capital	$ 4.1
Financing	0.2
Operating and Maintenance	5.0
Total Costs	**$ 9.3**
Ratio of Benefits to Costs	**1.7**

The 1.7 ratio of benefits to costs indicates that the MWRRS is expected to have a positive impact on the Midwest economy. The user benefit analysis, which is based on criteria established by the FRA for passenger rail projects, estimates that implementation of the MWRRS will generate more than $15.9 billion in economic benefits to the region.

The $15.9 billion translates into substantial growth in employment, per capita income, commercial property values, and rents. Equally important is the expected increase in the Midwest region's tax base. These benefits are not benefits that are over and above the user benefits, but rather the translation of the user benefits into supply side factors (income, property values, etc.) that impact the regional economy.

11.5 Other Benefits

As noted in the FRA study, there are other benefits, not quantifiable without a full environmental impact study (EIS) analysis, that are attributable to the implementation of a passenger rail system. These include benefits to commuter and long-distance passenger rail services, environmental benefits, and rail transportation safety and productivity improvements.

Commuter and Long-distance Passenger Rail Benefits

MWRRS infrastructure improvements will enable both commuter rail and Amtrak long-distance passenger rail services in the Midwest region to achieve faster trip times where track is shared with the MWRRS. This will generate time savings for existing passengers, and it is expected, attract new passengers to these services.

Environmental Benefits

The use of the MWRRS instead of auto and air, currently the dominant travel modes in the Midwest region, will promote a number of environmental benefits in addition to those previously mentioned, including the following:

- More efficient land use
- Less noise pollution
- Minimal alterations to hydrological characteristics
- Minimal visual intrusion on the landscape
- Minimal disturbances to natural flora and fauna

Rail Transportation Safety and Productivity Improvements

MWRRS infrastructure improvements are expected to increase rail safety and productivity, both for its operations and for commuter, long-distance, and freight rail services in the region. In addition, the provision of improved railway crossings and signaling equipment should result in increased highway safety. Under the MWRRI implementation plan, three to five percent of the grade crossings on rights-of-way used by the MWRRS are anticipated to be closed annually to increase safety.

11.6 Economic Rent Analysis

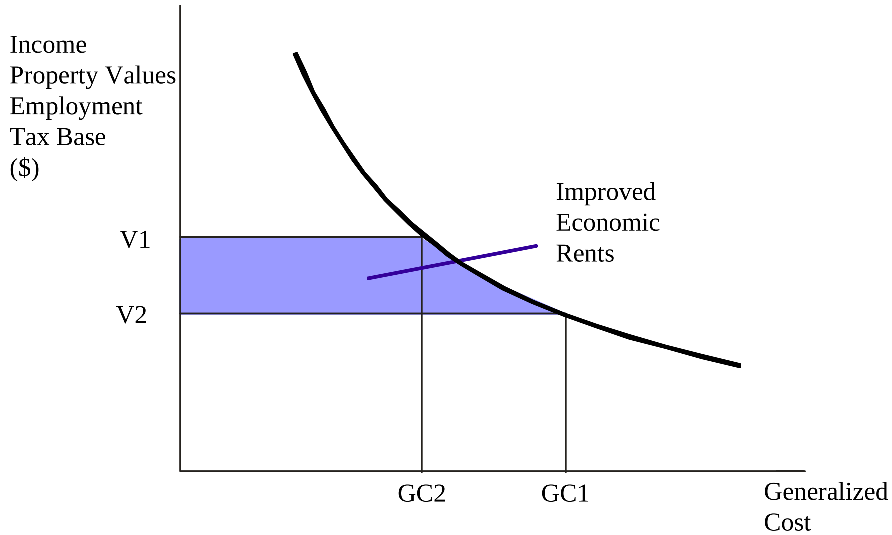
Community benefits derived from implementation of the MWRRS include increased property values, income and jobs. These are measured by evaluating the relationship between improved accessibility and the performance of the economy in terms of its overall size.

11.6.1 Economic RENT© *Model*

Economic rent is generated as a result of a transportation investment that improves the level of accessibility in a location. This improvement generates a benefit in terms of increased economic value. In some locations (*e.g.*, agriculture areas), improved accessibility has been shown to have minimal impact. In urban areas, however, developers have typically been interested in locating new development in highly accessible areas. A high level of accessibility makes the property more desirable and allows the developer to charge higher rents. It will also increase income potentials and job opportunities.

The impact of a new investment is measured by identifying changes in accessibility that creates new commercial development opportunities. This then causes an increase in household income and property value and is depicted in an economic rent curve. This curve is generated for each location using population, employment, household income, and property value information. For the MWRRS, this analysis focused on station locations and their surrounding communities. The economic rent concept is illustrated in Exhibit 11.3.

Exhibit 11.3
Economic Rent Illustration



It should be noted that the shape of the economic rent curve reflects the economic impact of an improvement in accessibility. Large cities typically have very steep curves, which indicate more significant economic impacts due to a transportation improvement; smaller communities have flatter curves, which indicate less significant economic impacts.

The fundamental equation for economic rent is as follows:

$$\text{Economic Rent} = f\,(I_t, E_t, P_t, C_t, T_t)$$

Where:

I_t is a measure of industrial structure in year t

E_t is a measure of educational levels in year t
P_t is a measure of population structure in year t
C_t is a measure of cultural type in year t
T_t is a measure of transportation efficiency in year t

In the short term and in the absence of a major dislocation, I_t, E_t, P_t, and C_t remain unchanged. As a result, the economic rent model becomes:

$$ER = f\,(T_t)$$

Using a socioeconomic proxy (SE_t) for economic rent measures of economic welfare, and generalized cost as a proxy for transportation efficiency as measured in time and cost terms, the economic rent equation can be rewritten as:

$$SE_t = \beta_o C_{ij}^{\beta 1}$$

Where:

SE_t = Socioeconomic measures such as employment, income, property value

GC_{ik} = Weighted generalized cost of travel from market center to location *i* for all modes *1* to *k*

β_o and β_1 = Calibration parameters

11.6.2 Economic RENT© *Results*

For the entire MWRRS, joint development potential is estimated to generate $2.6 billion. Over 18,000 jobs are expected to be created; urban household income is estimated to increase by $14.5 million. Exhibit 11.4 shows economic rent analysis results by state.

Exhibit 11.4
Economic Rent Analysis

State	Employment Value (# of Jobs)	Household Income ($ in Thousands))	Joint Development Potential ($ in Millions)
Iowa	350	235	31
Illinois	3,558	4,531	878
Indiana	1,758	1,488	249
Michigan	3,873	2,576	342
Minnesota	1,233	704	156
Missouri	2,245	1,350	297
Nebraska	488	255	35
Ohio	2,873	1,673	353
Wisconsin	1,853	1,664	254
Total	**18,231**	**$14,476**	**$2,595**

The states in the MWRRS experience different levels of community benefits. The difference depends on the proportion of MWRRS extension and population size of each state. Overall, Illinois with the greatest share of the system will experience the largest community benefit from implementation of the MWRRS, while Nebraska with the least miles and stations obtains the smallest community benefit.

11.7 Station Development

A key output of the community analysis is the increase in property values that can be expected at station locations throughout the MWRRS. These can be equated to the joint development opportunities, which will exist in and around the stations for public-private partnerships. Of the estimated $2.6 billion in joint development, approximately one half of this total will come from private sector investments, one quarter from state, county and municipal sources, and the final quarter from the Federal government.

There are 104 stations serving the MWRRS and Exhibit 11.5 shows the profile of these stations. Over 70 MWRRS stations and communities were visited to evaluate the potential of each community to maximize the economic development potential from the MWRRS. This evaluation was conducted using the methodology shown in Exhibit 11.6.

Exhibit 11.5
MWRRS Station Profile

		General Characteristics				
Station Names	***State***	***County***	***Address***	***Zip Code***	***Feeder Bus***	***Urban Area (sq.mi)***
Carbondale	Illinois	Jackson	401 South Illinois Avenue	62901	n	
Carlinville	Illinois	Macoupin	128 Alton Street	62626	n	
Centralia	Illinois	Marion	103 East Broadway Street	62801	n	
Champaign	Illinois	Champaign	116 North Chestnut Street	61820	n	30
Chicago Union (Carbondale)	Illinois	Cook	225 South Canal Street	60661	n	1,585
Chicago Union (Cincinnati)	Illinois	Cook	225 South Canal Street	60661	n	1,585
Chicago Union (Cleveland)	Illinois	Cook	225 South Canal Street	60661	n	1,585
Chicago Union (Detroit)	Illinois	Cook	225 South Canal Street	60661	n	1,585
Chicago Union (Milwaukee)	Illinois	Cook	225 South Canal Street	60661	n	1,585
Chicago Union (Quincy)	Illinois	Cook	225 South Canal Street	60661	n	1,585
Chicago Union (St. Louis)	Illinois	Cook	225 South Canal Street	60661	n	1,585
Du Quoin	Illinois	Perry	20 North Chestnut Street	62832	n	
Dwight	Illinois	Livingston	119 West Main Street	60420	n	
Effingham	Illinois	Effingham	South Bankers Street	62401	n	
Galesburg	Illinois	Knox	225 South Seminary Street	61401	n	
Glenview	Illinois	Cook	1116 Depot Street	60025	n	
Homewood	Illinois	Cook	181 First Street & park Avenue	60430	n	
Joliet	Illinois	Will	50 East Jefferson Street	60431	n	
Kankakee	Illinois	Kankakee	199 South East Avenue	60901	n	
Kewanee	Illinois	Henry	3rd & Depot Streets	61443	n	
La Grange Road	Illinois	Cook	25 West Burlington Avenue	60525	n	
Lincoln	Illinois	Logan	Broadway at Chicago Street	62656	n	
Macomb	Illinois	Mcdonough	120 East Calhoun Street	61455	n	
Mattoon	Illinois	Coles	1718 Broadway	61938	n	
Mendota	Illinois	La Salle	8th Street	61342	n	
Naperville	Illinois	Du Page	East 4th & Ellsworth Avenue	60540	n	
Normal	Illinois	Mclean				31
Plano	Illinois	Kendall	Main Street west of Center Street	60545	n	
Princeton	Illinois	Bureau	107 Bicentennial Drive	61356	n	
Quincy	Illinois	Adams	30th Street & Wismann Lane	62301	n	
Rantoul	Illinois	Champaign	North Kentucky Street	61866	n	
Rock Island	Illinois	Rock Island				
Springfield	Illinois	Sangamon	Washington & 3rd Streets	62701	n	81
Upper Alton	Illinois	Madison				
Elkhart	Indiana	Elkhart	131 Tyler Avenue	46515	n	52
Hammond-Whiting	Indiana	Lake	1135 Calumet Avenue	46320	n	
Indianapolis	Indiana	Marion	350 South Illinois Street	46225	n	469
Lafayette	Indiana	Tippecanoe	200 North Street	47901	n	32
Michigan City	Indiana	La Porte	100 Washington Street	49117	n	
Shelbyville	Indiana	Shelby				
South Bend	Indiana	St. Joseph	2702 West Washington Avenue	46619	n	120
Waterloo	Indiana	De Kalb	Lincoln & Center Streets	46793	n	
Atlantic	Iowa	Cass				
Des Moines (Osceola)	Iowa	Polk	Main & East Caly Streets	50213		160
Iowa City	Iowa	Johnson				30
Newton	Iowa	Jasper				

Note: General characteristics information is provided by Amtrak timetable for fall/winter 1998.

This chapter is the original chapter from the 2000 Plan report. It has not been updated to reflect the findings of the 2004 Plan.

Exhibit 11.5
MWRRS Station Profile--continued

		General Characteristics				
Station Names	*State*	*County*	*Address*	*Zip Code*	*Feeder Bus*	*Urban Area (sq.mi)*
Albion	Michigan	Calhoun	300 North Eaton Street	49224	n	
Ann Arbor	Michigan	Washtenaw	325 Depot Street	48104	n	124
Battle Creek	Michigan	Calhoun	104 Capitol Avenue S.W.	49107	n	54
Birmingham *	Michigan	Oakland	449 South Eaton Street	48009	n	
Dearborn	Michigan	Wayne	16121 Michigan Avenue	48126	n	
Detroit	Michigan	Wayne	11 West Baltimore Avenue	48202	n	1,120
Dowagiac	Michigan	Cass	100 Railroad drive	49047	n	
Durnad	Michigan	Shiawassee	200 Railroad Avenue	48429	n	
East Lansing	Michigan	Ingham	1240 South Harrison Street	48823	n	99
Flint	Michigan	Genesee	1407 South Dort highway	48503	n	164
Grand Rapids	Michigan	Kent	Market & Wealthy Streets	49503	n	223
Holland	Michigan	Allegan	171 Lincoln Avenue	49423	n	
Jackson	Michigan	Jackson	300 West Capitol Street	39201	n	42
Kalamazoo	Michigan	Kalamazoo	459 North Burdick Street	49007	n	85
Lapeer	Michigan	Lapeer	73 Howard Street	48446	n	
Niles	Michigan	Berrien	598 Dey Street	49120	n	120
Plainwell *	Michigan	Allegan				
Pontiac	Michigan	Oakland	1600 Wide Track Drive	48342	n	
Port Huron	Michigan	St. Claire	2223 16th Street	48060	n	29
Royal Oak	Michigan	Oakland	201 South Sherman Drive	97470	n	
Red Wing	Minnesota	Goodhue	Levee Street	55066	n	
St. Paul-Minneapolis	Minnesota	Ramsy/Hennepin	730 Transfer Road	55114	n	1,063
Winona	Minnesota	Winona	65 East Mark Street	55987	n	
Hermann	Missouri	Gasconade	Wharf & gutenburg Streets	65041	n	
Independence	Missouri	Jackson	600 South Grand Avenue	64050	n	
Jefferson City	Missouri	Cole	101 Jefferson Street	65101	n	
Kansas City	Missouri	Clay	2200 Main Street	64108	n	762
Kirkwood	Missouri	St. Louis	110 West Argonne Road	63122	n	
Lee's Summit	Missouri	Jackson	220 South Main Street	64063	n	
Sedalia	Missouri	Pettis	Pacific & Osahe Streets	65301	n	
St. Louis	Missouri	St. Louis City	550 South 16th Street	63103	n	728
Warrensburg	Missouri	Johnson	100 South Holden Street	64093	n	
Washington	Missouri	Franklin	Front & Elm Streets	63090	n	
Omaha	Nebraska	Douglas	1003 South 9th Street	68108	n	193
Bryan	Ohio	Williams	Page & Lynn Streets	43506	n	
Cincinnati	Ohio	Hamilton	1301 Western Avenue	45203	n	512
Cleveland	Ohio	Cuyahoga	200 Cleveland Memorial	44114	n	636
Elyria	Ohio	Lorain	410 East River Road	44035	n	
Sandusky	Ohio	Erie	Depot Station at hayes Avenue	44870	n	
Toledo	Ohio	Lucas	415 Emerald Avenue	43602	n	193
Allenton	Wisconsin					
Appleton	Wisconsin	Outagamie	500 North Oneida Street	54911	y	58
Brookfield	Wisconsin	Waukesha			n	
Columbus	Wisconsin	Columbia	359 Ludington Street	53925	n	
Fond Du Lac	Wisconsin	Fond Du Lac	24 West Pioneer Road	54935	y	
General Mitchell Field *	Wisconsin					
Green Bay	Wisconsin	Brown	800 Cedar Street	54301	y	100
La Crosse	Wisconsin	La Cross	601 Street & Andrew Street	54602	n	34
Madison Airport	Wisconsin	Dane	800 Langdon Street	53706	y	
Milwaukee Union	Wisconsin	Milwaukee	433 West St. Paul Avenue	53203	n	512
Neenah *	Wisconsin	Winnebago				
Oconomowoc	Wisconsin	Waukesha				
Oshkosh	Wisconsin	Winnebago	124 North Main Street	54901	y	
Portage	Wisconsin	Columbia	400 West Oneida Street	53901	n	
Sturtevant	Wisconsin	Racine	2904 Wisconsin Street	53177	n	
Tomah	Wisconsin	Monroe	West Washington Street	54660	n	

Note: General characteristics information is provided by Amtrak timetable for fall/winter 1998.

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Exhibit 11.5
MWRRS Station Profile – continued

		1990 Socioeconomic Characteristics (City)						
Station Names	***State***	***Population***	***Urbanized Population***	***City Population Size***	***Population Density***	***Density Category***	***Employment***	***Per Capita Income***
Carbondale	Illinois	27,003	NA	Small	NA	NA	11,098	$8,037
Carlinville	Illinois	5,416	NA	Small	NA	NA	2,436	$10,314
Centralia	Illinois	14,274	NA	Small	NA	NA	5,648	$12,404
Champaign	Illinois	63,502	115,524	Small	3,851	High Density	32,714	$13,025
Chicago Union (Carbondale)	Illinois	2,783,726	6,792,087	Large	4,285	High Density	1,207,108	$12,899
Chicago Union (Cincinnati)	Illinois	2,783,726	6,792,087	Large	4,285	High Density	1,207,108	$12,899
Chicago Union (Cleveland)	Illinois	2,783,726	6,792,087	Large	4,285	High Density	1,207,108	$12,899
Chicago Union (Detroit)	Illinois	2,783,726	6,792,087	Large	4,285	High Density	1,207,108	$12,899
Chicago Union (Milwaukee)	Illinois	2,783,726	6,792,087	Large	4,285	High Density	1,207,108	$12,899
Chicago Union (Quincy)	Illinois	2,783,726	6,792,087	Large	4,285	High Density	1,207,108	$12,899
Chicago Union (St. Louis)	Illinois	2,783,726	6,792,087	Large	4,285	High Density	1,207,108	$12,899
Du Quoin	Illinois	6,697	NA	Small	NA	NA	2,544	$10,613
Dwight	Illinois	4,230	NA	Small	NA	NA	1,892	$12,918
Effingham	Illinois	11,927	NA	Small	NA	NA	5,670	$12,896
Galesburg	Illinois	33,530	NA	Small	NA	NA	14,086	$11,982
Glenview	Illinois	38,436	NA	Small	NA	NA	18,805	$30,531
Homewood	Illinois	19,278	NA	Small	NA	NA	9,796	$20,979
Joliet	Illinois	77,217	NA	Small	NA	NA	32,754	$13,091
Kankakee	Illinois	27,541	NA	Small	NA	NA	10,322	$10,349
Kewanee	Illinois	12,969	NA	Small	NA	NA	5,207	$10,136
La Grange Road	Illinois	15,362	NA	Small	NA	NA	7867	21660
Lincoln	Illinois	15,418	NA	Small	NA	NA	7,206	$11,502
Macomb	Illinois	19,952	NA	Small	NA	NA	8,180	$9,135
Mattoon	Illinois	18,441	NA	Small	NA	NA	8,238	$11,791
Mendota	Illinois	7,017	NA	Small	NA	NA	2,851	$11,449
Naperville	Illinois	85,806	NA	Small	NA	NA	45,705	$23,934
Normal	Illinois	40,023	94,186	Small	3,038	High Density	21,262	$12,101
Plano	Illinois	5,104	NA	Small	NA	NA	2,719	$13,046
Princeton	Illinois	7,197	NA	Small	NA	NA	3,405	$13,584
Quincy	Illinois	39,682	NA	Small	NA	NA	17,362	$11,708
Rantoul	Illinois	17,212	NA	Small	NA	NA	6,124	$11,360
Rock Island	Illinois	40,630	NA	Small	NA	NA	17,063	$12,381
Springfield	Illinois	105,417	159,086	Small	1,964	Low Density	53,528	$14,813
Upper Alton	Illinois	33,064	NA	Small	NA	NA	13,004	$10,904
Elkhart	Indiana	44,661	98,787	Small	1,900	Low Density	21,893	$13,331
Hammond-Whiting	Indiana	84,236	NA	Small	NA	NA	35,762	$11,576
Indianapolis	Indiana	731,278	914,761	Medium	1,950	Low Density	367,512	$14,478
Lafayette	Indiana	44,622	100,103	Small	3,128	High Density	22,767	$13,468
Michigan City	Indiana	33,822	NA	Small	NA	NA	14,382	$10,868
Shelbyville	Indiana	15,347	NA	Small	NA	NA	7,330	$12,533
South Bend	Indiana	105,511	237,932	Small	1,983	Low Density	47,503	$11,949
Waterloo	Indiana	2,040	NA	Small	NA	NA	964	10493
Atlantic	Iowa	637	NA	Small	NA	NA	3,363	$11,931
Des Moines (Osceola)	Iowa	193,189	293,666	Small	1,835	Low Density	99,816	$13,710
Iowa City	Iowa	59,735	71,372	Small	2,379	Medium Density	33,465	$13,277
Newton	Iowa	16,700	NA	Small	NA	NA	7,890	$12,055

Note: Socioeconomic characteristics information is provided by Census Bureau; urbanized population and size of the area information is provided by 1996 National Transit Database.

This chapter is the original chapter from the 2000 Plan report. It has not been updated to reflect the findings of the 2004 Plan.

Exhibit 11.5
MWRRS Station Profile – continued

		1990 Socioeconomic Characteristics (City)						
Station Names	***State***	***Population***	***Urbanized Population***	***City Population Size***	***Population Density***	***Density Category***	***Employment***	***Per Capita Income***
Albion	Michigan	10,066	NA	Small	NA	NA	3,896	$9,005
Ann Arbor	Michigan	109,608	263,192	Small	2,123	Medium Density	59,668	$17,786
Battle Creek	Michigan	53,516	77,921	Small	1,443	Low Density	21,874	$12,963
Birmingham *	Michigan	19,997	NA	Small	NA	NA	11,380	$37,061
Dearborn	Michigan	89,286	NA	Small	NA	NA	38,978	$16,852
Detroit	Michigan	1,027,974	3,697,529	Large	3,301	High Density	335,462	$9,443
Dowagiac	Michigan	6,418	NA	Small	NA	NA	2,484	$9,351
Durnad	Michigan	4,283	NA	Small	NA	NA	1,709	$11,401
East Lansing	Michigan	50,677	265,095	Small	2,678	Medium Density	26,344	$11,212
Flint	Michigan	140,925	326,023	Small	1,988	Low Density	47,016	$10,415
Grand Rapids	Michigan	189,126	436,336	Small	1,957	Low Density	85,877	$12,070
Holland	Michigan	30,745	NA	Small	NA	NA	14,823	$13,344
Jackson	Michigan	37,425	78,126	Small	1,860	Low Density	14,838	$10,410
Kalamazoo	Michigan	80,277	164,430	Small	1,934	Low Density	36,210	$11,956
Lapeer	Michigan	7,759	NA	Small	NA	NA	2,872	$10,777
Niles	Michigan	12,458	237,932	Small	1,983	Low Density	5,653	$11,772
Plainwell *	Michigan	4,057	NA	Small	NA	NA	1,747	$11,761
Pontiac	Michigan	71,136	NA	Small	NA	NA	26,357	$9,847
Port Huron	Michigan	33,694	62,774	Small	2,165	Medium Density	13,281	$11,210
Royal Oak	Michigan	65,410	NA	Small	NA	NA	35,027	$18,065
Red Wing	Minnesota	15,134	NA	Small	NA	NA	7,192	$13,161
St. Paul-Minneapolis	Minnesota	368,385	2,079,676	Medium	1,956	Low Density	133,383	$13,727
Winona	Minnesota	25,435	NA	Small	NA	NA	12,437	$10,756
Hermann	Missouri	2,754	NA	Small	NA	NA	1,229	$11,564
Independence	Missouri	112,301	NA	Small	NA	NA	56,201	$13,208
Jefferson City	Missouri	35,517	NA	Small	NA	NA	17,033	$15,701
Kansas City	Missouri	434,829	1,275,315	Medium	1,674	Low Density	211,817	$13,799
Kirkwood	Missouri	28,318	NA	Small	NA	NA	13,757	$22,058
Lee's Summit	Missouri	46,418	NA	Small	NA	NA	24,084	$16,658
Sedalia	Missouri	19,800	NA	Small	NA	NA	8,557	$10,455
St. Louis	Missouri	396,685	1,946,526	Medium	2,674	Medium Density	161,434	$10,798
Warrensburg	Missouri	15,244	NA	Small	NA	NA	6,655	$9,490
Washington	Missouri	11,367	NA	Small	NA	NA	5,433	$13,273
Omaha	Nebraska	342,862	544,292	Medium	2,820	Medium Density	167,866	$13,957
Bryan	Ohio	8,348	NA	Small	NA	NA	26,749	$11,691
Cincinnati	Ohio	364,114	1,212,675	Medium	2,369	Medium Density	158,881	$12,547
Cleveland	Ohio	505,616	1,677,492	Medium	2,638	Medium Density	182,225	$9,258
Elyria	Ohio	56,746	NA	Small	NA	NA	26,257	$11,980
Sandusky	Ohio	29,764	NA	Small	NA	NA	13,137	$11,620
Toledo	Ohio	332,943	489,155	Medium	2,534	Medium Density	141,298	$11,894
Allenton	Wisconsin	800	NA	Small	NA	NA	NA	NA
Appleton	Wisconsin	65,695	160,918	Small	2,774	Medium Density	33,379	$14,735
Brookfield	Wisconsin	35,184	NA	Small	NA	NA	17,654	$24,814
Columbus	Wisconsin	4,093	NA	Small	NA	NA	2084	13269
Fond Du Lac	Wisconsin	37,755	NA	Small	NA	NA	17,928	$12,472
General Mitchell Field *	Wisconsin	NA	NA	NA	NA	NA	NA	NA
Green Bay	Wisconsin	96,466	161,931	Small	1,619	Low Density	47,686	$12,969
La Crosse	Wisconsin	51,140	78,928	Small	2,321	Medium Density	24,796	$10,898
Madison Airport	Wisconsin	190,766	NA	Small	NA	NA	108,284	$15,143
Milwaukee Union	Wisconsin	628,088	1,226,293	Medium	2,395	Medium Density	274,237	$11,106
Neenah *	Wisconsin	23,219	NA	Small	NA	NA	11,313	$15,074
Oconomowoc	Wisconsin	10,993	NA	Small	NA	NA	5,403	$14,331
Oshkosh	Wisconsin	55,006	NA	Small	NA	NA	27,170	$11,843
Portage	Wisconsin	8,640	NA	Small	NA	NA	3,834	$11,241
Sturtevant	Wisconsin	3,803	NA	Small	NA	NA	2,031	$12,627
Tomah	Wisconsin	7,572	NA	Small	NA	NA	3,266	$12,682

Note: Socioeconomic characteristics information is provided by Census Bureau; urbanized population and size of the area information is provided by 1996 National Transit Database.

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Exhibit 11.5
MWRRS Station Profile – continued

		Annual Ridership			**Parking Availability**			
Station Names	***State***	***Base (1996)***	***Year 2010***	***Year 2020***	***Short Term***	***Long Term***	***# of Parking Spaces***	***Paved/ Unpaved***
Carbondale	Illinois	43721	84604	96752	$	$		
Carlinville	Illinois	5051	14811	16942	free	free		
Centralia	Illinois	5417	11746	13441	free	free		
Champaign	Illinois	46294	185421	211559	none	none	0	
Chicago Union (Carbondale)	Illinois	82474	191809	217501	$	$		
Chicago Union (Cincinnati)	Illinois	12621	351166	397255	$	$		
Chicago Union (Cleveland)	Illinois	55569	446280	502620	$	$		
Chicago Union (Detroit)	Illinois	359350	1257740	1416453	$	$		
Chicago Union (Milwaukee)	Illinois	327315	997715	1128684	$	$		
Chicago Union (Quincy)	Illinois	93698	334384	377551	$	$		
Chicago Union (St. Louis)	Illinois	190417	773145	873268	$	$		
Du Quoin	Illinois	2787	4819	5469	free	free		
Dwight	Illinois	5113	12391	14092	none	none	0	
Effingham	Illinois	5262	17908	20610	free	free		
Galesburg	Illinois	25615	84943	96472	free	free		
Glenview	Illinois	19619	257694	294692	free	free		
Homewood	Illinois	9025	113863	128815	$	$		
Joliet	Illinois	19770	174153	200081	$	$		
Kankakee	Illinois	5394	51682	58823	none	none	0	
Kewanee	Illinois	5210	16848	19158	free	free		
La Grange Road	Illinois	6287	39091	44179	none	none	0	
Lincoln	Illinois	12984	22939	26107	free	free		
Macomb	Illinois	29679	66683	75946	free	free		
Mattoon	Illinois	9711	62336	70813	free	free		
Mendota	Illinois	7156	28392	31989	free	free		
Naperville	Illinois	17434	157849	184045	free	free		
Normal	Illinois	73190	310741	353056				
Plano	Illinois	2639	19117	21758	none	none	0	
Princeton	Illinois	8998	150506	170515	free	free		
Quincy	Illinois	18393	56066	64154	free	free		
Rantoul	Illinois	2017	44150	50523	free	free		
Rock Island	Illinois	0	21818	24647				
Springfield	Illinois	94125	323917	368824	free	free		
Upper Alton	Illinois	25378	151152	171959				
Elkhart	Indiana	8747	61362	70063	free	free		
Hammond-Whiting	Indiana	18493	106959	122075	none	none	0	
Indianapolis	Indiana	8566	479496	548259	free	$		
Lafayette	Indiana	2337	46431	53024	free	free		
Michigan City	Indiana	3039	22308	25413	free	free		
Shelbyville	Indiana	0	3237	3700				
South Bend	Indiana	5874	70076	80036	free	free		
Waterloo	Indiana	9502	56008	64273	free	free		
Atlantic	Iowa	0	285	320				
Des Moines (Osceola)	Iowa	0	101167	114552				
Iowa City	Iowa	0	176160	199350				
Newton	Iowa	0	17750	20180	free	free		

Note: Ridership information is provided by TEMS demand forecasting model.
Parking availability information is gathered from Amtrak timetable for fall/winter 1998.

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Exhibit 11.5
MWRRS Station Profile – continued

		Annual Ridership			**Parking Availability**			
Station Names	***State***	***Base (1996)***	***Year 2010***	***Year 2020***	***Short Term***	***Long Term***	***# of Parking Spaces***	***Paved/ Unpaved***
Albion	Michigan	2019	11178	12668	free	free		
Ann Arbor	Michigan	104599	371143	420155	$	$		
Battle Creek	Michigan	50461	133008	150662	free	free		
Birmingham *	Michigan	0	0	0	free	free		
Dearborn	Michigan	78235	198651	223017	free	free		
Detroit	Michigan	69369	558703	626691	free	none		
Dowagiac	Michigan	1583	10363	11754	free	free		
Durnad	Michigan	3878	27845	31448	free	free		
East Lansing	Michigan	24642	159426	181480	free	free		
Flint	Michigan	16810	183859	207901	free	free		
Grand Rapids	Michigan	29316	257594	293763	free	free		
Holland	Michigan	20898	59450	68477	free	free		
Jackson	Michigan	28643	65262	74138	free	$		
Kalamazoo	Michigan	82273	319476	361114	$	$		
Lapeer	Michigan	4267	15452	17562	free	free		
Niles	Michigan	24305	38465	43397	none	none	0	
Plainwell *	Michigan	0	0	0				
Pontiac	Michigan	11654	117142	134017	free	free		
Port Huron	Michigan	17093	45123	51406	free	free		
Royal Oak	Michigan	29004	156722	179041	$	none		
Red Wing	Minnesota	6036	29676	34212	free	free		
St. Paul-Minneapolis	Minnesota	70301	376335	432739	free	free		
Winona	Minnesota	12522	33283	38202	free	free		
Hermann	Missouri	10581	20123	23142	free	free		
Independence	Missouri	6112	14789	17038	free	free		
Jefferson City	Missouri	111955	301832	342581	free	free		
Kansas City	Missouri	98719	309010	353799	free	$		
Kirkwood	Missouri	52945	124856	143259	free	free		
Lee's Summit	Missouri	18272	29822	34396	none	none	0	
Sedalia	Missouri	10389	15818	18203	free	free		
St. Louis	Missouri	163395	822602	935512	free	free		
Warrensburg	Missouri	10845	18572	21433	free	free		
Washington	Missouri	12562	26108	29987	none	none	0	
Omaha	Nebraska	7642	81174	92612	free	free		
Bryan	Ohio	3833	27670	31577	free	free		
Cincinnati	Ohio	6046	212834	241466	free	$		
Cleveland	Ohio	16524	395959	447285	none	none	0	
Elyria	Ohio	1828	51865	58791	free	free		
Sandusky	Ohio	1547	24756	28098	free	free		
Toledo	Ohio	14450	189176	214238	free	free		
Allenton	Wisconsin	0	31746	36419				
Appleton	Wisconsin	0	81283	93431	none	none	0	
Brookfield	Wisconsin	0	211870	243159				
Columbus	Wisconsin	8304	91202	104221	free	free		
Fond Du Lac	Wisconsin	0	80815	92453	none	none	0	
General Mitchell Field *	Wisconsin	0	0	0				
Green Bay	Wisconsin	0	78796	90614	none	none	0	
La Crosse	Wisconsin	12881	77119	89169	free	free		
Madison Airport	Wisconsin	0	407345	466395				
Milwaukee Union	Wisconsin	316542	1112349	1262537	$	$		
Neenah *	Wisconsin	0	0	0				
Oconomowoc	Wisconsin	0	25704	29884				
Oshkosh	Wisconsin	0	149281	171419				
Portage	Wisconsin	3631	18773	21637	free	free		
Sturtevant	Wisconsin	28709	153023	174023	free	free		
Tomah	Wisconsin	4173	17860	20746	free	free		

Note: Ridership information is provided by TEMS demand forecasting model.
Parking availability information is gathered from Amtrak timetable for fall/winter 1998.
Stations marked with an asterisk are in the same zone as another station, and the model assigns riders to a single station in a zone. The zone system will be refined to distribute appropriate riders to these stations.

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Exhibit 11.5
MWRRS Station Profile – continued

		Other Transportation Access				
Station Names	***State***	***Local Bus***	***Intercity Bus***	***Intercity Bus Company***	***Taxi***	***Rental Car***
Carbondale	Illinois	y	y	Greyhound/Burlington Trlwys	y	y
Carlinville	Illinois	n	n	--	n	n
Centralia	Illinois	n	n	--	n	n
Champaign	Illinois	n	y	Greyhound/Illini-Swallow/Southeastern Trlwys	y	y
Chicago Union (Carbondale)	Illinois	y	y	Greyhound +		
Chicago Union (Cincinnati)	Illinois	y	y	Greyhound +		
Chicago Union (Cleveland)	Illinois	y	y	Greyhound +		
Chicago Union (Detroit)	Illinois	y	y	Greyhound +		
Chicago Union (Milwaukee)	Illinois	y	y	Greyhound +		
Chicago Union (Quincy)	Illinois	y	y	Greyhound +		
Chicago Union (St. Louis)	Illinois	y	y	Greyhound +	y	y
Du Quoin	Illinois	n	n	--	y	n
Dwight	Illinois	n	y	Greyhound/Southeastern Trlwys	n	n
Effingham	Illinois	y	y	Greyhound	y	n
Galesburg	Illinois	y	y	Illi-Swallow/Burlington Trlwys	y	n
Glenview	Illinois	y	n	--	y	y
Homewood	Illinois	y	n	--	n	n
Joliet	Illinois	y	y	Greyhound/Burlington Trlwys/Southeastern Trlwys	n	n
Kankakee	Illinois	y	y	Greyhound/Southeastern Trlwys	n	n
Kewanee	Illinois	n	n	--	y	n
La Grange Road	Illinois	y	n	--	y	n
Lincoln	Illinois	n	y	Greyhound	n	n
Macomb	Illinois	n	n	--	y	n
Mattoon	Illinois	n	y	Greyhound	y	n
Mendota	Illinois	n	y	Greyhound	n	n
Naperville	Illinois	y	n	--	y	n
Normal	Illinois		n	--		
Plano	Illinois	n	n	--	n	n
Princeton	Illinois	n	y	Burlington Trlwys	n	y
Quincy	Illinois	n	y	Jefferson/Burlington Trlwys	y	n
Rantoul	Illinois	n	y	Greyhound/Southeastern Trlwys	y	n
Rock Island	Illinois		n	--		
Springfield	Illinois	y	y	Greyhound/Burlington Trlwys/Southeastern Trlwys	y	y
Upper Alton	Illinois		n	--		
Elkhart	Indiana	n	y	Greyhound	y	y
Hammond-Whiting	Indiana	n	y	Greyhound +	y	n
Indianapolis	Indiana	n	y	Greyhound +	y	y
Lafayette	Indiana	y	y	Greyhound/Southeastern Trlwys	y	n
Michigan City	Indiana	n	y	Greyhound	y	n
Shelbyville	Indiana		n	--		
South Bend	Indiana	n	y	Greyhound	y	n
Waterloo	Indiana	n	y	Greyhound/Jefferson/Burlington Trlwys	n	n
Atlantic	Iowa		y	Burlington Trlwys		
Des Moines (Osceola)	Iowa		y	Greyhound +		
Iowa City	Iowa		y	Greyhound/Jefferson/Burlington Trlwys		
Newton	Iowa	n	y	Greyhound	y	n

Note: Intercity bus information is gathered from Russell's Official National Motor Coach Guide for United States and Canada.

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Exhibit 11.5
MWRRS Station Profile – continued

		Other Transportation Access				
Station Names	*State*	*Local Bus*	*Intercity Bus*	*Intercity Bus Company*	*Taxi*	*Rental Car*
Albion	Michigan	n	y	Greyhound	n	n
Ann Arbor	Michigan	n	y	Greyhound/Indian Trails	y	n
Battle Creek	Michigan	y	y	Greyhound/Indian Trails	y	n
Birmingham *	Michigan	y	n	--	y	n
Dearborn	Michigan	n	n	--	y	y
Detroit	Michigan	y	y	Greyhound +	y	y
Dowagiac	Michigan	n	n	--	n	y
Durnad	Michigan	n	y	Indian Trails	y	n
East Lansing	Michigan	y	y	Greyhound/Indian Trails	y	y
Flint	Michigan	y	y	Greyhound +	y	y
Grand Rapids	Michigan	y	y	Lorenz Bus	y	n
Holland	Michigan	n	y	Greyhound	y	n
Jackson	Michigan	y	y	Greyhound/Indian Trails	y	n
Kalamazoo	Michigan	n	y	Greyhound/Indian Trails	y	y
Lapeer	Michigan	n	n	--	y	n
Niles	Michigan	n	n	--	y	n
Plainwell *	Michigan		y	Indian Trails		
Pontiac	Michigan	y	y	Greyhound/Indian Trails	y	n
Port Huron	Michigan	n	y	Cha-Co Trails	y	n
Royal Oak	Michigan	y	y	Greyhound/Indian Trails	y	n
Red Wing	Minnesota	n	y	Greyhound	y	n
St. Paul-Minneapolis	Minnesota	n	y	Greyhound +	y	y
Winona	Minnesota	y	y	Greyhound/Jefferson	y	n
Hermann	Missouri	n	n	--	n	n
Independence	Missouri	n	n	--	y	n
Jefferson City	Missouri	n	y	Sho-Me	y	n
Kansas City	Missouri	y	y	Greyhound +	y	y
Kirkwood	Missouri	y	n	--	y	n
Lee's Summit	Missouri	n	n	--	n	n
Sedalia	Missouri	n	n	--	y	n
St. Louis	Missouri	n	y	Greyhound +	y	y
Warrensburg	Missouri	n	y	Greyhound	y	n
Washington	Missouri	n	n	--	y	n
Omaha	Nebraska	n	y	Greyhound +	y	y
Bryan	Ohio	n	n	--	y	n
Cincinnati	Ohio		y	Greyhound/GLC/Delta	y	
Cleveland	Ohio	n	y	Greyhound +	n	n
Elyria	Ohio	y	y	Greyhound	y	n
Sandusky	Ohio	n	y	Greyhound	y	n
Toledo	Ohio	y	y	Greyhound/Fullington Trlwys/Southeastern Trlwys	y	y
Allenton	Wisconsin		n	--		
Appleton	Wisconsin	n	y	Jack Rabbit	n	n
Brookfield	Wisconsin		n	--		
Columbus	Wisconsin	n	y	Greyhound	y	y
Fond Du Lac	Wisconsin	n	y	Greyhound/Lamers Bus Line	n	n
General Mitchell Field *	Wisconsin		n	--		
Green Bay	Wisconsin	n	y	Greyhound/Lamers Bus Line	n	n
La Crosse	Wisconsin	n	y	Greyhound/Jefferson	y	n
Madison Airport	Wisconsin		y	Greyhound +		
Milwaukee Union	Wisconsin	y	y	Greyhound +	y	y
Neenah *	Wisconsin		n	--		
Oconomowoc	Wisconsin		n	--		
Oshkosh	Wisconsin		y	Greyhound/Lamers Bus Line		
Portage	Wisconsin	n	y	Greyhound	y	n
Sturtevant	Wisconsin	y	n		y	n
Tomah	Wisconsin	n	y	Greyhound/Jefferson/Jack Rabbit	y	n

Note: Intercity bus information is gathered from Russell's Official National Motor Coach Guide for United States and Canada.

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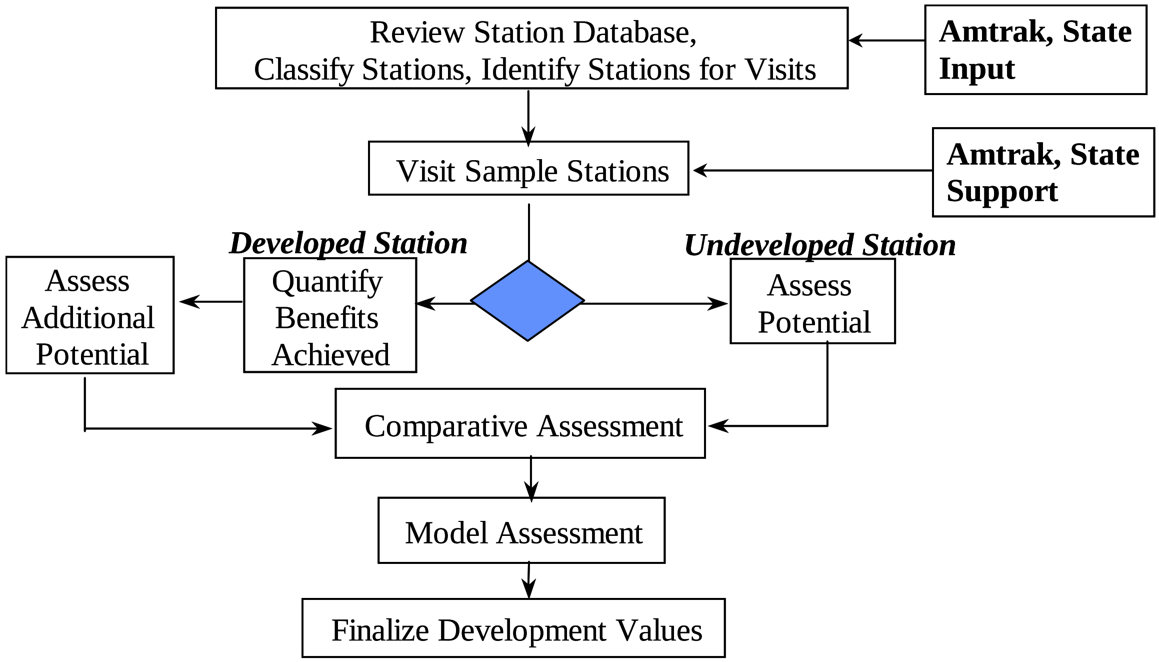
Exhibit 11.6
Joint Station Development Methodology



The main factors impacting the development potential included station location, land availability around the station for development, and community commitment to the station and urban development. The ability of a location to achieve its highest potential is affected by the following factors:

- Level of modal integration at station
- Frequency of existing rail and bus services
- Accessibility of the station to the community
- Existing level of connectivity to regional modal networks
- Level of existing economic development

In assessing stations and communities, factors such as community size, proximity of station to major economic markets, current economic base, and density along the corridor were taken into account. Then the potential for each community to realize economic benefits from the MWRRS was determined within the context of the economic rent analysis.

11.7.1 Multimodal Connectivity

MWRRS station development will bring together many modes of travel–trains, planes, taxis, private automobiles, and regional, inter-city, and airport buses–at a single location in order to maximize benefits and efficiencies. Savings in time and increased economic activity will assure the highest output in economic rent, along with an increase in property values and joint development potential. The multimodal transportation centers, which will be well located will encourage other joint-use occupancies and help create "smart growth" areas in urban centers.

In the same way that large department stores anchor a shopping center and create trips that stimulate activity in nearby shops, a multimodal transportation center will stimulate retail, office, and residential development. Without the synergies achieved by bringing all modes of transportation together in one location, there are significant negative impacts on the economic development potential. The MWRRI analysis and the experiences of other transportation centers indicate that property values and joint development potential decline by 30 percent or more when the station is a single or limited transportation center. Thus, connectivity is critical to success in the station development effort.

11.7.2 Station Case Studies

In order to verify the results of economic rent model, two communities were evaluated that have implemented multimodal transportation center – Champaign-Urbana, Illinois and Lafayette, Indiana.

Champaign-Urbana, Illinois

Champaign-Urbana recently opened a new 60,000 square feet multimodal transportation center. The station is situated in the center of the community and houses Greyhound, Amtrak, taxis, local buses, and airport shuttles. In addition, the station accommodates other joint-use occupancies including office space, retail space, a restaurant, and community meeting rooms. With an initial investment of $8 million, the station has already generated over $30 million in joint development projects in the surrounding area. The economic rent model estimates a joint development potential of $70 million. Even without the rail frequencies and expansion of feeder buses anticipated for the MWRRS, the Champaign-Urbana station has already achieved more than half of its $70 million joint development potential.

Lafayette, Indiana

Lafayette, Indiana has had similar results with its integrated multimodal transportation center. With an initial investment of $8 million, the community built a multimodal (Greyhound, Amtrak, local buses, and taxis) transportation center, which also provides office space, currently leased to a local bank and several community agencies. This project involved combining the old station with new construction in order to achieve a unique result for the community, and the surrounding area is now bustling with economic development. Over $70 million in private-public projects have been identified. Given that the economic rent model estimated $70 million in potential joint development, Lafayette promises to far outpace the model when rail frequencies increase with implementation of the MWRRS.

11.7.3 Station Planning Process

To illustrate the station planning process, Bloomington-Normal, Illinois was evaluated. The first step was to understand existing conditions in the community. Currently, Amtrak has a small-single use building that is safe and efficient, but separated from the downtown business community. There is a mixture of commercial uses in the area, ranging from some heavy industry to national offices for State Farm Insurance; The Illinois State University is also a major influence in the community. Taking these inputs, the study team determined the ways in which the development of a multimodal transportation center could maximize the development of the downtown. Using the economic rent model, the joint development potential for Bloomington-Normal was estimated to be $70 million. Exhibit 11.7 shows an example of a development plan for a downtown station area, as well as the

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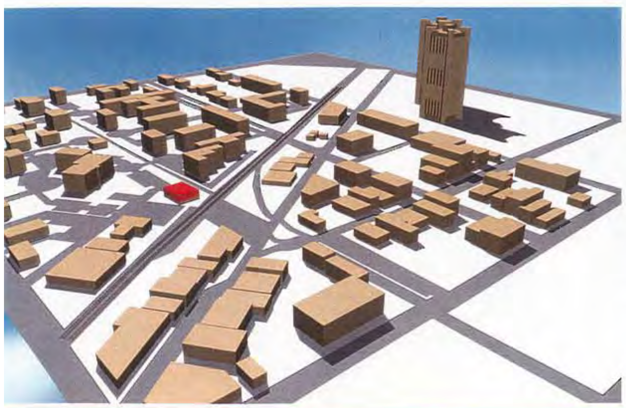
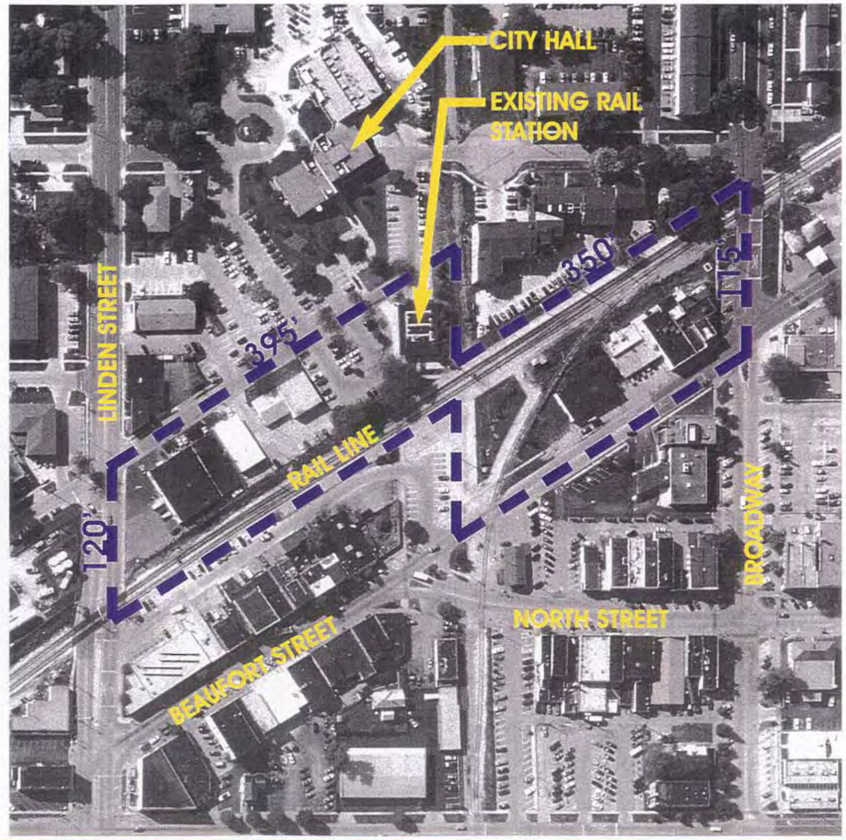
current station. Actual development will probably lie between the two scenarios, but this exercise demonstrates the process needed to fully realize the economic development potential of a multimodal center.

Exhibit 11.7
Bloomington-Normal, Illinois

EXISTING CONDITIONS

THE CURRENT STATION IS FUNCTIONAL, CLEAN, AND SAFE, BUT MISSES ITS POTENTIAL. LOCATED ON A DEAD END STREET ON THE FAR SIDE OF THE TRACKS FROM THE DOWNTOWN COMMERCIAL ACTIVITY, THIS STATION FAILS TO CAPTURE THE SYNERGIES AVAILABLE IN THIS GROWING AND VIBRANT COMMUNITY. THE STATION NEEDS TO BE INTEGRATED INTO THE COMMERCIAL ACTIVITY OF THE TOWN AND COMBINED WITH OTHER RELEVANT TRANSPORTATION MODES INCLUDING CITY BUSES, UNIVERSITY TRANSPORTATION, TAXIS, AND NEW INTERCITY BUS CONNECTIONS. THE PROXIMITY OF THE UNIVERSITY, TOGETHER WITH MAJOR EMPLOYERS SUCH AS STATE FARM INSURANCE, MAKES THIS AREA A PRIME TARGET FOR REDEVELOPMENT AND RELOCATION OF A MODERN INTERMODAL TRANSPORTATION CENTER WHICH WILL SERVE AS A MAJOR CATALYST TO BLOOMINGTON-NORMAL'S FUTURE GROWTH.





Normal, Illinois

Illinois Department of Transportation

Station Area Development Plan
Normal, Illinois
EXISTING CONDITIONS

TEMS
Transportation Economics & Management Systems, Inc.
Frederick, MD

Hickok Warner Fox
Architects
Washington, DC

This chapter is the original chapter from the Phase 3B report. It has not been updated to reflect the findings of Phases 4 and 5.

11.7.4 Station Development Evaluation Process

For many communities in the Midwest, region, while rail stations are a fixture in their downtown areas, they have failed to keep pace with transportation developments. These stations are often too small to accommodate the demands of a full multimodal transportation center or are located in areas that do not maximize economic development potential. Communities must evaluate their needs and identify the best strategy to develop efficient transportation hubs. The basic steps in the evaluation process include the following:

- Identify and evaluate sites (existing or new)
- Integrate available transportation modes
- Encourage joint use occupancy (office/retail/residential)
- Increase economic activity in the area of the station
- Incorporate adjacent land use potential
- Increase regional development opportunities

11.8 Conclusion

An economic analysis was completed for the MWRRS using the same criteria and structure used by the FRA in its 1997 study, *High-Speed Ground Transportation for America.* This analysis generates a benefit to cost ratio of 1.7. The FRA, in its independent study, confirmed that a Midwest rail passenger system offers the highest level of economic benefit associated with rail investment anywhere in the U.S. except for Amtrak's Northeast Corridor.

The system is expected to generate resource savings in automobile operating costs, airport and highway congestion relief, and reduced energy usage and exhaust emissions. The extensive regional passenger rail network and the connectivity that it provides will afford an attractive travel choice resulting in reduced automobile trips for commuting, business, and leisure purposes.

With respect to the 100 communities that will be connected to the MWRRS by a station, they can expect to see major increases in economic development associated with the $16-17 billion that will be spread across the region in terms of increased income and property values. This will be partly due to the extra 18,000 direct and indirect jobs created by the MWRRS, and partly due to the more than $6.6 billion of net economic benefit generated by the MWRRS.

12. Institutional and Organizational Issues

12.1 Background

This chapter addresses the institutional arrangements that will help support the engineering, implementation and overall management of the MWRRS. This topic was initially addressed in the 1998 Midwest Regional Rail System Technical Report. The sections that follow trace the progress made from the initial study in 1998 through the end of the current study plan.

Institutional arrangements relate to the organizational structure and agreements between participating entities (*e.g., s*tates) responsible for undertaking or overseeing project-related activities. Institutional arrangements may take many forms throughout the planning, engineering, construction and operating plans of the MWRRS.

The 1998 Technical Report discussed, at a general level, the concept of institutional arrangements and how these arrangements might be incorporated into MWRRI planning, management and implementation-related activities. Institutional arrangements can now be addressed in detail. This chapter is *descriptive* as opposed to *prescriptive* in identifying the most appropriate and effective institutional arrangements for the MWRRI.

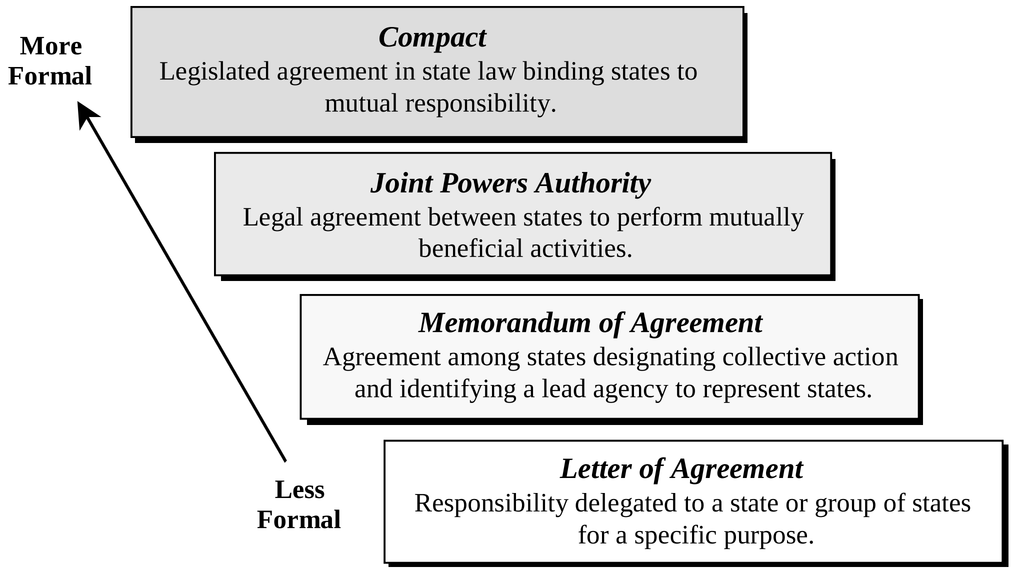
12.2 MWRRS Project Objectives

Under many circumstances, institutional arrangements will be needed to provide the structure necessary to achieve multi-state objectives stemming from the MWRRI. While many of these objectives will be achieved through informal arrangements between states, achieving others might require formal, multi-state agreements.

As the MWRRI progresses to more detailed planning – and ultimately to pursuing funding, particularly federal funding for implementation – a number of diverse activities will most likely require multi-state participation and cooperation. As MWRRS implementation activities progress, the need will exist to define the institutional arrangements that will best facilitate the implementation and development of the project, as well as meet the needs of project participants including freight and commuter railroads, contractors and federal funding agencies.

As noted in the studies conducted in 1998 through 2000, there is a wide range of institutional arrangements that can be made. Exhibit 12-1 illustrates a continuum and definition of institutional arrangements which range from less formal arrangements such as a letter of agreement to a more formal multi-state legislated compact arrangement. The level of arrangement selected will reflect the administrative needs of the states and the degree of complexity of the issues involved.

Exhibit 12-1
Continuum of Institutional Arrangements



12.3 Guiding Principles in Selecting Institutional Arrangements

Certain guiding principles should be taken into account when considering and ultimately selecting institutional arrangements to support MWRRI activities. The overall objective is to achieve project goals and to neither expand nor create new bureaucracies. Foremost among these is ensuring that institutional arrangements are designed so that intrusion upon states' powers and immunities is minimized. While the form of arrangement is important, equal attention must also be given to identifying when such multi-state arrangements are necessary and what needs to be incorporated into these arrangements. Another guiding principle in selecting institutional arrangements is to determine if existing arrangements are sufficient to meet the current need.

12.3.1 Multi-State Participation Activities

Previous studies confirmed that activities for the MWRRI requiring multi-state participation fall into three broad categories – project planning, business arrangements, and policy and operational oversight. Exhibit 12-2 lists these activities by project category.

Exhibit 12-2
MWRRS Activities by Category

Project Planning	**Business Arrangements**	**Policy Oversight Arrangements**
Hire consultants Oversee project planning Conduct environmental review Garner project support	Issue and retire state debt Federal grant activities Major procurements System construction Outsourcing decisions	Train operator oversight Capital investments Service quality standards Receipt of revenue Payment to contractors Disbursements to states

12.3.2 Project Planning

Project planning requires arrangements that support joint funding and collective oversight of the planning process among the states. An institutional arrangement defined and formulated by a joint, signed letter, or *Multi-State Contract* by each of the participating states and/or agencies proved sufficient thus far to successfully proceed with MWRRS project planning.

An institutional arrangement for the collective governance of many of the activities involved would enhance the effectiveness of project oversight, as well as provide more efficient, comprehensive project management by the states. It is important that policy governance be defined as more than just advisory. The governing entity must have authority to direct action. It is anticipated that these objectives can be met through an interstate agreement.

The states can enter into agreements to establish the contractual arrangements necessary to achieve intercity service within the jurisdictions of the contracting states. A contract can be established quickly and without legislative approval. It is flexible in design, allowing states to form a legal arrangement that is tailored to their needs and project-specific objectives.

12.3.3 Business Arrangements

Business arrangements entail contractual agreements with lending institutions, investors, suppliers, contractors and freight and commuter railroads. As such, provisions must be made to protect the interest of states, define fiduciary responsibilities and achieve objectives according to a schedule and within limits of affordability. Likewise, investors and contractors will seek clarity regarding identification of the contracting entity and financial responsibility. The federal government, in particular, will require that a Designated Recipient be named by states submitting grant applications, receiving grant funds and being responsible for protecting and maintaining the federal assets resulting from the MWRRS. The following describes the different kinds of arrangements possible between states.

State-to-State Contract

The states may enter into agreements amongst themselves to make the contractual arrangements that would be necessary to achieve intercity service within the jurisdictions of the states. Such agreements may be established without prescribing the precise form or content, and may not require separate enactment by each participating state. Cooperative agreements have been authorized in many states. In entering into agreements with participating states, each state would have to assure the others that it would enact all necessary legislation and regulations to implement the plan for the MWRRS.

The advantages of a contract are the speed and flexibility of establishing the agreement structure, since legislative approval is unnecessary, and the ability of such a contract to hold a state harmless from legal liability. The disadvantage of such a contract is that it may not fully reflect the collective good and credibility that might be achieved with a more formal agreement.

Interstate Compact

Congress has from time to time agreed to allow states, or agencies or authorities created by states, to enter into specific agreements that involve interstate commerce. The most recent consent was made in blanket form as part of the Amtrak Reform and Privatization Act passed in 1997. This act grants the consent of Congress for states to enter into interstate compacts to promote the provision of intercity passenger rail service including:

- Retaining existing service or commencing new service;
- Assembling rights-of-way; and
- Performing capital improvements, including:
  - The construction and rehabilitation of maintenance facilities and intermodal passenger facilities
  - The purchase of locomotives
  - Operational improvements, including communications, signals and other systems.

The terms of a compact for the MWRRS would provide that the states join to establish a unified system that would operate across state lines, and cooperate and share jointly the administrative and financial responsibilities of operating such a system. For example, an MWRRI compact could describe the manner of adoption of the compact by the states and provide for broad authority to implement a business plan. The compact could also describe the institutional framework, such as a policy board consisting of members from each of the participating states directing an operator. It could identify the terms for enactment, such as providing that the compact could become effective upon the adoption or enacting into law by two or more participating states.

The agreed-upon compact language must be identical for each state. However, each state would most likely enact its own enabling legislation that conforms or accommodates formation of a compact. This enabling legislation may include, but not necessarily be limited to, zoning, insurance, bonding authority, rates, tariffs and fares, labor, safety and the environment.

Compacts and Sovereign Immunity

States enjoy sovereign immunity. Some states have waived some of their sovereign immunity in order to conduct business. Waiving of immunity is usually tailored to a specific action, such as contracts, provision of public services or certain types of torts. For example, the State of Maryland waived sovereign immunity with respect to the operations of the Mass Transit Administration.

The nature and extent of liability concerning a compact depends upon the content of the compact agreement, and what level of liability, if any, would be assumed by the state. The determination of how much sovereign immunity is waived is dictated by the terms of the compact. For example, a state's indemnification limits can be proportional to its financial contribution to operating and capital or to other factors. In the Washington Metropolitan Area Transportation Authority (WMATA) compact, the states assume no direct liability but assume responsibility to finance the organization, with the result that each state indirectly pays for a portion of the liability.

A compact for the MWRRS would join the states in a structure that would be recognized by Congress for seeking federal funding for significant infrastructure improvements. The compact would provide the states with a formal structure that would operate across state lines and allow the states to cooperate and share jointly the administrative and financial responsibilities of implementing the system. A disadvantage of a compact is the timeframe and requirements for state legislative approval.

12.3.4 Policy Oversight Arrangements

Institutional arrangements would identify the responsibilities of the states in deciding MWRRS policy and broad service delivery issues. It would also outline responsibilities for management oversight of the rail operator, including periodic review of operating performance and contractor performance.

The establishment of a policy oversight entity could also be an appropriate arrangement. The authority of the policy board could be derived from an agreement among the member states. The policy board would interact with the rail operator through the provision of required funds and the specification of service plans.

- The policy board would follow all the normal procedures of a governmental entity by allocating funds for the greatest public benefit; allowing public participation in all decision-making; and by making complete and detailed financial disclosure.
- The rail service provider would operate in a commercial environment as a strictly private sector, for-profit business enterprise. The service provider would make its decisions on a commercial basis, and would be allowed to protect the confidentiality of its proprietary business data.

It is essential to the future of the MWRRS to separate the policy board's requirement for service and funding oversight from the operator's business requirements to be profitable. As pointed out by the Amtrak Reform Council in 1997, the current Amtrak structure by combining governmental and non-governmental functions in a single entity does not do this. Amtrak might serve as an operator of the system, but authority and control over the allocation of capital dollars should be vested in the states and the FRA, rather than in the operator.

In summary, while some MWRRS activities can be accomplished by the individual states, others will require varying levels of institutional arrangements. These institutional arrangements will range from informal cooperative state agreements, to complex arrangements such as multi-state contracts or multi-state compacts. Informal agreements are adequate for planning, but as the system moves towards implementation, more formalized arrangements may become necessary. Exhibit 12-3 provides a table of required MWRRI actions and potential types of institutional arrangements. The exhibit shows that MWRRS activities relating to planning can be accomplished through cooperative agreements and memoranda of agreement.

Exhibit 12-3 MWRRS
Actions and Potential Institutional Arrangements

MWRRS Potential Actions and Responsibilities	*Informal Cooperative Agreement*	*Multi-State Contract*	*Multi-State Compact*
Level of Institutional Action Required			
Agency Approval	X	X	X
Legislative Approval			
Arrangements Supporting Planning Activities			
System Plan	X	X	X
Service Plan	X	X	X
Service Standards	X	X	X
Arrangements Supporting State Management Activities			
Stakeholder Support	X	X	X
Procurements		X	X
System Construction Oversight		X	X
Vendor Selection		X	X
System Implementation Oversight		X	X
Full Time Administrative Support		X	X
System Accounting		X	X
Arrangements Supporting State Financial Responsibilities			
Federal Grant Applications and Awards		X	X
Capital Program Development/Monitoring		X	X
Multi-State Cost Sharing		X	X
Multi-State Revenue Distribution		X	X

As the project moves toward activities involving funding, procurement and construction, more formal arrangements such as multi-state contracts will be required. These arrangements, however, must be defined to minimize any intrusion to existing state powers and immunities, and care must be taken to ensure that these arrangements do not become new bureaucracies. Within this context, the role of a Joint Powers Authority could play in MWRRI policy, management, funding, implementation and operations oversight was assessed.

12.4 Joint Powers Authority

A Joint Powers Authority (JPA) provides for the joint exercise of powers of two or more public agencies. State law establishes the authority for state agencies to establish a JPA, and they can be established in a relatively short period through administrative action. A Joint Powers Authority can be established under a multi-state contract. JPA agreements specify the responsibilities and powers of the new entity. The powers of the JPA are derived from existing powers of the member states and not through legislative action specific to the JPA. Consequently, JPA powers are limited to activities common to the JPA partner states. Such powers could include: hiring employees and contractors, procuring equipment, exercising eminent domain, and in some instances, levying taxes. JPAs are also associated with the delivery of a defined service and the creation of a special district relating to its purpose.

Wisconsin, for example, put enabling legislation in place permitting multi-state agreements. The following is an excerpt from the Wisconsin State Code Section 85.06(2)(c), (f), (g), (h) relating specifically to expanding and improving rail passenger service:

> "The Department (of Transportation) shall administer a rail passenger service assistance and promotion program and may do the following:
>
> - Consult with other states for additional rail passenger service in the state
> - Apply for and accept funds for rail passenger service
> - Acquire equipment or facilities.
> - Provide rail passenger service or support for rail service
> - Enter into agreements with other states to assist or promote rail passenger service"

In contrast to a JPA, the creation of a multi-state compact requires passage of identical state law by each member state. The multi-state compact is usually associated with the creation of a district in which a certain activity is provided and regulated. Withdrawal from the compact also requires the passage of state law. In contrast to the powers of a JPA, the powers granted to the compact can differ from its member states. Once established, a multi-state compact usually results in a new organization that contains all of the activities necessary to operate a self-contained agency or business (*e.g.*, administrative, technical, financial, legal, personnel). Member involvement is formalized at the board level, thus leaving daily responsibilities to the compact staff.

12.4.1 JPA Case Study – Altamont Commuter Express

The Altamont Commuter Express (ACE) is a new commuter rail service operating between Stockton and San Jose, California. ACE utilizes Union Pacific right-of-way and Herzog Transit Services, Inc. operates daily service between nine stations. ACE is operated and managed under the aegis of a JPA governed by a Joint Powers Board created by the San Joaquin Regional Rail Commission, Alameda Congestion Management Agency and Santa Clara Valley Transportation Authority.

This JPA was initially established for a 36-month period. The agreement between the entities stipulated membership and powers, financial commitment of members relating to ACE operation and administrative procedures. Three board members represent each member entity. ACE operations are primarily supported by fares, CMAQ funds and operating subsidy from each member entity defined as the daily percentage of boardings and alightings occurring in each county. Sharing of capital costs is agreed upon on a per-case basis. Stations remain the responsibility of the local jurisdictions. For the 36-month demonstration period, the San Joaquin Regional Rail Commission served as the managing agency for ACE service, providing management, planning, finance and support services. The service and the JPA arrangement continue to be successful.

12.4.2 Case Study Summary

From these and other case studies reviewed for MWRRI applicability, the following common elements and benefits were extracted:

- The administrative and operational efficiency of the transportation service system is enhanced through a formal coordinating arrangement particularly as it relates to coordination with private and public funding entities and managing contractor activity
- A single managing entity enhances system recognition by the public and in building and sustaining broad stakeholder support
- Inherent to the institutional arrangement are shared service-delivery decisions and mutual transportation and financial benefits
- The absence of physical ownership of the system right-of-way does not preclude establishing a formal multi-state arrangement
- The arrangements served as a forum for continuing service design, deliver, and quality

12.5 MWRRI Institutional Arrangement Recommendation

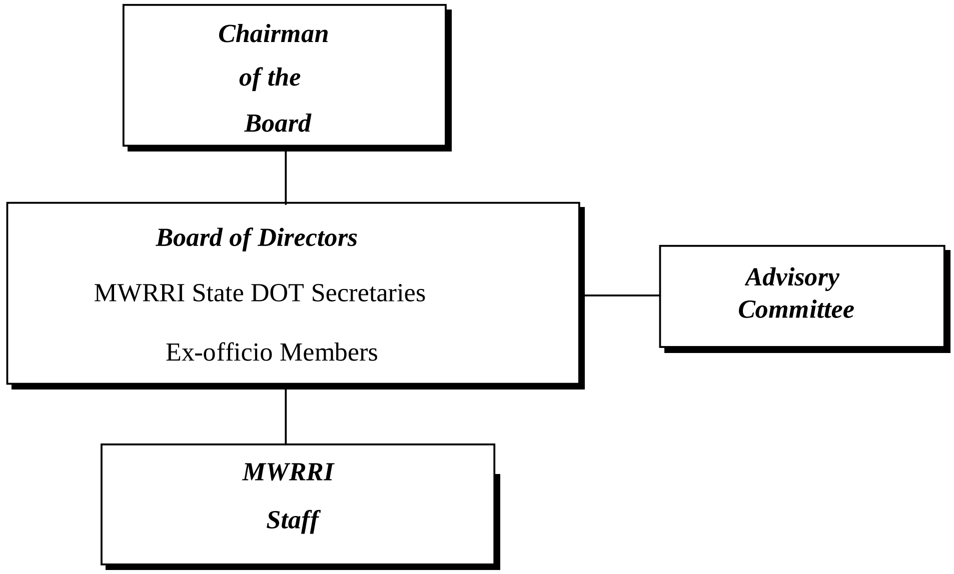
At this stage in the MWRRI planning process, establishing a formal managing entity through a Joint Powers Agreement (JPA) for MWRRS implementation and operation activities could provide increased focus, visibility and support for the MWRRI.

The MWRRI JPA could provide coordinated oversight and management responsibility for MWRRS planning, funding, financial and service-related elements. Additionally, it could serve as the entity to formally and collectively set MWRRI policies, priorities and direct actions, *e.g.*, financial, service related, etc., and provide ongoing implementation and operations-related oversight.

12.5.1 Example: MWRRI Organizational Arrangement

A board of directors would govern the MWRRI JPA. Both voting and non-voting members would comprise this board. Voting members would consist of the State Department of Transportation Secretaries from each MWRRI state. As shown in Exhibit 12-4, supporting the board would be a small MWRRI staff and an Advisory Committee.

Exhibit 12-4
Example Institutional Arrangement – MWRRI-JPA



12.5.2 MWRRI-JPA Responsibilities

While the MWRRI-JPA would coordinate and augment MWRRI activities specifically performed by each state, the JPA would also perform responsibilities specified in the JPA agreement. Responsibilities might include:

- Securing project funding and serving as the designated recipient for federal assets
- Performing financial activities including coordination of grant-related activities, management of system revenues, calculation and collection of state financial support, distribution of system revenue
- Solicitation and selection of contractors for construction projects, system operations and maintenance, and station and on-board services
- Monitoring and enforcing service standards
- Performing operations oversight
- On-going coordinated system planning
- Assisting states in generating stakeholder support
- Coordinating state MWRRI/MWRRS activities and related transportation projects and services

A key responsibility of an MWRRI-JPA would involve the flow of federal funds to support system construction and managing system generated revenue.

12.5.3 MWRRI-JPA Staff Responsibilities

A small staff would support the JPA. Staff responsibilities and activities may include:

Board of Directors support	Construction management

Carry out Board policy	Service operator oversight
System-wide budgeting	Operations planning
Fund management and accounting	Contract management
MWRRS advocacy	Ongoing system evaluation

MWRRI-JPA staff size is intended to remain small, and given the changing nature of MWRRS focus – particularly during the implementation years – it is conceivable that staffing size and responsibilities will be modified periodically to reflect project and system needs. Alternative staffing arrangements could include the hiring of staff, engaging contract management and rotating of staffing responsibility to each member state. Exhibit 12-5 describes each of these potential staffing arrangements.

Exhibit 12-5
Alternative Staffing Arrangements

Hire Board Staff	***Contract Management***	***Rotating State Responsibility***
Three full-time employees as core: ▪ Executive Director ▪ Secretarial support ▪ Consultant support as needed ▪ Increase permanent staff size as needed ▪ Secure office space/ equipment ▪ Salaries/Benefits ▪ Directly supervised by Board	▪ Firm hired for Board services, program management and oversight ▪ Senior consultant assigned to direct efforts ▪ Staff expands and decreases in size in response to MWRRS needs ▪ Skills of staff modified to best respond to MWRRS needs ▪ Contracting mechanisms used by state to retain consultant ▪ Office space and equipment optional	▪ Executive Director with core staff provided by state ▪ Increase direct involvement of states ▪ Requires dedicated full-time state employee for one- year ▪ Potentially requires shifting of financial, contractual responsibilities annually

12.6 Summary

The MWRRI is a complex undertaking that, through the joint activities of nine states, has developed a proposed regional passenger rail system that will greatly enhance travel options throughout the Midwest region. While some advanced planning, funding, implementation and operating activities will be performed by individual states, many activities will require multi-state coordination. Ongoing partnership is integral to the successful implementation and operation of the MWRRS.

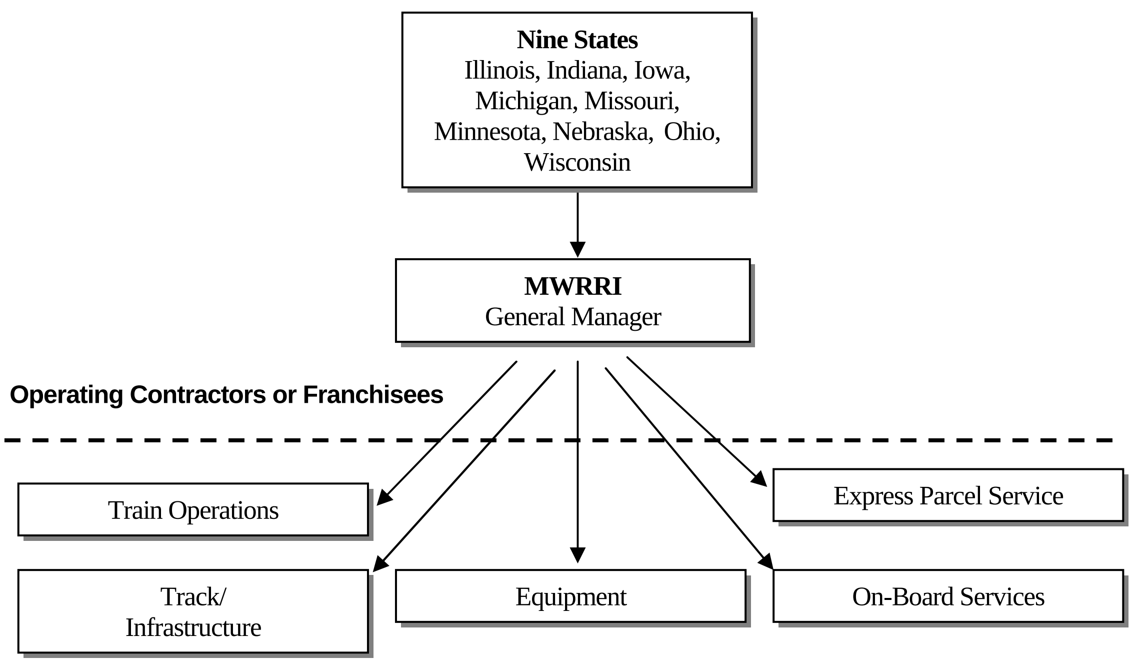
Additional analysis of arrangements and substantial discussion among the participating states is required to effectively define institutional arrangements for the MWRRI and the passenger rail system that will ensue. As part of this continued dialogue, the following questions should be considered within the context of the MWRRI:

- Where does a state's responsibility cease and multi-state responsibilities begin?
- What are the functional responsibilities?

- What are the funding-related responsibilities?
  - Capital
  - Operating
  - Grants and other sources
  - Distribution of revenue
- What role(s) should the states assume regarding policy development?
- What role(s) should the states play pertaining to program management?
- What responsibilities should the states assume regarding operating arrangements with freight and commuter railroads and the selection of the MWRRS passenger rail operator?
- What levels of oversight should the states assume during implementation and operation?

Implementation of the MWRRS will remain the responsibility of the states. Once operational, the states might find it advantageous to either broaden the roles and responsibilities of the MWRRI Steering Committee or take action to establish a formal organization charged with operations and system oversight. Various institutional structures in the Midwest region and in other parts of the U.S. can serve as models for multi-state coordination. These models range from ad hoc multi-state committees, to committees established by multi-state agreement, to a Joint Powers Authority established through legislative authority. So far, the discussion has focused on the institutional arrangements facilitating interstate cooperation to allow smooth operation of the MWRRS. Exhibit 12-6 illustrates a practical structure for an overall organization for MWRRI.

Exhibit 12-6
Potential MWRRI Organizational Oversight



12.7 *Operator Selection Criteria*

As shown in Exhibit 12-6, MWRRS could develop several different contract or partnership relationships to obtain the full range of services needed to operate a modern passenger rail service. A train operator would develop the authorized service, and operate the system to a high standard but need not be responsible for equipment or track maintenance. The MWRRI could contract directly with freight railroads for track access, maintenance and infrastructure improvements; with equipment manufacturers for train maintenance services; with hospitality firms to provide on board service and with a freight courier firm to develop express parcel service.

In this contract model, an MWRRI general manager would establish service criteria, administer federal and state capital funding, and select and monitor the performance of the operating contractors. Amtrak performs this supervisory role today, but under the proposed MWRRS plan, this overall management responsibility would be vested in the MWRRI-JPA.

It appears that Amtrak would have only a minor role concerning train dispatch and track maintenance, since host freight railroads will continue to perform these functions as they do today. If desired, Amtrak could compete for the other four operating contracts in rolling stock maintenance, train operations, on-board services and express parcel service.

Innovative models of service delivery should be carefully considered for application to the MWRRS. By eliminating the role of train conductors, VIA Rail Canada has achieved very high levels of customer satisfaction. This type of structure has the added potential of simplifying the contractual relationship between MWRRS and the freight railroads. By expanding the scope of an on-board service contract to assume all customer-care responsibilities, freight railroads could take over all train operations by providing the operating train crews. This would simplify lines of accountability for on-time performance, clarify cost accounting and avoid disputes over track access rights. This arrangement, which is well established in commuter operations, could be extended to intercity rail systems as well.

Key requirements for selecting operating contractors may include, but not be limited to:

- *Experience*: The existence of an operating entity that has demonstrated knowledge and capabilities in the management, scheduling, maintenance, planning and financial control of rail equipment and/or facilities.
- *Service*: The ability to provide high quality, reliable, on-time service combined with an affordable rate structure based upon an appropriate grant of resources and investment.
- *Planning*: The experience and capability to plan for effective operations, maintenance, engineering and mechanical requirements.
- *Insurance*: The ability to develop and manage safety programs, negotiate and maintain adequate insurance coverage at an acceptable cost, handle claims and administration, and oversee litigation where necessary.
- *Labor*: The ability to negotiate with organized labor, and maintain constructive relationships that would not threaten system performance. This includes the ability to work with labor to derive mutually beneficial productivity agreements.

- *Governance*: A proven capability to provide the management for business operations, with accountability for delivering quality service at the authorized cost.

Regardless of the contracting structure, the MWRRS concept mandates cost-effective provision of services and a high quality of service, to achieve the operating results projected in this study. To that end, the MWRRS represents a paradigm shift toward a well capitalized, efficiently operated and highly developed passenger rail system, which offers an opportunity for innovation in both technology and organization. As such, it cannot be compared to the passenger rail service that exists today in the Midwest region.

12.8 Cost and Revenue Allocation

Because of the geography of the nine MWRRS states and the prominence and location of Chicago, it is clear that a Chicago hub system offers the most effective means of developing a passenger rail network. While several states have sought to develop their own intercity rail systems, the role of Chicago in these corridors means an interstate component is inevitable. This is true even of the Chicago-St. Louis line, which terminates in Missouri. By creating a single system and realizing both revenue and cost economies of scale, the MWRRI has created a project that can justify extensive federal involvement in development of a modern passenger rail service.

Indeed, one purpose of the MWRRI has been to unify the states' interests to ensure that the MWRRS can obtain its fair share of federal funding. The Northeast Corridor (NEC) has benefited for many years from extensive federal investment, in many cases without even requiring a local or state funding match. In contrast, several MWRRI states have been investing their own funds in passenger rail often without any federal assistance. With a reasonable level of investment in infrastructure, the Midwest region can begin an incremental approach to building its own modern passenger rail system that can return an operating surplus like the NEC already does.

Only by working in collaboration with each other can the MWRRI states expect to achieve a successful passenger rail system. A key part of this collaboration will be the way in which states work together in sharing the costs and revenues for both the development and operation of the system. Following a series of discussions and workshops dealing with the cost and revenue allocation process, a *near* agreement (*i.e.* agreement in principal but without formal ratification) has been reached on a number of issues. The following is a summary of allocation issues considered since the 1998 MWRRS Technical Report was finalized:

- Allocation goals and objectives
- Form of the State Match: Infrastructure or Equipment
- Shared Assets: Chicago Terminal and Equipment Maintenance Facilities
- Joint-Benefit Segments and Bilateral Agreements
- Allocation methodology

12.8.1 Objectives for Cost Allocation

A sound cost allocation system acknowledges certain basic principles, and seeks to maintain system integrity while protecting equity interests among participating states. Any allocation solution must represent a combination of logic, equity, accommodation and negotiation. Basic principles agreed upon among the states during earlier discussions included the following:

- Allocate capital investment and operating costs of the system among stakeholders in a fair and equitable manner
- Incorporate the minimum level of complexity necessary to meet the needs and objectives of the MWRRI
- Determine the best performance metrics on which to determine allocation of costs and revenues, acknowledging that individual corridor solutions may vary based on ridership potential, fare levels, speeds and frequencies, and hence each states' level of financial participation may also vary
- Acknowledge that asset ownership, whether it is common (*e.g.*, fleet) or individual (*e.g.*, stations) is to be subordinate to system-controlled use
- Preserve freedom of action for the states, *e.g.*, the ability to join the plan at any time or leave at will, wherever possible, acknowledging there may be a corresponding cost for doing so
- Identify criteria for defining common or shared system costs

The major objectives of an allocation system are to encourage operating efficiencies of scale, to promote the desired actions and to avoid unintended consequences. For the MWRRI, the main objectives were to:

- Encourage deployment of cost-effective services
- Maximize operating cash flow
- Satisfy requirement to minimize or eliminate operating subsidies

Cost-effective services have been defined as those exhibiting a positive net present value (NPV) of revenues minus direct operating costs over a 20-year time horizon. Under these criteria, some initial operating losses during the ramp-up years may be acceptable, provided those losses can be recouped from operating surpluses later. The minimum threshold of a positive NPV should be achieved for the system as a whole, for each state as a responsible entity, and for each corridor or line as an entity. Strategies that support these objectives include:

- Limiting service expansion to reasonable levels, consistent with demand
- Maintaining control over operating costs
- Establishing and maintaining fares at market levels

Corridor responsibility implies financial responsibility for rolling stock costs, station costs, operating costs, operating revenues and, by extension, initial operating deficits and distribution of subsequent operating surpluses. Infrastructure costs are also identified on a corridor basis, but may be treated somewhat differently, based on the availability of federal capital assistance.

12.8.2 Form of the State Match: Infrastructure or Equipment

MWRRI project funding is assumed to comprise primarily federal funds of up to 80 percent of the total capital project costs, including infrastructure and rolling stock. The remaining 20 percent state and local match can be made up of rolling stock purchases, improvements to stations and other improvements made within state boundaries.

Rolling stock purchases are clearly needed for each corridor, based on anticipated service and levels of ridership. The states can negotiate among themselves their share of trains needed to start service on each corridor. Therefore, the purchase of rolling stock can become the majority of each state's matching share for federal infrastructure funding.

It is anticipated that states can purchase rolling stock using bonds guaranteed by the full faith and credit of states, and associated with specific revenue streams such as a gasoline or sales tax. This type of bond has the lowest rates. It may also be possible for states to directly finance their purchase through equipment vendors, which would come at a slightly higher interest rate. It is expected that the strongest corridors will have enough free cash flow to repay their equipment cost, while the weaker corridors will not be able to do this. All corridors however, are projected to generate a positive operating ratio by 2025, which is one of the FRA's key prerequisites for obtaining federal capital.

Amtrak was able to privately finance its Acela Express equipment purchase, so it is not unreasonable to expect the strongest MWRRS corridors will also cover their own equipment costs. Making a commitment to use passenger revenue streams to repay rolling stock costs, even though those revenue streams are not the dedicated funding source for the bond issuance, encourages fiscal responsibility. States will be less likely to encourage excessive amounts of service or hold fares below market levels, if there is an anticipated revenue target to achieve.

States may retain title to their rolling stock, so long as such an ownership does not give any state the right to interfere with appropriate maintenance and operating practices. In other words, a state would not be permitted to restrict cars from traveling on any MWRRS corridor, but each state may retain title to a certain number of rail cars. A state's ability to invest in rolling stock would eliminate the need to invest one state's funds in the infrastructure of another state.

12.8.3 Shared Chicago Terminal and Equipment Maintenance Facilities

The Chicago hub is central to the MWRRS. Chicago is the site of extensive passenger and equipment transfer activity since all trains, except for the St. Louis-Kansas City service, either originate or terminate there. In addition, Chicago generates and attracts the majority of passengers since it is by far the largest population center in the region.

Because of the need for complex construction in an urban environment, Chicago-area improvements also happen to be the most expensive work of the whole MWRRS. In addition to line improvements, Union Station and equipment maintenance facilities are a system, rather than a route-specific, expense. The total cost of all of these investments would be $1.19 billion.

The most expensive single component of this investment, costing $656 million, would be for the *South-of-the-Lake* improvement from Chicago to Porter, IN. This would establish a dedicated passenger corridor from downtown Chicago to the south and east.

Although completion of the South of Lake improvement is critical to the business success of MWRRS, the benefits of many corridor investments in infrastructure cross state lines. This is particularly true of Chicago-area improvements. For example, the proposed investments in Indiana and Illinois will do little to benefit the residents of those states but Michigan will benefit greatly. Likewise, track improvements between Indianapolis and Cincinnati will primarily benefit Ohio residents, even though most of the track is in Indiana. Furthermore, these improvements will be made on infrastructure that is mostly owned by freight railroads. This combination of cross-state boundary investments and private-entity ownership makes a compelling case for a strong federal role in financing track and infrastructure investment.

Thus, it has been proposed that the cost of the shared Chicago terminal improvements be treated as a system responsibility, not just a responsibility of the State of Illinois. Exhibit 12-7 identifies those areas of proposed federal responsibility for track improvements, signals, station improvements, administration, dispatching and station operations as have previously been agreed upon by the MWRRI states.

Exhibit 12-7
Chicago Terminal Area

The City of Chicago, the Metra commuter railroad, Amtrak's long-distance trains service and the freight railroads will significantly benefit from the Chicago-area improvements proposed for the MWRRS. Indeed, some of the proposed MWRRS improvements have already been included in the CREATE Chicago Rail Improvement Plan[1] recently announced by the Association of American Railroads. Although the MWRRI might fund some of these Chicago improvements, it is clear that the benefit of these investments goes far beyond the need for providing MWRRS passenger service.

Allocation of Shared System Expenses

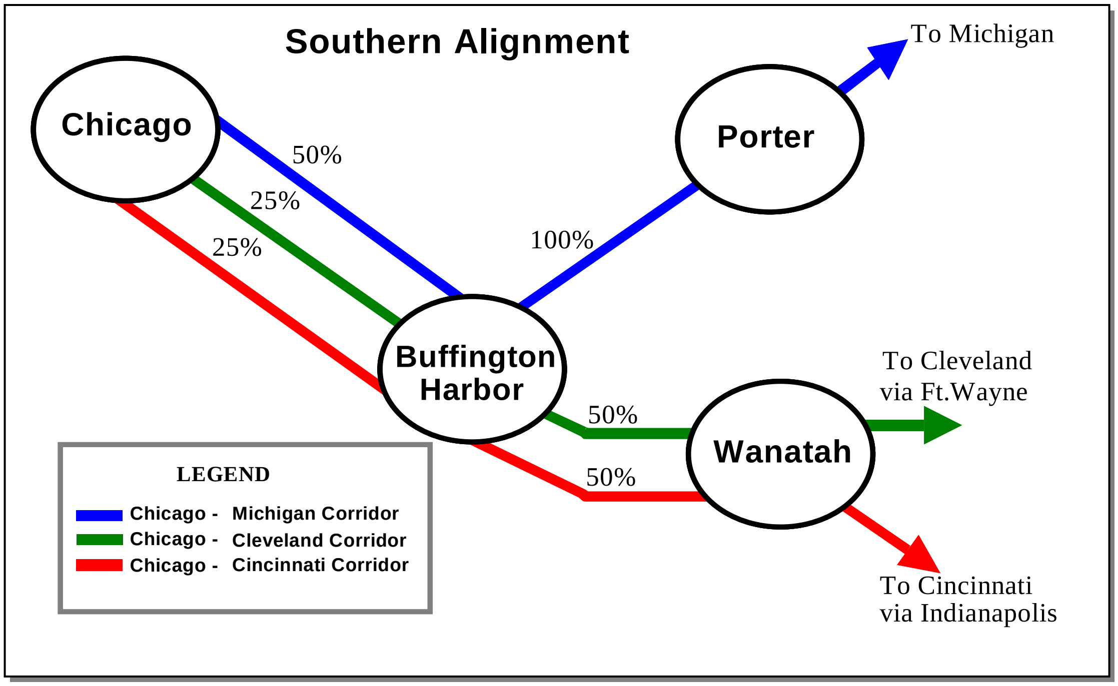
Since Chicago Terminal improvements are to be treated as a system expense, the capital costs of these improvements have been assigned in accordance with each state's train-miles. However, the St. Louis-Kansas City line does not use the Chicago-area improvements, and the Omaha/Quincy lines gain little benefit from them. Funds for rerouting Carbondale trains off the St. Charles Air Line are being provided so Chicago can accomplish its urban redevelopment goals, and this will occur whether MWRRS passenger-related improvements proceed or not. Therefore, in this analysis, these three routes do not contribute any funds for the capital costs associated with the Chicago-area improvements.

There is a need for sharing the costs of the South of the Lake improvement between the Michigan, Cleveland and Cincinnati routes. While capital costs are assumed 100 percent federally funded, track maintenance costs (both operating and cyclical) still have to be shared between these three routes. As shown in Exhibit 12-8, the MWRRI states have previously agreed to allocate these costs based on relative train miles:

- From Chicago to Buffington Harbor
    - 50 percent to Michigan
    - 25 percent to Cleveland
    - 25 percent to Cincinnati
- From Buffington Harbor to Porter, IN
    - 100 percent to Michigan
- From Buffington Harbor to Tolleston and beyond to Wanatah, IN
    - 50 percent to Cleveland
    - 50 percent to Cincinnati

[1] For a description of the proposed public/private partnership to address Chicago rail congestion problems, see: http://www.aar.org/ViewContent.asp?Content_ID=1566

Exhibit 12-8
***South-of-the-Lake* Cost Allocations**



12.8.4 Joint-Benefit Segments and Bilateral Agreements

Of special concern are four MWRRS corridors in which one state clearly benefits from infrastructure improvements made in another state, but where the relative benefit is not clearly indicated, *i.e.*, where one state has not declared responsibility for the entire corridor. Exhibits 12.9 and 12.10 identify the segments that may require bi-lateral cost and revenue sharing agreements.

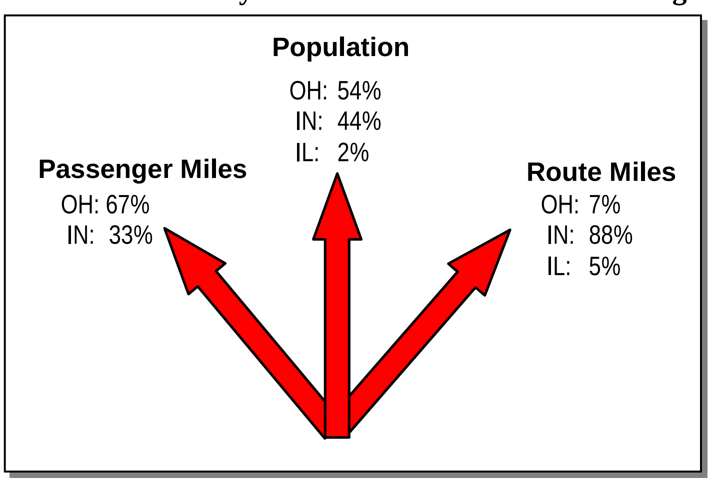
Exhibit 12-9
Corridors/Segments Possibly Requiring Bi-lateral Agreements

Corridor/Segment	*States Involved*
Madison-Twin Cities	Wisconsin and Minnesota
Fort Wayne-Toledo	Indiana and Ohio
Indianapolis-Cincinnati	Indiana and Ohio
Des Moines-Omaha	Iowa and Nebraska

Exhibit 12-10
Joint-Benefit Corridors and Areas of Responsibility

A shown in Exhibit 12-11, 54 percent of the population served by the Cincinnati-Chicago line consists of *Ohio* residents, who generate 67 percent of the passenger miles. However, 88 percent of the route mileage is in Indiana. It may therefore be reasonable to expect Ohio to contribute at least a portion of the cost of developing this route. However, as the following discussion shows, accounting-based methods for allocating revenues all have significant practical problems:

Exhibit 12-11
Allocation Variations by Method for the Cincinnati-Chicago Line



Population Based

- Population does not directly equate to costs incurred or benefits received. Service levels and/or accessibility to rail or alternative transportation modes may be markedly different from one population center to another – even within the same corridor.
- Population is only a surrogate for rail demand and does not necessarily translate directly to rail demand.
- The U.S. Census is collected every ten years. Consequently, population data may not be as reliable in intervening years. Further, these data are not necessarily available in the desired segmentation or level of aggregation.

Passenger Counts by State of Origin or Residence

Two possible methods were identified for allocating costs and revenues:

- Option A: Using ticket counts, allocate costs and revenues based on passengers by station of boarding within each state.
- Option B: Survey riders and split costs and revenues based on passengers by state of residence, *e.g.*, consider only Ohio and Indiana residents for the Chicago-Indianapolis-Cincinnati and the Chicago-Cleveland routes and ignore residents of Kentucky, Illinois, Pennsylvania, Michigan, etc. It is presumed that Illinois passengers, at least those from Chicago, might also be excluded, while passengers from Kankakee might be included. The potential complications are numerous.

While both methods provide a measure of benefit to state residents, results are not available until after operations start, making this system hard to plan and budget for. This measure only marginally relates to the cost or benefit of providing service, and does not take into account the length of trips.

Passenger Miles by State of Origin or Residence

Again using either ticket counts or surveys of riders, passenger counts could be weighted based on trip length, fare paid or some other measure.

Amtrak's Base-Increment System

Amtrak uses a service junction-based system, called Base-Increment, to allocate revenues and costs between route segments of some trains. Base-Increment accounting is not used on all trains, and is generally used only when the route of a core system train is extended at a state's request under a local subsidy agreement. Then the state subsidy will not be supporting the entire cost of the train, but only the service extension the state has requested. Base-Increment accounting allows Amtrak to determine the revenues (and corresponding costs through RPS allocation) associated with each segment of a train's route. Base-Increment accounting is a standard Amtrak accounting method that states have readily accepted, since it tends to increase the revenues allocated to their state-supported trains.

In the Midwest region, for example, the Chicago-St. Louis-Kansas City *Anne Rutledge* has been set up as a Base-Increment train with two segments – the Chicago-St. Louis leg and the St. Louis-Kansas City leg that includes all stations beyond St. Louis to Kansas City. Each leg defines an accounting *bucket* into which ticket revenues are credited on an all-or-nothing basis. One hundred percent of the revenue, riders and passenger miles originating or terminating at stations west of St. Louis are attributed to the St. Louis-Kansas City leg. Only local traffic between Chicago-St. Louis is assigned to the Chicago-St. Louis leg. Amtrak's Base-Increment methodology therefore, assigns connecting revenue earned between St. Louis and Chicago to the St. Louis-Kansas City segment.

Since the St. Louis-Kansas City segment was established as a separate MWRRS route, a Base-Increment approach was used to attribute incremental Chicago-St. Louis connecting revenues. This is a sensible progression since all ticket revenues associated with stations west of St. Louis would be lost to MWRRI if St. Louis-Kansas City service were not operated. Service extensions on Michigan branch lines are beneficial to the MWRRI for the same reason. No adjustments were needed for Michigan as Michigan revenues are only reported on a consolidated basis in the MWRRI financials.

Meeting in the Middle

Since results are unavailable until actual operations begin, accounting-based definitions are unsuitable for determining capital share allocations. Capital shares have to be agreed before construction starts based on the best available information. States retain the authority to negotiate bi-lateral or tri-lateral agreements to allocate funding responsibilities and revenues in a given corridor. If states on shared corridors are unable to agree on an appropriate mechanism for sharing costs and revenues and, as a result, require additional formality or evaluation, they may wish to engage in a mediation assessment to investigate the relative values of:

- Economic benefits such as jobs and economic development
- Financial benefits
- Travel benefits of regional mobility

An equitable manner of apportioning a route's revenues and operating costs might be based simply on the relative train-mile share. Essentially, a fixed percentage table would be agreed upon upfront that would determine each state's share of operating surplus (or subsidy requirement) for each route. Since operating surpluses may be used to repay state revenue bonds, the level of each state's investment might also influence the level of revenue allocated to each state.

It is the states' responsibility to develop bilateral agreements that best meet their goals and objectives. However, until such agreements are reached, a working assumption is required for analysis purposes.

- For this analysis, it was assumed that each state would take responsibility for completing its own infrastructure between Madison-Twin Cities and Fort Wayne-Toledo.
- A 50/50 capital cost sharing between Iowa and Nebraska was assumed for Des Moines-Omaha, and a 50/50 cost sharing between Indiana and Ohio for the Indianapolis-Cincinnati segment. State revenue allocations also represent this 50/50 cost split on the joint benefit segments.

Exhibits 12-12 and 12-13 show capital costs, revenues and operating cost responsibility allocated to each state, based on:

- Each state's relative share of capital investment in the corridor, or
- An allocation based on train miles *outside* the Chicago Terminal area. Since the capital cost of shared Chicago Terminal assets would be federally funded with a matching share provided by all of the states, it would be inequitable to include those train-miles in Illinois' revenue share calculation.

Exhibit 12-12 shows that, under the capital share methodology, Illinois and Ohio fare better since their routes tend to be more costly to develop. Under a train-mile methodology, Iowa and Michigan fare better since they operate many train miles over infrastructure that is relatively inexpensive to develop. However, the results are very close whether the simple train-mile or a more complex capital share methodology is used.

Exhibit 12-13 reports the level of capital investment allocated to each state. The "Surplus/20% State Ratio" column compares the level of state contribution with the passenger revenue stream that will ultimately be available to service the debt. While this analysis stops short of developing a state-specific financing plan, it appears that Illinois, Michigan, Minnesota and Wisconsin should have sufficient operating surpluses to fully cover their equipment capital costs.

The *Rolling Stock minus 20% State* column in Exhibit 12-13 compares the rolling stock capital to an assumed 20 percent match requirement for the federal-funding grant. Since the current estimates for infrastructure costs have been significantly increased, the rolling stock cost no longer comprises 20 percent of the project total. Overall, $452 million or about 30 percent of the total state match will need to be directly invested in infrastructure; the balance of $1,071 million is in equipment making up the remainder of the state's total required contribution.

Individual states, however, still have the latitude to decide whether to make their contribution in the form of equipment or infrastructure investment. States can minimize the need to build infrastructure in other states by buying rolling stock instead. Nebraska, for example, could contribute its 20 percent match by purchasing trains and using federal dollars to pay for the Des Moines-Omaha infrastructure improvements. Some states may not want to own any equipment and prefer to make their investment totally in infrastructure. Other states, particularly Nebraska and Ohio, may choose to make up the difference by providing their entire matching shares in the form of equipment.

Exhibit 12-12
Allocation of 2025 Operating Costs and Revenues by State
(Millions of 2002$)

State	***Allocation by State Capital Invest***				***Allocation by Train Miles***			
	Operating				***Operating***			
	Costs	***Revenue***	***Surplus***	***Ratio***	***Costs***	***Revenue***	***Surplus***	***Ratio***
Illinois	$111.0	$141.8	$30.8	1.28	$108.0	$137.7	$29.7	1.28
Indiana	$56.5	$76.6	$20.1	1.36	$61.4	$82.4	$21.0	1.34
Iowa	$22.7	$23.1	$0.3	1.02	$23.4	$23.8	$0.4	1.02
Michigan	$85.1	$112.7	$27.6	1.32	$91.2	$120.8	$29.6	1.32
Minnesota	$18.7	$31.0	$12.3	1.65	$18.9	$31.2	$12.3	1.65
Missouri	$35.3	$46.6	$11.3	1.32	$35.3	$46.6	$11.3	1.32
Nebraska	$6.7	$6.8	$0.1	1.02	$5.5	$5.6	$0.1	1.02
Ohio	$50.7	$62.0	$11.3	1.22	$43.3	$52.9	$9.6	1.22
Wisconsin	$79.3	$131.3	$51.9	1.65	$79.1	$130.8	$51.8	1.65
Total MWRRS	**$466.1**	**$631.8**	**$165.7**	**1.36**	**$466.1**	**$631.8**	**$165.7**	**1.36**

Exhibit 12-13
Allocation of Capital Costs by State
(Millions of 2002$)

State	***Total Capital***	***Infra-structure***	***Rolling Stock by Train-Miles***	***Funding***		***Rolling Stock minus 20% State***	***2025 Operating Surplus****	***Surplus / 20% State Ratio***
				Federal 80%	***State 20%***			
Illinois	$1,356	$1,038	$318	$1,085	$271	$47	**$30.8**	**11.4%**
Indiana	$1,070	$908	$162	$856	$214	($52)	**$20.1**	**9.4%**
Iowa	$298	$240	$58	$238	$60	($2)	**$0.3**	**0.6%**
Michigan	$873	$682	$191	$698	$175	$16	**$27.6**	**15.8%**
Minnesota	$352	$313	$38	$281	$70	($32)	**$12.3**	**17.4%**
Missouri	$978	$892	$85	$782	$196	($110)	**$11.3**	**5.8%**
Nebraska	$88	$74	$14	$70	$18	($4)	**$0.1**	**0.6%**
Ohio	$1,197	$1,097	$100	$958	$239	($139)	**$11.3**	**4.7%**
Wisconsin	$1,490	$1,329	$161	$1,192	$298	($137)	**$51.9**	**17.4%**
Total MWRRS	$7,700	$6,572	$1,128	$6,160	$1,540	($412)	**$165.7**	**10.8%**

* The 2025 operating surplus is based on allocation by capital cost.

12.8.5 Allocation Methodology

A proposed methodology for revenue and cost allocation is provided:

- Calculate direct operating expense for the system by corridor
  - Assign each major direct cost category to an appropriate operating unit, *e.g.*, train crew and track maintenance right-of-way to train miles; station costs and marketing to passengers
  - Calculate the system operating cost for each major direct cost category
  - Sum the units for the system, *e.g.*, train miles and passengers
  - Calculate the unit cost for each direct cost category, *e.g.*, train crew cost per train mile, marketing cost per passenger
  - Multiply the unit costs by the units (miles, passengers) for each corridor
  - Calculate the direct operating cost for each corridor
- Calculate system-wide costs
  - Calculate the system-wide costs for administration, Chicago hub, operations, etc.
  - Divide the system-wide costs by total direct costs to yield an overhead percentage
  - The system operator takes a guaranteed 10 percent profit margin based on certain budgeted costs under its direct control. Alternatively, an equivalent amount can be allocated as a percentage of revenue.
  - Multiply the direct operating cost for each corridor by the overhead percentage plus one to determine the operating cost for each corridor
- Identify revenue by corridor
  - Calculate corridor revenue based on ticket sales and riders by corridor
  - Reserve 3 percent of net operating surplus (revenues exceeding costs) for system requirements for infrastructure, route development, etc.
  - The remainder of the operating surplus reverts to the states to repay revenue bonds or to establish reserve for future capital investments

12.9 Summary

There is no simple or single cost allocation method that will ensure complete fairness and equity to each state. As was depicted in Exhibit 12-9, four of the corridors traverse two or more state lines, clearly provide service to more than one state, and are without clear designations as to areas of responsibility. As such, the process designed for the MWRRI has sought to minimize the impact of cost allocation.

In most other cases, corridor segments are clearly *owned* by their respective states. Areas of possible contention – the Chicago hub issue, for example – are most easily dealt with by ensuring only federal dollars are used to build infrastructure in that area, and that any revenues and operating costs or losses are carried by the individual corridor trains operating into the Chicago hub. It is anticipated that this will be a profitable segment for each corridor.

The allocation methodology is based on corridor-level responsibilities, with capital and operating costs and revenues allocated to each corridor. Simplicity in data collection and calculation would again be key to the approach used, while maintaining accountability for service and fare decisions. Various methods for allocating costs and net revenues within each corridor have been discussed:

- Split costs and revenues based on the population of the major cities served
- Split costs and revenues based on a service junction, *e.g.*, all costs from Indianapolis to Cincinnati become the responsibility of Ohio, based on track and/or train miles, or by using Amtrak's Base-Increment methodology
- Identify a mutually agreeable sharing of responsibility. For example, Illinois currently provides 25 percent of the funding for the state-supported service between Chicago and Milwaukee.
- Survey riders, split costs and revenues based on passengers by state of origin, *e.g.*, Ohio vs. Indiana, for the Chicago-Indianapolis-Cincinnati route
- Use survey data and/or ticket sales to split costs and revenues based on passenger or train miles, adjusted for service levels

Each case has unique characteristics. The recommendation is that each set of states creates their own bi-lateral or tri-lateral agreement for sharing costs and net revenues. However, it is believed that the advantages of a negotiated, fixed percentage allocation mechanism outweigh the disadvantages. Allocating the operating surplus based on each state's capital contribution is a simple mechanism to ensure an equitable allocation.

13. Conclusion and Next Steps

13.1 Introduction

The MWRRS is both an enhancement to the Midwest region's transportation network and an engine for economic growth. The region's economy, like that of many other regions in the U.S., is experiencing significant growth. Trends in economic and population growth are expected to continue and it is essential that the region's transportation network keep pace with demand to sustain this growth. Because commercial and economic growth, to a large degree, is dependent upon travel within the region, mobility – for both passenger and freight – is key to sustaining the region's economic vitality and quality of life. The Midwest Regional Rail Service (MWRRS) will serve as a key component in achieving a 21st century transportation system for the region. The MWRRS is designed to provide a coordinated passenger rail network with attractive travel times, service reliability and the system-wide connectivity necessary to offer an attractive mobility option and to foster economic growth in the Midwest region.

13.2 MWRRS Benefits

13.2.1 Expanded Regional Mobility

The MWRRS will connect the major metropolitan areas and urban centers within nine Midwest states. It will encompass a rail network of more than 3,000 route miles and serve a population of almost 60 million people. More than 80 percent of the region's population will reside within an hour's drive of a MWRRS rail station or feeder bus terminal. The MWRRS will provide the travel time and travel-related amenities that appeal to business and leisure travelers. In many respects, the conveniences provided by the MWRRS will exceed those offered by passenger air service, including direct downtown-to-downtown service, access to smaller urban areas throughout the system and frequent connectivity to regional centers. The MWRRS will also fill the void created by the continuing decline of commercial air service to smaller urban areas in the Midwest region.

13.2.2 Increased the Attractiveness and Popularity of Intercity Rail Service

It is anticipated that the MWRRS could reverse the erosion of intercity passenger rail service that has taken place over the past several decades. The MWRRS has the potential to parallel the success of Amtrak's service on the Northeast Corridor. It will provide an opportunity to restore the value and utility of passenger rail service in the region by broadening stakeholder support (*e.g.*, elected officials, businesses and travelers) and by providing a publicly popular service.

13.2.3 Environmental Benefits

Modal shift projections prepared as part of this study suggest that a large number of intercity trips will be diverted from auto to MWRRS trains. This will lessen congestion along several major highway corridors during peak travel times, thereby lessening the projected auto vehicle miles for the region and significantly reducing auto emissions levels.

13.2.4 Derived Economic Benefits

The MWRRS will generate significant user benefits and provide reasonable levels of resource savings in auto operating costs and in airport and highway congestion relief. The MWRRI 2000 plan reported a 1.7 ratio of total benefits to total capital costs, which represents the highest level of economic benefit associated with investment in a passenger rail service outside of Amtrak's Northeast Corridor.

13.2.5 Derived Community Benefits

The MWRRS Economic Analysis conducted in 2000, showed that the system will generate significant economic growth in the region – 4,000 construction jobs associated with the implementation of the MWRRS and 1,500 new permanent jobs associated with the operation of the service. As a result of the construction and operating cost increases in the 2002 plan, these job creation estimates can only increase. There will be opportunities for redevelopment surrounding stations in urban areas, as well as $9.1 billion in economic benefits that will generate substantial increases in employment in the service, commercial and tourism industries. The public and private sectors will be able to participate in joint development projects ranging from the construction of new multi-use terminals in major cities to new commercial, retail, and service facilities near suburban and intermediate stations.

13.2.6 Expanded Commercial Business Opportunities

Integral to the provision of a comprehensive and coordinated passenger rail service is the availability of passenger amenities and complementary transportation services to make travel on the MWRRS convenient and attractive. Service and patronage levels will support a wide array commercial business opportunities for large and small entrepreneurs. Examples of business opportunities include on-board food and business support services (*e.g.,* cellular phones and photocopying; dining and shopping facilities at stations) and ground transportation services (*e.g.*, taxis, buses, limousines and rental cars).

13.2.7 Other Benefits

In addition to fostering regional mobility, generating substantial new economic growth and contributing to improved congestion management and air quality, the MWRRS system will also:

- Provide a regional intercity passenger rail service for a capital investment of approximately $2 million per mile for infrastructure
- Provide a competitive passenger rail system with vastly improved travel times, service frequencies and fares that can compete with the air and auto modes
- Offer its passengers a level of comfort and convenience superior to that of air travel
- Generate revenue surpluses after paying its operating costs that can offset part of the states' share of the capital costs
- Improve the safety and productivity of rail passenger and freight, by making track, signaling and grade crossing improvements – thus keeping the Midwest region competitive as a major transportation hub for the nation
- Improve the performance and travel times of long-distance Amtrak service by its use of the same improved track infrastructure and station facilities as the MWRRS trains

13.3 Challenges

A series of short- and long-term actions are necessary to advance the MWRRS plan towards implementation. The key challenges and requisite actions are summarized below:

13.3.1 Project Funding and Funding-Related Activities

Since the time the MWRRI began planning for a passenger rail system in the region, aside from passenger rail corridor improvements in the west and the Northeast Corridor, the MWRRS was the *only* coordinated regional passenger rail improvement program moving towards implementation. Over the course of the past five or so years, this has changed. Today a number of southern, Gulf Coast and New England states, along with Florida, Washington state and California are in the process of developing their own passenger rail upgrade programs. While planning for the MWRRS has moved ahead, many of these other projects have successfully secured Congressional earmarks or federal funds to support planning, preliminary engineering and environmental analysis activities.

A vigorous action plan to obtain funding commitments for MWRRS implementation is now essential in project planning. Efforts are required to secure federal funding commitments to advance the project into the design, engineering and environmental review stages. Likewise, a coordinated multi-state effort must be launched to secure a dedicated, long-term, capital-funding source to support system-wide engineering and construction.

Action must also commence to gain federal agency approval to conduct an environmental review of the MWRRS in order to satisfy National Environmental Policy Act (NEPA) requirements and to position the MWRRS project for receipt of federal grant funding and TIFIA loans.

13.3.2 Project Advocacy

A regional stakeholder coalition is required to solicit active support for the MWRRS and secure the required levels of state and federal funding. This regional stakeholder coalition should consist of elected officials – mayors, legislators, governors and members of Congress – as well as private sector advocates and the public. Their foremost responsibilities include soliciting active support for the MWRRS and assuming an active role in securing federal and state funding.

Actions should be taken to establish a board of advisors representing major corporations and businesses throughout the Midwest region. Members would consist of the CEOs and senior staff representatives from the private sector. This board would provide a forum for presenting the economic benefits of the MWRRS and publicizing the MWRRS' contribution to regional commerce and economic growth. The voice of business is extremely powerful in soliciting the support from other businesses, local and national elected officials and the community-at-large.

In addition, consideration should be given to the creation of an external board of advisors comprised of a cross-section of interested Midwesterners. Nominated by the Secretaries of Transportation from the MWRRI states, this board would serve as a vehicle to provide further stakeholder promotion and public feedback on the MWRRS. Meetings of the advisors would involve an exchange of information about the status of the project and comments, concerns and questions to the MWRRI Steering Committee and to the state DOTs.

13.3.3 Interstate/Amtrak Cooperation and Institutional Arrangements

The phased implementation of the MWRRS will result in various states performing different activities during the same year. For example, during the initial phases of implementation, Illinois, Michigan, Minnesota and Wisconsin will be performing construction-related activities, while Indiana, Iowa, Nebraska, Missouri and Ohio will be involved in design, environmental studies and pre-construction activities. To properly support these activities, the management and institutional structures required for the MWRRS must be flexible and evolve over time to respond to the changing needs of the states as their corridors progress from planning stage to revenue service.

The actual pace of the phasing plan hinges upon the capability of each state to proceed with project implementation activities. Since the federal government is the predominant funding source for infrastructure improvement costs, the MWRRS management structure will evolve over time in response to the level of funding and the complexity of the system being managed.

The MWRRI Steering Committee comprised of representatives from nine states and Amtrak has managed the concept and feasibility planning activities over the past several years. This Steering Committee should continue into the initial years of project implementation. Its role, however, will evolve from planning, coordination and review to one that is more involved in project funding, satisfying grant requirements and addressing implementation issues. At this stage of the MWRRI, it is essential that a strong working relationship be forged between the states, Amtrak, the freight railroads and the various labor unions to ensure that system needs are identified and that the underlying principles of the MWRRS vision are incorporated into the actual service provided.

The actual implementation of the MWRRS will remain the responsibility of the states. Once operational, the states may find it advantageous to broaden the roles and responsibilities of the MWRRI Steering Committee or to take action to establish a formal organization charged with operations and system oversight. There are various institutional structures in the Midwest and in other parts of the country that can serve as models for such a multi-state coordination. These models range from ad hoc multi-state committees, to committees established by multi-state agreement to a Joint Powers Authority established through legislative authority.

13.3.4 Shared Rights-of-Way with Freight and Commuter Railroads

While the 2004 Plan for the MWRRI was being developed, considerable progress was made in opening a dialog with freight railroads and considerable resources were expended in carrying out preliminary capacity studies. Continued dialogue with the freight and commuter railroads is needed. The key steps are to finalize agreement on planned right-of-way improvements, use of shared rights-of-way, and potential adjustments and refinements required to accommodate freight, commuter rail and proposed MWRRS operations.

Freight railroad support of the MWRRS is essential. Ongoing discussions with freight railroads on MWRRS infrastructure needs, operating requirements and service plans are essential to gain freight railroad support, and to coordinate actions between freight and commuter railroads and the MWRRI states. Some states have already initiated such discussions. These discussions will help the states gain a better understanding of freight operating requirements, schedules and other needs and develop more refined corridor-specific MWRRS operating plans.

A defined process should be put in place to establish ongoing working arrangements between the freight railroads and the MWRRI states, with the objective of reaching consensus on capital and operating requirements and short- and long-term service needs.

The MWRRI states should nurture the support of their respective governors and legislatures and continue to voice their support for, and assist in shaping, Congressional legislation favorable to intercity passenger rail. The MWRRI states should adopt intercity/high-speed passenger rail policies advocating (1) a national system of which intercity passenger rail is an integral part, (2) a national intercity passenger rail system, (3) a dedicated federal multi-year funding source, (4) preservation of the integrity of the freight railroads, and (5) a competitive selection process among service providers.

13.4 Next Steps

There are many steps that the nine participating states need to take in order to continue the momentum toward implementation of the MWRRS. These actions can be separated into immediate, short-term, medium-term, *i.e.*, over the next two to three years, and long-term actions, *i.e.*, three years and beyond. Immediate and short-term actions include:

- Update the economic impact analysis to identify benefits to system users and the region
- Plan endorsement by the states
- Finalize the implementation plan
- Build grassroots support for the project
- Schedule further discussions with the freight railroads
- Secure federal/state funds for preliminary engineering and design and the required environmental reviews

Medium-term actions include:

- Secure federal/state funds for construction
- Refine and finalize the operating plan
- Develop marketing program
- Select construction projects

Long-term actions include:

- Construct Phases 1 through 7 over a ten-year period
- Manufacture and assembly of rolling stock
- Introduce full MWRRS service

Concurrent with continuing efforts to broaden and strengthen support for the MWRRS from local, state and federal stakeholders, the business community and citizens, there is a need to advance the technical planning for the proposed system, refine the financing plan and strategies and develop institutional arrangements related to the MWRRS. These additional activities are necessary to effectively define and position the MWRRS for funding and ultimately implementation. Work on these activities will be undertaken immediately following this study to enhance the case for the MWRRS.