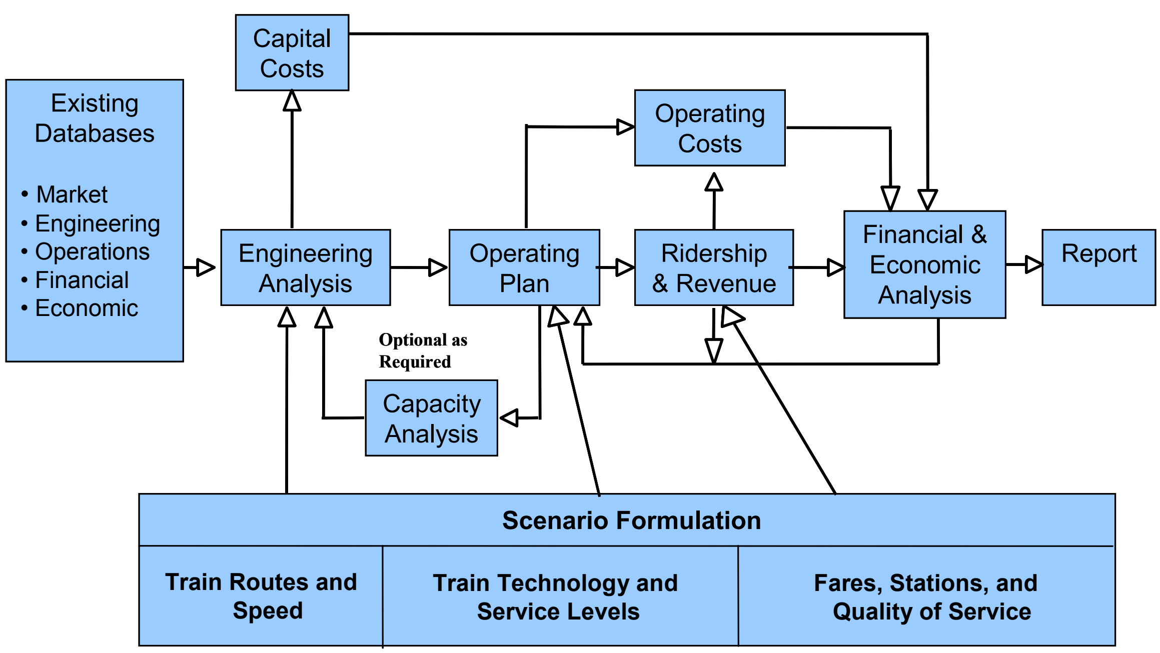
4

Operating Strategy

This section describes the key assumptions used to develop the passenger rail service scenarios and operating plans; it identifies potential station locations and provides an assessment of equipment technologies and fleet requirements. The TRACKMAN™, LOCOMOTION™ and COMPASS™ software programs (components of the RightTrack™ software system) are used in an interactive analysis to calculate train travel times, build corridor train schedules, and to recommend train technology and rail system operating strategies. As Exhibit 4.1 shows, the business plan is the final result of an iterative process that requires progressive fine-tuning of the operating strategy, in order to accommodate the specific requirements of travel demand in the study corridor. A key requirement for the analysis is to adjust the train size and frequency levels to appropriately match demand, providing enough capacity while still producing acceptable load factors, and respecting the financial constraints on the operation of the system (e.g., the requirement to produce a positive operating ratio.) The results of the interactive analysis are then used to identify the system operating costs. The Appendices provide additional detail on the RightTrack™ system.

Exhibit 4.1: Business Planning Process – Interactive Analysis



4.1 Train Service and Operating Assumptions

The primary objective of the study was to assess alternative service and speed improvements for the Minneapolis-Duluth/Superior Corridor. An earlier *Study of Restoring Passenger Service to Duluth and the Iron Range* (February 2000) evaluated 50-mph, 60-mph and 79-mph improvement options. The current study extended the speed range by evaluating 79-mph, 110-mph and 125-mph scenarios.

Corridor train timetables were developed for the 79-mph, 110-mph and 125-mph Scenarios. Based on the preliminary demand estimates for each of the potential station locations and an optimal number of train frequencies were determined. The faster options with their higher ridership can also support more train frequencies. However, in order to advance a fair comparison between speeds, an analysis was made in which the operating plans overlapped with 4 daily train frequencies. The 79-mph scenario used smaller trains in order to balance the capacity need.

The challenge of developing a final operating plan is to maximize the utilization of the train sets so it is possible to capture a portion of the daily commuter traffic to and from Minneapolis/St. Paul from the corridor, provide an effective intercity service for business travelers, while still providing recreational and leisure travelers with convenient options. Clearly the higher the frequency of service possible the easier it is to meet these needs.

A second consideration for the service is the quality of travel offered. Quality of service can have a significant impact on ridership levels and it is critical that any new rail service offers a modern transportation environment that is comfortable, convenient, economical, and safe. It is assumed in this analysis that the quality of service offered by the rail system would reflect all of these critical attributes. An example of how quality of service can affect ridership is demonstrated by the Pacific Northwest Corridor experience, in which the introduction of new Talgo trains raised ridership by 70 percent without any major change in train schedules, frequency or fares.

4.2 Potential Station Locations

Based on an assessment of the prospective rail demand, the study identified the general locations for potential stations along the Minneapolis-Duluth/Superior Corridor. On the average, station spacing on a high-speed rail system should be limited to one stop every 30-60 miles. More station stops will increase travel times, decrease average train speeds and cause the service to be less competitive.

It should be noted that, consistent with the assumptions made in earlier passenger planning studies including the MWRRS, the capital costs assume that stations will be developed jointly between the rail system and the communities they serve. The rail capital costs for stations include only the facilities that are required for rail operations, primarily the cost of track and platforms. It is assumed that the stations themselves will be provided by the local communities, and that their investment will be supported by joint commercial development, shared transit use and other economic activities.

Passenger rail stations would be located in downtown centers, and in suburban areas near interstate highways, and adjacent to major attractions such as Hinckley Casino. The primary means of accessing stations would be by automobile, public transit, or by walking. Stations would have automobile drop-off areas and long-term parking lots. Most stations would be served by taxis, regional transit, feeder bus and shuttle bus operators. Downtown stations would be within walking distance to major trip generators and employment and activity centers.

Specific station site planning is beyond the scope of this study and sites will be finalized in future project development phases. Local governments, business interests and citizens groups would be involved in the station location planning and design process. However, six station sites as shown in Exhibit 4.2 have been assumed for the purpose of this study. A map of the corridor is shown in Exhibit 1.1.

Exhibit 4.2: Potential Station Sites for the Minneapolis-Duluth/Superior Corridor

City Name	Potential Station Location
Minneapolis, MN	Expanded North Star station at 5th Street
Suburban North, MN	A suburban station stop in Anoka County at Foley Blvd. A station study is needed to finalize the site development.
Cambridge, MN	Downtown location, station location and parking study needed in order to finalize the site
Hinckley, MN	The base study assumes a downtown location with a shuttle bus connection to the Casino. A station location and parking study is needed in order to finalize the site. An alternative to provide direct rail service to the casino.
Superior, WI	Station location study needed.
Duluth, MN	A downtown location either at the historic train station or across the freeway in adjacent open land. A station location and parking study is needed in order to finalize the site.

4.3 Train Technology Assumptions

Key elements of the operating plan have significant implications for the procurement of rolling stock. The operating plan has been developed to accommodate the requirement for fast, frequent and reliable service with minimal delays for station stops or equipment servicing. The most important characteristic of the operating plan is the overall train travel time. Travel times are directly dependent upon train technology because differences in design can improve train performance by increasing rates of acceleration and braking, increasing operating speed and permitting higher speeds through curves.

The development of a North American passenger rail industry will benefit from many years of advanced rail technology development in Europe and Asia. This technology is available for North American applications and could be used to upgrade equipment fleets throughout the country. Over the past few years, domestic high-speed rail has become a reality with the introduction of Amtrak's *Acela* technology in the Northeast Corridor and the new Spanish *Talgo* trainsets currently in operation in the Pacific Northwest. Amtrak, the FRA and Bombardier have worked together to develop an Advanced Turbine Locomotive, the *Jet Train*. This gas turbine technology is capable of speeds up to 150-mph and does not require the expensive electrification of the corridor infrastructure. Several electrified very high-speed intercity rail systems operate at even higher speeds throughout the world. Exhibit 4.3 illustrates some of the various train technologies that are available and that were included in the scope of evaluation of this study.

Exhibit 4.3: Some Potential Trainset Options for the Minneapolis-Duluth/Superior Corridor

79-mph

Loco-Hauled Coaches

Colorado DMU

Desiro USA

110-125 mph
"Integrated Trainsets" Tilting and Non-Tiling Variants

Talgo T21

ICE TD / ACE 3

Jet Train

One factor that determines transit time is a passenger car's "tilt" or "non-tilt" design. Tilting equipment is especially advantageous for increasing train speed on existing tracks. Onboard hydraulic systems (active tilt) or car suspension designs (passive tilt) lower the centrifugal forces felt inside cars. This allows trains to operate at higher speeds through curves, reducing transit time. Applications include Talgo's pendular passive tilting system, which allows commercial speeds of up to 125-mph, and the Acela / Jet Train design with an active tilting system and commercial speeds of 150-mph. Talgo has recently developed a new integrated tilting trainset, the Talgo-XXI, which includes the locomotives and passenger cars.

Another factor to consider when determining the suitability of train technology used for Minneapolis to Duluth rail service is compliance with Federal Railroad Administration (FRA) safety requirements. The FRA has Tier 1 safety requirements that pertain to all passenger trains operating up to a maximum speed of 125-mph. More stringent Tier 2 requirements are applied to passenger trains operating in excess of 125-mph, up to 150-mph.

Given these determinants several passenger locomotives and car technologies have been evaluated including both locomotive haul trainsets, as well as self-propelled Diesel Multiple Units (DMU) trains. DMUs are self-propelled trainsets where the locomotive diesel power engine is integrated into the passenger cars. Conventional non-tilting 79-mph train sets have been assumed for the 79-mph operating evaluation, whereas the 110-mph and 125-mph evaluations assumed tilting train sets. All technologies are non-electric, powered either by diesel engines or by gas turbines.

Exhibit 4.4 describes some of the various train technologies that are available. Integrated trainsets, which do not allow coupling or uncoupling individual cars (except in the repair shop), are listed separately from locomotives that can operate with a variety of passenger car types. These trains are all available in different train sizes and capacities. DMU consists are somewhat shorter since they don't need to include space for locomotives, and DMU train sizes are easier to adjust either upwards or downwards to meet demand, since each unit is individually self-propelled. Double deck equipment (which is not applicable to a tilting 110-mph or higher speed service) also tends to require less platform length than single-level equipment of equivalent capacity. Train sizes in the range of 200-400 seats have been utilized for development of operating plans in this study, and for planning purposes a train (platform) length of 600 feet has been conservatively assumed.

Exhibit 4.4: Available Technologies:
Trainsets

	Maximum Operating Speed	Steerable Bogie	Tilting	Status	Tier 1 Compliance
Bombardier DMU Voyager	125-mph	No	Yes	In Service (UK)	No
Bombardier DMU Flexliner	110-mph	No	No	In Service (DK)	No
Bombardier/Siemens DMU ICE TD	125-mph	No	Yes	In Service (Germany)	No
Siemens American Cities Express	110-mph	Yes	Yes	Under Development	Under Development
Talgo XXI	125-mph	Yes	Yes	Testing	Testing

Locomotives

	Maximum Operating Speed	Steerable Bogie	Tilting	Status	Tier 1 Compliance
Bombardier Advanced Turbine Locomotive	150-mph	No	No	Testing	Yes
General Electric P42	110-mph	No	No	In Service (US)	Yes
General Motors F59	110-mph	No	No	In Service (US)	Yes
General Motors/Siemens DE30AC	100-mph	No	No	In Service (US)	Under Development
Siemens Rh2016	90-mph	No	No	Testing	Yes

Passenger Cars for Locomotives

	Maximum Operating Speed	Steerable Bogie	Tilting	Status	Tier 1 Compliance
Amtrak Horizon Type Cars	110-mph	No	No	In Service (US)	Yes
Bombardier Acela Express	150-mph	No	Yes	In Service (US)	Yes
Bombardier Push Pull Coach	79-mph	No	No	In Service (US)	Yes
Siemens American Cities Express Cars	110-mph	Yes	Yes	Under Development	Under Development
Talgo TPU	125-mph	Yes	Yes	In Service (US)	Yes

The earlier MWRRS study compared three different train technologies and determined that any of the three –DMU, JetTrain, or Talgo – could perform within the required operational parameters. A life cycle cost analysis verified that two of the three technologies could operate within the cost parameters of the initial MWRRS business plan.

It was therefore determined that the MWRRS operating and financial plans should adopt as a "generic train" for analysis purposes the most conservative option, the Talgo T21 passive tilt technology. This train appeared to be slightly more expensive than the DMU options then under consideration. Because this technology is also slightly slower than the DMU on most corridors, the ridership and revenue forecasts are also more conservative than if the better performing DMU had been selected. Selecting a generic, Talgo-type train for the Minneapolis to Duluth operating and financial plans does not suggest that Talgo would actually be selected for the corridor operation. Rather, this selection increases the flexibility for choosing a technology, because multiple manufacturers and technologies will be able to meet the broader performance parameters provided by this conservative approach.

4.3.1 Other General Rolling Stock Service and Operational Requirements

The following general assumptions have been made regarding operating requirements for the rolling stock:

- Train consists will be reversible for easy push pull operations (able to operate in either direction without turning the equipment at the terminal stations).

- Trains will be accessible from low-level station platforms for passenger access and egress, which is required to ensure compatibility with freight operations.

- Trains will have expandable consist capacity for seasonal fluctuations and will allow for coupling two or more trains together to double or triple capacity as required.

- Train configuration will include galley space, accommodating roll-on/roll-off cart service for on-board food service. Optionally, the train may include a bistro area where food service can be provided during times when they are not passing through the train with the trolley cart.

- On-board space is required for stowage of small but significant quantities of mail and express packages, and also to provide for an optional checked baggage service for pre-arranged tour groups.

- Each end of the train will be equipped with a standard North American coupler that will allow for easy recovery of a disabled train by conventional locomotives.

- Trains will not require mid-route servicing, with the exception of food top-off. Refueling, potable water top-off, interior cleaning, required train inspections and other requirements will be conducted at night, at the layover facilities located at or near the terminal stations. Trains would be stored overnight on the station tracks, or they would be moved to a separate train layover facility. Ideally, overnight layover facilities should be located close to the passenger stations and in the outbound direction so a train can continue, without reversing direction, after its final station stop.

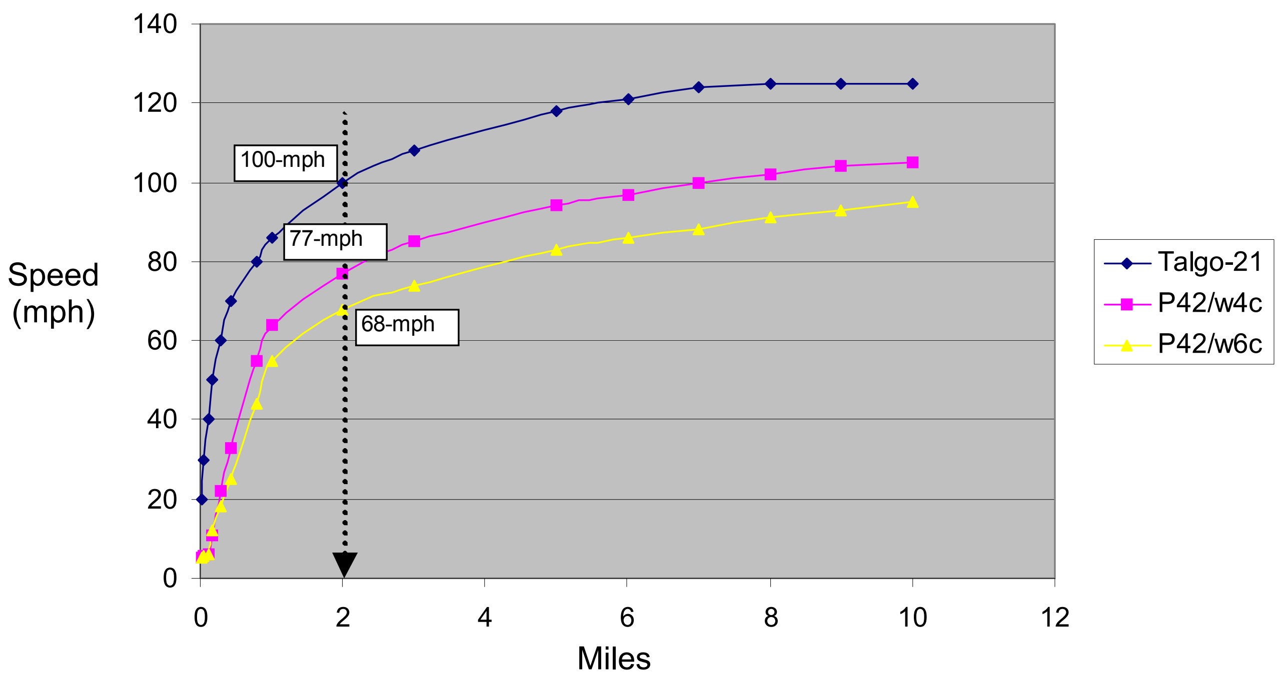
- Trains must meet all applicable regulatory requirements including: FRA safety requirements for crash-worthiness; requirements for accessibility for disabled persons; material standards for rail components for high-speed operations; and environmental regulations for waste disposal and power unit emissions.

4.4 Operating Plans and Train Performance

A Train Performance Calculator was used to determine train-running times for each operating scenario. The program used route infrastructure and train performance characteristics to estimate running times and levels of service for the 79-mph, 110-mph and 125-mph scenarios. The TEMS LOCOMOTION™ Train Performance Calculator is described in the Appendices. To guarantee a high level of reliability in "on-time" performance, recovery time between five and eight percent of base running time was incorporated into the schedules. Recovery time is a cushion in the schedule to allow for minor delays en route due to freight traffic congestion along the line, mechanical difficulties, weather factors, temporary speed restrictions or other operating difficulties.

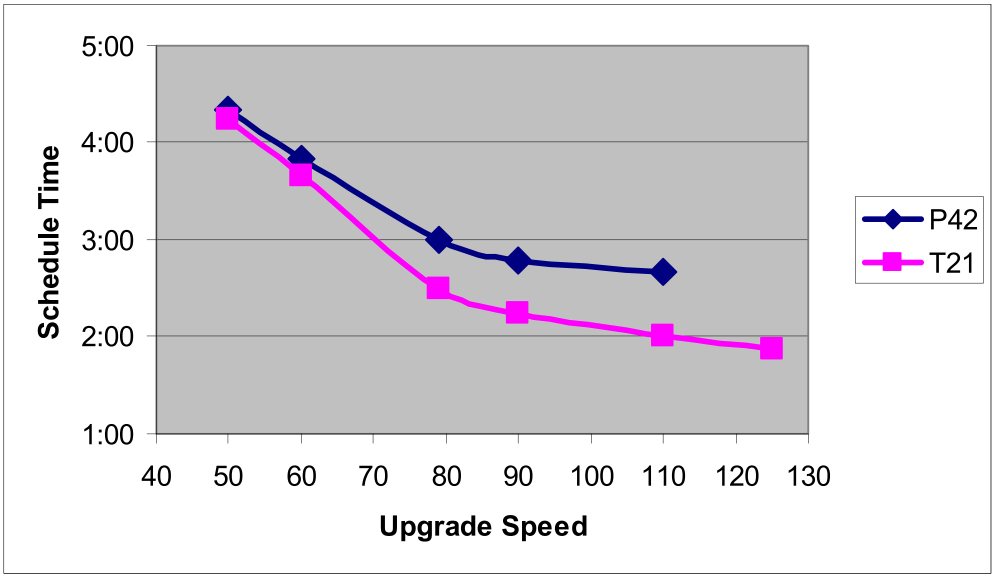
Scheduled running times from Duluth to Minneapolis depend strongly upon both the level of infrastructure upgrade as well as the dynamic (acceleration/deceleration) capabilities of the trains. For example, Exhibit 4.5 shows the acceleration curves of the 125-mph Talgo T21 train as compared to a typical locomotive-hauled 79-mph train set. It can be seen that the modern train set, being powered to achieve 125-mph, is also able to accelerate much faster. This difference in acceleration, as well as the train's tilting capability, can result in a substantial improvement in end-to-end running times, particularly if the tracks and signals are also upgraded to permit a 110-mph top speed. In contrast, it can be seen that conventional trains are hardly able to take advantage of an improved 110-mph infrastructure, since they are simply not designed nor powerful enough to go that fast. If the ultimate intention is to upgrade the line to support 110-mph top speeds, it is therefore essential to procure trains up-front that are capable of taking advantage of the improved infrastructure.

Exhibit 4.5: Comparative Train Acceleration Curves



Specifically, Exhibit 4.6 shows the equipment/infrastructure tradeoff that has been calculated for the Minneapolis-Duluth/Superior Corridor. It can be seen that T21 running times could vary from above 4 hours using today's 50-mph infrastructure to less than 2 hours on improved 125-mph infrastructure. However, the conventional P42-locomotive hauled train can do hardly better than 3 hours on an upgraded 79-mph infrastructure, and is not really able to take much advantage of improvements beyond that speed.

Exhibit 4.6: Comparative Minneapolis to Duluth Running Times



The TEMS LOCOMOTION™ output includes the specific train speed profiles by mile as well as the overall running time calculation. Exhibit 4.7 shows the acceleration profile for a 79-mph conventional P42 train with 6 cars, while Exhibit 4.8 shows a similar profile for a 110-mph T21. Exhibit 4.9 shows a 125-mph speed profile. Even with a program of curve easements, the 125-mph top speed would allow only 10-minute timesavings over the 110-mph option. The main reason for this is the dynamic performance of the train itself, which is close to its ultimate capability, and therefore takes a long time to reach top speed.

Exhibit 4.7: 79-mph Speed Profile, 79-mph P42 w/6 Cars – 3:00 Running Time

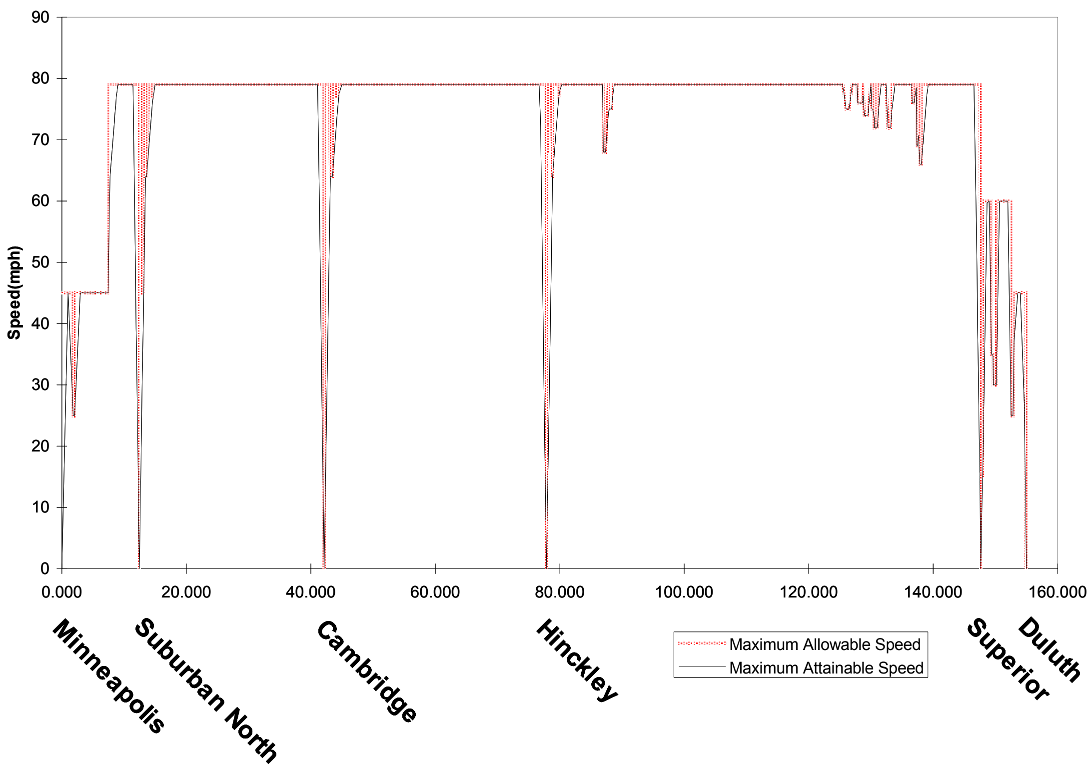


Exhibit 4.8: 110-mph Speed Profile, Talgo T21 – 2:00 Running Time

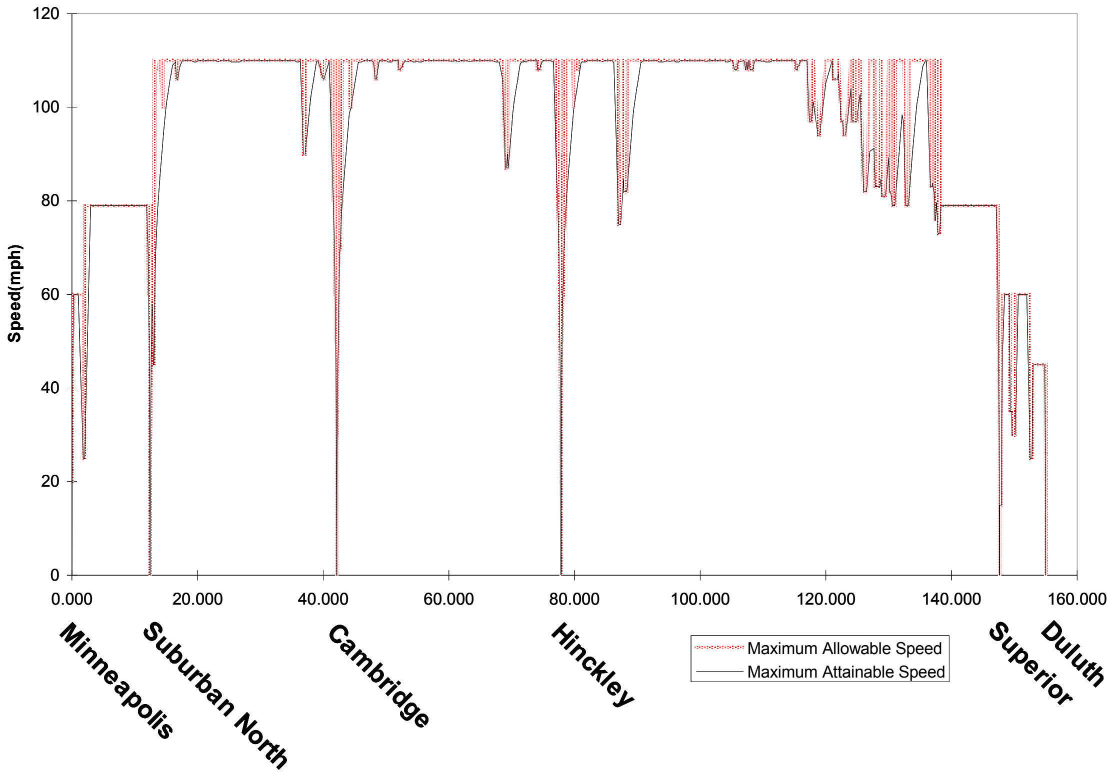


Exhibit 4.9: 125-mph Speed Profile, Talgo T21 – 1:50 Running Time

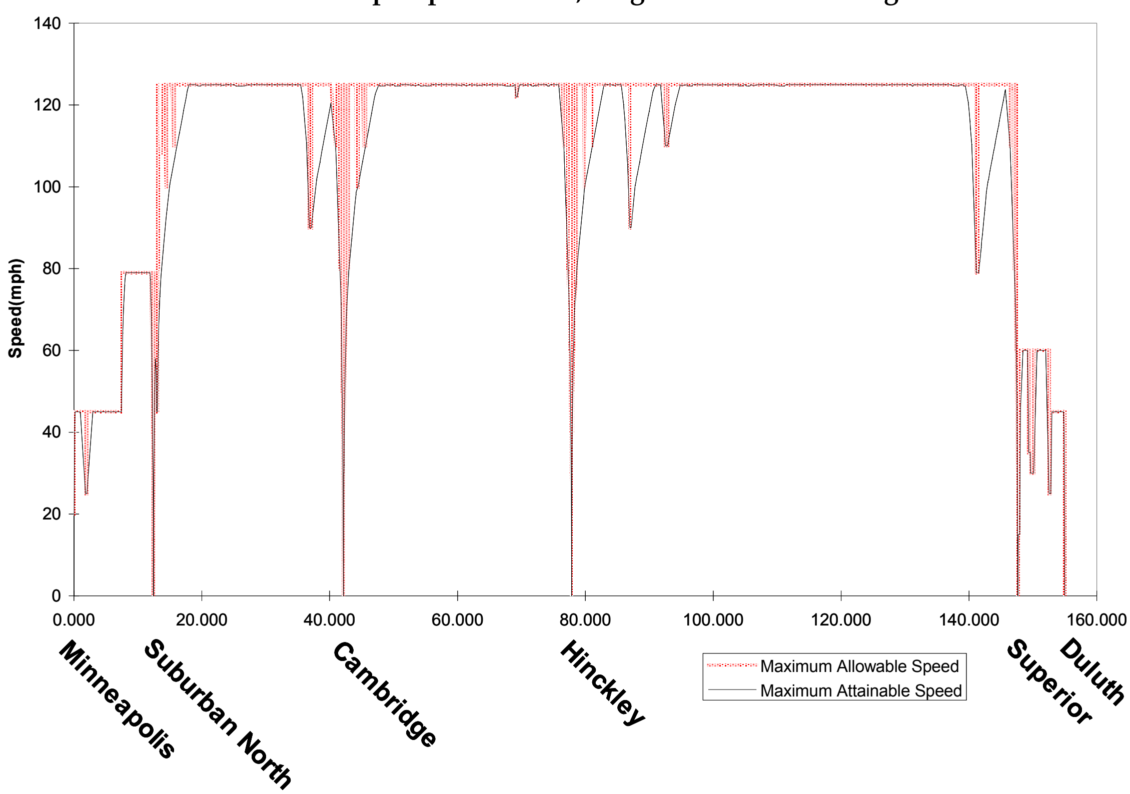
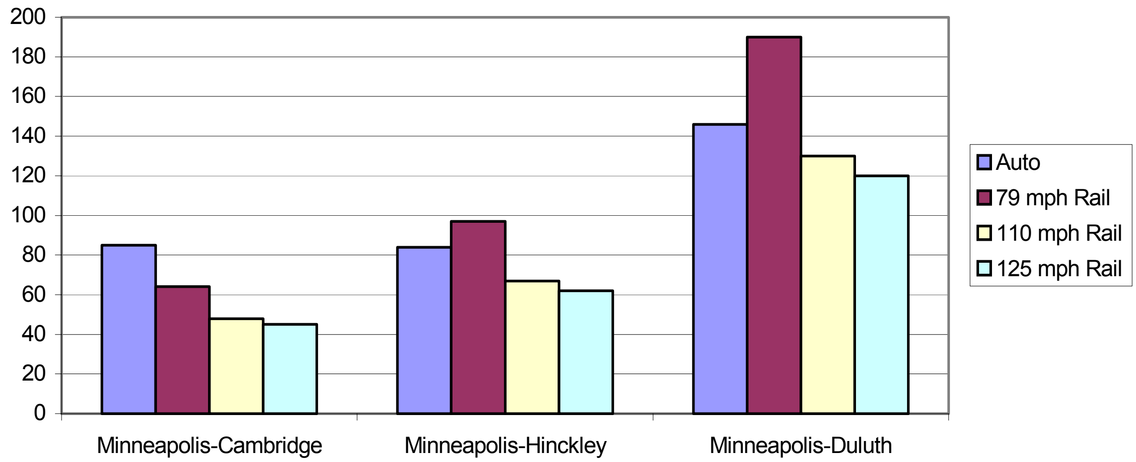


Exhibit 4.10 summarizes the travel times for each speed scenario, and provides a comparison with existing travel time for auto. It can be seen that 79-mph service is competitive to auto travel times only in the Cambridge to Minneapolis OD pair. The reason for this is that Cambridge is located off I-35 so automobile must use local streets and state highways for commuting to Minneapolis. All the other OD pairs in the corridor are directly competitive to I-35 travel times. A 110-mph or 125-mph service is needed in order to be able to offer auto-competitive travel times at Hinckley, Superior and Duluth.

Exhibit 4.10: Travel Time Comparison, Auto vs. Rail Speed Options



4.5 Train Scheduling and Fleet Requirements

The number of train sets required for day-to-day operations must be large enough to cover all assignments in the operating plan with sufficient spares for maintenance, yet without excess equipment sitting idle.

Under the basic option (a shuttle bus service to the Hinckley casino) weekday service will face a stronger demand than weekends, due to the added influx of commuter and business travel. Accordingly the schedule would be thinned on weekends, to reflect an overall operation equivalent to 312 days per year (half-day service on Saturday (largely morning) and a half-day service on Sunday (largely evening). An 8-round trip schedule for 312-days a year would generate a total of 773,760 annual train-miles.

With a direct rail link to the Hinckley casino, it is anticipated that the weekend trains would likely be utilized by casino trips, permitting a full schedule of operations every day of the week. The overall operation equivalent would then become 365 days per year. Because trains would be fully utilized on weekends as well as on weekdays, the Casino option would utilize equipment better. The Casino option would also utilize line capacity better, since the improved tracks would also be used every day.

A set of scenarios as shown in Exhibit 4.11 have been evaluated by this study. In addition, these scenarios form the basis of the demand forecasting and financial evaluation that are presented elsewhere. For the 79-mph speed, train frequency ranging from one to four daily round trips has been evaluated. For the higher 110-mph and 125-mph speeds, train frequencies from four to eight round trips have been evaluated.

In addition, a special 110-mph operating plan has been developed for the direct Casino Rail Link option. Because most of the added Casino travel will come from the Twin Cities, an adjustment to the operating plan was needed to accommodate the additional riders. The new plan provides an average of 9 daily round trips south of Hinckley but only 6 trains running all the way through to Duluth. In spite of reducing train miles, this plan actually provides more seating capacity than the basic eight round trip option because of the assumed use of larger trains.

The scheduled running time and corresponding full (average) fare level associated to each base scenario are shown in Exhibit 4.11. These are the values that were taken into the demand-forecasting model. It can be seen that the faster scenarios assume higher levels of fare, to recapture for the train operator some of the added value created by the enhanced rail service. This ability to simultaneously raise both fares and ridership levels is the key to the financial viability of the proposed 110-mph rail service.

Exhibit 4.11: Train Speed/Frequency Scenarios

	79/1	**79/2**	**79/4**	**110/4**	**110/8**	**125/4**	**125/8**
Speed (mph)	79	79	79	110	110	125	125
Frequency (train/day)	1	2	4	4	8	4	8
Fare ($/mile)	0.22	0.22	0.22	0.35	0.35	0.35	0.35
Running Time (minutes)	170	170	170	120	120	110	110

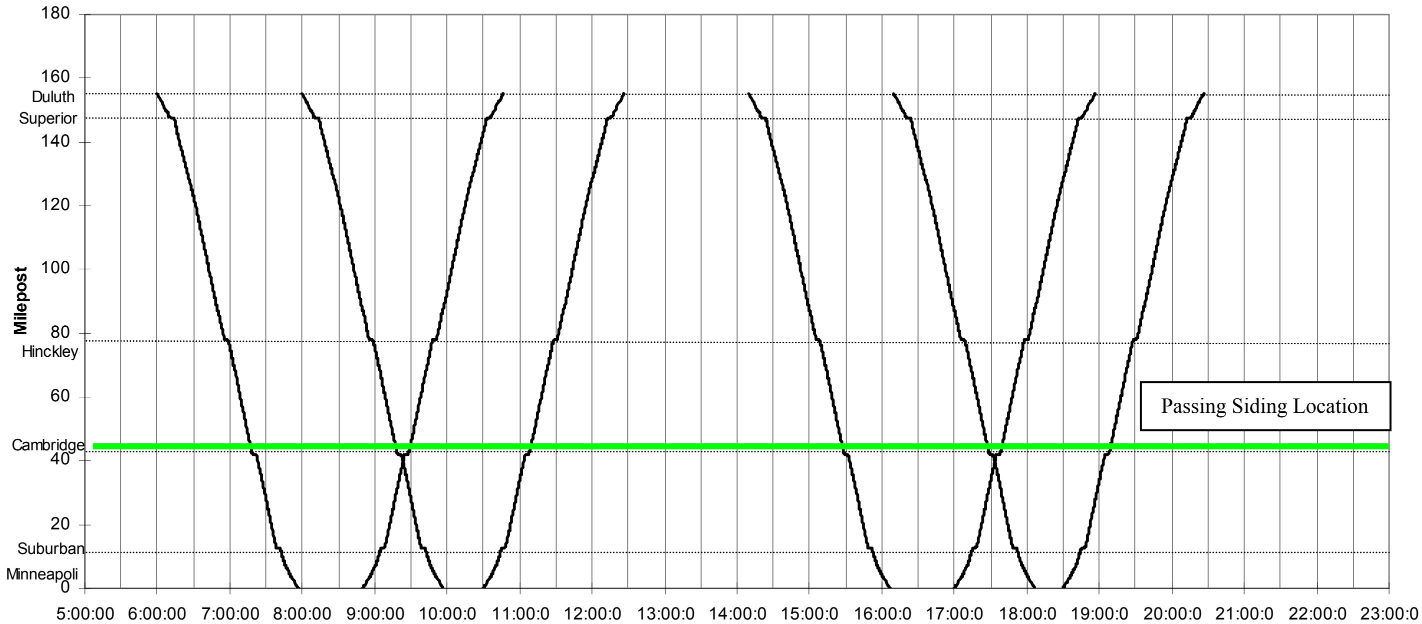
Train schedules can be displayed in either a tabular or graphical format. For example, Exhibit 4.12 shows a graphical representation of the 110/4 train schedule. It shows two trainsets starting out in Duluth, making an early morning run into Minneapolis, arriving by 8AM and 10AM, respectively. Turning around in Minneapolis, there is enough time for each train to make a late morning-mid afternoon round trip from Minneapolis to Duluth and back again. Two pairs of passenger trains meet at the long passing siding provided at Cambridge. Note that the requirement for meeting at Cambridge requires that any shifts applied to the schedule of one train must also be applied to the schedule of the train in the opposite direction, e.g. these two schedules are "locked together." Finally, these two train sets provide two return trips for commuters and business travelers from Minneapolis back to Duluth in the evening.

In addition, the scheduling process determines the number of train sets that are need to operate the service. The graphical schedule as shown in Exhibit 4.12 serves as a visualization tool. It helps establish the locations of train meets and passes, to ensure that these occur only in places where passing sidings have been provided.

In this example, two train sets are sufficient to provide four daily round trips between Duluth and Minneapolis. However, arrangements need to be made for covering the schedules in case of any mechanical problems with the train sets. For this reason, depending on the projected availability of the train sets and their planned maintenance rotation cycles, an extra "protect" train set may be needed to serve as a backup. Since one train could "protect" more than two other trains, running more frequencies tends to contribute to better economies of scale.

Detailed train schedules for each of the eight evaluation scenarios of Exhibit 4.11, as well as the special scenario for direct rail service to the Casino, are included in the Appendices. Each of these schedules indicates the number of trains that are required to cover the schedule as well as the train size assumption that was employed in the cost analysis for each year.

Exhibit 4.12: Graphical Schedule, 110/4 Scenario



4.5.1 Understanding Train Size, Frequency and Load Factor Tradeoffs

In addition to timing trains to meet the anticipated needs of the market, there is the question of determining how many trains are needed, what size they should be and over what portions of the route they need to run. It is convenient to standardize the size of the trains for each forecast year, so individual trains become fully interchangeable and can be used for covering any set of equipment rotations or schedules.

The chosen combination of train sizes and frequencies must at a minimum, ensure there are enough seats to carry all the passengers over the peak load segment; beyond this to minimize empty seat-miles, it is desirable to match supply to the forecasted demand as closely as possible over each segment. The segment-loading chart, as shown in Exhibit 4.13, is a useful tool for this purpose. This chart shows the passengers on board the train over every segment the route. The chart is useful for determining both the peak load segment as well as for forecasting average load factor across the entire route.

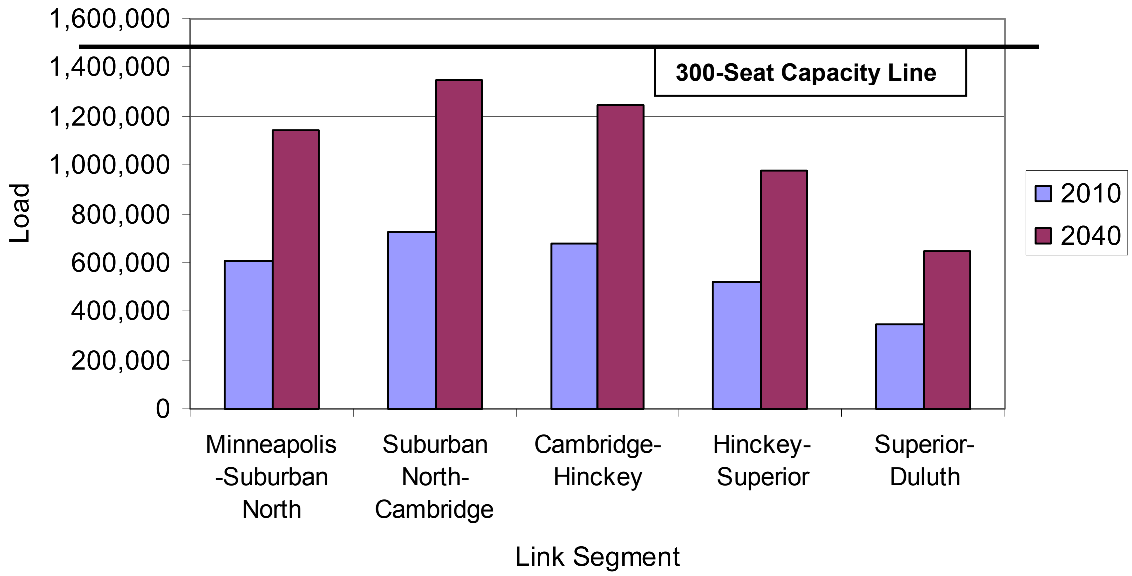
Specifically, Exhibit 4.13 shows the forecast loading for years 2010 and 2040 for the 110/8 base scenario. It can be seen that the peak load segment is from Suburban North to Cambridge. (This is because some riders from the northern suburbs may find it more convenient to park their cars at Suburban North than drive to downtown Minneapolis.) In 2010, the forecast is for 726 thousand riders in both directions, or 363 thousand each way on the peak-load segment. By 2040, ridership would nearly double to 1,349 thousand. (In these numbers, connecting MWRRS traffic has been excluded, since the MWRRS hasn't been built yet. Also, this base forecast assumes a bus connection to the casino at Hinckley.) This discussion focuses on the implications of this projection for operations planning and equipment procurement.

A standard assumption is that services will be thinned to a 50% level on weekends, leading to an annual equivalent of 312 days of operation. A 300-seat train capacity line has been added to Exhibit 4.13. This shows that eight round trips a day for a 300-seat train would provide:

300 seats * 8 trips * 2 directions * 312 days = 1,497,600 seating capacity

By 2040, 300-seat trains would produce a 90% load factor across the peak load segment, showing that capacity has been appropriately matched to demand that year. With only a shuttle bus connection to the casino, traffic drops off only slightly north of Hinckley. The load factor from Hinckley north to Superior would be 65%. Even so, the overall operation still generates an acceptable average load factor of 70%, so no trains need to turn back at Hinckley in the base.

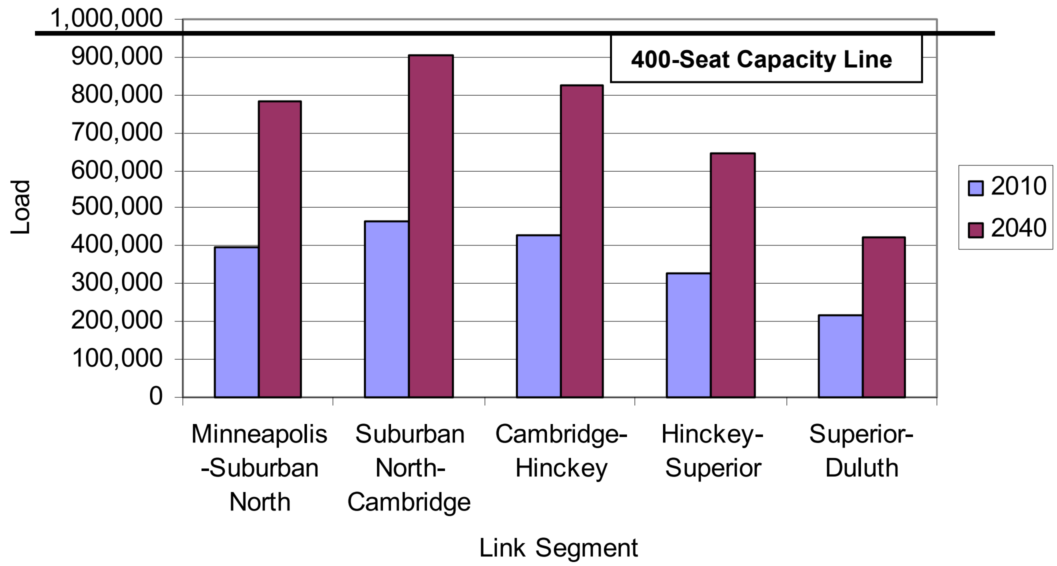
Exhibit 4.13: Segment Loading Chart, 110/8 Scenario



For 2010, the general pattern of demand is the same, but ridership across the peak load segment is only 726 thousand. Smaller 150-seat trains would suffice for a 2010 startup. Eight frequencies could accommodate this demand. Comparatively, this would be a very small train, only 2 standard coaches. A Diesel Multiple Unit (DMU) technology using self-propelled rather than locomotive hauled cars, such as the 195-seat Siemens ICE TD/ACE 3 train could be a cost-effective equipment option.

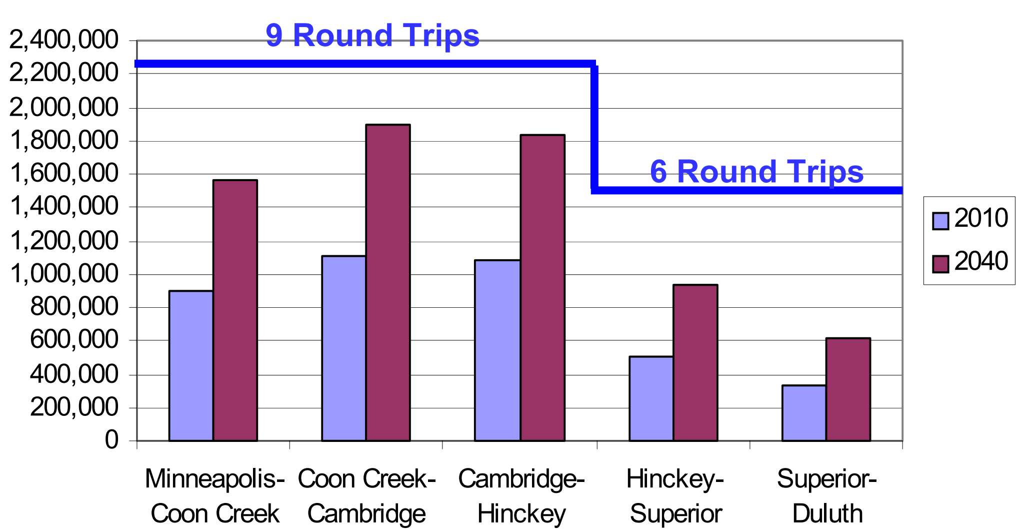
As shown in Exhibit 4.14 for the 110/4 scenario, because fewer trains are being operated, 2010 ridership would be reduced from 726 thousand down to 463 thousand over the peak load segment. The 2040 comparison is 1,349 thousand down to 902 thousand riders. These economic elasticities reflect a one-third reduction in ridership for a 50% reduction in train frequency. As a result of running fewer trains, longer 400-seat trains would need to operate in 2040 -- this would provide 998,400 seats, giving a peak load factor of 90%; a 200 to 250-seat train would suffice for an initial startup of four trains at 110-mph without a casino direct rail link.

Exhibit 4.14: Segment Loading Chart, 110/4 Scenario



Introduction of direct rail service to the Hinckley casino would change the forecast pattern of demand. Since most of the added casino patronage would come from the Twin Cities, adding casino traffic would require more seating capacity be added to the south end of the line. Only one additional late-night frequency was added to the south end of the line, so running larger trains has provided most of the capacity increase. To better balance capacity to demand, some of the trains need to be turned back at Hinckley. This actually results in a slight decrease of planned train miles as compared to the original plan, which ran eight trains all the way through to Duluth. Exhibit 4.15 shows the result of operating six round trips through from Minneapolis to Duluth along with three additional trains from Minneapolis to Hinckley. 250-seat trains would be used to start in 2010, growing to 400 seats by 2040. The frequency reduction north of Hinckley reduces empty seats, better balancing supply to demand over the entire line.

Exhibit 4.15: Segment Loading Chart, 110/6+9 Scenario with Casino Direct Rail



Development of a direct rail link to the Casino would also present an opportunity for development of a station stop at Sandstone. The three local trains that terminate at Hinckley could easily be extended to Sandstone, without harming the schedule objective for the overall Minneapolis to Duluth service. Doing this is attractive from an operational perspective given the undesirability of developing a train turn-around facility or crew base at the Casino location. Given development of an operational base and passenger station at Sandstone, perhaps one of the through trains might also be considered for stopping there. This would provide one train a day north and four trains south. In addition, this can be done without harming the overall finances and economics of the 110-mph train system given the increased revenue and ridership of the casino option.

While the 110-mph scenarios described in this chapter are illustrative of the operations planning process, the results for 125-mph scenarios are not significantly different. End-to-end 125-mph schedules are only about 10-minutes faster than 110-mph, primarily due to the performance limitations of diesel trains, which can accelerate only very slowly at speeds above 110-mph (see Exhibit 4.4.[1]) As a result the demand forecasts at 125-mph are only slightly better than for 110-mph. The same basic pattern of train operations would be expected to emerge; the difference is that the need for capacity additions would develop at a slightly quicker pace.

A similar approach was also employed for the planning of the 79-mph scenarios. Because of the relative ease of adding cars and the fact that the acceleration requirements for 79-mph aren't as demanding, 79-mph trains were allowed to run larger than the 400-seat limit assumed for 110-mph integrated trainsets.

The results of the detailed scheduling process for each scenario are included in the Appendix.

[1] Results for an electrified 125-mph scenario could be better, but an electrification scenario is beyond the scope of this study.

5

Operating Costs

This chapter describes the various costs associated with operating a Minneapolis to Duluth passenger rail service.

Operating costs are categorized as variable or fixed.

- **Variable or Direct costs** change with the volume of activity and are directly dependent on ridership, passenger miles or train miles. For each variable cost, a principal cost driver is identified and used to determine the total cost of that operating variable. An increase or decrease in any of these will directly drive operating costs higher or lower.
- **Fixed costs** are generally predetermined, but may be influenced by external factors, such as the volume of freight tonnage or may include a relatively small component of activity-driven costs. As a rule, costs identified as fixed should remain stable across a broad range of service intensities. Within fixed costs are two sub-categories:
  - **Route** costs such as track maintenance and station expense that, although fixed, can still be clearly identified at the route level.
  - **Overhead or System** costs such as headquarters management, call center, accounting, legal, and other corporate fixed costs that are shared across routes or even nationally. A portion of overhead cost (such as direct line supervision) may be directly identifiable but most of the cost is fixed. Accordingly, assignment of such costs becomes an allocation issue that raises equity concerns. These kinds of fixed costs are handled separately.

Operating costs were developed based on the following premises:

- Based on results of recent studies, a variety of sources including suppliers, current operators' histories, testing programs and prior internal analysis from other passenger corridors were used to develop the cost data. However, as the rail service is implemented, actual costs will be subject to negotiation between the passenger rail authority and the contract rail operator(s).
- Freight railroads will maintain the track and right-of-way, but ultimately, the actual cost of track maintenance will be resolved through negotiations with the railroads. For this study a track maintenance cost model was used that reflects actual freight railroad cost data.
- Maintenance of train equipment will be contracted out to the equipment supplier.
- Train operating practices follow existing work rules for crew staffing and hours of service. Operating expenses for train operations, crews, management and supervision were developed through a bottoms-up staffing approach based on typical passenger rail organizational needs.

The costing approach originally developed for the Midwest Regional Rail System (MWRRS) was adapted for use in this study. Following the MWRRS methodology, nine specific cost areas were applicable to this study.[1] As shown in Exhibit 5.1, variable costs include equipment maintenance, energy and fuel, train and onboard (OBS) service crews, and insurance liability. Ridership influences marketing, sales and station costs. Fixed costs include administrative costs, and track and right-of-way maintenance costs. The MWRRS cost model was updated to reflect current $2006 costs, and also was validated with recent operating experience based on publicly-data available from other sources, particularly the Northern New England Passenger Rail Authority's (NNEPRA) *Downeaster* costs and new data on Illinois operations that was provided by Amtrak.

Exhibit 5.1: Categories and Primary Cost Drivers

Drivers		Cost Categories
Train Miles	→	Equipment Maintenance Energy and Fuel Train and Engine Crews Onboard Service Crews
Passenger Miles	→	Insurance Liability
Ridership and Revenue	→	Sales and Marketing
Fixed Cost	→	Service Administration Track and ROW Maintenance Station Costs

The MWRRS costing framework was developed in conjunction with nine states that comprised the MWRRS steering committee and with Amtrak. In addition, freight railroads, equipment manufacturers and others provided input to the development of the costs. The original concept for the MWRRS was for development of a new service based on operating methods directly modeled after state-of-the-art European rail operating practice. Along with anticipated economies of scale, modern train technology could reduce operating costs when compared to existing Amtrak practice. In the original 2000 MWRRS Plan, European equipment costs were measured at 40 percent of Amtrak's costs. However, in the final MWRRS plan that was released in 2004, train-operating costs were significantly increased to a level that is more consistent with Amtrak's current cost structure. However, adopting an Amtrak cost structure for Minneapolis to Duluth financial planning does not suggest that Amtrak would actually be selected for the corridor operation. Rather, this selection increases the flexibility for choosing an operator without excluding Amtrak, because multiple operators and vendors will be able to meet the broader performance parameters provided by this conservative approach.

The analysis was conducted using 2006 constant dollars.

[1] This corridor has no planned feeder bus services for which the rail service is financially responsible, and the treatment of operator profit will be discussed in parallel to Service Administration.

5.1 Minneapolis-Duluth/Superior Corridor - Variable or Direct Costs

5.1.1 Train Equipment Maintenance

Equipment maintenance costs include all costs for spare parts, labor and materials needed to keep equipment safe and reliable. The costs include periodical overhauls in addition to running maintenance. It also assumes that facilities for servicing and maintaining equipment are designed specifically to accommodate the selected train technology. This arrangement supports more efficient and cost-effective maintenance practices. Acquiring a large fleet of trains with identical features and components, allows 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.

The MWRRS study developed a cost of $9.87 per train mile for a 300-seat train in $2002. Before this figure can be used for the Duluth corridor, however, it must be adjusted to reflect the smaller 200-seat train that will be used in the early years of the system. Data provided by equipment manufacturers at the original MWRRI 1999 equipment symposium was used to calculate these adjustments. The smaller 200-seat train was estimated to cost $8.95 per train mile in $2002, a savings of 92¢ per train mile over the MWRRS rate. In the four train scenarios because the Duluth corridor will only run a few trains as compared to MWRRS, using manufacturers' data from the 1999 equipment symposium, equipment costs were adjusted upwards by 25% to reflect the lack of economies of scale, and by an additional 9% for inflation. Therefore the cost of a 200-seat T21 train was estimated as $12.19 per mile.

The available evidence suggests that the maintenance cost for a 300-seat DMU would be about the same as for a Talgo T21, but for smaller trains DMU costs scale more directly to seating capacity. Accordingly the DMU maintenance cost for a 200-seat train was estimated as two-thirds of the cost for a 300-seat train. With the economies of scale and inflation adjustments, this would come to $8.96 per train mile in $2006. It can be seen that the DMU is substantially more cost effective for smaller trains, and because of its greater flexibility, it allows closer matching of seating capacity to travel demand.

5.1.2 Train and Engine Crew Costs

Crew costs are those costs incurred by the onboard train operating crew. The operating crew consists of an engineer, a conductor and an assistant conductor and is subject to federal Hours of Service regulations. Costs for the crew include salary, fringe benefits, training, overtime and additional pay for split shifts and high mileage runs. 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. In addition, an allowance was built in for spare/reserve crews on the extra board. The costing of train crews was based on Amtrak's 1999 labor agreement, adjusted for inflation to 2006.

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, which occurs if train crews have to stay overnight in a hotel away from their home base. Since train schedules have continued to evolve throughout the lifetime of this study and a broad range of service frequencies and speeds have been evaluated, a parametric approach was needed to develop a system average per train mile rate for crew costs. Such an average rate necessarily involves some approximation, 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.

In the previous Ohio Hub study, crew costs varied from $3.42 per train mile for efficient round trips with no need for overnight accommodations, up to $3.94 per train mile if some overnight layovers are required (consistent with the MWRRS result) and rising to $6.60 per train mile because of extremely poor crew utilization in some of the start-up scenarios. For this study, the intermediate value of $3.94 per train mile was selected as the base, and raised with inflation to a $2006 value of $4.29 per train mile.

5.1.3 Fuel and Energy

A consumption rate of 2.42 gallons/mile was estimated for a 110-mph 300-seat train, based upon nominal usage rates of all three technologies considered in Phase 3 of the MWRRS Study. For each scenario, these costs were scaled to the size of the train and raised to reflect the recent fuel cost increases. For smaller trains, DMU fuel costs scale down more proportionately than they do for locomotive-hauled trains. In the MWRRS plan, a diesel fuel cost of $0.96 per gallon led to a train mile rate of $2.32 per train mile for a 110-mph 300-seat train. A comparable rate in the current study would be $3.94 per train mile, reflecting the roughly 50% increase in the cost of fuel based on the gasoline price in the base year.

The overall model is based on fuel costs that were in effect during the base year of 2006 and that formed the basis of the demand model calibration. This demand model does reflect the ridership gains that occurred nationally, but in particular on the Boston-Portland corridor, largely as a result of the fuel price increases that occurred in 2006. The assumed diesel fuel cost on the operating side is consistent with the level of gasoline prices that were assumed for development of the demand forecasts. Since this study is now being completed at the end 2007 it must be noted that fuel costs have remained extremely volatile on practically a day-to-day basis, and have since risen to unprecedented high levels.

However, it has been more important to maintain the consistency of the fuel price assumption throughout the study, than to attempt to update the study to reflect every price fluctuation of a highly volatile market. At present, it appears that the fuel price assumption of this study may be on the low side. However, because the auto and air modes are less energy efficient than rail, any increases to fuel costs tends to increase the revenue of the rail system more than it raises the fuel cost. Therefore the overall study result is conservative, with respect to the fuel price assumption that is now employed.

5.1.4 Onboard Services (OBS)

Onboard service (OBS) costs are those expenses for providing food service onboard the trains. OBS adds costs in three different areas: equipment, labor and cost of goods sold. Equipment capital and operating cost is built into the cost of the trains and is not attributed to food catering specifically. However, the Duluth corridor study assumes none of the small 200-seat trains will have a dedicated dining or bistro car. Instead, an OBS employee or food service vendor would move through the train with a trolley cart, offering food and beverages for sale to the passengers. In the future, larger 300-seat trains may be able to provide as an enhancement a small walk-up café area where the attendant works when not passing through the train with the trolley cart.

The goal of the OBS franchising should be to ensure a reasonable profit for the provider of on-board services, while maintaining a reasonable and affordable price structure for passengers. The key to attaining OBS profitability is selling enough products to recover the train mile related labor costs. If small 200-seat trains were used for start-up, given the assumed OBS cost structure, even with a trolley cart service the OBS operator will be challenged to attain profitability. However, the expanded customer base on larger 300-seat trains can provide a slight positive operating margin for OBS service.

In practice, it is difficult for a bistro-only service to sell enough food to recover its costs. Bistro-only service may cover its costs in Amtrak's northeast corridor that operates very large trains, but it will be difficult to scale down this business model to the Duluth corridor that will, by necessity, operate much smaller 200 to 300-seat trains. 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. Many customers appreciate the convenience of a trolley cart service and are willing to purchase food items that are brought directly to them. While some customers prefer stretching their legs and walking to a bistro car, other customers will not bother to make the trip.

The cost of goods sold is estimated as 50 percent of OBS revenue, based on Amtrak's route profitability reports. Labor costs, including the cost of commissary support and OBS supervision, have been estimated at $1.67 per train mile. This cost is consistent with Amtrak's level of wages and staffing approach for conventional bistro car services. However, this Business Plan recommends that an experienced food service vendor provide food services and use a trolley cart approach.

A key technical 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 the carts. Although convenient passageways often have not been provided on U.S. equipment, the ability to support trolley carts is an important equipment design requirement for the planned service.

5.1.5 Insurance Costs

Liability costs were estimated at 1.2¢ per passenger-mile, the same rate that was assumed in the earlier MWRRS study brought to $2006. In 2014, for example, insurance is projected to cost nearly $1.2 million a year, although this expense continues to go up as ridership rises. Federal Employees Liability Act (FELA) costs are not included in this category but are applied as an overhead to labor costs.

The Amtrak Reform and Accountability Act of 1997 (§161) provides for a limit of $200 million on passenger liability claims. Amtrak carries that level of excess liability insurance, which allows Amtrak to fully indemnify the freight railroads in the event of a rail accident. This insurance protection has been a key element in Amtrak's ability to secure freight railroad cooperation. In addition, freight railroads perceive that the full faith and credit of the United States Government is behind Amtrak, while this may not be true of other potential passenger operators. A recent General Accounting Office (GAO) review[2] has concluded that this $200 million liability cap applies to commuter railroads as well as to Amtrak. If the GAO's interpretation is correct, the liability cap may also apply to potential Duluth corridor franchisees.

[2] See: http://www.gao.gov/highlights/d04240high.pdf

If this liability limitation were in fact available to potential franchisees, it would be much easier for any operator to obtain insurance that could fully indemnify a freight railroad at a reasonable cost.

5.2 Minneapolis-Duluth/Superior Corridor – Route Fixed Costs

5.2.1 Track and Right-of-Way Costs

Currently, it is industry practice for passenger train operators providing service on freight-owned rights-of-way to pay for track access, dispatching and track maintenance. The rates for all of these activities will ultimately be based upon a determination of the appropriate costs that result from negotiations between the parties. The purpose here is to provide estimates based on the best available information; however, it is important to recognize that this Study is a feasibility-level analysis and that as the project moves forward, additional study and discussions with the railroads will be needed to further refine these costs. Both capital and operating costs will be estimated.

To accommodate passenger trains on the Minneapolis to Duluth rail line, the corridor requires a substantial increase in capacity. Once constructed, these improvements will need to be maintained to FRA standards required for reliable and safe operations. The costing basis assumed in this report is that of *incremental* or *avoidable* costs. Avoidable costs are those that are eliminated or saved if an activity is discontinued. The term *incremental* is used to reference the change in costs that results from a management action that increases volume, whereas *avoidable* defines the change in costs that results from a management action that reduces volume. Following the same standard that was established for the MWRRS, the following cost components were included within the Track and Right-of-Way category:

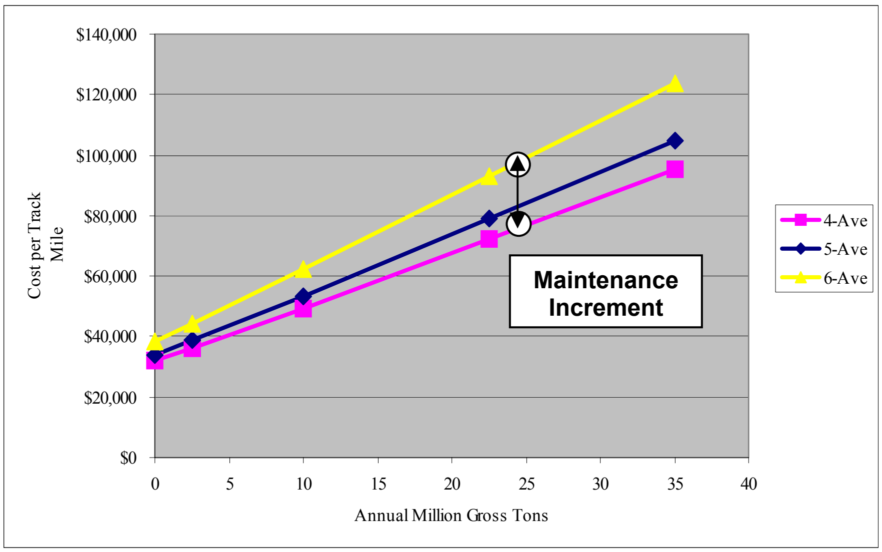
- **Track Maintenance Costs.** Costs for track maintenance were estimated based on Zeta-Tech's January 2004 draft technical monograph *Estimating Maintenance Costs for Mixed High-Speed Passenger and Freight Rail Corridors*.[3] However, Zeta-Tech's costs are conceptual and are still subject to negotiation with the freight railroads.
- **Dispatching Costs and Out-of-Pocket Reimbursement.** 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. These costs are included as an additive to Track and Right-of-Way Maintenance costs.
- **Costs for Access to Track and Right-of-Way.** Access fees, particularly train mile fees incurred as an operating expense, are specifically excluded from this calculation. 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 made to the corridor for balancing up-front capital with ongoing operating payments.[4]

[3] Zeta-Tech, a subsidiary of Harsco (a supplier of track maintenance machinery) is a rail consulting firm who specializes in development of track maintenance strategies, costs and related engineering economics.

[4] For 110-mph service, the level of infrastructure improvements to the corridor called for in this study should provide enough capacity to allow superior on-time performance for both freight and passenger operations. It is believed that the capacity improvements proposed in the Engineering evaluation provide a reasonable planning basis for establishing costs for this study; but needs to be confirmed by a detailed capacity analysis. The recommended strategy for 110-mph service is to provide enough up-front capital improvement to mitigate not only freight delays, but also the need for providing additional operating incentives that could adversely affect the passenger system's ability to attain a positive operating ratio.

Exhibit 5.2 shows the conceptual relationship between track maintenance cost and total tonnage that was calibrated from the earlier Zeta Tech study. It shows a strong relationship between tonnage and maintenance cost. At low tonnage, the cost differential for maintaining a higher track class is not very large, but as tonnage grows, so too does the added cost. If freight needs only Class 4 track, the passenger service would have to pay the difference, called the "maintenance increment", which for a 25 MGT line as shown in Exhibit 5.2, would come to about $25,000 per mile per year. The required payment to reimburse BNSF for its added track cost would be less for lower freight tonnage, more for higher freight tonnage.

Exhibit 5.2: Track Maintenance Cost Function



Following the Zeta Tech methodology, a "maintenance increment" is calculated based on *freight tonnage only*, since a flat rate of $1.56 per train mile as used in the Zeta-Tech report was added to reflect the direct cost of added passenger tonnage regardless of track class. This cost, which was developed by Zeta-Tech's TrackShare® model, includes not only directly variable costs, *but also an allocation of a freight railroad's fixed cost*. Accordingly, it complies with the Surface Transportation Board's definition of "avoidable cost." An allowance of 39.5¢ per train-mile was added for freight railroad dispatching and out-of-pocket costs.

The result of this calculation for an 8-round trip 110-mph service comes to an annual track operating cost of $3.95 million. It is broken out as follows:

- $1.51 million directly for passenger train miles and out-of-pocket expense
- $2.44 million for maintaining higher Class VI (110-mph) track on the Hinckley Subdivision, 125 miles, average $19,520 per year per mile. This assumes Class IV (79-mph) track in the Twin Ports terminal north of Boyleston and Twin Cities terminal south of Coon Creek Junction.

Because passenger trains don't add much tonnage, the added cost for maintaining 110-mph track is largely independent of the number of passenger trains operated. Once the track is built there is an incentive to operate as many trains as possible, for reducing the average unit cost. However, if fewer than eight trains are operated, the average cost goes up since this fixed cost must be spread across a smaller base of passenger train miles.

Assumed track costs are $4.50 per train mile for the 79-mph scenarios reflecting the likely need to include some operating incentive and additional out-of-pocket payments at this low speed and frequency level. For 110-mph, an average cost of $9.00 per train mile was assumed for 4 trains at 110-mph reflecting the high cost of maintaining a high track class for only a few trains. Since the maintenance incremental is largely fixed, this reduces to $5.11 per train mile if eight round trips are operated at 110-mph. It can be seen that the added cost for 110-mph track is not exorbitant, provided enough trains are operated to spread the cost over a reasonably broad base. For 125-mph, estimated track costs were slightly higher at $11.00 per train mile for 4 trains, dropping to $7.00 for 8 trains.

In addition to an *operating* component of track maintenance cost (which is shown in Exhibit 5.2) the track cost methodology also identifies a *capital* cost component. For track maintenance:

- *Operating costs* cover expenses needed to keep existing assets in service and include both surfacing and a regimen of facility inspections.
- *Capital costs* are those related to the physical replacement of the assets that wear out. They include expenditures such as for replacement of rail and ties, but these costs are not incurred until many years after construction. In addition, the regular maintenance of a smooth surface by reducing dynamic loads actually helps extend the life of the underlying rail and tie assets. Therefore, capital maintenance costs are gradually introduced using a table of ramp-up factors provided by Zeta-Tech (Exhibit 5.3). A normalized capital maintenance level is not reached until 20 years after completion of the rail upgrade program.

Exhibit 5.3: Capital Cost Ramp-Up Following Upgrade of a Rail Line

Year	% of Capital Maintenance	Year	% of Capital Maintenance
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%		

For development of the Business Plan, only the operating component of track maintenance cost is treated as a direct operating expense. Capital maintenance costs are incorporated into the Financial Plan and into the Benefit Cost analysis. Because these capital costs do not start occurring until rather late in the project life, usually they have a very minor effect on the Benefit Cost calculation. These costs can be financed using direct capital grants or from surplus operating cash flow. The latter option has been assumed in this study. Accordingly, maintenance capital expenses only reduce the net cash flow generated from operations; they do not affect the operating ratio calculations.

5.2.2 Station Operations

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 expenses.

- Staffed stations were assumed at the route endpoints of Duluth and Minneapolis. Additional unstaffed stations were assumed at Suburban North, Cambridge, Hinckley, and Superior. All stations were assumed open for two shifts. The cost for the staffed stations includes eight positions at each new location.
- The cost for unstaffed stations covers the cost of utilities, ticket machines, cleaning and basic facility maintenance, which is also included in the staffed station cost. Volunteer personnel such as Traveler's Aid, if desired could staff these stations.

The total annual operating cost for stations comes to $1.52 million. This stations cost is practically independent of the number of trains operated or their speed, so running the largest number of trains at the highest speed possible generates the best economies of scale.

5.3 Minneapolis-Duluth/Superior Corridor – System Overhead Costs

While both variable and route-specific costs can be clearly identified, the allocation of corporate overhead to passenger rail services raises a number of issues. A small shift in allocations by Amtrak can have a large and unanticipated impact on subsidy needs. Furthermore, the timing of these shifts in many states' experience has often been disadvantageous, subject to the whims of Federal funding appropriations, as Amtrak has sought to make up its own funding gaps by increasing subsidy demands for state-supported trains, often claiming that trains are paying less than their fully-allocated costs.

Accordingly, states have desired a means for insulating the finances of locally supported rail services from the vagaries of the Federal funding process. In addition, states have desired to protect their ability to recoup at least some portion of the investment that they would be making for development of 110-mph rail services. The system operator, who benefits from large capital investments made by others including state and local matching funds, must pay an appropriate franchise fee for the use of the assets. Without any limitation on the allocation of corporate overheads, an operator would have the ability to confiscate any operating surpluses that may be generated by the system, leaving the sponsoring agency to bear the full load of capital costs all by itself. An alternative institutional structure has been proposed for providing predictability to the financial planning of rail services.

5.3.1 The MWRRS Franchising Model

The Midwest Regional Rail System proposed a franchising model for developing 110-mph rail services:

- A public policy board would follow all the normal procedures of a governmental entity by allocating capital for the greatest public benefit, allowing public participation in all decision-making and making complete and detailed financial disclosures.

- A rail service provider would operate in a commercial environment as a private sector, for-profit, business enterprise. The service provider would make its decisions on a commercial basis and would be allowed to protect the confidentiality of its proprietary business data.

In this environment, it is essential to separate the policy board's requirement for service and funding oversight from the operator's business requirements to be profitable. As pointed out by the Amtrak Reform Council in 1997, the current Amtrak structure, by combining governmental and non-governmental functions in a single entity, does not do this. Amtrak might serve as an operator of the system, but the MWRRS Franchising model assumes that authority and control over the allocation of capital dollars will be vested in states rather than the operator.

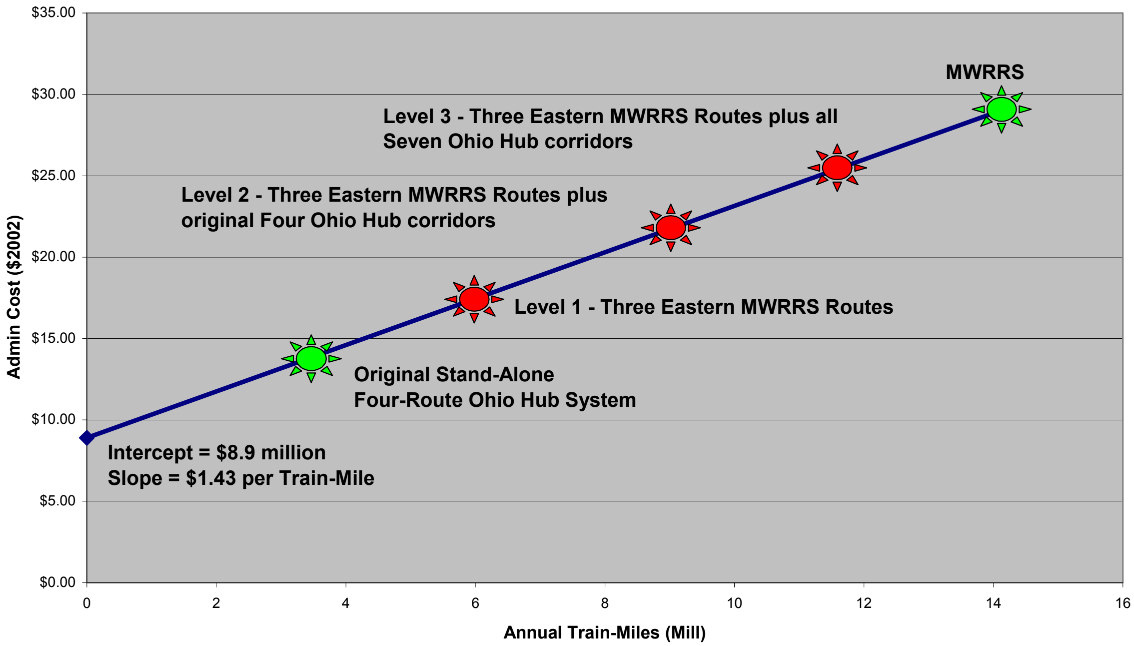
For development of this institutional structure, it was understood that the system operator would need to have a reasonable allowance not only for its variable costs but also for overheads. In addition, the operator would need to earn a profit margin.[5] Therefore, the MWRRI developed, in conjunction with Amtrak, a hypothetical stand-alone management organization, including a President, Operations supervision, Finance and Marketing structure, including a dedicated call center. This organization was not simply hypothetical – it was intended to reflect an actual management structure that could be capable of administering a network the size of the proposed MWRRS operation. As a result, the system overhead as well as train and route costs all became clearly identifiable.

Later, the Ohio Hub[6] study further refined the organizational structure proposed by the MWRRS to reflect its own needs. This organization reduced the number of staff positions and consolidated the functions of some middle-level managers, to better reflect the needs of a smaller Ohio network. This restructuring converted some of the administrative cost, which had all formerly been considered fixed, into a variable cost based on train miles. As shown in Exhibit 5.4, the result was development of a Fixed + Variable cost framework for the implementation of a stand-alone management structure.

[5] The MWRRS operator was assumed to take a 10 percent mark-up on directly-controlled costs, including insurance, stations, sales and marketing, administration, train crew, and energy and fuel. Costs related to track maintenance; on-board service, equipment maintenance and parcel service were out-sourced to other service provider and assumed to include their own profit margins.

[6] The Ohio Hub is a proposed 1,244 mile intercity passenger rail system that would serve over 22 million people in five states and southern Ontario, Canada. Seven rail corridors with 44 stations would connect twelve major metropolitan areas, and many smaller cities and towns. For more information see: http://www.ohiohub.com

Exhibit 5.4: Fixed + Variable Administrative Cost Structure



This cost structure for a stand-alone administrative organization had a fixed cost of $8.9 million plus $1.43 per train-mile (in $2002) for added staff requirements as the system grew. Inflated to $2006, this became $9.7 million plus $1.56 per train mile.

However, the Sales and Marketing category also has a substantial fixed cost component for advertising and call center expense, adding another $2.5 million per year fixed cost, plus variable call center expenses of 62¢ per rider.[7] Finally, credit card and travel agency commissions are all variable: 1.8 percent and 1 percent of revenue, respectively. *Therefore, the overall financial model for a Stand-alone organization therefore has $12.2 million ($9.7 + $2.5 million) annually in fixed cost for administrative, sales and marketing expenses.*

- To understand the impact of these fixed costs on the overall financials of the project, the MWRRS and Ohio Hub had 13.8 million and 3.7 million train-miles each. These fixed costs added 88¢ per train-mile to the MWRRS and $3.30 per train-mile to the Ohio Hub, respectively.
- By comparison, the Minneapolis-Duluth/Superior Corridor would generate 773,760 annual train miles for eight round-trips, or half of that 386,880 for four round-trips. A stand-alone Administrative structure would add an equivalent of $15.77 or $31.53 per train-mile respectively. While a stand-alone administrative organization may be appropriate and affordable for a large multi-route hub system, it is clear that a relatively small operation like Minneapolis to Duluth will need a shared administrative cost structure.

[7] In the MWRRS cost model, call center costs were built up directly from ridership, assuming 40 percent of all riders call for information, and that the average information call will take 5 minutes for each round trip. Call center costs, therefore, are variable by rider and not by train-mile. Assuming some flexibility for assigning personnel to accommodate peaks in volume and a 20 percent staffing contingency, variable costs came to 57¢ per rider. These were inflated to 62¢ per rider in $2006.

Although the MWRRS Franchising model still remains valid, there is a clear need to assume a shared rather than stand-alone administrative cost structure for this corridor. It is therefore necessary to assume that an existing operator who has the experience necessary to implement the rail passenger system will operate the Minneapolis-Duluth/Superior Corridor. Most likely, the successful bidder will also have an established market presence in the Twin Cities area so that its existing management organization can be grown incrementally to support the needs of this service.

5.3.2 Shared Overhead Cost Allocation

Section 403(b) of the National Railroad Passenger Service Act of 1970 (PL 91-518) provided that any state, regional or local agency may request Amtrak to initiate service on new routes or expand service on existing routes if it were willing to reimburse Amtrak just 50 percent of the solely-related cost of providing the service.[8] The Amtrak Reform and Accountability Act of 1997 repealed this provision of the 1970 law; since then, Amtrak's policy has been that all state-supported services need to cover their direct operating losses through a combination of fare box revenues and state support. Implicit in this policy[9] however, is an "embedded" subsidy from Amtrak (and thus from the Federal government) in the form of unallocated overhead and equipment related costs.

However, consistent with the spirit of the original 403(b) law, Amtrak has sometimes been willing to start a service by requiring enough subsidy for direct operating losses only, overlooking some of the overhead costs in the early ramp-up years of the service. While this willingness to give sponsors a "cost break" certainly helps during the ramp-up phase, it has also been Amtrak's practice to seek to recover at least some contribution towards overhead costs after a service gets established. This generally results in an increase in the subsidy requirement after the first few years of operation, if the initial service was not provided under a full-cost agreement. Indeed, according to *Amtrak's Strategic Reform Initiatives and FY05 Grant Request*, Amtrak plans to transition states to *full coverage of fully-allocated operating losses* (excluding interest and depreciation), plus an equipment capital charge, for all corridor trains over a four-year period starting in FY08. This seems to indicate that Amtrak plans an even more aggressive stance towards requiring full-cost recovery for state supported services in the near future.

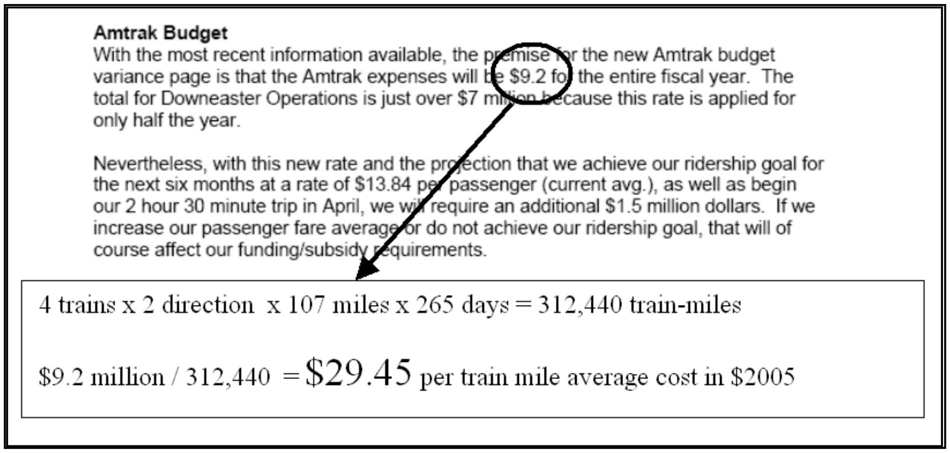
The rates for overhead cost allocation will ultimately be based upon a determination of the appropriate costs that result from negotiations between the parties. The purpose here is to provide estimates based on the best available information; however, it is important to recognize that this Study is a feasibility-level analysis and that as the project moves forward, additional study and discussions with potential operators will be needed to further refine these costs.

However, for assessing a likely level of cost allocation, a benchmarking exercise was conducted based upon Amtrak's most recent subsidy agreement with the Northern New England Passenger Rail Authority (NNEPRA) for the *Downeaster* service as well as other corridor costs. This way, one can get an idea of the likely magnitude of costs that might be expected. Per Exhibit 5.5, Amtrak's subsidy support increased 16% from $29.45/tm in 2005 to $34.11/tm in 2006: an increase of nearly $5 per train mile, which came mostly from an increased allocation of fixed call center and administrative costs as Amtrak sought to move towards full-cost recovery. Adopting this $5 per train mile as the expected allocation of fixed costs,

[8] See: http://www.fra.dot.gov/downloads/RRDev/reex-may78.pdf
[9] See: http://www.amtrak.com/pdf/strategic06.pdf

it is interesting to note that the final result of the NNEPRA actual contract comes very close to the $34.13 result we developed for four round trips in the Minneapolis-Duluth/Superior Corridor.

Exhibit 5.5: ***Downeaster*** **Average Costs**


Amtrak Budget
With the most recent information available, the premise for the new Amtrak budget variance page is that the Amtrak expenses will be $9.2 for the entire fiscal year. The total for Downeaster Operations is just over $7 million because this rate is applied for only half the year.

Nevertheless, with this new rate and the projection that we achieve our ridership goal for the next six months at a rate of $13.84 per passenger (current avg.), as well as begin our 2 hour 30 minute trip in April, we will require an additional $1.5 million dollars. If we increase our passenger fare average or do not achieve our ridership goal, that will of course affect our funding/subsidy requirements.

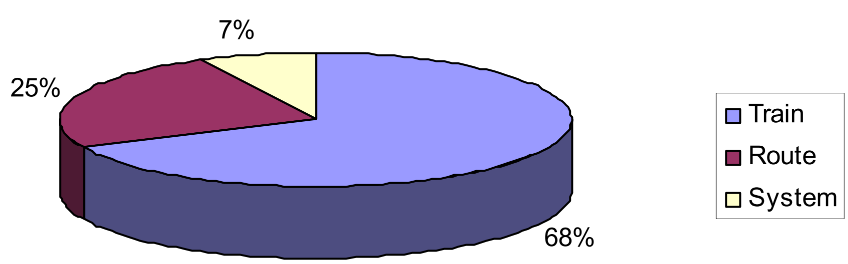
4 trains x 2 direction x 107 miles x 265 days = 312,440 train-miles

$9.2 million / 312,440 = $29.45 per train mile average cost in $2005

With regard to Amtrak's actual level of administrative costs, the most recent published data that gives this detail is the 1998 report *Intercity Passenger Rail: Financial Performance of Amtrak's Routes* by the U.S. General Accounting Office.[10] At the time, Amtrak was still detailing its costs by Train, Route and System breakdowns. Appendix II, Table II.4, summarized in Exhibit 5.6, shows that System overhead costs comprised only 7% of the 1998 total cost. However, this 7% factor does not capture all the overhead cost, since reservations and management support computer systems were reported as a Route-level expense.

By comparison, *Downeaster's* estimated overhead rate of $5 per train mile comprises 14.7% of its overall cost. This $5 allowance is also known to include a component of reservations call center cost, and therefore it covers more than just the train's 7% allocated share of System costs. Therefore, this $5 per Train Mile factor is considered to reflect a reasonable estimate of Amtrak's fully allocated overhead cost. Practically, the application of this factor results in overall cost projections that are consistent with corridor results seen elsewhere. The further validation of overhead costs developed by this methodology will be discussed in the next section.

Exhibit 5.6: Amtrak Reported Train, Route, and System Cost (1998 data)



10 See: http://ntl.bts.gov/lib/000/300/377/rc98151.pdf

5.4 Minneapolis-Duluth/Superior Corridor - Cost Results

Exhibit 5.7 summarizes the average cost per train mile results from the variety of scenarios that were evaluated for the Minneapolis-Duluth/Superior Corridor. Train-mile cost results are estimated in a $34-$52 range for 79-mph service; a $33-44 range for 110-mph service[11] and $36-49 for 125-mph service, depending on the number of daily round trips operated. These results reflect the economies from spreading route-level fixed costs over a broader base as the number of train-miles are increased, but assume a fixed allocation of $5 per train-mile for overhead administrative costs.

Exhibit 5.7: Projected Average 2010 Costs per Train Mile for Minneapolis-Duluth Options

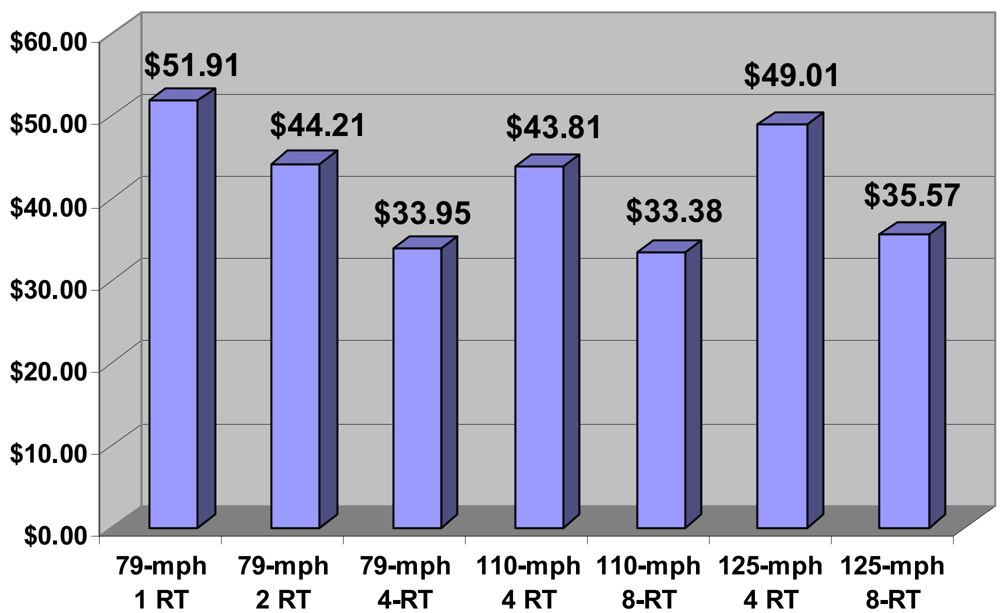


Exhibit 5.8 shows the projected cost breakdown for the eight-train a day 110-mph Minneapolis to Duluth in 2025. With a negotiated $5 per train mile contribution to fixed administrative and call center costs, the largest single category of expense would be for train equipment maintenance (24%), followed by track (14%), train crew (11%), administration and management (12%), on board services expense and fuel (9% each) and call center (7%).

[11] These 110-mph costs show improved economies of scale for operating up to 8 round trips per day.

Exhibit 5.8: 2025 Operating Cost Breakdown by Expense Type ($2006 Mill)

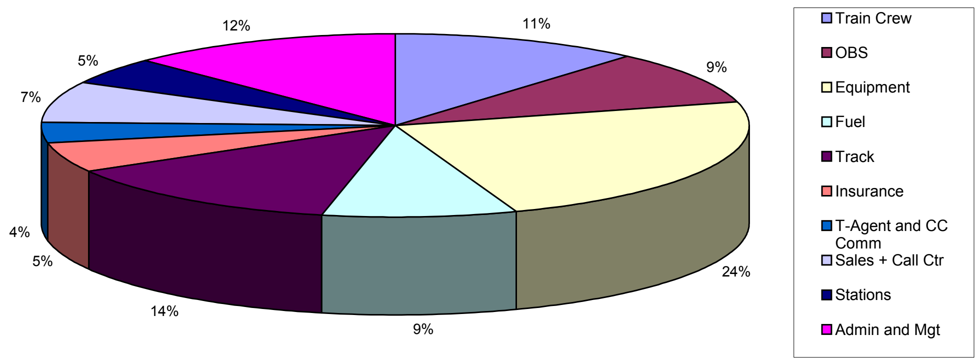


Exhibit 5.9 summarizes the operating cost assumptions, as they have been described in this Chapter.

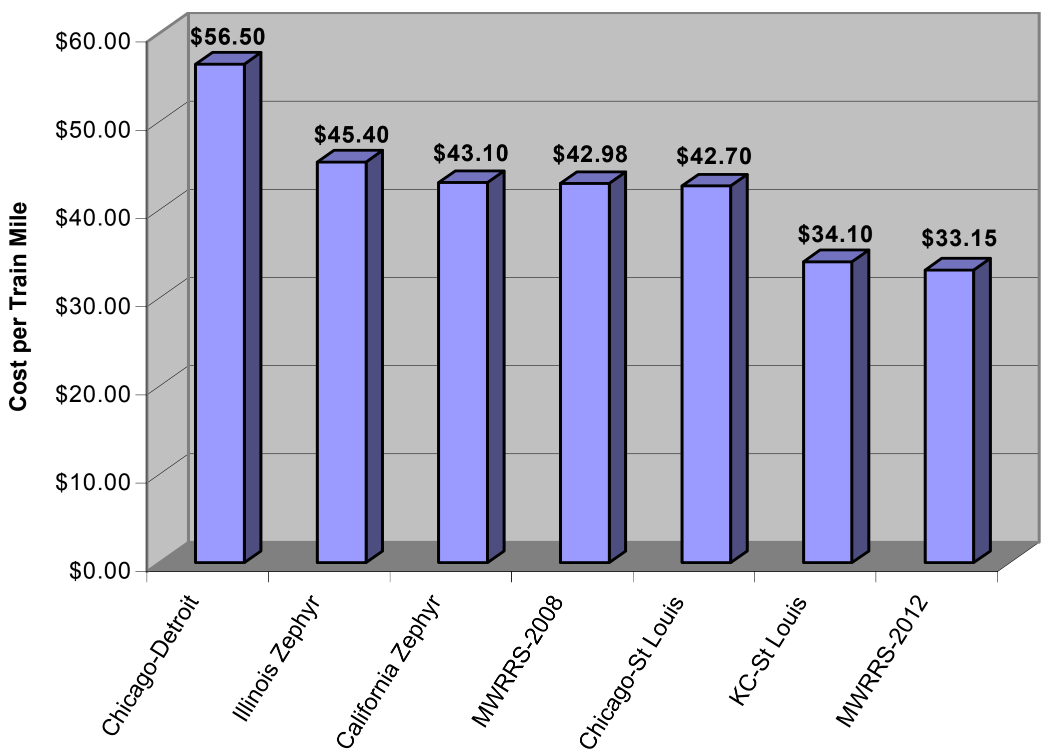
Exhibit 5.9: Summary of Unit Costs

Category	Basis	Type	Cost ($2006)
Train Crew	Train Miles	Variable	$4.29
OBS	Train Miles + OBS Revenue	Variable	$1.67 (labor) + 50% OBS Revenue
Equipment Maintenance	Train Miles	Variable	$12.19 (200 Seat Train)
Energy/Fuel	Train miles	Variable	$3.94
Track/ROW	Train Miles	Fixed	$4.50/TM for 4 trains at 79-mph $5.11/TM for 8 trains at 110-mph $9.00/TM for 4 trains at 110-mph
Station Costs	Passenger	Fixed	$1.52 million
Insurance	Pass-miles	Variable	$0.012
Sales/Mktg	Passenger + Ticket Revenue	Both Fixed and Variable	Allocation of $5 per train mile, plus variable call center expenses of 62¢ per rider
Admin	Train miles	Fixed	

5.5 Validation of Cost Results

This study uses a well-established costing framework that traces its roots back to a number of previous rail studies. However, the current form of the costing model was mainly established as a result of the extensive work that was performed for the Midwest Regional Rail Initiative, with the active support and participation of Amtrak, freight railroads, and a consortium of nine Midwestern States. The MWRRS costing framework was extensively validated at the time when it was first developed. Exhibit 10-22 from the MWRRS report (Exhibit 5.10 below) compared model-projected MWRRS costs to Amtrak's fully allocated RPS costs.[12] Since then, the costing framework has been continuously updated and enhanced as a result of subsequent rail planning projects in Ohio and Florida.

Exhibit 5.10: Comparison: Projected MWRRS vs. Amtrak RPS Costs (in $2002)



As shown in Exhibit 5.10, the model-predicted costs were in the same range as actual Amtrak experience – in fact, projected average cost for the "MWRRS 2008" start-up service of $42.98 came in slightly higher than Amtrak's fully-allocated RPS cost for the Chicago-St. Louis corridor at the time. Amtrak's costs for the Chicago-Detroit corridor were higher because of the high cost of maintaining dedicated passenger track, spread over the relatively few train miles operated.

By 2012, spreading the system's fixed cost over a larger base of train-miles would have reduced the average cost per train mile to $33.15. This cost would have been somewhat lower than most of Amtrak's

[12] 1997 Amtrak costs adjusted for inflation to 2002, excluding depreciation. Source: *Intercity Passenger Rail: Financial Performance of Amtrak's routes*, U.S. General Accounting Office, May 1998. This validation chart was included in the MWRRS report that was published in 2004.

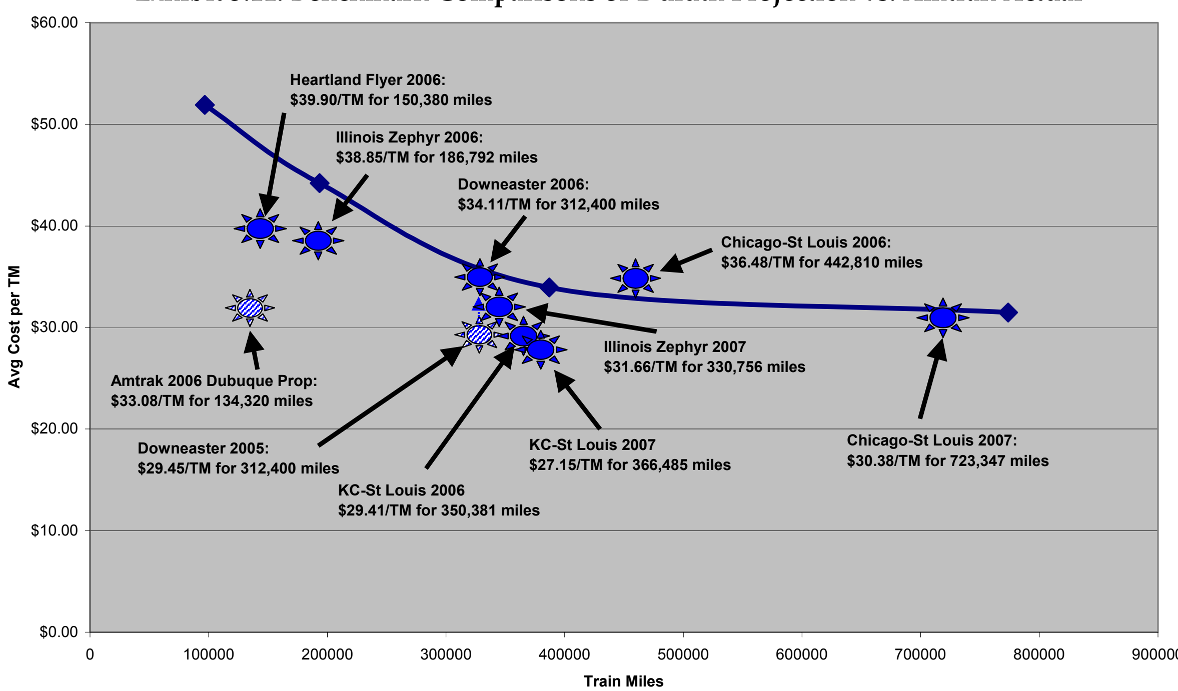
costs at the time, but still in range of some existing services in the Midwest region; roughly comparable to the level of costs that were then being allocated to the St. Louis-Kansas City route.

The results of the 79-mph costing were then further validated against a number of current Amtrak operations. A combination of RPS data furnished by Amtrak along with published information on the financial performance of other state-supported services was used to establish the benchmark data. Several comparable services were included in the benchmark:

- Downeaster
- Illinois Zephyr
- St Louis to Chicago
- St Louis to Kansas City
- Heartland Flyer
- Rockford, Il (Proposed)

These results, as compared to the cost function calculated for the 79-mph Minneapolis to Duluth service, are summarized in Exhibit 5.11.

Exhibit 5.11: Benchmark Comparisons of Duluth Projection vs. Amtrak Actual



RPS data furnished by Amtrak showed that the cost per train mile assigned to all of the Illinois corridors, in agreement with the cost model, dropped dramatically as a result of the doubling of train frequencies. A doubling of train frequency (train miles) for the Illinois Zephyr and Chicago-St Louis routes (from one to two trains and three to five trains) reduced the average total cost per train mile from $38.85 and $36.48 down to $31.66 and $30.38, respectively, just as the costing model would have predicted.[13]

[13] The Chicago to St. Louis line includes a significant stretch (120 miles) of FRA Class VI track from Springfield to Dwight, IL, which is shared with Union Pacific freight trains. This shows that the added maintenance cost for Class VI track shared with freight trains

For a new service from Chicago to Dubuque as shown in Exhibit 5.12, Amtrak recently proposed a cost of $33.08 per train mile to Illinois DOT[14]. This cost seems low in comparison to other corridors of a similar length, raising the question of whether Amtrak is pricing this service at full cost. However, the service would share the same Chicago maintenance base and overhead cost structure with other existing Illinois and Wisconsin state-sponsored services, and therefore as part of a larger system, Amtrak's pricing of the proposed service shows the efficiencies that Dubuque corridor can gain by being part of a larger, multi route Chicago Hub system. Amtrak's pricing of the Dubuque corridor clearly reflects these Hub efficiencies.

Exhibit 5.12: Proposed Chicago to Dubuque Service

VI. Summary – Proposed Chicago-Rockford-Dubuque Service

This section summarizes key elements of each route alternative between Chicago and Dubuque

	Route A UP Belvidere	Route B ICE Airport	Route C CN Direct	Route D ICE-CN Hybrid
Length of Route (miles)	184.0	188.6	182.2	181.0
No. of Rail Carriers	4	5	2	4
Proposed Scheduled Running Time (hours:minutes)	5:25	5:42	5:10	5:22
"Order of Magnitude" Capital Cost ($ millions)	$43.8	$48.9-$55.4	$32.3	$34.5
Estimated Annual Ridership	53,600	44,300	74,500	58,400
Estimated Annual Revenue ($ millions)	$1.1	$1.0	$1.5	$1.2
Estimated Annual Operating Expense ($ millions)	$4.1	$4.1	$4.4	$4.2
Estimated Annual Operating Contract ($ millions)	$3.0	$3.1	$2.9	$3.0

The most direct existing analog to the proposed Minneapolis to Duluth service would be the Heartland Flyer operation from Fort Worth to Oklahoma City, which with 150,380 annual train miles is costing over $6 million a year,[15] an average of $39.90 per train mile. Because of its relative isolation from the rest of the Amtrak system, this corridor has the highest train-mile rate of any of the corridors benchmarked. But the Minneapolis-Duluth/Superior Corridor at 155 miles is even shorter than the Heartland Flyer's 206 miles, and would not even share a common downtown Twin Cities station or maintenance base (as the Heartland Flyer in Fort Worth does.) The Duluth corridor therefore, as a stand-alone operation, would likely be even more expensive to operate than the Heartland Flyer, if priced on a fully allocated basis.

However, even if the cost of a Minneapolis to Duluth 79-mph service could be reduced to the optimistic $33.08 that was quoted for the Dubuque corridor, the one-train a day option at 79-mph would still need a substantial operating subsidy. However, the $51.91 per train mile reflects a more reasonable assessment of the likely full cost for one daily round trip from Minneapolis to Duluth.

need not be a "deal killer." See: http://www.fra.dot.gov/us/content/648 and http://illinoisissues.uis.edu/features/2002apr/train.html although the signal system and train equipment currently deployed on the Chicago to St. Louis corridor does not permit operation at that speed.

[14] See: http://www.dot.state.il.us/amtrak/RCK_Feasibility.pdf

[15] See: http://findarticles.com/p/articles/mi_qn4182/is_20010619/ai_n10146131

If it is decided to negotiate with Amtrak, it is important to understand that Amtrak may offer favorable pricing for a start-up service that could be raised in the future. It is therefore recommended to obtain a long-term commitment to pricing rather than negotiating on a year-by-year basis, and to understand up-front what Amtrak's fully allocated cost position will be.

Most certainly, the best strategy for improving bargaining leverage would be to bundle the Minneapolis-Duluth/Superior Corridor into a package of intercity rail services, such as a possible Minneapolis hub system, that would be large enough to support its own dedicated administrative cost structure. The Duluth corridor could then benefit from Hub economies just as the proposed Dubuque operation has. These economies of scale could be achieved by building corridor revenues through an aggressive approach to 110-mph implementation, or possibly by co-developing the service along with the MWRRS or other Twin Cities rail corridors.

6

Financial and Economic Viability

The analysis uses the same criteria and structure as the 1997 FRA *Commercial Feasibility Study.*[1] The study set out criteria for establishing a public-private partnership between the federal government, state and local communities, and the private sector for intercity rail projects. The study described two conditions that were considered essential for receiving federal funding support for proposed intercity passenger rail projects:

- An operating cost ratio of at least 1.0, defined as a pre-condition for an effective public/private partnership, so that once the system has been constructed, a private operator could operate the system on a day-to-day without requiring an operating subsidy[2], and
- A benefits/cost ratio greater than 1.0, to ensure that the project makes an overall positive contribution to the economy, at both the regional and national levels.

The *Commercial Feasibility Study* makes it clear that "*federal consideration of specific High-Speed Ground Transportation project proposals could apply additional criteria that could differ from, and be much more stringent than, this report's threshold indicators for partnership potential.*"

This chapter discusses both the operating performance and economic performance of the corridor alternatives and presents the financial and economic analysis of the system's construction and operation. This analysis integrates operating and maintenance costs with revenue projections for the year-by-year calculation of operating ratios. User benefits, externalities, and other mode benefits are assessed against capital and operating costs for calculation of Benefit Cost ratios over the lifetime of the project.

6.1 Financial Performance Measures

Financial performance was evaluated by analyzing the operating cash flows for each alternative. The ratio of operating revenues to operating costs (i.e., operating cost ratio) provides a key indicator of the financial viability of the Minneapolis-Duluth/Superior Corridor. The operating ratio is calculated as follows:

$$\text{Operating Ratio} = \frac{\text{Total Annual Revenue}}{\text{Total Annual Operating Cost}}$$

[1] U.S. Federal Railroad Administration, *High-Speed Ground Transportation for America*, pp. 3-7 and 3-8, September 1997

[2] As defined in the Commercial Feasibility Study, a positive operating ratio does not imply that a passenger service can attain "commercial profitability." Since "operating ratio" as defined here does not include any capital-related costs, this report shows that the proposed Ohio Hub network meets the requirements of the Commercial Feasibility Study by covering at least its direct operating costs and producing a cash operating surplus.

6.2 Revenue, Cost and Operating Ratio Forecasts

Revenue, cost and operating ratio forecasts were produced for the scenarios defined for the seven alternatives shown in Exhibit 6.1.

Exhibit 6.1: Train Speed/Frequency Scenarios

	79/1	79/2	79/4	110/4	110/8	125/4	125/8
Speed (mph)	79	79	79	110	110	125	125
Frequency (train/day)	1	2	4	4	8	4	8
Fare ($/mile)	0.22	0.22	0.22	0.35	0.35	0.35	0.35
Running Time (minutes)	170	170	170	120	120	110	110

In general, the scenarios start with rather small trains and, holding train frequency constant, expand capacity by adding cars. However, this implies step-functions in the cost as additional cars are added. For locomotive-hauled technologies there comes a point where additional locomotives must be added in order to run longer trains. As described in Chapter 4 a practical limit of 400-seats was assumed for the generic Talgo T21 train, based on assumed locomotive power capabilities and the added weight that is required to meet the buff strength requirements of U.S. rail safety regulations.[3] Some of the step-functions associated with adding cars can be seen in the cost functions; but because of the maximum train size limitation, some scenarios (particularly in the lower train frequency ranges) run out of seating capacity before the end of the planning period in 2040. This implies the need to add more train frequencies in order to accommodate the forecast traffic demand.

Exhibits 6.2 through 6.9 show the forecast financial results for each scenario. These exhibits were all developed on the basis that operations start in 2010, but because of a two-year ramp up period would not attain "steady state" financial performance until 2012. The year 2012 is the first full year after ramp-up where the financial results will reflects the long-term economic performance of each system alternative. For this reason, 2012 performance rather than 2010 is often discussed in the following text and exhibits.

6.2.1 79-mph Scenarios

None of the 79-mph scenarios are able to attain a positive operating ratio. However, as the number of trains operated increases, the subsidy per train declines. Nonetheless, the total subsidy requirements grow as frequency is added as shown in Exhibit 6.10.

- The one-round trip a day scenario shown in Exhibit 6.2 is projected to have a fully allocated cost per train mile of $52. In 2012 (after ramp-up) this scenario would require $2.5 million in subsidy. For only one train it yields an average of $2.5 million per train. This scenario runs out of seating capacity after 2028.
- For the two round trips scenario shown in Exhibit 6.3, the train-mile operating cost declines to $44. In 2012 (after ramp-up) this scenario would require $4.2 million in subsidy, an average of $2.1 million per train. This scenario runs out of seating capacity after 2031.

[3] The Talgo equipment currently operating in the Pacific Northwest is based on European UIC standards, but it is operating in the U.S. under an FRA waiver.

- For the four round trips scenarios shown in Exhibit 6.4, cost declines to $34 per train-mile. In 2012 (after ramp-up) this scenario would require $6.0 million in subsidy, an average of $1.5 million per train. This scenario has enough capacity through 2040.

Exhibit 6.2: P42- 1 Train @ 79-mph

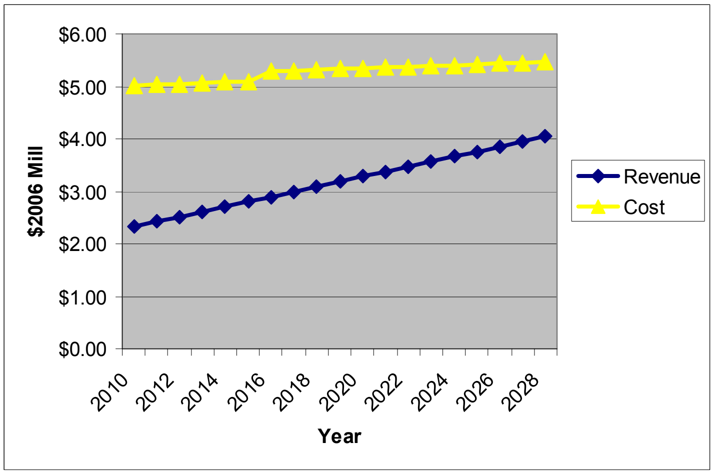


Exhibit 6.3: P42- 2 Trains @ 79-mph

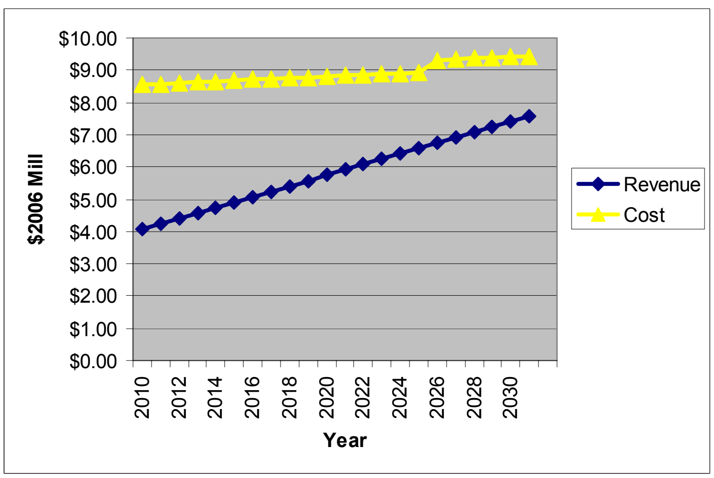
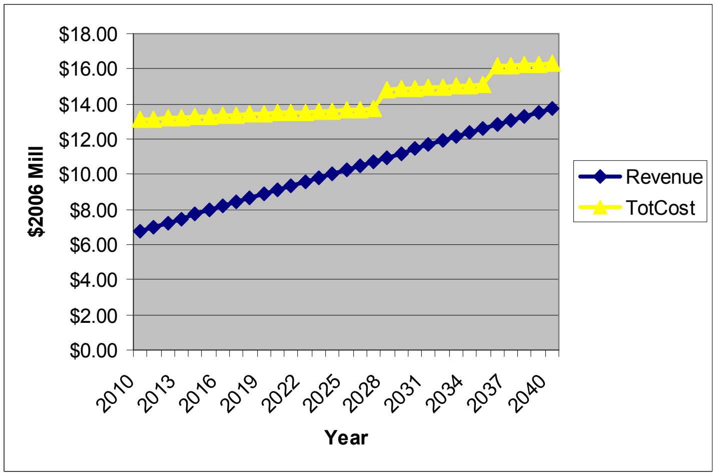


Exhibit 6.4: P42- 4 Trains @ 79-mph



6.2.2 110-mph Scenarios

All of the 110-mph scenarios are able to attain a positive operating ratio. Adding frequencies requires more capital, but improves the operating result.

- The four-round trip day scenario in Exhibit 6.5 is projected to have a fully allocated cost per train mile of $44, which is substantially higher than the cost for an equivalent 79-mph service because of the added track and fuel expense. However, in 2012 (after ramp-up) this scenario would produce a $1.3 million operating surplus. This scenario runs out of capacity after 2024.
- For six round trips scenario shown in Exhibit 6.6, the train-mile operating cost declines to $37. In 2012 (after ramp-up) this scenario would produce a $2.1 million operating surplus. This scenario has enough capacity through 2027.
- For eight round trips in Exhibit 6.7, the train-mile operating cost declines to $33, in the same approximate range as four round trips at 79-mph. In 2012 (after ramp-up) this scenario produces a $4.6 million operating surplus. This scenario has enough seating capacity through 2040.

Exhibit 6.5: 4 Trains @ 110-mph

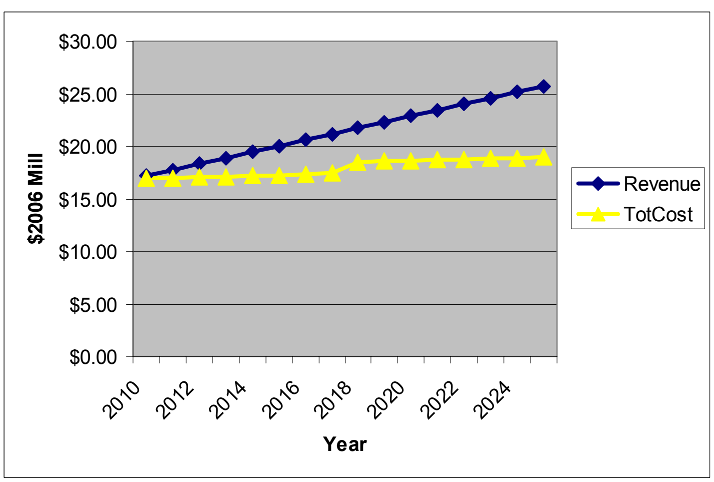


Exhibit 6.6: 6 Trains @ 110-mph

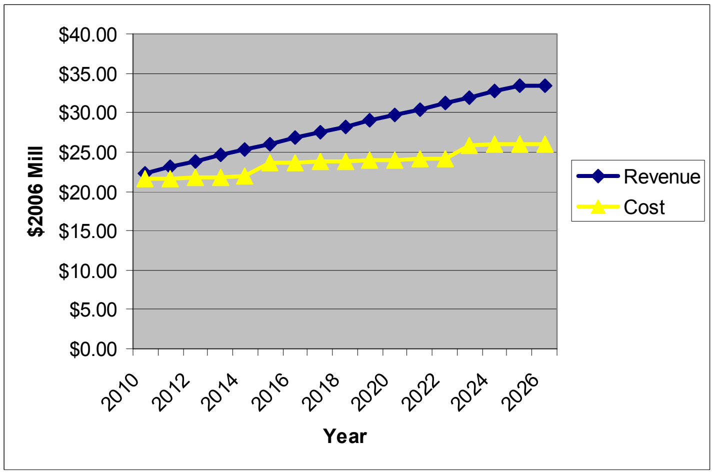
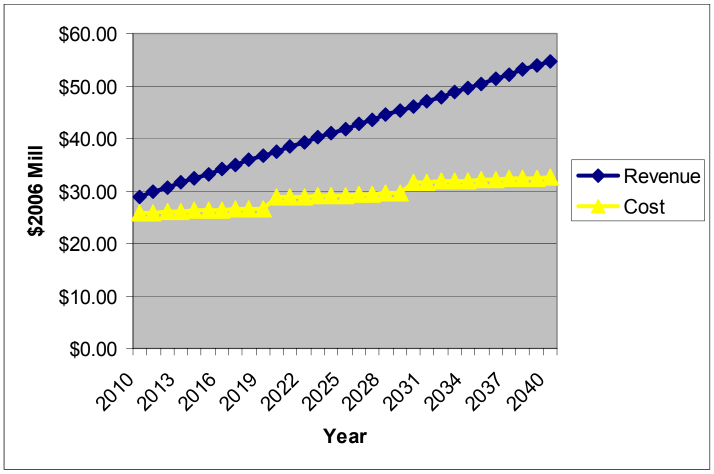


Exhibit 6.7: 8 Trains @ 110-mph



6.2.3 125-mph Scenarios

All of the 125-mph scenarios are able to attain a positive operating ratio. However, it is not really cost effective to upgrade the track to 125-mph and then only run four trains.

- The four-round trips per day scenario in Exhibit 6.8 is projected to have a fully allocated cost per train mile of $49, which is substantially higher than the cost for 110-mph service because of the added track and fuel expense. However, in 2012 (i.e., after the ramp-up period) this scenario would produce a $0.7 million operating surplus, which is lower than the surplus produced by the 110-mph scenario due to the higher track costs. This scenario runs out of capacity after 2021.
- For eight round trips per day in Exhibit 6.9, the train-mile operating cost declines to $36. In 2012 (after ramp-up) this scenario produces a $5.2 million operating surplus, which is better than the 110-mph scenario, but the capital expense required to achieve it is much greater. This scenario has enough capacity through 2040.

Exhibit 6.8: 4 Trains @ 125-mph

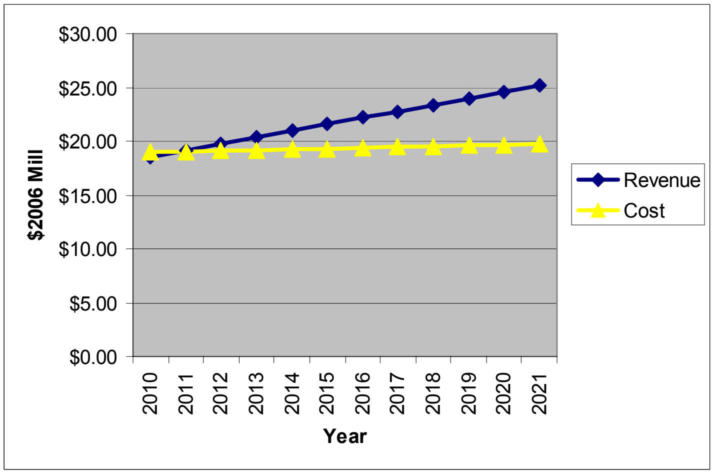
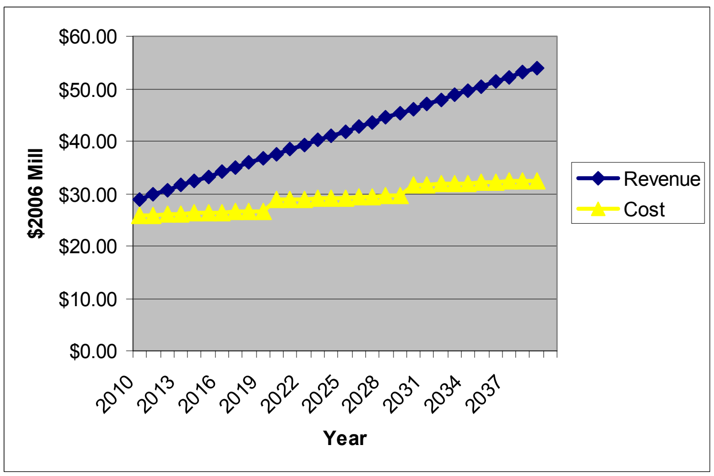


Exhibit 6.9: 8 Trains @ 125-mph



6.2.4 110-mph Casino Direct Rail Scenario (6+9 Plan)

A special operating plan was developed for directly connecting a 110-mph rail system to the Grand Casino in Hinckley. Because of heavy expected passenger loads on the south end of the line, the train size had to be increased and an additional train frequency was added south of Hinckley.

Although the Casino adds substantial riders, these riders travel only half the length of the corridor, so they do not yield as much revenue as a longer distance rider does. To maintain the financial performance of the system, the operating plan had to be adjusted to more closely match capacity to demand. Planned train frequencies from Hinckley to Duluth were reduced from eight to six – although because of the longer trains, the actual seating capacity provided on this segment did not change by much.

The Casino Direct Rail scenario reflects development of a customized new "6+9" operating plan that better matches train capacity to demand conditions on the corridor. However, with regard to the scenarios that had been developed earlier, "6+9" would be the most directly comparable to the 110-mph/8-train scenario that utilized a shuttle bus connection from downtown Hinckley to the casino.

The financial results of the Casino Direct Rail scenario are shown in Exhibit 6.10. The direct rail link would add about $8 million in revenue, but only $1.6 million in costs in 2012. Provided the operating plan is suitably adjusted, addition of the casino traffic yields about a 20 point improvement in the rail corridor's operating ratio. The 2012 operating ratio would improve from 1.18 in the base to 1.40 with Casino Direct Rail. 2040 operating ratios would improve from 1.68 to 1.89.

Exhibit 6.10: Casino Direct Rail with 6+9 Trains @ 110-mph

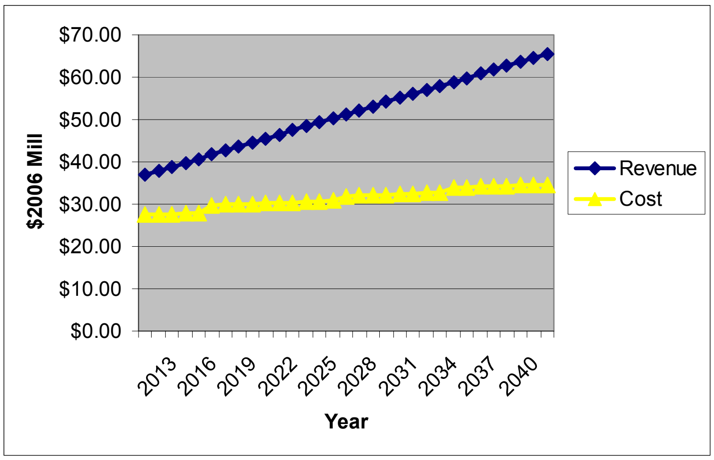


Exhibit 6.11 summarizes the projected 2012 financial performance of each system alternative.

Exhibit 6.11: 2012 Financial Performance Summary (After System Ramp-up)

Speed	Frequency	Equipment	Cost per TM	2012 Revenue	2012 Total Cost	2012 Surplus (Subsidy)	Annual Surplus (Subsidy) per Train
79-mph	1	P42	$52.20	$2,516,004	$5,049,223	($2,533,219)	($2,533,219)
79-mph	2	P42	$44.48	$4,403,007	$8,603,323	($4,200,316)	($2,100,158)
79-mph	4	P42	$34.13	$7,246,847	$13,204,331	($5,957,484)	($1,489,371)
110-mph	4	Diesel Tilt	$44.15	$18,334,663	$17,079,452	$1,255,211	$313,803
110-mph	6	Diesel Tilt	$37.40	$23,835,062	$21,705,729	$2,129,333	$354,889
110-mph	8	Diesel Tilt	$33.62	$30,661,248	$26,017,649	$4,643,600	$580,450
110-mph	6+9 Casino	Diesel Tilt	$38.14	$38,837,854	$27,668,563	$11,169,291	$1,489,239
125-mph	4	Diesel Tilt	$49.37	$19,757,951	$19,102,159	$655,792	$163,948
125-mph	8	Diesel Tilt	$35.83	$32,923,638	$27,722,861	$5,200,777	$650,097

6.3 Economic Benefits

The Minneapolis-Duluth/Superior Corridor will provide a wide range of benefits that contribute to economic growth and strengthen the region's manufacturing, service and tourism industries. It will improve mobility and connectivity between regional centers and smaller urban areas, and will create a new passenger travel alternative. This will stimulate further economic growth within the corridors. These economic benefits were evaluated using TEMS' *RENTS™* Model.

The methodology used to estimate economic benefits and costs is based on the approach the Federal Railroad Administration (FRA) used in its analysis of the feasibility of implementing high-speed passenger rail service in selected travel corridors throughout the country. The key elements of the economic benefits analysis conducted for this study are listed in Exhibit 6.12 and further discussed below.

Exhibit 6.12: Key Elements of the Economic Benefits Analysis

Types of Benefits	Types of Costs	Measures of Economic Benefits
Consumer surplus System revenues Benefits for users of other modes Resource benefits	Capital investment needs Operations and maintenance expenses	Benefit-cost ratio Net Present Value

Two measures of economic benefit were used to evaluate the alternative options – net present value (NPV) and cost/benefit ratio, which are defined as follows:

Net Present Value = Present Value of Total Benefits – Present Values of Total Costs

Cost Benefit Ratio = $\frac{\text{Present Value of Benefits}}{\text{Present Value of Costs}}$

Present values are calculated using the standard financial discounting formula:

$$PV = \Sigma \; C_t / (1 + r)^t$$

Where:

PV = Present value of the project benefits or costs (e.g., revenue)
C_t = Cash flow for *t* years
r = Interest Rate reflecting opportunity cost of capital
t = Time

For this analysis, the discount rate, or the opportunity cost of capital was set at 3.9 percent[4] real (i.e., excluding inflation).

[4] The discount rate used in this Study is based on *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, Circular N. A-94, Appendix C, issued by the Office of Management and Budget.

6.3.1 Economic Benefits

A transportation improvement is seen as providing economic benefits in terms of time and cost savings, as well as convenience, comfort and reliability. Benefits are expected to include the following:

- **User Benefits**: The reduction in travel times and costs (consumer surplus and system revenues) that users of the systems receive
- **Benefits to Users of Other Modes**: The reduction in travel times and costs that users of other modes receive as a result of lower congestion levels
- **Resource Benefits**: Savings in operating costs for other modes, and reductions (savings) in emissions as a result of travelers being diverted from air, bus and auto to the rail system.

The analysis of user benefits is based on the measurement of *generalized cost* of travel, which includes both time and money. Time is converted into money by the use of a Values of Time calculation. The Values of Time (VOT) used in this Study were derived from stated preference surveys conducted in previous studies and used in the *COMPASS*™ multimodal demand model for developing ridership and revenue forecasts. These VOTs are consistent with previous academic and empirical research, and other transportation studies conducted by TEMS.

Benefits to users of the rail system are measured by the sum of *system revenues* and *consumer surplus*, which is defined as the additional benefit, or *surplus* individuals receive from the purchase of a commodity or service. Consumer surplus is used to measure the demand side impact of a transportation improvement on users of the service. It is defined as the additional benefit consumers (users of the service) receive from the purchase of a commodity or service (travel), above the price actually paid for that commodity or service.

Consumer surpluses exist because there are always consumers, who are willing to pay a higher price than that actually charged for the commodity or service, (i.e., these consumers receive more benefit than is reflected by the system revenues alone). Revenues are included in the measure of consumer surplus as a proxy measure for the consumer surplus foregone because the price of rail service is not zero. This is an equity decision made by the FRA to compensate for the fact that highway users pay zero for use of the road system (the only exception being the use of toll roads). The benefits apply to existing rail travelers as well as new travelers who are induced (those who previously did not make a trip) or diverted (those who previously used a different mode) to the new passenger rail system.

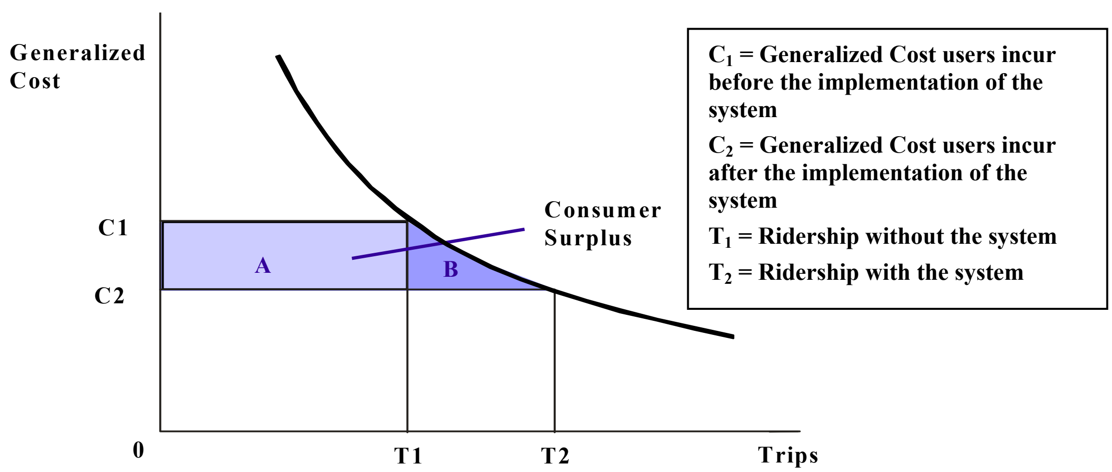
User benefits incorporate both the measured consumer surplus and the system revenues, since the revenues are user benefits transferred from the rail user to the rail operator.

6.3.2 Consumer Surplus

In consumer surplus analysis, improvements in service (for all modes of transportation in the corridor) are measured by improvements in generalized cost (combination of time spent and fares paid by users to take a trip). In some cases, individuals (for example, current bus and rail users) may pay higher fares to use an improved mode of travel, but other aspects of the improvement will likely compensate for the increased fare. A transportation improvement that leads to improved mobility reduces the generalized cost of travel, which in turn leads to an increase in consumer surplus.

To calculate consumer surplus, the number of trips and generalized cost of travel without the system were compared to the number of trips and generalized cost of after the Minneapolis to Duluth rail service were implemented. In Exhibit 6.13, the shaded area under a typical demand curve represents improvements in the generalized cost of travel for induced and/or diverted users (the consumer surplus). The shaded area is defined by the points (0, C_1), (0, C_2), (T_1, C_1), and (T_2, C_2). The equation assumes that Area B is a triangle and the arc of the demand curve is a straight line. Equation 1, which follows the exhibit, measures consumer surplus.

Exhibit 6.13: Consumer Surplus Graphically Displayed



Equation 1: CS = $[(C_1 - C_2)\ T_1] + [(C_1 - C_2)(T_2 - T_1)(0.5)]$

Where:

CS = Consumer Surplus
Rectangle A = $(C_1 - C_2)\ T_1$
Triangle B = $(C_1 - C_2)(T_2 - T_1)(0.5)$

The formula for consumer surplus is as follows:

Consumer Surplus = $(C_1 - C_2)*T_1 + ((C_1 - C_2)*(T_2 - T_1))/2$

Where:

C_1 = Generalized Cost users incur before the implementation of the system

C_2 = Generalized Cost users incur after the implementation of the system

T_1 = Number of trips before operation of the system
T_2 = Number of trips during operation of the system

TEMS' *COMPASS*™ demand forecasting model estimates consumer surplus by calculating the increase in regional mobility (i.e., induced travel) and traffic diverted to the system (Area B in Exhibit 6.13), and the reduction in travel costs, measured in terms of generalized cost, for existing system users (Area A). The reduction in generalized cost generates the increase in users' benefits. Consumer surplus consists of the additional benefits derived from savings in time, fares and other utility improvements.

6.3.3 Passenger Revenues

Passenger revenues provide another measure of system benefit. The fare rate that passengers pay shows the direct value of the benefit they receive. Passenger revenues are calculated by multiplying the fares charged by the number of riders. Revenues are incorporated in the FRA methodology as a benefit because they are considered a component of consumer surplus that has been transferred to the railroad operator. Revenue benefits apply to existing rail travelers as well as new travelers who are induced or diverted to the new passenger rail system.

6.3.4 Benefits to Users of Other Modes

In addition to rail-user benefits, travelers using other modes will also benefit from the rail system because it will contribute to highway congestion relief and reduce travel times for users of other modes. These benefits were measured by identifying the estimated number of air and auto passenger trips diverted to rail, and multiplying each by the benefit levels used in the FRA *Commercial Feasibility Study.*

6.3.5 Resource Benefits

The implementation of a transportation project also has an impact on the resources all travelers use. The consequent reduction in airport congestion attributable to the rail system will result in resource savings to airline operators and reduced emissions of air pollutants for all non-rail modes.

6.3.6 Costs

Costs are the other side of the equation in the cost/benefit analysis. Costs include up-front capital costs, as well as ongoing operating and maintenance expenses.

6.3.7 Capital Investment Needs

The capital investment needs for each option were calculated using input from the Engineering Assessment outlined in Chapter 3. The capital investment estimates include both infrastructure and rail equipment needs.

6.3.8 Operating and Maintenance Expenses

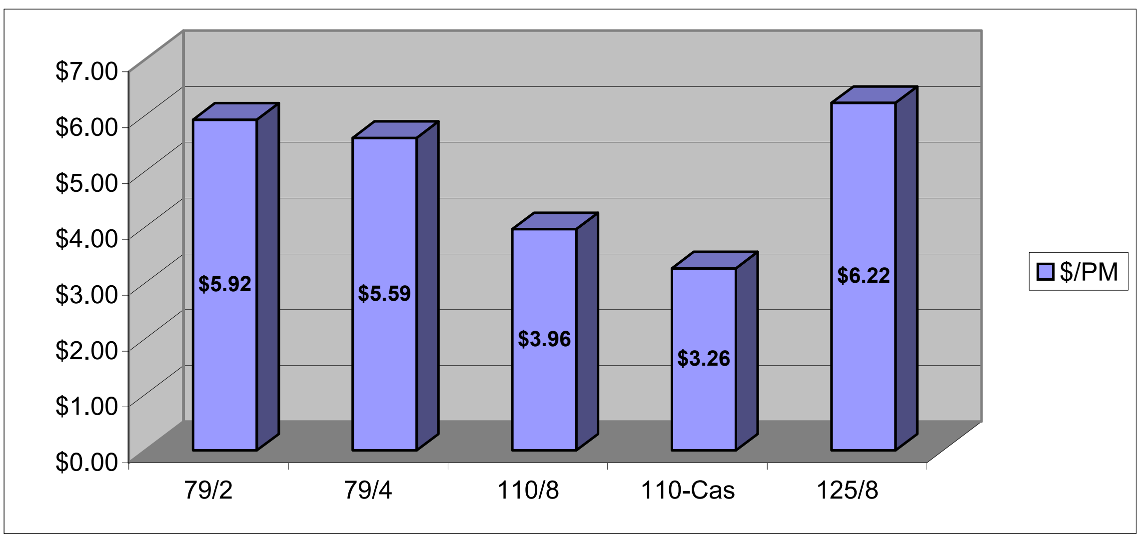
The operating and maintenance expenses for each alternative were calculated using the output of the operating cost analysis set forth in Chapter 5. A capital track maintenance component was separately calculated for the High-Speed Scenario. Since the need for infrastructure replacement does not occur for some years into the future, this cost has minimal impact on the cost/benefit ratio calculation, but has been included for completeness.

6.4 Economic Benefits Results

Exhibit 6.14 shows the result of a preliminary efficiency calculation, showing the effectiveness of capital spending in terms of its ability to attract ridership to the Minneapolis-Duluth/Superior Corridor. This simple metric shows that terms of capital dollar per passenger mile, the 110-mph option is clearly the most cost effective. This result agrees with the more sophisticated Benefit Cost calculation, summarized in Exhibit 6.15, which takes many more factors into account. These results show that the basic 110-mph / 8 train combination produces a very healthy positive Benefit Cost return of 2.32. With a direct rail service to the casino, the Benefit Cost ratio improves even more to 2.97. Exhibit 6.16 shows the detail supporting this calculation.

The 110-mph / 8 train combination far outperforms any 4 train option because the eight train option has the ability to attract substantially higher ridership without much additional capital cost. Going past 110-mph to 125-mph however, does not significantly further increase ridership, revenues or consumer surplus because the limitations of diesel train technology do not allow the trains to take full advantage of the improved infrastructure at that speed. This reflects in the reduced benefit cost ratio that has been estimated for that level of speed improvement with conventional diesel traction.

Exhibit 6.14: Capital Efficiency per Passenger Mile



Scenario	79/2	79/4	110/8	110-Cas	125/8
Capital ($ Mill)	$75.4	$202.1	$362.6	$394.0	$609.8
Pass-Miles (Mill)	12.73	36.13	91.57	120.83	98.02

Exhibit 6.15: Calculated Benefit Cost Ratios

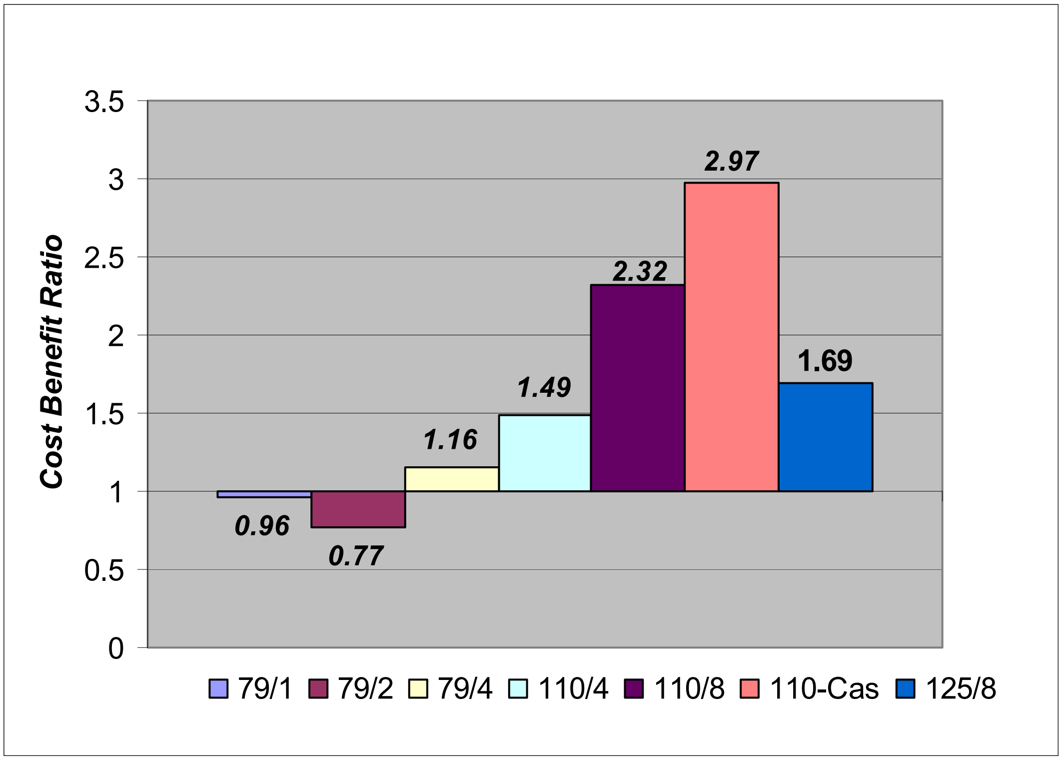


Exhibit 6.16: Benefit Cost Detail for 110-mph Options
(Net Present Value, in millions 2006$)

OPTION	8-Train Base	Casino Direct
Revenue	$673.4	$829.5
Consumer Surplus	$782.2	$1,134.2
Other Mode + Resource	$545.4	$806.2
Total Benefit	**$2,001.0**	**$2,770.0**
Capital Cost	$353.1	$383.7
Operating Cost	$488.3	$525.6
Track Capital Maintenance	$21.9	$24.1
Total Cost	**$863.3**	**$933.5**
Cost/Benefit Ratio	**2.32**	**2.97**
Net Benefit-Cost	**$1,137.8**	**$1,836.5**

6.5 Conclusions

On the basis of the *Commercial Feasibility* criteria that have been established by the FRA, any of the 110-mph or 125-mph options are viable. Financially, the 110-mph options are strongest because they are able to provide positive operating ratios at a reasonable level of capital investment in the system. 125-mph options require substantial additional investment in grade crossing separation. While these grade separations produce additional community benefits, from a rail operating perspective with diesel technology they do not improve the performance of the rail system by that much.[5]

In terms of technology, 110-mph options are far superior to any of the 79-mph options both in operating performance and cost-benefit results. 110-mph service boosts ridership on average by about 50% for the same train frequency, doubles revenues and could enable the Minneapolis-Duluth/Superior Corridor to satisfy the FRA Commercial Feasibility requirements for receiving Federal capital funding. A 110-mph upgrade more than doubles consumer surplus and environmental benefits without proportionately raising capital or operating cost, and therefore 110-mph produces much higher cost benefit ratios than a 79-mph option. Similarly since it avoids the need for full separation at grade crossings, the 110-mph speed optimizes the investment profile for upgrading this corridor.

The analysis also shows the clear financial and economic benefit of including a direct Casino Rail link in the system plan for the corridor. The added ridership associated with direct rail service to the casino would substantially improve both the revenue and operating performance of the corridor. The added ridership enables the operation of longer, more efficient trains that can provide a stronger revenue base sooner to help offset the fixed administrative costs associated with implementation of the rail corridor system.

For this reason the 110-mph 8-train a day option, or 6+9 trains at 110-mph with the Casino rail link, were recommended as the most cost effective and beneficial alternatives. As a result, these options were both taken forward for development of a detailed implementation plan for the corridor. This will be discussed in the next chapter.

[5] With full grade separation, the next quantum threshold for improving performance would entail electrification, which could enable speeds to go up to 150-mph or higher.

7

Implementation Plan

Given the scale of the capital improvements needed for the Minneapolis to Duluth/Superior Corridor, it has been assumed that implementation of the system will be accomplished in phases. While the steering committee expressed a desire to start rail service at the earliest possible date, some minimum infrastructure elements are needed before any service can be launched.

One of the primary purposes of the Implementation Plan is to provide a framework for organizing and analyzing the cash flow in the financial analysis, as well as for determining the Capital funding requirements for the project. It is expected that the Implementation Plan will continue to evolve as the project advances into the detailed planning and engineering phase.

The timeframe takes the project through design and manufacture of rolling stock, project development, preliminary engineering, design and final construction of the rail system's infrastructure. Project development includes all environmental reviews and/or the steps necessary under the National Environmental Policy Act (NEPA), including public involvement and necessary engineering to obtain a Record of Decision under the NEPA requirements. Such an approach allows the sponsoring agencies to secure funding and to develop infrastructure as needed. Where Categorical Exclusions or Findings of No Significance (FONSI) can be obtained during the Environmental review, some infrastructure elements might be released for implementation sooner, based on the availability of funds to progress the work.

Financial projections for start-up options include ramp-up factors that assume 50% of the full revenues in the first year, and 90% in the second year. A possible advantage for launching a service early is that it can give a "head start" enabling higher ramp up factors than normal for the following year. However, there is a potential downside as well – if customers have a negative experience, launching service prematurely could actually prove detrimental to the long-term forecast for the system. Two different capital plans have been developed for the implementation of the project:

- **Front-Loaded Capital Plan:** By accelerating the time frame for track upgrade and equipment procurement, it may be possible to launch 79-mph service a year or two ahead of the 110-mph start up. A plan has been developed for supporting an early launch of 79-mph service, and the additional start-up subsidy requirements for these services have been identified.
- **Back-Loaded Capital Plan:** There is also a desire to minimize the level of operating subsidy that must be provided to the system. Waiting until service can be directly launched at 110-mph will minimize both the start-up subsidy requirement as well as the possibility of a negative customer experience. In addition, it provides more flexibility in timing the expenditure of capital funds so improvements can be completed on a "just in time" basis.

To enable an "apples-to-apples" comparison, the "Front Loaded" and "Back Loaded" capital plans both support implementation of 110-mph rail service in the same year, 2012. However, the "Back Loaded" plan is more consistent with the expected constraints in Federal funding, as they are now understood. However, this report does not recommend whether to launch a service early at 79-mph or wait until the full 110-mph system is constructed. That is a policy decision that will have to be made by the Steering Committee. The purpose of this chapter is simply to help the committee understand its options.

7.1 The "Front Loaded" Capital Plan

A capital plan was developed for enabling the launch of 79-mph rail service as early as possible. Phasing the elements of the 110-mph plan, could enable a 79-mph service to be launched a few years ahead of the full 110-mph system without introducing any rework or additional capital cost. This plan allows service to be gradually introduced and launched in phases, while still moving eventually to a 110-mph rail system. Subject to funding availability, the "front loaded" capital plan would support:

- One or two round-trips at 79-mph, starting in 2010.
- Four to six round trips at 79-mph in 2011.
- Full service at 110-mph with eight round trips could be in place as early as 2012.

Exhibits 7.1 and 7.2 summarize the "Front Loaded" implementation plan for 110-mph rail service on the Minneapolis-Duluth/Superior Corridor. The second year, 2010 would be the year of greatest expense when a funding capability of $219 million would need to be in place. The track work, line capacity and signaling system upgrades would all be under construction at the same time. A problem has arisen, however, with respect to the projected year 2009 funding requirement of $78 million, since it appears unlikely that this level of Federal funding can be made available so quickly.

As shown in Exhibit 7.1, the "Front Loaded" implementation plan has the following features:

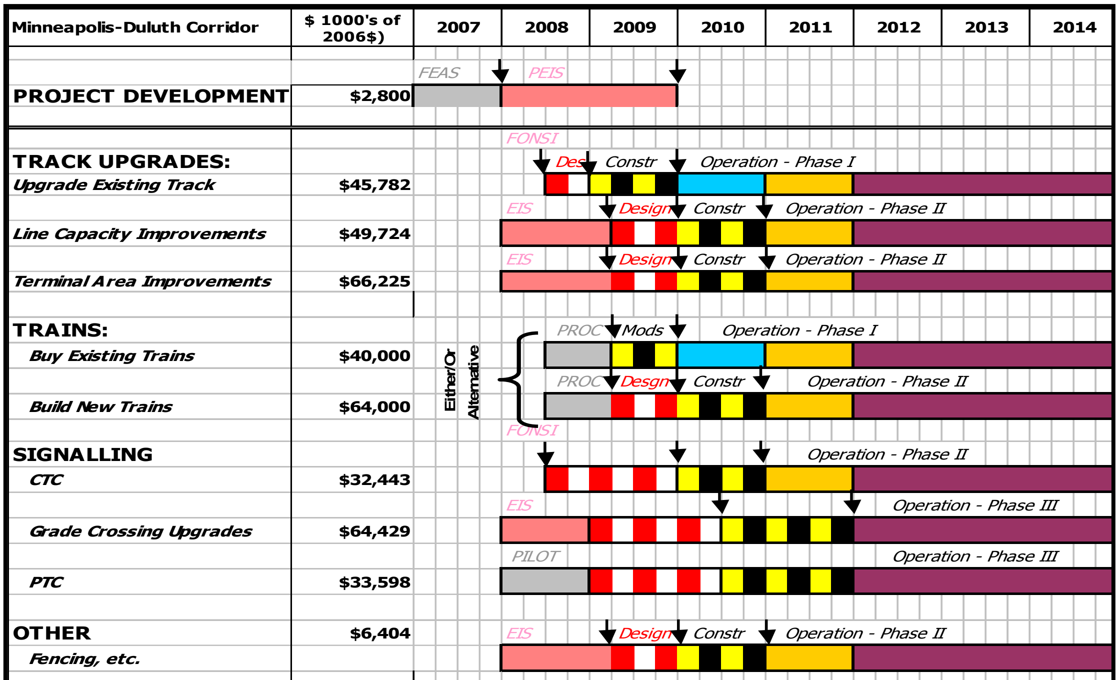
- **Year 2008**. This year is allocated for project development and planning. It assumes that engineering design will be progressed to at least the 10% level; that any significant environmental issues will be identified and mitigation plans developed; that funding, institutional and legal agreements needed for implementation of the system will be ratified; and that work on both the equipment procurement and interoperable PTC efforts will be progressed.

- **Year 2009**. Track upgrades need to be completed first, so the track gang's work windows won't be broken up by passenger train schedules.[1] Also in 2009 the equipment acquisition process needs to start. Either existing trains would be acquired and modified for North American service; or new trains would be ordered and custom-built.[2]

[1] The $45.8 million cost includes the 110-mph track upgrading cost of $36 million, the cost for upgrading switches and electric locks, and a 12% contingency factor that was built into the entire project cost estimates. Completion of track upgrades in 2009 could allow a limited 79-mph service to start in 2010, if suitable trains could be procured quickly enough.

[2] It may be hard for equipment manufacturers to obtain an economical production lot size for a small order of new equipment. It is therefore suggested to try to obtain existing trains and operate them, if necessary, under an FRA waiver – if possible, this would be both more economical and faster than trying to build new trains. The implementation plan shows an either/or option, but the capital cost is based upon the more conservative cost of new trains. Nonetheless, the earliest that new trains are expected to be available would be 2011 at best. If existing trains could be purchased, they could probably be in service at a year earlier.

Exhibit 7.1: Proposed 2012 "Front Loaded" Plan and Costs

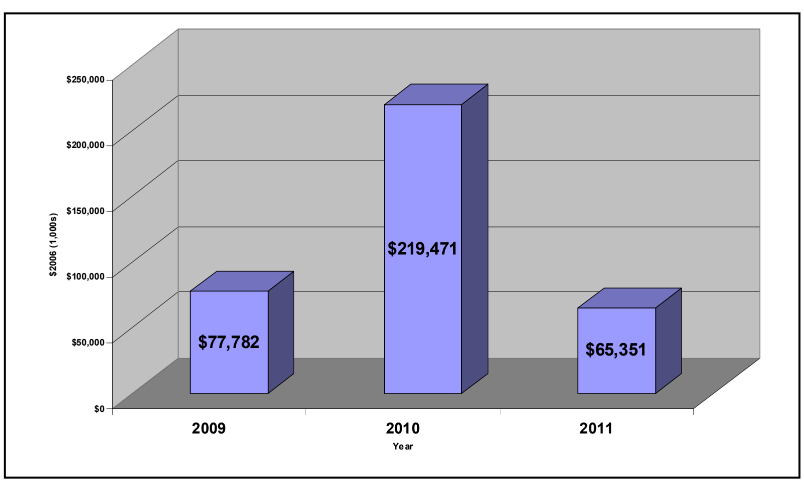


Total Investment Costs by Year		2007	2008	2009	2010	2011	2012	2013	2014
Project Development	$2,800	$300	$1,250	$1,250					
Upgrade Existing Track	$45,782			$45,782					
Line Capacity Improvements	$49,724				$49,724				
Terminal Area Improvements	$66,225				$66,225				
Buy Trains	$64,000			$32,000	$32,000				
CTC	$32,443				$32,443				
Grade Crossings	$64,429				$21,476	$42,953			
PTC	$33,598				$11,199	$22,398			
Other	$6,404				$6,404				
Total Capital by Year	$362,604			$77,782	$219,471	$65,351			

Key to Implementation Stages:
Project Development
Environmental + PE
Design
Construction

Operations:
Phase 1 — ***79-mph 1 to 2 trains***
Phase 2 — ***79-mph 4 to 6 trains***
Phase 3 — ***110-mph 6 to 8 trains***

Exhibit 7.2: "Front Loaded" Capital Plan Requirement



- **Year 2010.** In 2010, the main construction year, track capacity upgrades between Coon Creek and Boylston are underway, along with terminal area improvements and installation of a CTC signaling system. Once in place these upgrades would permit additional frequencies, up to six round trips per day, at 79-mph in 2011.

- **Year 2011.** The implementation wraps up with the installation of the quad gate grade crossing improvements and an interoperable PTC signaling system. These components are expected to take the longest both due to design and engineering requirements, as well as long manufacturing and installation lead times. Note that if the CTC and PTC signaling systems are designed to work together, there could be some cost savings as opposed to progressing separate procurement processes for these two related subsystems. Upon completion of the signal and crossing upgrades, 110-mph service could possibly start as early as 2012.

7.2 The "Back Loaded" Capital Plan

Based on the anticipated funding constraints, an alternative capital plan has been developed that pushes back to 2011 much of the 2009 funding commitment. This plan has also sought to equalize the funding commitment by year in order to reduce the peak year funding requirement. This results in a compressed two-year implementation of the system that still supports the startup of 110-mph rail service in 2012. However, delaying the capital funds sacrifices the ability to launch a preliminary 79-mph service, since not all the required elements can be in place before the 110-mph service launch in 2012. The second year, 2010 would still be the year of the greatest expense since the track work, line capacity and signaling system upgrades would all be under construction at the same time.

However, some costs were shifted from 2009 and 2010 back to 2011, including costs for trains, track upgrades, and line capacity expansion. Some funds were brought forward from 2010 into 2009 for supporting some line capacity additions as well as early engineering development for interoperable PTC.

These shifts reduced the 2009 capital funding from $78 million down to $15 million. 2010 capital requirements were also reduced from $219 million down to $194 million. However, 2011 funding requirements increased from $65 million up to $153 million, reflecting the "just in time" nature of the Back-Loaded capital plan.

As shown in Exhibits 7.3 and 7.4, during 2010 a funding capability of $194 million would have to be in place. It was anticipated that this could be obtained using a combination of direct State and Federal grants, plus short-term loan financing for any amounts that exceed the Federal funding cap.

The only operational ramp-up that is feasible for the Back Loaded capital plan is the direct 110-mph startup, which has a ramp-up subsidy requirement of $10 million. It is anticipated that this can be covered by a TIFIA[3] loan and repaid within the first 2-3 years of full operations of the 110-mph system.

[3] The Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA) established a Federal credit program for eligible transportation projects of national or regional significance under which the U.S. Department of Transportation (DOT) may provide three forms of credit assistance – secured (direct) loans, loan guarantees, and standby lines of credit.

The program's fundamental goal is to leverage Federal funds by attracting substantial private and other non-Federal co-investment in critical improvements to the nation's surface transportation system.

The DOT awards credit assistance to eligible applicants, which include state departments of transportation, transit operators, special authorities, local governments, and private entities. See: http://tifia.fhwa.dot.gov

Exhibit 7.3: Proposed 2012 "Back Loaded" Plan and Costs

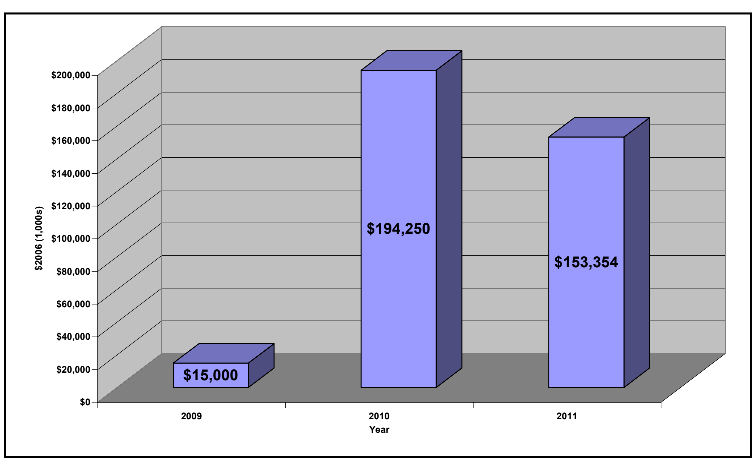
Minneapolis-Duluth Corridor	$ 1000's of 2006$)	2007–2014 schedule
PROJECT DEVELOPMENT:	**$2,800**	FEAS, PEIS
TRACK UPGRADES:		FONSI, Des, Constr, Operation
Upgrade Existing Track	**$45,782**	
Line Capacity Improvements	**$49,724**	EIS, Design, Constr, Operation
Terminal Area Improvements	**$66,225**	EIS, Design, Constr, Operation
TRAINS:		PROC, Desgn, Constr, Operation
Build New Trains	**$64,000**	
SIGNALLING		FONSI, Operation
CTC	**$32,443**	
Grade Crossing Upgrades	**$64,429**	EIS, Operation
PTC	**$33,598**	PILOT, Operation
OTHER	**$6,404**	EIS, Design, Constr, Operation
Fencing, etc.		

Total Investment Costs by Year		2007	2008	2009	2010	2011	2012	2013	2014
Project Development	$2,800	$300	$1,250	$1,250					
Upgrade Existing Track	$45,782				$22,891	$22,891			
Line Capacity Improvements	$49,724			$10,000	$39,724				
Terminal Area Improvements	$66,225				$33,112	$33,112			
Buy Trains	$64,000				$32,000	$32,000			
CTC	$32,443				$32,443				
Grade Crossings	$64,429				$21,476	$42,953			
PTC	$33,598			$5,000	$6,199	$22,398			
Other	$6,404				$6,404				
Total Capital by Year	$362,604			$15,000	$194,250	$153,354			

Key to Implementation Stages:
Project Development
Environmental + PE
Design
Construction

Operations:
Phase 3 — ***110-mph 6 to 8 trains***

Exhibit 7.4: "Back Loaded" Capital Plan Requirement for 110-mph 8 Train Option



7.3 The "Back Loaded" Capital Plan with Casino Direct Rail

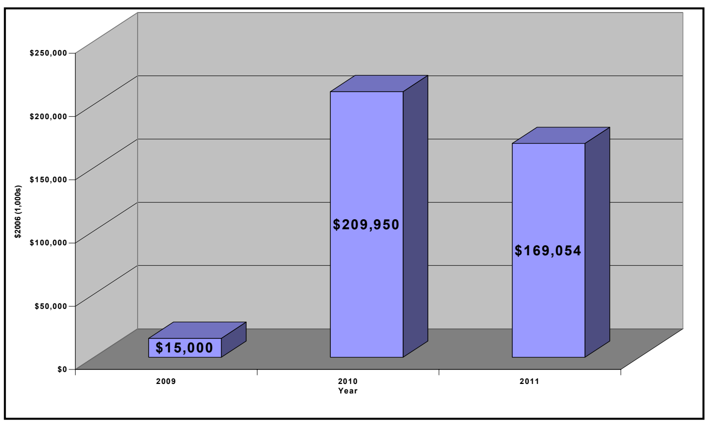
Providing a direct rail service rather than a shuttle bus connection to the Grand Casino at Hinckley would substantially boost the ridership, revenues and financial performance of the passenger rail system:

- As discussed in Chapter 6, a direct rail link would improve the system's annual operating surplus by about $6.4 million. (It would add about $8 million in revenue, but only $1.6 million in costs in 2012.)
- In contrast, adding the Southern Loop connection would raise the project's total cost from $362.6 million to $394.0 million, a net cost increase of $31.4 million.

Based on this, it can be seen that the Southern Loop connection has a financial payback period of only 4.9 years; so the rail connection clearly is viable as an enhancement to the basic 110-mph rail system.

On this basis the funding requirements for an expanded $394.0 million project that includes a Casino rail link have been calculated. The results are shown in Exhibit 7.5, and show that a funding capability of $210 million will need to be in place to meet peak year (2010) capital needs. Other aspects of the financial plan are very similar to those already developed for the "Back Loaded" 110-mph base plan.

Exhibit 7.5: "Back Loaded" Capital Plan Requirement for 110-mph w/Casino Direct Rail

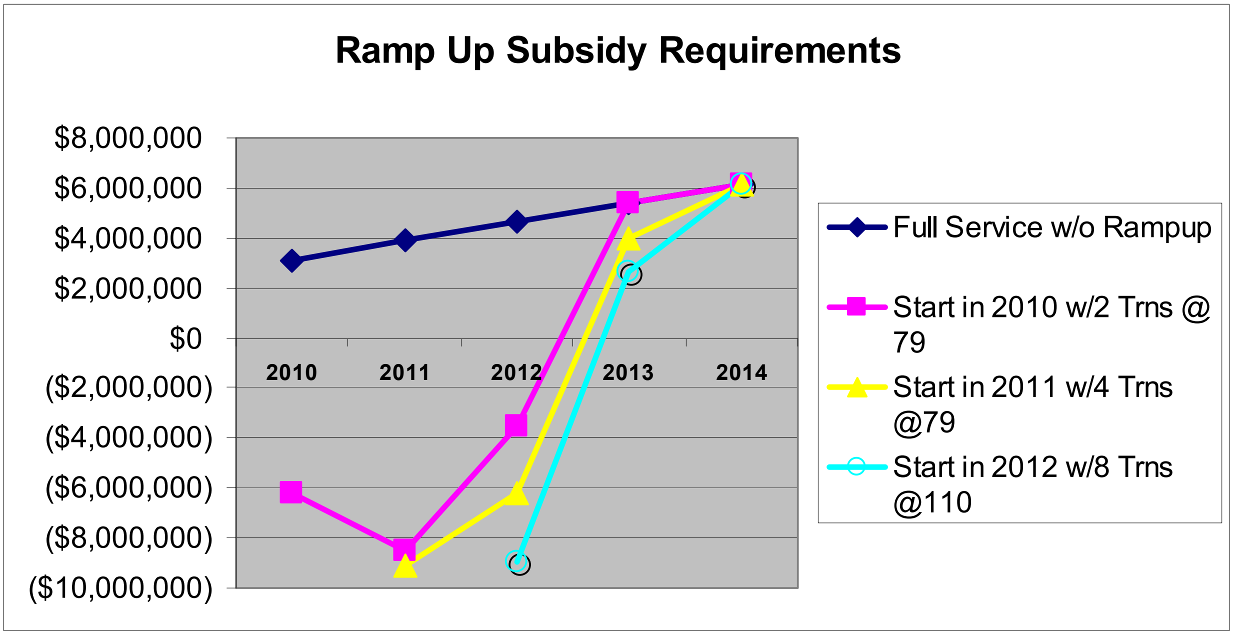


7.4 Financial Results of the Implementation Plan

Under the "Front Loaded" capital plan, two different options could be available for phasing in a 79-mph service in advance of full 110-mph system implementation. Under the "Back Loaded" plan the only option available would be to directly implement the 110-mph service in 2012, since some of the improvements needed to support a 79-mph system would not be in place prior to 2012. Exhibit 7.6 compares three different options for starting up the Minneapolis to Duluth service.

Exhibit 7.6: Ramp-Up Subsidy Requirements

Year	2010	2011	2012	2013	2014	TIFIA LOAN
Start in 2010 w/2 Trns @ 79	($6.20)	($8.53)	($3.51)	$5.41	$6.18	($18.25)
Start in 2011 w/4 Trns @79		($9.13)	($6.23)	$4.01	$6.18	($15.36)
Start in 2012 w/8 Trns @110			($8.95)	$2.61	$6.18	($8.95)



As shown in Exhibit 7.6, the total "Start Up" subsidy requirement would be $18 million for two years of 79-mph operation; $16 million for one year of 79-mph operation and about $9 million for a direct startup at 110-mph. Based on the projection that a fully-ramped up 110-mph system would generate a $3-6 million dollar annual operating surplus, a TIFIA loan for these start up losses could be repaid within the first 2-3 years of full system operations.

7.5 Pro forma Cash Flows

The pro forma cash flows are shown in Exhibit 7.7 and Exhibit 7.8. These present the forecasted total revenues and operating expense projections for 2012 through 2040. Since these projections are based on the *Back Loaded* capital plan, operations can't start before 2012. This plan includes two years of revenue ramp up at 50% and 90% factors for the first and second years, respectively, so the first year of full operations occurs in 2014*.

Exhibit 7.7 Minneapolis to Duluth 110-mph Rail Service: 8-Train Base Plan - Preliminary Operating Statement

Thousands of 2006 $	Total to 2040	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Revenues											
Ticket Revenue	**$1,080,230**	$13,567	$25,107	$28,659	$29,422	$30,185	$30,948	$31,711	$32,474	$33,236	$33,999
On Board Services	**$86,418**	$1,085	$2,009	$2,293	$2,354	$2,415	$2,476	$2,537	$2,598	$2,659	$2,720
Express Parcel Service (Net Rev)	**$54,011**	$678	$1,255	$1,433	$1,471	$1,509	$1,547	$1,586	$1,624	$1,662	$1,700
Total Revenues	**$1,220,660**	$15,331	$28,371	$32,385	$33,247	$34,109	$34,971	$35,833	$36,695	$37,557	$38,419
Train Operating Expenses											
Energy and Fuel	**$75,081**	$2,013	$2,013	$2,013	$2,013	$2,013	$2,013	$2,013	$2,013	$2,542	$2,542
Train Equipment Maintenance	**$204,890**	$5,494	$5,494	$5,494	$5,494	$5,494	$5,494	$5,494	$5,494	$6,937	$6,937
Train Crew	**$96,367**	$3,323	$3,323	$3,323	$3,323	$3,323	$3,323	$3,323	$3,323	$3,323	$3,323
On Board Services	**$80,631**	$1,833	$2,295	$2,437	$2,467	$2,498	$2,528	$2,559	$2,589	$2,620	$2,650
Service Administration	**$147,171**	$5,075	$5,075	$5,075	$5,075	$5,075	$5,075	$5,075	$5,075	$5,075	$5,075
Total Train Operating Expenses	**$604,139**	$17,738	$18,200	$18,342	$18,372	$18,403	$18,434	$18,464	$18,495	$20,497	$20,527
Other Operating Expenses											
Track & ROW Maintenance	**$114,663**	$3,954	$3,954	$3,954	$3,954	$3,954	$3,954	$3,954	$3,954	$3,954	$3,954
Station Costs	**$40,547**	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398
Sales & Marketing	**$51,009**	$643	$1,190	$1,358	$1,394	$1,429	$1,465	$1,501	$1,536	$1,572	$1,607
Insurance Liability	**$43,345**	$549	$1,015	$1,158	$1,188	$1,218	$1,248	$1,278	$1,308	$1,338	$1,368
Total Other Operating Expenses	**$249,564**	$6,544	$7,557	$7,868	$7,934	$7,999	$8,065	$8,130	$8,196	$8,262	$8,327
Total Operating Expenses	**$853,703**	$24,283	$25,757	$26,210	$26,306	$26,402	$26,498	$26,594	$26,690	$28,758	$28,854
Cash Flow From Operations	**$366,957**	($8,952)	$2,614	$6,175	$6,941	$7,707	$8,473	$9,239	$10,005	$8,799	$9,565
Operating Ratio	**1.43**	0.63	1.10	1.24	1.26	1.29	1.32	1.35	1.37	1.31	1.33

* In contrast, some of the earlier Financials, such as the Operating Ratio discussions in Chapter 6, assumed that operations could start as early as 2010 based on the *Front Loaded* capital plan and they don't include the ramp-up factors. A 2010 start-up would make 2012 the first year of full operations.

Exhibit 7.7: Minneapolis to Duluth 110-mph Rail Service: 8-Train Base Plan - Preliminary Operating Statement (ctd)

Thousands of 2006 $	Total to 2040	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Revenues											
Ticket Revenue	**$1,080,230**	$34,762	$35,525	$36,288	$37,051	$37,813	$38,576	$39,339	$40,102	$40,865	$41,627
On Board Services	**$86,418**	$2,781	$2,842	$2,903	$2,964	$3,025	$3,086	$3,147	$3,208	$3,269	$3,330
Express Parcel Service (Net Rev)	**$54,011**	$1,738	$1,776	$1,814	$1,853	$1,891	$1,929	$1,967	$2,005	$2,043	$2,081
Total Revenues	**$1,220,660**	$39,281	$40,143	$41,005	$41,867	$42,729	$43,591	$44,453	$45,315	$46,177	$47,039
Train Operating Expenses											
Energy and Fuel	**$75,081**	$2,542	$2,542	$2,542	$2,542	$2,542	$2,542	$2,542	$2,542	$3,050	$3,050
Train Equipment Maintenance	**$204,890**	$6,937	$6,937	$6,937	$6,937	$6,937	$6,937	$6,937	$6,937	$8,324	$8,324
Train Crew	**$96,367**	$3,323	$3,323	$3,323	$3,323	$3,323	$3,323	$3,323	$3,323	$3,323	$3,323
On Board Services	**$80,631**	$2,681	$2,711	$2,742	$2,772	$2,803	$2,833	$2,864	$2,894	$2,925	$2,955
Service Administration	**$147,171**	$5,075	$5,075	$5,075	$5,075	$5,075	$5,075	$5,075	$5,075	$5,075	$5,075
Total Train Operating Expenses	**$604,139**	$20,558	$20,588	$20,619	$20,649	$20,680	$20,710	$20,741	$20,771	$22,698	$22,728
Other Operating Expenses											
Track & ROW Maintenance	**$114,663**	$3,954	$3,954	$3,954	$3,954	$3,954	$3,954	$3,954	$3,954	$3,954	$3,954
Station Costs	**$40,547**	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398
Sales & Marketing	**$51,009**	$1,643	$1,679	$1,714	$1,750	$1,786	$1,821	$1,857	$1,893	$1,928	$1,964
Insurance Liability	**$43,345**	$1,398	$1,428	$1,458	$1,488	$1,517	$1,547	$1,577	$1,607	$1,637	$1,667
Total Other Operating Expenses	**$249,564**	$8,393	$8,458	$8,524	$8,590	$8,655	$8,721	$8,786	$8,852	$8,918	$8,983
Total Operating Expenses	**$853,703**	$28,950	$29,047	$29,143	$29,239	$29,335	$29,431	$29,527	$29,623	$31,615	$31,711
Cash Flow From Operations	**$366,957**	$10,331	$11,096	$11,862	$12,628	$13,394	$14,160	$14,926	$15,692	$14,562	$15,328
Operating Ratio	**1.43**	1.36	1.38	1.41	1.43	1.46	1.48	1.51	1.53	1.46	1.48

Exhibit 7.7: Minneapolis to Duluth 110-mph Rail Service: 8-Train Base Plan - Preliminary Operating Statement (ctd)

Thousands of 2006 $	**Total to 2040**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Revenues										
Ticket Revenue	**$1,080,230**	$42,390	$43,153	$43,916	$44,679	$45,442	$46,204	$46,967	$47,730	$48,493
On Board Services	**$86,418**	$3,391	$3,452	$3,513	$3,574	$3,635	$3,696	$3,757	$3,818	$3,879
Express Parcel Service (Net Rev)	**$54,011**	$2,120	$2,158	$2,196	$2,234	$2,272	$2,310	$2,348	$2,386	$2,425
Total Revenues	**$1,220,660**	$47,901	$48,763	$49,625	$50,487	$51,349	$52,211	$53,073	$53,935	$54,797
Train Operating Expenses										
Energy and Fuel	**$75,081**	$3,050	$3,050	$3,050	$3,050	$3,050	$3,050	$3,050	$3,050	$3,050
Train Equipment Maintenance	**$204,890**	$8,324	$8,324	$8,324	$8,324	$8,324	$8,324	$8,324	$8,324	$8,324
Train Crew	**$96,367**	$3,323	$3,323	$3,323	$3,323	$3,323	$3,323	$3,323	$3,323	$3,323
On Board Services	**$80,631**	$2,986	$3,017	$3,047	$3,078	$3,108	$3,139	$3,169	$3,200	$3,230
Service Administration	**$147,171**	$5,075	$5,075	$5,075	$5,075	$5,075	$5,075	$5,075	$5,075	$5,075
Total Train Operating Expenses	**$604,139**	$22,759	$22,789	$22,820	$22,850	$22,881	$22,911	$22,942	$22,972	$23,003
Other Operating Expenses										
Track & ROW Maintenance	**$114,663**	$3,954	$3,954	$3,954	$3,954	$3,954	$3,954	$3,954	$3,954	$3,954
Station Costs	**$40,547**	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398
Sales & Marketing	**$51,009**	$2,000	$2,035	$2,071	$2,106	$2,142	$2,178	$2,213	$2,249	$2,285
Insurance Liability	**$43,345**	$1,697	$1,727	$1,757	$1,787	$1,817	$1,847	$1,877	$1,907	$1,937
Total Other Operating Expenses	**$249,564**	$9,049	$9,114	$9,180	$9,246	$9,311	$9,377	$9,443	$9,508	$9,574
Total Operating Expenses	**$853,703**	$31,807	$31,904	$32,000	$32,096	$32,192	$32,288	$32,384	$32,480	$32,576
Cash Flow From Operations	**$366,957**	$16,093	$16,859	$17,625	$18,391	$19,157	$19,923	$20,689	$21,455	$22,220
Operating Ratio	**1.43**	1.51	1.53	1.55	1.57	1.60	1.62	1.64	1.66	1.68

Exhibit 7.8: Minneapolis to Duluth 110-mph Rail Service: Casino Direct Rail - Preliminary Operating Statement

Thousands of 2006 $	Total to 2040	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Revenues											
Ticket Revenue	**$1,319,097**	$17,185	$31,693	$36,060	$36,905	$37,750	$38,595	$39,440	$40,285	$41,130	$41,975
On Board Services	**$105,528**	$1,375	$2,535	$2,885	$2,952	$3,020	$3,088	$3,155	$3,223	$3,290	$3,358
Express Parcel Service (Net Rev)	**$65,955**	$859	$1,585	$1,803	$1,845	$1,887	$1,930	$1,972	$2,014	$2,056	$2,099
Total Revenues	**$1,490,579**	$19,419	$35,813	$40,748	$41,702	$42,657	$43,612	$44,567	$45,522	$46,477	$47,432
Train Operating Expenses											
Energy and Fuel	**$88,367**	$2,383	$2,383	$2,383	$2,860	$2,860	$2,860	$2,860	$2,860	$2,860	$2,860
Train Equipment Maintenance	**$241,146**	$6,503	$6,503	$6,503	$7,804	$7,804	$7,804	$7,804	$7,804	$7,804	$7,804
Train Crew	**$90,344**	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115
On Board Services	**$87,847**	$1,897	$2,477	$2,652	$2,686	$2,720	$2,754	$2,787	$2,821	$2,855	$2,889
Service Administration	**$137,973**	$4,758	$4,758	$4,758	$4,758	$4,758	$4,758	$4,758	$4,758	$4,758	$4,758
Total Train Operating Expenses	**$645,676**	$18,657	$19,237	$19,412	$21,223	$21,257	$21,290	$21,324	$21,358	$21,392	$21,426
Other Operating Expenses											
Track & ROW Maintenance	**$107,497**	$3,707	$3,707	$3,707	$3,707	$3,707	$3,707	$3,707	$3,707	$3,707	$3,707
Station Costs	**$40,547**	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398
Sales & Marketing	**$67,268**	$885	$1,631	$1,854	$1,896	$1,938	$1,980	$2,022	$2,064	$2,105	$2,147
Insurance Liability	**$55,073**	$724	$1,335	$1,517	$1,552	$1,586	$1,620	$1,655	$1,689	$1,723	$1,758
Total Other Operating Expenses	**$270,385**	$6,715	$8,071	$8,477	$8,553	$8,629	$8,705	$8,781	$8,858	$8,934	$9,010
Total Operating Expenses	**$916,061**	$25,371	$27,308	$27,888	$29,776	$29,886	$29,996	$30,106	$30,215	$30,325	$30,435
Cash Flow From Operations	**$574,518**	($5,952)	$8,505	$12,859	$11,927	$12,772	$13,617	$14,462	$15,307	$16,151	$16,996
Operating Ratio	**1.63**	0.77	1.31	1.46	1.40	1.43	1.45	1.48	1.51	1.53	1.56

Exhibit 7.8: Minneapolis to Duluth 110-mph Rail Service: Casino Direct Rail - Preliminary Operating Statement (ctd)

Thousands of 2006 $	Total to 2040	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Revenues											
Ticket Revenue	**$1,319,097**	$42,820	$43,665	$44,510	$45,355	$46,200	$47,045	$47,890	$48,735	$49,580	$50,425
On Board Services	**$105,528**	$3,426	$3,493	$3,561	$3,628	$3,696	$3,764	$3,831	$3,899	$3,966	$4,034
Express Parcel Service (Net Rev)	**$65,955**	$2,141	$2,183	$2,226	$2,268	$2,310	$2,352	$2,395	$2,437	$2,479	$2,521
Total Revenues	**$1,490,579**	$48,387	$49,341	$50,296	$51,251	$52,206	$53,161	$54,116	$55,071	$56,026	$56,980
Train Operating Expenses											
Energy and Fuel	**$88,367**	$2,860	$2,860	$2,860	$3,146	$3,146	$3,146	$3,146	$3,146	$3,146	$3,146
Train Equipment Maintenance	**$241,146**	$7,804	$7,804	$7,804	$8,584	$8,584	$8,584	$8,584	$8,584	$8,584	$8,584
Train Crew	**$90,344**	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115
On Board Services	**$87,847**	$2,923	$2,956	$2,990	$3,024	$3,058	$3,092	$3,125	$3,159	$3,193	$3,227
Service Administration	**$137,973**	$4,758	$4,758	$4,758	$4,758	$4,758	$4,758	$4,758	$4,758	$4,758	$4,758
Total Train Operating Expenses	**$645,676**	$21,459	$21,493	$21,527	$22,627	$22,661	$22,695	$22,729	$22,762	$22,796	$22,830
Other Operating Expenses											
Track & ROW Maintenance	**$107,497**	$3,707	$3,707	$3,707	$3,707	$3,707	$3,707	$3,707	$3,707	$3,707	$3,707
Station Costs	**$40,547**	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398
Sales & Marketing	**$67,268**	$2,189	$2,231	$2,273	$2,315	$2,356	$2,398	$2,440	$2,482	$2,524	$2,565
Insurance Liability	**$55,073**	$1,792	$1,826	$1,861	$1,895	$1,929	$1,963	$1,998	$2,032	$2,066	$2,101
Total Other Operating Expenses	**$270,385**	$9,086	$9,162	$9,238	$9,314	$9,390	$9,467	$9,543	$9,619	$9,695	$9,771
Total Operating Expenses	**$916,061**	$30,545	$30,655	$30,765	$31,942	$32,051	$32,161	$32,271	$32,381	$32,491	$32,601
Cash Flow From Operations	**$574,518**	$17,841	$18,686	$19,531	$19,310	$20,155	$21,000	$21,845	$22,689	$23,534	$24,379
Operating Ratio	**1.63**	1.58	1.61	1.63	1.60	1.63	1.65	1.68	1.70	1.72	1.75

Exhibit 7.8: Minneapolis to Duluth 110-mph Rail Service: Casino Direct Rail - Preliminary Operating Statement (ctd)

Thousands of 2006 $	Total to 2040	2032	2033	2034	2035	2036	2037	2038	2039	2040
Revenues										
Ticket Revenue	**$1,319,097**	$51,270	$52,115	$52,960	$53,805	$54,650	$55,495	$56,340	$57,185	$58,030
On Board Services	**$105,528**	$4,102	$4,169	$4,237	$4,304	$4,372	$4,440	$4,507	$4,575	$4,642
Express Parcel Service (Net Rev)	**$65,955**	$2,564	$2,606	$2,648	$2,690	$2,733	$2,775	$2,817	$2,859	$2,902
Total Revenues	**$1,490,579**	$57,935	$58,890	$59,845	$60,800	$61,755	$62,710	$63,665	$64,620	$65,574
Train Operating Expenses										
Energy and Fuel	**$88,367**	$3,146	$3,432	$3,432	$3,432	$3,432	$3,432	$3,432	$3,432	$3,432
Train Equipment Maintenance	**$241,146**	$8,584	$9,365	$9,365	$9,365	$9,365	$9,365	$9,365	$9,365	$9,365
Train Crew	**$90,344**	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115	$3,115
On Board Services	**$87,847**	$3,261	$3,294	$3,328	$3,362	$3,396	$3,430	$3,463	$3,497	$3,531
Service Administration	**$137,973**	$4,758	$4,758	$4,758	$4,758	$4,758	$4,758	$4,758	$4,758	$4,758
Total Train Operating Expenses	**$645,676**	$22,864	$23,964	$23,998	$24,032	$24,065	$24,099	$24,133	$24,167	$24,201
Other Operating Expenses										
Track & ROW Maintenance	**$107,497**	$3,707	$3,707	$3,707	$3,707	$3,707	$3,707	$3,707	$3,707	$3,707
Station Costs	**$40,547**	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398	$1,398
Sales & Marketing	**$67,268**	$2,607	$2,649	$2,691	$2,733	$2,775	$2,816	$2,858	$2,900	$2,942
Insurance Liability	**$55,073**	$2,135	$2,169	$2,204	$2,238	$2,272	$2,307	$2,341	$2,375	$2,410
Total Other Operating Expenses	**$270,385**	$9,847	$9,923	$10,000	$10,076	$10,152	$10,228	$10,304	$10,380	$10,456
Total Operating Expenses	**$916,061**	$32,711	$33,887	$33,997	$34,107	$34,217	$34,327	$34,437	$34,547	$34,657
Cash Flow From Operations	**$574,518**	$25,224	$25,003	$25,848	$26,693	$27,538	$28,383	$29,227	$30,072	$30,917
Operating Ratio	**1.63**	1.77	1.74	1.76	1.78	1.80	1.83	1.85	1.87	1.89

8

Corridor Impact Analysis

8.1 Economic Rent Methodology

The concept of Economic Rent is derived from basic Ricardian economic theory and provides a means of explaining the increased value of economic resources (land, labor and capital) and their change in value in different circumstances or market conditions. Accessibility is a key spatial variable that affects the likely uses of economic resources and, therefore, their value. Changes in accessibility result in changes in the economic rent that economic resources can command and, therefore, the value and character of the economic activities that take place at any location. As a result, for important economic welfare criteria (such as employment, household income, and property values) an evaluation can be made of the likely change in economic rent that will be associated with an improvement in accessibility generated by a given transportation investment.

Economic rent may be defined as the difference between what the factors, or productive services, of a resource-owner earn in their current occupation and the minimum sum he is willing to accept to stay there. It is then a measure of the resource-owner's gain from having the opportunity of placing his factors in the chosen occupation at the existing factor price, given the prices his factors would earn in all other occupations. It is the proper counterpart of consumers' surplus when this is regarded as the consumers' gain from having the opportunity of buying a particular good at the existing price, where all other prices are given. And like a change in the consumers' surplus, it is a measure of the change of his welfare when the relevant prices in the market are altered. Whereas the increase of consumers' surplus is a measure of his welfare gain for a fall in one or more product prices, the increase in that person's economic rent is a measure of his welfare gain from an increase in the price or the volume of the sale of his factors, i.e. increased sales should generate increased profit.

Conventionally, a person's price-demand curve is drawn as sloping downward to the right, his price-supply curve as sloping upward to the right. If income effects are zero, the individual's demand curve must slope downward: it can slope upward—the characteristic of a so-called "Giffen good"—only if the income effect is negative, and largely relative to the substitution effect. Similar concerns apply to the individual's supply curve. If the income-effect or rather, the 'welfare effect'[1] is zero, the individual supply

[1] Assuming his money income constant, a fall in the price of a good, which makes a person better off, can be regarded as an increase in his real income. There is some rise in his money income that (given all other prices constant) will be accepted by him as equivalent to a fall in the price of that good. Here, no difficulty arises in identifying the increase in his welfare with the income effect so measured. In the case of his supplying a service to the market, however, the person's money income cannot be assumed constant, since, obviously, it varies with the amount of the service he elects to supply at the price offered. What is more, a rise or fall in the resulting money income does not necessarily correspond with a rise or fall in his welfare. A rise in the wage rate, for instance, may result in workers choosing to reduce hours while maintaining the same income, notwithstanding which his welfare has increased: for his income is the same while he enjoys additional leisure. A positive welfare effect, that is, can be associated with no

curve must slope upward: it can slope downward, or become 'backward-bending,' only if the welfare effect is positive and large relative to the substitution effect[2].

Typically, the level of economic rent can be calculated as follows:

$$\text{Economic Rent (ER)} = f\,(P_t, I_t, E_t, C_t, T_t)$$

Where:

P_t is a measure of Population structure of an area in year t;

I_t is a measure of Industrial structure of an area in year t;

E_t is a measure of Education level of an area in year t;

C_t is a measure of Cultural characteristics of an area in year t;

T_t is a measure of Transportation efficiency of an area in year t.

Any analysis region (area) has its own 'Economic Rent Profile'. Economic rent profile shows the spatial distribution of the economy in terms of key factors such as income, property value and wealth. Each of the characteristics listed above can have a significant impact on economic rent profile.

Population Structure: The population structure can affect the economic potential of an area positively or negatively. For example, an aging population could have a negative effect on the economy as the number of workers in the work force may fall. This can reduce productivity and, as a result, reduce the economic rent profile. The US might experience this problem in the second quarter of the 21th century as baby boomers age if technology improvements and increased output do not raise productivity sufficiently. Typically, the more productive the adult population of an area is, the higher the economic rent profile.

Industrial Structure: The nature of the industrial structure and resource base defines the potential economic rent profile of an area, e.g., manufacturing, commercial, agricultural, residential, and service industry. The higher the value added by industry, the higher the area's economic rent profile. For example, the "new economy" jobs in biotech, computers and finance all have very high incomes and economic rent profiles associated with them. The City of Toronto in the 1970s and 1980s was saved from a major loss of economic rent associated with the failing metal manufacturing industry and its associated jobs by a massive infusion of financial sector jobs[3].

Education Level: Educational levels can have a dramatic impact on economic rent potential of an area. Typically, a higher education level (especially Ph.D.'s or other high degrees) will increase the wealth

change in his money income or even with a reduction in his money income. For this reason, it is more sensible to talk of the 'welfare effect' resulting from a change in the supply price.

[2] An increase of welfare has a normal or positive welfare effect if the person offers less at any given price—if that is, he keeps more of the good he is offering for himself. A worker who came into an inheritance would supply less labor. Hence if the price of a good a person supplies is raised, the substitution effect induces him to supply more while a positive welfare effect causes him to supply less. As distinct then from the income effect on the demand side, the welfare effect on the supply side, if it is positive, works against the substitution effect.

[3] See: Metcalf, A.E. Metropolitan Toronto Goods Movement Study. Toronto Roads and Traffic Department. Frederick, MD: TEMS, Inc, 1987

generated by the population. Minnesota, for example, boasts one of the highest concentrations of graduates and Ph.D.'s in the US, which supports the growth of high tech industry in the region.

Cultural Characteristics: Differences in cultural, ethnic and other social characteristics of an area can impact its economic potential. For example, cultural belief systems can impact the ability of a population to work at certain jobs or in a certain way and, therefore, the level of economic rent that can be attained. A survey by the United Nations of the economic growth potential of Arab countries found that the low level of freedom, limited Internet use and the absence of women in the workforce have had a marked negative impact on economic productivity[4].

Transportation Efficiency: Transportation efficiency can greatly affect the economic potential of an area. The more effective a transportation system in moving people and goods, the greater its ability to generate wealth if the economy is responsive to the opportunity presented. It is no coincidence that most of the US's large east coast cities grew as 'break of bulk' ports at locations that had good harbors and good routes to the interior resources and markets of the US. Since the quality of a transportation system is a management variable and can be changed in the short term, investment in the transportation system can generate economic development if the investment is made in a growing and vibrant economy. The level of response that the economy will have to a transportation investment is measured by the economic rent profile.

Where it is important to recognize that education, population, industry, structure, and culture can change over time changing the economic rent profile. However, these are not characteristics that typically change rapidly. Only if an area experiences a significant dislocation or migration associated with rapid and dramatic population and industrial base shifts will it experience a radical change in its economic rent profile. For example, the influx of Hong Kong residents to Vancouver, Canada, in the 1980s dramatically changed the economic rent profile of several areas of the city's downtown. The effect was largely due to the wealth and "entrepreneurial" capability of this new population. In the United States one of the issues for the Midwest is the fact that while it has some of the country's leading academic institutes, it is still losing much of this talent because it is not developing the New Economy businesses at a sufficient rate.

In the absence of a major dislocation, we can assume that the economic rent factors I_t, E_t, P_t, and C_t will remain largely unchanged in the short term (10-20 years). However, transportation efficiency can change significantly in the "short term." Major transportation infrastructure projects can dramatically change the accessibility of markets and the opportunity for economic growth. This can apply to the measurement of goods in a manufacturing-dominated economy or to the movement of people in a service industry-dominated economy. The economic rent generated by transportation improvements (T_t) has driven the desire to move people more quickly and cost-effectively over time. As a result, if population, industrial structure, education levels, and cultural characteristics remain constant, the Economic Rent (ER) model reduces to:

$$ER = f(T_t)$$

By using socioeconomic variables (SE_i) as a proxy for economic welfare and generalized cost (GC_i) as a specific metric for transportation efficiency measured in terms of time and cost the economic rent equation can be rewritten as:

4 Arab Human Development Report. New York: United Nations Development Program, 2002.

$$SEi = ß_o GC_i^{\beta_1}$$

Where:

SE_i – Economic rent factors – i.e. socioeconomic measures such as employment, income, property value of zone i;

GC_i - Weighted generalized cost of travel by all modes and for all purposes from (to) zone i to (from) other zones in the study area;

$ß_o$ and β_1 - Calibration parameters.

The resulting curve generated by this function is the economic rent profile for transportation accessibility. For public modes (rail, bus, air) and private modes (auto), the generalized cost of travel includes all aspects of travel time (access/egress time and in-vehicle time), travel cost (fares, tolls, parking charges), and service frequency.

The generalized cost of travel is typically defined in travel time rather than dollars. Costs are converted to time by applying appropriate conversion factors. The generalized cost of travel between zones i and j for mode m and purpose p is calculated as follows:

$$GC_{ijmp} = TT_{ijm} + \frac{TC_{ijmp}}{VOT_{mp}} + \frac{VOF_{mp} * OH}{VOT_{mp} * F_{ijm}}$$

Where:

TT_{ijm} = Travel time between zones i and j for mode m (in-vehicle time + waiting time + delay time + connect time + access/egress time + interchange penalty), with waiting, delay, connect and access/egress time multiplied by two to account for additional disutility felt by travelers for these activities[5];

TC_{ijmp} = Travel cost between zones i and j for mode m and purpose p (fare + access/egress cost for public modes, operating cost for auto);

VOT_{mp} = Value of Time for mode m and purpose p;

VOF_{mp} = Value of Frequency for mode m and purpose p;

F_{jjm} = Frequency in departures per week between zones i and j for mode m;

OH = Operating Hours per week.

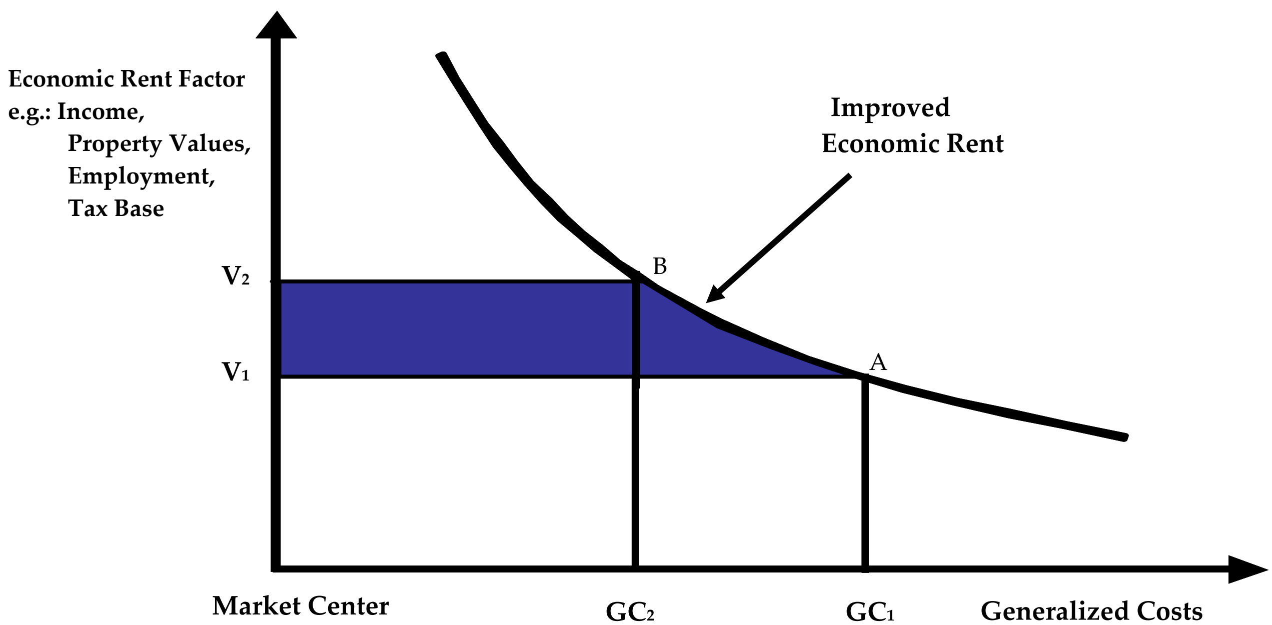
The Economic Rent theory builds from the findings in Urban Economics, and Economics of Location that support Central Place Theory[6]. Central Place Theory argues that in normal circumstances places that are

[5] Issues of travel time calculation, including the weighting factor for travel time is broadly discussed in the literature. See, for example: Manski, C. and McFadden, D. Structural Analysis of Discrete Data with Econometric Applications. London: MIT Press, 1981; Glaister, S. Fundamentals of Transport Economics. New York: St. Martin's Press, 1981.

[6] See: Christaller, W. Central Places in Southern Germany. (Transl. by Baskin, C. W.) Englewood Cliffs: Prentice Hall, 1966 and Loesh, A. The Economics of Location. New Haven: Yale University Press, 1954

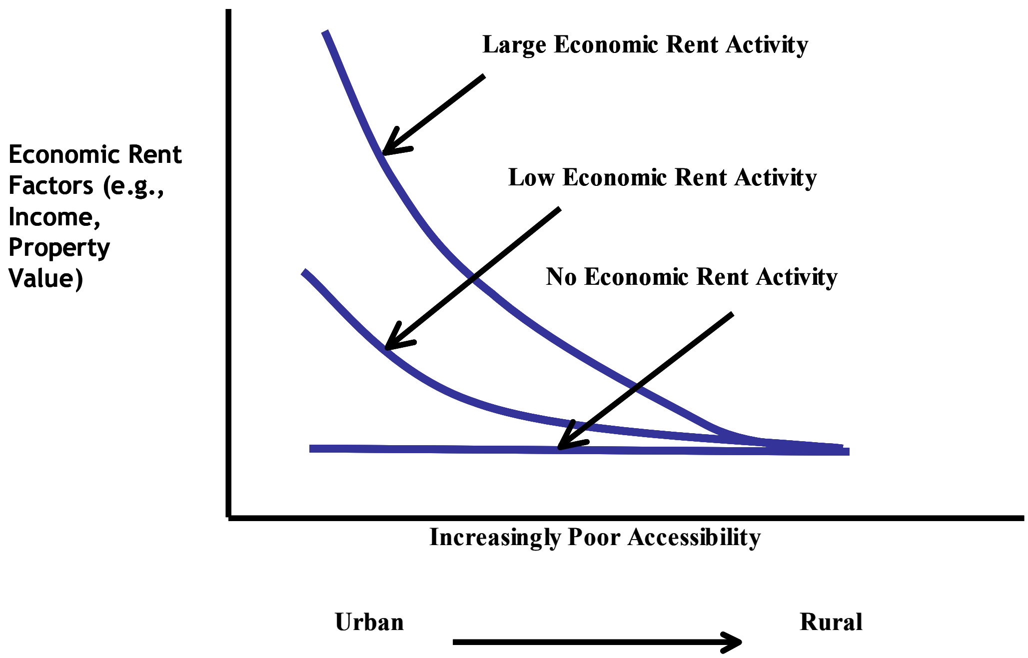
closer to the "center" have a higher value or economic rent. This can be expressed in economic terms, particularly jobs, income, and property value. There is a relationship between economic rent factors (as represented by employment, income, and property value) and impedance to travel to market centers (as measured by generalized cost). As a result, lower generalized costs associated with a transport system improvement lead to greater transportation efficiencies, and increased accessibility. This, in turn, results in lower business costs/higher productivity and, consequently, in an increase in economic rent. This is represented by moving from point B to point A in Exhibit 8.1.

Exhibit 8.1: Economic Rent Illustration



It should be noted that the shape of the economic rent curve reflects the responsiveness of the economy to an improvement in accessibility. Large cities typically have very steep curves, which indicate more significant economic impacts due to a transportation improvement; smaller communities have less steep curves, and rural areas have very flat curves that indicate lower economic responsiveness (see Exhibit 8.2).

Exhibit 8.2: Types of Economic Rent Curve



Given that the economic rent profiles exist in all directions from a given market center it is inevitable that the rent profiles will link into 'rent tents,' and that the rent tents will merge across the study area into a 'rent surface' which measures the economic rent for the whole study area – Minneapolis-Duluth/Superior Rail Corridor. As the economy grows so the rent tents become higher and the economic rent profiles steeper.

8.2 Super Zone System

The development of a 'super zone structure' is a critical input for measuring the economic rent 'profiles', and their associated market areas that exist today in the study area. The economic rent profile provides an understanding of the local economy and the economic rent surface, the interdependence of cities, towns and urban areas along the rail corridors of the study area. Within any settlement pattern the largest markets will tend to dominate hinterlands that will include other cities. Using Christalla Location Theory it is likely that different urban areas will belong to a hierarchy of settlements within a market area of a dominant city. In Minnesota, for example, Twin Cities' market area hinterland includes Cambridge. As a result, to develop the relevant economic rent 'profiles' or 'tent' it is necessary to divide the study area into super zones that describe the economic rent tent of the dominant city and its supporting urban areas.

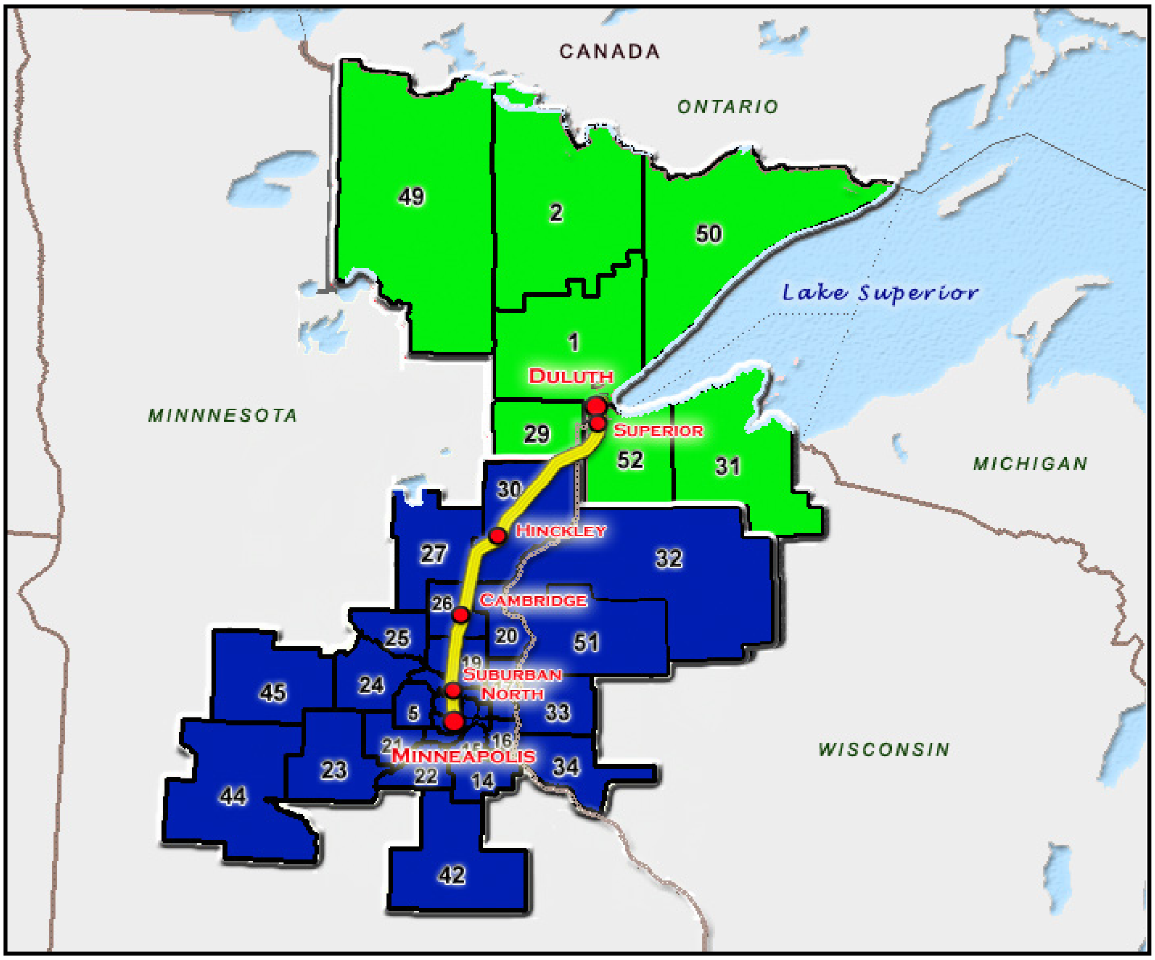
By evaluating the role of each city and its connectivity to the rail station, Minneapolis-Duluth/Superior Intercity Passenger Rail Corridor study area was partitioned into two super zone regions (or market areas), as shown in Exhibit 8.3. Twin Cities were selected as the major city (cities) in the super zone system. The Duluth/Superior market area also formed its own super zone. Each 'super zone center' is an urbanized area (large city). The population density in each principal city (center of the super zone) is much higher than the average density in this super zone (see Exhibit 8.4).

In access to the datasets described in Chapter 4 additional databases developed specifically for the Minneapolis-Duluth/Superior Intercity Rail Corridor Economic Rent Analysis include the following[7]:

Property Data: specifying the commercial and residential value of individual properties.
Tax Data: specifying the level of taxation in each zone.

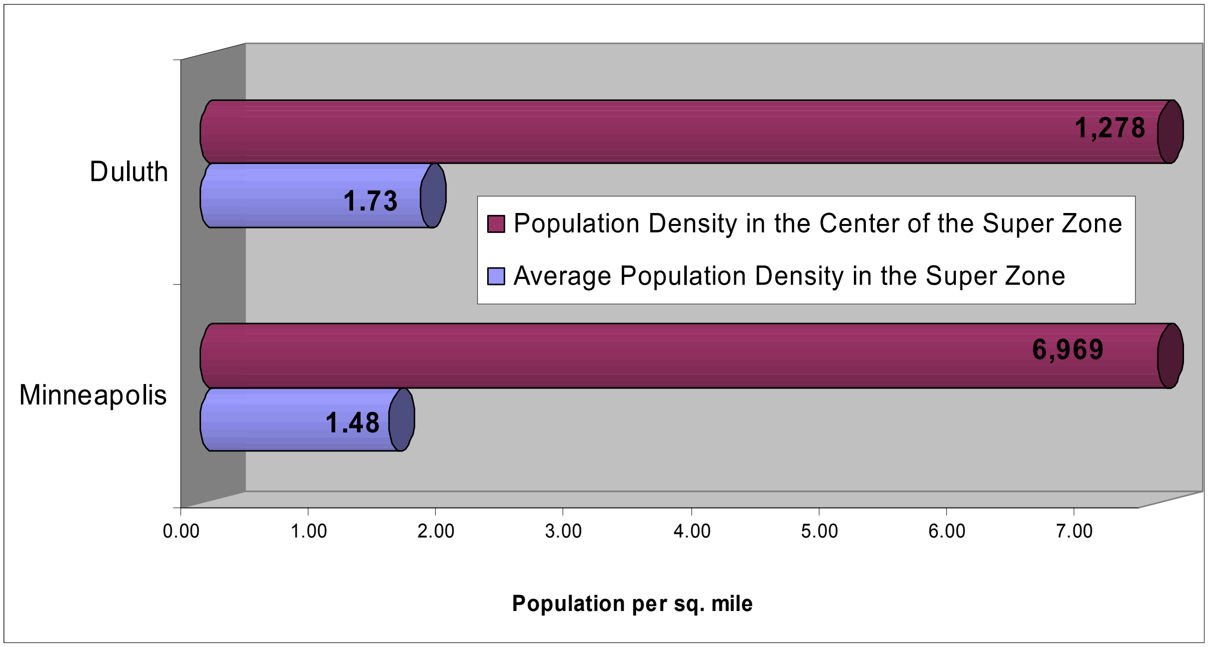
Economic Rent analysis is performed separately for each transportation zone in the frame of each super zone and for each level. The particular role of each city in the super zone (in terms of socio-economic characteristics and connectivity in transportation network) is especially considered in the final stage of Economic Rent analysis – in the process of distributing benefits between stations.

Exhibit 8.3: Minneapolis-Duluth/Superior Intercity Passenger Rail Corridor 'Super Zone' System



[7] Sources: Minnesota Department of Revenue, http://www.taxes.state.mn.us/ and Wisconsin Department of Revenue, http://www.revenue.wi.gov/.

Exhibit 8.4: Population Density, 2006. Super Zone Center vs. Average in Super Zone



8.3 Economic Rent Model Calibration

In Minneapolis-Duluth/Superior Corridor network we have four modes *m:* auto, bus, air and rail modes and two types of trip purposes *p:* business and non-business. For each zone *i* of the zone system, the accessibility, measured in generalized cost is estimated as follows:

$$GC_i = \sum_p \sum_m \sum_j GC_{ij}^{mp} * T_{ij}^{mp} \quad , i=1,N$$

Where:

GC_{ij}^{mp} - generalized cost of travel from zone *i* to zone *j* by mode *m* for purpose *p;*

T_{ij}^{mp} - number of trips from zone *i* to zone *j* by mode *m* for purpose *p;*

N - total number of transportation zones in the network.

The economic rent function ($SEi = ß_o GC_i^{\beta_1}$) can be transformed into a linear function (linear regression model) by applying the natural logarithm[8] (ln) to both parts of the original economic rent function:

$$\ln (SE_i) = \ln (ß_o) + \beta_1 \ln (GC_i)$$

[8] Natural logarithm is a logarithm to base 'e' of a given number, where 'e' is an irrational constant approximately equal 2.71828183. The natural logarithm of x is written: ln (x) or ln x. See, for example: http://www.mathwords.com/n/natural_logarithm.htm or http://www.themathpage.com/aPreCalc/logarithms.htm

or simply[9]:

$$\ln (SE_i) = \beta_o + \beta_1 \ln (GC_i)$$

Where:

SE_i – Economic rent factor (socioeconomic variable) of zone i;

GC_i - Weighted generalized cost of travel by all modes and for all purposes from (to) zone i to (from) other zones in the zone system;

βo and β_1 – Regression coefficients.

In the regression equation ln (SE_i) is the criterion (dependent) variable, while ln (GC_i) is the predictor (independent) variable. βo and β_1 are the coefficients of the regression line (βo is the intercept and β_1 is the slope). Regression coefficients βo and β_1 are to be estimated in the regression model.

Application of regression analysis allowed developing the Minneapolis-Duluth/Superior Intercity Rail Corridor Economic Rent Model. In this process we established the mathematical relationship between the measure of accessibility (generalized cost of travel) and the economic rent socioeconomic variables (employment density, income density and property value density) for each transportation zone. Exhibits 8.5 through 8.7 show the observed values for natural logarithm (LN) of socio-economic variable (employment density, income density and property value density) versus natural logarithm (LN) of generalized costs of travel. The regression line reflects the relationship between socioeconomic indicators in each transportation zone included in the zone system and corresponding generalized costs. By the tight clustering of data points around the regression line, it can be seen that in each case a very strong relationship was identified. In order to identify the strength of the relationships using not visual, but formal statistical methods we analyzed the values of the coefficient of determination (R^2) and Student's t statistics (t)[10].

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[9] $\beta_o = \ln (\beta_o)$
[10] About regression analysis see, for example: Kachigan, S.K. Multivariate Statistical Analysis: A Conceptual Introduction. Second Edition. New York: Radius Press, 1991, pp. 176-179.

Exhibit 8.5: Employment Density as a Function of Accessibility

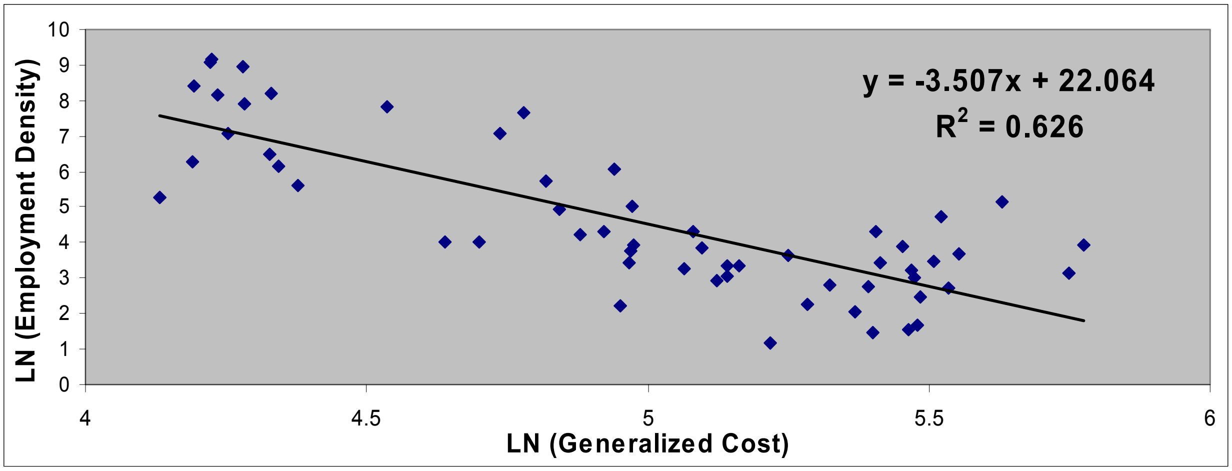


Exhibit 8.6: Income Density as a Function of Accessibility

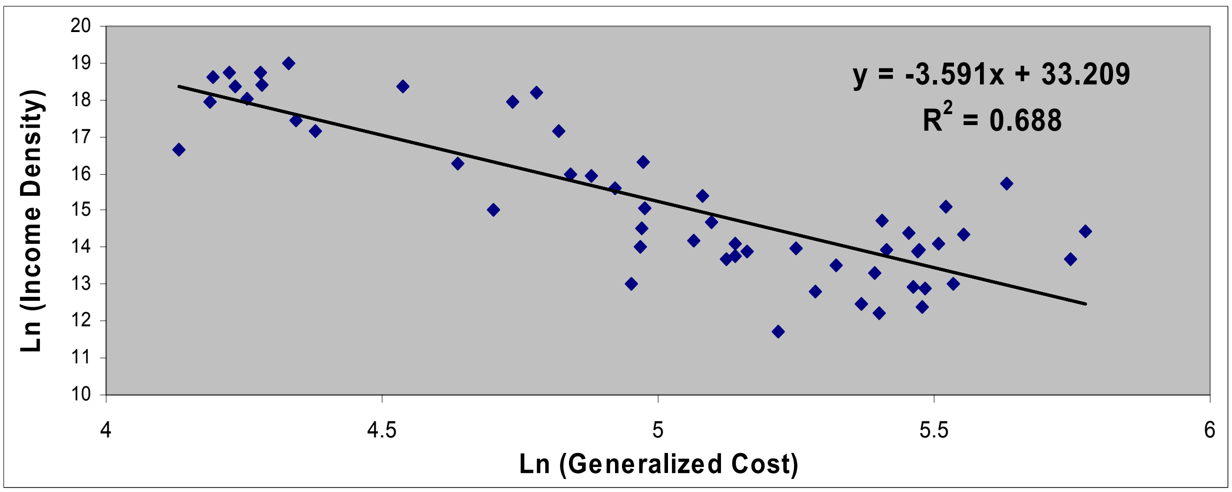
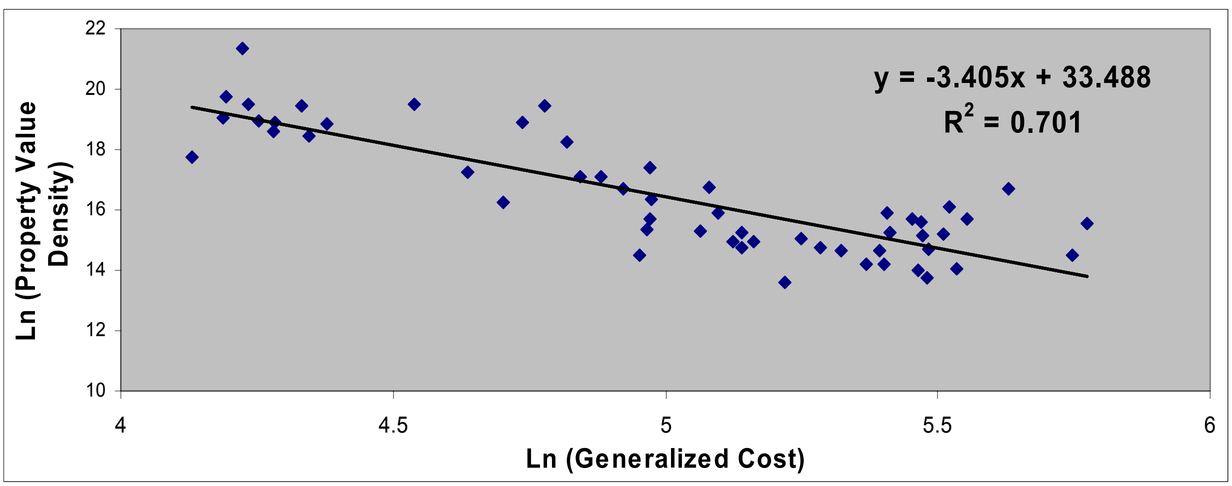


Exhibit 8.7: Property Value Density as a Function of Accessibility



The value of the ***coefficient of determination*** (R^2) shows how much the criterion (dependent) variable is influenced by predictor variable chosen in the study. In other words, the coefficient of determination measures how well the model explains the variability in the dependent variable. As a result, the coefficient of determination illustrates the strength of the relationship between the criterion and predictor variables.

Performing a 't-test' and calculating a Students' ***t-statistics*** for both the regression coefficients (β_0 – the intercept and β_1 - the slope) we analyze the significance of the regression coefficients. Assuming a Normal distribution, a t-statistics that equals two in absolute value is generally accepted as statistically significant.

Regression statistics for each of the three socioeconomic indicators used in the model, as well as statistical measures of confidence are presented in Exhibit 8.8.

Exhibit 8.8: Economic Rent Coefficients for Employment, Income and Property Value Densities

Economic Rent Factor	Slope (β_1)	T-statistics for β_1	Intercept (β_0)	T-statistics for β_0	Coefficient of Determination (R^2)	Number of observations (N)
Employment Density	-3.51	-9.60	22.06	12.06	0.63	57
Income Density	-3.59	-10.70	33.21	19.66	0.69	54
Property Value Density	-3.41	-11.04	33.49	21.58	0.70	54

It can be seen that the calibration was successful and regression coefficients in each equation were shown to be significant. This shows that the economic rent profiles are well developed for the Minneapolis-Duluth/Superior Intercity Passenger Rail Corridor study settlement patterns. Each equation has highly significant 't' values and coefficients of determination (R^2). This reflects the strength of the relationship and, given the fact that there is a strong basis for the relationship, shows firstly that the socioeconomic variables selected provide a reasonable representation of economic rent, and, secondly, that generalized cost is an effective measure of market accessibility.

Given the performance of the models, the next step in developing the Economic Rent model is to determine the change in socioeconomic indicators as a result of accessibility improvement. In order to calculate change in economic rent factors we differentiate the economic rent function with respect to generalized cost. The result of such differentiation is present in equations below.

$$\Delta EmpD_i = \frac{\partial EmpD_i}{EmpD_i} = \beta_1^E \frac{\partial GC_i}{GC_i}$$

$$\Delta IncD_i = \frac{\partial IncD_i}{IncD_i} = \beta_1^I \frac{\partial GC_i}{GC_i}$$

$$\Delta PvD_i = \frac{\partial PvD_i}{PvD_i} = \beta_1^{pv} \frac{\partial GC_i}{GC_i}$$

Where:

GC_i - Weighted generalized cost of zone i;

$EmpD_i$, - Employment density of zone i;

$IncD_i$ - Income density of zone i;

PvD_i - Property value density of zone i;

$\beta_1^E\ \beta_1^I\ \beta_1^{pv}$ - Slope coefficients in regression equations.

It is easy to see that slopes β_1^E, β_1^I and β_1^{PV} in each regression equation represent economic rent elasticities. Each particular, elasticity shows how much each economic rent factor changes when generalized cost of travel changes [11].

The relative change in employment density ($\Delta EmpD_i$), household income density ($\Delta IncD_i$) and property value (ΔPvD_i) for each particular zone i equals the relative change in generalized cost $\frac{\partial GC_i}{GC_i}$ multiplied by regression coefficient $\beta^E{}_1$, $\beta^I{}_1$ or $\beta^{PV}{}_1$, respectively.

The value for each slope coefficient (β_1) is obtained from the corresponding regression equation. Since area (size - S_i) of each transportation zone remains constant, absolute change in employment (∂Emp_i), household income (∂Inc_i) and property value (∂Pv_i) will be obtained from the following equations:

[11] More about the role of elasticity in a measurement of economic rent profile change see: Metcalf, A., Markham, J., Fenney, B. 'A price resistance model for personal travel.' Regional Studies, Journal of the Regional Studies Association. 10, 1976. pp. 79-88; Metcalf, A. 'Transport and Regional Development in Ireland.' Transport and Regional Development (Ed. By Blonk, W.A.G.) Westmead, England: Saxon House, 1978, pp. 190- 208.

$$\partial Emp_i = \partial EmpD_i * S_i = \beta_1^E \frac{\partial GC_i}{GC_i} EmpD_i * S_i$$

$$\partial Inc_i = \partial IncD_i * S_i = \beta_1^I \frac{\partial GC_i}{GC_i} IncD_i * S_i$$

$$\partial Pv_i = \partial PvD_i * S_i = \beta_1^{Pv} \frac{\partial GC_i}{GC_i} PvD_i * S_i$$

In order to calculate the impact of accessibility improvement on average household income we also had to determine how the improvement in accessibility influences the number of households that are supported by any given area. To do this we use Economic Rent model to predict household density that is supported by any given level of market access. The results of regression analysis are shown in Exhibit 8.9 and economic rent coefficients are given in Exhibit 8.10. Again, it can be seen that good statistical relationships were derived with strong 't' values and coefficients of determination R^2.

Exhibit 8.9: Household Density as a Function of Accessibility

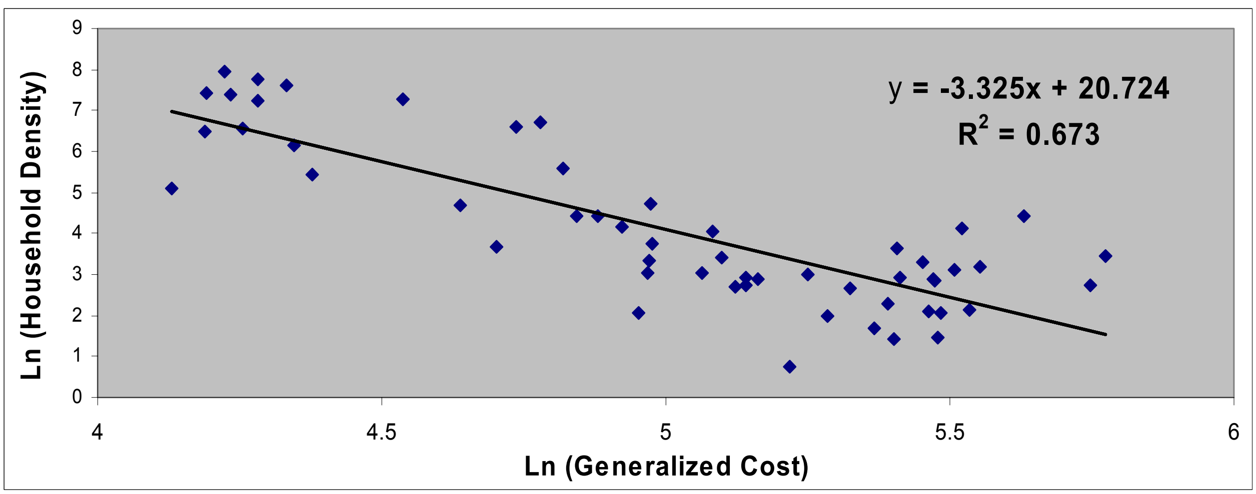


Exhibit 8.10: Economic Rent Coefficients for Household Density

Economic Rent Factor	Slope (β_1)	T-statistics for β_1	Intercept (β_0)	T-statistics for β_0	Coefficient of Determination (R^2)	Number of observations (N)
Household Density	-3.33	-10.36	20.72	12.83	0.67	54

Change in average household income ($\partial AvInc_i$) in zone *i* is calculated as follows:

$$\partial AvInc_i = \frac{\partial Inc_i}{(Hh_i + \partial Hh_i)},$$

where: $$\partial Hh_i = \beta_1^{Hh} * \frac{\partial GC_i}{GC_i} HhD_i * S_i$$

∂Hh_i - the change in the number of households in zone *i* as a result of accessibility improvement;

Hh_i - the base number of households in zone i;

HhD_i - the base household density in zone i;

β_1^{Hh} - the regression coefficient for household density obtained from the table in Exhibit 8.10.

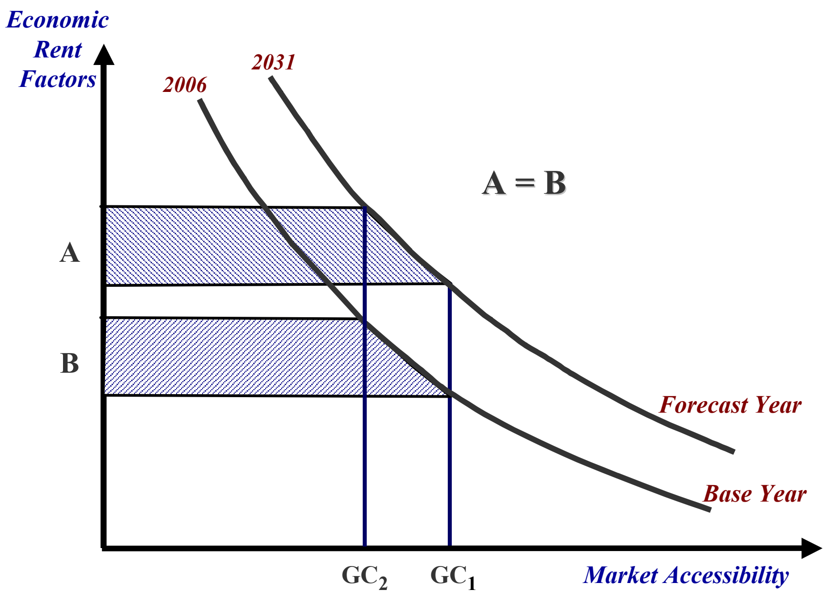
The results of the analysis show that a statistically powerful Economic Rent model can be developed that reflects the responsiveness of the economy to improved transportation access. The level of economic performance relates to the strength of the economy in the area around Minneapolis-Duluth/Superior Corridor and diversity of its industry in the Corridor.

8.4 Assessment of the Impact of Economic Growth

A key assumption in the Economic Rent analysis is the impact of economic growth on the economic rent profile[12]. Economic growth will cause the economic rent profile to grow as each component that supports the economic rent profile, land, labor and capital becomes more valuable. As the economy expands, labor wages increase, so space becomes more valuable, and assets become more expensive. This increase in factor prices results in a rise in the economic rent profile. If the rise in the economic rent profile is constant across its whole profile as shown in Exhibit 8.11, then the increase in economic rent associated with an improvement in market accessibility (i.e. a reduction from GC_1 to GC_2) for the region is the same. As a result, in Exhibit 8.12 area A is equal to area B. This means that economic growth will not change the responsiveness of the economy to transportation improvements or the economic rent benefits of the project. This is the assumption made in this study.

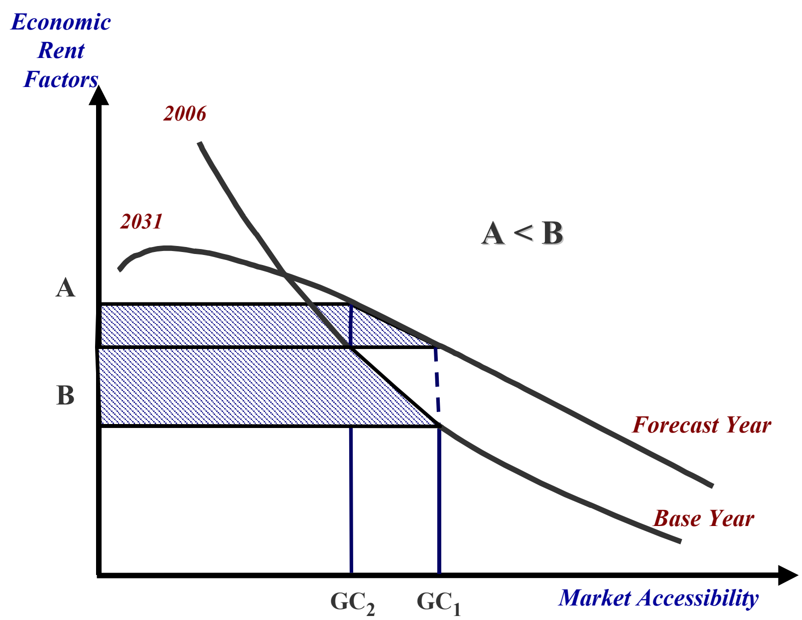
[12] Economic Rent profile as it was defined in section 8.1 shows the spatial distribution of the economy in terms of its key factors - income, property values and wealth.

Exhibit 8.11: Impact of Economic Growth. Type 1 - Constant Profile



Under most economic conditions, however, the growth in economic rent is not the same over the region and the profile will not grow proportionally along its entire length. For example, if there is a major dislocation in the economy of a city, then as shown in Exhibit 8.12 there may be decline in the forecast year economic rent profile at the market center while in the more peripheral areas (surrounding the market center) there is economic growth, i.e., growth occurs in the suburbs, but not the market center. In this environment the forecast year benefits, as measured by area A, are smaller than the base year economic benefits, measured by area B. This would suggest that using the base year economic rent profile would overstate benefits.

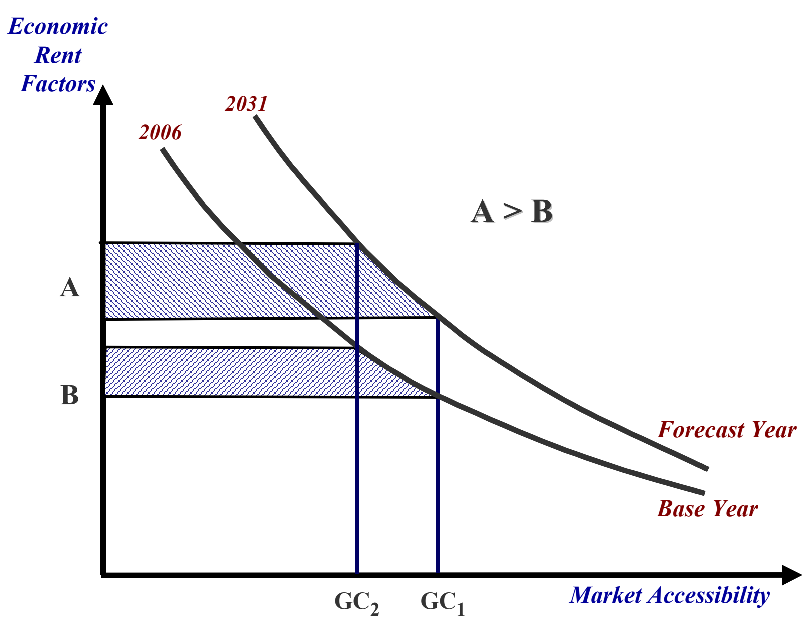
Exhibit 8.12: Impact of Economic Growth. Type 2 - Decrease in Profile



This type of growth, however, does not occur in normal markets, but rather in markets that suffer economic dislocations. For example, both Detroit and Buffalo experienced this type of growth impact when their downtown businesses failed. In Buffalo the issue was the decline of metal industries, while in Detroit it was more related to social demographic pressures. In this case a forecast of economic benefits based on a base year assessment will be an overstatement of the benefit. Certainly if any city market areas along the Minneapolis-Duluth/Superior Corridor suffer a major dislocation (such as experienced by Buffalo) during the life of the project, then the forecasts prepared for the Minneapolis-Duluth/Superior Corridor could be overstated.

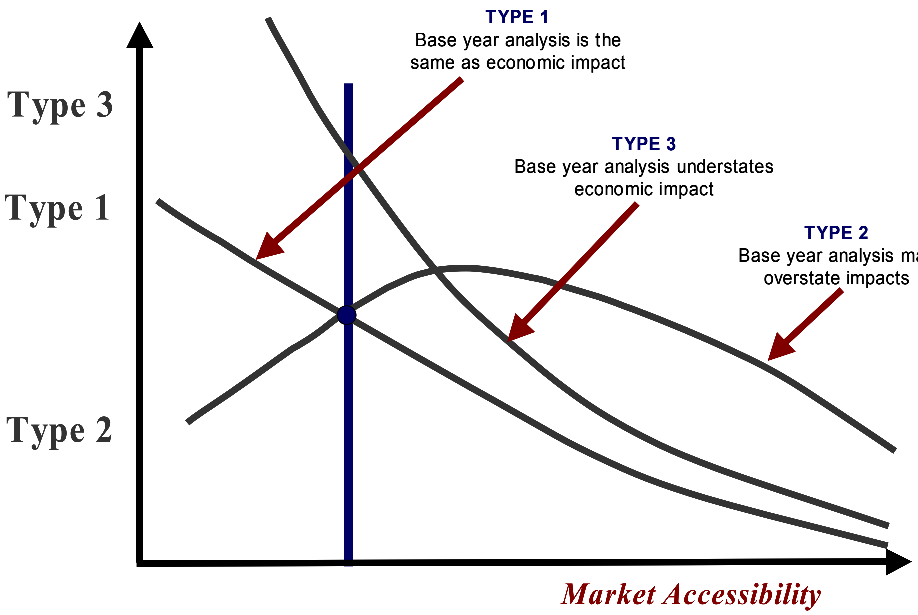
Under a normal economic growth situation in which the economy expands for a corridor, the typical impact is for growth to expand much faster at the market center than in the periphery. This reflects the fact that the market center provides the greater opportunities for growth in a normal economy and market. For example, the flood of Hong Kong Chinese into City of Vancouver in Canada in the 1990s increased economic growth and income across the city. However, the impact was most heavily focused in the city center with the development of new high-rise buildings, restaurants and businesses within the downtown area. This increased the economic profile of the downtown area more that it did in suburban areas. In this case the measurement of economic benefit using the base year economic profile will understate the size of the benefits to be derived from the project. Area B will be smaller than area A. (See Exhibit 8.13.) Since this is the usual impact of economic growth on a market center, and as our study suggests ongoing long-term economic growth it is likely that using area B to estimate economic rent benefits understates the overall economic benefits to be derived from an Economic Rent analysis.

Exhibit 8.13: Impact of Economic Growth. Type 3 - Increase in Profile



As a result, it can be seen in Exhibit 8.14 there are three conditions that can exist in the forecast year.

Exhibit 8.14: Types of Economic Growth



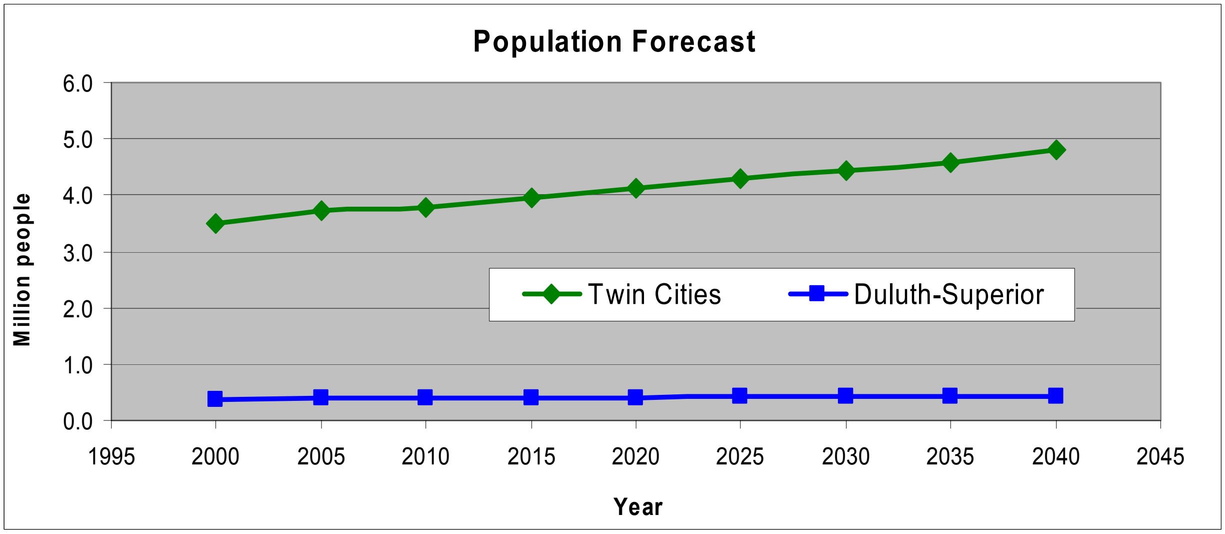
Type 1 has constant growth. This means that base and forecast year impacts along the economic rent are the same, and the base year analysis understates the benefits.

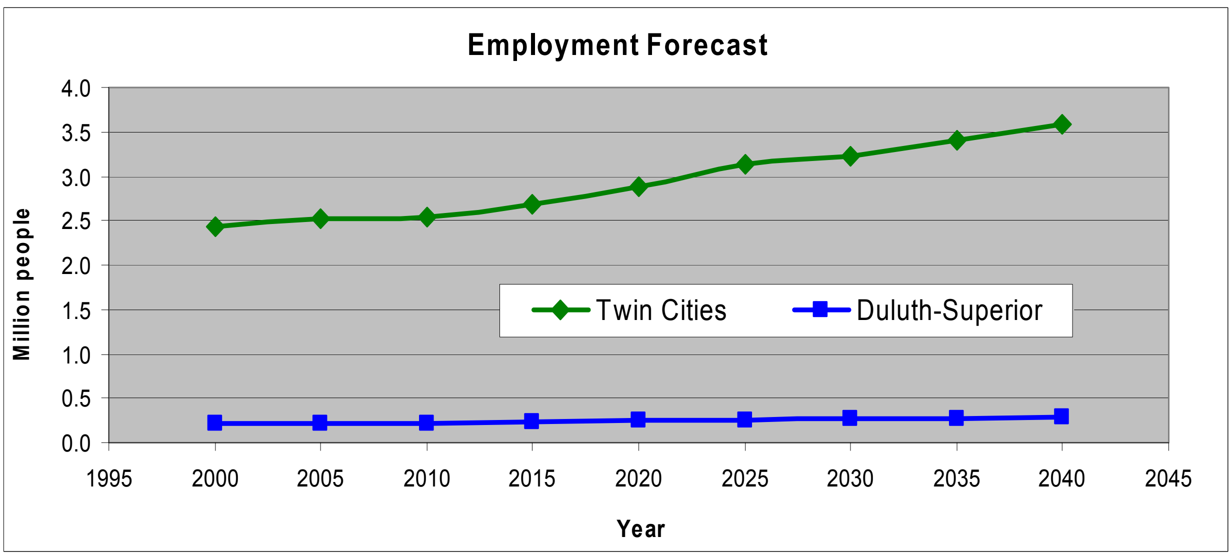
Type 2 has negative growth at the market/city center. This typically results from a dislocation to the economy due to a loss of the economic base of the region. If this occurs the economic rent results, particularly in market centers, would be less than those that would be achieved if a base year economic rent profile is used. Using the base year economic rent profile will overstate the benefits.

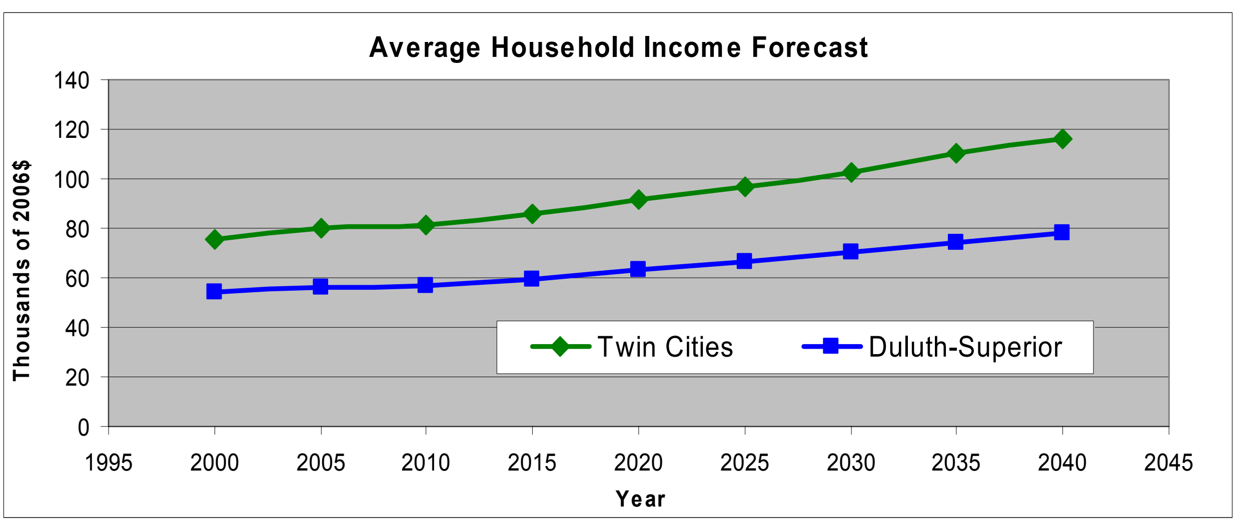
Type 3 has increased positive economic growth at the market center. As a result, the future year benefits are higher than suggested by measuring the economic rent profile in the base year.

While Type 3 is the normal situation for a city or market center, we have selected Type 1 as the basis for estimating economic benefits, which we believe is a reasonable and conservative assumption. In most towns a Type 3 environment will generate benefits greater than those estimated in this study. In one or two towns it is possible that a Type 2 conditions could prevail and lower economic benefits would be generated from the project. However, it is worth noting that such a weak performance would not be consistent with the current economic projections for Minneapolis-Duluth/Superior Corridor study area economy. (See Exhibit 8.15.)

Exhibit 8.15: Socioeconomic Forecasts by Super Zone







8.5 Economic RENTS™ Results

For the Minneapolis-Duluth/Superior Corridor two super zone region the building of the high-speed rail system will create between six and fifteen thousand jobs (depending on the rail technology implemented and frequency used); it will increase development potential (property value) by $0.8-1.9 billion and the household income by $0.3-0.7 billion. It should be noted that the increase in employment, income and property value in Minneapolis-Duluth/Superior Corridor study area represents a growth on the overall economy of between 0.2 and 0.4 percent on current levels. Both state and federal tax benefits are estimated in the range between $50 and $123 million per year depending on technology and frequency alternative. Exhibits 8.16 through 8.17 represent the overall Economic Rent results by rail technology and frequency for the base case and with the Hinckley Casino link.

In terms of the time scale associated with the presented benefits it is likely that these benefits will be achieved after the completion of the building of the entire system and within two or three years of the start of operation by the Minneapolis-Duluth/Superior Passenger Rail Corridor. The benefits will be proportional to the development of the system routes and schedules. It should be noted that the benefits of the system are likely to increase over time in line with growth in the economy as the analysis used the base year economic rent profile not the forecast year economic rent profile. Increases in the economic rent profile will significantly expand these results. If the economy grows by 50 percent by 2050, the estimated benefits will at least increase accordingly.

Exhibit 8.16: Overall Economic Rent Benefits for the Minneapolis-Duluth/Superior Corridor Derived from Implementation of the Intercity Passenger Rail System by Rail Technology and Frequency (Shuttle Bus Connection to Casino)

Economic Rent Factor	110/4	125/4	110 /8	125 /8
Employment (# productivity jobs[13])	5,952	6,760	13,833	14,641
Income (2006$)	$267 mill	$302 mill	$617 mill	$653 mill
State Income Tax[14] (2006$)	$11 mill	$13 mill	$26 mill	$27 mill
Federal Income Tax[15] (2006$)	$30 mill	$34 mill	$69 mill	$73 mill
Property Value (2006$)	$767 mill	$869 mill	$1,778 mill	$1,880 mill
Property Tax[16] (2006$)	$ 9 mill	$ 10 mill	$ 21 mill	$ 23 mill
Average Household Income (2006$)	$161	$182	$372	$393

[13] Jobs identified here are productivity jobs and not construction or operating jobs. These productivity jobs derived from Minneapolis-Duluth/Superior Intercity Passenger Rail Corridor implementation are estimated in the range of 178-439 thousand person years of work over the 30-year time of the project.

[14] State income tax benefits were calculated as a share of increase in income estimated by Economic Rent model and using data on gross personal income, adjusted gross income (http://www.allcountries.org/) and minimum personal income tax rates for the State of Minnesota (www.taxes.state.mn.us/) and State of Wisconsin (www.revenue.wi.gov/) Minimum personal income tax rates (5.35% for Minnesota and 4.6% for Wisconsin) were applied in order to keep estimates at the conservative level.

[15] Federal income tax benefits were calculated as a share of increase in income estimated by Economic Rent model and using data on gross personal income, adjusted gross income and gross taxes for the State of Minnesota and State of Wisconsin from the following source: http://www.allcountries.org/

[16] Property tax benefits are calculated by applying the effective property tax rates in the State of Minnesota (http://www.taxes.state.mn.us) and in the State of Wisconsin (www.revenue.wi.gov/) to the estimated in the frame of Economic Rent model property value increase in each of these States.

Exhibit 8.17: Economic Rent Benefits for the Minneapolis-Duluth/Superior Corridor Derived from Implementation of the Intercity Passenger Rail System by Rail Technology and Frequency (Direct Connection to Casino)

Economic Rent Factor	110/4	125/4	110/8	125/8
Employment (# productivity jobs[17])	6,651	7,459	14,533	15,340
Income (2006$)	$302 mill	$338 mill	$653 mill	$688 mill
State Income Tax[18] (2006$)	$13 mill	$14 mill	$27 mill	$29 mill
Federal Income Tax[19] (2006$)	$34 mill	$38 mill	$73 mill	$77 mill
Property Value (2006$)	$870 mill	$972 mill	$1,881 mill	$1,983 mill
Property Tax[20] (2006$)	$ 10 mill	$ 12 mill	$ 23 mill	$ 24 mill
Average Household Income (2006$)	$182	$203	$391	$412

Distribution of employment, income and property value benefits by super zones is shown in exhibits 8.18 through 8.20 for the base case and the Casino link option.

[17] Jobs identified here are productivity jobs and not construction or operating jobs. These productivity jobs derived from Minneapolis-Duluth/Superior Intercity Passenger Rail Corridor implementation are estimated in the range of 178-439 thousand person years of work over the 30-year time of the project.
[18] State income tax benefits were calculated as a share of increase in income estimated by Economic Rent model and using data on gross personal income, adjusted gross income (http://www.allcountries.org/) and minimum personal income tax rates for the State of Minnesota (www.taxes.state.mn.us/) and State of Wisconsin (www.revenue.wi.gov/) Minimum personal income tax rates (5.35% for Minnesota and 4.6% for Wisconsin) were applied in order to keep estimates at the conservative level.
[19] Federal income tax benefits were calculated as a share of increase in income estimated by Economic Rent model and using data on gross personal income, adjusted gross income and gross taxes for the State of Minnesota and State of Wisconsin from the following source: http://www.allcountries.org/
[20] Property tax benefits are calculated by applying the effective property tax rates in the State of Minnesota (http://www.taxes.state.mn.us) and in the State of Wisconsin (www.revenue.wi.gov/) to the estimated in the frame of Economic Rent model property value increase in each of these States.

Exhibit 8.18: Employment Benefits (Job Creation) by Super Zone & Rail Technology

"Super Zone" Center	Shuttle Bus Connection to Casino				Direct Connection to Casino			
	110/4	**125/4**	**110/8**	**125/8**	**110/4**	**125/4**	**110/8**	**125/8**
Twin-Cities	4,942	5,569	11,406	12,033	5,615	6,241	12,079	12,705
Duluth-Superior	1,010	1,191	2,427	2,608	1,037	1,217	2,454	2,634
Total:	**5,952**	**6,760**	**13,833**	**14,641**	**6,651**	**7,459**	**14,533**	**15,340**

Exhibit 8.19: Income Benefits (in millions of 2006$) by Super Zone & Rail Technology

"Super Zone" Center	Shuttle Bus Connection to Casino				Direct Connection to Casino			
	110/4	**125/4**	**110/8**	**125/8**	**110/4**	**125/4**	**110/8**	**125/8**
Twin-Cities	230.3	259.3	529.9	558.9	264.8	293.7	564.4	593.4
Duluth-Superior	36.4	42.9	87.4	93.9	37.5	43.9	88.5	94.9
Total	**$267**	**$302**	**$617**	**$653**	**$302**	**$338**	**$653**	**$688**

Exhibit 8.20: Property Value Benefits (in millions of 2006$) by Super Zone & Rail Technology

"Super Zone" Center	Shuttle Bus Connection to Casino				Direct Connection to Casino			
	110/4	**125/4**	**110/8**	**125/8**	**110/4**	**125/4**	**110/8**	**125/8**
Twin-Cities	663.5	747.3	1,529.4	1,613.1	763.1	846.9	1,628.9	1,712.7
Duluth-Superior	103.5	121.9	248.3	266.7	106.9	125.3	251.7	270.1
Total	**$767**	**$869**	**$1,778**	**$1,880**	**$870**	**$972**	**$1,881**	**$1,983**

To obtain state results, the overall results were disaggregated to the zone level and then state totals were estimated. Derived benefits are different for different high speed rail technologies. Exhibits 8.21 through 8.22 show the possible range of Economic Rent benefits obtained by state.

Exhibit 8.21: Economic Rent Benefits for the Minneapolis-Duluth/Superior Corridor Derived from Implementation of the Intercity Passenger Rail System by State and Rail Technology (Shuttle Bus Connection to Casino)

Economic Rent Factor	110/4	125/4	110/8	125/8
State of Minnesota:				
Employment (# productivity jobs)	5,647	6,409	13,114	13,876
Income (2006$)	$252 mill	$285 mill	$583 mill	$616 mill
State Income Tax 2006$)	$10.6 mill	$12.0 mill	$24.5 mill	$25.9 mill
Federal Income Tax (2006$)	$28.5 mill	$32.3 mill	$66.0 mill	$69.7 mill
Property Value (2006$)	$722 mill	$817 mill	$1,672 mill	$1,767 mill
Property Tax (2006$)	$ 8.4 mill	$ 9.5 mill	$ 19.5 mill	$ 20.6 mill
Average Household Income (2006$)	$167	$189	$384	$406
State of Wisconsin:				
Employment (# productivity jobs)	305	351	719	765
Income (2006$)	$15 mill	$17 mill	$34 mill	$37 mill
State Income Tax (2006$)	$0.5 mill	$0.6 mill	$1.2 mill	$1.3 mill.
Federal Income Tax (2006$)	$1.5 mill	$1.7 mill	$3.5 mill	$3.8 mill
Property Value (2006$)	$45 mill	$52 mill	$106 mill	$113 mill
Property Tax (2006$)	$ 0.8 mill	$ 0.9 mill	$ 1.8 mill	$ 2.0 mill
Average Household Income (2006$)	$102	$117	$240	$255

Exhibit 8.22: Economic Rent Benefits for the Minneapolis-Duluth/Superior Corridor Derived from Implementation of the Intercity Passenger Rail System by State and Rail Technology (Direct Connection to Casino)

Economic Rent Factor	110/4	125/4	110/8	125/8
State of Minnesota:				
Employment (# productivity jobs)	6,321	7,083	13,778	14,550
Income (2006$)	$286 mill	$320 mill	$617 mill	$650 mill
State Income Tax2006$)	$12.0 mill	$13.4 mill	$26.0 mill	$27.3 mill
Federal Income Tax (2006$)	$32.4 mill	$36.2 mill	$69.8 mill	$73.6 mill
Property Value (2006$)	$821 mill	$916 mill	$1,770 mill	$1,866 mill
Property Tax (2006$)	$ 9.6 mill	$ 10.7 mill	$ 20.7 mill	$ 21.8 mill
Average Household Income (2006$)	$189	$211	$407	$429
State of Wisconsin:				
Employment (# productivity jobs)	330	376	744	790
Income (2006$)	$16 mill	$18 mill	$36 mill	$38 mill
State Income Tax (2006$)	$0.5 mill	$0.6 mill	$1.2 mill	$1.3 mill.
Federal Income Tax (2006$)	$1.6 mill	$1.8 mill	$3.7 mill	$3.9 mill
Property Value (2006$)	$49 mill	$56 mill	$110 mill	$117 mill
Property Tax (2006$)	$ 0.8 mill	$ 1.0 mill	$ 1.9 mill	$ 2.0 mill
Average Household Income (2006$)	$110	$125	$248	$263

8.6 Economic Benefits by Station

Final Economic Rent analysis translates economic benefits calculated for super zones and states into benefits for each high speed technology frequency option for each rail station. The results of RENTS™ analysis for six Minneapolis-Duluth/Superior Corridor stations are shown in exhibits 8.23 through 8.26. The tables include the impact of a direct link to Hinckley Grand Casino. Expected economic benefits are estimated in terms of increase in employment, household income and property values (development potential).

Exhibit 8.23: Minneapolis-Duluth/Superior Corridor Economic Benefits by Station (110-mph/4 Train Option)

Station Name		Employment (# jobs)	Income (Millions 2006$)	Development Potential (Millions 2006$)
Minneapolis		2,400-3,300	$100-130	$280-390
Suburban North		600-900	$45-70	$110-170
Cambridge		300-500	$20-25	$60-80
Hinckley	Shuttle Bus Connection to Casino	130-190	$5-10	$25-35
	Direct Connection to Casino	700-1,000	$35-50	$105-160
Superior		300-400	$10-15	$30-40
Duluth		600-800	$20-30	$60-80

Exhibit 8.24: Minneapolis-Duluth/Superior Corridor Economic Benefits by Station (125-mph/4 Train Option)

Station Name		Employment (# jobs)	Income (Millions 2006$)	Development Potential (Millions 2006$)
Minneapolis		2,700-3,800	$110-150	$320-440
Suburban North		650-1,000	$50-80	$130-190
Cambridge		400-600	$20-30	$60-90
Hinckley	Shuttle Bus Connection to Casino	140-210	$5-10	$25-40
	Direct Connection to Casino	700-1,050	$35-55	$110-165
Superior		300-400	$10-15	$30-50
Duluth		700-900	$25-35	$70-90

Exhibit 8.25: Minneapolis-Duluth/Superior Corridor Economic Benefits by Station (110-mph/8 Train Option)

Station Name		Employment (# jobs)	Income (Millions 2006$)	Development Potential (Millions 2006$)
Minneapolis		5,700-7,400	$220-290	$670-900
Suburban North		1,400-2,000	$100-150	$250-390
Cambridge		700-1,100	$40-60	$120-170
Hinckley	Shuttle Bus Connection to Casino	300-400	$15-20	$55-80
	Direct Connection to Casino	800-1,300	$40-60	$135-205
Superior		700-900	$25-30	$70-90
Duluth		1,400-1,900	$50-70	$140-190

Exhibit 8.26: Minneapolis-Duluth/Superior Corridor Economic Benefits by Station (125-mph/8 Train Option)

Station Name		Employment (# jobs)	Income (Millions 2006$)	Development Potential (Millions 2006$)
Minneapolis		6,100-8,200	$240-320	$700-900
Suburban North		1,500-2,100	$110-160	$270-390
Cambridge		700-1,100	$40-60	$120-170
Hinckley	Shuttle Bus Connection to Casino	300-450	$15-20	$60-85
	Direct Connection to Casino	900-1,300	$40-65	$140-210
Superior		700-1,000	$25-35	$70-100
Duluth		1,500-2,000	$50-70	$150-210

8.7 Conclusion

The Economic Rent analysis shows benefits of the following:

- 0.2 to 0.4 percent growth in the corridor economy, depending on technology.
- 6 to 15 thousand (30 year) jobs across the Minneapolis-Duluth/Superior Corridor, which is equivalent to 180 to 450 thousand person years of work over the 30 years.
- Increase in income between $267 and 688 million per year or $ 5 to 12 billion over the life of the project.[21]
- The development potential, assuming full advantage is taken by local communities of the development option available from the Minneapolis-Duluth/Superior Intercity Passenger Rail Corridor project, is between 0.8 and 2 billion dollars, and may be higher with effective planning and urban renewal.
- Expected state tax benefits (both income and property taxes) for the Minneapolis-Duluth/Superior Corridor are in the range of $20 to 53 million per year (its is equivalent to $0.4 to 1 billion over the life of the project).
- Total expected tax benefits (state and federal) from the Minneapolis-Duluth/Superior Corridor project implementation are in the range of at least $50 to 130 million per year or $0.9 to 2.4 billion over the life of the project.

Analysis of the Minneapolis-Duluth/Superior Intercity Passenger Rail Project shows that the total benefits will be distributed between states in the following way:

- Minnesota – 90-95 percent
- Wisconsin – 5-10 percent

[21] 3.9% discount rate is assumed here.

9

Institutional Framework Alternatives

The recent market trend of an increasingly diverse service-oriented economy has put more emphasis on the role of the private sector in implementing changes and setting new standards in the transportation industry. The private sector, using two major management tools—productivity gains by investment in new technologies and marketing strategies directed at opportunities that are emerging in the transportation market—has been significantly involved in the development of new standards in the transportation industry. During the process of conceptualizing the Minneapolis-Duluth/Superior Corridor System, the focus has been put onto effectively improving the productivity and partnering benefits by adopting private sector tools, where appropriate.

The following list shows a range of potential public-private arrangements that the Minneapolis-Duluth/Superior Corridor System could adopt:

- **Full Privatization** – The private sector finances and runs the whole operation.
- **Cost and Risk Sharing** (e.g., turnkey development) – A hybrid privatization approach where the public helps with capital financing, but the private sector is expected to also provide substantial capital, and to subsequently operate the system on a commercially profitable basis including the responsibility to repay its own capital costs.
- **Public Financing with Operating Franchises** – A public/private initiative where the public sector provides all the capital, primarily for infrastructure, while the private sector runs the trains. Such an operation must at least cover its operating cost, but without the responsibility for repaying initial capital investment, a positive operating ratio (greater than 1.00) would produce an operating profit.
- **Contracting** – The public sector provides both capital and operating funds. Operations may be contracted to the private sector, but the responsibility for commercial business decision-making rests with the sponsoring public agency.
- **Cooperative Agreements for Technology Development** – This is a special purpose public/private partnership established for the purpose of research, development and technology transfer.

Full privatization is extremely difficult to achieve in passenger rail, due to government capital subsidies provided to other modes of transportation, and because the cost-structure of automobile ownership makes it difficult to charge a rail fare that is high enough to fully recover capital costs. This financing model has been tried on several high-speed rail projects in the US, such as the proposed Texas TGV and

Florida FOX systems, but none of these projects has been able to achieve the financial rates of return needed to attract private investment.

Recognizing that high-speed rail projects are unlikely to be financed purely by the private sector, cost and risk-sharing arrangements have recently been proposed for High-speed rail systems in Florida and elsewhere. These appear to have a higher chance for success than the earlier efforts that were based on a full privatization model. This is because the projects are in markets where using very high speed technology generates substantial cash flows over and above operating costs that can make a substantial contribution to capital costs, while still producing a very good return for the private sector.

However, for a corridor such as the Minneapolis-Duluth/Superior, the benefits of private sector participation can be attracted only if a large measure of financial "risk" – most notably associated with infrastructure investment – can be shifted to the public sector. This is because the market is relatively thin, and cannot support very high speed rail service. At 110-mph the market can, however, produce a return over and above the operating costs. The FRA, in their proposals for developing public/private partnerships, has identified the need for amelioration of this "risk." The FRA has proposed that the public sector be responsible for providing capital, while the private sector operates the system without an operating subsidy. Two critical conditions have to be met in order for this "franchising model" to work:

- Once started, the rail system must be able to generate at least enough revenue to cover its own operating costs.
- The investment must produce a positive benefit/cost ratio (greater than 1.00) that shows the overall project makes a net contribution to the US economy.

Given the ability to meet these conditions a franchising arrangement takes the form of a concession, granted in return for either an up-front or an ongoing payment, which grants the right to use the publicly provided rail assets for providing passenger service. Commercial decision making – the right to determine schedules, fares and service frequencies – is then left up to the franchise operator, who can operate with a minimum of government interference or regulation so long as the basic conditions of the franchise continue to be met.

In contrast, a contracting arrangement implies that the responsibility for commercial decision-making resides with the sponsoring government entity. While a contracting arrangement may be necessary for a loss-making transit service, for an intercity passenger system today, it is the least attractive option since it "crowds out" the private sector's ability to tailor its services to best meet the need of the marketplace.

For evaluating the Minneapolis-Duluth/Superior corridors business potential, it is anticipated that varying levels of private sector participation may be possible. It is likely that the private sector could participate with the passenger rail system in provision of the following services:

- Train operations
- Station operations
- Express parcel service
- Call center operations
- On-board services

- Feeder bus services
- Vehicle maintenance
- Track maintenance
- Parking

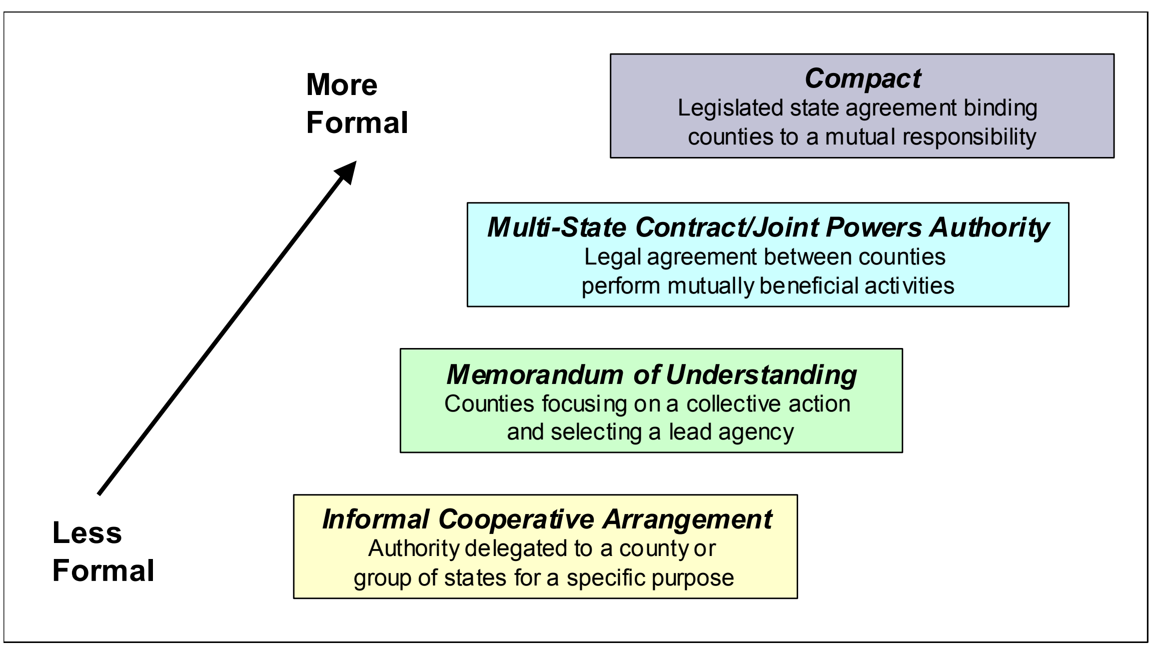
New technologies in the communication industry have greatly enhanced transportation management control, by allowing businesses to monitor and diagnose the performance of their operations and to provide effective and efficient customer response service. As a result of these changes in transportation management control, both capital and operating costs in the transportation industry has decreased while service capabilities have improved.

9.1 Institutional Agreement Framework

As the Minneapolis-Duluth/Superior Intercity Rail Study progresses to more detailed planning and ultimately to securing funding for implementation of the Minneapolis-Duluth/Superior System, multi-county participation and cooperation become necessary for the system's success. With the progression of a series of activities, it is important to define the institutional arrangement that meets the needs of the Minneapolis-Duluth/Superior corridor counties collective action while minimizing intrusion on the authorities, powers and immunities of each county/city.

Institutional arrangements are the organizational structure and agreements between participating entities (e.g., counties) responsible for undertaking or overseeing project-related activities. A continuum and definition of institutional arrangements range from less formal arrangements such as a Letter of Agreement to a more formal multi-state legislated compact arrangement. The level of arrangement selected will reflect the administrative needs of the counties and the degree of complexity of the issues being dealt with. Exhibit 9.1 depicts the continuum of institutional agreement.

Exhibit 9.1: Continuum of Institutional Agreements



An example of an existing passenger rail compact is the Interstate Rail Passenger Advisory Council (Interstate High-Speed Intercity Rail Passenger Network Compact). Its purpose is to explore the potential for high-speed rail within the Great Lakes region and to encourage a cooperative and coordinated regional approach for planning and development activities. It is the policy of the Compact member states "to cooperate and share jointly the administrative and financial responsibilities of preparing a feasibility study concerning the operation of such a (passenger rail) system connecting major cities in Ohio, Indiana, Michigan, Pennsylvania and Illinois."

The origin of this Interstate Rail Passenger Advisory Council can be traced to January 30, 1979, when a bill was introduced in the Ohio legislature to create a high-speed rail compact with Ohio's neighboring states. That bill was signed into law on August 28, 1979, and neighboring states were contacted and urged to join the Compact. By 1981, Michigan, Pennsylvania, Illinois and Indiana had joined the Compact. In the early 1990's, New York and Missouri also became members of the Compact.

The Council continues to provide an institutional framework in which state rail transportation officials assemble to advance interstate rail projects. The Council's current project involves overseeing the development of the Ohio and Lake Erie Regional Rail - Ohio Hub Study.

9.1.1 Guiding Principle in Selecting Institutional Arrangements

It is essential to take account a certain guiding principles to support Minneapolis-Duluth/Superior Intercity Rail Corridor activities when considering and ultimately selecting institutional. The overall objectives of the principles should support the achievement of project goals without expanding or creating new bureaucracies. Most importantly, key to the success of a successful institutional arrangement is to ensure that the arrangement is designed in a manner that minimizes intrusion upon county powers and immunities. Moreover, while the form of arrangements is important, it is equally important to identify when multi-county arrangements are necessary and what authorities need be incorporated into these arrangements.

9.1.2 Multi-State Participation Activities

Since the Minneapolis-Duluth/Superior Intercity Rail System involves the seven counties, two cities, and relates to two states Minnesota and Wisconsin, a multi county/state agency participation is required in order to implement the System. The activities and institutional issues requiring multi-state/agency participation for the Study falls into three broad categories: project planning, business arrangements, and policy/operational oversight. Exhibit 9.2 lists these activities by project category.

Exhibit 9.2: Typical Institutional Arrangement Activities by Category

Project Planning	Business Arrangement	Policy
Hiring consultants Project planning oversight Environmental review Garnering project support	Issue and retire county/ state debt Federal grant activities Major procurements System construction Outsourcing decisions	Train operator oversight Capital investments Service quality standards Receipt of revenue Payment to contractors Disbursements to states

In the Project Planning activities, arrangements support joint funding and collective oversight of the planning process among states and any relevant agencies. Then, the Business Arrangement activities involve the contractual agreement(s) with lending institutions, investors, suppliers, contractors, freight, and commuter railroads while protecting the interest of states, defining fiduciary responsibility, and achieving objectives according to a schedule and the counties and within limits of affordability.

While some activities can be accomplished by individual counties or states, others will require varying levels of institutional arrangements. Institutional arrangements would identify county/state responsibilities in deciding on policies and broad service delivery issues. Then, the establishment of a policy oversight entity would interact with the rail operator through the provision of required funds and the specification of service plans. Exhibit 9.3 illustrates those activities relating to planning that can be accomplished through different cooperative agreements.

Exhibit 9.3: Actions and Potential Institutional Arrangements

Minnesota-Duluth/Superior Study Potential Actions and Responsibilities	Informal Cooperative Agreement	Memorandum of Agreement	Multi-Agency Agreement	Multi-Agency Compact
Level of Institutional Action Required				
Agency Approval	X	X	X	
Legislative Approval				X
Arrangements Supporting Planning Activities				
System Plan	X	X	X	X
Service Plan	X	X	X	X
Service Standards	X	X	X	X
Arrangements Supporting State Management Activities				
Stakeholder Support	X	X	X	X
Procurements		X	X	X
System Construction Oversight			X	X
Vendor Selection		X	X	X
System Implementation Oversight			X	X
Full Time Administrative Support			X	X
System Accounting			X	X
Arrangements Supporting State Financial Responsibilities				
Federal Grant Applications and Awards			X	X
Capital Program Development			X	X
Multi-State Cost Sharing			X	X
Multi-State Revenue Distribution			X	X

9.1.3 Multi-County/State/Agency Participation Institutional Framework

In this Study, the multi-county/state/agency participation is required in order to implement proposed system. To meet the needs of planning, building and operating a passenger railroad, there are mainly two kinds of institutional arrangements possible between states. These are Contract and Interstate Compact. The details of each arrangement are discussed below.

County/State-to-County/State Contract

- Agreements among counties and states to make the contractual arrangements that would be necessary to achieve intercity service within the jurisdictions of the counties and states.
- Possibility to establish the arrangement without prescribing the precise form or content or separate enactment by each participating county/state.
- Requirements of assurance for the participating counties/states to enact all necessary legislation and regulations to implement the plan for the Minneapolis-Duluth/Superior System.
- The advantages of the speedy and flexible agreement structure, since legislative approval is not required, and the ability of a contract to hold a county/state harmless from legal liability.
- The disadvantage of possibility of not being able to fully reflect the collective good and credibility that might be achieved with a more formal agreement.

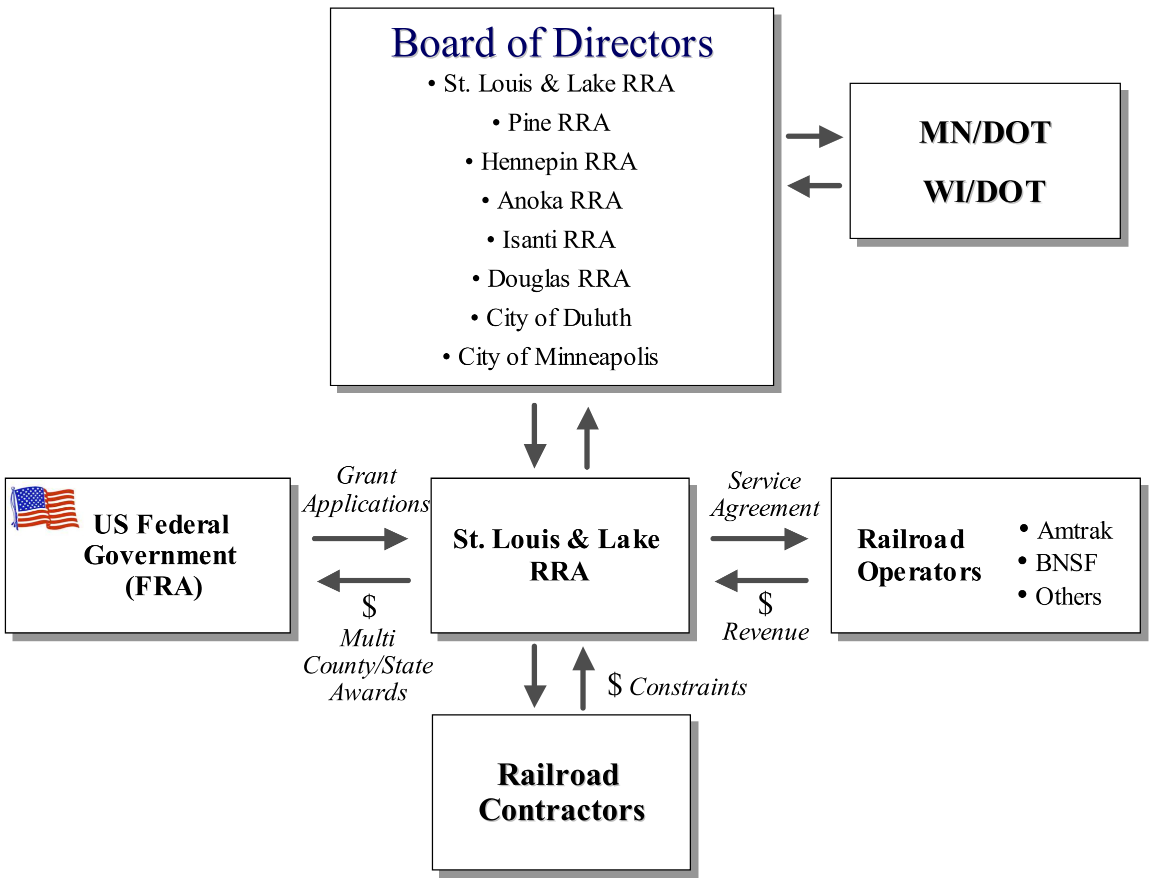
Interstate/County Compact

- Permission by congress to allow counties/states, agencies, or authorities created by states to enter specific agreements that involve interstate commerce.
- The most recent consent of the Amtrak Reform and Privatization Act in 1997, which grants the consent of Congress to counties/states to enter into compacts to promote the provision of intercity passenger rail service.
- Agreements among counties/states to establish a system, which would operate across state lines, and cooperate and share jointly the administrative and financial responsibilities of implementing the operations of such a system.
- The compact could also describe the institutional framework, such as a Policy Board consisting of members from each of the participating counties/states directing an operator. It could identify the terms for enactment, such as providing that the compact could become effective upon the adoption or enacting into law by two or more participating states.
- Identical agreed-upon compact language for each county/state.
- Allowance of waiving sovereign immunity to a specific action, such as contracts, provision of public services, or certain types of torts, by counties/states.
- Its main advantage lies in the formal structure, which is recognized by Congress to seek federal funding for significant infrastructure improvements and to establish the Minneapolis-Duluth/Superior intercity passenger service.
- The disadvantage of a time frame and state legislative approval requirements.

Following discussions between the counties, cities and other participants a Joint Power Authority was agreed and recently approved

As a preliminary concept, the following framework has been developed to show the character of the Federal, State, and local funding for the project, relationship with the states, railroad operator, and railroad contractors.

Exhibit 9.4: Federal Funding and Revenue Flow for a Bi/Multi-State Agreement Institutional



10

Conclusions and Next Steps

The Minneapolis-Duluth/Superior Passenger Rail System provides a major opportunity to enhance northern Minnesota's intercity transportation network. Its implementation will enhance mobility in the state and be an engine of economic growth for the cities and towns along the corridor connected to the system. It will provide significant environmental benefits in terms of improved emissions and reduced energy use.

This feasibility study and business plan has identified the costs, and benefits to be derived from, the implementation and operation of the proposed Intercity Passenger Rail System. Specifically, the study has defined the market for passenger rail service in the Minneapolis-Duluth/Superior and has developed an operating plan that reflects market needs. The associated operating costs, infrastructure improvements and capital costs have been geared to matching the market requirements. Furthermore, using the proposed implementation plan, an analysis of a preliminary financing plan and economic feasibility was conducted. These assessments show the ability of the proposed system to meet public/private partnerships requirements as defined by the USDOT Federal Railroad Administration, and as a result be a candidate for federal capital contributions. While no Federal program is currently available for the project considerable support exists for an Intercity Passenger Rail Bill. It is anticipated that this would offer a 50 to 80 percent match to state funds.

It should be noted that the current study proposals are both unfunded and un-negotiated with the freight railways that both own and use the corridor. If the recommendation of this study to proceed with more detailed analysis is accepted by the counties and cities of the corridor, detailed engineering, operating, and environmental studies should be carried out in conjunction with the freight railroads.

10.1 Improved Regional and National Mobility and Connectivity

The proposed Minneapolis-Duluth/Superior Passenger Rail System will link two of the major urban areas of the state, and provide enhanced business, commuter, social and tourist travel between the Twin Cities and the urban areas of Duluth and Superior. By incorporating new technology and improving existing transportation connectivity, the proposed system will be comparable to the existing Northeast Corridor (in terms of average train speeds) and other potential systems being developed in California, Midwest, Ohio, Pacific North West and Carolinas.

10.2 Environmental and Economic Benefits

The Minneapolis-Duluth/Superior Rail System will bring considerable environmental and economic benefits to the region. The implementation of such a transportation project reduces auto congestion and emissions of air pollutants by shifting traffic from road to rail. Moreover, the proposed system will generate significant user benefits with improved mobility, travel time and resource savings in automobile operating costs. A ratio of 2.3 total benefits to total costs means that will achieve an economic return of over twice the cost of the program. This is a very good return on public investment.

The transportation investments of the Minneapolis-Duluth/Superior Rail System will increase in terms of jobs, income and development potential of urban areas and cities along the corridor. This will be achieved through the increased efficiency and productivity given by the rail system and the transfer benefit from the Federal investment. It is estimated that over 0.5 billion in economic benefits that will be generated by the project will result in a substantial increase in employment and income in the region's construction service, commercial and tourism industries.

10.3 Challenges

The proposed Minneapolis-Duluth/Superior Passenger Rail System will encounter a series of challenges as the project proceeds through the planning and implementation stages. These challenges include:

10.3.1 Public Funding

Securing federal funding requires the corridors, counties, and towns to work with the state's political leadership to obtain project funding, and to complete the next step PEIS (Programmatic Environmental Impact Study) process in order to establish eligibility for federal funding.

10.3.2 Long-term Debt

The issuance of long-term debt requires advance financial planning by the Minneapolis-Duluth/Superior steering committee. Specifically, there may be a need for additional issue bonds for transportation purposes to provide a match for Federal funds.

10.3.3 Freight Railroads

A critical component of the Minneapolis-Duluth/Superior Passenger Rail System implementation plan is the use of freight railroad tracks for passenger services. While Amtrak (currently) and the states (in the future) will have the right to operate on lines owned by the freight railroads, capital investment in, and operation of, the Intercity Passenger Rail System must be carefully integrated with the needs of the freight railroads to secure their cooperation and support for the project. A key aim of the Intercity Passenger Rail System is to increase capacity, train speeds, improve communications and raise safety standards for freight rail operations.

A key element in this study has been recognition of the freight railroads' need to maintain its capacity with respect to infrastructure. Further details must still be coordinated with the freight railroads to ensure sufficient capacity for existing and future freight and passenger rail service needs. Funding for the infrastructure improvements required by law to meet the high safety standards for the passenger rail service and freight railroads requirements have been incorporated in the capital cost estimates for the Minnesota-Duluth/Superior Passenger Rail Service. However, these needs have not yet been negotiated with the freight railroads, and more detailed discussions and evaluations are required. It is proposed that the freight railroads should be heavily involved in the PEIS process to provide guidance and direction on their needs and requirements.

10.4 Results and Key Findings

The results of the analysis suggest that the alternatives for development of the corridor could consist of:

- A 79-mph rail service of 1 or 2 trains per day with a 3-hour timetable from end to end. This would need to depend on state and local support for capital ($75 million) and on ongoing operating subsidy of $3-5 million per year.

- Or, a 110-mph rail service of 6-10 trains per day with a 2-hour timetable for Minneapolis-Duluth rail service. This could be funded with both federal and state dollars and would not require any ongoing operating subsidy. The Casino rail link considerably enhances ridership and revenues at a marginal cost (both operating and capital), and as a result produces enhanced financial and economic results, and significantly lowers the project risk.

The following are the key findings of this Study:

- At 79-mph passenger rail service is not self-sustaining and cannot cover its operating costs, and both the capital and operating costs would likely need to be raised from state and local sources given the failure to meet Federal Railroad Administration commercial feasibility requirements.

- Operating revenues will only cover operating costs for speeds of 110-mph or higher. After the initial ramp up period, the ridership and revenue forecasts suggest that 110-mph passenger rail service will be self-sustaining and that passenger and ancillary revenues will cover direct operating costs. Over time, significant capital investment will be needed to fund a higher speed passenger rail system expansion given the forecast high rate of traffic growth, but these capital needs should be eligible for Federal matching grant support.

- A Casino link significantly enhances the overall financial and economic performance of the 110-mph option.
- Improving railroad infrastructure increases total transportation capacity: The Minnesota-Duluth/Superior Passenger Rail System will increase railroad capacity for both freight and passenger trains and will improve freight railroad reliability, operational fluidity, and eliminate bottlenecks.
- Rail investments improve highway/railroad crossing safety: The Minnesota-Duluth/Superior Passenger Rail System will invest over $150 million in fencing, signaling and highway/railroad grade crossing improvements. This will greatly improve safety for both freight and passenger trains, as well as highway users.
- Rail transportation investments generate significant economic impact: The Minnesota-Duluth/Superior Passenger Rail System will provide a permanent increase in regional

employment and income and is expected to create at least 1,000 construction jobs, 500 permanent rail operating jobs, and 60,000-90,000 indirect person years of work over the life of the project.

- Passenger rail service spurs economic development activity: Travel and tourism, property values, and opportunities for downtown redevelopment are expected to increase. Minnesota-Duluth/Superior Passenger Rail System stations will be close to cultural, academic, and research institutions, sports franchises and entertainment facilities and will be within a short walk, taxi ride, or transit to the major business and tourist centers of Minnesota. The proposed system will be connected to both the North Shore Tourist railroad and feeder bus systems to provide access to the Iron Range and Northwest Wisconsin.
- The proposed system is very economical compared both to green field high-speed rail proposals as well as the cost for investing in competing modes. Preliminary capital investment* for the project for 110-mph train base case service, including rolling stock is estimated at $360 million, while that for the Casino link option is $390 million per mile, or $2.3-2.5 million for the 155-mile system.

10.5 Suggested Next Steps

Concurrent with continuing efforts to broaden and strengthen support for the Minneapolis-Duluth/Superior Passenger Rail System for local, state and federal stakeholders, the business community and citizens, there is a need to advance the technical planning for the proposed system, refine the financing plan and strategies and develop institutional arrangements related to the Minneapolis-Duluth/Superior Passenger Rail System. Additionally, it is important to secure funds for preliminary engineering and design, required environmental reviews, project construction and finalizing operating plans for system implementation.

Next steps involve detailed coordination with the freight railroads, holding citizen participation and outreach meetings, conducting environmental and engineering reviews and alternatives analysis. There are a number of actions that need to be taken in order to continue implementation of the Minneapolis-Duluth/Superior Passenger Rail System. These include:

- Economic Impact Study
- Additional alternatives analysis
- Begin the equipment procurement process
- Finalization of the implementation plan
- Securing funds for advanced project planning
- Environmental assessments
- Building grassroots support for the project
- Discussions with the freight railroads and capacity studies

The ideal means for advancing Minneapolis-Duluth/Superior Passenger Rail planning would be through the Programmatic Environmental Impact Statement (PEIS) process. The PEIS process would:

* This estimate is subject to more detailed engineering, operating, and environmental review.

- Further delineate the "purpose and need" of the proposed Minneapolis-Duluth/Superior Passenger Rail System
- Identify cumulative impacts of the system, and
- Evaluate other possible alternative route options and system configurations within the framework of a formalized planning process.
- Provide a unified framework that would support the anticipated multi-phased, multi-year implementation of the Minneapolis-Duluth/Superior rail system.