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.

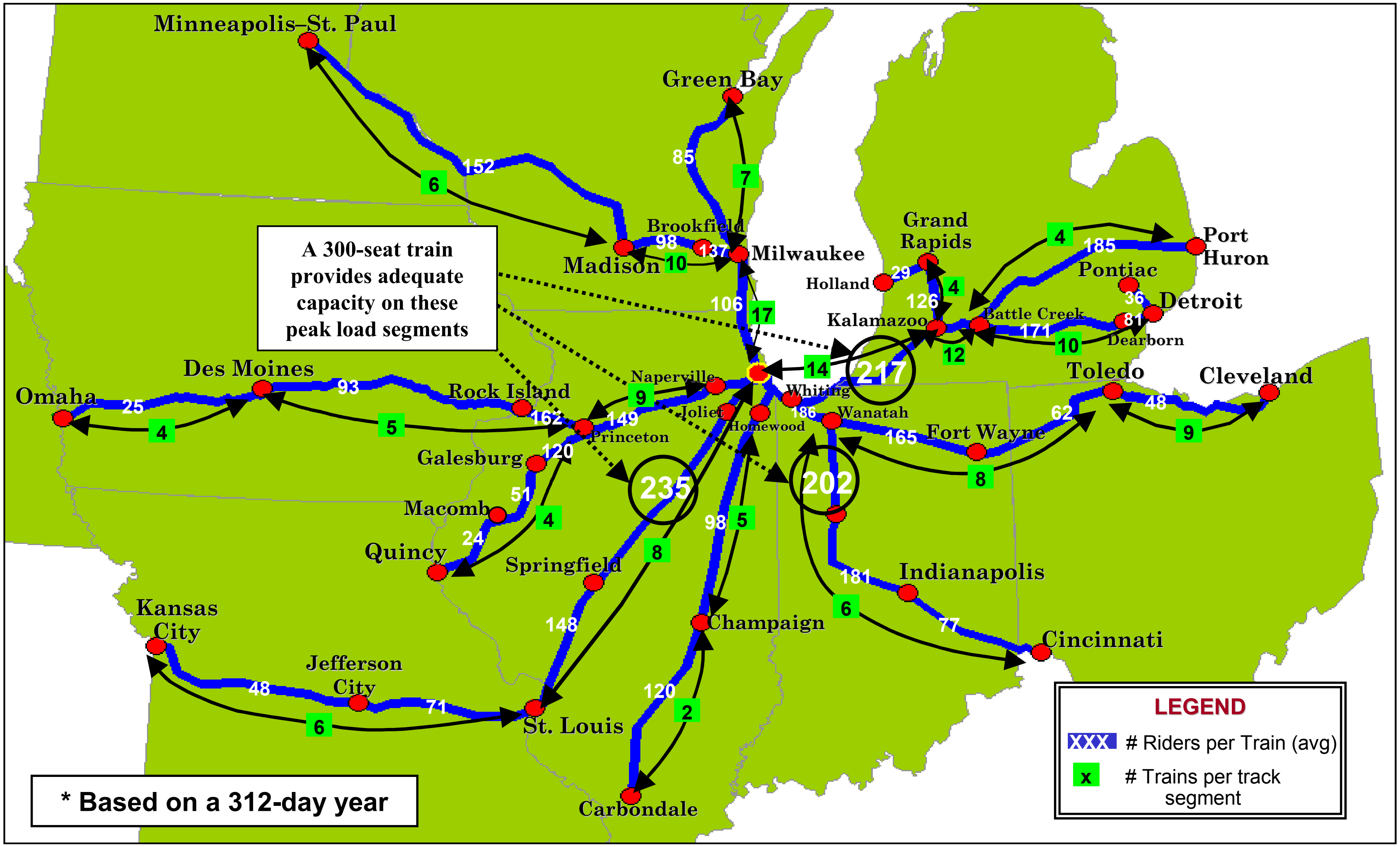
- Five percent for lines with limited freight activity:
  - Chicago-Detroit and Michigan branch lines
  - Chicago-Cincinnati
  - Chicago-St. Louis
  - Chicago-Toledo (Southern Alignment)
- Eight percent for moderate freight activity:
  - Chicago-Carbondale
  - Chicago-Quincy/Omaha
- Ten percent for very 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

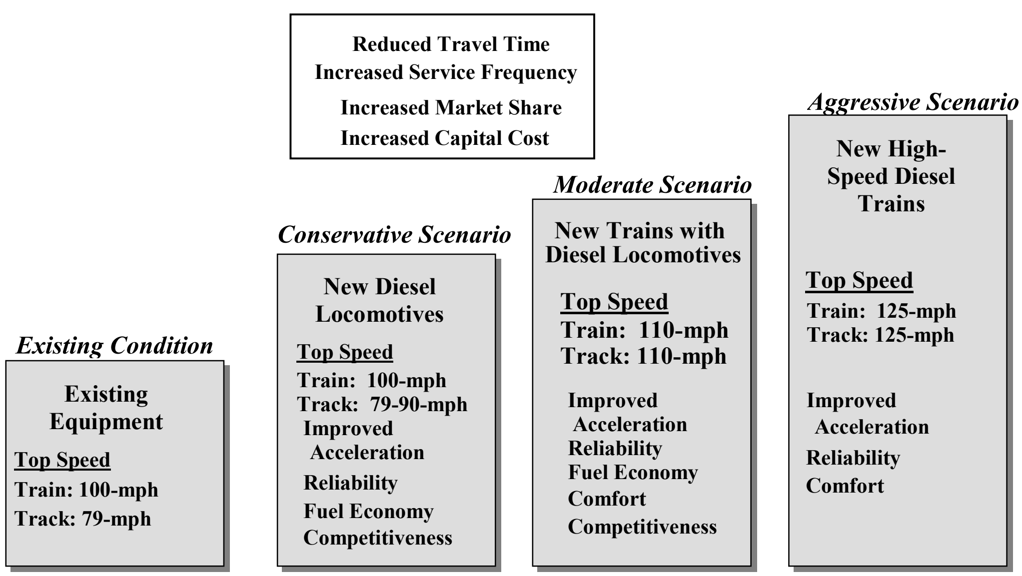
This section discusses the selection of a generic train technology, which can be used to estimate travel times in the schedules used for modeling purposes. The text documents the process by which the train technology and moderate speed option were selected during the study conducted in 2000.

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

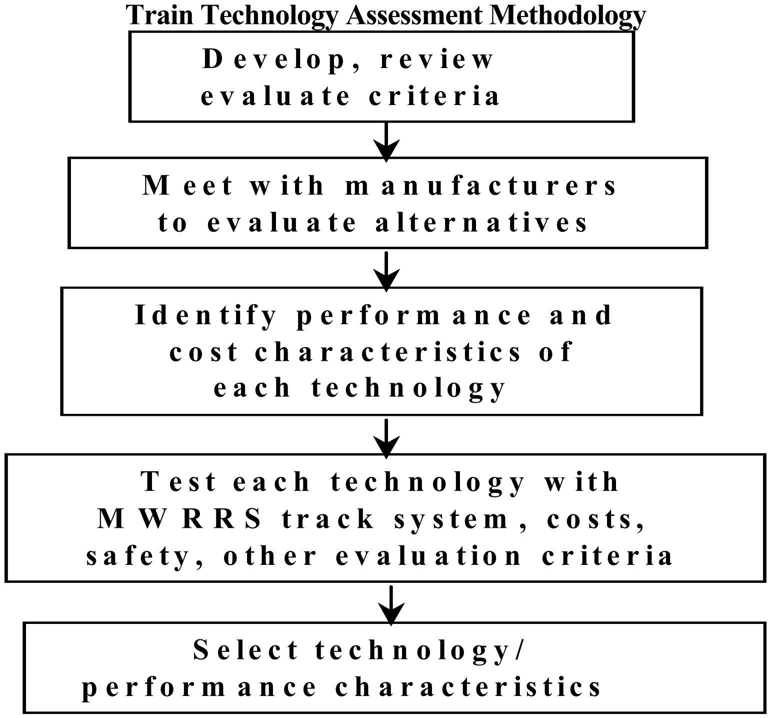


[3] However, the connectivity provided by the Cleveland Hub System rectifies forecast light ridership on the east end of the Cleveland line. Three additional destinations served by Cleveland Hub – Detroit, Columbus and Pittsburgh – would add significantly to the ridership on the MWRRS Cleveland line. 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

5 locations provide nightly access to 17 trains

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

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:

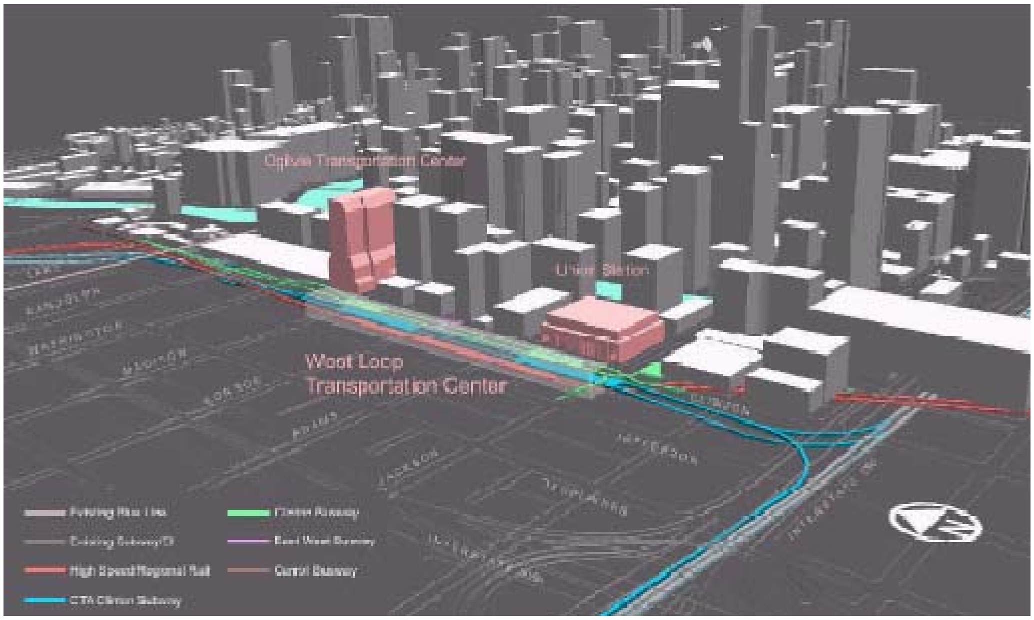
- Amtrak and Metra jointly sponsored a June 2002 study by HDR/CANAC that focused on short-term solutions for accommodating Metra growth and Phase I MWRRS services at CUS by 2008. A longer-term study is needed that takes account of Metra's plans for shifting some operations to other downtown stations, 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

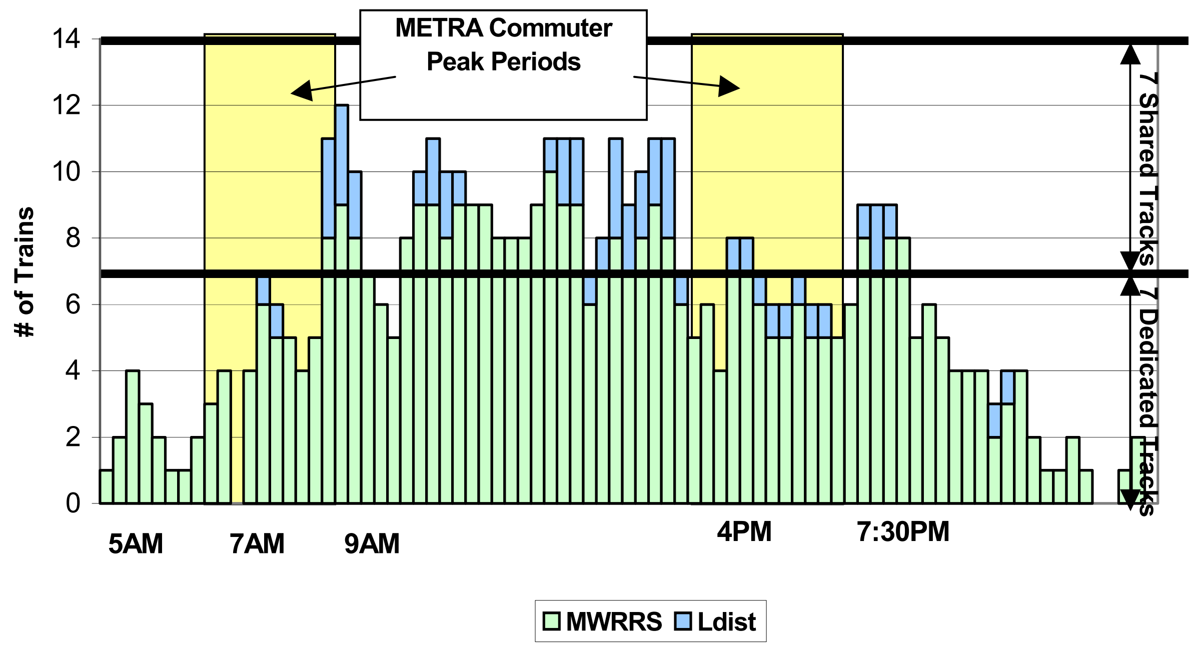
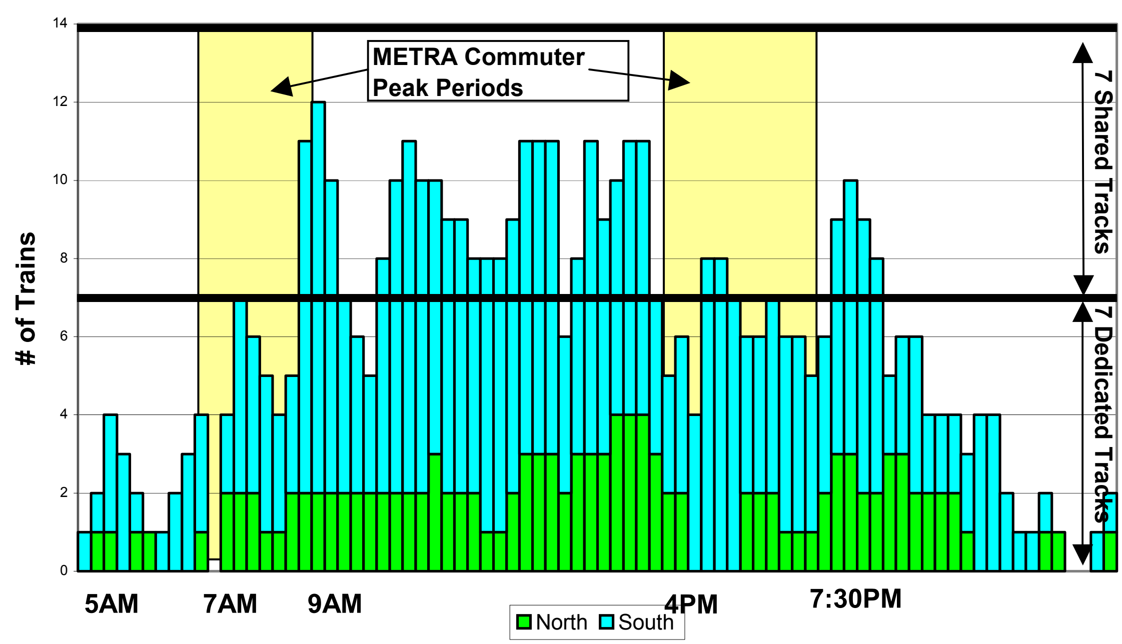


Exhibit 7- 14
CUS Track Occupancy: North/South



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.

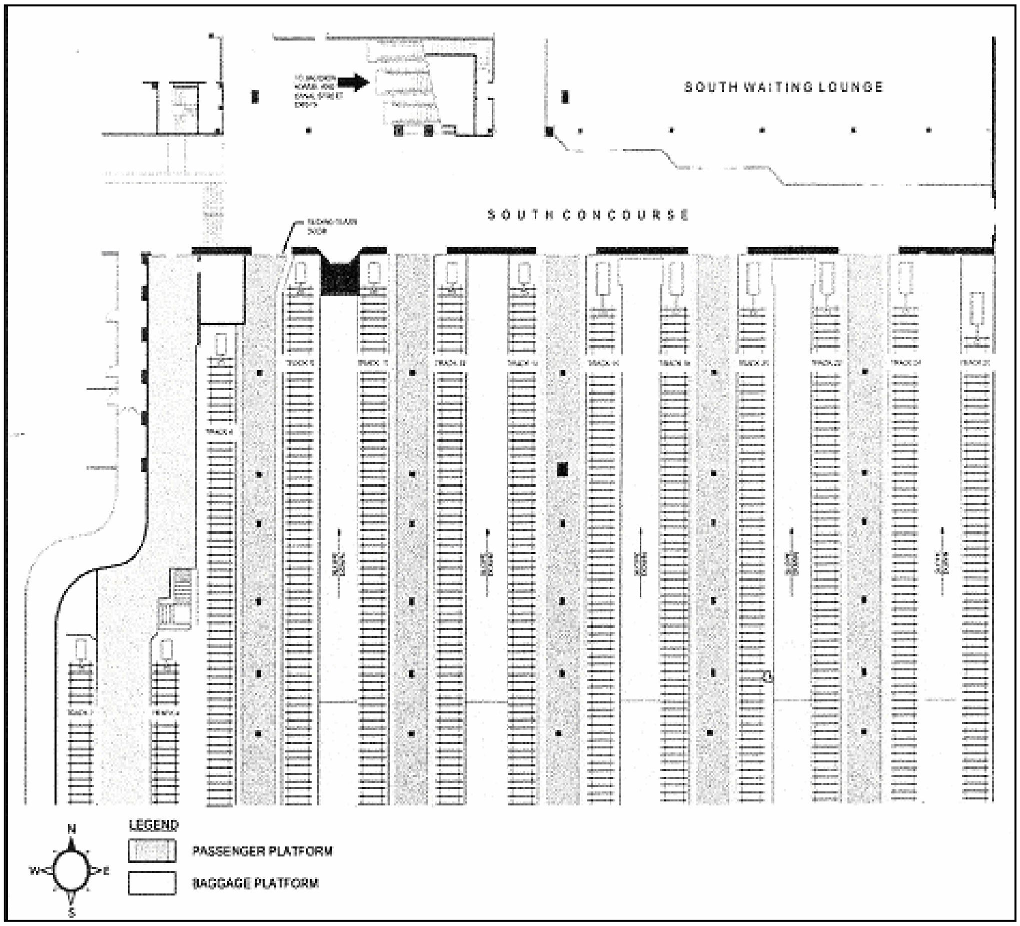
It is believed that the current CUS platform configuration will work well not only for MWRRS passengers, but also for express parcel traffic. As shown in Exhibit 7-16, separate baggage platforms were constructed between each track. A ramp descends directly from each platform to the basement, where the 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

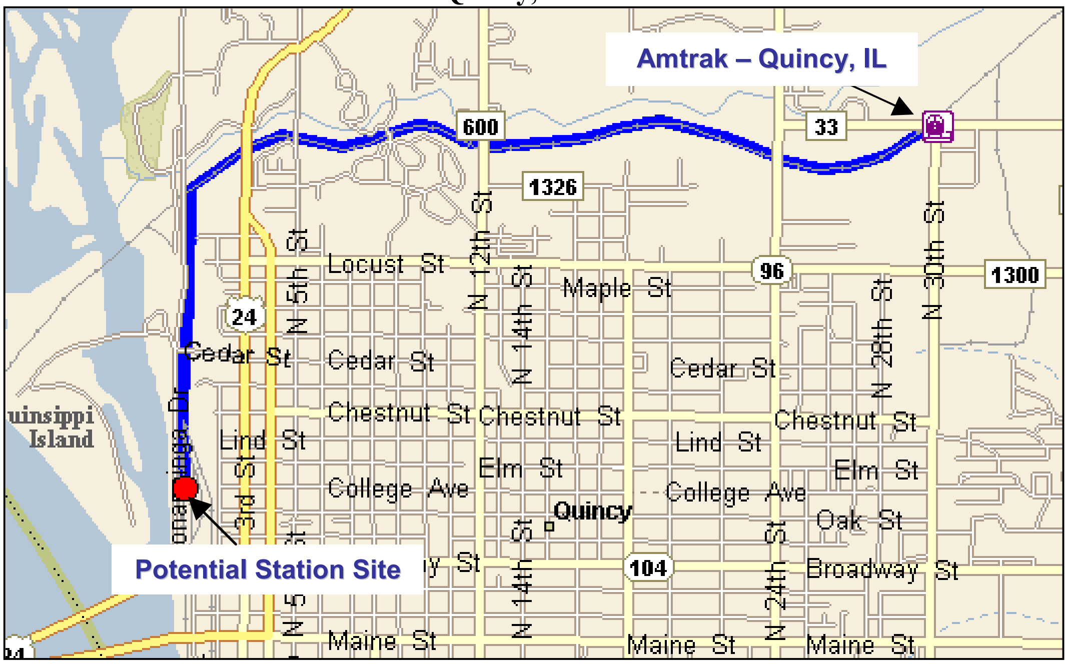
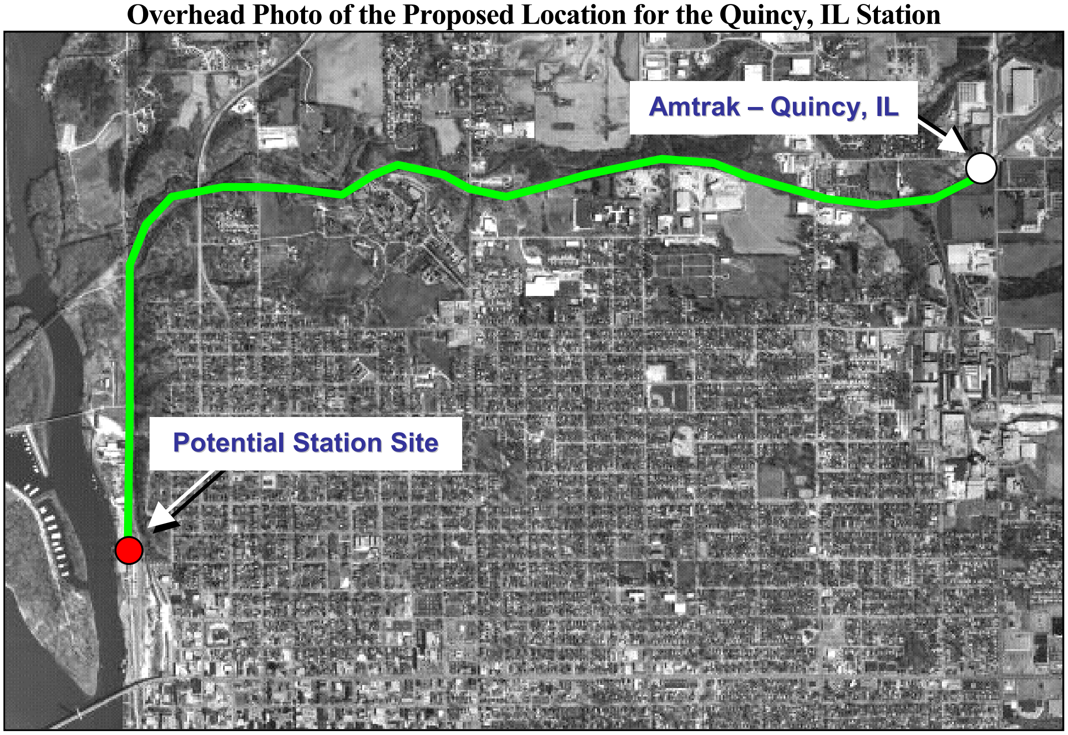


Exhibit 7-17
Overhead Photo of the Proposed Location for the Quincy, IL Station



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

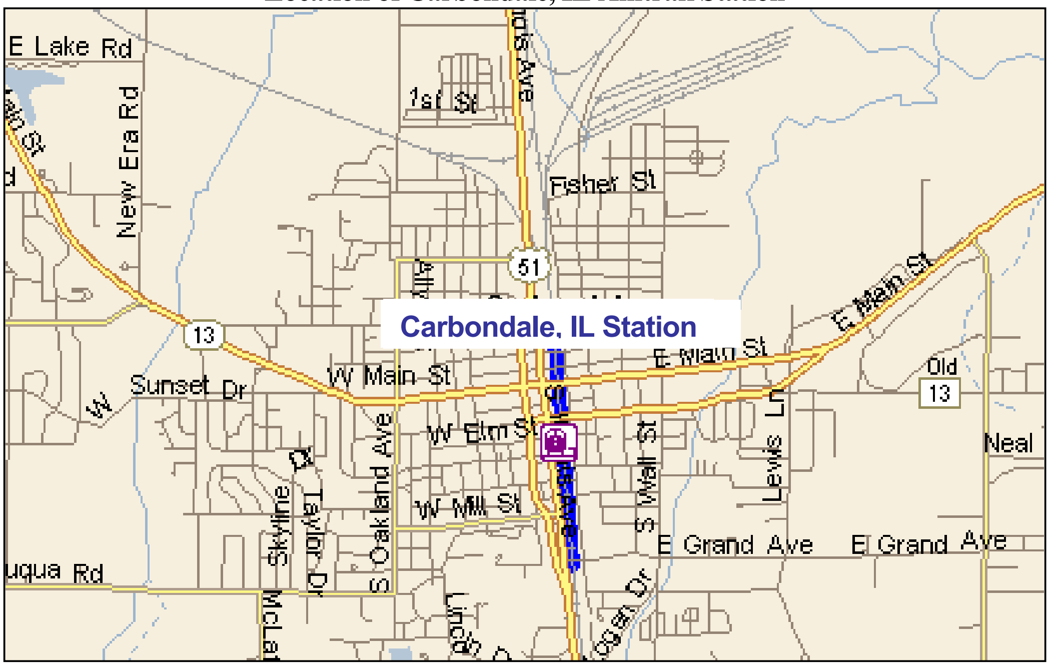
The Quincy station needs a dedicated platform track for reversing passenger trains. This is not a problem for the current Amtrak operation since the train pauses for only a few minutes before continuing to West Quincy, but extended layover times of 30-40 minutes for trains turning back to Chicago may 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

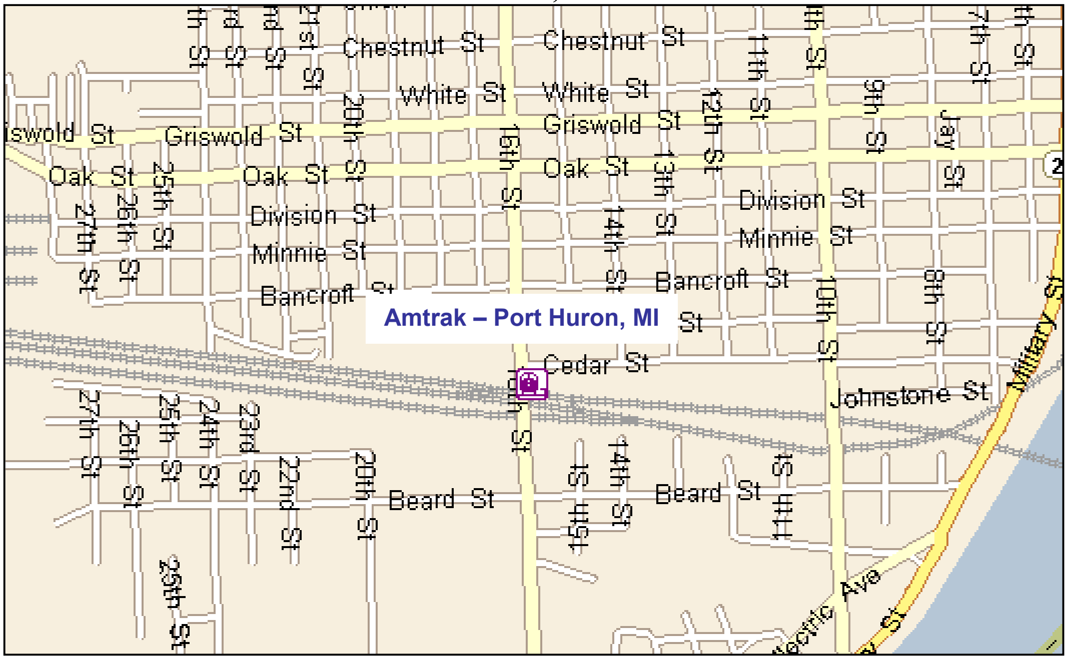
Current facilities at Carbondale seem adequate to support the proposed MWRRS operation, assuming that the Rock Track can be used for storing the mid-day equipment turn 401-402 as well as the overnight layover of 403-400. Mechanical servicing facilities on the Rock Track may not be adequate, in which 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

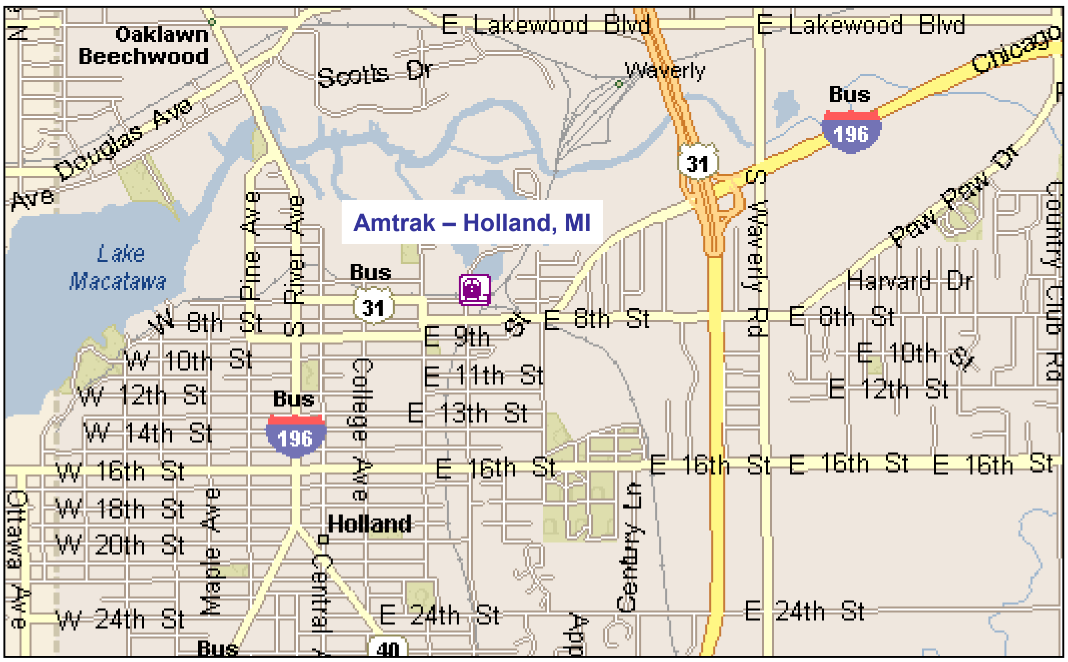


Exhibit 7-24
Photo of the Holland, MI Amtrak Station

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:

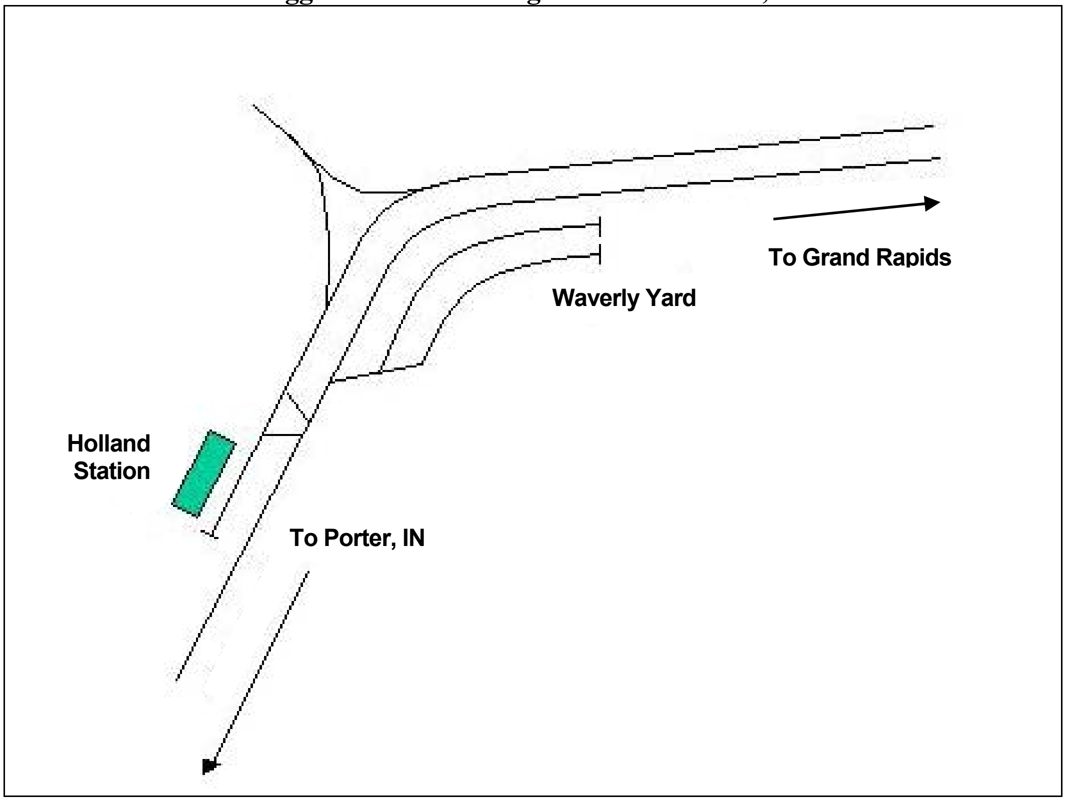
- In the immediate vicinity of the Holland station, or
- In CSX's Waverly yard – about a mile northeast of the station

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.

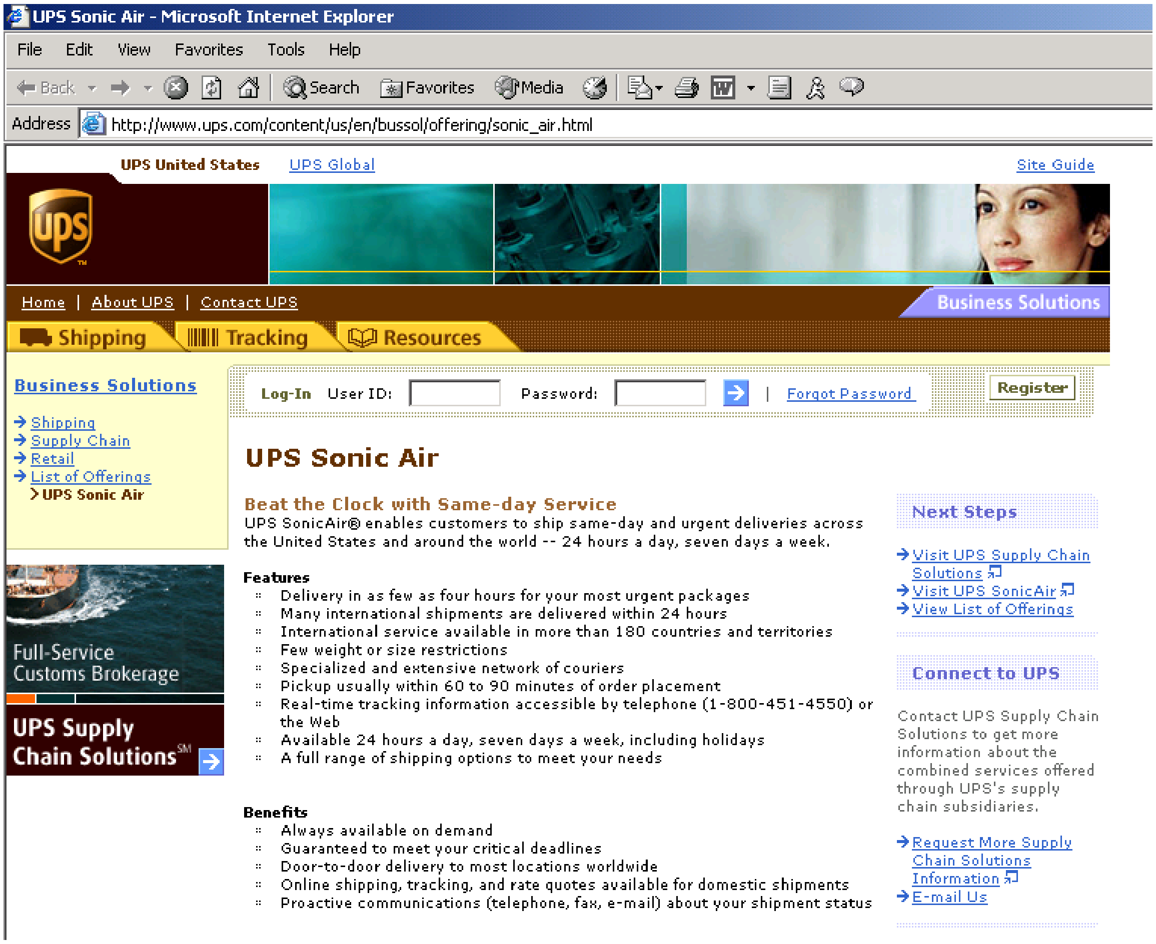
MWRRS will improve corridor frequencies and speeds enough to make rail attractive for parcels as well as passengers. To see how an MWRRS express parcel service could be organized the structuring of similar American and European services was investigated.

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

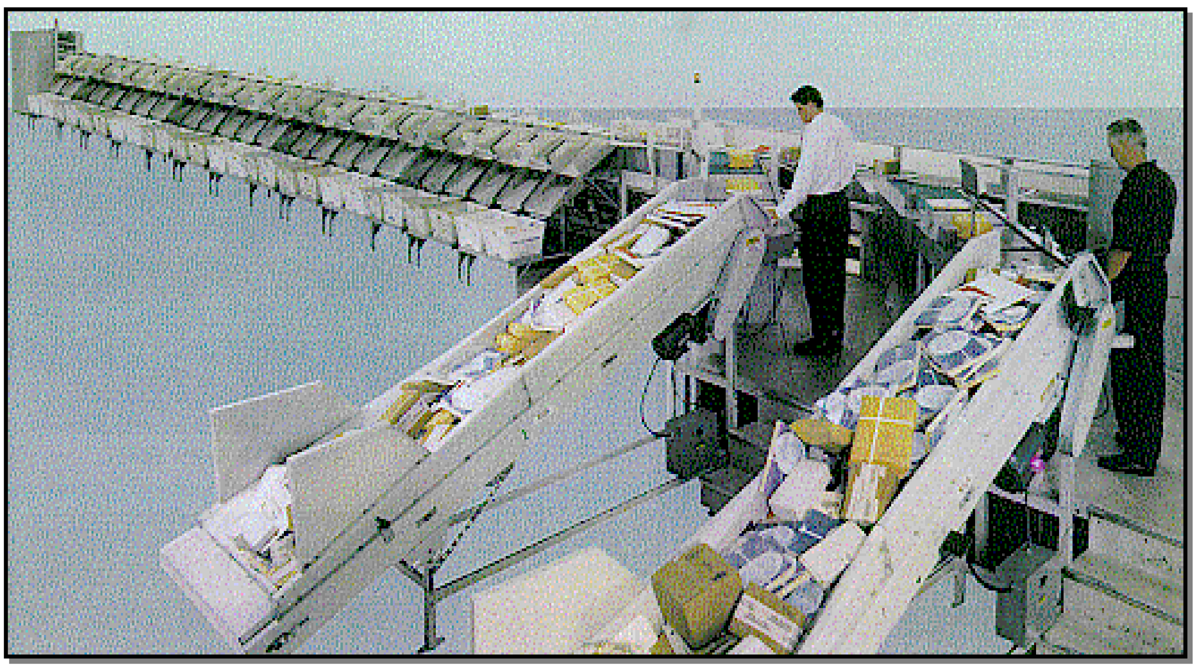
At Chicago, packages arriving from local couriers are sorted for departure on the correct outbound train. Packages from arriving trains are sorted for delivery to local couriers or further movement on outbound connecting trains. Most MWRRS parcels will originate, terminate or pass through Chicago. The 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.

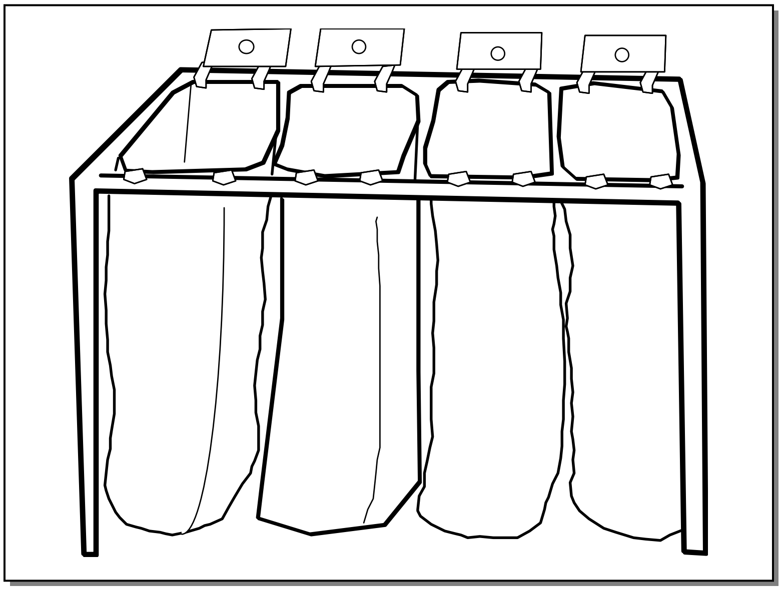
The Esprit package service uses manual sorting and Lockheed Martin recommends manual sorting as the best, lowest cost method until the cost of a machine can be justified. The capacity of even Lockheed Martin's smallest machine that sorts 2,500 packages per hour with up to 56 outputs, shown in Exhibit 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

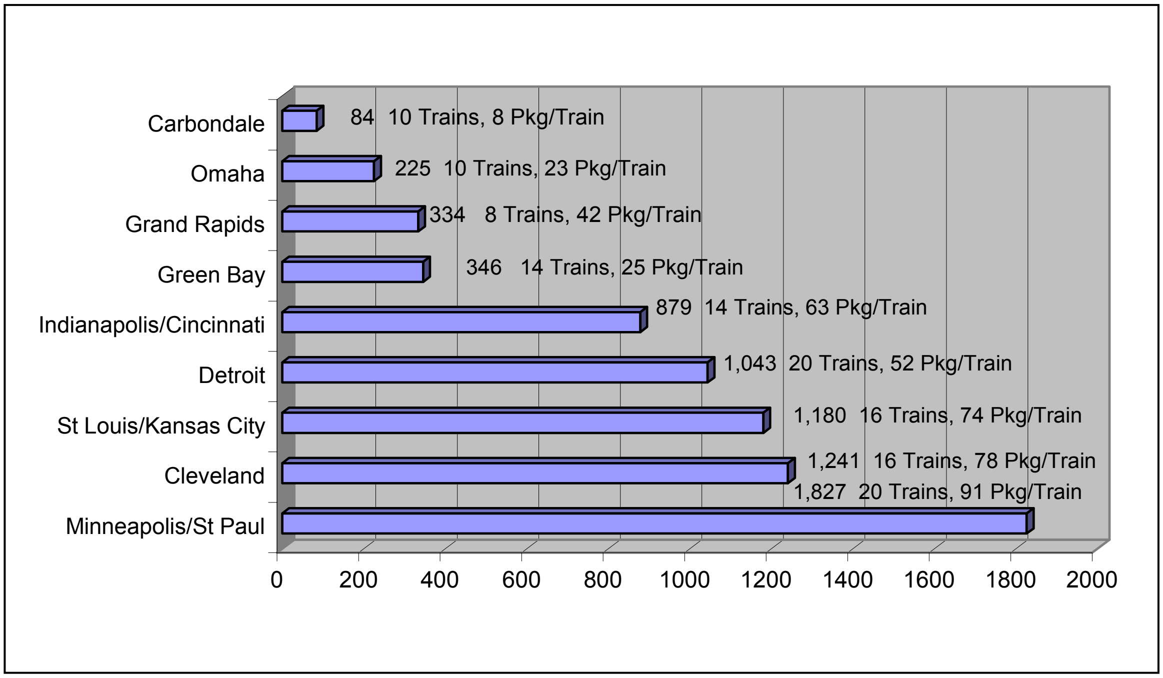
If, however, a space of sufficient size cannot be found, the amount budgeted in the express parcel business plan is sufficient to allow space to be leased at a nearby office building at commercial rates. Automated sorting can be considered a future possibility, as the cost of a new machine is $650,000. 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.

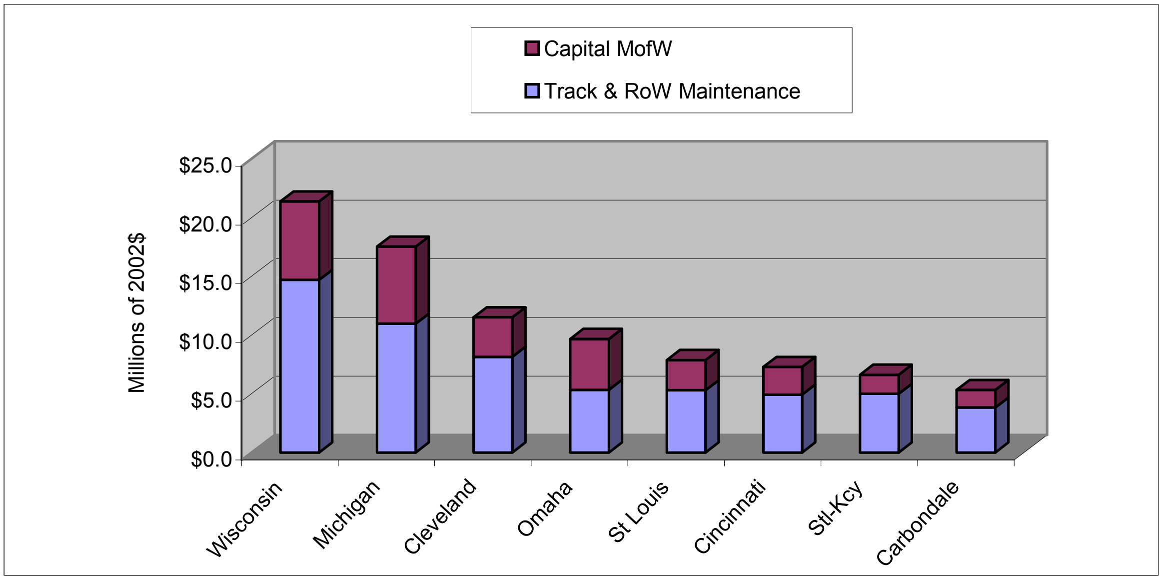
Exhibit 7-37
Cost Adjustments Following Upgrade of a Rail Line

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.

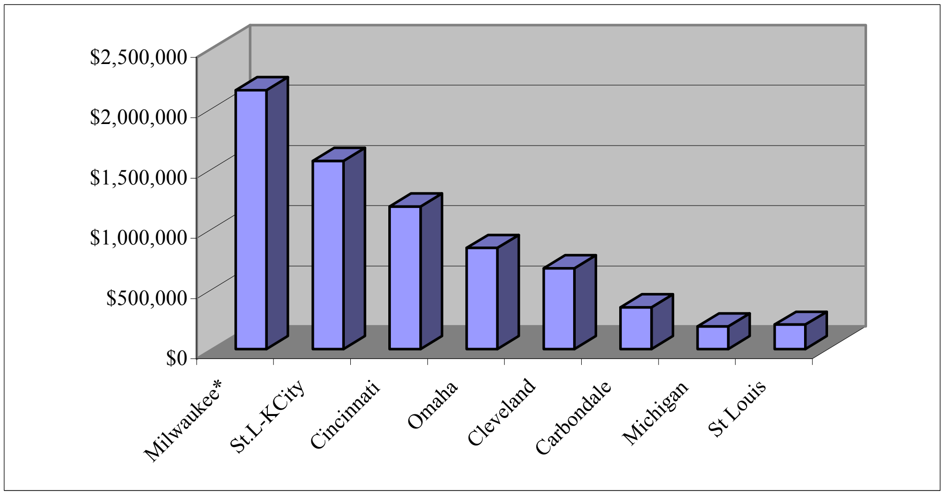
Exhibit 7-37
MWRRS Station Operating Expenses (2002$)

	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.) <u>$8.07 Million</u>
- 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

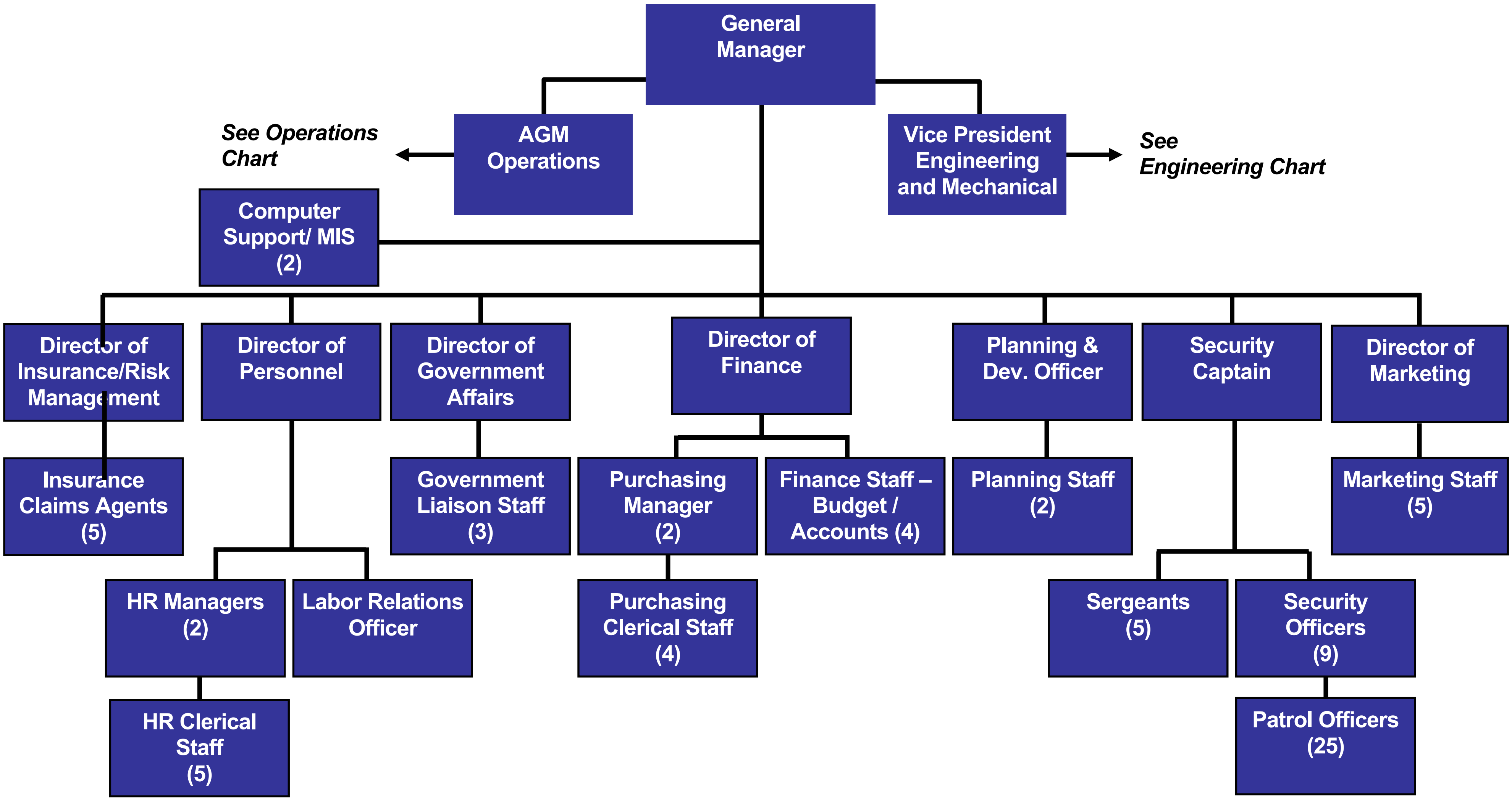


Exhibit 7-42
Proposed MWRRS Operations Structure

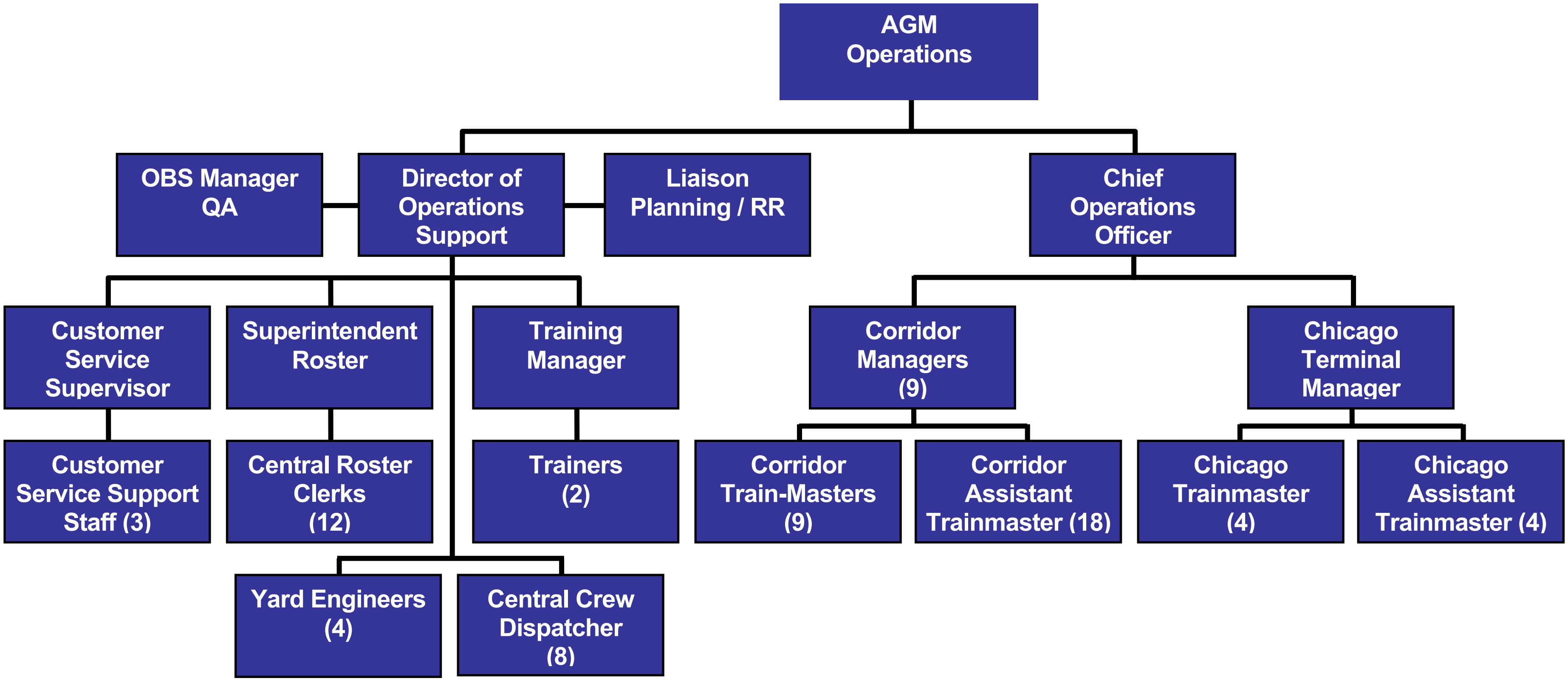
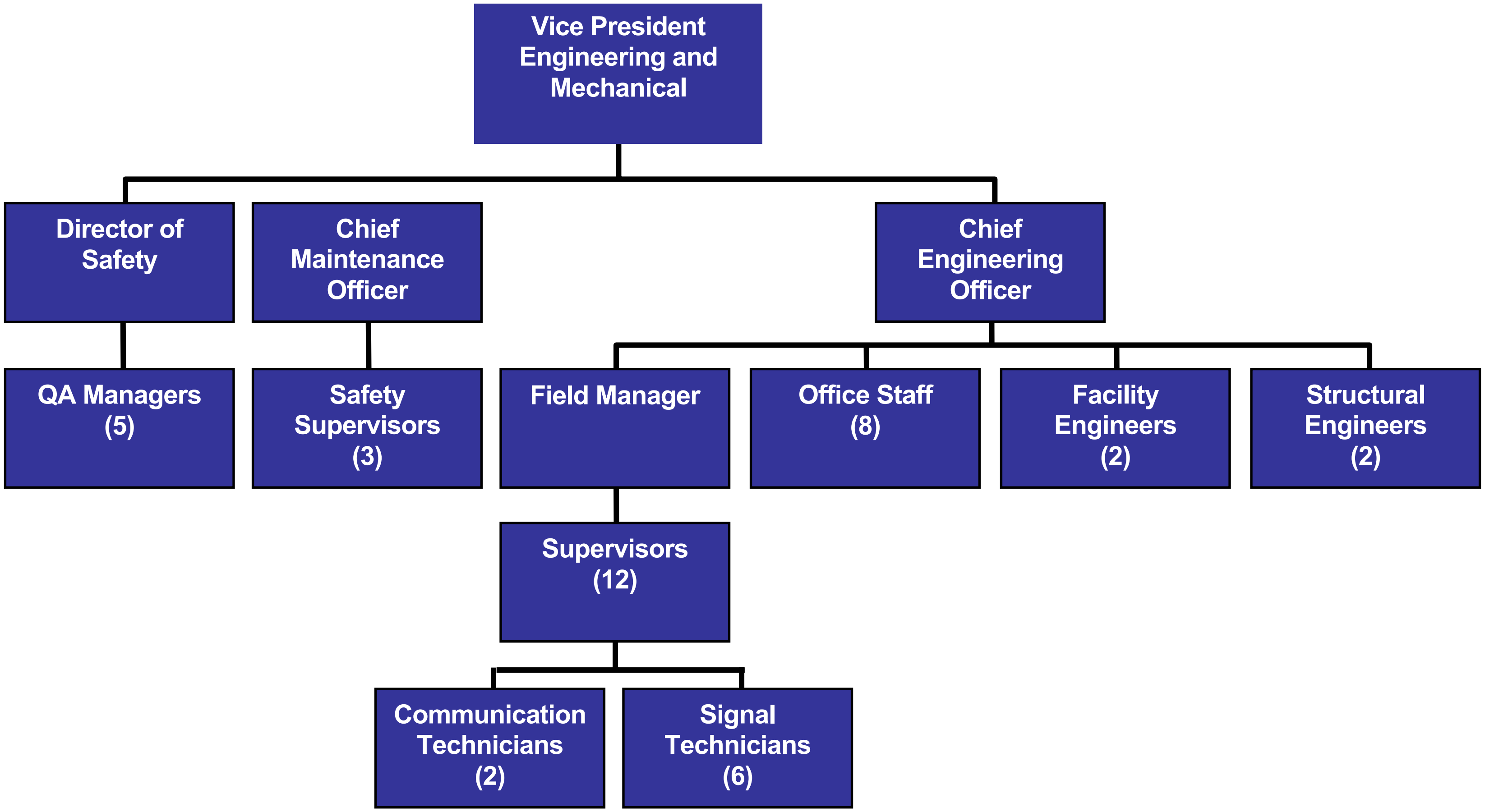


Exhibit 7-43
Proposed MWRRS Engineering/Equipment Maintenance Structure



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%