Prepared For

Northeast Indiana Passenger Rail Association

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Northern Indiana/Ohio Passenger Rail Corridor Feasibility Study and Business Plan

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1 INTRODUCTION

1.1 OVERVIEW OF EXISTING TRAVEL MARKET

The purpose of this Feasibility Study and Business Plan is to evaluate the case for developing high-speed rail operations in the Northern Indiana/Ohio Passenger Rail Corridor between Chicago, Fort Wayne, and Columbus.

The Chicago-Fort Wayne-Columbus corridor (Exhibit 1-1) was initially proposed in the Midwest Regional Rail Initiative (MWRRI) 2004 (Phase 5) which is federally approved and was incorporated into the Ohio and Lake Erie Regional Rail: Ohio Hub Study (2007) as an incremental corridor.

Exhibit 1-1: Chicago-Fort Wayne-Columbus Corridor

These proposals were for 110 mph Diesel technology service linking Chicago with Northwest Indiana, Northeast Indiana, and Central Ohio (Exhibits 1-2 and 1-3).

Exhibit 1-2: MWRRS Planned Phase 5 – Development of Indiana Corridors

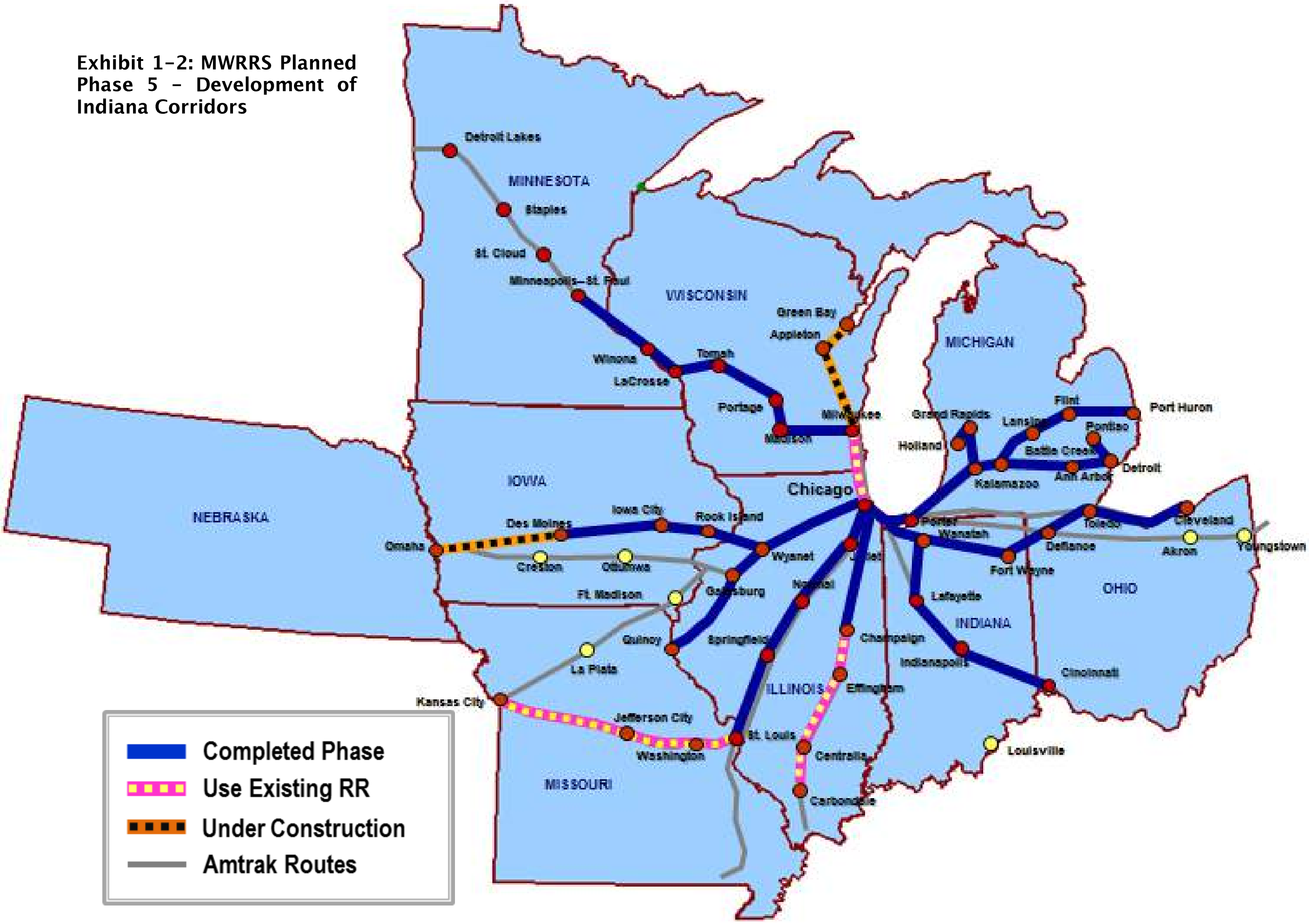
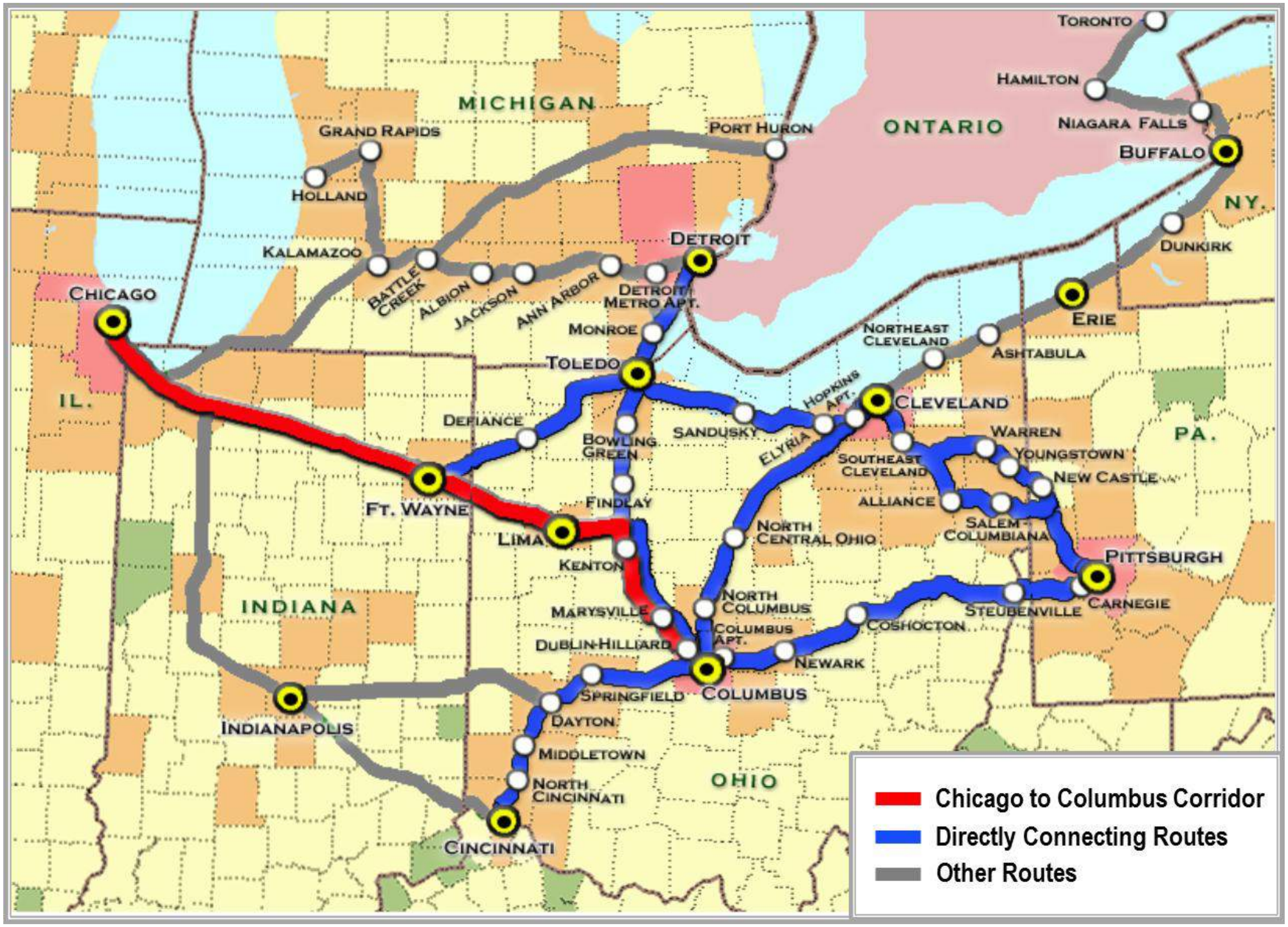


Exhibit 1-3: Development of Indiana Corridors: Phase 5



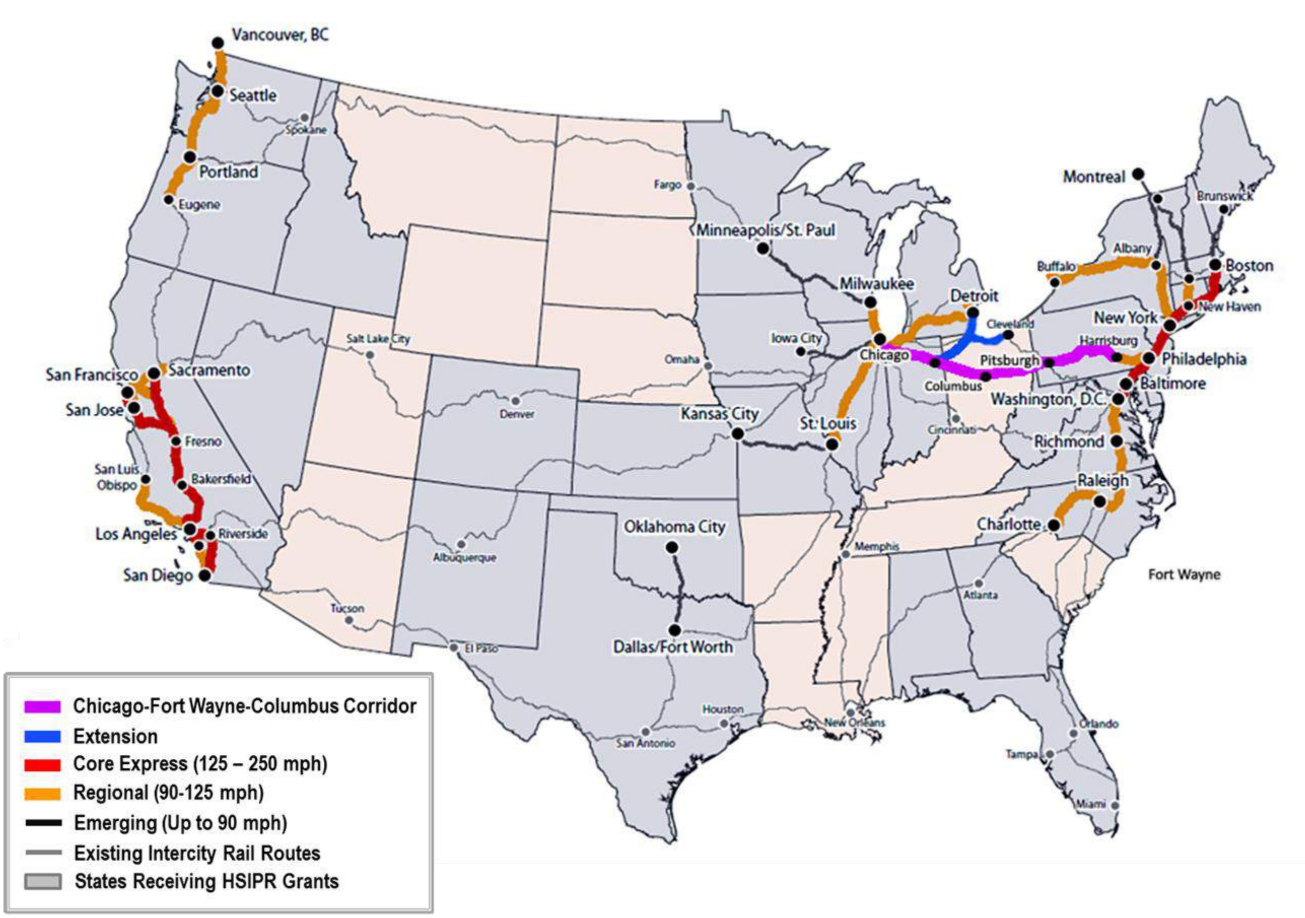
The proposed service parallels some of the most congested highway corridors in the US including I-80, I-94 and I-90 in the Chicago, Northwest Indiana (Gary) area, where all the east-west connections for the northern part of the country are forced together by Lake Michigan. This creates a major bottleneck, which will only become more congested in the future. In addition, the Columbus beltway I-270 is heavily congested in peak hours, especially where it is intersected by other radial routes such as I-70, US-33, US-23, and I-71.

Recognition of the need to provide improved transportation through these bottlenecks for both freight and passenger has resulted in a number of significant rail investments including the Chicago Region Environmental and Transportation Efficiency Program (CREATE) projects proposals for Grand Crossing and Englewood Flyover, the Indiana Gateway project, and the Detroit-Chicago Passenger rail corridor (Exhibit 1-4) development as part of Phase 1 of the Midwest Regional Rail Program.

Exhibit 1-4: Detroit-Chicago and Indiana Gateway

The corridor, however, offers more than just a good regional rail link that will overcome increasing highway congestion and rising oil prices that will reduce regional mobility in the future. It provides the first leg of an East-West Rail System connection between Chicago and Philadelphia. The Ohio Hub system shows the Chicago-Columbus Corridor connecting to Pittsburgh, which together with onward service to Harrisburg and Philadelphia could provide the first interregional link between the Northeast Corridor, Ohio Hub, and Midwest Regional Passenger Rail Systems.

Exhibit 1-5: Detroit-Chicago and Indiana Gateway



This connectivity could prove a critical first step in coalescing the regional rail systems of the US into a single national network.

Previous studies such as the MWRRI and Ohio Hub have pointed to both the financial and economic value of the project as a freestanding corridor, and its enhanced value as part of a national network. The Midwest Regional Rail System (MWRRS)[1] is a proposed Chicago Hub network of interconnecting 110-mph diesel-powered passenger rail lines. In the past several years several key elements of the 2004 MWRRS plan have started to be implemented, particularly on the Chicago to Milwaukee, St Louis, Iowa City and Detroit lines. The Fort Wayne line has always been a critical component of the MWRRS plan and according to the implementation plan, is next-in-line for development in order of priority.

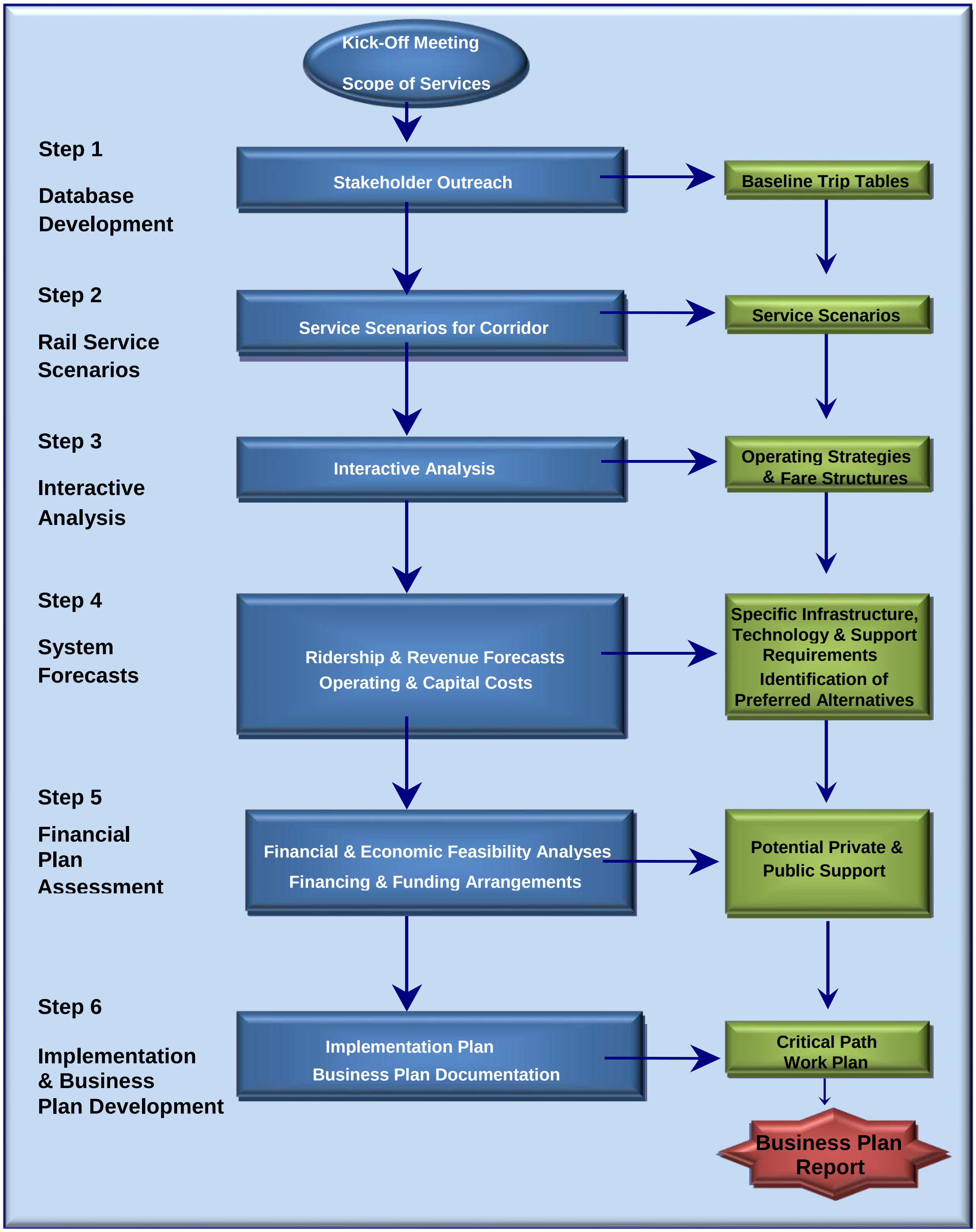
[1] The MWRRS Project Notebook is available on-line at: http://www.dot.state.mn.us/planning/railplan/studies.html.

The Ohio Hub system was originally conceived in 2004 as an eastern complement to the MWRRS. It consisted of a Cleveland Hub network consisting of four interconnecting 110-mph diesel-powered passenger rail lines. However in 2007 the Ohio concept was expanded by the addition of three Columbus-centered routes to Pittsburgh, Toledo/Detroit and Fort Wayne/Chicago. As a result the Ohio Hub system would have major interconnecting points not only at Cleveland, but also at Columbus and Toledo as well. As a result, the name of the system was changed from “Cleveland Hub” to “Ohio Hub” reflecting the expanded statewide and multiple-hub focus of the proposed corridor system. The Ohio Hub study funded the initial feasibility-level assessment of the rail route connecting Columbus to Fort Wayne, but the scope of that assessment did not extend west of Fort Wayne. The full set of Ohio Hub report was formerly available on-line but had been taken down in the past couple of years. Presumably they are still available on-request from ORDC.

As a result the current study is the first one that takes a fully integrated view of the entire Chicago-Fort Wayne-Lima-Columbus corridor from end-to-end. This study evaluates the ability of the corridor to be built as an independent project, providing the first part of Phase 5 of the MWRRI and an initial phase of the Ohio Hub.

This study takes the development of the corridor to a more advanced stage of analysis that sets the project to meet USDOT FRA Service Development Plan (SDP) requirements, when accompanied by a Service NEPA Analysis. The Service Development Plan (SDP) and Service NEPA documents are required to seek USDOT funding for future planning and environmental work. The first step in that process is to complete the Business Plan that shows the financial and economic criteria of the USDOT FRA can be achieved. This would set the project up for Federal funding.

Exhibit 1-6: Steps in Development of a Business Plan



In developing the Business Case, the TEMS team used the TEMS RightTrack™ Business Planning process that was explicitly designed for High-Speed Rail planning. RightTrack™ uses a six step Business Planning Process as shown in Exhibit 1-6.

Key steps in the process are the definition of the proposed rail service in terms of its ability to serve the market; an Interactive Analysis to identify the best level of rail service to meet demand, and provide value for money in terms of infrastructure; ridership and revenue estimates for the specific rail service proposed; and the financial and economic assessment of each option.

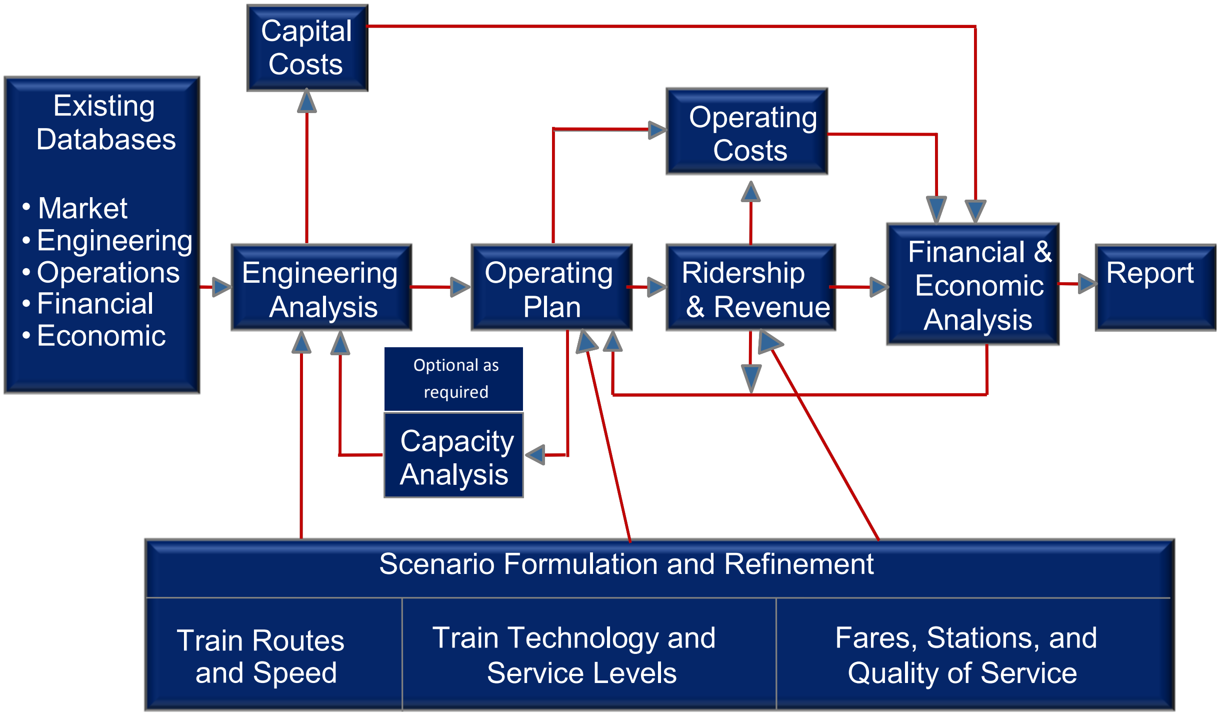
1.2 STUDY PROCESS

The Business Planning Process is designed to provide a rapid evaluation of routes, technologies, infrastructure improvements, different operating patterns and plans to show what impact this will have on Ridership and Revenues, and Financial and Economic results.

The current study entailed an interactive and quantitative evaluation, with regular feedback and adjustments between track/technology assessments and operating plan/demand assessments. It culminated in a financial and economic assessment of alternatives. Exhibit 1-7 illustrates the process that led up to the financial and economic analysis.

The study investigated the interaction between alignments and technologies to identify optimum trade-offs between capital investments in track, signals, other infrastructure improvements, and operating speed. The engineering assessment included GOOGLE© map and/or ground inspections of significant portions of track and potential alignments, station evaluations, and identification of potential locations and required maintenance facility equipment for each option. TRACKMAN™ was used to catalog the base track infrastructure and improvements. LOCOMOTION™ was used to simulate various train technologies on the track at different levels of investment, using operating characteristics (train acceleration, curving and tilt capabilities, etc.) that were developed during the technology assessment. The study identified the infrastructure costs (on an itemized segment basis) necessary to achieve high levels of performance for the train technology options evaluated.

Exhibit 1-7: Interactive Analysis Process

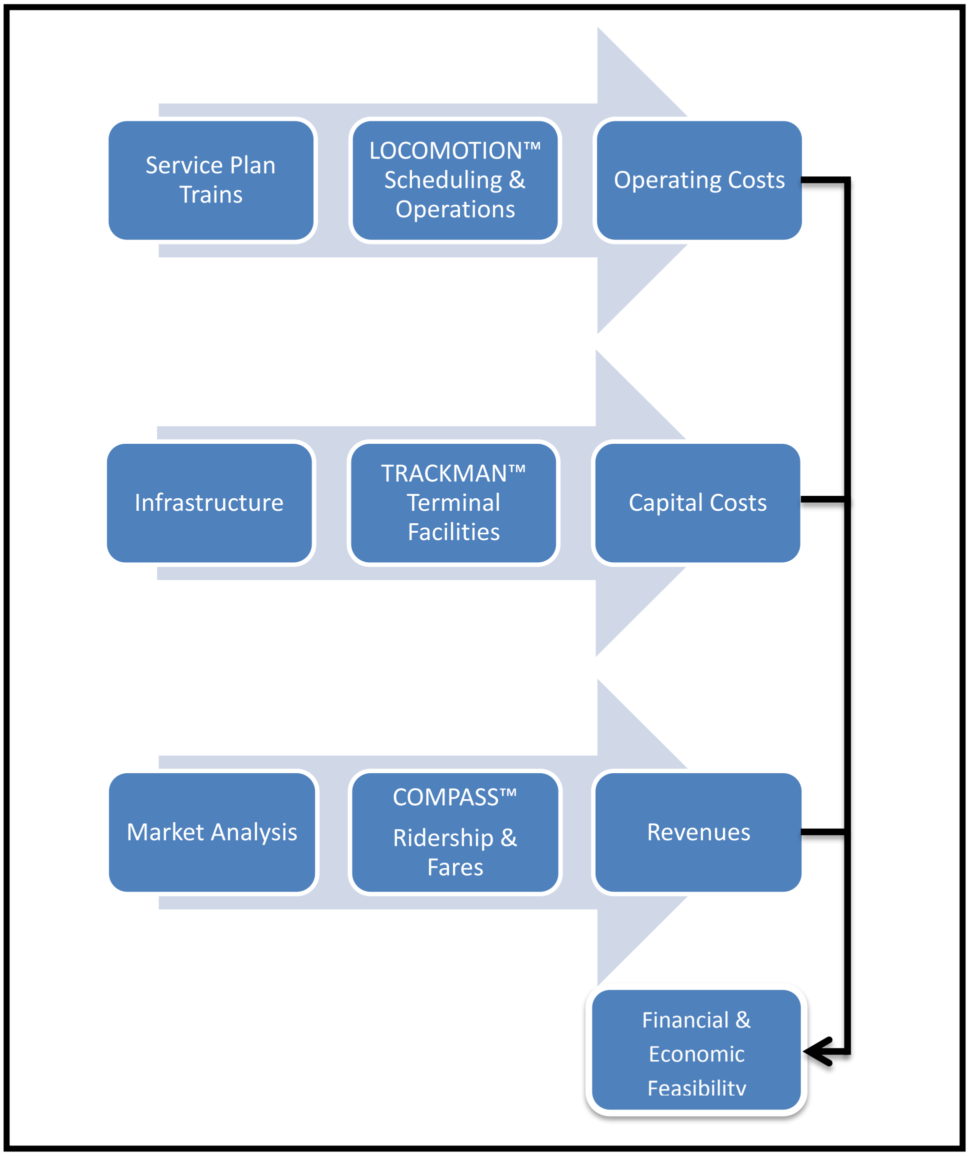


A comprehensive travel demand model was developed using the latest socioeconomic data, traffic volumes (air, bus, auto, and rail) and updated network data (e.g., gas prices) to test likely ridership response to service improvements over time. The ridership and revenue demand estimates, developed using the COMPASS™ demand modeling system, are sensitive to trip purpose, service frequencies, travel times, fares, fuel prices, congestion and other trip attributes. See Exhibit 1-8.

A detailed operating plan was developed and refined, applying train technologies and infrastructure improvements to evaluate travel times at different levels of infrastructure investment. Train frequencies were tested and refined to support and complement the ridership demand forecasts, match supply and demand, and to estimate operating costs.

Financial and economic results were analyzed for each option over a 30-year horizon using criteria recommended by USDOT FRA Cost Benefit guidelines, and OMB Social Discount Rates. The analysis provided a summary of capital costs, revenues, and operating costs for the life of the project, and developed the Operating Ratio and Cost Benefit Ratio for each option.

Exhibit 1-8: Interactive Analysis Process*



*A brief description of all the softwares used by TEMS are shown in Appendix 6.

1.3 REPORT STRUCTURE

The following is the report structure for the Northeast Indiana Passenger Rail Association (NIPRA) Feasibility Study and Business Plan.

Chapter 1: Introduction: The Study Context – This chapter documents NIPRA goals and objectives and the study team response including the Business Planning process. It includes a discussion of the Alternatives analysis process, study requirements and the review process.

Chapter 2: The Proposed Alternative – This chapter describes the development of a proposed Alternative. It identifies the key characteristics associated with the Alternative including the –

- Route and alignment
- Operating plan
- Ridership and revenue
- Capital and operating costs
- Financial and economic return

Chapter 3: Market Analysis – This chapter documents the character of travel in the Chicago-Fort Wayne-Columbus Corridor. In particular, it evaluates intercity travel markets from and between the corridor's major cities. The analysis considers the likely changes in markets and modes of travel over time; and specifically, the impact of socioeconomic growth, and transportation issues such as oil and gas prices, highway congestion and the character of competition between high-speed rail and auto, bus, and the air modes of travel.

Chapter 4: Infrastructure, Rolling Stock and Capital Investment – This chapter defines the potential route for the corridor between Chicago-Fort Wayne-Columbus. It reviews existing conditions and the ability to develop effective alignments in each segment. The analysis then reviews the engineering standards that are required for any given high-speed rail technology. The analysis also considers engineering needs for improving the CSX/Chicago, Fort Wayne and Eastern Railroad (CFE), CSX Toledo, and Scottslawn subdivisions.

The analysis considers diesel technologies capable of speeds up to 130 mph. A critical factor was the station stopping pattern and the types of service offered (e.g., express, regular, and the travel times and potential frequencies).

For each route and technology option, unit capital costs were used to estimate Infrastructure, Equipment, and Maintenance Facility Capital Costs.

Chapter 5: Operating Plan and Costs – For each route and technology option operating plan, station stopping patterns, frequencies, train times and train schedules were developed. Using operating cost drivers such as passenger volumes, train miles, and operating hours, operating costs were calculated for each year the system is planned to be operational.

Chapter 6: Financial and Economic Analysis – For each option, a detailed financial analysis was developed including key financial measures such as Operating Ratio and Cash Flows. A detailed Economic Analysis was carried out for each option using guideline criteria set out by USDOT FRA and

OMB for Benefit-Cost Analysis. Following OMB direction, a series of discounting procedures were developed ranging from 3 percent and 7 percent.

Chapter 7: Economic Impacts – A preliminary Supplyside Economic Impact study was completed to show the likely impact of improved economic productivity on the economy of the corridor, and on the individual communities along the route. The analysis used the Economic Rent Analysis developed for the MWRRI and Ohio Hub.

Chapter 8: Conclusions and Findings – This chapter sets out the major conclusions and findings of the study. It summarizes the key ridership, revenue, operating, capital and implementation results, along with the financial and economic analysis for each alternative.

2 THE PROPOSED SYSTEM

2.1 INTRODUCTION

The original MWRRI and Ohio Hub proposals for the corridor are for 110-mph Diesel train service. The train would be capable of tilting to improve speed on curves, and would have a capability of reaching speed of up to 130 mph if suitable sections of route were available. To exceed 110 mph the track would need to be free of grade crossings and be fully grade separated. This technology has been available since the 1980's and has been thoroughly tried and tested.

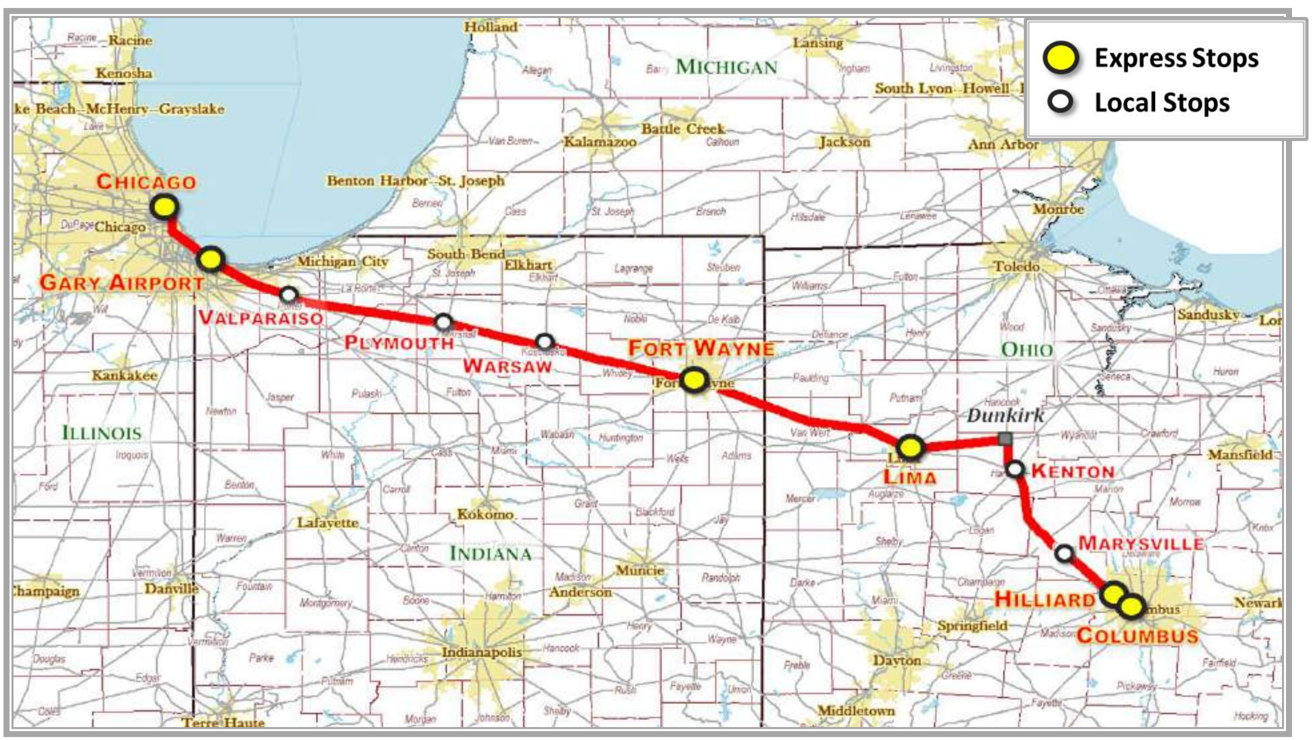
Early versions included the British HST that operated at speeds up to 125 mph, the German ICE-TD, the Italian Pendolino, Spanish Talgo T21, and the Canadian Jet Train.

The MWRRI and Ohio Hub used the Spanish Talgo T21 as its generic train noting that most manufacturers could produce very good trains that would meet the technology requirements of USDOT FRA Tier 1; with only very limited modifications.

Talgo T21

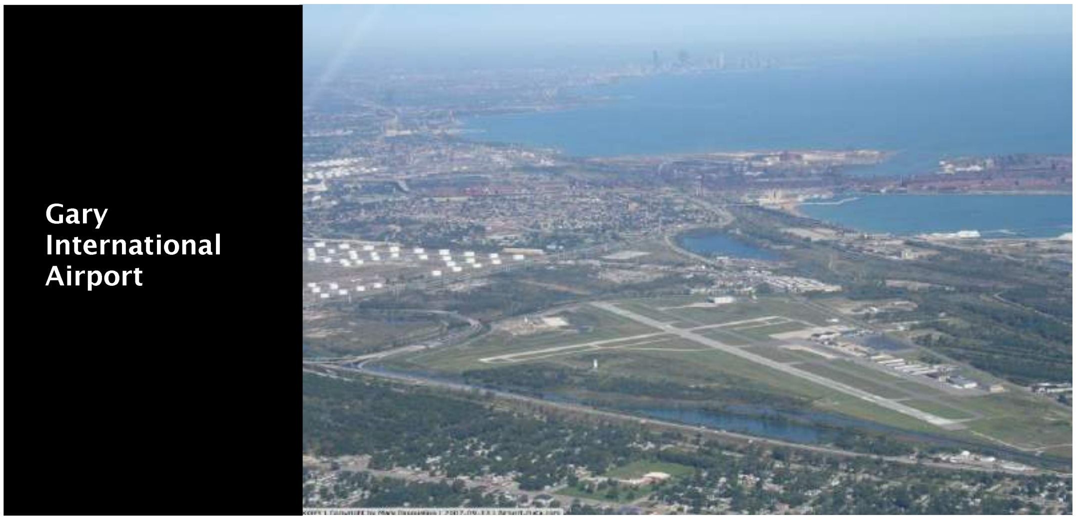
The proposed route for the alternative is shown in Exhibit 2-1.

Exhibit 2-1: Proposed Route Map



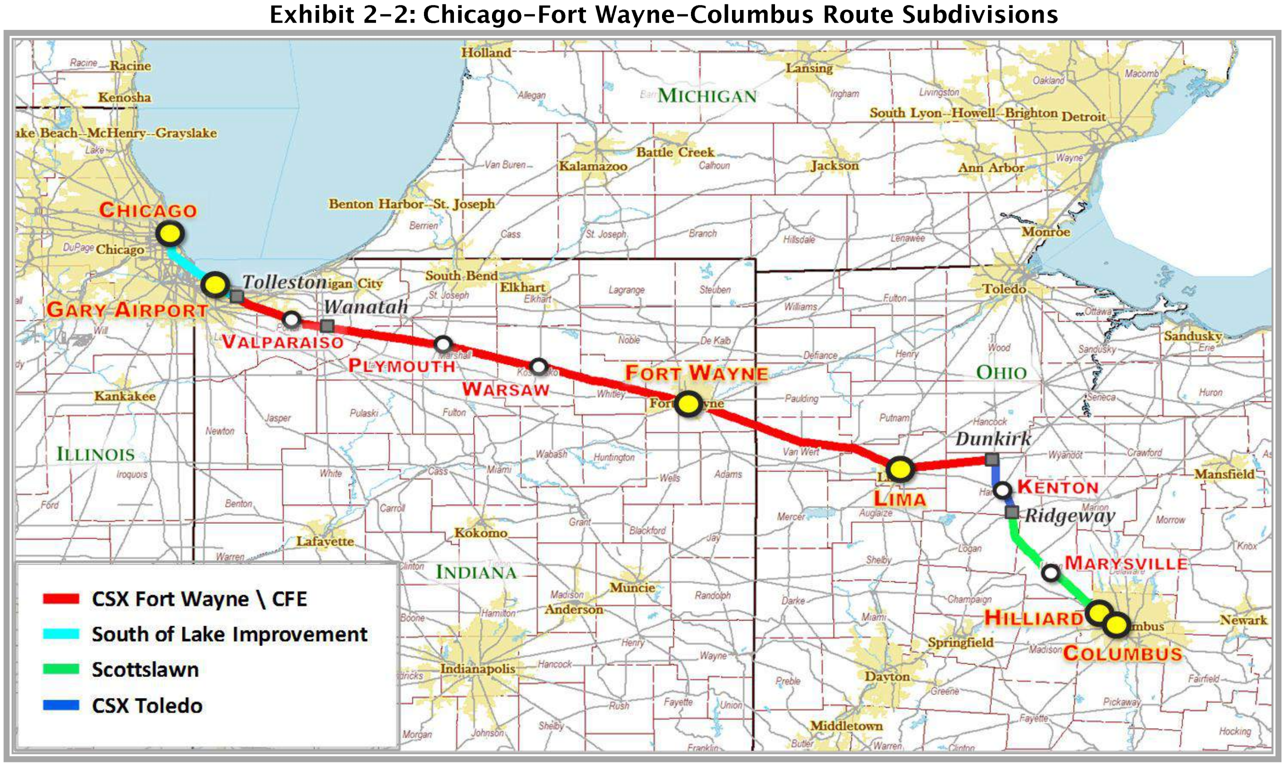
The proposed route for the corridor has very good geometry with very few curves outside the urban areas. The land is very flat and the tracks were laid straight for many miles across the fertile glacial prairies of Indiana and its Corn Belt.

It would use the proposed MWRRI South of the Lake route from Chicago to Tolleston going past the Gary Regional Airport, where it would connect onto the CSX/CFE Fort Wayne Route to Fort Wayne through Valparaiso, Plymouth, Warsaw and onto Lima and Dunkirk.



At Dunkirk it would connect to the CSX Toledo route and just beyond Kenton the Scottslawn route through Marysville and Hilliard to Columbus. See Exhibit 2-2. Chicago-Columbus Map

Exhibit 2-2: Chicago-Fort Wayne-Columbus Route Subdivisions



In terms of the proposed train service, it is proposed that there would be 12 trains per day in each direction as far as Lima and 10 trains between Lima and Columbus divided between Express and Regular service. Express trains would stop at the major stations with over 300,000 riders per year. As can be seen in Exhibit 3-25 of Chapter 3, six stations – Chicago, Gary, Fort Wayne, Lima, Hilliard, and Columbus have more than 300,000 riders per year. The Regular trains would stop at all 11 stations along the route. Exhibit 2-3 shows the proposed station stopping pattern, trains per day in each direction, and the proposed train times.

Exhibit 2-3: Station Stopping Pattern and Levels of Train Service

Stations	(Trips > 300,000)	(Trips < 300,000)
Chicago	✓	✓
Gary Airport	✓	✓
Valparaiso	–	✓
Plymouth	–	✓
Warsaw	–	✓
Fort Wayne	✓	✓
Lima	✓	✓
Kenton	–	✓
Marysville	–	✓
Hilliard	✓	✓
Columbus	✓	✓
Total Trains	**6 Trains**	**6-4 Trains**
Overall Time	**3:45 hours**	**4:00 hours**

It can be seen that due to the fact that the rail route is very straight with few curves the Regular train time will be 4 hours while the train time for the Express Service will be 3 hours 45 minutes. From Fort Wayne in the middle of the corridor service to Chicago will be well under 2 hours while to Columbus would be a little more than 2 hours. However, raising the speed on the Fort Wayne to Gary segment up to 130 mph would save about 25 minutes for both Express and local trains

The quality and level of train service together with the problems of congestion and increased fuel prices for bus, air and auto users will result in a ridership of over 2 million trips with the corridor and over 2 ½ million trips when connections to other MWRRI corridors being developed in Phase 1-4 are considered.

These other corridors include –

- Chicago-Detroit
- Chicago-Milwaukee
- Chicago-St. Louis
- Chicago-Iowa City

The increase in energy prices from today's $80-100 per barrel is forecasted by the US Energy Information Agency to $160 per barrel in 2050; Central Case. In considering the impact of future energy prices, improved auto and aircraft energy efficiency was also taken into account.

The Capital Cost for the project is well in line with the original proposals of the MWRRI and the Ohio Hub with costs in 2002 dollars. The cost in 2012 dollars is $1.2 Billion that includes all track upgrades, signaling systems, fencing and safety infrastructure at crossings, equipment and maintenance facilities.

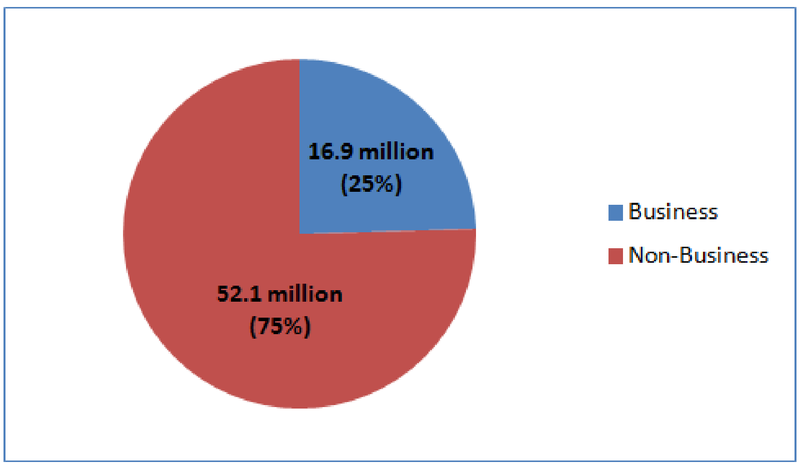
3 MARKET ANALYSIS

3.1 OVERVIEW OF EXISTING TRAVEL MARKET

The Chicago-Fort Wayne-Columbus corridor is an important corridor in the Midwest region. It covers the States of Illinois, Indiana, and Ohio, with a population of 14.15 million in 2011. The Chicago-Fort Wayne-Columbus corridor is distinguished for its high employment and population. The region hosts a large number of finance and business services, manufacturing facilities, universities, military bases, and research and high-tech industry. The corridor area currently has over eight million jobs and per capita income was $43,397 in 2011. The Bureau of Economic Analysis (BEA) data and Woods & Poole Economics projections show that the Chicago-Fort Wayne-Columbus corridor's demographic and economic growth will continue over the next several decades, the population is projected to be 17.8 million in 2040, employment will be 11.2 million in 2040, and per capita income is projected to be $67,563 in 2040 in 2011 dollars.

The Chicago-Fort Wayne-Columbus corridor has a high level of business and commuter travel among its urban areas together with significant social and tourist travel. The total annual intercity trips in the corridor were estimated to be 69 million in 2011. As shown in Exhibit 3-1, 25 percent of the intercity trips were business trips and 75 percent trips were non-business commuter, social, and tourist trips in 2011.

Exhibit 3-1: 2011 Corridor Intercity Trips by Purpose



3.2 BASIC STRUCTURE OF THE COMPASS™ TRAVEL MARKET FORECAST MODEL

The COMPASS™ Multimodal Demand Forecasting Model is a flexible demand forecasting tool used to compare and evaluate alternative passenger rail network and service scenarios. It is particularly useful in assessing the introduction or expansion of public transportation modes such as air, bus or high-speed rail into markets. Exhibit 3-2 shows the structure and working process of the COMPASS™ Model. As shown, the inputs to the COMPASS™ Model are base and proposed transportation networks, base and projected socioeconomic data, value of time and value of frequency from Stated Preference surveys, and base year travel data obtained from government agencies and transportation service operators.

The COMPASS™ Model structure incorporates two principal models: a Total Demand Model and a Hierarchical Modal Split Model. These two models are calibrated separately. In each case, the models are calibrated for origin-destination trip making in the study area. The Total Demand Model provides a mechanism for replicating and forecasting the total travel market. The total number of trips between any two zones for all modes of travel is a function of (1) the socioeconomic characteristics of the two zones and (2) the travel opportunities provided by the overall transportation system that exists (or will exist) between the two zones. Typical socioeconomic variables include population, employment and income. The quality of the transportation system is measured in terms of total travel time and travel cost by all modes.

The role of the COMPASS™ Modal Split Model is to estimate relative modal shares of travel given the estimation of the total market by the Total Demand Model. The relative modal shares are derived by comparing the relative levels of service offered by each of the travel modes. Three levels of binary choice were used in this study (see Exhibit 3-3). The first level separates rail services from bus services. The second level of the hierarchy separates air travel, the fastest and most expensive mode of travel, from surface modes of rail and bus services. The third level separates auto travel with its perceived spontaneous frequency, low access/egress times, and highly personalized characteristics, from public modes (i.e., air, rail and bus). The model forecasts changes in riders, revenue and market share based on changes travel time, frequency and cost for each mode. A more detailed description of the COMPASS™ Model is given in Appendix 2.

Exhibit 3-2: Structure of the COMPASS™ Model

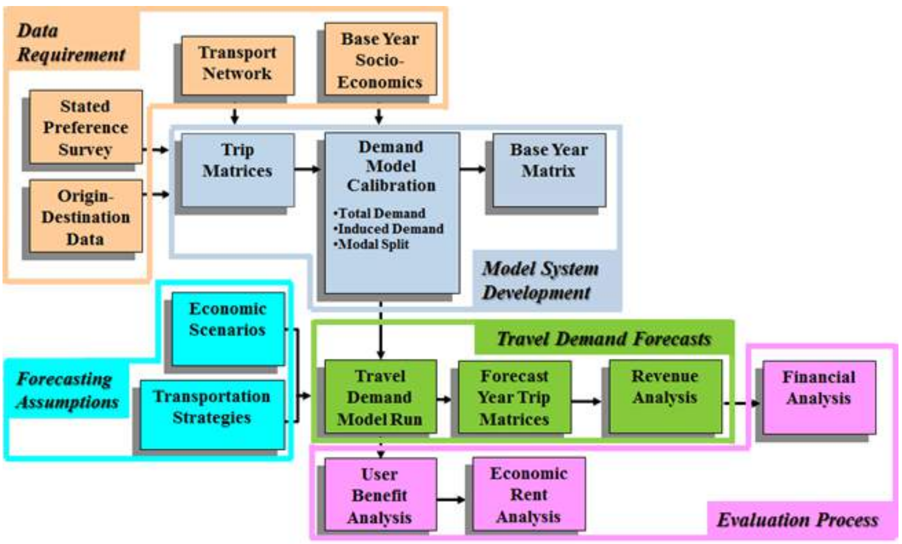
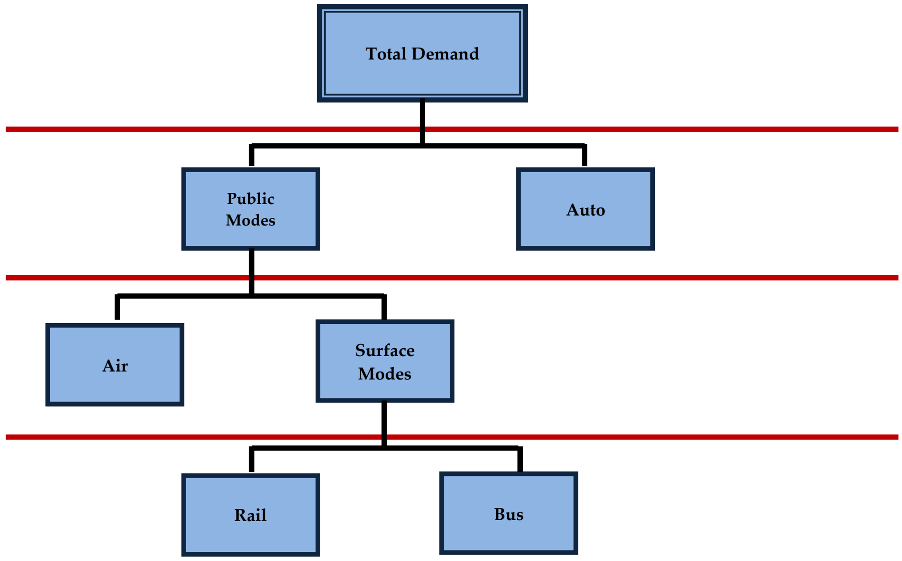


Exhibit 3-3: Hierarchical Structure of the Modal Split Model



A key element in evaluating passenger rail service is the comprehensive assessment of the travel market in the corridor under study, and how well the passenger rail service might perform in that market. For the purpose of this study, this assessment was accomplished using the following process –

- Building the zone system that enables more detailed analysis of the travel market and developing base year and future socioeconomic data for each zone.
- Compiling information on the travel market in the corridor for auto, air, bus, and the proposed passenger rail travel.
- Identifying and quantifying factors that influence travel choices, including future gas price, future vehicle fuel efficiency improvement, and highway congestion.
- Developing and calibrating total travel demand and modal split models for travel demand forecasting.
- Forecasting travel, including total demand and modal shares.

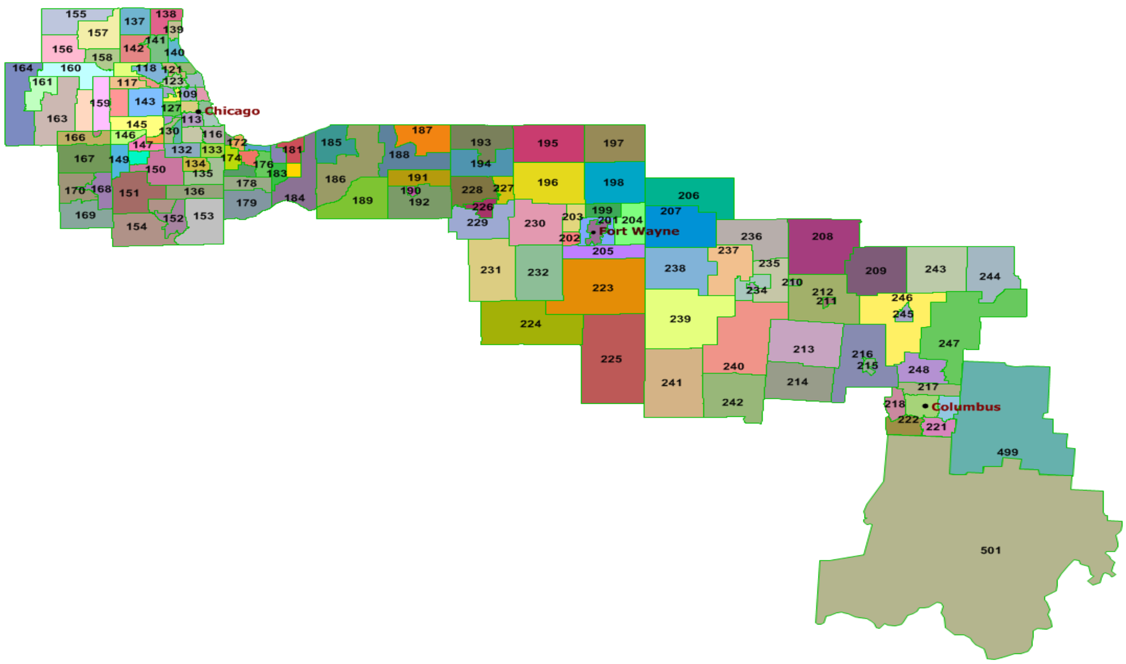
The following sections document the modeling process and the forecasting results.

3.3 ZONE DEFINITION

The zone system provides a representation of the market areas among which travel occurs from origins to destinations. For intercity passenger rail planning, most rural zones can be represented by larger areas. However, where it is important to identify more refined trip origins and destinations in urban areas, finer zones are used. The travel demand model forecasts the total number of trip origins and destinations by mode and by zone pair.

A 142-zone system was developed for the Chicago-Fort Wayne-Columbus corridor region based on aggregation of the 2010 census tracts and traffic analysis zones (TAZs) of Chicago Metropolitan Agency for Planning (CMAP) and Mid-Ohio Regional Planning Commission (MORPC). The study area includes the States of Indiana, Ohio, and Illinois. In the zone system, there are 45 zones in Indiana, 35 zones in Ohio, and 62 zones in Illinois. Exhibit 3-4 shows the 142-zone system for the corridor study area.

Exhibit 3-4: Study Area Zone System*



* Refer to Appendix 1 for further details.

3.4 SOCIOECONOMIC BASELINE AND PROJECTIONS

The travel demand forecasting model requires base year estimates and future growth forecasts of three socioeconomic variables of population, employment and per capita income for each of the zones in the study area. A socioeconomic database was established for the base year (2011) and for each of the forecast years (2015-2050). The data was developed at five-year intervals using the most recent census data and Bureau of Economic Analysis (BEA) data, as well as the latest socioeconomic forecasts from Woods & Poole Economics (a firm that specializes in long-term demographic and economic projections that are widely used by government agencies, consulting firms and retailers), Chicago Metropolitan Agency for Planning (CMAP), and Mid-Ohio Regional Planning Commission (MORPC).

Base-year estimates were developed using U.S. Census data and recent estimates from the Bureau of Economic Analysis (BEA), Woods & Poole Economics data, and socioeconomic data of Chicago Metropolitan Agency for Planning (CMAP) and Mid-Ohio Regional Planning Commission (MORPC. Forecasts by zone were made using the Bureau of Economic Analysis (BEA) historical data, Woods & Poole Economics forecasts, and socioeconomic forecasts of Chicago Metropolitan Agency for Planning (CMAP) and Mid-Ohio Regional Planning Commission (MORPC). Exhibit 3-5 shows the base year and projected socioeconomic data in the study area. According to the data developed from these sources, the population of the study area will increase from 14.15 million in 2011 to 19.23 million in 2050, the total employment of the study area will increase from 8.03 million to 12.55 million in 2050, and per capita income will increase from $43,397 in 2011 to $78,557 in 2050 in 2011 dollars.

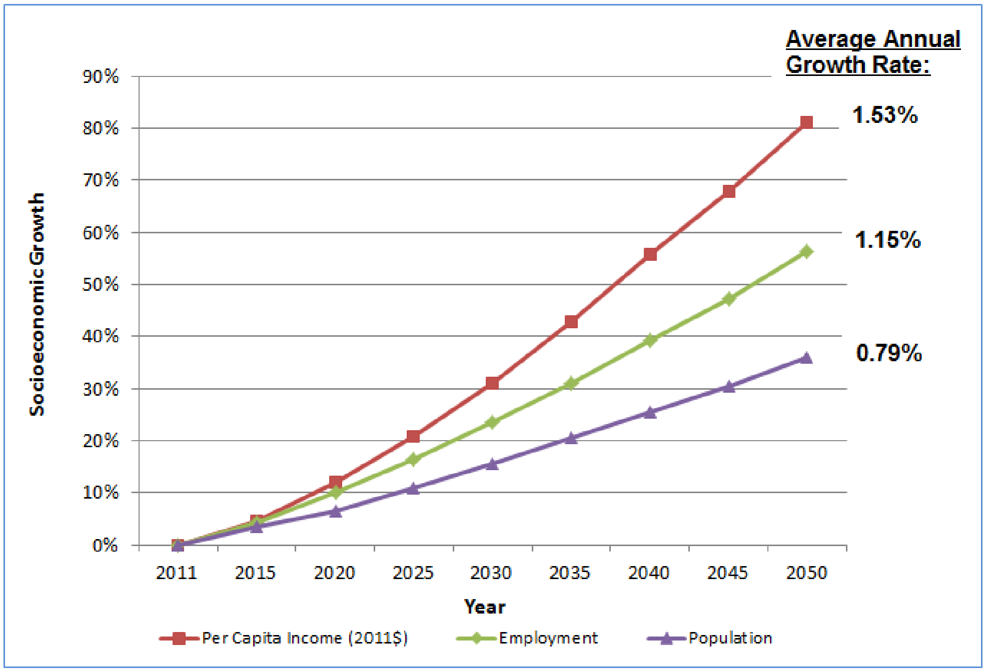
Exhibit 3-5: Study Area Base and Projected Socioeconomic Data

Year	2011	2015	2020	2025	2030	2035	2040	2045	2050
Population	14,151,958	14,627,812	15,079,111	15,701,834	16,358,461	17,047,225	17,770,771	18,458,932	19,230,882
Employment	8,032,871	8,377,654	8,848,292	9,359,749	9,916,796	10,525,223	11,191,790	11,821,692	12,550,913
Per Capita Income (2011$)	43,397	45,434	48,581	52,395	56,874	62,004	67,563	72,872	78,557

Exhibit 3-6 shows the socioeconomic growth projections for the study area. The exhibit shows that there is higher growth of employment and income than population. However, travel increases are historically strongly correlated to increases in employment and income, in addition to changes in population. Therefore, travel in the corridor is likely to continue to increase faster than the population growth rates, as changes in employment and income outpace population growth, and stimulate more demand for traveling.

The exhibits in this section show the aggregate socioeconomic projection for the whole study area. It should be noted that in applying socioeconomic projections to the model, separate projections were made for each of the individual 142 zones using the data from the listed sources. Therefore, the socioeconomic projections for different zones are likely to be different and thus may lead to different future travel sub-market projections. A full description of socioeconomic data of each zone can be found in the Appendix 1.

Exhibit 3-6: Study Area Socioeconomic Data Growth Rates



3.5 EXISTING TRAVEL MODES

In transportation analysis, travel desirability is measured in terms of cost and travel time. These variables are incorporated into the basic transportation network elements. Correct representation of the existing and proposed travel services is vital for accurate travel forecasting. Basic network elements are called nodes and links. Each travel mode consists of a database comprised of zones and stations that are represented by nodes, and existing connections or links between them in the study area. Each node and link is assigned a set of attributes. The network data assembled for the study included the following attributes for all the zone pairs.

For public travel modes (air, rail, bus) –

- Access/egress times and costs (e.g., travel time to a station, time/cost of parking, time walking from a station, etc.)
- Waiting at terminal and delay times
- In-vehicle travel times
- Number of interchanges and connection times
- Fares
- Frequency of service

For private mode (auto) –

- Travel time, including rest time
- Travel cost (vehicle operating cost)
- Tolls
- Parking Cost
- Vehicle occupancy

The transportation service data of different modes available in the study corridor were obtained from a variety of sources and coded into the COMPASS™ networks as inputs to the demand model.

The highway network was developed to reflect the major highway segments within the study area. The sources for building the highway network in the study area are as follows –

- State and Local Departments of Transportation highway databases
- The Bureau of Transportation Statistics HPMS (Highway Performance Monitoring System) database

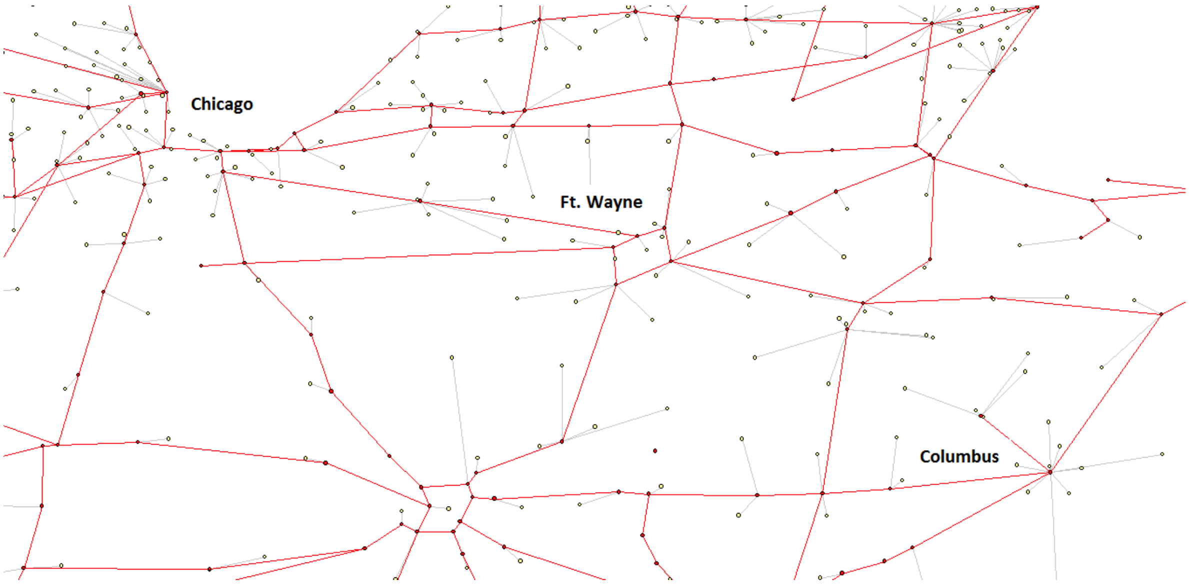
The main roads included in the highway network are shown in Exhibit 3-7.

Exhibit 3-7: Major Roads in the COMPASS™ Highway Network

Road Name	Road Description
Interstate 94	Chicago-Gary
Interstate 90	Gary-South Bend
Interstate 65	Gary-Indianapolis
Interstate 70	Indianapolis -Columbus
Interstate 69	Angola- Indianapolis
Interstate 75	Toledo - Cincinnati
Interstate 80	Joliet - Cleveland
Route 130	Gary-Valparaiso
Route 30	Valparaiso-Lima
Route 117	Lima-Bellefontaine
Route 33	Bellefontaine-Columbus

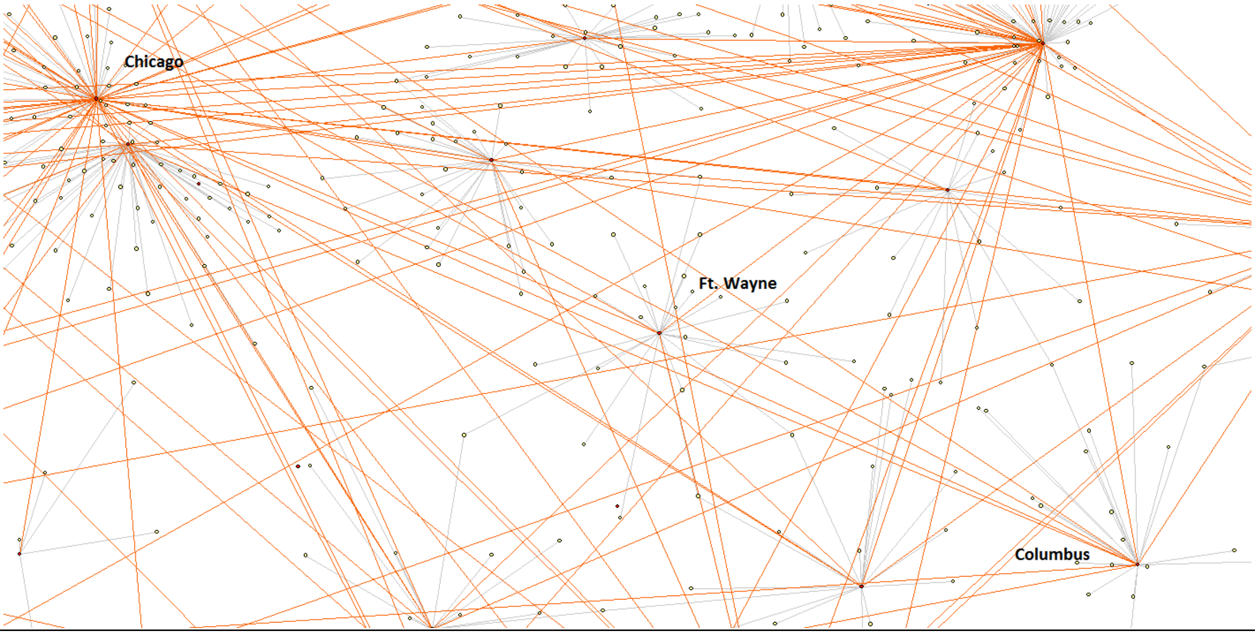
The highway network of the corridor area coded in COMPASS™ is shown in Exhibit 3-8.

Exhibit 3-8: COMPASS™ Highway Network for the Corridor Area



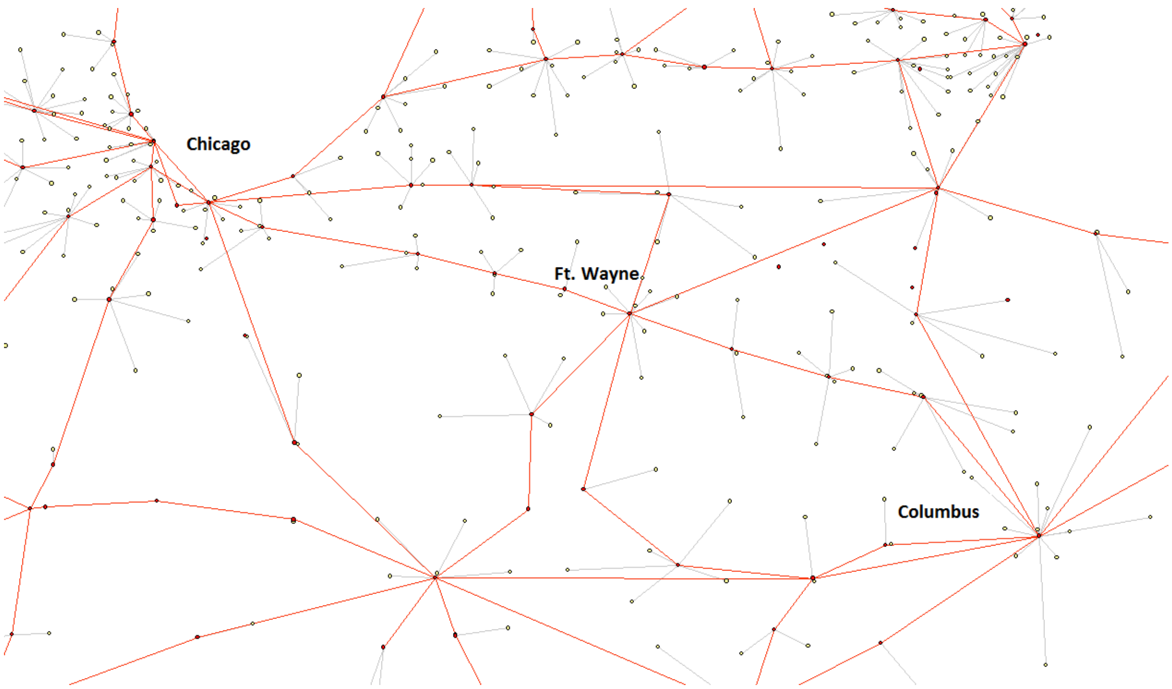
American Airlines, Delta, United Airlines, US Airways, and Southwest Airlines provide air service in the corridor area. Air network attributes contain a range of variables that include time and distance between airports, airfares, and connection times. Travel times, frequencies and fares were derived from official airport websites, websites of the airlines serving airports in the study area, and the BTS 10% sample of airline tickets. Exhibit 3-9 shows the air network of the corridor area coded in COMPASS™

Exhibit 3-9: COMPASS™ Air Network for the Corridor Area



Bus travel data of travel time, fares, and frequencies, were obtained from official schedules of the Greyhound, Megabus, and Lakefront operators. Exhibit 3-10 shows the bus network of the corridor area coded in COMPASS™.

Exhibit 3-10: COMPASS™ Bus Network for the Corridor Area



Currently there is no passenger rail service provided in the Chicago-Fort Wayne-Columbus corridor. Therefore, a baseline passenger rail service for the corridor was derived in order to develop a baseline passenger rail travel demand estimation with trip generation rates for passenger rail service in other corridors in the Midwest that have similar socioeconomic and trip-making characteristics. The baseline rail service assumed Amtrak 79-mph service with a frequency of 3 trains per day, a six hour running time from Chicago to Columbus, and full fare is assumed to be 21 cents per mile. These assumptions are based on typical rail service characteristics in the Midwest region such as the Chicago-Detroit corridor.

3.6 ORIGIN-DESTINATION TRIP DATABASE

The multi-modal intercity travel analyses model requires the collection of base year 2011 origin-destination (O-D) trip data describing annual personal trips between zone pairs. For each O-D zone pair, the annual personal trips are identified by mode (auto, air, and bus) and by trip purpose (Business and Non-Business). Because the goal of the study is to evaluate intercity travel, the O-D data collected for the model reflects travel between zones (i.e., between counties, neighboring states and major urban areas) rather than within zones.

TEMS extracted, aggregated and validated data from a number of sources in order to estimate base travel between origin-destination pairs in the study area. The data sources for the origin-destination trips in the study are –

- 2004 MWRRI Study Database
- Amtrak station-to-station trip and station volume data
- Annual average daily traffic (AADT) from State DOTs
- BTS ten percent Ticket Samples

The travel demand forecast model requires the base trip information for all modes between each zone pair. In some cases this can be achieved directly from the data sources, while in other cases the data providers only have origin-destination trip information at an aggregated level (e.g., AADT data, station-to-station trip and station volume data). Where that is the case, a data enhancement process of trip simulation and access/egress simulation needed to be conducted to estimate the zone-to-zone trip volume. The data enhancement process is shown in Exhibit 3-11.

For the auto mode, the quality of the origin-destination trip data was assured by comparing it to AADTs and traffic counts on major highways and adjustments have been made when necessary. For public travel modes, the origin-destination trip data was validated by examining station volumes and segment loadings.

Exhibit 3-11: Zone-to-Zone Origin-Destination Trip Matrix Generation and Validation

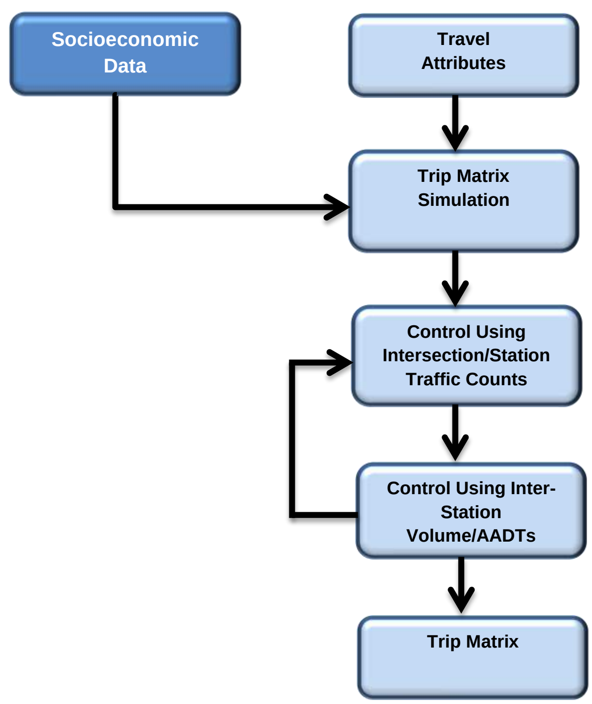
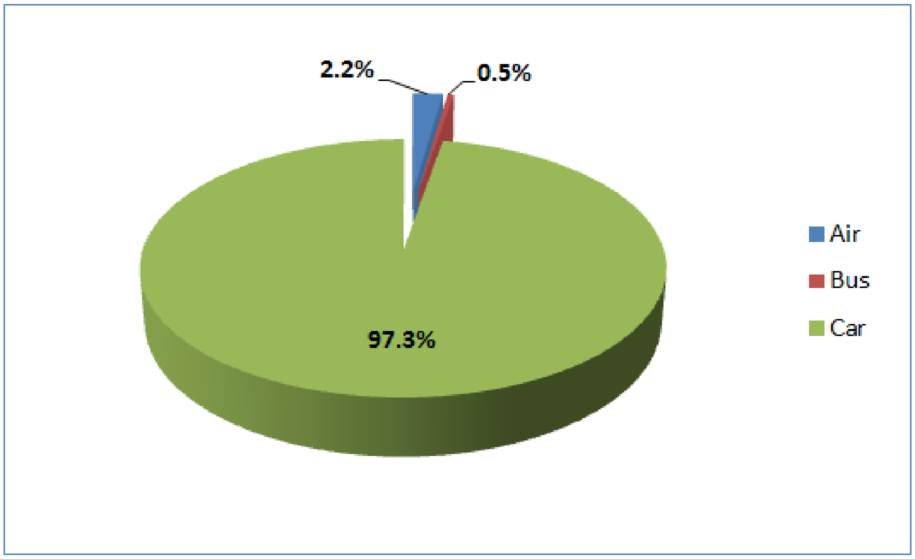


Exhibit 3-12 shows the base 2011 travel market share of air, bus, and auto modes. It can be seen that auto mode dominates the travel market with more than 97 percent of market share. Public modes have less than three percent of travel market share.

Exhibit 3-12: 2011 Base Travel Market Share by Mode



3.7 FUTURE TRAVEL MARKET STRATEGIES

3.7.1 FUEL PRICE FORECASTS

An important factor in the future attractiveness of passenger rail is fuel price. Exhibit 3-13 shows the Energy Information Agency (EIA)[1] projection of crude oil prices for three oil price cases, namely high world oil price case that is aggressive oil price forecast, reference world oil price case that is moderate and is also known as the central case forecast, and the conservative low world oil price case. In this study, the reference case oil price projection was used to estimate transportation cost in future travel market. EIA projects oil price to 2035, the oil price projections after 2035 were estimated based on historical prices and EIA projections. The EIA reference case forecast suggests that crude oil prices are expected to be $120 per barrel (2011$) in 2020 and will remain at that high level and will increase to $137 per barrel (2011$) in 2035.

EIA has also developed a future retail gasoline price forecast, which is shown in Exhibit 3-14. The implication of this is a reference case gasoline price of $4.6 per gallon (2011$) in 2020, with a high case price of $6.6 per gallon and a low case price of $3.1 per gallon. Since gas is currently $3.6 a gallon in a weak economy environment, $5 per gallon once the economy starts to grow again seems realistic. Exhibit 3-15 shows the EIA forecast of diesel price for the three cases.

[1] EIA periodically updates historical and projected oil prices at www.eia.gov/forecasts/aeo/tables_ref.cfm

Exhibit 3-13: Crude Oil Price Forecast by EIA

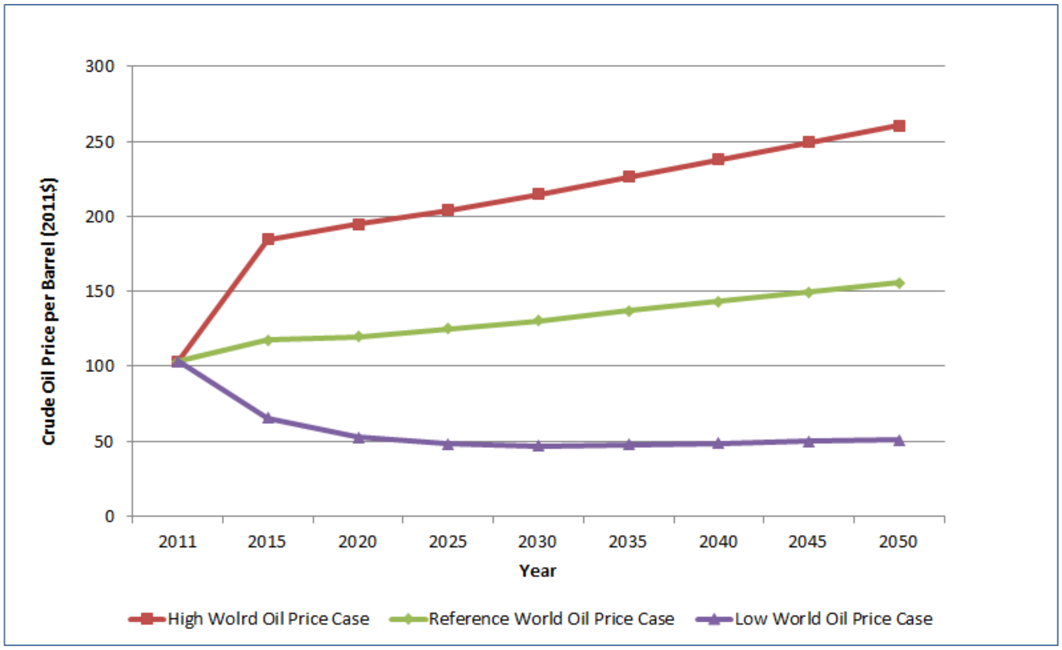


Exhibit 3-14: U.S. Retail Gasoline Prices Forecast by EIA

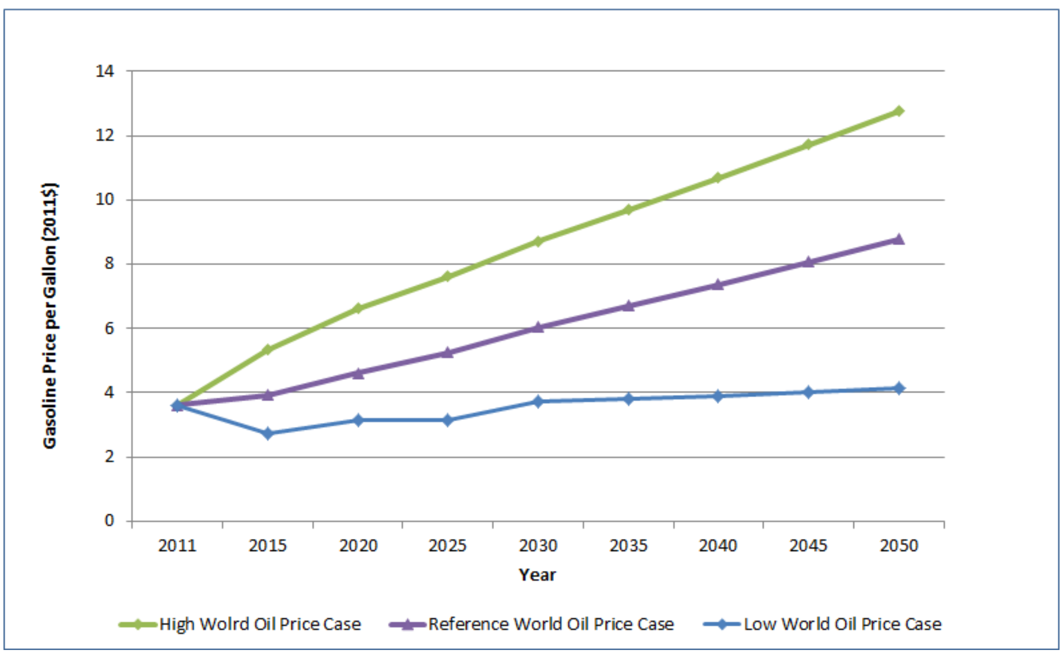
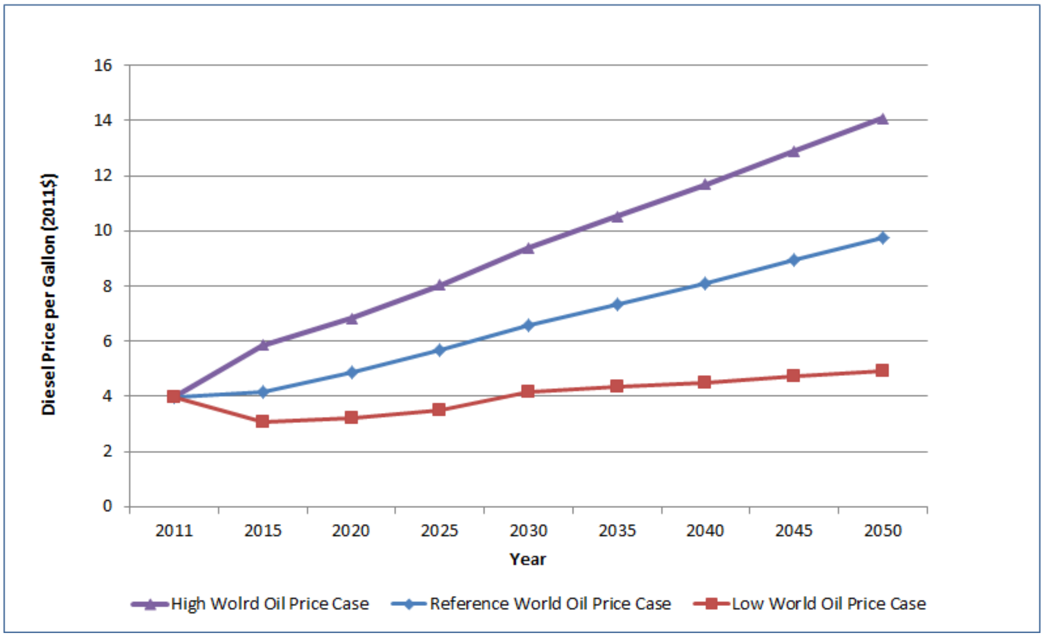


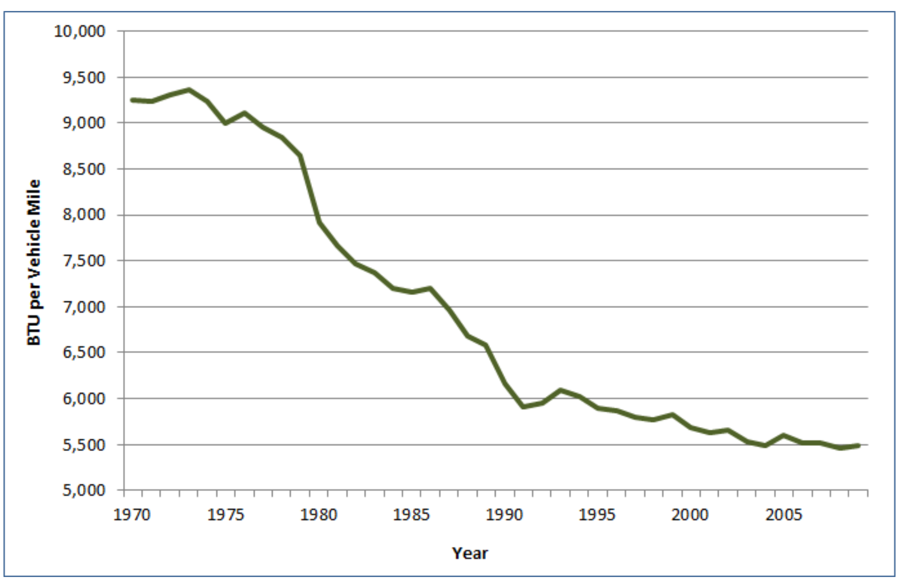
Exhibit 3-15: U.S. Retail Diesel Prices Forecast by EIA



3.7.2 VEHICLE FUEL EFFICIENCY FORECASTS

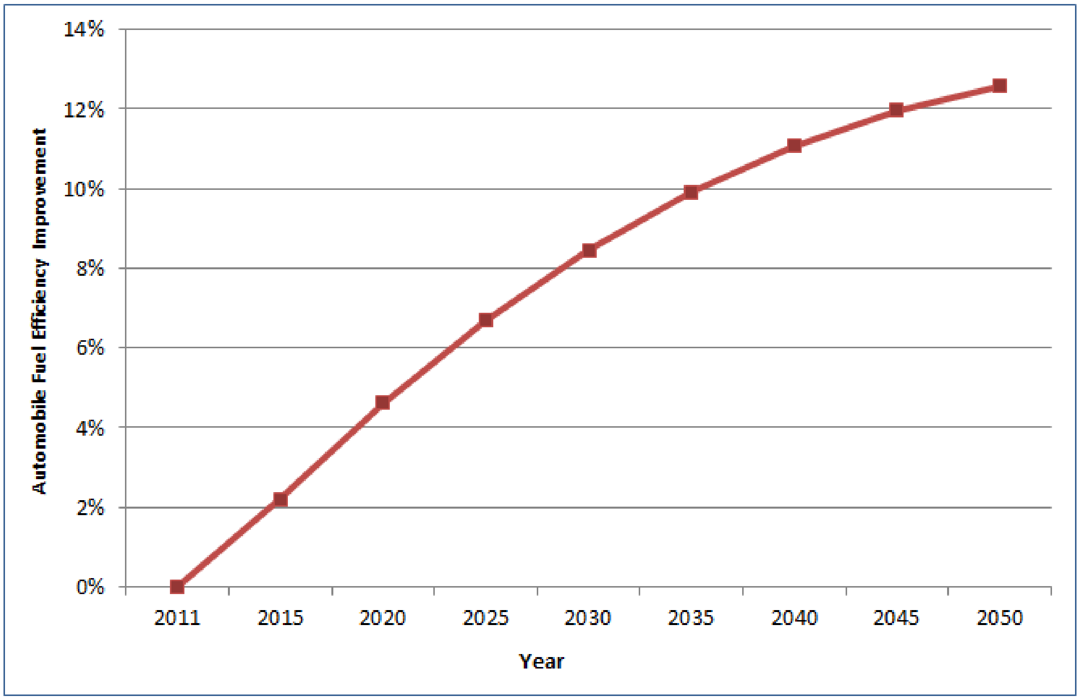
Future improvement in automobile technology is likely to reduce the impact of high gas prices on automobile fuel cost with better fuel efficiency. The EIA Energy Intensities of Highway Passenger Modes Data Table has the historical Btu (British thermal unit) per vehicle-mile data for automobiles since 1970 as show in Exhibit 3-16.

Exhibit 3-16: EIA Historical Highway Automobile Energy Intensities Data



From Exhibit 3-16 it can be seen that automobile fuel efficiency has been improving gradually during the past few decades but the improvement has slowed down in recent years. Future automobile fuel efficiency improvement that was projected and shown in Exhibit 3-17 was based on the historical automobile fuel efficiency data. It shows that automobile fuel efficiency is expected to improve by nearly 13 percent by 2050.

Exhibit 3-17: Auto Fuel Efficiency Improvement Projections



3.7.3 HIGHWAY TRAFFIC CONGESTION

The level of service of auto and bus travel incorporates the highway congestion scenarios to ensure that the automobile traveling impedances are properly reflected. The average highway travel time in the Chicago-Fort Wayne-Columbus corridor was estimated to have an average annual growth rate of 0.4% due to increased travel demand and congestion. This means that the auto travel time from Chicago to Columbus will increase from a current average six hours to six hours and 45 minutes in 2040, which is a 12% increase.

To estimate travel time increase within the corridor, historical highway traffic volumes were obtained from the State DOTs. The average annual travel time growth in the corridor was estimated with the historical highway traffic volume data and the BPR (Bureau of Public Roads) function that can be used to calculate travel time growth with increased traffic volumes –

$$T_a = T_d * [1 + \alpha * \left(\frac{V}{C}\right)^{\beta}]$$

Where:

T_a is actual travel time,

T_d is highway design travel time,

V is traffic volume,

C is highway design capacity,

α is a calibrated coefficient and is often set to 0.15 for highway segments,

β is a calibrated coefficient and is often set to 4.0 for highway segments.

Future travel times then can be calculated based on historical data for each segment of the highway route with assumptions as shown below –

- α = 0.15
- β = 4.0
- Highway lane capacity = 1600 vehicles/hour
- Number of lanes is based on actual situation of each highway segment

As a result, passenger rail offers an increasing time advantage over auto and bus travel markets that rely upon highway infrastructure and are affected by increasing congestion and travel times. The time advantage will have greater impact on business and commuter travel purposes which have higher values of time and which makes the high-speed rail more competitive with these travelers.

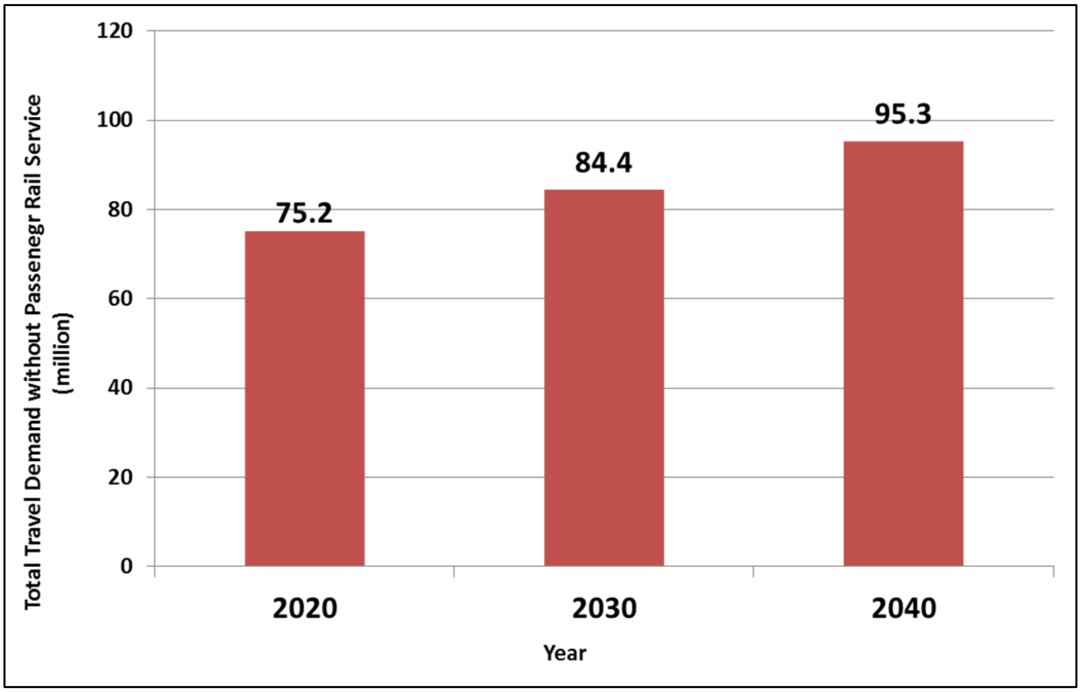
3.8 CORRIDOR TRAVEL MARKET FORECASTS WITHOUT PASSENGER RAIL SERVICE

This section presents the Chicago-Fort Wayne-Columbus corridor travel market forecast without the passenger rail service. In the 2011 base year, the available transportation modes available for the corridor intercity travel market are auto, air, and bus with 69 million trips per year. The auto mode has 97.3 percent market share of the intercity and inter-urban travel market, air mode has 2.2 percent share of the intercity and inter-urban travel market, and bus has 0.5 percent of the market share. By applying the *COMPASS*™ mode choice and total demand models without the passenger rail mode, the travel market with the existing modes can be estimated for future years.

Exhibit 3-18 shows the Chicago-Fort Wayne-Columbus corridor total travel demand forecasts for 2020, 2030, and 2040. It can be seen that with the existing transportation modes, the corridor travel demand will increase to 75.2 million in 2020, to 84.4 million in 2030, and increases to 95.3 million in

2040. The average annual corridor travel market growth rate is 1.1 percent, which is in line with the socioeconomic growth within the corridor.

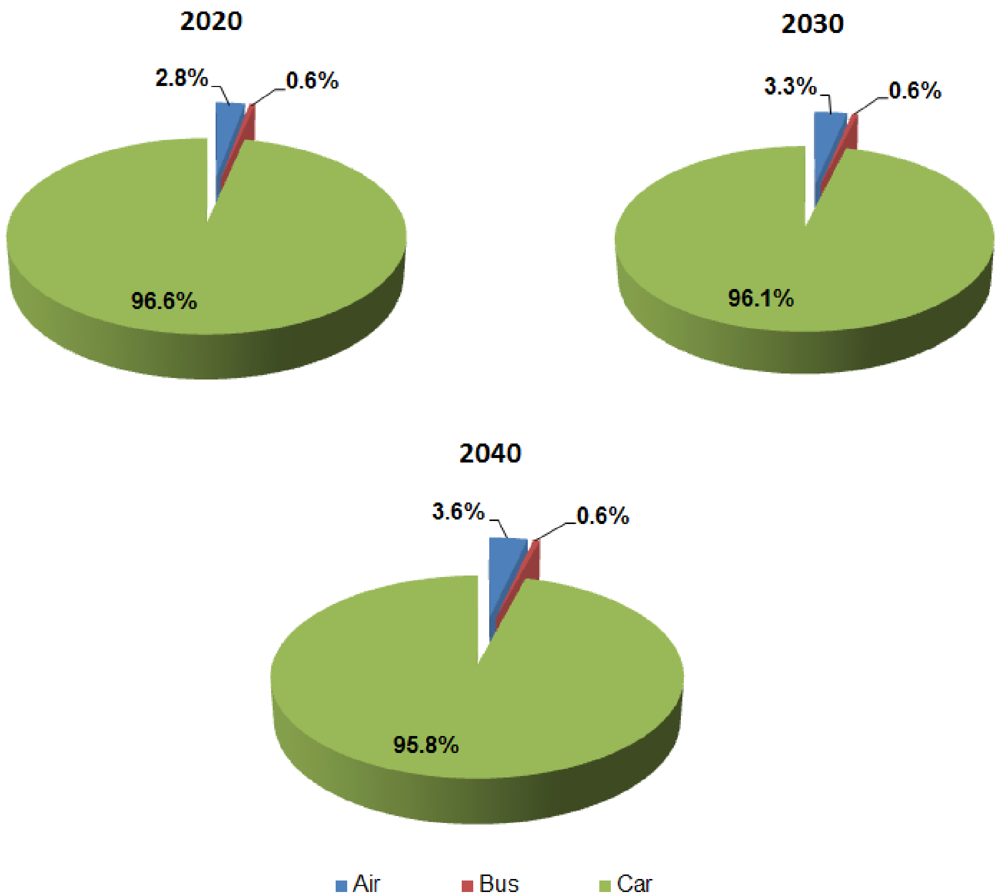
Exhibit 3-18: Chicago-Fort Wayne-Columbus Corridor Travel Demand Forecast without Passenger Rail Service (million)*



* Output of COMPASS™ Model Runs

Exhibit 3-19 shows the market share forecast of existing transportation modes in the corridor without passenger rail. It can be seen that the market share of car trips decreases to 96.6 percent in 2020, it keeps decreasing to 96.1 percent in 2030 and its market share drops to 95.8 percent in 2040. The loss of market share of car travel is due to projected gas price increases and highway congestions. The public modes of air and bus will have increased market share in the study area because they are relatively less affected by fuel price and highway congestion than the car mode.

Exhibit 3-19: Chicago-Fort Wayne-Columbus Corridor Travel Market Share Forecast without Passenger Rail Service*

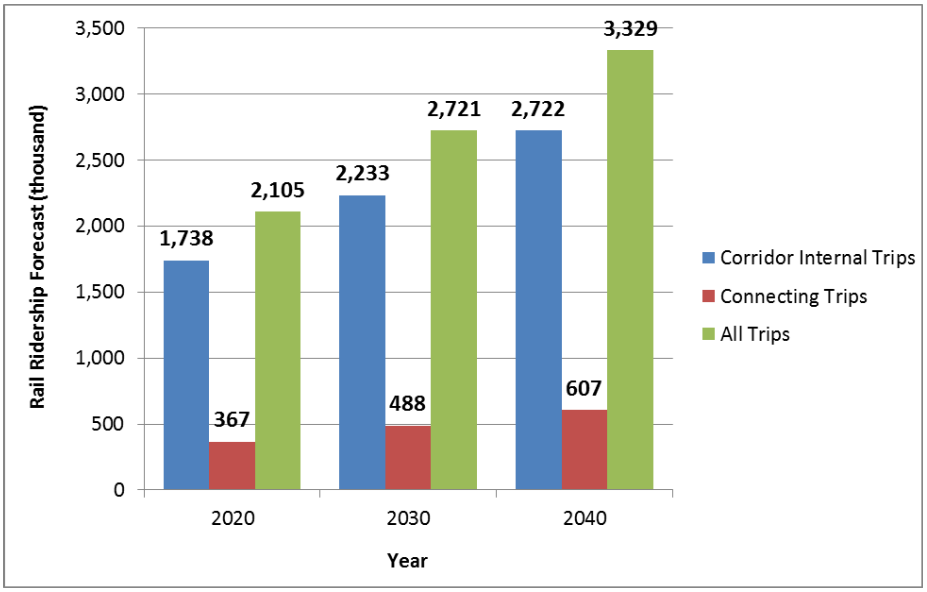


* Output of COMPASS™ Model Runs

3.9 CORRIDOR TRAVEL MARKET FORECASTS WITH PASSENGER RAIL SERVICE

Exhibit 3-20 presents the passenger rail ridership forecasts for the Chicago-Fort Wayne-Columbus corridor for years 2020, 2030, and 2040. The rail mode has 2,105 thousand trips in 2020 growing to 2,721 thousand in 2030 and to 3,329 thousand trips in 2040. A trip is defined as a passenger making a one-way trip and a round trip generates two one way trips. Of the rail trips in the corridor, 18 percent are connecting rail trips traveling from outside the Chicago-Fort Wayne-Columbus corridor.

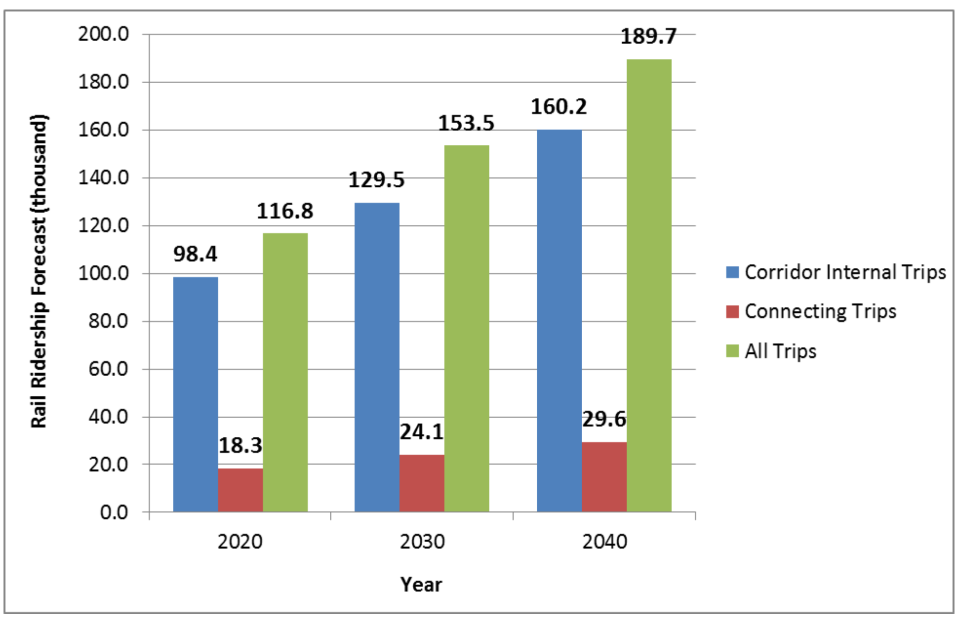
Exhibit 3-20: Rail Ridership Forecast (thousand)*



* Output of COMPASS™ Model Runs

Exhibit 3-21 shows the annual fare-box revenue for years 2020, 2030, and 2040. It can be seen that the annual revenue of 2020 is $116.8 million increasing to $153.5 million in 2030 and to $189.7 million in 2040. All revenue forecasts are presented in 2012 dollar values.

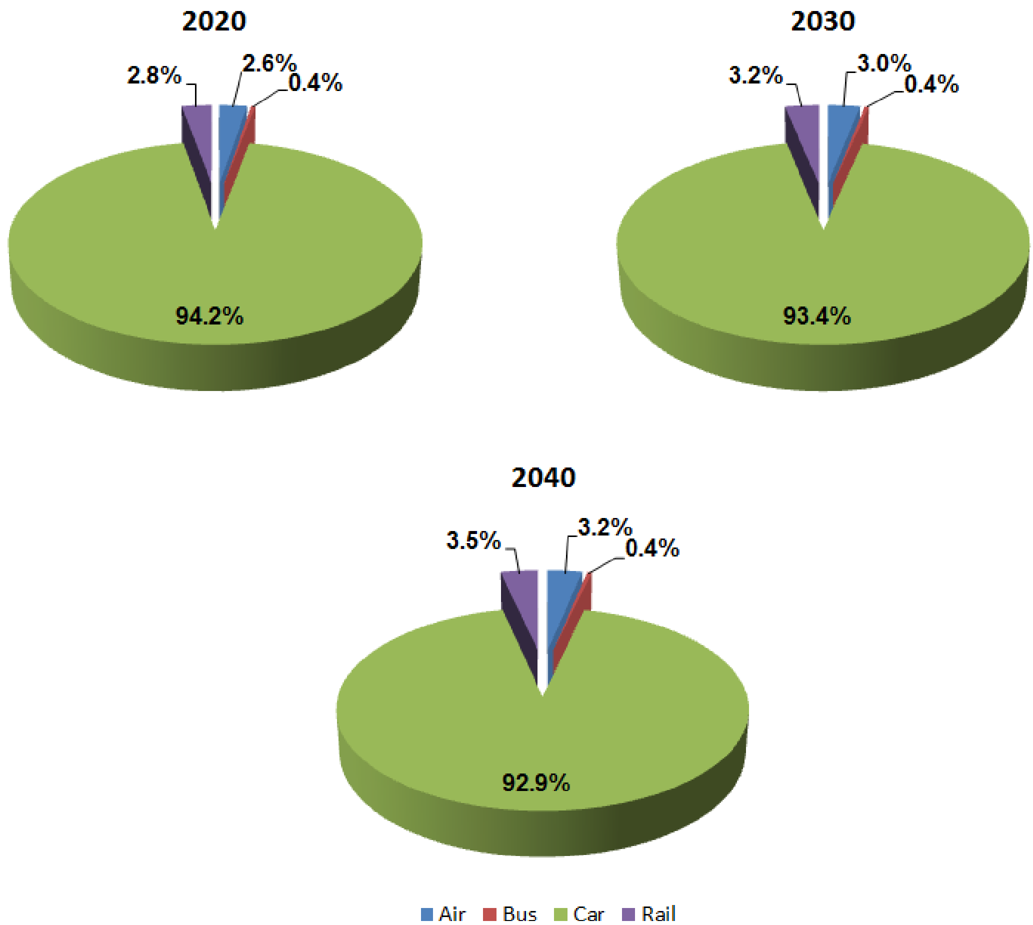
Exhibit 3-21: Rail Fare-Box Revenue Forecasts (million 2012$)*



* Output of COMPASS™ Model Runs

The corridor transportation mode market share forecasts are shown in Exhibit 3-22. The auto mode continues to demonstrate its dominance in the corridor maintaining a market share above 90 percent from 2020 to 2040. Rail market share will increase from 2.8 percent in 2020, to 3.2 percent in 2030, and will reach 3.5 percent in 2040. Air market share will be 2.6 percent to 3.2 percent in the corridor, and the market share growth is due to increased congestion and fuel prices. Bus market share will remain at 0.4 percent.

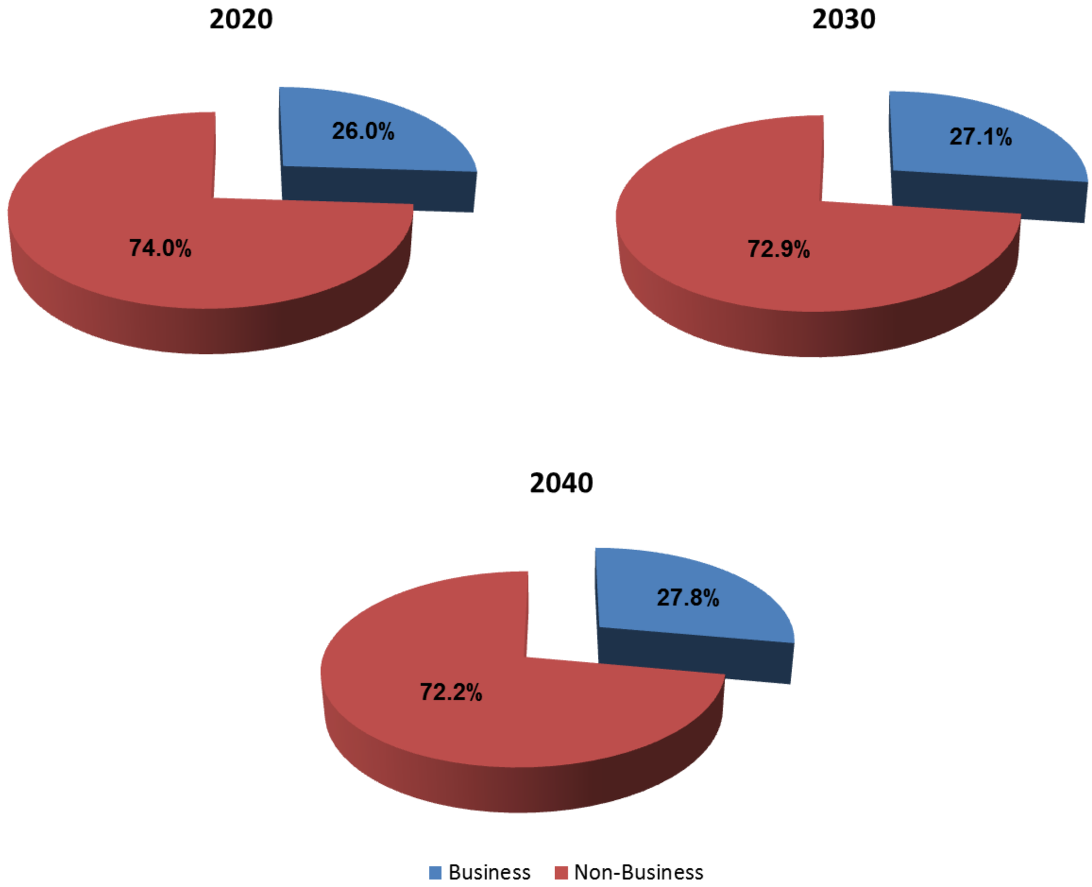
Exhibit 3-22: Chicago-Fort Wayne-Columbus Corridor Travel Market Share Forecast*



* Output of COMPASS™ Model Runs

The purpose split of the rail ridership as illustrated in Exhibit 3-23 shows that percentage of each trip purposes of rail travel. The Non-Business trips account for about 72 to 74 percent of the overall rail travel market, the Business trips account for about 26 to 28 percent.

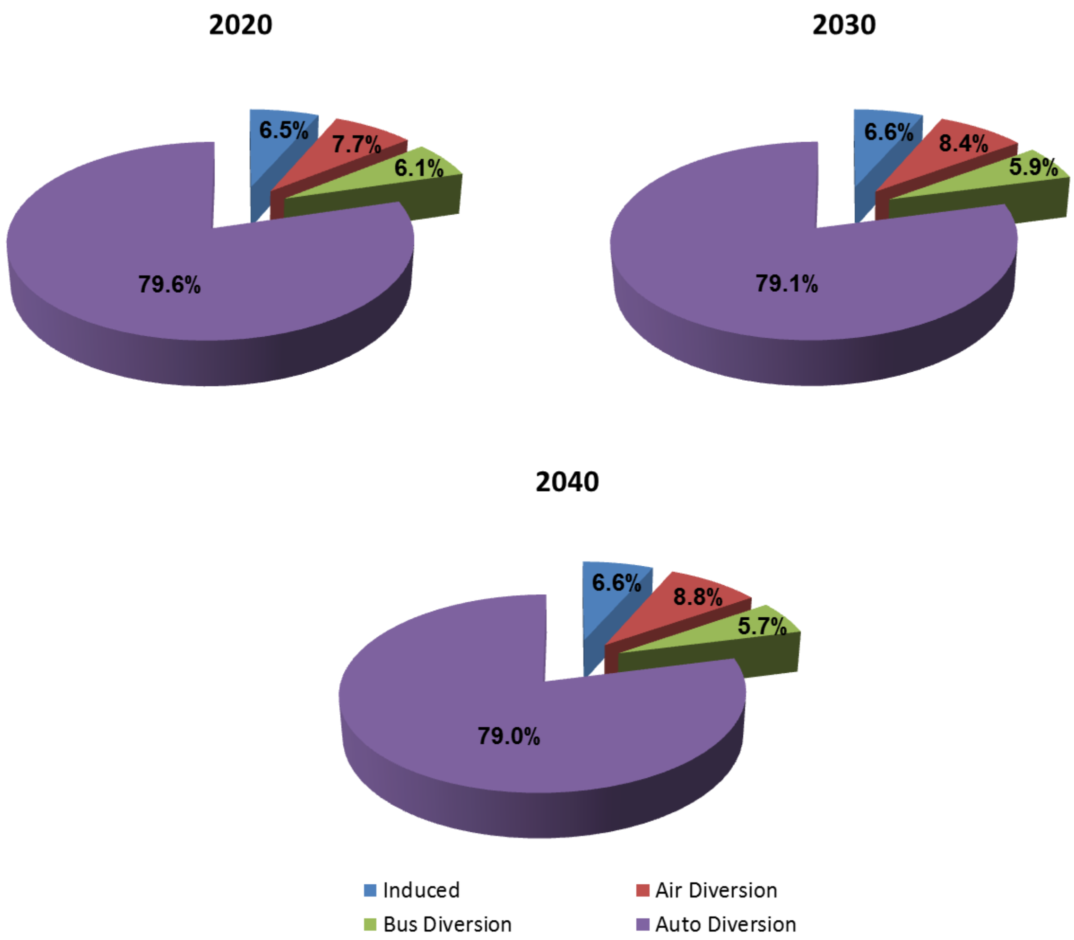
Exhibit 3-23: Rail Trip Purpose Forecast*



* Output of COMPASS™ Model Runs

Exhibit 3-24 illustrates the sources of the rail trips of 2020, 2030, and 2040. The trips diverted from other modes are the most important source of rail trips, which accounts for 93.4 percent of overall rail travel market. Induced travel demand in the corridor as result of the new passenger rail service is 6.6 percent of the rail travel market. As for the diverted trips from other modes, 85 percent trips are from auto mode, but the auto driving still dominates future travel market, this is because auto driving has a strong base in the current Chicago-Fort Wayne-Columbus corridor.

Exhibit 3-24: Rail Trip Sources Forecast*



* Output of COMPASS™ Model Runs

Exhibit 3-25 shows the annual rail station volumes in 2030. It can be seen that major stations where express trains stop all have an annual volume of more than 300,000 passengers in 2030. Other stations where only regular trains stop have annual station volumes from 122 thousand to 175 thousand in 2030.

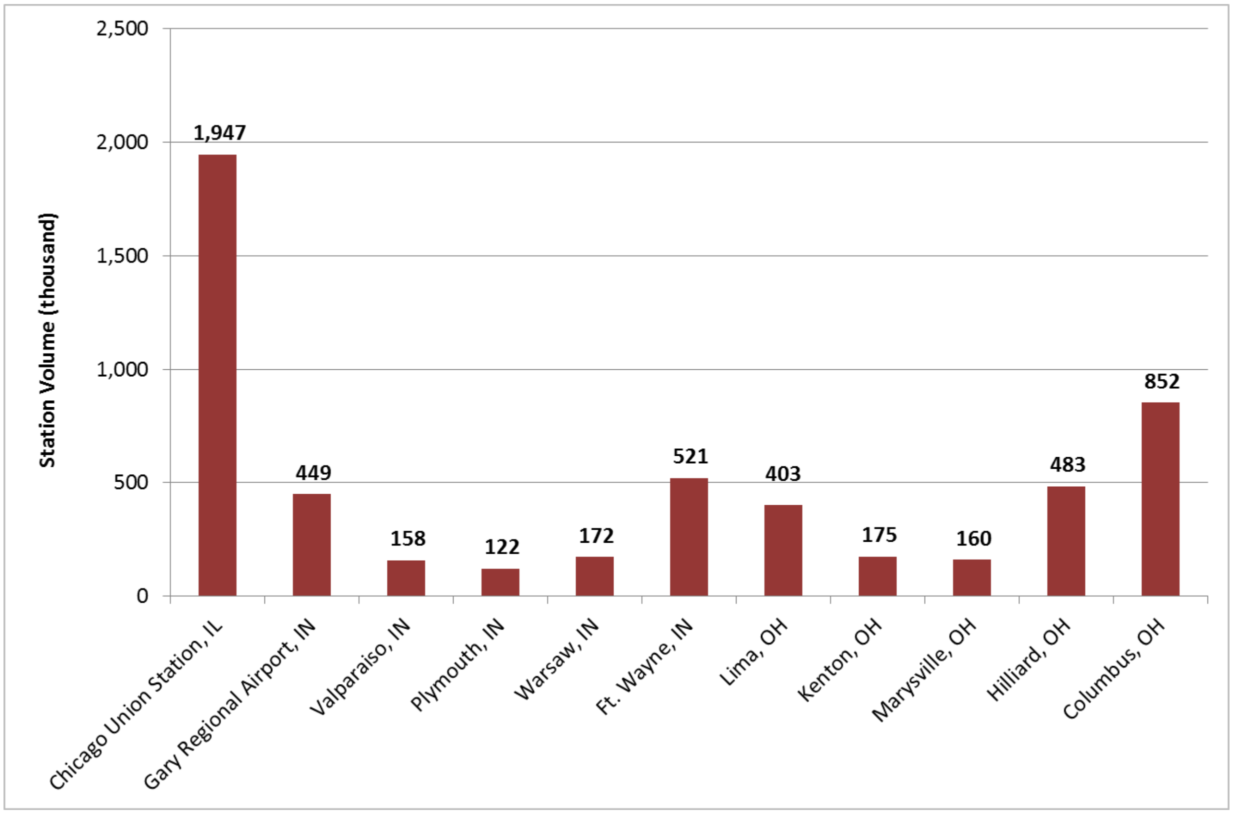
300,000 annual station volumes is a rule of thumb to determine major stations that has been successfully used in previous studies. However, the six major stations in the Chicago-Ft. Wayne-Columbus corridor have more than 400,000 riders per year, and the local stations have less than 200,000 riders per year, this justifies the selection of major and local stations in the corridor.

In comparison to the earlier MWRRI studies, the following changes have been made:

- Gary Airport has been updated to a major station, but it was a local station in the MWRRI study.

- Valparaiso has been selected as a local station, but it was not a station in the MWRRI study.
- The train frequency from Plymouth to Warsaw has been increased from four to six stopping trains.

Exhibit 3-25: 2030 Annual Rail Station Passenger Volumes (thousand)*



* Output of COMPASS™ Model Runs

4 INFRASTRUCTURE AND CAPITAL COSTS

4.1 CONTEXT OF THE ENGINEERING ASSESSMENT

The Chicago terminal is central to the MWRRS project. In 2000, FRA and the MWRRS agreed to establish the Chicago terminal limits as Rondout, Porter, Joliet and Aurora[1]. From Chicago, IL to Tolleston, IN, the Chicago-Fort Wayne-Columbus passenger route would use the proposed MWRRS South-of-the-Lake improvement. It was agreed in 2000 that the responsibility for developing this infrastructure would be borne by the MWRRS as a whole, so Chicago terminal capital costs are not solely attributable to any single route and are not included here.

From Tolleston, IN to Columbus, OH, the proposed passenger alignment utilizes parts of two different rail lines. Both are former ConRail routes that were allocated to CSX when ConRail was split.
They are –

- The former Pennsylvania Railroad (PRR)Fort Wayne main line runs from Tolleston, IN (in the Chicago suburbs) to Crestline, OH (from which point CSX and Norfolk Southern (NS) main lines continue farther east.) Fort Wayne, IN lies at the approximate midpoint of the line. After the ConRail split, CSX decided not to use this line for through freight traffic, so it was leased to the Chicago, Fort Wayne and Eastern Railroad (CFE).[2] The proposed passenger service would use this line from Tolleston, Indiana as far east as Dunkirk, Ohio.
- The former New York Central Toledo and Scottslawn Subdivisions run from Toledo to Columbus. Since the development of CSX's North Baltimore terminal, the Toledo branch has become CSX's primary route for its rapidly growing intermodal traffic.[3] The proposed passenger service would use this line from Dunkirk, Ohio south to Columbus.

[1] See Illinois DOT HSIPR grant application at http://www.dot.il.gov/stimulus/CTL.pdf

[2] Most freight operations are concentrated on the central segment between Fort Wayne, IN and Lima, OH. CFE focuses on bringing cars from Fort Wayne to a CSX interchange at Lima, and also runs one daily train to Chicago for interchange with the western railroads. CFE also interchanges some cars with its sister shortline, the Indiana and Ohio Railroad (former DT&I) at Lima. NS regularly exercises its trackage rights over the easternmost part of the line from Crestline to Bucyrus, OH. NS still has trackage rights over the rest of the line but seldom uses them. From Lima to Bucyrus, the Fort Wayne line is very lightly used.

[3] In the past, the Scottslawn line was mainly used to link the St. Louis mainline at Ridgeway to the Honda plant at Marysville, and to Buckeye yard in Columbus. After the ConRail split, the line was lightly used north of Ridgeway since CSX initially favored its parallel C&O route via Marion and Fostoria. However, the C&O line doesn't have the clearances needed for double-stack trains. As a result, CSX has started using the Scottslawn and Toledo Subdivisions for intermodal trains. The line links intermodal trains from Columbus and Marion to Chicago, and from Columbus and North Baltimore to St. Louis. The former C&O Columbus-Toledo line is losing coal traffic while the Toledo branch is gaining intermodal traffic, so the Scottslawn line via Marysville may soon become CSX's main Toledo to Columbus route. Therefore it appears that the former C&O line via Marion could offer a viable alternative for passenger trains. it seems unlikely that CSX would need to maintain two parallel lines if one line could provide enough capacity. The C&O line crosses the Fort Wayne line at Upper Sandusky, about 19 miles east of Dunkirk. The Marion alternative should be assessed in the Tier I environmental study as a possible alternative to the Scottslawn line.

As a result of these important differences in freight usage, this study makes different assumptions regarding the approach to upgrading in the two line segments.

- Because the Fort Wayne line is only lightly used, this study assumes that the existing track from Dunkirk to Tolleston can be upgraded for passenger use[4] as was assumed by previous studies.
- In contrast, because of growing freight traffic along the Toledo branch and Scottslawn Subdivisions, the study assumes that it will be necessary to add a new track to the CSX line from Dunkirk to Columbus. The result would be a fully double tracked line.

4.2 HISTORICAL CONTEXT FOR THE STUDY

The former PRR Fort Wayne line has been rendered surplus by freight traffic shifts over the years. This has created an opportunity to implement a high-speed passenger service using the line.

ConRail inherited the Fort Wayne line from the bankrupt Penn Central in 1976, by which time there was already a substantial backlog of deferred maintenance. By the early 1980's ConRail had already made the decision to focus its investment on its parallel former NYC "Water Level" route through Toledo rather than on the Fort Wayne line. By 1990, track conditions to Fort Wayne had deteriorated to the point that it was necessary to reroute Amtrak trains off the corridor. This move allowed ConRail to remove the signaling system. West of Fort Wayne the only Conrail train remaining on the line was FWEL and ELFW, which only ran from Fort Wayne to Warsaw before turning north to Elkhart.[5]

However by 1994, the capacity of Norfolk Southern's Chicago District was strained to the limit, leading NS to purchase the Fort Wayne line from Valparaiso west to Gary on June 2, 1994, and from Warsaw to Valparaiso soon after, with trackage rights east from Warsaw to Fort Wayne, giving NS an alternative to its Chicago District. After purchasing the Fort Wayne line west of Warsaw, Norfolk Southern made large investments to improve the track and installed new connections at Fort Wayne, Argo, Plymouth, and Valparaiso to afford operational flexibility for using the line. Even today the Fort Wayne to Chicago track is in good shape, in contrast with the line east of Fort Wayne, which never received the benefit of this type of investment.

In 1998, Norfolk Southern and CSX engaged in a bidding war over ConRail, which culminated in an agreement between the two major carriers to jointly purchase ConRail and divide the property. NS and CSX agreed to allocate the Fort Wayne line west of Crestline to CSX. This included not only the

[4] Consistent with prior study assumptions, the existing Fort Wayne track would be upgraded, but the track would continue to be shared with local freight trains.
[5] See: http://thecrhs.org/OnLocationWithConrail/FortWayneLine

Warsaw to Crestline section that was still owned by ConRail, but also the Warsaw to Gary section that was owned by NS[6].

It is clear that local traffic played a significant role in the railroads' strategy for dividing the lines. In dividing ConRail, the carriers took care to minimize the number of "two to one" points created by the consolidation. A "two to one" is a location that formerly was served by two railroads which, after a merger transaction, is served by only one railroad. The Surface Transportation Board views this as a reduction of competition and typically orders merger conditions granting third parties a right to serve local customers.[7] CSX and NS, having paid a very high price for ConRail, did not want to risk opening the market to third parties who hadn't paid the price for entry. Since NS's market position in Fort Wayne was already very strong, NS couldn't have taken ConRail's Fort Wayne line without likely triggering STB protective conditions to preserve rail competition.

As a result, NS and CSX agreed to allocate the Fort Wayne line to CSX. Since Norfolk Southern received the "water level" route via Toledo, it didn't really need the Fort Wayne line anymore[8], so NS was happy to divest the property to CSX. The end result was that the Fort Wayne infrastructure once again fell into disuse under CSX control.

CSX however, did want to keep the Fort Wayne local traffic. During the brief period during which it operated the line, CSX negotiated contracts with the on-line shippers. Once these CSX-focused traffic patterns were in place, CSX leased the line to a shortline operator, the Chicago, Fort Wayne and Eastern (CFE) but included restrictive covenants (called "paper barriers") that effectively prevent CFE from shifting the traffic back to NS. In this way CSX could hope to protect at least some of the investment that it had made in the ConRail transaction.

The result, then, is a substantially upgraded but essentially disused rail alignment from Fort Wayne to Chicago that could be developed into an efficient dedicated route for high-speed passenger trains. Given NS' ownership of two parallel freight lines into Chicago, including the high-capacity "water level" route via Toledo, it is unlikely that NS would need to use this portion of the Fort Wayne line for

[6] In theory this balanced track capacity into Chicago; but in reality the Fort Wayne capacity was not really usable, largely due to the deteriorated track that still remained east of Fort Wayne as well as the fact that ConRail had removed the signals. Rather than making a large investment for upgrading the Fort Wayne line, CSX opted instead to focus traffic on a single line by restoring double track on its former B&O Garrett Subdivision.

[7] For example to prevent Norfolk Southern from establishing a rail monopoly, the STB could have given the Canadian National the right to serve Fort Wayne. Rather than risking this, NS and CSX chose to divide the lines in such a way as to minimize the likelihood that STB would need to impose protective conditions.

[8] Norfolk Southern diverted much of its Chicago-bound traffic away from Fort Wayne to the Elkhart line; while routing more St. Louis and Kansas City traffic through Fort Wayne. While NS is still running plenty of trains through Fort Wayne, the trains are running in different directions than before. While traffic shifts have however relieved much of the capacity pressure on the NS Chicago District, they have increased the train counts through the CP Mike interlocking, exacerbating the potential for freight/passenger conflicts east of the Fort Wayne train station.

its existing freight trains. NS may be able to develop a new market for high-speed intermodal service to Chicago. Using the improved Fort Wayne line infrastructure, this could be much faster than any existing service, but it would require a commitment to developing new freight markets. Infrastructure needs for providing local freight service will be protected in any upgrading plans for implementing rail passenger services from Fort Wayne to Chicago.

East of Fort Wayne, Norfolk Southern still retains trackage rights but has been discouraged from using them on account of poor track conditions. The Fort Wayne line east to Bucyrus and Crestline is shorter but slower than NS's existing main line via Bellevue. NS has expressed an interest in routing Heartland Corridor intermodal trains from Bucyrus to Fort Wayne, but because of current track conditions the route offers no operating advantage to them. However, if the track were rehabilitated as far as Dunkirk or possibly Upper Sandusky, it is likely that the Fort Wayne line would become an attractive short cut. The route is not only more direct but also has the advantage of bypassing congested terminals in Bellevue and Cleveland. Freight potentials both east and west of Fort Wayne should be further explored in follow up discussions with all three railroads, CSX, NS (including Triple Crown) and CFE.

4.3 INFRASTRUCTURE IMPROVEMENT CATEGORIES AND UNIT COSTS

The unit costs used for this Business Plan update are generally consistent with those used in the earlier MWRRI and Ohio Hub studies. The MWRRI costs were originally derived from the 1997 Chicago/Milwaukee Rail Corridor Study and the 1993 Chicago to St. Louis High-Speed Rail Capital Cost Estimates, completed for the Wisconsin and Illinois Departments of Transportation by Envirodyne Engineers, Inc. in association with Pricewaterhouse. The unit costs were subsequently validated by the study of high-speed rail operations in the Chicago to St. Louis corridor, completed by DeLeuw Cather & Co. in association with Sverdrup Civil, Inc. for the Illinois Department of Transportation but the cost database has been significantly updated over the years to remain current with labor and materials inflation as well as localized regional price adjustments.

The capital cost estimates in this report are presented in 2012 dollars, as compared to the earlier 2004 Ohio Hub report, 2004 MWRRS plan and 2007 Ohio Hub plan, which all expressed costs in 2002 dollars. Construction and materials costs have increased significantly since the development of the original plans. According to the Engineering News Record (ENR) factors given Appendix 3, the overall cost basis has increased by inflation about 43% since 2002[9].

[9] From 2002 to 2007, the cost increase multiplier was 7880/6462 = 1.219. From 2007 to 2012 the factor is directly gives as 1.17. Multiplying these together 1.219 * 1.17 = 1.426 or a 43% increase.

Consistent with the capital costing methodology that was used in these earlier studies, the costs for infrastructure improvements fall into one of eight categories –

- Trackwork – Includes upgrades to existing track, and additional new tracks (double track and passing sidings) to provide places for trains to meet and overtake one another.
- Passenger stations and support facilities, including a train service and inspection facility and train layover facilities
- Turnouts (switches)
- Bridges under – A road, river or another railroad goes underneath the track
- Bridges over – A road or another railroad goes over the track
- Roadway crossings of rail tracks
- Signals – Includes installation of a basic Centralized Traffic Control (CTC) signal system, as well as a Positive Train Control (PTC) radio-based safety overlay system. PTC relays signal indications directly into the locomotive cab, where they are used for safety enforcement.
- Curves

Each category contains a set of infrastructure improvement elements. Each element, along with its unit cost is listed in Exhibit 4-1.

Exhibit 4-1: Engineering and Cost Estimate Assumptions and Definitions

Trackwork

Item No.	Description	Unit	Unit Cost (Thousands of 2012$)
1.1	HSR on Existing Roadbed	per mile	$1,424
1.2a	HSR on New Roadbed	per mile	$1,519
1.2b	HSR on New Roadbed & New Embankment	per mile	$2,140
1.2c	HSR on New Roadbed (Double Track)	per mile	$3,835
1.3	Timber & Surface w/ 33% Tie Replacement	per mile	$318
1.4	Timber & Surface w/ 66% Tie Replacement	per mile	$475
1.5	Relay Track w/ 136# CWR	per mile	$508
1.6	Freight Siding	per mile	$1,308
1.65	Passenger Siding	per mile	$1,973
1.71	Fencing, 4 ft Woven Wire (both sides)	per mile	$73
1.72	Fencing, 6 ft Chain Link (both side)	per mile	$219
1.73	Fencing, 10 ft Chain Link (both side)	per mile	$251
1.74	Decorative Fencing	per mile	$565

Stations

Item No.	Description	Unit	Unit Cost (Thousands of 2012$)
2.1	Full Service – New	each	$1,434
2.2	Full Service – Renovated	each	$717
2.3	Terminal – New	each	$2,868

2.4	Terminal – Renovated	each	$1,434
2.5	Layover Facility	lump sum	$7,950-$9373
2.6	Service and Inspection Facility	lump sum	$27,207

Turnouts

Item No.	Description	Unit	Unit Cost (Thousands of 2012$)
4.1	New #24 High-Speed Turnout	each	$645
4.2	New #20 Turnout Timber	each	$178
4.3	New #10 Turnout Timber	each	$99
4.4	New #20 Turnout Concrete	each	$357
4.5	New #10 Turnout Concrete	each	$169

Bridges-under

Item No.	Description	Unit	Unit Cost (Thousands of 2012$)
5.1	Four-Lane Urban Expressway	each	$6,933
5.2	Four-Lane Rural Expressway	each	$5,772
5.3	Two-Lane Highway	each	$4,379
5.4	Rail	each	$4,379
5.5	Minor River	each	$1,162
5.6	Major River	each	$11,613
5.71	Convert Open Deck Bridge To Ballast Deck (single track)	per LF	$7
5.72	Convert Open Deck Bridge To Ballast Deck (double track)	per LF	$13
5.73	Single Track on Flyover Structure	per LF	$9
5.8	Single Track on Approach Embankment w/Retaining Wall	per LF	$4

Bridges-over

Item No.	Description	Unit	Unit Cost (Thousands of 2012$)
6.1	Four-Lane Urban Expressway	each	$2,993
6.2	Four-Lane Rural Expressway	each	$4,200
6.3	Two-Lane Highway	each	$2,729
6.4	Rail	each	$8,762

Crossings

Item No.	Description	Unit	Unit Cost (Thousands of 2012$)
7.1	Private Closure	each	$119
7.2	Four Quadrant Gates w/Trapped Vehicle Detector	each	$706
7.3	Four Quadrant Gates	each	$413
7.31	Convert Dual Gates to Quad Gates	each	$215
7.41	Convert Flashers Only to Dual Gates	each	$72
7.4a	Conventional Gates Single Mainline Track	each	$238
7.4b	Conventional Gates Double Mainline Track	each	$294
7.5a	Single Gate with Median Barrier	each	$258
7.5b	Convert Single Gate to Extended Arm	each	$22
7.71	Pre-cast Panels without Roadway Improvements	each	$115

7.72	Pre-cast Panels with Roadway Improvements	each	$215
7.8	Michigan -Type Grade Crossing Surface	each	$22
7.9	Install Constant Warning Time (CWT) system	each	$108

Signals

Item No.	Description	Unit	Unit Cost (Thousands of 2012$)
8.1	Signals for Siding w/ High-Speed Turnout	each	$1,818
8.2	Install CTC System (single track)	per mile	$262
8.21	Install CTC System (double track)	per mile	$430
8.3	Install PTC System	per mile	$282
8.4	Electric Lock for Industry Turnout	per mile	$148
8.5	Signals for Crossover	per mile	$1,004
8.6	Signals for Turnout	per mile	$574

Curves

Item No.	Description	Unit	Unit Cost (Thousands of 2012$)
9.1	Elevate and Surface Curves	per mile	$83
9.2	Curvature Reduction	per mile	$564
9.3	Elastic Fasteners	per mile	$118
9.5	Realign Track for Curves	lump sum	varies

Costs are expressed as a percentage of the expected construction cost for construction contingency, design, engineering, program management, construction management, and project development have been included in the unit cost values. These costs include –

Construction contingency	15%
Design engineering	7%
Program Management	3%
Construction management and inspection	4%
Owner's management – environmental, etc.	2%

Capital costs include placeholders as conservative estimates for large and/or complex engineering projects that have not been estimated on the basis of unit costs and quantities. Placeholders provide lump sum budget approximations based on expert opinion rather than on an engineering estimate. Placeholders are used where detailed engineering requirements are not fully known. These costs will require special attention during the project development phase. The following list highlights some of the key placeholder costs that have been assumed in this analysis –

- Rail-to-Rail Grade Separations – also called "Flyovers" at Ridgeway, CP Mike in downtown Fort Wayne, Warsaw and Spriggsboro west of Valparaiso
- A new high-speed connection at Dunkirk.
- Highway grade separations and curve easement between Tolleston and Fort Wayne.

4.4 INFRASTRUCTURE DESCRIPTION

4.4.1 COLUMBUS TO CP MOUNDS

During the "3-C Quick Start" planning efforts, it was decided to locate the Columbus downtown station at its historical site at CP-138, the junction of the CSX Buckeye branch and the NS Dayton District, directly underneath the Columbus Convention Center. As shown in Exhibit 4-2, from this location, the station platform tracks could potentially be accessed from any direction.

Photo 1: Planned Platform Area underneath Columbus Convention Center, showing Buckeye Line Junction at CP-138

This analysis assumes that the Columbus-to-Chicago corridor will share a common access with the proposed 3-C corridor, so trains from both Cincinnati and Chicago would enter Columbus using the NS Dayton District's Scioto River bridge. Immediately across the river, the NS Dayton District crosses the CSX Columbus Subdivision (former C&O) tracks at CP Scioto. It will be very difficult to reconfigure the two bridge approaches to grade separate this junction. The NS Buckeye line offers a potential alternative for Chicago trains from CP-138 to CP Mounds, crossing the CSX Columbus Subdivision at CP Hocking. However this crossing is also constrained by two river bridges and has a highway bridge overhead and a grade separation at CP Hocking would not address the need of the 3-C trains.

Exhibit 4-2: Columbus Terminal Area – Rail Map

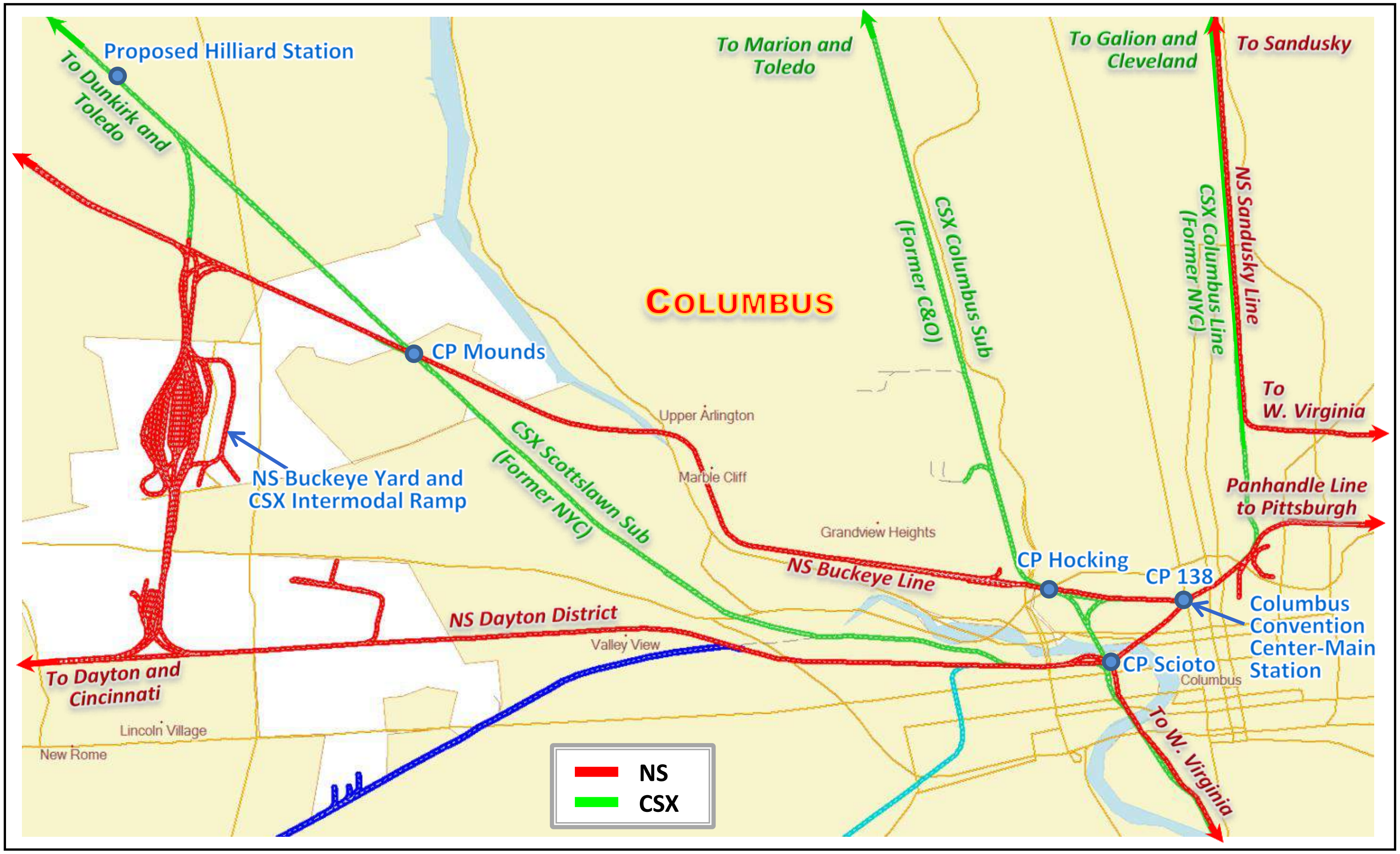


Photo 2: NS Dayton District Scioto River bridge

Photo 3: CP Scioto Diamond Crossing with Southbound CSX Train approaching on former C&O Columbus Subdivision

Photo 4: CP Hocking view west along the Buckeye Line. The double-tracked CSXT Columbus Subdivision to Marion passes through the girder bridge on the right.

A possible solution for untangling the rail conflict at CP Scioto would be to concentrate all CSX freight on the Scottslawn Subdivision towards Toledo.

- This would free the CSX Columbus Subdivision for passenger trains. The Columbus Subdivision could be accessed using the Buckeye branch to CP-Hocking. No grade separation would be needed at CP-Hocking and the needed connection is already in place.
- Instead of going straight across the diamond at CP Scioto, CSX freight trains from the south would turn left towards the Scottslawn Subdivision. The distance from CP Scioto to the Scottslawn junction is 0.65 miles, which provides enough room to effect a grade separation. Beyond the junction, the Scottslawn Subdivision heads northwesterly along the Scioto River to CP Mounds, bypassing the NS Buckeye freight yard.

It is recommended that these grade separation and freight and passenger routing issues be considered in the Tier I environmental assessment. Since the final route selection for Chicago has not been made, it is recommended to keep the options open at the downtown Columbus station. Specifically, if possible the platform design in downtown Columbus should accommodate trains arriving from either the NS Dayton District or CSX Buckeye lines.

The current Feasibility study assumes that passenger trains will use the NS Dayton District to the Scottlawn Subdivision, and that they cross the CSX Columbus Subdivision at grade at CP Scioto. From here it is assumed that passenger trains will follow the Scottslawn Subdivision and Toledo Branch to Dunkirk, OH, from where they would follow the former PRR Fort Wayne line to Chicago. This is the same routing that was proposed by the earlier 2007 Ohio Hub study.

Because of continuing growth in freight traffic along this CSX line, it has been assumed that an additional track will be needed, so the whole line from CP Scioto to Dunkirk would be double tracked and equipped with the latest signaling and Positive Train Control technology. Passenger trains would operate up to 110-mph. Highway grade crossings would receive quad gates in compliance with FRA regulations, and private crossings would be either gated or closed.

CP Mounds is where the Buckeye branch crosses the Scottslawn subdivision. The Buckeye branch provides a possible route alternative to using the Scottlawn subdivision via CP Scioto. Following the Buckeye branch to CP-138, trains would cross the CSX Columbus Subdivision at CP Hocking instead of CP Scioto. However, the current diamond crossing of the Buckeye Branch at CP Mounds would impose a speed restriction on passenger trains. To eliminate the diamond and its associated speed restriction, it is proposed to replace this diamond with two switches. A placeholder cost of $1.434 million has been provided for replacing this diamond crossing.

Photo 5: Diamond crossing at CP Mounds. This would be replaced by two switches to eliminate the speed restriction associated with the diamond

Exhibit 4-3 summarizes the cost of proposed improvements to this segment, which include –

- Upgrade CTC signaling
- Install Constant Warning Time (CWT) grade crossing warning systems
- Add a double track to support 79-mph operations from CP Scioto to CP Mounds

The main costs are $14.3 million for double tracking CP Scioto to CP Mounds, $5.7 million for crossings and signals, and $17.0 million for the bridges needed to accommodate the additional track. In addition a $27 million cost for a Columbus Servicing and Inspection facility has been included in this segment. Detailed costs are shown in Appendix 3.

Exhibit 4-3: Columbus to CP Mounds Costs

Cost Category	110 - Diesel	
	Cost (1000s)	% of Total Segment Cost
Trackwork	$14,284	20.08%
Turnouts	$889	1.25%
Curves	$0	0.00%
Signals	$5,713	8.03%
Stations/Facilities	$30,075	42.28%
Bridge-Under	$17,518	24.62%
Bridge-Over	$0	0.00%
Crossings	$1,226	1.72%
Segment Total	$69,705	97.98%
Placeholders	$1,434	2.02%
TOTAL	**$71,139**	**100.00%**
Cost/Mile (7.0 Miles)	**$10,163**	

4.4.2 CP MOUNDS TO DUNKIRK

Just north of CP Mounds is the proposed location of the Hilliard station, which would serve as a western Columbus suburban station. Because of highway congestion and parking costs associated with the downtown Columbus Convention Center site, it is expected that the Hilliard station (which could offer free parking) would attract considerable ridership from Columbus' entire northern and western suburbs. Hilliard would be a major station and the proposed operating plan has all trains stopping there.

Marysville is a medium sized community that, in recent years, has experienced rapid growth. However it is still not as large a city as some of the older Ohio communities (for example, Marion.) As a result it is planned that about 50% of trains (local service) will stop at the Marysville station. Curves in Marysville will limit train speeds through the town.

Photo 6: Single Track and Industrial Siding at North Main Street in Marysville, Ohio

Ridgeway is the junction with CSX's east-west St. Louis to Cleveland main line[10]. The Subdivision name designation along the former Toledo-Columbus line also changes here: south of Ridgeway, the line is called the Scottslawn Subdivision, whereas north of Ridgeway it is called the Toledo Branch. Currently the rail lines cross at grade, but it is proposed that the current diamond crossing be eliminated and replaced by a double-tracked flyover grade separation.

[10] Ridgeway is an important junction for freight trains. Currently connection tracks exist in three out of four quadrants, with a new connection track under construction in the fourth (northeast) quadrant. This new connection will allow direct moves of intermodal trains from Chicago towards Schneider National's double-stack intermodal terminal at Marion, Ohio. So freight connection tracks will exist in all four quadrants of the Ridgeway crossing, showing the importance of this junction.

Photo 7: CSX Scottslawn Subdivision at Ridgeway – View South towards Columbus

Kenton is the next passenger station along the line. It is not a large city, but serves as the county seat of Hardin County, Ohio. However, this stop also benefits from proximity to Marion (for Chicago trips) and Findlay (for Columbus travelers.) As a result local train stop is planned. A number of sharp curves in Kenton will restrict train speeds through the area.

Photo 8: Sharp Curve at South End of Kenton, Ohio

Finally, Dunkirk is where the CSX Toledo Branch crosses the Fort Wayne line. A new 2-mile high-speed connection track is proposed to be built in the open countryside south and west of Dunkirk, avoiding adverse environmental impacts by staying completely out of town. The track would connect to the Toledo branch about 1½ miles south of Dunkirk and connect to the Fort Wayne line about 1¼ miles west of town. The connection track would have an average curve of about 1˚so 110-mph trains could connect to the Fort Wayne line without a speed restriction.

Photo 9: Dunkirk Crossing looking West on the Fort Wayne Line. The passenger train would switch off onto a high-speed connection track before it reaches this point.

Photo 10: Looking west from Dunkirk across open countryside. The high-speed connection would join the Fort Wayne line about a mile west of here.

Exhibit 4-4 summarizes the cost of proposed improvements to this segment, which include –

- From CP Mounds to Dunkirk, construct a new a Class 6 track on 28-foot separation, where practicable, with crossovers at 15 mile intervals.
- Grade separate the CSX rail crossing at Ridgeway
- Install CTC and PTC signaling
- Install CWT and four quadrant gate grade crossing warning systems
- Upgrade the existing track to Class 6 for shared freight and passenger use
- Install chain link fencing through populated areas including: Columbus to Hilliard, Marysville, West Mansfield, and Kenton
- Construct a new 2-mile long high-speed connection track at Dunkirk

The main costs are $170.5 million for adding and upgrading track from CP Mounds to Dunkirk, $91.1 million for crossings and signals, and $57.4 million for the flyover of the CSX line at Ridgeway. Detailed costs are shown in Appendix 3.

Exhibit 4-4: CP Mounds to Dunkirk Costs

Cost Category	110 - Diesel	
	Cost (1000s)	% of Total Segment Cost
Trackwork	$170,541	46.29%
Turnouts	$2,759	0.75%
Curves	$2,309	0.63%
Signals	$44,666	12.12%
Stations/Facilities	$5,736	1.56%
Bridge-Under	$32,392	8.79%
Bridge-Over	$5,986	1.62%
Crossings	$46,396	12.59%
Segment Total	$310,784	84.35%
Placeholders	$57,654	15.65%
TOTAL	**$368,439**	**100.00%**
Cost/Mile (65.2 Miles)	**$5,651**	

4.4.3 DUNKIRK TO FORT WAYNE

The Fort Wayne line features excellent geometry with long stretches of tangent track, and has only a few generally mild curves. This potentially enables a very high-speed capability, which is broken up only by the occasional small town along the tracks. Because the alignment is very good, special grade crossing treatment and/or grade separations are envisioned to allow passenger trains to fully exploit the speed capability of the line. This eastern segment of the Fort Wayne line is envisioned for passenger operation at up to 110-mph. Highway grade crossings would receive quad gates in compliance with FRA regulations, and private crossings would be either gated or closed.

Photo 11: Straight Track on the Fort Wayne line, County Road 75 Crossing east of Ada.

From Dunkirk, OH the proposed rail corridor heads west to Fort Wayne, passing through the towns of Ada, Lima, Delphos and Van Wert. East of Lima, a fair amount of old jointed rail is still in place and tie conditions show deferred maintenance on the lightly-used east end of the line. As a result, the cost estimate for rehabilitating this segment includes 40.8 miles of new 132# Continuous Welded Rail, so almost half the mileage between Dunkirk and Fort Wayne would receive new rail.

Photo 12: PRR #155 Jointed Rail still in service at Dola, Ohio

Short urban zones crossing street grids in Ada, Lima, Delphos and Van Wert need careful assessment in the Tier I EIS to develop the most appropriate grade crossing treatments.

- **Ada** - There are only two grade crossings and it is assumed that these can be fully treated using quad gates and other appropriate technology, so train operations would not be restricted through this area.
- **Lima** - an urban street grid system and two separate diamond rail grade crossings will limit maximum train speeds to 60-mph in the vicinity of the rail passenger station. There is also a 1˚ curve on the west end of town. However, these restrictions do not significantly affect trip times, since all trains are planned to stop in Lima anyway.
- **Delphos** - crossings are only mildly restrictive to operations, since the two curves at Delphos only measure 1˚ each. (In contrast, the curve in Van Wert is more than twice as sharp.) The maximum speed through Delphos was modeled as 79-mph assuming improvements to grade crossing and warning systems.
- **Van Wert** – this is the most restrictive urban zone east of Fort Wayne. In addition to crossing a dense urban street grid, there are two curves (one exceeding 2˚) and a diamond crossing of a rail branch line. A 60-mph speed limit was assumed here although it might be raised a little bit by the installation of an OWLS (One Way Low Speed) crossing diamond. Because of the difficulty of easing curves in a built up urban environment, a true high-speed option would likely need a new greenfield rail alignment to bypass Van Wert, Middle Point and Delphos.

Photo 13: Fort Wayne Line at Ada historic passenger station MP 245.5 - View east

Photos 14 and 15: CSX/NS Diamond Crossing and Train Station at Lima, OH

Photo 16: The main track alignment needs straightening in Delphos, OH

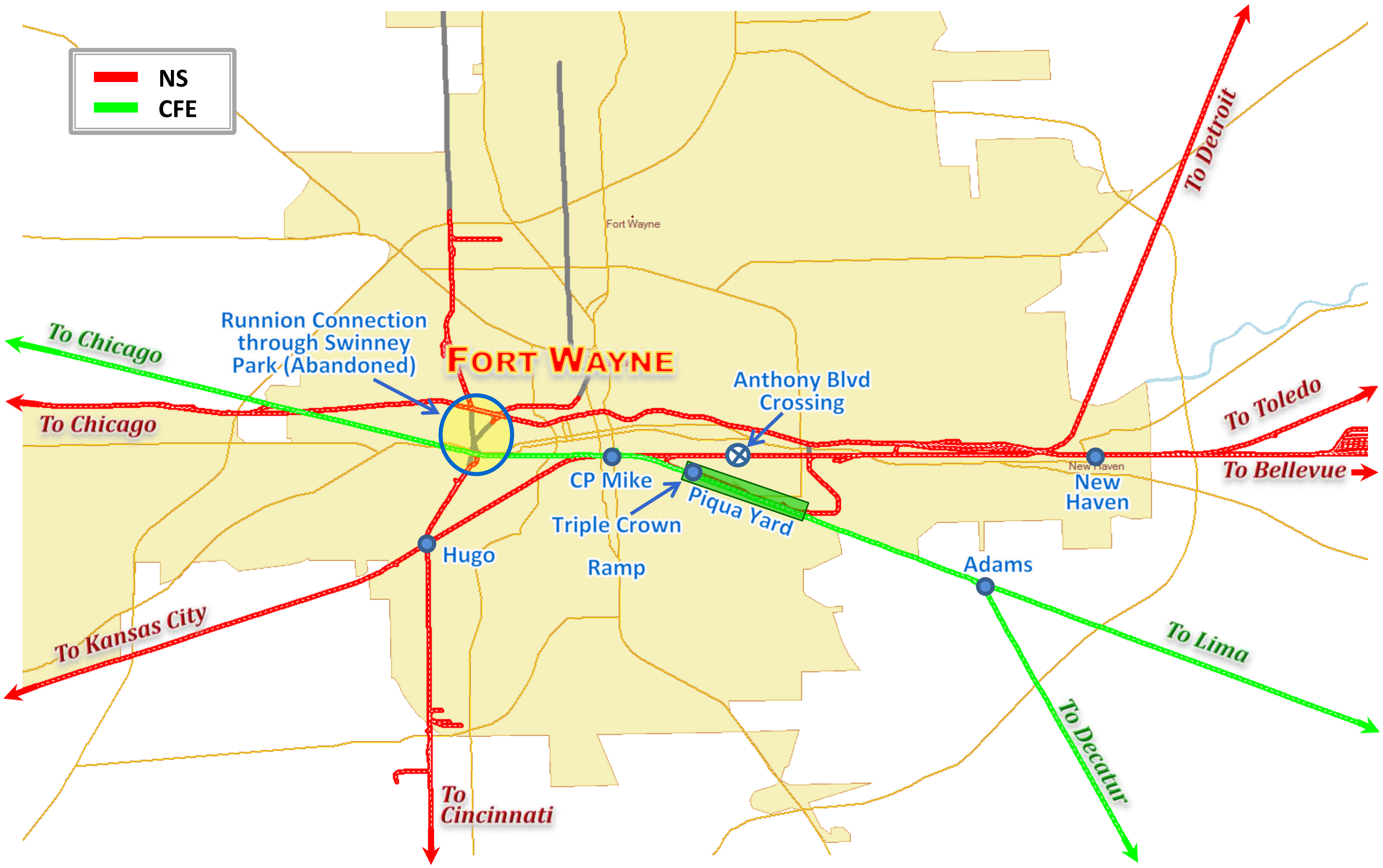
Photo 17: Urban Grid Crossings in Van Wert, OH

Photo 18: 2° Curve in built-up area of Van Wert, OH

Photo 19: Branch line connection and Crossing Diamond in Van Wert, OH

As shown in Exhibit 4-5, entering Fort Wayne, the rail alignment passes by Piqua Yard, crosses the Norfolk Southern mainline at Mike interlocking through a series of crossover switches, and enters the Fort Wayne train station. This segment needs to be carefully laid out to avoid imposing unnecessary speed restrictions on passenger trains. The Decatur branch joins at Adams several miles east of Fort Wayne, but this does not impose any need to reduce passenger train speeds.

Exhibit 4-5: Fort Wayne Terminal Area - Rail Map



Operationally and physically, Piqua Yard has been partitioned into two main sections –

- From Meyer Road to Pioneer Road, the eastern end of the yard is used by the CFE for assembling freight trains.
- From Pioneer Road to Mike interlocking, the western end is used by Norfolk Southern for their Triple Crown intermodal facility.

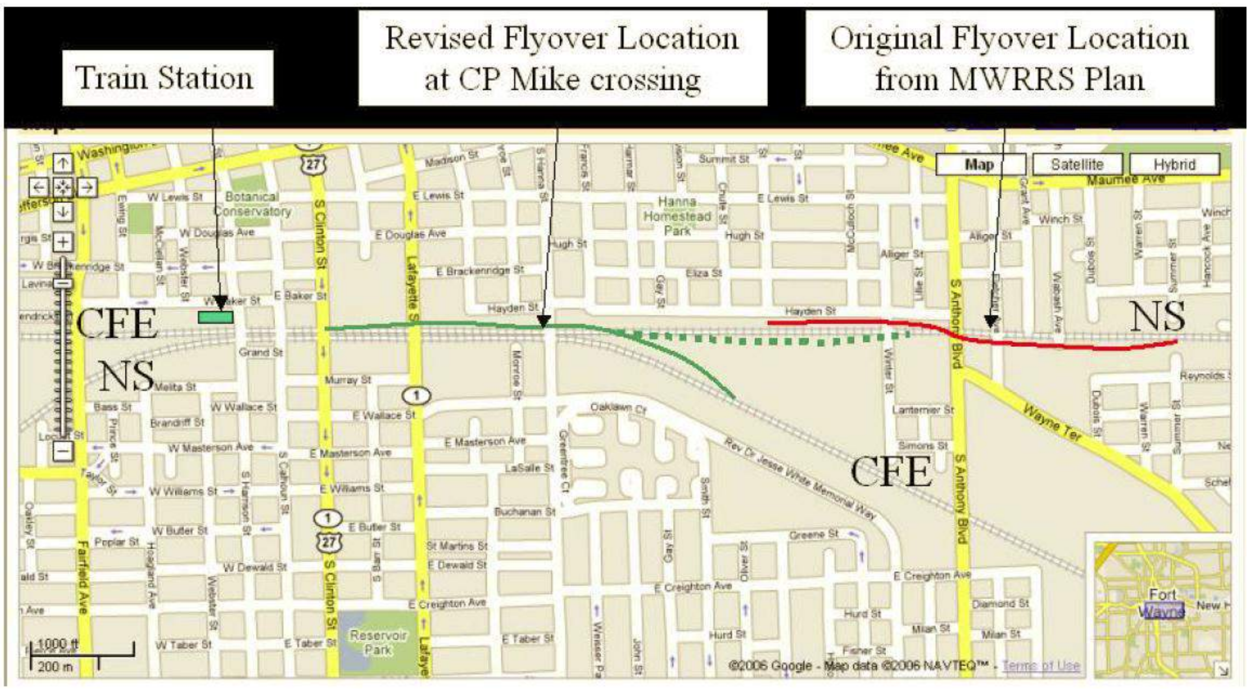
The main body of CFE yard tracks starts just west of the Meyer Road highway grade crossing, but from Meyer Road to Pioneer Road there is about 150' of unused Right of Way south of the tracks. This right of way could allow construction of a high-speed passenger track around the yard. Building this track may require some minor facility relocation, for example, the CFE freight car repair tracks would need to be moved to make room for this high-speed passenger track.

Photo 20: East end of Piqua Yard showing available Right of Way south of Track

Along the Triple Crown facility north of Pioneer Road, speeds need to be reduced on the final approach to Mike interlocking and the Fort Wayne rail station. Mike interlocking is also where the proposed Midwest Regional Rail (MWRRS) route to Toledo and Cleveland would join the Fort Wayne line, just east of the Fort Wayne train station. At Mike interlocking, a major rail grade separation has been proposed to eliminate conflict between crossing Norfolk Southern freight trains and the proposed passenger train operation. However, a grade separation structure at Mike interlocking is bound to be complicated – not only must the design take into account the need for diverging passenger movements (both towards Toledo/Cleveland and Columbus) but also it must not interfere with freight train movements at Mike interlocking, including NS movements in and out of the Triple Crown intermodal yard.

The 1997 Ohio Hub study (see Exhibit 4-6) identified a solution, although several other solutions may also be possible. It suggested shifting the already-planned MWRRS flyover a few thousand feet west so that the flyover would occur directly on top of Mike interlocking. Shifting the bridge farther west would allow both Columbus and Toledo/Cleveland passenger trains to use the proposed flyover. Trains would ascend to a switch on top of the bridge, where the tracks would split. The northern leg of the bridge would descend to the south side of the Norfolk Southern rail corridor for Toledo/Cleveland trains, while the southern leg would descend to the south side of the Fort Wayne line for Columbus trains. More recently the City of Fort Wayne has proposed to grade-separate the Anthony Boulevard grade crossing, the location of which can be seen in both Exhibits 4-5 and 4-6.

Exhibit 4-6: Passenger Flyover at CP Mike from 1997 Ohio Hub Study



As background, the 1997 report included a $20 million placeholder for "modifications" to the original MWRRS flyover; but the cost for the original structure had been separately estimated as $17.7 million, so the total structure would cost $37.7 million in 2002 dollars. Bringing this to current 2012 dollars, the cost of the passenger flyover at Mike has been estimated as $54 million. Clearly this Fort Wayne grade separation project would be one of the single most expensive investments needed to develop the corridor.

As a result, *four alternatives* for accomplishing this grade separation, plus a "No Build" option are proposed for consideration in the Tier I environmental evaluation –

a) Passenger trains fly over the freight line at Mike Interlocking, as described above.
b) Freight trains fly over the passenger line at Mike Interlocking; this simplifies the grade separation structure since a splitting design is not needed, but the freight requirement will likely be for a double tracked flyover structure featuring long approaches with gentle gradients.
c) Restore the historical Runnion Connection using the former NKP alignment through Swinney Park in west Fort Wayne; however unlike the original rail line, any restoration would need to include grade separations over the CFE rail line, Jefferson Boulevard and Main Street.
d) Restore the historical Runnion Connection using the former GR&I alignment through Swinney Park in west Fort Wayne; however including new grade separations over the Fort Wayne line and Jefferson Boulevard, and utilizing the existing GR&I bridge over Main Street.
e) No build –only incremental improvements to the existing at grade rail crossing – with no grade separation structures.

Photo 21: CP Mike Crossing in Fort Wayne, IN

Photos 22 and 23: Abandoned NKP Right of Way crossing Jefferson Boulevard, and Abandoned GR&I Bridge crossing Main Street in Fort Wayne

Appendix 5 provides more background on the context for the Runnion Connection options as well as potential impacts of the proposed rail grade separations on the City's plans for grade separating Anthony Boulevard. As a result, it is recommended that these options be further developed in the Tier I Environmental study, working directly with the freight railroads and community stakeholders, to identify the best solution for grade separating the rail lines through Fort Wayne. Exhibit 4-7 summarizes the cost of proposed improvements to this segment, which include –

- Install CTC and PTC signaling
- Install CWT and four quadrant gate grade crossing warning systems
- Upgrade the existing track to Class 6 for shared use by high-speed passenger and freight service. This includes installing new welded rail on nearly half the mileage, 40.8 miles of track.
- Construct 22 miles of double track on the existing roadbed to allow freight and passenger trains to pass
- Install chain link fencing through populated areas including: Ada, Lima, Elida, Delphos, Van Wert, Convoy, Monroeville, Maples, Adams, and Fort Wayne
- Construct a new flyover grade-separated crossing over the NS main line in Fort Wayne

The main costs are $59.5 million for upgrading the track, $31.3 million for the additional double track, $119.2 million for crossings and signals, and $54 million for the flyover of the NS line at Mike interlocking in Fort Wayne. Detailed costs are shown in Appendix 3.

Exhibit 4-7: Dunkirk to Fort Wayne Costs

Cost Category	110 - Diesel	
	Cost (1000s)	% of Total Segment Cost
Trackwork	$104,534	34.72%
Turnouts	$3,333	1.11%
Curves	$245	0.08%
Signals	$61,274	20.35%
Stations/Facilities	$2,868	0.95%
Bridge-Under	$40,807	13.55%
Bridge-Over	$0	0.00%
Crossings	$57,942	19.24%
Segment Total	$271,003	90.00%
Placeholders	$30,114	10.00%
TOTAL	**$301,117**	**100.00%**
Cost/Mile (82.9 Miles)	**$3,632**	

4.4.4 FORT WAYNE TO TOLLESTON

As discussed in the earlier sections on freight and historical context, the western end of the Fort Wayne line is no longer needed for mainline freight service, since both Norfolk Southern and CSX each have double-tracked high capacity lines entering Chicago. However, the route has excellent geometry that could potentially support world class high-speed service. As a result, it is proposed to develop a high capacity passenger rail line that can serve as the entryway into Chicago for *several* of the proposed eastern MWRRS and Ohio Hub passenger routes. As shown in Exhibit 4-8, direct or connecting services to Columbus, Toledo, Cleveland, Detroit, Indianapolis, Cincinnati and Louisville could all use the line.[11] Because of this very high planned passenger density, a higher level of investment is justified on this strategic section of corridor.

Exhibit 4-8: Strategic Significance of the Fort Wayne Line

This assessment will consider two speed options for the Fort Wayne to Chicago segment –

- First the development of the route to MWRRS basic 110-mph standards will be described.
- Then an enhanced 130-mph option will be developed.

This 130-mph option is based on the maximum speed capability of current diesel-electric train technology. Even higher speeds could be considered by a future assessment of electrification options. This analysis will show how the Fort Wayne line can be effectively developed into a high-capacity route for high-speed passenger trains.

From Fort Wayne, the proposed rail corridor heads west to Tolleston, IN, passing through the towns of Warsaw, Plymouth, Valparaiso and Gary. Because of the prior NS investment, the old jointed rail has already been largely eliminated and so the engineering cost estimate does not need to provide for any rail replacement.

[11]As a result, capital costs for developing this corridor segment are not solely attributable to the Columbus service, and can be shared as additional services are added.

Starting in Fort Wayne trains would stop at the historic passenger station site. The historic station building has been beautifully restored and could serve as a station once again. Alternatively a new rail facility could be developed in vacant land adjacent to the historic building. The Fort Wayne transit center is located adjacent to the rail station building. There is plenty of room on the rail right of way above the station to develop multiple platform tracks and a bypass track for freight trains.

Photo 24: Interior of the restored Fort Wayne train station

In regards to speed restrictions along the way, there are only a few minor speed restrictions associated with curves in the 110-mph option. For this option curve adjustments are limited only to minor easements and spiral adjustments within the right of way. The 130-mph upgrade option described next takes a more aggressive approach towards the few curve speed restrictions that exist along the line.

Short urban zones crossing street grids in Warsaw and Gary need careful assessment in the Tier I EIS to develop the most appropriate grade crossing treatments.

- **Warsaw** - Of these, the most restrictive urban zone is clearly at Warsaw. In addition to crossing a dense urban street grid, there are two curves (1˚ and 0˚ 40') and a diamond crossing of an NS main line track. The City of Warsaw wants to relocate the train station from its historical location to a new site, with better accessibility and parking. A 60-mph speed limit was assumed here.
- **Gary** - The Broadway area also features an urban street grid, but the rail right of way here is wide enough to set back adjoining development by a safe distance. Also the area through which the tracks pass is not a particularly pedestrian-friendly zone, so pedestrian conflicts did not appear to be a major issue. Our view was that conventional grade crossing treatments may suffice but nonetheless, planned train speeds have been restricted to 79-mph through this area.

Photos 25 and 26: NS Crossing Diamond and Urban Street Grid in Warsaw, IN

Photo 27: The Broadway area of Gary, IN. It can be seen that auto traffic density is high, but that the set back of adjoining development from the rail right of way is greater than it is at Warsaw. Also it is not a very pedestrian-friendly area.

In addition to the NS rail grade crossing at Warsaw (already mentioned) there are at- grade rail diamond crossings at Plymouth, Hanna, Spriggsboro and Tolleston. To eliminate the speed restrictions associated with these diamonds, the crossings would be dealt with as follows –

- **Plymouth** and **Hanna** – these at-grade rail crossings are light density branch lines. These two restrictions can be eliminated by installation of OWLS (One Way Low Speed) crossing diamonds.

- **Spriggsboro** –A grade separation of the CN mainline west of Valparaiso would be expensive. The 110-mph scenario accepted a 60-mph speed restriction, while the 130-mph scenario does implement a full grade separation here.

- **Tolleston** - The active CFE tracks end at Tolleston. Beyond Tolleston, tracks remain in place but are out of service past the Gary Airport to Buffington Harbor. The former diamond crossing at Tolleston would have to be restored if the Porter branch remains in place; but this analysis instead assumes that the Porter branch moves to the grade separated IHB Dune Park alignment.[12] Doing this would eliminate the need for the Tolleston crossing diamond and associated speed restriction. Alternatively if the Porter branch remains on its current alignment, then an OWLS (One Way Low Speed) crossing diamond may be considered for Tolleston.

4.4.5 130-MPH ENHANCEMENTS TO THE FORT WAYNE TO TOLLESTON SEGMENT

From Fort Wayne to Tolleston, to fully exploit the high-speed capability of the alignment, an enhanced 130-mph option has also been developed. The 130-mph option includes all the 110-mph improvements, along with full grade separation of all highway and mainline railroad crossings. The 130-mph option also addresses several curve speed restrictions which clear the way for sustained 130-mph running and for even higher speeds in the future. Specific improvements that are part of the 130-mph option include –

- Full grade separation of the urban street grids in Gary and Warsaw, mostly likely accomplished by raising the tracks, but the specific measures remain to be determined by a detailed environmental study.
- Full grade separation of the mainline railroad crossings at Warsaw and Spriggsboro. This eliminates potential freight/passenger train conflicts and delays, and eliminates 60-mph speed restrictions at these crossings.
- Approximately 5.2 miles of easements, the longest realignment of which would ease two 1° 30’ curves about 3 miles west of Columbia City, shown in Exhibit 4-9.

The cost increase associated with this set of grade separations and curve easements is estimated at $390 million. This difference includes an offset of approximately $86 million for avoiding cost of quad-gating and other conventional grade crossing treatments between Tolleston and Fort Wayne. That is, the $86 million quad-gating cost could be avoided by making an up-front commitment to full grade separation of the Chicago to Fort Wayne line rather than developing the line in two phases.

[12] At Tolleston, CFE trains current enter the CSX Porter branch to Indiana Harbor Belt’s Blue Island yard. If relocating the Porter Branch breaks the connection to Blue Island, there are several other options for freight trains coming off the west end of the Fort Wayne line. These include directly connecting to the CN at Spriggsboro, to the NS at Valparaiso, to the CSS&SB south of Gary Airport, or continuing along the passenger alignment to multiple rail connections at Buffington Harbor. From Plymouth, IN freight trains could connect to both CN and CSX at Walkerton, or continue onto the CSS&SB at Stillwell.

Photo 28: 1° 34' Curve at MP 344.5 west of Columbia City, there is a ravine on the inside of this curve.

Photo 29: 2° 06' Curve at MP 435.3 at Hobart.

Exhibit 4-9: Proposed Columbia City Curve Easement

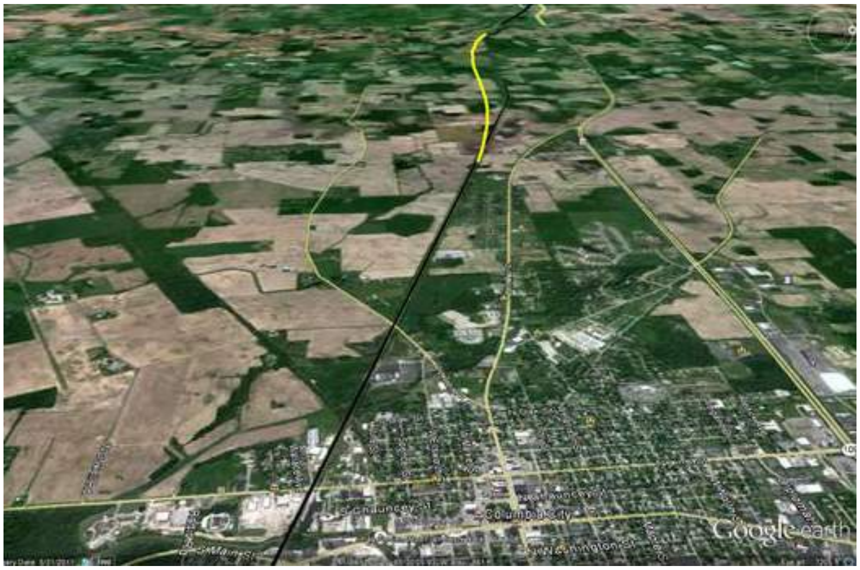


Exhibit 4-10 summarizes the cost of proposed improvements to this segment, which include –

- Install CTC and PTC signaling
- Install CWT and four quadrant gate grade crossing warning systems
- Upgrade the existing track to Class 6 for shared use by high-speed passenger and freight service.
- Construct 25 miles of double track on the existing roadbed to allow freight and passenger trains to pass
- Install chain link fencing through populated areas including: Columbia City, Pierceton, Warsaw, Bourbon, Plymouth, Hanna, Wanatah, Valparaiso, Hobart, and the Broadway area of Gary
- For the 130-mph option, construct a new flyover grade-separated crossing over the NS at Warsaw and the CN at Spriggboro. Implement full grade separation and ease 5.2 miles of curves.

The main costs are $73.1 million for upgrading the track, $35.6 million for the additional double track, $166.6 million for crossings and signals, and $390 million of additional costs for grade separations and curve easements, for the enhanced 130-mph option. Detailed costs are shown in Appendix 3.

Exhibit 4-10: Fort Wayne to Tolleston Costs

Cost Category	110 - Diesel		130 - Diesel	
	Cost (1000s)	% of Total Segment Cost	Cost (1000s)	% of Total Segment Cost
Trackwork	$108,820	34.18%	$108,820	15.36%
Turnouts	$12,094	3.80%	$12,094	1.71%
Curves	$0	0.00%	$0	0.00%
Signals	$80,066	25.15%	$80,066	11.30%
Stations/Facilities	$7,170	2.25%	$7,170	1.01%
Bridge-Under	$0	0.00%	$0	0.00%
Bridge-Over	$0	0.00%	$403,879	56.99%
Crossings	$86,456	27.16%	$0	0.00%
Segment Total	$294,606	92.54%	$612,029	86.37%
Placeholders	$23,747	7.46%	$96,613	13.63%
TOTAL	**$318,354**	**100.00%**	**$708,642**	**100.00%**
Cost/Mile (123.2 Miles)	**$2,584**		**$5,752**	

4.4.6 COMPARISON TO 2007 OHIO HUB PLAN

The main differences as compared to the earlier 2007 Ohio Hub study relate to the CSX Scottslawn and Toledo branch segments and to the final approach into downtown Columbus.

- Firstly, the 2007 study located the Columbus Multi-Modal Transportation Terminal on the Buckeye Line west of CP-138, between High St. and Front St. From this location an extended flyover structure (shown in Exhibit 2-53 of the 2007 report) was proposed to connect the Buckeye line back to both the Dayton District and Scottslawn Subdivision at CP Scioto. The cost of the Buckeye Line flyover would have been $78.9 million in 2012 dollars. Since the station location has now been relocated to the Columbus Convention Center, the costs for this flyover have been eliminated.

- However, this cost savings was largely offset by additional double tracking from Ridgeway all the way to Dunkirk, which is now included in the current plan.
- Finally, the 2007 plan was improved by adding the cost for a new 2-mile high-speed connection at Dunkirk, rather than the low-speed connection that had been assumed before.

Regarding the Fort Wayne line, there were few changes other than the development of the 130-mph enhanced option. It is noted that the 2007 Ohio Hub study already included costs for flyover rail grade separations at Ridgeway and Fort Wayne, and for approximately 50% rail replacement from Fort Wayne east to Dunkirk. These costs were retained from the earlier study and were upgraded to current 2012 dollars. Except for these changes, the engineering assumptions from the earlier studies were updated (based on an updated 2012 unit costing basis) for this study.

4.5 ROLLING STOCK COST

The Talgo T-21 train shown in Exhibit 4-11, was selected as a representative generic train consistent with the Midwest Regional Rail System (MWRRS) and other previous study assumptions. The T-21 is a passive tilt train that is capable of achieving speeds up to 130-mph. Although the T-21 is an attractive train, multiple equipment vendors could easily meet the assumed technical specification for both acceleration and tilt. For example, the T-21 tilts only 6 inches but the Acela tilts 7 inches. As a result, any active tilting train could easily meet the T-21 performance benchmark. The cost for a generic 130-mph diesel train shown in Exhibit 4-9 is $72 thousand per seat based on recent benchmarks. A 350-seat train would cost $25.2 million per trainset. The required fleet of 9 trainsets would cost $226.8 million in 2012 dollars.

Exhibit 4-11: Talgo T-21 Generic 130-mph Diesel Train

4.6 CAPITAL COST SUMMARY

The Capital costs were assessed in 2012 dollars for two alternatives –

- 110-mph diesel upgrades all the way from Columbus to Chicago
- A 130-mph enhanced option that grade separates and upgrades the Fort Wayne to Tolleston segment to allow 130-mph running, consistent with the top speed capabilities of the assumed diesel trainsets. From Fort Wayne to Columbus the infrastructure upgrades would be the same as in the 110-mph option.

These costs are summarized in Exhibit 4-12 below showing that the total cost ranges from $1.28 billion up to $1.68 billion, depending on the level of enhancements that the Fort Wayne to Tolleston segment receives. The $1.68 billion cost would result in an 130-mph speed all the way from Fort Wayne to Tolleston, but obviously it is possible to implement the investment in a phased manner. If a phased implementation were desired, then further analysis is needed to optimize the phasing.

Exhibit 4-12: Columbus-Fort Wayne-Chicago Capital Cost Summary

Infrastructure Breakdown 2012 US dollars (thousands)	Diesel 110 mph	Diesel 130 mph
Track	$ 1,013,198	$ 1,403,486
Stations	$ 45,849	$ 45,849
Total Cost 9 (350 seat) Trains	$ 226,800	$ 226,800
Total	**$ 1,285,847**	**$ 1,676,135**

4.7 IMPLEMENTATION PLAN

The business plan analysis has shown that the Chicago-Fort Wayne-Columbus line has independent utility and can be built as a free standing project once the South of the Lake improvement is implemented.

Given the feasibility level of the proposed capital cost program, an initial estimate of the project's program was developed. The construction plan assumed that a variety of financing techniques could be used to smooth the provision of capital while the construction program itself would reflect a far more peaked distribution. Exhibit 4-13 shows the capital cost distribution that was used for the economic analysis of the 110-mph option. Exhibit 4-14 shows the equivalent distribution for the slightly more expensive, enhanced 130-mph option.

Exhibit 4-13: Implementation Cash Flows for Diesel-110 Option

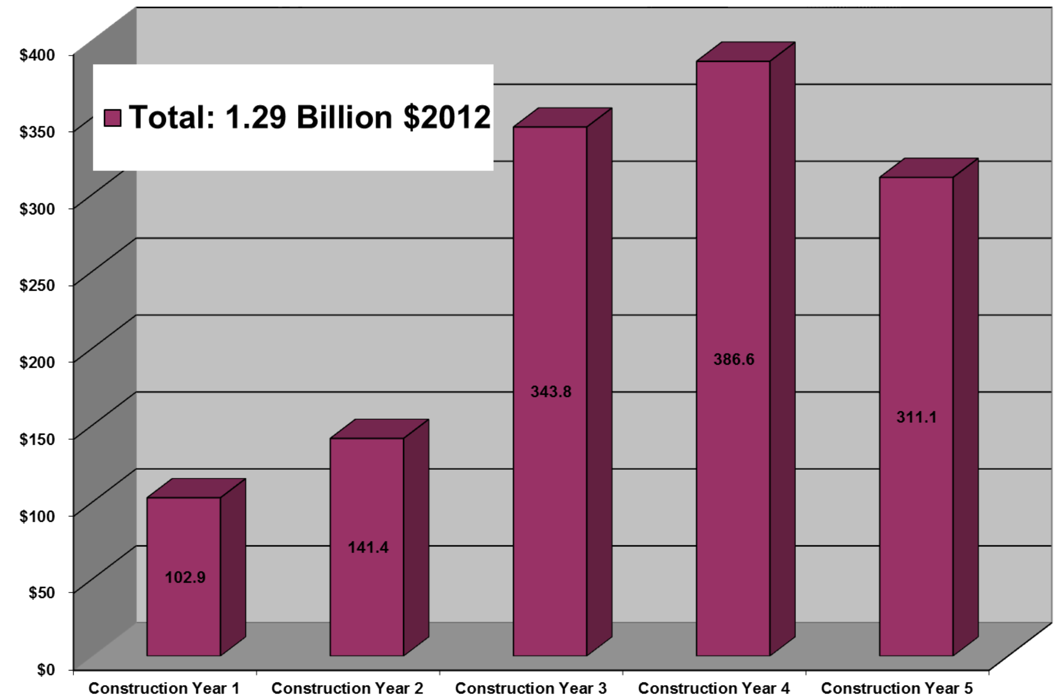
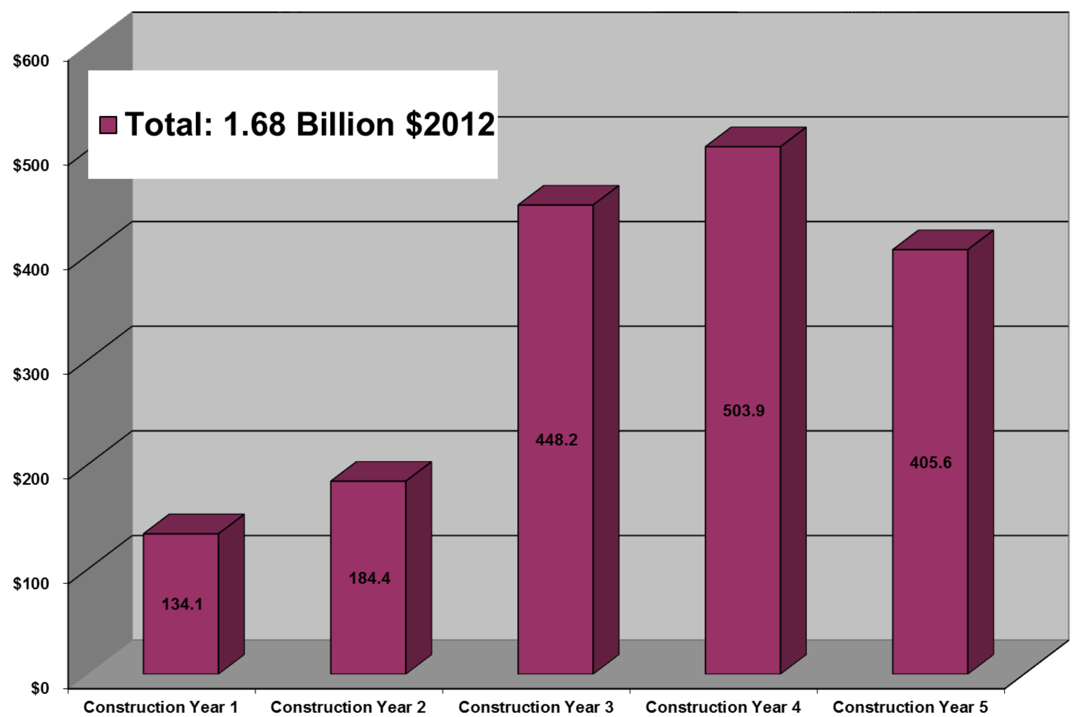


Exhibit 4-14: Implementation Cash Flows for Diesel-130 Option



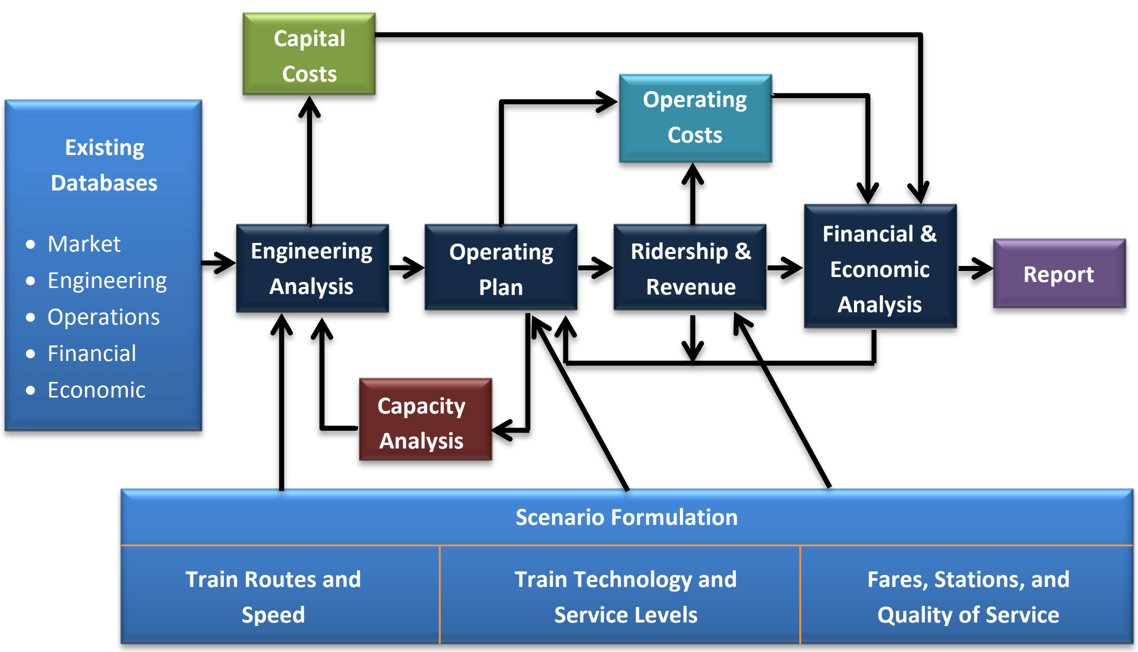
5 OPERATING PLAN AND COSTS

5. 1 INTRODUCTION

This section describes the development of the Operating Plan and Operating Costs for each of the two alternatives Diesel-110 and Diesel-130. This section develops the key processes and assumptions that will be used for developing passenger rail service scenarios and operating plans; it describes the methodologies that will be used to identify potential timetables, station stops and for assessing equipment technologies and fleet requirements.

As Exhibit 5-1 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, for providing enough capacity while still producing acceptable load factors. In addition, there is a need to respect financial constraints on system operation (e.g., the requirement for high-speed rail systems to produce a positive operating ratio.) The results of the interactive analysis are then used to identify system operating costs.

Exhibit 5-1: Business Planning Process – Interactive Analysis



As a rule, the higher ridership associated with faster options can also support more train frequencies, along with larger, more efficient trains. Train size and frequencies will be increased together, in a balanced way, to accommodate the ridership increase. Train frequency increases the ridership and revenue impact of an initial speed improvement. At the same time, ridership increases associated with higher speed options often allow the use of larger, more efficient trains. This is why an iterative approach is needed to identify the optimal investment and operating strategy for each corridor.

5. 2 TRAIN TECHNOLOGY ASSUMPTIONS

Key elements of the operating plan have significant implications for the procurement of rolling stock. An operating plan will be 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 train design can improve performance, by increasing rates of acceleration and braking, increasing operating speed and by permitting higher speeds through curves.

The North American passenger rail supply 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. Several electrified very high-speed intercity rail systems operate at much higher speeds throughout the world.

A key study assumption that determines transit time is a passenger car's "tilt" or "non-tilt" design. The track in curves is typically banked or "super elevated" up to six degrees (6˚), which results in designation of a "balance speed" for each curve, at which speed a vehicle occupant would feel no sideways force in the curve. However, vehicles typically operate around curves faster than this balance speed, since some sideways force is acceptable, and is actually helpful for preventing motion sickness. Up to four degrees (4˚) of imbalance (or "cant deficiency") is acceptable for passenger comfort. Beyond this, onboard hydraulic systems (active tilt) or car suspension designs (passive tilt) can permit even higher speeds, by lowering the centrifugal forces felt inside cars. Tilting rail vehicles typically employ three to five degrees (3˚ - 5˚) of tilt – allowing trains to go through curves with seven to nine degrees (7˚ - 9˚) of imbalance.

At speeds up to 160-mph -- typical for upgraded existing rail lines or interstate highway rights of way - tilting equipment is advantageous for increasing train speed. Specific applications include Talgo's passive tilting train such as the T-21 described in Chapter 4, as representative of the class of high-speed diesel trains that are appropriate for operation on existing rail lines at speeds of 90-130 mph. The Talgo T-21 is designed for commercial speeds of up to 130-mph, while electric Acela with an active tilting system, operates in the U.S. northeast corridor at commercial speeds of up to 160-mph.

True high-speed trains typically do not include tilting mechanisms, because the allowable cant deficiency reduces to only 2.5 degrees (2.5°) at 220-mph. This limitation on cant deficiency at the wheel-rail interface eliminates the benefit of tilt for true high-speed rail. It should be noted that the geometric standards for interstate highway alignments generally allow speeds of 125-150 mph which are in the effective range for tilting trains, but the curves are usually too sharp to support true high-speed trains (186-mph +). As a result, high-speed trains need very gentle curves, which are typically only obtained through development of new "greenfield" alignments. However, the Chicago- Fort Wayne- Columbus corridor presents an almost unique opportunity for an existing rail line because its geometry is so good. It could be possible to upgrade this corridor all the way up to 220-mph standards if desired while utilizing much of the existing rail right of way and infrastructure.

5.3 TRAIN PERFORMANCE AND SCHEDULE – DIESEL–110 AND DIESEL–130

The Diesel-110 and Diesel-130 options are both based on the identical generic, high-speed trains consistent with the MWRRS analysis. As described previously, both scenarios assumes diesel trains which can operate up to 130-mph on grade separated track; however, on upgraded track that still has highway grade crossings (and quad gates) FRA allows a maximum top speed of 110-mph.

Thus it is not the train technology, rather it is concern over the safety of grade crossings that has ultimately resulted in the design speed of 110-mph for most of the MWRRS system. Given a train frequency of 8-10 trains per day a design speed of 110-mph usually results in a "sweet spot" because it avoids the need for full grade separation. For many corridors, this speed has the lowest investment threshold for any service that is generally able to satisfy the FRA economic criteria (Positive Operating Ratio and Positive Cost Benefit ratio.)

Even so, higher levels of investment may be justified on busier lines so as the Fort Wayne to Tolleston segment which in the future is expected to carry trains from other cities as well as Columbus. Train speed profiles show the simulated train speeds, based on both track and equipment performance characteristics. Exhibits 5-2 and 5-3 show Express speed profiles for the 110-Diesel and 130-Diesel options. These show speed (in mph) on the Y-axis and cumulative distance from Chicago (miles) on the X-axis. Exhibit 5-4 shows the resulting train running times. The Express vs. Local stops were selected based on projected On/Off station volumes, as described in Chapter 2.

Exhibit 5-2: Chicago to Columbus, Diesel-110, 4-Stop Express in 3:45

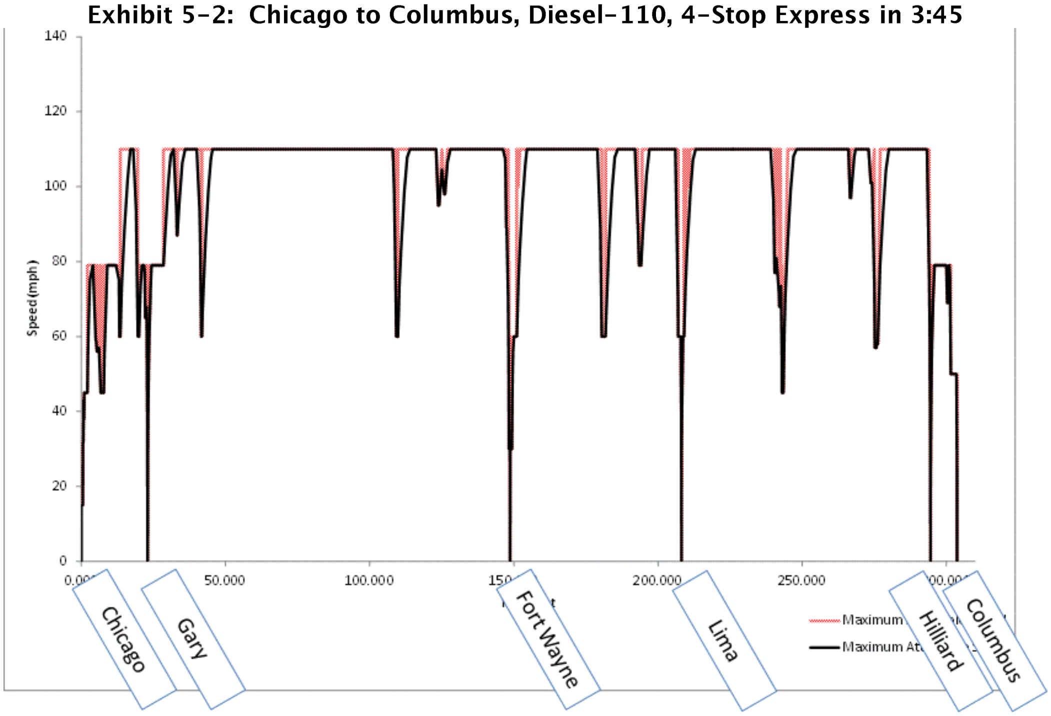


Exhibit 5-3: Chicago to Columbus, Diesel-130, 4-Stop Express in 3:20

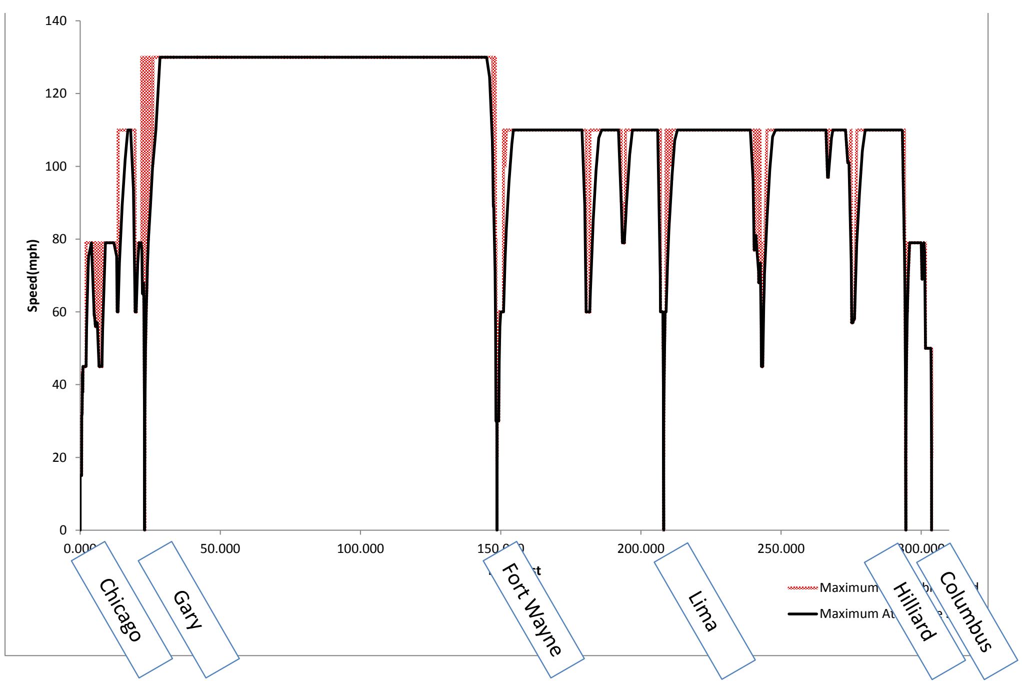


Exhibit 5-4: Chicago to Columbus, Running Times

	Diesel-110		Diesel-130	
From	**Express**	**Local**	**Express**	**Local**
Chicago Union Station, IL	0:00	0:00	0:00	0:00
Gary Regional Airport, IN	0:24	0:24	0:23	0:23
Valparaiso, IN	-	0:38	-	0:36
Plymouth, IN	-	1:01	-	0:57
Warsaw, IN	-	1:18	-	1:13
Ft. Wayne, IN	1:38	1:47	1:30	1:39
Lima, OH	2:22	2:31	2:11	2:20
Kenton, OH	-	2:54	-	2:40
Marysville, OH	-	3:26	-	3:07
Hilliard, OH	3:31	3:45	3:09	3:23
Columbus, OH	3:45	3:59	3:20	3:34

5.4 TRAIN TIMETABLE AND CYCLING

A pro-forma train schedule and equipment cycling analysis was conducted for a "worst case" 12-round trip timetable. To develop the "worst case" schedule, the 4-hour local train running times were selected from the 110-Diesel local train result. Then a set of pro-forma of train schedules were developed based on this "worst case" running time. This is not proposed as an actual operating timetable but only shows that six trains could cover twelve round trips per day, even if all the trains operated as locals. If express trains or 130-mph speed improvements were introduced, this cycling schedule would still be feasible because equipment turn times would exceed the 30-minute minimum that is required for reversing the train direction, light cleaning and restocking of the train between trips. Each train would make two round trips based on the indicated schedule. Based on this, a fleet of 9 trains would allow –

- Six trains in active service
- One train in the shop
- Two trains on hot standby ("protect")

Exhibit 5-5 shows the detailed train schedules along with the train which is assigned to cover that trip. Exhibit 5-6 shows the resulting equipment rotations and scheduled endpoint terminal layovers. This shows that 12 Round Trips can be covered by 6 active trains.

Exhibit 5-5: Diesel - 110 - "Worst Case" 4:00 Timetable with Train Equipment Assignments

EASTBOUND (Chicago - Fort Wayne - Columbus)

	Chicago	Ft Wayne	Columbus	*Trip Time*	TRAIN	Trip #
Regular	5:00	6:45	9:00	*4:00*	2	1
Super Exp	6:00	7:45	10:00	*4:00*	4	1
Express	7:00	8:45	11:00	*4:00*	6	1
Local	9:25	11:10	13:25	*4:00*	1	2
Regular	10:00	11:45	14:00	*4:00*	3	2
Express	11:30	13:15	15:30	*4:00*	5	2
Local	14:30	16:15	18:30	*4:00*	2	3
Regular	16:00	17:45	20:00	*4:00*	4	3
Express	17:00	18:45	21:00	*4:00*	6	3
Regular	18:30	20:15	22:30	*4:00*	1	4
Express	19:00	20:45	23:00	*4:00*	3	4
Super Exp	21:00	22:45	1:00	*4:00*	5	4

WESTBOUND (Columbus - Fort Wayne - Chicago)

	Columbus	Ft Wayne	Chicago	*Trip Time*	TRAIN	Trip #
Super Exp	4:55	7:10	8:55	*4:00*	1	1
Regular	5:25	7:40	9:25	*4:00*	3	1
Super Exp	6:00	8:15	10:00	*4:00*	5	1
Super Exp	9:30	11:45	13:30	*4:00*	2	2
Local	10:30	12:45	14:30	*4:00*	4	2
Regular	11:30	13:45	15:30	*4:00*	6	2
Super Exp	14:00	16:15	18:00	*4:00*	1	3
Local	14:30	16:45	18:30	*4:00*	3	3
Regular	16:30	18:45	20:30	*4:00*	5	3
Express	19:45	22:00	23:45	*4:00*	2	4
Super Exp	20:30	22:45	0:30	*4:00*	4	4
Regular	21:30	23:45	1:30	*4:00*	6	4

Exhibit 5-6: Train Rotations and Layovers

TRAINSET #	Trip #	From	Depart	To	Arrive	Dwell
1	1	Columbus	4:55	Chicago	8:55	
1	2	Chicago	9:25	Columbus	13:25	0:30
1	3	Columbus	14:00	Chicago	18:00	0:35
1	4	Chicago	18:30	Columbus	22:30	0:30
2	1	Chicago	5:00	Columbus	9:00	
2	2	Columbus	9:30	Chicago	13:30	0:30
2	3	Chicago	14:30	Columbus	18:30	1:00
2	4	Columbus	19:45	Chicago	23:45	1:15
3	1	Columbus	5:25	Chicago	9:25	
3	2	Chicago	10:00	Columbus	14:00	0:35
3	3	Columbus	14:30	Chicago	18:30	0:30
3	4	Chicago	19:00	Columbus	23:00	0:30
4	1	Chicago	6:00	Columbus	10:00	
4	2	Columbus	10:30	Chicago	14:30	0:30
4	3	Chicago	16:00	Columbus	20:00	1:30
4	4	Columbus	20:30	Chicago	0:30	0:30
5	1	Columbus	6:00	Chicago	10:00	
5	2	Chicago	11:30	Columbus	15:30	1:30
5	3	Columbus	16:30	Chicago	20:30	1:00
5	4	Chicago	21:00	Columbus	1:00	0:30
6	1	Chicago	7:00	Columbus	11:00	
6	2	Columbus	11:30	Chicago	15:30	0:30
6	3	Chicago	17:00	Columbus	21:00	1:30
6	4	Columbus	21:30	Chicago	1:30	0:30

5.5 OPERATING COSTS

This section describes the build-up of the unit operating costs and the structure of the operating cost model. The bottom-up costing framework that was originally developed for the US Midwest Regional Rail System[1] (MWRRS) and Ohio Hub studies was adopted for this study. This enables the development of costs based on directly-controllable and route-specific factors, and allows sensitivity analyses to be performed on the impact of specific cost drivers. It also enables direct and explicit treatment of overhead cost allocations to ensure that costs which do not belong to a corridor are not inappropriately allocated to the corridor, as would be inherent in a simple average cost-per-train mile approach. This also allows benchmarking and direct comparability of forecasted costs with those estimated for other North American High-Speed rail systems.

An important issue for costing is the degree to which new operating methods can be introduced along with new technology. For example, 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. For example, in the original 2000 MWRRS Plan, European equipment maintenance 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 was more consistent with Amtrak's current cost structure.

Nine specific categories of rail costs were used for this study, as shown in Exhibit 5-7. Operating costs can be categorized as variable or fixed. As described below, fixed costs include both Route and System overhead costs. Route costs can be clearly identified to specific train services but do not change much if fewer or additional trains are operated. Train-mile driven variable costs[2] include equipment maintenance, energy and fuel, train and onboard service (OBS) crews, and insurance liability. Ridership drives marketing and sales costs. Fixed costs include administrative costs, station costs, and track and right-of-way maintenance costs. Costs for maintenance of signals, communications and power supply systems are included in the track and right-of-way costs.

[1] As background, the MWRRS costing framework was originally 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 methodology has however, been more recently 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 data on Illinois and Oklahoma operations that was provided by Amtrak. It has been brought to a 2012 costing basis and includes additional cost categories, such as electrification, the unit costs for which have been added into the MWRRS framework.

[2] Some of these cost drivers can be refined in future, more detailed studies. For example once detailed operational timetables are finalized, explicit crew schedules can be developed (including terminal layovers, deadhead, and extra board requirements) to develop a more precise estimate of crew costs.

Exhibit 5-7: Rail Cost Categories

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

- **Variable 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, train control 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 fine-tuned and updated to 2012 dollars consistent with the ridership/revenue and capital cost projections, then applied to the train-miles, number of stations, passenger volumes and other cost factors developed specifically for this study.

Cost factors that vary by train technology, such as fuel usage and equipment maintenance, were developed from discussions with manufacturers and/or users of the technology and/or by cost benchmarking from both public and confidential sources. In development of the cost database, we focused on fine-tuning those items with the greatest potential impact on the bottom line. 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 base-line cost data. However, when the rail service is actually implemented in the future, some costs such as track access fees may be subject to further negotiation between the infrastructure owner and the contract rail operator(s).

- Freight railroads will maintain the track and right-of-way that they own, but ultimately, the actual cost of track maintenance will be resolved through negotiations with the railroads.

- While the original 2000 MWRRS costing basis assumed that maintenance of train equipment would be contracted out to the equipment supplier, it was subsequently raised to a level more consistent with Amtrak's current cost. The current cost basis is consistent with the anticipated maintenance level required for each train technology but is consistent with VIA's existing labor agreements and pay scales.

- Train operating practices follow existing work rules for crew staffing and hours of service to develop an average rate per train-mile.

Exhibit 5-8 summarizes the operating unit costs that were used for this study.

Exhibit 5-8: Operating Unit Cost Summary

Variable Per Train Mile		
Train Crew (3-person)	$	4.92
OBS (1-person)	$	2.56
Equip Mtce (for 300 seat train)	$	12.34
Fuel or Energy (for 300 seat train)	$	8.71
Variable Per Other		
Insurance per Psgr Mile	$	0.014
Call Center per Rider	$	0.709
Credit Card + Travel Agency Commissions of Rev		2.8%
Fixed Costs		
Stations (Staffed)	$	644,640
Stations (Unstaffed)	$	80,580
Dedicated Guideway per Track Mile	$	53,720
Admin and Mgt Fixed	$	1,745,900
Admin and Mgt Var TM	$	1.64

5.5.1 VARIABLE COSTS

Variable costs include those that directly depend on the number of train-miles operated or passenger volumes handled. They include train equipment maintenance, train crew cost, fuel and energy, onboard service, and insurance costs.

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, tilting 130-mph diesel train (such as the Talgo T-21) in US $2002. This was updated to $12.34 per train mile for a 300-seat train in 2012 dollars.

TRAIN CREW COSTS

The train operating crew incurs crew costs. Following Amtrak staffing policies, the operating crew would consist 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. Costing of train crews was based on Amtrak's 1999 labor agreement, adjusted for inflation to 2012.

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. For this study, an intermediate value of $4.92 per train mile was selected for 110-mph scenarios. A higher rate would have been used for a conventional Amtrak 79-mph service, and a lower rate would be used for a 220-mph electric service.

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.

The goal of 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. 350-seat trains as recommended here should provide a comfortable positive profit margin for the OBS operator.

Because the trolley cart has been shown to double OBS revenues, it can result in profitable OBS operations in situations where a bistro-only service would be hard-pressed to sell enough food to recover its costs. 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 $2.56 per train mile. This cost is generally 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[3].

FUEL AND ENERGY

Both the ridership and operating cost models are based on fuel costs in $2012 and that will form the basis of the demand model calibration. 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. A consumption rate of 2.42 gallons/mile[4] 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. Assuming $3.60 a gallon for diesel fuel according to Energy Information Administration (EIA)[5], this

[3] 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.

[4] The same fuel rates from the MWRRS study were applied to both the 110-mph and 130-mph scenarios. In the 130-mph scenario it should be noted that curve easements and urban area improvements have eliminated the acceleration and braking that were needed by the 110-mph option, offsetting some of the energy requirements for the higher speed. Also the diesel engine is operating at higher thermodynamic efficiency when running at full throttle. These fuel differences were considered too close to call for a feasibility-level analysis but could be refined in future work.

[5] EIA diesel retail price in 2012 excluding the taxes http://www.eia.gov/petroleum/gasdiesel/

translates into a cost of $8.71 per train mile, roughly doubling the cost of diesel fuel as compared to the earlier MWRRS study.

INSURANCE COSTS

Liability costs were estimated at 1.4¢ per passenger-mile, the same rate that was assumed in the earlier MWRRS study brought to 2012 dollars. 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 General Accounting Office (GAO) review 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 rail franchisee operators. 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. It is recommended that the agency sponsoring the rail service seek qualified legal advice on this matter.

5.5.2 FIXED ROUTE COSTS

This cost category includes those costs that, while largely independent of the number of train-miles operated, can still be directly associated to the operation of specific routes. It includes such costs as track maintenance, which varies by train technology and station operations.

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, 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, the rail corridors would need 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. The following cost components are included within the Track and Right-of-Way category:

- **Costs for track maintenance** are estimated based on Zeta-Tech's6 January 2004 draft technical monograph Estimating Maintenance Costs for Mixed High-Speed Passenger and Freight Rail Corridors. Zeta-Tech costs will be adjusted for inflation to $2012. 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.

Exhibit 5-9 shows the conceptual relationship between track maintenance cost and total tonnage that was calibrated from the original 2002 Zeta-Tech study. It shows a strong relationship between tonnage and maintenance cost for FRA track classes 4 through 6 (corresponding to a 79-mph to 110-mph track speed[7].) 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. For shared track, 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, would come to about $25,000 per mile per year (in 2002 $USD).

[6] Zeta-Tech, now a subsidiary of Harsco rail, has been a leading consultancy and applied technology firm dedicated in particular to railway track maintenance issues. They were contracted by FRA to develop a track maintenance costing methodology for the MWRRS. For more on this firm, see: http://www.zetatech.com/

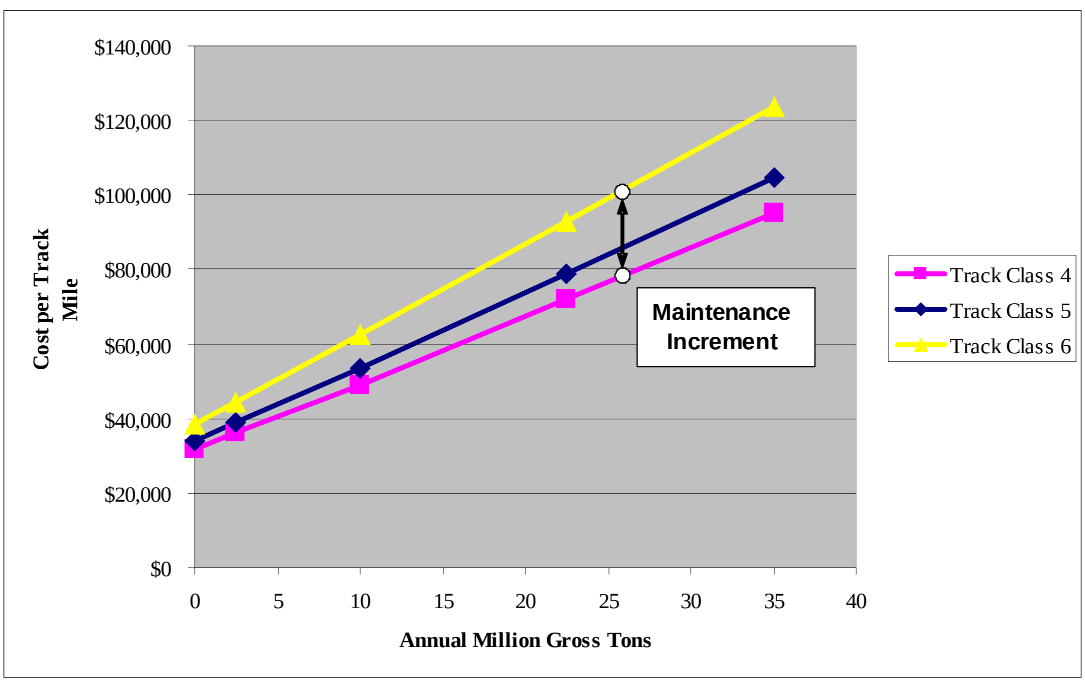
[7] For more background on FRA's Track Classification system, a good reference is:
http://trn.trains.com/en/Railroad%20Reference/ABCs%20of%20Railroading/2006/05/Track%20classifications.aspx

The required payment to reimburse a freight railroad for its added track cost would be less for lower freight tonnage and more for higher freight tonnage.

The cost of shared track depends strongly on the level of *freight* tonnage, since passenger trains are relatively lightweight and do not contribute much to the total tonnage. In fact, following the Zeta-Tech methodology, the "maintenance increment" is calculated based on *freight tonnage only*; since a flat rate of $1.56 per train mile (2002 $USD) as used in the Zeta-Tech report, was already included 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 includes an allocation of a freight railroad's fixed cost. An allowance of 39.5¢ per train-mile has also been added for freight railroad dispatching and for out-of-pocket costs.

The Zeta-Tech cost function can also be used for costing dedicated passenger track such was assumed for this study. With dedicated track, the passenger system is assumed to cover the entire cost for maintaining its own track. (Freight would then have to reimburse the passenger operator on a car-mile basis for any damage it causes to the passenger track.) Because passenger train tonnage is very low, however, it can be seen that the cost differential between Class 4, 5 and 6 track is very small. Adjusting Zeta-Tech's 2002 costs shown in Exhibit 7-4 up to 2012 dollars, the average annual cost per track-mile for maintaining dedicated Class 4 track is about $48,000; the cost for Class 6 track is $53,720, and for Class 7/8 track $55,700.

Exhibit 5-9: Zeta-Tech Track Maintenance Cost Function (in $US 2002)



In addition to an operating component of track maintenance cost, Zeta-Tech's 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 (see Exhibit 5-10). A normalized capital maintenance level is not reached until 20 years after completion of the rail upgrade program.

Exhibit 5-10: 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 was treated as a direct operating expense. Capital maintenance costs were 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, they usually 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.

STATION OPERATIONS

A simplified fare structure, heavy reliance upon electronic ticketing and avoidance of a reservation system, was assumed by the current study to minimize station personnel requirements. Station costs include personnel, ticket machines and station operating expenses.

- Staffed stations will be assumed at major stations. All stations were assumed open for two shifts. The cost for the staffed stations includes eight positions at each new location, costing $644,640 per year in 2012 dollars, as well as the cost of utilities, ticket machines, cleaning and basic facility maintenance.
- The cost for unstaffed stations covers only the cost of utilities, ticket machines, cleaning and basic facility maintenance, costing $80,580 per year. Volunteer personnel such as Traveler's Aid, if desired could staff these stations.

The station 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.

SYSTEM OVERHEAD COSTS

The category of System Overhead largely consists of Service Administration or management overheads, covering such needs as the corporate procurement, human resources, accounting, finance and information technology functions, as well as call center administration. A stand-alone administrative organization appropriate for the operation of a corridor system was originally developed for the MWRRS and later refined for the Ohio Hub studies. This MWRRS organizational structure was developed with Amtrak's input and had a fixed cost of $8.9 million plus $1.43 per train-mile (in US 2002 dollars) for added staff requirements as the system grew.

However, the Sales and Marketing category also had a substantial fixed cost component for advertising and call center expense. The primary expenses represented in this category consist of a $2.3 million per year fixed cost for advertising and call center expenses[8]. Assuming some flexibility for assigning personnel to accommodate peaks in volume and a 20 percent staffing contingency, variable call center costs came to 57¢ per rider (in US 2002 dollars). Finally, credit card and travel agency commissions were all variable: 1.8 percent and 1 percent of revenue, respectively.

Therefore, the overall financial model for a Stand-alone organization has $11.2 million ($8.9 + $2.3 million, US $2002) annually in fixed cost for administrative, sales and marketing expenses, plus

[8] 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.

$1.43 per train-mile and 57¢ per rider variable costs in US 2002 dollars. Based on the Consumer Price Index tables[9], this was inflated by 25% to $14.0 Million fixed and 70.9¢ per rider variable costs in US 2012 dollars. The train-mile rate was inflated by a more moderate 15% to $1.64 per train mile reflecting a 1% efficiency gain per year through the application of information technology which offsets some of the inflationary growth of variable administrative expenses.

However, the planned Chicago-Fort Wayne-Columbus corridor would be able to share either the MWRRS or Ohio Hub administrative cost structure, so the Columbus line has received only an equitable share (1/8) of the fixed administrative cost. (The remainder of this cost would be the responsibility of other MWRRS routes.) This allocated administrative cost is $1,745,900 per year plus the variable overheads of $1.64 per train mile, 2.8% of revenue for Travel Agency and Credit Card commissions, and 70.9¢ per rider for variable call center expenses.

5.6 2030 OPERATING COST RESULT

Exhibits 5-11 and 5-12 summarize the operating cost results in 2030 for the Diesel-110 and Diesel-130 options. 2030 was used as the sample year, because it reflects a fully "ramped up" operational result approximately mid-way through the life of the system. This it reflect a more "typical" or "average" operating result than would an early or late year. These cost breakdowns are seen to be very similar.

- For **Diesel-110** -- to handle the anticipated demand and given the planned frequency of 12 round trips per day, 350 seat trains are needed. In 2030, overall costs are $125.9 million for 2.14 million Train Miles. This yields an average cost of $58.91 per train mile for a 350-seat train.
- For **Diesel-130** -- the enhanced diesel option with 130-mph running west of Fort Wayne -- 350 seat trains are still needed. The train size didn't need to go up because fare increases held ridership close to its original value. In 2030, overall costs are $127.5 million for 2.14 million Train Miles. This yields an average cost of $59.65 per train mile for a 350-seat train.

[9] See: ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt

Exhibit 5-11: 2030 Operating Cost Breakdown for Diesel-110

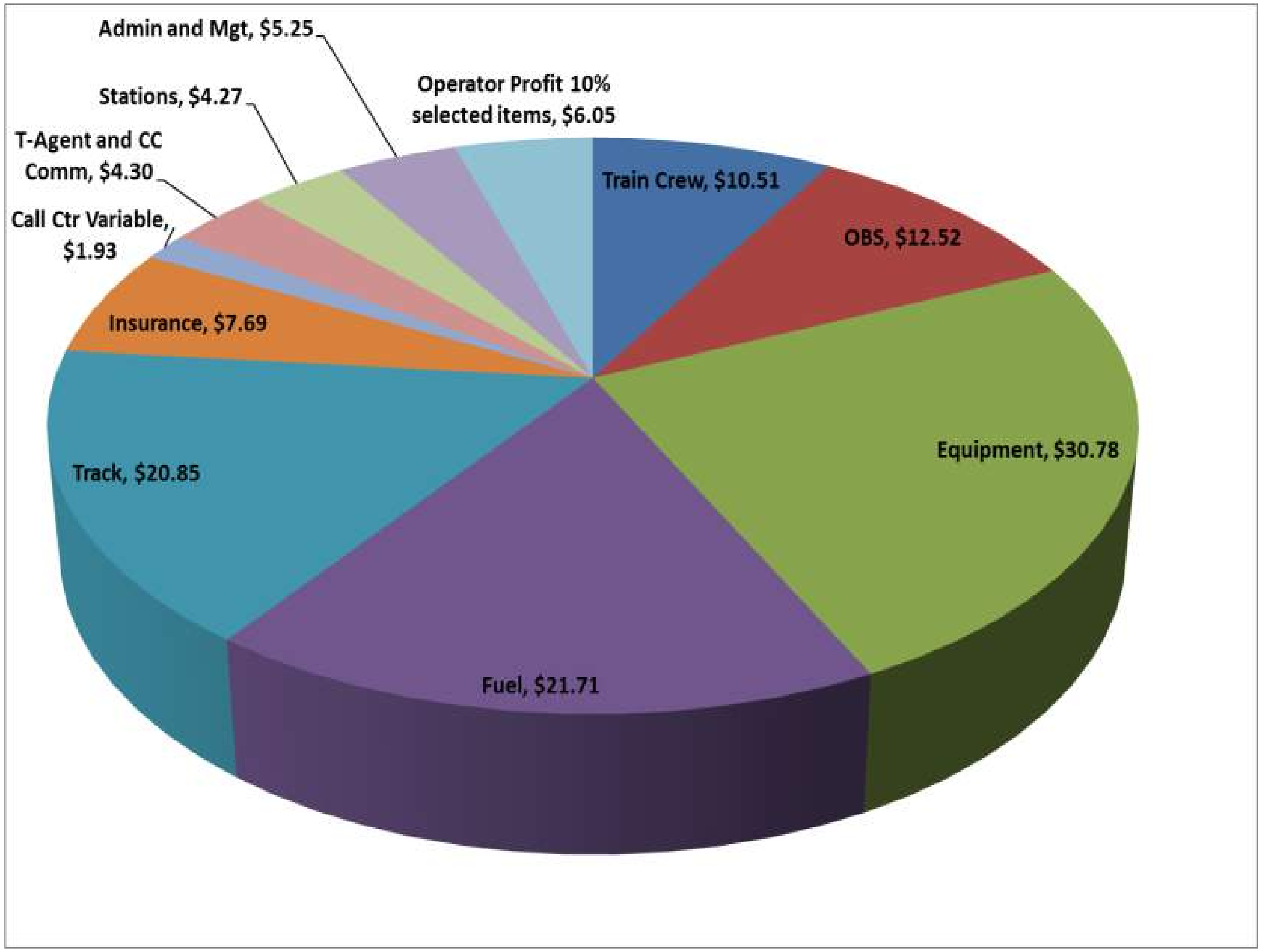
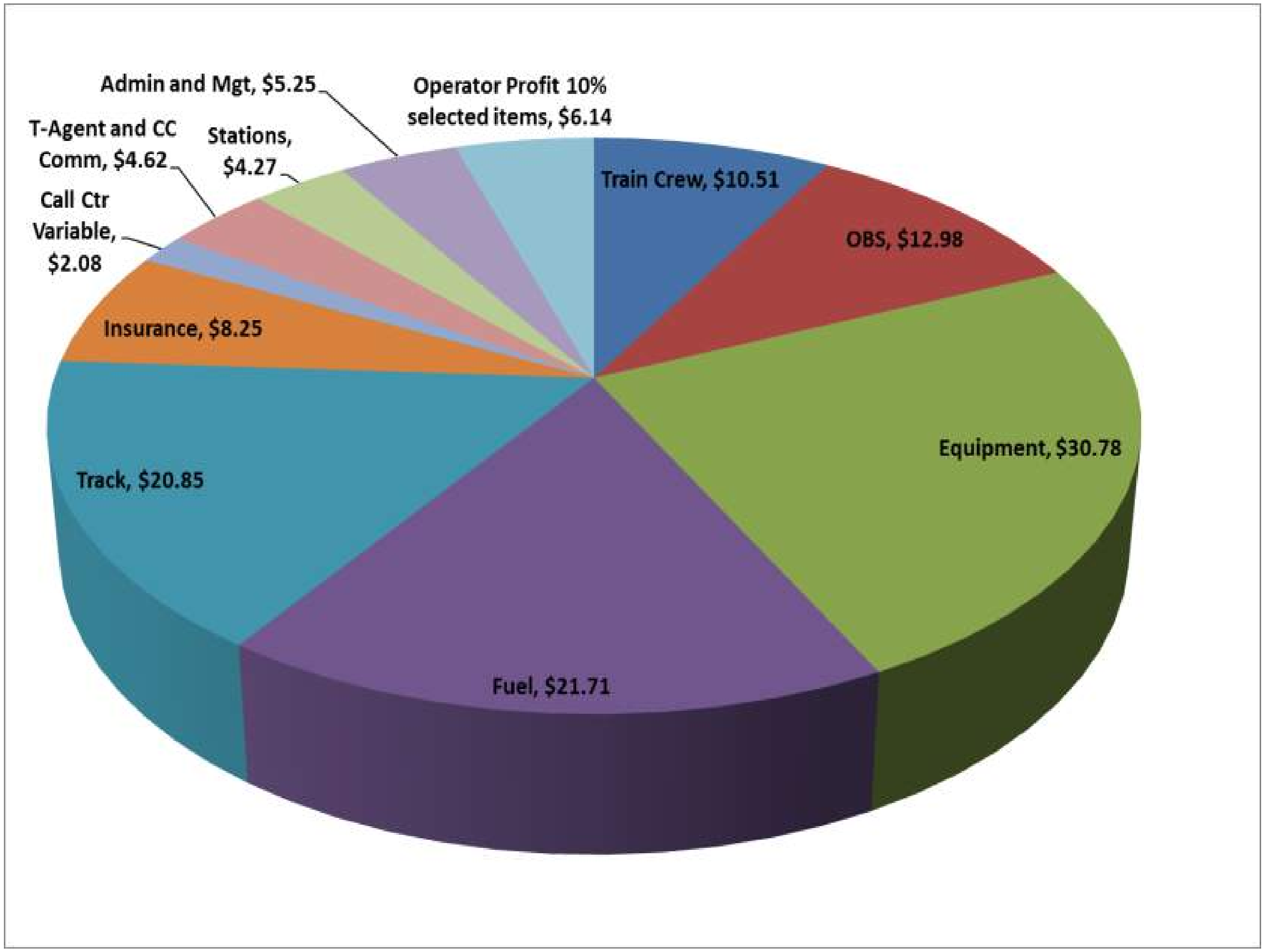


Exhibit 5-12: 2030 Operating Cost Breakdown for Diesel-130



6 EVALUATION OF ALTERNATIVES

6.1 STUDY OBJECTIVES

This analysis uses the same criteria and structure as the 1997 FRA Commercial Feasibility Study. 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, 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."

Operating ratios are usually expressed on a year-by-year basis, but they can also be expressed as a Present Value of Revenue / Present Value of Operating Cost over the lifetime of a project.

Benefit Cost ratios are usually expressed as a Present Value of Total Benefit / Present Value of Total Cost over the lifetime of a project.

At a feasibility level of study, analysis is based on a number of assumptions that are needed to carry out the analysis. These assumptions include such factors as: rate of socioeconomic growth, rate of demographic growth, rate of energy price increase and the capital cash flows in accordance with a multi-year, implementation plan. Once more detailed assessments are made and more specific information on the rate of ridership and revenue growth and a system implementation plan detailing the capital cash flows become available, then that information can be included to further refine the initial estimates of the Financial Return and Benefit Cost ratio.

This chapter describes the process by which the alternatives were evaluated and how this analysis lead to the identification of a number of feasible options based on the economic and financial criteria adopted.

6.2 FINANCIAL AND ECONOMIC OBJECTIVES

For each alternative being evaluated, measures of financial and economic efficiency were calculated. These measures were determined from assessments integrating the forecasted capital, operating and maintenance costs with the forecasted revenue projections over the lifetime of the project. Specifically, the analysis was based on the following components –

- Operating and implementation plans for the alternative passenger rail service options
- Cost estimates for operations, infrastructure and acquisition of rolling stock
- Ridership and revenue estimates based on projected travel demand. These forecasts include assumptions regarding fare levels and oil prices, highway congestion and the responsiveness of the air industry to the introduction of the Diesel 110mph and 130mph Alternatives.
- Cash flow analysis that includes statements of revenues and expenses for each alternative.

Two measures, net present value (NPV) and Benefit Cost ratio were used to evaluate the economic returns of the system. Similar measures, net present value (NPV) and Operating ratio, were used to evaluate the financial returns and the potential for franchising the operations

Both measures require the development of a project's year-by-year financial and economic returns, which are then discounted to the base year to estimate present values (PV) over the lifetime of the project. For this analysis, a 30-year project life from 2020 to 2050 was assumed, with an five year implementation period from 2013-2017, and two years of ramp-up from 2018-2019. Revenues and cost cash flows were discounted to the 2010 base year using two discount rates: 3 percent and 7 percent. The 3 percent discount rate reflects the real cost of money in the market as reflected by the long term bond markets, and the 7 percent discount rate reflects the Federal government's desire to establish a benchmark comparison by discounting long term benefits at a greater rate than the market for public securities.

The operating ratios reported here in this chapter, follow a commercial criteria definition; but are different from the commercial operating ratio calculations that are typically presented by freight railroads and intercity bus companies. For the current analysis, the selected feasibility criteria were as follows –

- The Operating Ratio as calculated here includes direct operating costs only. The operating ratio calculations presented here do not include capital costs, depreciation or interest. The costs used are incremental costs.
- The Operating Ratio presented here is defined as Revenues/Costs. It should be noted that freight railroads and intercity bus companies typically define it as the reciprocal

Costs/Revenues.

As defined by this analysis, a positive operating ratio does not imply that a passenger service can attain full financial profitability by covering its capital costs, but it does allow the operation to be franchised and operated by the private sector. The definition puts passenger rail on the same basis as other passenger transportation modes, such as intercity bus and air, where the private sector operates the system but does not build or own the infrastructure it uses. It does, however, pay access fees paid to the freight railroads where they own the track. In the case of passenger rail, these would include track access costs. All calculations are performed using the standard financial formula, as follows –

Financial Measure:

$$\text{Operating Ratio} = \frac{\text{Present Value of Revenues}}{\text{Present Value of Costs}}$$

Economic Measures:

Net Present Value = Present Value of Benefit – Present Values of Costs

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

Present Value is defined as:

$$PV = \Sigma\, C_t / (I + r)^t$$

Where:

PV = Present value of all future cash flows

C_t = Cash flow for period t

r = Discount rate reflecting the opportunity cost of money

t = Time

In terms of Economic Benefits, a positive NPV and Benefit Cost Ratio imply that the project makes a positive contribution to the economy. For this analysis, revenues and cost cash flows were discounted to the 2010 base year using two discount rates: 3 percent and 7 percent. The 3 percent discount rate reflects the real cost of money in the market as reflected by the long term bond markets, and the 7 percent discount rate reflects the Federal government's desire to establish a benchmark comparison by discounting long term benefits at a greater rate than the market for public securities. Consistent with standard practice, Benefit Cost ratios are calculated from the perspective of the overall society without regard to who owns particular assets, receives specific benefits or incurs particular costs.

6.2.1 KEY ASSUMPTIONS

The analysis projects travel demand, operating revenues and operating and maintenance costs for all years from 2012 through 2050. The financial analysis has been conducted in real terms using constant 2012 dollars. Accordingly, no inflation factor has been included and a real discounting rate of 3 to 7 percent was used. Revenues and operating costs have also been projected in constant dollars over the time frame of the financial analysis. A summary of the key efficiency measure inputs are presented below.

Ridership and Revenue Forecasts

Ridership and revenue forecasts were prepared for 2020, 2030 and 2040. Revenues in intervening years were projected based on interpolations, reflecting projected annual growth in ridership. Revenues included not only passenger fares, but also onboard service revenues. Because of this, the revenues are slightly higher than those that were forecasted in Chapter 3.

Capital Costs

Capital costs include rolling stock, track, freight railroad right-of-way purchase or easement fees, bridges, fencing, signaling, grade crossings, maintenance facilities and station improvements. The capital cost projections are based on year-by-year projections of each cost element and include all of the capital costs, plus some selected elements of additional costs as needed to support year-by-year capacity expansion of the system. A year-by-year implementation plan was developed which detailed the Capital cash flows and funding requirements. Using this information, the Benefit Cost calculations were able to be assessed.

Operating Expenses

Major operating and maintenance expenses include equipment maintenance, track and right-of-way maintenance, administration, fuel and energy, train crew and other relevant expenses. Operating expenses were estimated in 2012 constant dollars so that they would remain comparable to revenues. However, these costs do reflect the year-by-year increase in expense that is needed to handle the forecasted ridership growth, in terms of not only directly variable expenses such as credit card commissions, but also the need to add train capacity and operate either larger trains, or more train-miles every year in order to accommodate anticipated ridership growth.

Operating costs are included as a cost, whereas system revenues are included as a benefit in the discounting calculation over the life of the system. In this way they directly offset one another in the Net Present Value calculation and also reflected in the Benefit Cost calculation. It can be seen that a system that requires an operating subsidy, e.g., where costs exceed revenues, will tend also to reflect this in the Benefit Cost ratio. This is why slow speed options such as conventional Amtrak services often fail on both the Operating Ratio and Benefit Cost ratio criteria.

Implementation Period

According to the implementation plan, the planning and construction period for this corridor will take up to five years with the start-up of full system operations not occurring until 2018.

6.2.2 ESTIMATE OF ECONOMIC BENEFITS

A key requirement is the need for public capital investment to be supported by the economic benefit that will be generated by the rail system. Calculation of the economic benefit includes both consumer surplus and revenues generated by the system and environmental and external mode benefits; while costs include both capital and operating costs. Similar to the way most highway projects are justified, the primary justification for intercity rail projects relies on time savings multiplied by the user's value of time. The consumer surplus term equates to the passenger user's value of time savings as being the benefit an individual receives over and above the fare charged for using the system.

Calculation of benefit cost ratios requires a detailed, year-by-year forecast to support the calculation of Net Present Values for all the costs and benefits associated with the project. Specifically, a year-by-year estimate of system revenues, consumer surplus, operating costs, capital costs, and external benefits is needed to develop the Benefit Cost Analysis.

In line with Federal, State and Municipal projections, the rate of population growth, the increasing price of oil, and the increasing congestion on Ohio, Indiana and Illinois highways, means that there is a gradual increase in rail users over the life of the project. This has several consequences for the correct calculation of Benefit/Cost ratios for the project –

- It would be inappropriate to increase the ridership and revenue of the system in future years, without also reflecting the added operating and capital costs that will be needed to accommodate this growth in traffic.
- The result is a steady improvement in the system financial performance that reflects improved economies of scale over the 30-year life of the system. While the Benefit Cost ratios calculated do take this forecast growth into account, they also add the additional

capital cost for providing the capacity needed to handle it.

The economic benefits to be used in the analysis include two main categories –

- User Benefits (Consumer Surplus)
- Other Mode and Resource Benefits

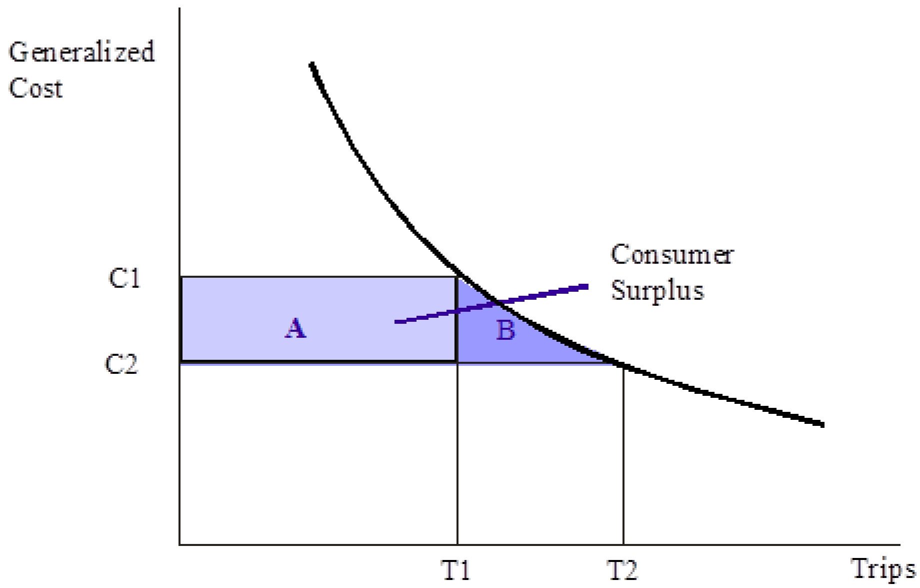
User Benefits

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

Benefits to users of the rail system are measured by the sum of system revenues and consumer surplus. Consumer surplus is used to measure the demand side impact of a transportation improvement on users of the service. It is defined as the additional benefit consumers (users of the service) receive from the purchase of a commodity or service (travel), above the price actually paid for that commodity or service. Consumer surpluses exist because there are always consumers who are willing to pay a higher price than that actually charged for the commodity or service, i.e., these consumers receive more benefit than is reflected by the system revenues alone. Revenues are included in the measure of consumer surplus as a proxy measure for the consumer surplus forgone because the price of rail service is not zero. This is an equity decision made by the USDOT to compensate for the fact that highway users pay zero for use of the road system (the only exception being the use of toll roads). The benefits apply to existing rail travelers as well as new travelers who are induced (those who previously did not make a trip) or diverted (those who previously used a different mode) to the new passenger rail system.

The COMPASS™ demand model estimates passenger travel benefits (consumer surplus) by calculating the increase in regional mobility, traffic diverted to rail, and the reduction in travel cost measured in terms of generalized cost for existing rail users. The term generalized cost refers to the combination of time and fares paid by users to make a trip. A reduction in generalized cost generates an increase in the passenger rail user benefits. A transportation improvement that leads to improved mobility reduces the generalized cost of travel, which in turn leads to an increase in consumer surplus. Exhibit 6-1 presents a typical demand curve in which Area A represents the increase in consumer surplus resulting from cost savings for existing rail users, and Area B represents the consumer surplus resulting from induced traffic and trips diverted to rail.

Exhibit 6-1: Consumer Surplus Concept



The formula for consumer surplus is as follows –

Consumer Surplus = $(C_1 - C_2)$*T1 + $((C_1 - C_2)*(T_2 - T_1))/2$

Where:

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

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

T_1 = Number of trips before operation of the system

T_2 = Number of trips during operation of the system

The passenger rail fares used in this analysis are the average optimal fares derived from the revenue-maximization analysis that was performed for each alternative. User benefits incorporate the measured consumer surplus, as well as the system revenues, since these are benefits are merely transferred from the rail user to the rail operator.

Other Mode and Resource Benefits: In addition to rail-user benefits, travelers using auto or air will also benefit from the rail investment, since the system will contribute to highway congestion relief and reduce travel times for users of these other modes. For purposes of this analysis, these benefits were measured by identifying the estimated number of auto passenger trips diverted to rail and multiplying each by the updated monetary values derived from previous stated preference studies updated to 2012.

Highway Congestion: The highway congestion delay savings is the time savings to the remaining highway users that results from diversion of auto users to the rail mode. To estimate travel time increase within the corridor, historical highway traffic volumes were obtained from the State DOTs and local planning agencies. The average annual travel time growth in the corridor was estimated with the historical highway traffic volume data and the BPR (Bureau of Public Roads) function that can be used to calculate travel time growth with increased traffic volumes.

The Airport Congestion Delay Savings: The Airport Congestion Delay Savings were based on the MWRRS values for consistency.

Resources Benefits: The implementation of any transportation project has an impact on the resources used by travelers. The consequent reduction in highway congestion will result in resource savings to vehicle operators and reduced emissions of air pollutants for all non-rail modes. In addition, the use of high-speed rail will produce safety benefits associated with auto, air, rail and bus travel.

The Highway Congestion Delay Savings: Vehicle operating cost savings for non-business travelers have been included in the current analysis as an additional resource benefit. This reflects the fact that social/leisure travelers do not accurately value the full cost of driving when making trips. As a result, the consumer surplus calculation for commuters, social, leisure and tourist travelers has not fully reflected the real cost of operations of an automobile, but only the cost of gas. The difference between the cost of gas and the full cost of driving reflects a real savings that could be included in a Benefit Cost analysis. The highway congestion delay savings is the time savings to the remaining highway users that results from diversion of auto users to the rail mode. To estimate travel time increase within the corridor, historical highway traffic volumes were obtained from the State DOTs and local planning agencies. The average annual travel time growth in the corridor was estimated with the historical highway traffic volume data and the BPR (Bureau of Public Roads) function that can be used to calculate travel time growth with increased traffic volumes.

Emissions: The diversion of travelers to rail from the auto and air modes generates emissions savings. The calculated emissions savings are based on changes in energy use with and without the proposed rail service. This methodology takes into account the region of the country, air quality regulation compliance of the counties served by the proposed rail service, the projection year, and the modes of travel used for access/egress as well as the line-haul portion of the trip. The Airport Emissions were based on the MWRRS values for consistency. Highway Reduced Emissions were estimated from the vehicle miles traveled (VMT) and flight reductions derived from the ridership model. The assumption is that a reduction in VMT or flights is directly proportional to the reduction in emissions. The pollutant values were taken from the TIGER III Grant Benefit-Cost Analysis (BCA) Resource Guide[1].

Public Safety Benefits: Public Safety is calculated from the diverted Vehicle-Miles times the NHTSA[2] Fatality rate per Vehicle mile times the Unit value ($2012) of a fatality. This was calculated for 2020, 2030 and 2040 then extrapolated for all other years.

6.3 RESULTS OF THE ANALYSIS

The financial and economic analysis was applied to both alternatives –

- The Diesel 110 mph Alternative: Has track improvements as described in Chapter 4 and uses nine (350 seat) diesel trains.
- The Diesel 130 mph Alternative: The same as the Diesel 130 mph but it has track alterations to avoid crossings and other restrictions to meet FRA requirements for operational speeds of 130 mph.

6.3.1 FINANCIAL RESULTS

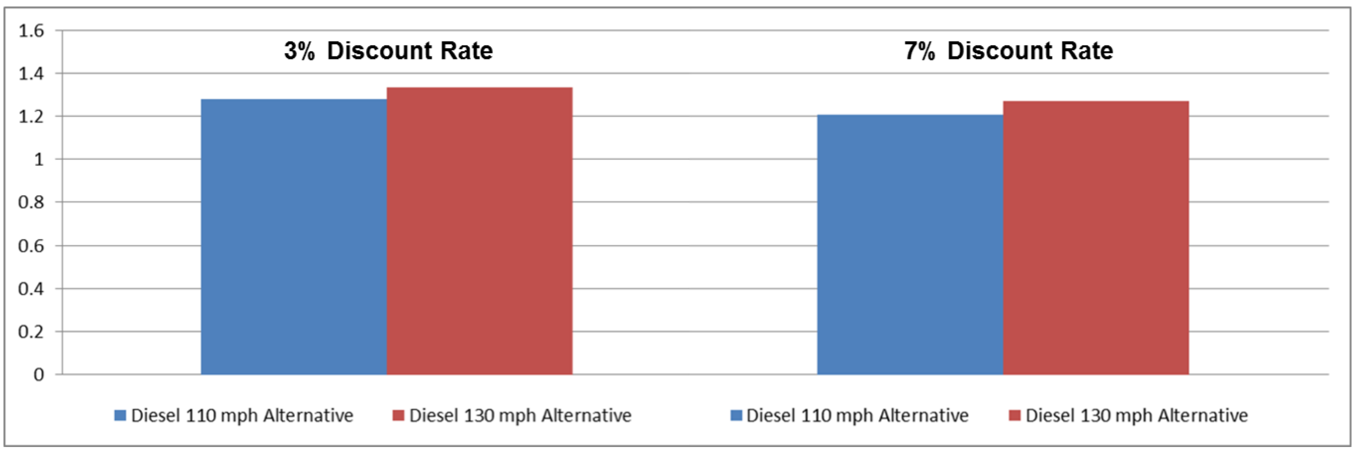
The financial results for both alternatives are shown in the exhibits below. Exhibit 6-2 shows the Diesel 110 mph Alternative revenue, operating, maintenance (O and M) cost and the operating ratios at the 3% discount rate, Exhibits 6-3 shows the comparison between the operating ratios of both Alternatives at the 3% and 7% discount rates. In addition, the financial cash flows for both Alternatives are shown in Exhibit 6-4 and 6-5.

[1] http://www.dot.gov/sites/dot.dev/files/docs/TIGER_BCA_RESOURCE_GUIDE.pdf
[2] http://www.nhtsa.gov/

Exhibit 6-2: Diesel 110 mph Alternative Financial Analysis

Diesel 110 mph Alternative Financial Analysis	
In US $ 2012 (millions) at the 3% discount rate	
Revenue	$2,709
On Train Service	$217
Total Financial Revenues	**$2,926**
Operating and Renewal Costs	$2,287
Total Financial Costs	**$2,287**
NPV (Surplus)	**$639**
Operating Ratio	**1.28**

Exhibit 6-3: Comparing the Alternatives Operating Ratios at the 3% and 7% Discount rates



It can be seen that both Alternatives have positive Operating ratios at the 3% and 7% discount rates, with the Diesel 130 mph Alternative having better results due to its higher revenue and ridership.

The results of this analysis show that all the proposed options are franchisable with a large positive cash flow that is greater than the system operating costs.

Exhibit 6-4: Detailed Financial Cash Flows for Diesel 110 by Year $2012 (Millions)

Diesel 110 Alternative Financial Proforma	2017	2018	2019	2020	2021	2022	2023
US $2012 (millions)							
Revenue	-	$58	$105	$117	$120	$123	$127
On Train Service	-	$5	$8	$9	$10	$10	$10
Total Revenue	-	**$63**	**$113**	**$126**	**$130**	**$133**	**$137**
Operating and Renewal Costs	-	$113	$119	$121	$121	$122	$122
Total Costs	-	**$113**	**$119**	**$121**	**$121**	**$122**	**$122**
Financial Surplus	-	**($50)**	**($6)**	**$5**	**$9**	**$11**	**$15**
Operating Ratio	-	**0.56**	**0.95**	**1.04**	**1.07**	**1.09**	**1.12**

Diesel 110 Alternative Financial Proforma	2024	2025	2026	2027	2028	2029	2030
US $2012 (millions)							
Revenue	$130	$134	$138	$141	$145	$149	$154
On Train Service	$10	$11	$11	$11	$12	$12	$12
Total Revenue	**$140**	**$145**	**$149**	**$152**	**$157**	**$161**	**$166**
Operating and Renewal Costs	$123	$123	$124	$124	$125	$125	$126
Total Costs	**$123**	**$123**	**$124**	**$124**	**$125**	**$125**	**$126**
Financial Surplus	**$17**	**$22**	**$25**	**$28**	**$32**	**$36**	**$40**
Operating Ratio	**1.14**	**1.18**	**1.20**	**1.23**	**1.26**	**1.29**	**1.32**

Diesel 110 Alternative Financial Proforma	2031	2032	2033	2034	2035	2036	2037
US $2012 (millions)							
Revenue	$157	$160	$164	$167	$171	$174	$178
On Train Service	$13	$13	$13	$13	$14	$14	$14
Total Revenue	**$170**	**$173**	**$177**	**$180**	**$185**	**$188**	**$192**
Operating and Renewal Costs	$127	$129	$130	$132	$133	$135	$136
Total Costs	**$127**	**$129**	**$130**	**$132**	**$133**	**$135**	**$136**
Financial Surplus	**$43**	**$44**	**$47**	**$48**	**$52**	**$53**	**$56**
Operating Ratio	**1.34**	**1.34**	**1.36**	**1.36**	**1.39**	**1.39**	**1.41**

Exhibit 6-4: Detailed Financial Cash Flows for Diesel 110 by Year $2012 (Millions) (cont.)

Diesel 110 Alternative Financial Proforma	2038	2039	2040	2041	2042	2043	2044
US $2012 (millions)							
Revenue	$182	$186	$190	$194	$198	$202	$207
On Train Service	$15	$15	$15	$16	$16	$16	$17
Total Revenue	**$197**	**$201**	**$205**	**$210**	**$214**	**$218**	**$224**
Operating and Renewal Costs	$138	$139	$141	$143	$145	$147	$150
Total Costs	**$138**	**$139**	**$141**	**$143**	**$145**	**$147**	**$150**
Financial Surplus	**$59**	**$62**	**$64**	**$67**	**$69**	**$71**	**$74**
Operating Ratio	**1.43**	**1.45**	**1.45**	**1.47**	**1.48**	**1.48**	**1.49**

Diesel 110 Alternative Financial Proforma	2045	2046	2047	2048	2049	2050
US $2012 (millions)						
Revenue	$211	$215	$220	$225	$230	$235
On Train Service	$17	$17	$18	$18	$18	$19
Total Revenue	**$228**	**$232**	**$238**	**$243**	**$248**	**$254**
Operating and Renewal Costs	$152	$154	$156	$159	$161	$163
Total Costs	**$152**	**$154**	**$156**	**$159**	**$161**	**$163**
Financial Surplus	**$76**	**$78**	**$82**	**$84**	**$87**	**$91**
Operating Ratio	**1.50**	**1.51**	**1.53**	**1.53**	**1.54**	**1.56**

Exhibit 6-5: Detailed Financial Cash Flows for Diesel 130 by Year $2012 (Millions)

Diesel 130 Alternative Financial Proforma	2017	2018	2019	2020	2021	2022	2023
US $2012 (millions)							
Revenue	-	$63	$113	$126	$129	$133	$136
On Train Service	-	$5	$9	$10	$10	$11	$11
Total Revenue	-	**$68**	**$122**	**$136**	**$139**	**$144**	**$147**
Operating and Renewal Costs	-	$113	$120	$122	$123	$123	$124
Total Costs	-	**$113**	**$120**	**$122**	**$123**	**$123**	**$124**
Financial Surplus	-	**($45)**	**$2**	**$14**	**$16**	**$21**	**$23**
Operating Ratio	-	**0.60**	**1.02**	**1.11**	**1.13**	**1.17**	**1.19**

Diesel 130 Alternative Financial Proforma	2024	2025	2026	2027	2028	2029	2030
US $2012 (millions)							
Revenue	$140	$144	$148	$152	$156	$161	$165
On Train Service	$11	$12	$12	$12	$12	$13	$13
Total Revenue	**$151**	**$156**	**$160**	**$164**	**$168**	**$174**	**$178**
Operating and Renewal Costs	$124	$125	$125	$126	$126	$127	$127
Total Costs	**$124**	**$125**	**$125**	**$126**	**$126**	**$127**	**$127**
Financial Surplus	**$27**	**$31**	**$35**	**$38**	**$42**	**$47**	**$51**
Operating Ratio	**1.22**	**1.25**	**1.28**	**1.30**	**1.33**	**1.37**	**1.40**

Diesel 130 Alternative Financial Proforma	2031	2032	2033	2034	2035	2036	2037
US $2012 (millions)							
Revenue	$168	$172	$176	$179	$183	$187	$191
On Train Service	$13	$14	$14	$14	$15	$15	$15
Total Revenue	**$181**	**$186**	**$190**	**$193**	**$198**	**$202**	**$206**
Operating and Renewal Costs	$129	$132	$134	$136	$138	$140	$142
Total Costs	**$129**	**$132**	**$134**	**$136**	**$138**	**$140**	**$142**
Financial Surplus	**$52**	**$54**	**$56**	**$57**	**$60**	**$62**	**$64**
Operating Ratio	**1.40**	**1.41**	**1.42**	**1.42**	**1.43**	**1.44**	**1.45**

Exhibit 6-5: Detailed Financial Cash Flows for Diesel 130 by Year $2012 (Millions) (cont.)

Diesel 130 Alternative Financial Proforma	2038	2039	2040	2041	2042	2043	2044
US $2012 (millions)							
Revenue	$195	$199	$203	$208	$212	$217	$221
On Train Service	$16	$16	$16	$17	$17	$17	$18
Total Revenue	**$211**	**$215**	**$219**	**$225**	**$229**	**$234**	**$239**
Operating and Renewal Costs	$145	$147	$149	$151	$154	$156	$158
Total Costs	**$145**	**$147**	**$149**	**$151**	**$154**	**$156**	**$158**
Financial Surplus	**$66**	**$68**	**$70**	**$74**	**$75**	**$78**	**$81**
Operating Ratio	**1.46**	**1.46**	**1.47**	**1.49**	**1.49**	**1.50**	**1.51**

Diesel 130 Alternative Financial Proforma	2045	2046	2047	2048	2049	2050
US $2012 (millions)						
Revenue	$226	$231	$236	$241	$246	$251
On Train Service	$18	$18	$19	$19	$20	$20
Total Revenue	**$244**	**$249**	**$255**	**$260**	**$266**	**$271**
Operating and Renewal Costs	$161	$163	$165	$168	$170	$173
Total Costs	**$161**	**$163**	**$165**	**$168**	**$170**	**$173**
Financial Surplus	**$83**	**$86**	**$90**	**$92**	**$96**	**$98**
Operating Ratio	**1.52**	**1.53**	**1.55**	**1.55**	**1.56**	**1.57**

6.3.2 ECONOMIC RESULTS

The economic results for both 110 mph and 130 mph alternatives are shown in the exhibits below. Exhibit 6-6 shows the Diesel 110 mph Alternative NPV break down of benefits, costs and the resulting ratio at the 3% discount rate. It can be seen that the project has a 1.7 Benefit Ratio and project Net Present Value of $2.5 Billion. It can be seen that the results for each alternative are very comparable. Exhibit 6-7 shows the comparison between the Benefit-Cost Ratios of both Alternatives at the 3% and 7% discount rates, Exhibit 6-8, shows the comparison between the Net Present Value Surplus of both Alternatives at the 3% and 7% discount rates.

Exhibit 6-6: Diesel 110 mph Benefit Cost Analysis

Diesel 110 Benefit Cost Results Net Present Value	
Constant US $2012 (millions) at the 3% Discount rate	
Benefits to Users	
Revenue	$2,709
On Board Service	$217
Total Revenue	**$2,926**
Consumer Surplus	$1,665
Total User Benefits	**$4,591**
Benefits to Public at Large	
Airport Congestion Delay Savings	$296
Airport Reduced Emissions	$169
Highway Congestion Delay Savings	$461
Highway Reduced Emissions	$320
Safety Benefits	$403
Total Benefits to Public at Large	**$1,650**
Total Benefits	**$6,241**
Costs	
Investment (Capital) Cost	$1,126
Operating and Renewal Costs	$2,287
Cyclic Maintenance	$167
Fleet Expansion and Refurbishment	$74
Total Costs	**$3,655**
NPV Economic Surplus	**$2,586**
Benefit Cost Ratio	**1.71**

Exhibit 6-7: Comparing the Alternatives Benefit-Cost results at the 3% and 7% Discount rates

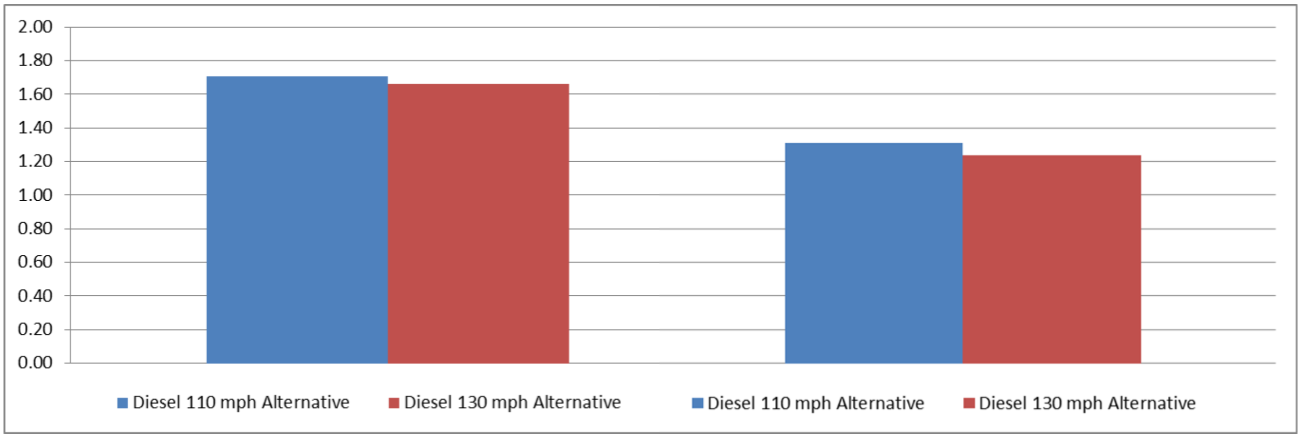
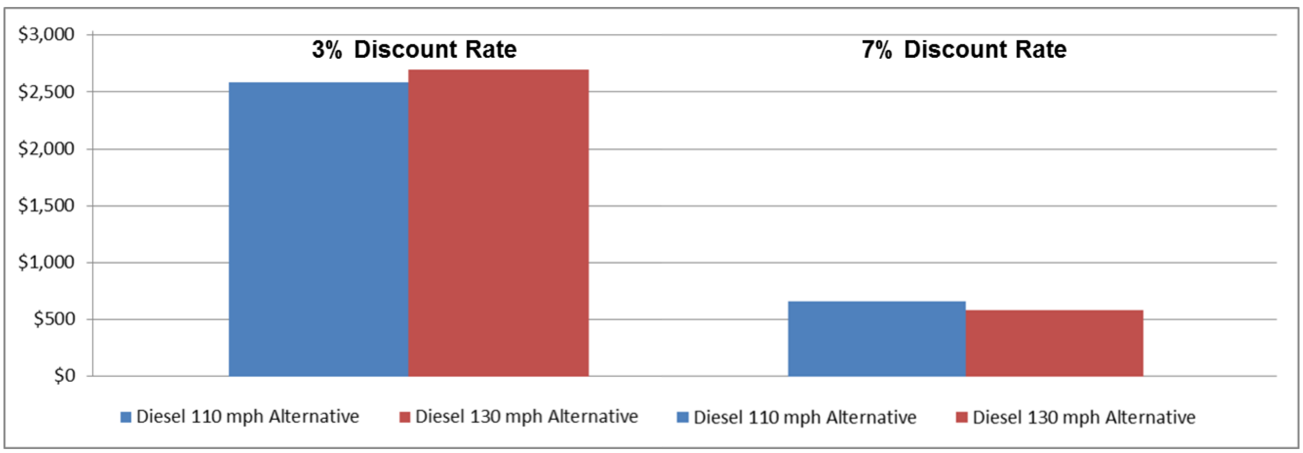


Exhibit 6-8: Comparing the alternatives NPV Economic Surplus at the 3% and 7% Discount rates



The Benefit Cost ratio and Net Present Value of the Economic Surplus for both alternatives are positive, showing they are each viable. The Diesel 130 option has a slightly lower Benefit Cost ratio at the 3% and 7% discount rate however it does have superior Net Present Value (NPV) results at the 3% discount rate. At 7 percent the 130 mph Alternative has a slightly lower Net Present Value (NPV). This is due to the higher capital cost of the Diesel 130 Alternative. As the 7% discount rate increases immediate costs and benefits they have a larger impact on the NPV compared to long term benefits, so at the 3% rate the Diesel 110 has the slightly lower NPV surplus and at the 7% the slightly greater.

Exhibit 6-9: Diesel 110 Alternative detailed Economic Benefits and Costs Flows by Year $2012 (Millions)

Diesel 110 Benefit Cost Proforma	2013	2014	2015	2016	2017	2018
Constant US $2012 (millions)						
Benefits to Users						
Revenue	-	-	-	-	-	$58
On Train Service	-	-	-	-	-	$5
Total Revenue	-	-	-	-	-	**$63**
Consumer Surplus	-	-	-	-	-	$36
Total User Benefits	-	-	-	-	-	**$99**
Benefits to Public at Large						
Airport Congestion Delay Savings	-	-	-	-	-	$6
Airport Reduced Emissions	-	-	-	-	-	$4
Road Congestion Relief	-	-	-	-	-	$9
Highway Reduced Emissions	-	-	-	-	-	$6
Safety Benefits	-	-	-	-	-	$9
Total Benefits to Public at Large	-	-	-	-	-	**$34**
Total Benefits	-	-	-	-	-	**$133**
Costs						
Investment (Capital) Cost	$103	$141	$344	$387	$311	-
Operating and Renewal Costs	-	-	-	-	-	$113
Cyclic Maintenance	-	-	-	-	-	-
Fleet Expansion	-	-	-	-	-	-
Total Costs	**$103**	**$141**	**$344**	**$387**	**$311**	**$113**

Exhibit 6-9: Diesel 110 Alternative detailed Economic Benefits and Costs Flows by Year $2012 (Millions) (cont.)

Diesel 110 Benefit Cost Proforma	2019	2020	2021	2022	2023	2024
Constant US $2012 (millions)						
Benefits to Users						
Revenue	$105	$117	$120	$123	$127	$130
On Train Service	$8	$9	$10	$10	$10	$10
Total Revenue	**$113**	**$126**	**$130**	**$133**	**$137**	**$140**
Consumer Surplus	$65	$72	$74	$76	$78	$80
Total User Benefits	**$178**	**$198**	**$204**	**$209**	**$215**	**$220**
Benefits to Public at Large						
Airport Congestion Delay Savings	$11	$13	$13	$13	$14	$14
Airport Reduced Emissions	$7	$7	$8	$8	$8	$8
Road Congestion Relief	$16	$18	$19	$19	$20	$20
Highway Reduced Emissions	$12	$13	$13	$14	$14	$15
Safety Benefits	$16	$18	$18	$19	$19	$20
Total Benefits to Public at Large	**$62**	**$69**	**$71**	**$73**	**$75**	**$77**
Total Benefits	**$240**	**$267**	**$275**	**$282**	**$290**	**$297**
Costs						
Investment (Capital) Cost	-	-	-	-	-	-
Operating and Renewal Costs	$119	$121	$121	$122	$122	$123
Cyclic Maintenance	-	-	$1	$4	$4	$5
Fleet Expansion	-	-	-	-	-	-
Total Costs	**$119**	**$121**	**$122**	**$126**	**$126**	**$128**

Exhibit 6-9: Diesel 110 Alternative detailed Economic Benefits and Costs Flows by Year $2012 (Millions) (cont.)

Diesel 110 Benefit Cost Proforma	2025	2026	2027	2028	2029	2030
Constant US $2012 (millions)						
Benefits to Users						
Revenue	$134	$138	$141	$145	$149	$154
On Train Service	$11	$11	$11	$12	$12	$12
Total Revenue	**$145**	**$149**	**$152**	**$157**	**$161**	**$166**
Consumer Surplus	$82	$85	$87	$89	$92	$94
Total User Benefits	**$227**	**$234**	**$239**	**$246**	**$253**	**$260**
Benefits to Public at Large						
Airport Congestion Delay Savings	$15	$15	$15	$16	$16	$17
Airport Reduced Emissions	$8	$9	$9	$9	$9	$10
Road Congestion Relief	$21	$22	$23	$23	$24	$25
Highway Reduced Emissions	$15	$16	$16	$17	$17	$18
Safety Benefits	$20	$21	$21	$22	$22	$23
Total Benefits to Public at Large	**$79**	**$83**	**$84**	**$87**	**$88**	**$93**
Total Benefits	**$306**	**$317**	**$323**	**$333**	**$341**	**$353**
Costs						
Investment (Capital) Cost	-	-	-	-	-	-
Operating and Renewal Costs	$123	$124	$124	$125	$125	$126
Cyclic Maintenance	$6	$6	$7	$9	$9	$9
Fleet Expansion	-	-	-	-	-	$30
Total Costs	**$129**	**$130**	**$131**	**$134**	**$134**	**$165**

Exhibit 6-9: Diesel 110 Alternative detailed Economic Benefits and Costs Flows by Year $2012 (Millions) (cont.)

Diesel 110 Benefit Cost Proforma	2031	2032	2033	2034	2035	2036
Constant US $2012 (millions)						
Benefits to Users						
Revenue	$157	$160	$164	$167	$171	$174
On Train Service	$13	$13	$13	$13	$14	$14
Total Revenue	**$170**	**$173**	**$177**	**$180**	**$185**	**$188**
Passenger Travel Benefits	$96	$98	$100	$103	$105	$107
Total User Benefits	**$266**	**$271**	**$277**	**$283**	**$290**	**$295**
Benefits to Public at Large						
Airport Congestion Delay Savings	$17	$18	$18	$18	$19	$19
Airport Reduced Emissions	$10	$10	$10	$10	$11	$11
Road Congestion Relief	$26	$26	$27	$28	$29	$30
Highway Reduced Emissions	$18	$19	$19	$20	$20	$21
Safety Benefits	$23	$24	$24	$25	$25	$26
Total Benefits to Public at Large	**$94**	**$97**	**$98**	**$101**	**$104**	**$107**
Total Benefits	**$360**	**$368**	**$375**	**$384**	**$394**	**$402**
Costs						
Investment (Capital) Cost	-	-	-	-	-	-
Operating and Renewal Costs	$127	$129	$130	$132	$133	$135
Cyclic Maintenance	$9	$11	$13	$13	$13	$13
Fleet Expansion	-	-	$45	-	-	-
Total Costs	**$136**	**$140**	**$188**	**$145**	**$146**	**$148**

Exhibit 6-9: Diesel 110 Alternative detailed Economic Benefits and Costs Flows by Year $2012 (Millions) (cont.)

Diesel 110 Benefit Cost Proforma	2037	2038	2039	2040	2041	2042
Constant US $2012 (millions)						
Benefits to Users						
Revenue	$178	$182	$186	$190	$194	$198
On Train Service	$14	$15	$15	$15	$16	$16
Total Revenue	**$192**	**$197**	**$201**	**$205**	**$210**	**$214**
Consumer Surplus	$109	$112	$114	$117	$119	$122
Total User Benefits	**$301**	**$309**	**$315**	**$322**	**$329**	**$336**
Benefits to Public at Large						
Airport Congestion Delay Savings	$19	$20	$20	$21	$21	$22
Airport Reduced Emissions	$11	$11	$12	$12	$12	$12
Road Congestion Relief	$31	$32	$33	$34	$35	$36
Highway Reduced Emissions	$21	$22	$23	$23	$24	$24
Safety Benefits	$26	$27	$28	$28	$29	$29
Total Benefits to Public at Large	**$108**	**$112**	**$116**	**$118**	**$121**	**$123**
Total Benefits	**$409**	**$421**	**$431**	**$440**	**$450**	**$459**
Costs						
Investment (Capital) Cost	-	-	-	-	-	-
Operating and Renewal Costs	$136	$138	$139	$141	$143	$145
Cyclic Maintenance	$15	$18	$18	$18	$18	$18
Fleet Expansion	-	-	-	$79	-	-
Total Costs	**$151**	**$156**	**$157**	**$238**	**$161**	**$163**

Exhibit 6-9: Diesel 110 Alternative detailed Economic Benefits and Costs Flows by Year $2012 (Millions) (cont.)

Diesel 110 Benefit Cost Proforma	2043	2044	2045	2046
Constant US $2012 (millions)				
Benefits to Users				
Revenue	$202	$207	$211	$215
On Train Service	$16	$17	$17	$17
Total Revenue	**$218**	**$224**	**$228**	**$232**
Consumer Surplus	$124	$127	$130	$132
Total User Benefits	**$342**	**$351**	**$358**	**$364**
Benefits to Public at Large				
Airport Congestion Delay Savings	$22	$23	$23	$24
Airport Reduced Emissions	$13	$13	$13	$13
Road Congestion Relief	$37	$38	$40	$41
Highway Reduced Emissions	$25	$26	$26	$27
Safety Benefits	$30	$31	$31	$32
Total Benefits to Public at Large	**$127**	**$131**	**$133**	**$137**
Total Benefits	**$469**	**$482**	**$491**	**$501**
Costs				
Investment (Capital) Cost	-	-	-	-
Operating and Renewal Costs	$147	$150	$152	$154
Cyclic Maintenance	$18	$18	$18	$18
Fleet Expansion	-	-	-	-
Total Costs	**$165**	**$168**	**$170**	**$172**

Exhibit 6-9: Diesel 110 Alternative detailed Economic Benefits and Costs Flows by Year $2012 (Millions) (cont.)

Diesel 110 Benefit Cost Proforma	2047	2048	2049	2050
Constant US $2012 (millions)				
Benefits to Users				
Revenue	$220	$225	$230	$235
On Train Service	$18	$18	$18	$19
Total Revenue	**$238**	**$243**	**$248**	**$254**
Consumer Surplus	$135	$138	$141	$144
Total User Benefits	**$373**	**$381**	**$389**	**$398**
Benefits to Public at Large				
Airport Congestion Delay Savings	$24	$25	$25	$26
Airport Reduced Emissions	$14	$14	$14	$15
Road Congestion Relief	$42	$43	$45	$46
Highway Reduced Emissions	$28	$29	$29	$30
Safety Benefits	$33	$33	$34	$35
Total Benefits to Public at Large	**$141**	**$144**	**$147**	**$152**
Total Benefits	**$514**	**$525**	**$536**	**$550**
Costs				
Investment (Capital) Cost	-	-	-	-
Operating and Renewal Costs	$156	$159	$161	$163
Cyclic Maintenance	$18	$18	$18	$18
Fleet Expansion	-	-	-	-
Total Costs	**$174**	**$177**	**$179**	**$181**

Exhibit 6-10: Diesel 130 Alternative detailed Economic Benefits and Costs Flows by Year $2012 (Millions)

Diesel 130 Economic Proforma	2013	2014	2015	2016	2017	2018
Constant US $2012 (millions)						
Benefits to Users						
Revenue	-	-	-	-	-	$63
On Train Service	-	-	-	-	-	$5
Total Revenue	-	-	-	-	-	**$68**
Consumer Surplus	-	-	-	-	-	$41
Total User Benefits	-	-	-	-	-	**$109**
Benefits to Public at Large						
Airport Congestion Delay Savings	-	-	-	-	-	$7
Airport Reduced Emissions	-	-	-	-	-	$4
Road Congestion Relief	-	-	-	-	-	$10
Highway Reduced Emissions	-	-	-	-	-	$7
Safety Benefits	-	-	-	-	-	$9
Total Benefits to Public at Large	-	-	-	-	-	**$37**
Total Benefits	-	-	-	-	-	**$146**
Costs						
Investment (Capital) Cost	$134	$184	$448	$504	$406	-
Operating and Renewal Costs	-	-	-	-	-	$113
Cyclic Maintenance	-	-	-	-	-	-
Fleet Expansion	-	-	-	-	-	-
Total Costs	**$134**	**$184**	**$448**	**$504**	**$406**	**$113**

Exhibit 6-10: Diesel 130 Alternative detailed Economic Benefits and Costs Flows by Year $2012 (Millions) (cont.)

Diesel 130 Economic Proforma	2019	2020	2021	2022	2023	2024
Constant US $2012 (millions)						
Benefits to Users						
Revenue	$113	$126	$129	$133	$136	$140
On Train Service	$9	$10	$10	$11	$11	$11
Total Revenue	**$122**	**$136**	**$139**	**$144**	**$147**	**$151**
Consumer Surplus	$73	$81	$84	$86	$88	$91
Total User Benefits	**$195**	**$217**	**$223**	**$230**	**$235**	**$242**
Benefits to Public at Large						
Airport Congestion Delay Savings	$12	$14	$14	$15	$15	$15
Airport Reduced Emissions	$7	$8	$8	$8	$9	$9
Road Congestion Relief	$17	$19	$20	$20	$21	$22
Highway Reduced Emissions	$12	$14	$14	$15	$15	$16
Safety Benefits	$17	$19	$19	$20	$20	$21
Total Benefits to Public at Large	**$65**	**$74**	**$75**	**$78**	**$80**	**$83**
Total Benefits	**$260**	**$291**	**$298**	**$308**	**$315**	**$325**
Costs						
Investment (Capital) Cost	-	-	-	-	-	-
Operating and Renewal Costs	$120	$122	$123	$123	$124	$124
Cyclic Maintenance	-	-	$1	$4	$4	$5
Fleet Expansion	-	-	-	-	-	-
Total Costs	**$120**	**$122**	**$124**	**$127**	**$128**	**$129**

Exhibit 6-10: Diesel 130 Alternative detailed Economic Benefits and Costs Flows by Year $2012 (Millions) (cont.)

Diesel 130 Economic Proforma	2025	2026	2027	2028	2029	2030
Constant US $2012 (millions)						
Benefits to Users						
Revenue	$144	$148	$152	$156	$161	$165
On Train Service	$12	$12	$12	$12	$13	$13
Total Revenue	**$156**	**$160**	**$164**	**$168**	**$174**	**$178**
Consumer Surplus	$93	$96	$98	$101	$104	$106
Total User Benefits	**$249**	**$256**	**$262**	**$269**	**$278**	**$284**
Benefits to Public at Large						
Airport Congestion Delay Savings	$16	$16	$17	$17	$18	$18
Airport Reduced Emissions	$9	$9	$10	$10	$10	$10
Road Congestion Relief	$22	$23	$24	$25	$25	$26
Highway Reduced Emissions	$16	$17	$17	$18	$18	$19
Safety Benefits	$21	$22	$23	$23	$24	$24
Total Benefits to Public at Large	**$84**	**$87**	**$91**	**$93**	**$95**	**$97**
Total Benefits	**$333**	**$343**	**$353**	**$362**	**$373**	**$381**
Costs						
Investment (Capital) Cost	-	-	-	-	-	-
Operating and Renewal Costs	$125	$125	$126	$126	$127	$127
Cyclic Maintenance	$6	$6	$7	$9	$9	$9
Fleet Expansion	-	-	-	-	-	$48
Total Costs	**$131**	**$131**	**$133**	**$135**	**$136**	**$184**

Exhibit 6-10: Diesel 130 Alternative detailed Economic Benefits and Costs Flows by Year $2012 (Millions) (cont.)

Diesel 130 Economic Proforma	2031	2032	2033	2034	2035	2036
Constant US $2012 (millions)						
Benefits to Users						
Revenue	$168	$172	$176	$179	$183	$187
On Train Service	$13	$14	$14	$14	$15	$15
Total Revenue	**$181**	**$186**	**$190**	**$193**	**$198**	**$202**
Passenger Travel Benefits	$109	$111	$113	$116	$118	$121
Total User Benefits	**$290**	**$297**	**$303**	**$309**	**$316**	**$323**
Benefits to Public at Large						
Airport Congestion Delay Savings	$18	$19	$19	$20	$20	$20
Airport Reduced Emissions	$11	$11	$11	$11	$11	$12
Road Congestion Relief	$27	$28	$29	$30	$31	$32
Highway Reduced Emissions	$19	$20	$20	$21	$22	$22
Safety Benefits	$25	$25	$26	$26	$27	$28
Total Benefits to Public at Large	**$100**	**$103**	**$105**	**$108**	**$111**	**$114**
Total Benefits	**$390**	**$400**	**$408**	**$417**	**$427**	**$437**
Costs						
Investment (Capital) Cost	-	-	-	-	-	-
Operating and Renewal Costs	$129	$132	$134	$136	$138	$140
Cyclic Maintenance	$9	$11	$13	$13	$13	$13
Fleet Expansion	-	-	$45	-	-	-
Total Costs	**$138**	**$143**	**$192**	**$149**	**$151**	**$153**

Exhibit 6-10: Diesel 130 Alternative detailed Economic Benefits and Costs Flows by Year $2012 (Millions) (cont.)

Diesel 130 Economic Proforma	2037	2038	2039	2040	2041	2042
Constant US $2012 (millions)						
Benefits to Users						
Revenue	$191	$195	$199	$203	$208	$212
On Train Service	$15	$16	$16	$16	$17	$17
Total Revenue	**$206**	**$211**	**$215**	**$219**	**$225**	**$229**
Consumer Surplus	$123	$126	$129	$132	$134	$137
Total User Benefits	**$329**	**$337**	**$344**	**$351**	**$359**	**$366**
Benefits to Public at Large						
Airport Congestion Delay Savings	$21	$21	$22	$22	$23	$23
Airport Reduced Emissions	$12	$12	$12	$13	$13	$13
Road Congestion Relief	$33	$34	$35	$36	$37	$38
Highway Reduced Emissions	$23	$23	$24	$25	$25	$26
Safety Benefits	$28	$29	$29	$30	$31	$31
Total Benefits to Public at Large	**$117**	**$119**	**$122**	**$126**	**$129**	**$131**
Total Benefits	**$446**	**$456**	**$466**	**$477**	**$488**	**$497**
Costs						
Investment (Capital) Cost	-	-	-	-	-	-
Operating and Renewal Costs	$142	$145	$147	$149	$151	$154
Cyclic Maintenance	$15	$18	$18	$18	$18	$18
Fleet Expansion	-	-	-	$100	-	-
Total Costs	**$157**	**$163**	**$165**	**$267**	**$169**	**$172**

Exhibit 6-10: Diesel 130 Alternative detailed Economic Benefits and Costs Flows by Year $2012 (Millions) (cont.)

Diesel 130 Economic Proforma	2043	2044	2045	2046
Constant US $2012 (millions)				
Benefits to Users				
Revenue	$217	$221	$226	$231
On Train Service	$17	$18	$18	$18
Total Revenue	**$234**	**$239**	**$244**	**$249**
Consumer Surplus	$140	$143	$146	$149
Total User Benefits	**$374**	**$382**	**$390**	**$398**
Benefits to Public at Large				
Airport Congestion Delay Savings	$24	$24	$25	$25
Airport Reduced Emissions	$14	$14	$14	$14
Road Congestion Relief	$39	$40	$42	$43
Highway Reduced Emissions	$27	$27	$28	$29
Safety Benefits	$32	$33	$33	$34
Total Benefits to Public at Large	**$136**	**$138**	**$142**	**$145**
Total Benefits	**$510**	**$520**	**$532**	**$543**
Costs				
Investment (Capital) Cost	-	-	-	-
Operating and Renewal Costs	$156	$158	$161	$163
Cyclic Maintenance	$18	$18	$18	$18
Fleet Expansion	-	-	-	-
Total Costs	**$174**	**$176**	**$179**	**$181**

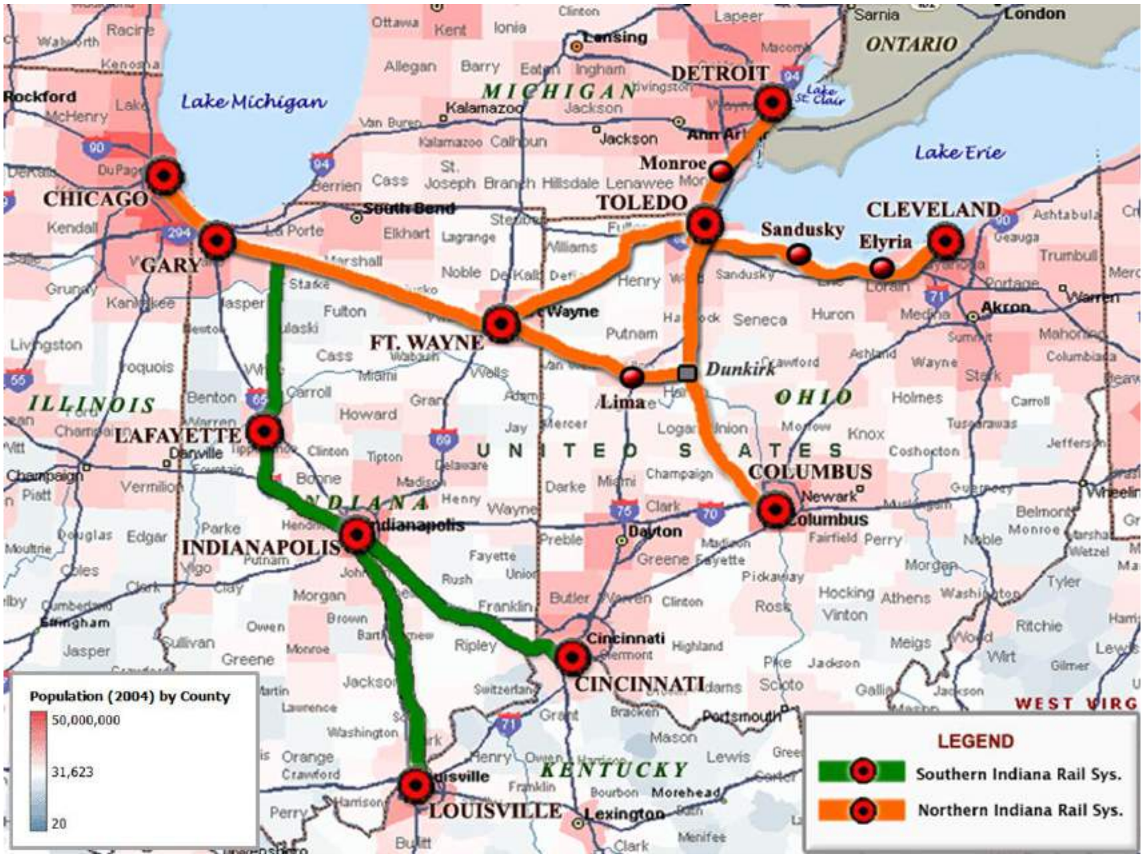
Exhibit 6-10: Diesel 130 Alternative detailed Economic Benefits and Costs Flows by Year $2012 (Millions) (cont.)

Diesel 130 Economic Proforma	2047	2048	2049	2050
Constant US $2012 (millions)				
Benefits to Users				
Revenue	$236	$241	$246	$251
On Train Service	$19	$19	$20	$20
Total Revenue	**$255**	**$260**	**$266**	**$271**
Consumer Surplus	$152	$156	$159	$162
Total User Benefits	**$407**	**$416**	**$425**	**$433**
Benefits to Public at Large				
Airport Congestion Delay Savings	$26	$26	$27	$27
Airport Reduced Emissions	$15	$15	$15	$16
Road Congestion Relief	$44	$46	$47	$49
Highway Reduced Emissions	$30	$30	$31	$32
Safety Benefits	$35	$35	$36	$37
Total Benefits to Public at Large	**$150**	**$152**	**$156**	**$161**
Total Benefits	**$557**	**$568**	**$581**	**$594**
Costs				
Investment (Capital) Cost	-	-	-	-
Operating and Renewal Costs	$165	$168	$170	$173
Cyclic Maintenance	$18	$18	$18	$18
Fleet Expansion	-	-	-	-
Total Costs	**$183**	**$186**	**$188**	**$191**

6.4 DIESEL 130 SHARED INFRASTRUCTURE COST SENSITIVITY ANALYSIS

The July 2007 Ohio and Lake Erie Regional Rail Ohio Hub Study considered the wider role of the Chicago to Columbus corridor. As shown in Exhibit 6-11, the corridor is also potentially fed by trains from connecting from other corridors, in particular: Cincinnati, Detroit, Pittsburgh and Cleveland.

Exhibit 6-11: Indiana/Ohio Extended Network



The track improvements of the Diesel 130 option would also benefit the traffic from outside the Chicago to Columbus corridor, if these beneficiaries of the Diesel 130 upgrade shared the capital costs for the upgrade, i.e. 200 million dollars, then the Diesel 130 Shared Cost Alternative would have a superior Benefit Cost Ratio to that of the Diesel 110 option at the 3% and 7% Discount rate. This assessment ignores the increased ridership and revenue that would be generated by the increased mobility offered to the Chicago-Fort Wayne-Columbus corridor.

Exhibit 6-12: Comparing the Alternatives Benefit-Cost results at the 3% and 7% Discount rates

Benefit Cost Ratio	Diesel 110	Diesel 130	Diesel 130 Shared Cost
3% Discount Rate	1.71	1.66	1.73
7% Discount Rate	1.31	1.24	1.32

7 Supplyside – The Economic Impact

7.1 Introduction

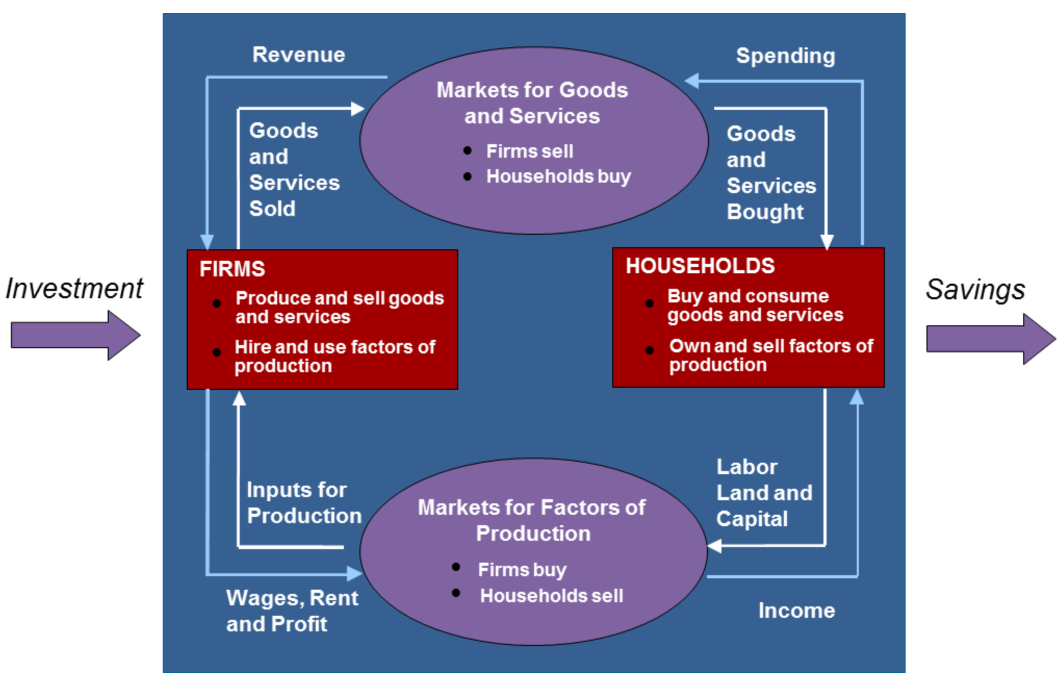
In order to estimate the economic impact of the Chicago to Fort Wayne to Columbus Corridor, it is important to understand the character of the different economic benefits that can be quantified.

Benefits will arise from the development and the presence of the High-Speed Rail system. The impact of these benefits will be significant, both at a firm and household level (see Exhibit 7-1 below). However, it is important to understand that the sets of benefits quantified in this report, assume equilibrium in the economy. In order for the economy to be in equilibrium, the Supplyside benefits must equal Demandside benefits. Supplyside and Demandside benefits should not be added together in the assessment of the full benefits of the project, as they are merely two different measurements of the same benefits.[1]

7.2 The Character of the Overall Economy

The model of the economy[2] shows that an economy is circular in character, with two equal sides (Exhibit 7-1).

Exhibit 7-1: Simple Model of the Economy



[1] See: Mishan, E. 'Cost Benefit Analysis,' New York, NY: Praeger Publishers, 1976.
[2] See Samuelson, P. & Nordhaus, W. Economics. 14th Edition. New York: McGraw-Hill. 1992.

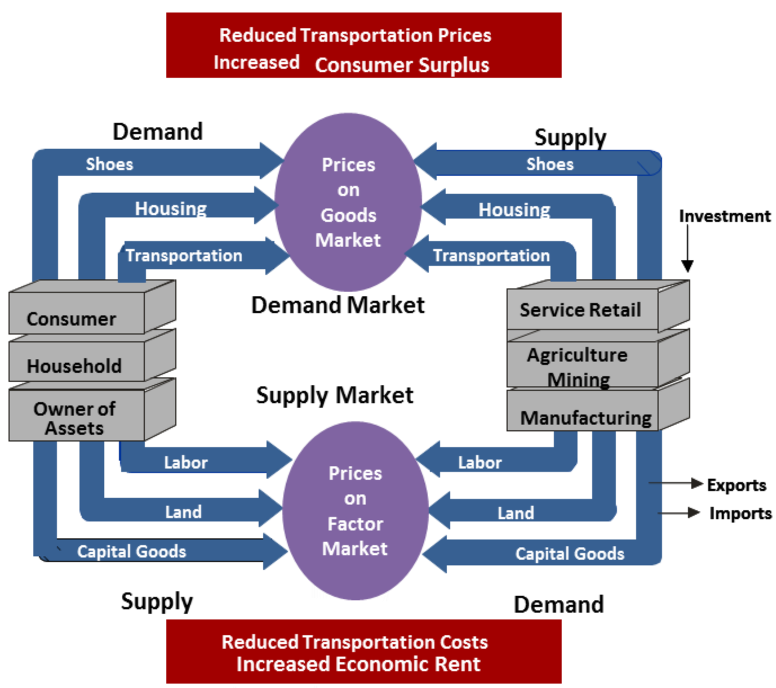
On one side of the economy is the consumer side – **the market for goods and services** – in which consumers buy goods and services by spending the income earned by working for a commercial enterprise. If a transportation investment improves travel times and costs for individuals, it increases consumer surplus. An analysis of the impact of a transportation investment on the market for goods and services quantifies the level of Consumer Surplus generated by a project, by showing how much time, money and resources individuals save.

The notion that a transportation project will be worthwhile if travel is made more cost effective is based on the idea that not only the cost, but also the travel time of a trip has value. In addition, academic and empirical research has shown that this concept holds true for commuters and recreational travelers as well. Considerable research has been carried out to both identify the theoretical justification for value of travel time and to quantify its value.

On the other side of the economy is the market for factors of production. Most importantly, it is the market for land, labor and capital, which individuals provide to firms in exchange for wages, rent and profit. From the perspective of policy makers and the local community, this side of the economy is very interesting as it shows how investment in a new transportation infrastructure changes the productivity of the economy by creating new business opportunities; and therefore, increases jobs, income and wealth.

One of the most important aspects of the circular economy model is that it shows that any project has two impacts, one in the consumer market – the benefits to travelers; the second, in the factor markets or Supplyside of the economy[3] – which identifies benefit to the community in terms of improved welfare due to increases in jobs, income and wealth. The supplyside benefits can be quantified as the increase in Economic Rent. This is shown in Exhibit 7-2.

Exhibit 7-2: Relation between Consumer Surplus and Economic Rent in the Economy



[3] See: Mishan, E. 'Cost Benefit Analysis,' New York, NY: Praeger Publishers, 1976.

For the economy to reach equilibrium, both sets of benefits must be realized. As such, the benefits of a project are realized twice, once on the Demandside and once on the Supplyside. As a result, there are two ways to measure the productivity benefits of a transportation project; and theoretically, both measurements must equal each other. This is a very useful property since in any specific analysis one measure can be used to check the other, at least at the aggregate level. This is very helpful and provides a check on the reasonableness of the estimates of project benefits.

However, in assessing the benefits of a transportation project, it is important not to double-count the benefits by adding Supplyside and Demandside benefits together. It must be recognized that these two sets of benefits are simply two different ways of viewing the same benefit. The two markets are both reflections of each other and measure the same thing. For example, if both sets of benefits equal $50 million, then the total benefit is only $50 million as expressed in two different ways: travelers get $50 million of travel benefits and the community gets $50 million in jobs, income, and increased profits. As a ripple effect (or transfer payment), the economy also gets an expanded tax base and temporary construction jobs.

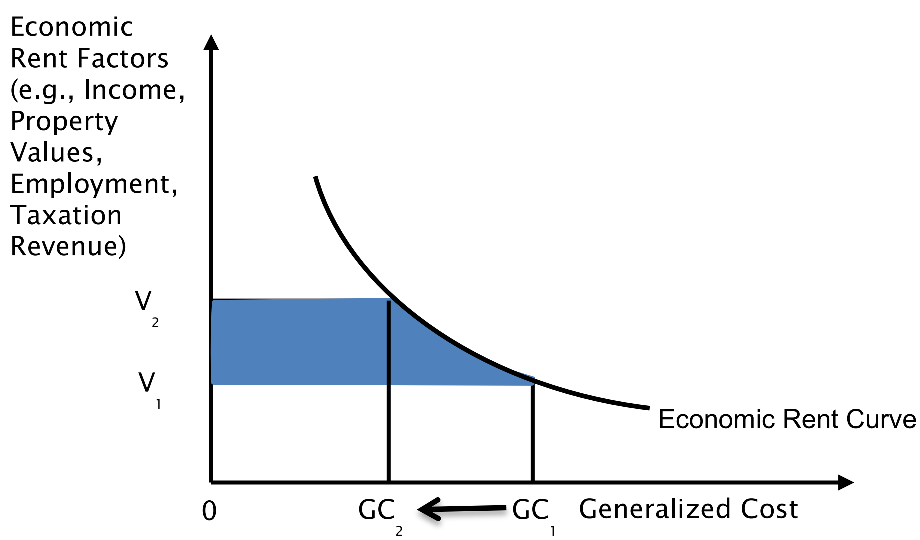
Therefore, if a given transportation project is implemented, equivalent productivity benefits will be seen in both the consumer market for goods and services (as the economy benefits from lower travel times and costs); as well as in the Supplyside factor markets. In the Supplyside side market, improved travel efficiency is reflected in more jobs, income and profit. Therefore, for a given transportation investment, the same benefit occurs on both sides of the economy. In the consumer markets, users enjoy lower travel costs and faster travel times. On the Supplyside of the economy, the factor markets take advantage of the greater efficiency in transportation. As a result, both sides of the economy move to a new level of productivity in which both sides of the economy are balanced in equilibrium.

Improved efficiency will generate Supplyside spending and productivity benefits that have a very real impact on the performance of the local economy. The method that develops estimates of productivity jobs and wealth creation is an Economic Analysis. It measures how the performance of a new transportation investment raises the efficiency of the economy. This efficiency improvement creates jobs and income, and raises local property values to reflect the improved desirability of living or working in the area.

7.3 ASSESSING SUPPLYSIDE BENEFITS

The Economic Rent theory builds from the findings of Urban Economics and The Economics of Location that support Central Place Theory[4]. Central Place Theory argues that in normal circumstances, places that are 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 investment 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 V1 to point V2 in Exhibit 7-3, as a result of the improved accessibility as measured by moving from GC1 to GC2.

Exhibit 7-3: Economic Rent Illustration

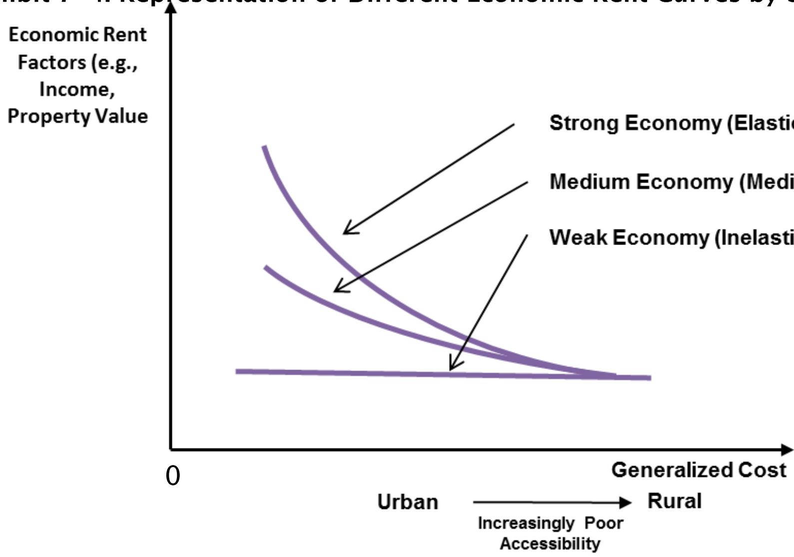


It should be noted that the shape of the economic rent curve reflects the responsiveness (elasticity) of the economy to an improvement in accessibility. Large cities typically have very large economic rent activity (represented by a steep Economic Rent Curve), which indicates that a project improving transportation accessibility will have a significant economic impact; smaller communities have less economic rent activity (less steep curves), and rural areas have very flat curves that indicate lower economic responsiveness. Similarly, depressed areas will experience flatter curves than better off areas. This is due to factors not directly related to transportation, such as level of education, population structure and industrial structure. A significantly improved transportation provision may

[4] Metcalf, A.E. 'Economic Rent: A New Dimension in the Economic Evaluation Process', Transportation Research Board, 71st Annual Meeting, January 12-16, Washington, DC, 1992.

bring a useful contribution to alleviating the problems faced by disadvantaged areas, but will not by itself solve the economic issues and problems that these areas face.

Exhibit 7-4: Representation of Different Economic Rent Curves by Strength of Economy



Finally, the strength of the relationship between generalized cost and economic factors is established by calculating the relationship between economic rent factors and generalized cost weighted by the amount of trips completed for the particular region of study. This ensures that when calculating the Supplyside effect of a transportation improvement, real gains in accessibility that benefit a large number of users, produce greater Supplyside benefits than projects that provide real accessibility gains for a small number of individuals.

The mathematical expression of the Economic Rent Curve is therefore –

$$SE_i = \beta_0 GC_i^{\beta_i}$$

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 auto travel for all purposes from (to) zone i to (from) other zones in the study area;

$ß_o$, $ß_1$ - Calibration parameters.

The resulting curve generated by this function is the economic rent profile for transportation accessibility. The generated cost of auto travel includes all aspects of travel time (in-vehicle time), and travel cost. The generalized cost of travel is typically defined in travel time rather than dollars. Costs are converted to time by applying appropriate value of time conversion factors. The generalized cost of auto travel between zones I and j for purpose p is calculated as follows –

$$GC_i = \sum_p \sum_m \sum_j GC_{ij}^{mp} + T_{ij}^{mp}$$

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;

In order to measure the effect of Chicago to Fort Wayne to Columbus Corridor project on the State's economy we use three socioeconomic indicators: employment, average household income and average property value.[5]

7.4 DATA SOURCES AND STUDY DATABASE

The purpose of the study is to explore the economic productivity impacts that will result from the Chicago to Fort Wayne to Columbus High-speed rail corridor. Economic Rent Model (RENTS™) generates producer impacts. The modeling and calibration process for the Economic Rent assessment for the current study draws heavily on the socio-economic database developed by TEMS for this study, property value and housing units from previous MWRRI Economic Rent Model database[6], which evaluated the potential for a High-Speed Rail link between Chicago to Fort Wayne to Columbus cities.

For the current study a preliminary economic Rent assessment was conducted. The socioeconomic variables such as employment, Income and number of households was collected from Census and MPO's at county and census tract level as discussed in Chapter 2.The property values was taken from the previous Midwest study and inflated to 2012 dollars.

Generalized cost generated from the COMPASS™ model was used for recalibration of the Economic Rent model. Transportation networks and trip databases developed for the corridor as discussed in Chapter 2 were used to generate the current and future generalized costs for each zone along the corridor. The 3 percent discount rate was used to reflect long term borrowing rates.

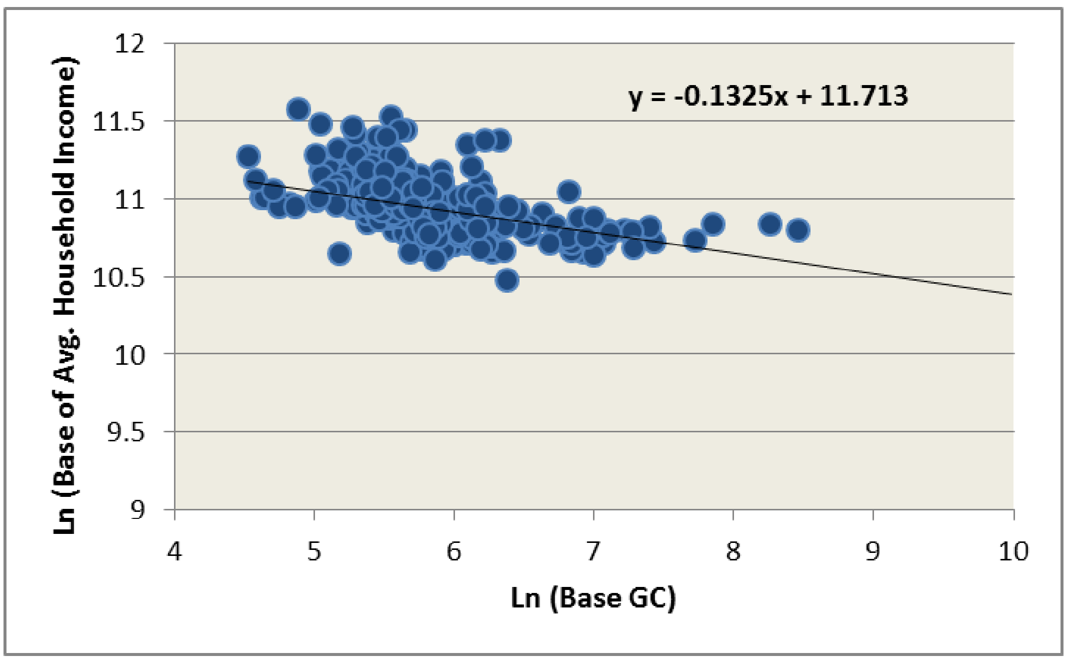
[5] Due to the limited availability of property value data, for each zone we use average value of all owner occupied housing units, and then factored this value to include commercial property.
[6] Midwest Regional Rail Initiative Project Notebook - Chapter 11, prepared by TEMS in association with HNTB, Nov. 2006.

7.5 SUPPLYSIDE ANALYSIS RESULTS: DERIVING ECONOMIC RENT ELASTICITIES

7.5.1 CALCULATING SENSITIVITIES

Economic Rent theory proposes that for a transportation project to have value, there will be a strong relationship between socioeconomic variables and accessibility. As such, the relationship between accessibility and income, employment, and property values along Chicago to Fort Wayne to Columbus corridor was calculated through regression analysis. This analysis established the level of sensitivity of the region's economy to transportation improvements. Exhibits 7-5 thru 7-7, show the relationship established between accessibility and income, employment, and property values for traffic and zones and Exhibit 7-8) shows with the statistical measures indicating the strength of the relationship found.

Exhibit 7-5: Relationship between Accessibility and Average Household Income[7]



[7] Mathematical relationship between the measure of accessibility (generalized cost of travel) and average household income (Economic Rent socio-economic variable) for each transportation zone.

Exhibit 7-6: Relation between Accessibility and Employment Density[8]

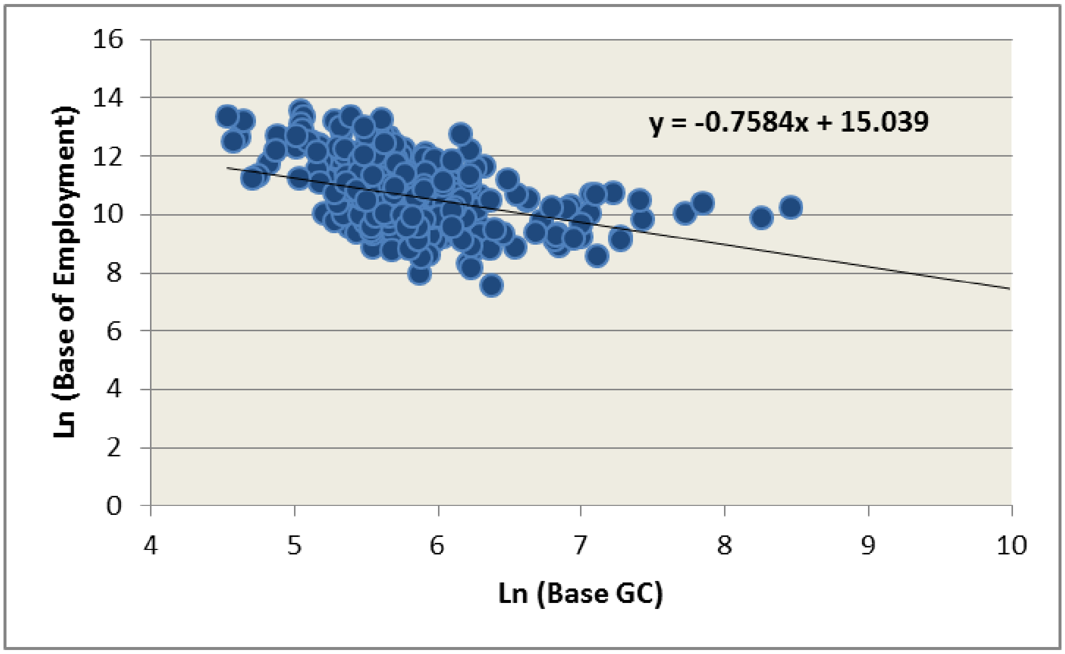
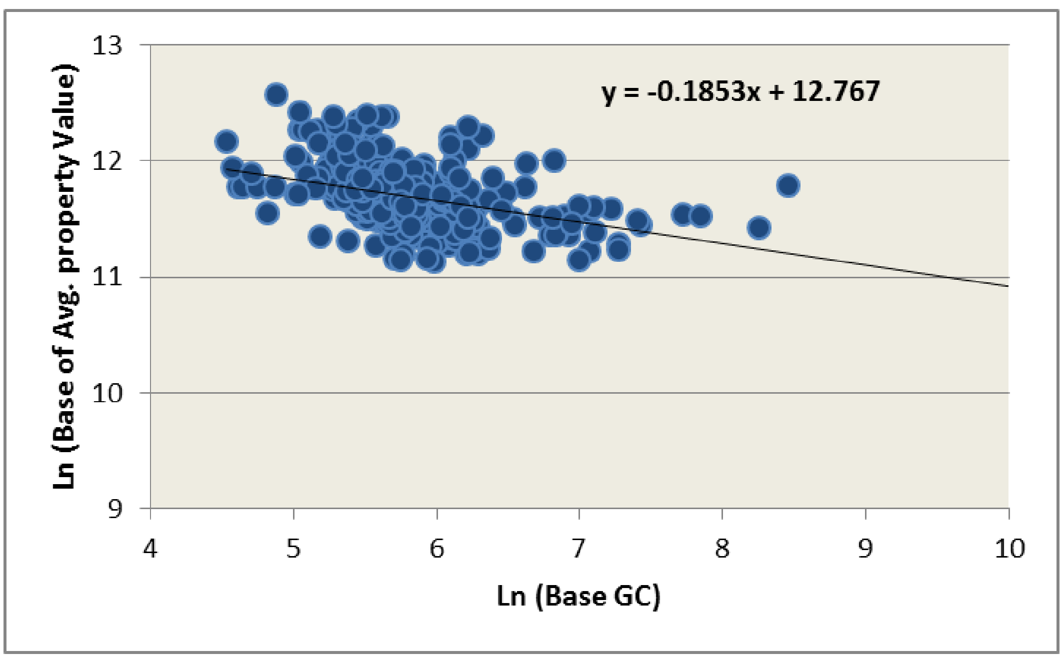


Exhibit 7-7: Relationship between Accessibility and Average Property Value[9]



[8] Mathematical relationship between the measure of accessibility (generalized cost of travel) and employment (Economic Rent socio-economic variable) for each transportation zone.
[9] Mathematical relationship between the measure of accessibility (generalized cost of travel) and average property value (Economic Rent socio-economic variable) for each transportation zone.

As can be seen in Exhibits 7-5, 7-6 and 7-7, the relationship between accessibility and socioeconomic characteristics is a linear relationship of the following form –

$$Ln(SE_i) = \beta_0 + \beta_1 Ln(GC_i)$$

Where:

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

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

βo and $\beta 1$ - Regression coefficients.

Exhibit 7-8: Economic Rent Coefficients for Socioeconomic Variables

	β_0	β_1	T-stat for β_1	T-stat for β_0	Multiple R
Employment	**15.039**	**-0.758**	**-8.431**	**28.530**	**0.413**
Average Household Income	**11.713**	**-0.133**	**-9.669**	**145.826**	**0.462**
Average Property Value	**12.767**	**-0.185**	**-8.511**	**100.052**	**0.417**

Each equation in Exhibit 7-8 has highly significant ‘t’ values and Multiple ‘R’ values. 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 or economic rent, and secondly that generalized cost is an effective measure of market accessibility.

Students’ t statistics were calculated for the two regression coefficients - β_0 (the intercept) and β_1 (the slope) indicate the significance of the regression coefficients. A t-statistics above the value of two in absolute terms is generally accepted as statistically significant.

It can be seen that for the current study, the preliminary calibration was successful and regression coefficients in each equation were shown to be significant. (See exhibit 7-8). Each equation has highly significant ‘t’ values and multiple R. 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.

The impact on the socioeconomic indicators gathered for the current study, with regard to the improvement in accessibility provided by the new High-Speed Rail system, is calculated according to the elasticities (i.e. the sensitivity of the socioeconomic parameters to accessibility) established through the differentiation of the economic rent function in above equation with respect to generalized cost. The result of such differentiation is present in following equation. It is easy to see that slope β_1E in the regression equation represent economic rent elasticities.

$$\Delta SE_I = \frac{\partial SE_I}{SE_I} = \beta_1^E \frac{\partial GC_I}{GC_I}$$

The resulting elasticities were then applied to each zone pair according to the specific generalized cost improvement calculated for each zone for each phase of the project. This allows for the effect of High-Speed Rail to be calculated from a Supplyside perspective.

The resulting effect on the socioeconomic parameters are presented below. All results presented are preliminary results for the whole corridor from Chicago to Fort Wayne to Columbus.

7.5.2 PRELIMINARY RESULTS

The Preliminary Results are derived using the data and statistical analysis specified in section 7.3 and 7.4. For 300 mile Chicago to Fort Wayne to Columbus high-speed rail corridor improvement will create more than 26 thousand jobs and employment is estimated to grow by 806,338 person years over a 30-year period. Property values are estimated to increase by $2.6 billion in 2012 dollars and household income is estimated to increase approximately by $7.1 billion over the life of the project discounted at 3 percent. These results are shown in Exhibit 7-9. Multiple Economic Rent studies performed by TEMS show that the maximum economic benefits are achieved in the radius of 5 miles from the improvement area[10].

Exhibit 7-9: Corridor wide Economic Benefits over 30 years Project Life

Benefit Parameter	Discount Rate at 3 percent
Supplyside Benefits:	
Income Benefits: (Billions 2012 $)	**$7.1**
Employment (Thousands of person years of work)	**806**
Residential[11] Property Value (Billions in 2012 $)	**$2.6**

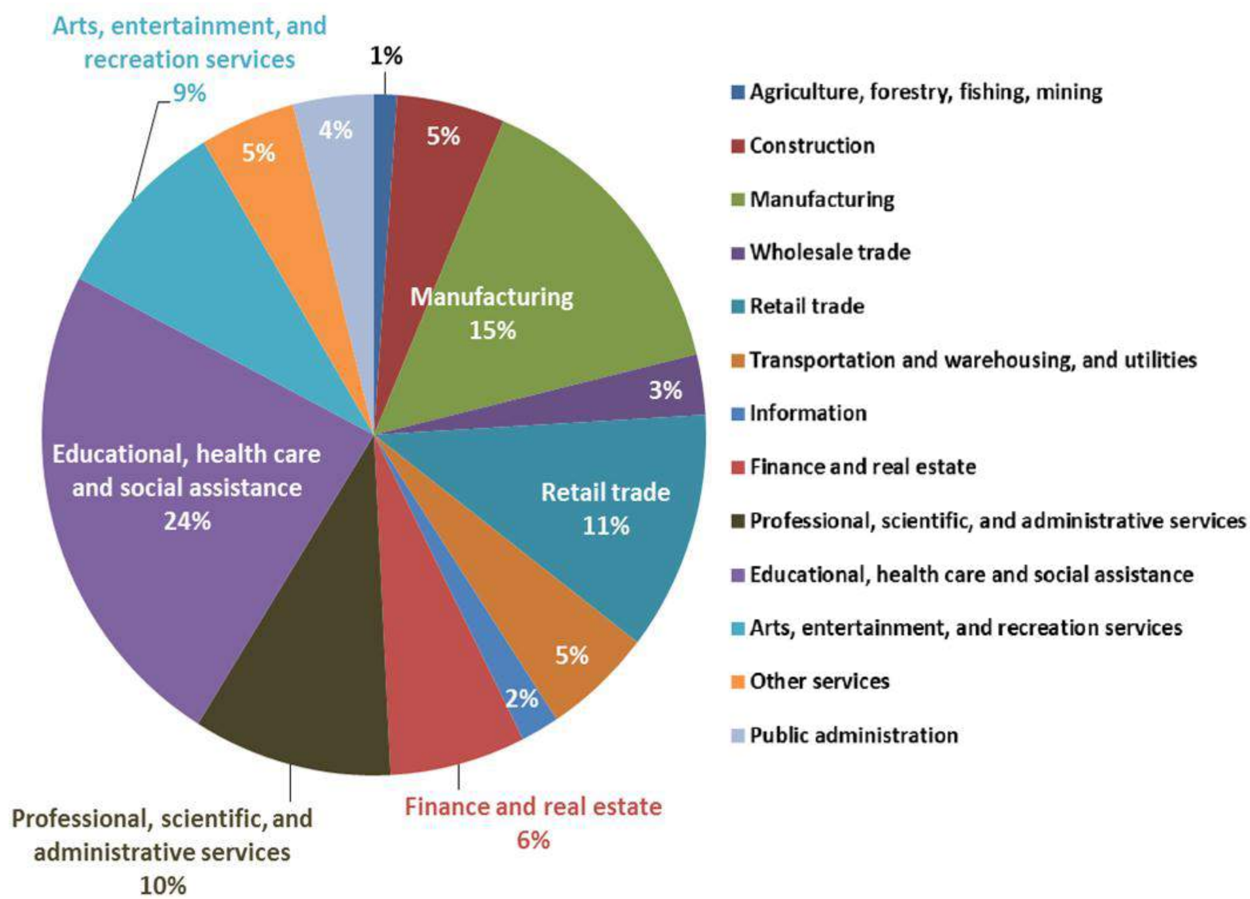
[10] 'Ohio Hub Passenger Rail Economic Impact Study' Prepared for Ohio Rail Development Commission, Ohio DOT. TEMS, Inc. May, 2007. Chapter 7, p. 51; Bzhilyanskaya, L., Metcalf, A. 'Economic Rent: The Supply-Side's Answer To Consumer Surplus' (forthcoming).
[11] Due to limitation in commercial property value availability only residential property values were considered.

7.5.2.1 JOB TYPE CREATION

Based on an analysis of the most accessible areas within the study, we expect most employment to be created in the Educational services, and health care and social assistance (24 percent), Manufacturing (15 percent), Retail Trade (11 percent), Arts, entertainment, and recreation, and accommodation and food services (9 percent) and finance and real estate industries (6 percent). These classifications are based on NAICS industry sector classification. Other services include construction (5 percent), transportation and warehousing, and utilities (5 percent), public administration (4 percent), wholesale trade (3 percent), information (2 percent), and Agriculture, forestry, fishing and hunting, and mining (1 percent).(See Exhibit 7-10)

Overall, the jobs created as a result of the High-Speed Rail system, will be in the tertiary sector and will be high paying. Greater Incomes within a region encourage more economic activity, which in turn, will boost the demand for workers with lower skills, thus expanding overall economic activity to the region.

Exhibit: 7-10: Job Creation Type Estimates



It should be noted that in addition to the substantial productivity jobs that are created over the life of the project, there will also be temporary construction jobs associated with the building of the system. These are estimated at around 12,000 person jobs of work for 5 years construction time of the project.[12]

7.5.3 INCOME BENEFITS

Better accessibility increases income through better efficiency in the allocation of resources and through overall growth in the employment market.

From an employer perspective, productivity of employees increases due to decreases in time spent traveling and better allocation of time. Employees traveling for business purposes and using rail mode instead of Air or Car, may now be expected to work or prepare for work during their travel. Non-rail users will benefit through decreases in congestion on the overall highway network, and more business will be conducted between the different cities. Overall, better productivity due to better accessibility will increase revenue for companies, some of which will be translated through increases in wages, increased interest and dividends, and by reinvestment of profits in new opportunities.

From an individual perspective, better productivity will not only lead to increases in salaries, but also the opportunity to have access to a wider pool of jobs, some at greater distances that are now made possible through better transportation links, with some jobs created closer to their place of residency. The increased dividends and interest will also increase non-income wages, as well as increase property prices and rental income.

From a government perspective, the increased income will increase the tax base. The figures shown are gross income before taxation. Taxation revenues are discussed in Section 7.5, and are of course transfer payments, as the income generated by employers and individuals is now transferred to government. While not strictly an economic benefit, they clearly affect the ability and willingness of government to finance a project.

It can also be seen that income generated by the project is equal to benefits calculated in the Demandside analysis. This is consistent with economy theory which states that Demandside benefits must be equal to Supplyside benefits. Regionwise impact will be developed in the next phase of the study.

[12] The estimation of temporary construction jobs were developed by using RIMS II Input Output multipliers for the corridor.

7.5.4 PROPERTY VALUES

High-Speed Rail along the Chicago to Fort Wayne to Columbus corridor will not only increase income and employment, it will also increase property valuation through the improved accessibility provided. More accessible places generate a premium in property prices. Property prices are also higher due to the income and employment level increase along the corridor as seen in Exhibit 7-9. All this ensures that property values will increase significantly for the life of the project.

As discussed in earlier chapters 4 and 6, the construction cost along the corridor is expected to be about $1.28 Billion for 110 option and $1.68 Billion for 130 option.

Most of the property development will happen around future stations through refurbishment of existing structures, conversion of parking lots and through the redevelopment of existing stations.

The density and height of the building projects will depend on existing property prices for each city served, the space around stations available for conversion, local rules and regulations such as height and zoning rules, and the level of increases in accessibility.

7.6 TRANSFER PAYMENT ANALYSIS RESULT

Transfer payments are benefits transferred from one party to the other. As such, they do not constitute an additional economic benefit resulting from a project, but merely a reallocation of resources. In this analysis, Federal, State and local taxation benefits are benefits transferred from individuals to Government[13]. In addition, temporary employment created by building the project is also a transfer payment as it is simply a reallocation of resources from one location to another, and does not add additional jobs to the overall economy. If the government spent the money in another State, the jobs would be created at that location.

7.6.1 FEDERAL AND STATE INCREASED INCOME TAX BASE

High-Speed Rail will have a significant impact on State and local finances. Increases in economic activity will lead to an increase in general tax receipts at the Federal, State and local level. Increased incomes will increase income taxation revenue and also lead to increased consumer spending. Exhibit 7-11 shows the additional taxation revenue expected for the corridor over the life of the project discounted at 3 percent.

[13] Mercator Advisors & VantagePoint Associates, “Financing High-Speed Intercity Passenger Rail with Tax Credits: Policy Issues and Fiscal Impacts, APTA, 2008

Exhibit 7-11: Tax Revenues for the Corridor over 30 years Project Life

Tax Revenues	Discount Rate at 3 percent
Transfer Payments - Tax Value (Millions 2012 $)	
Federal Income Tax[14]	**$894**
State Income Tax[15]	**$347**
Residential Property Tax[16]	**$679**
Total Tax Values	**$1,920**

* Excludes FICA (Federal Insurance Contributions Act) tax payments

As can be seen, the project will be fully funded through an increase in the income taxation base at the Federal and State level while creating a net revenue gain overall for government. This is important from a policy perspective and social justice consideration, a considerable share of the project will be paid for by Federal tax payers. The new taxation revenues that result from the project ($1.92 Billion) over the life of the project cover the cost of the project for 110 option and provide a return for government.

7.7 CONCLUSION

The summary of each set of benefits calculated for the corridor are given below. As seen in the analysis, the proposed Chicago to Fort Wayne to Columbus Corridor will not only generate financial and Demandside economic benefits but will provide a strong stimulus the economy along the corridor. It will create long term well paid service employment due to improved productivity. Furthermore, it will benefit the general population through higher incomes and higher property values. Federal and State government will be able to fully recoup the cost of their investment in the project through an expanded tax base.

7.7.1 ECONOMIC BENEFITS TO THE ECONOMY (SUPPLYSIDE ANALYSIS)

Supplyside benefits are the estimated benefits to business and the economy due to the increase in accessibility provided by improvements in transport infrastructure. It is based on the relationship (the elasticity) that the economy exhibits today to transportation accessibility (i.e., sensitivity to improved accessibility). Given the circular nature of the economy, Supplyside benefits under economic theory are equal to the Demandside benefits due to the integrated nature of the economy.

[14] http://taxfoundation.org/sites/taxfoundation.org/files/docs/ff131.pdf
[15] http://taxfoundation.org/state-tax-climate/illinois
[16] http://www.scribd.com/doc/82720797/Prop-Percent-of-Home-Value

Estimates over the 30 year life of the project are –

- $7.1 Billion (at 3% discount rates) increase in income over 30 years, throughout Chicago to Fort Wayne to Columbus Corridor in 2012 dollars.
- Long-term productivity employment will rise by 806,000 person years of work. Most of the jobs will be created in the Educational services, and health care and social assistance; Manufacturing; Retail Trade; Arts, entertainment, and recreation, and accommodation and food services; and finance and real estate industries.
- Property Values are estimated to rise by $2.6 Billion.

Three important pecuniary impact (transfer payments) benefits of the project are –

- $0.9 Billion new Federal taxation over 30 years will be generated.
- $0.35 Billion new State taxation over 30 years will be generated.
- $679 Million in property tax will be collected at the local level.
- A total of $1.92 Billion will be generated by new Federal and State taxation along with property taxation over 30 years life of the project.
- The temporary construction jobs are estimated around 12,000 person years of work for the period of construction.

The results of the current analysis show that High-Speed Rail will result in benefits to the government, the business community and the residents of Ohio, Illinois, and Indiana.

8 CONCLUSIONS

8.1 OVERALL FINDINGS

The results of the Business Plan Analysis show the following –

- In line with the findings of the MWRRI and the Ohio Hub Study the development of 110 mph or 130 mph Diesel passenger rail has positive financial and economic results and represents a sound project for Federal, State and private sector investment.
- In the new era of increasingly congested highways, more expensive air service, and increasing energy prices, the Chicago-Fort Wayne-Columbus corridor offers a way of maintaining intercity mobility and provides an effective way of providing new capacity for the rapidly growing intercity market.
- The 110 mph Diesel option as first defined by the MWRRI and Ohio Hub passenger rail studies provides an affordable low cost approach to providing High-Speed Rail. This approach is already being realized in the Chicago-St. Louis, and Chicago-Iowa city that are being developed as Phase I-IV of the MWRRI. The development of the Chicago-Fort Wayne-Columbus corridor represents part of Phase V of the MWRRI and the Ohio Hub plans.
- A key factor in the development of the 110 mph Diesel passenger rail option is the high-speed diesel technology that has been developed by a wide range of manufacturers following the success of the Paxman diesel technology developed by British Rail for its highly successful Intercity 125 mph train service.
- The 110 mph Diesel technology is actually capable of 130 mph and was only restricted to 110 mph in order to reduce capital costs for infrastructure. USDOT FRA regulations require that all crossings are grade separated at 125 mph and above. As a result, at lower levels of ridership the 110 mph option makes most sense. However, due to the growth of population and the economy, as well as increasing highway and airport congestion, and increasing energy costs the case for increasing speeds has dramatically improved. It can be seen in the financial and economic analysis that the case for taking speeds to 130 mph between Fort Wayne and Gary is very strong. While the Cost Benefit Ratios are marginally lower for 130 mph option (See Exhibit 8-1), if the extra capital cost can be shared by more than one route, the 130 mph produces higher financial and economic returns (See Exhibit 8-2), and a slightly higher Net Present Value at 3 percent; and only slightly lower at 7 percent (See Exhibit 8-3).

Exhibit 8-1: Comparing the Alternatives Benefit-Cost results at the 3% and 7% Discount rates

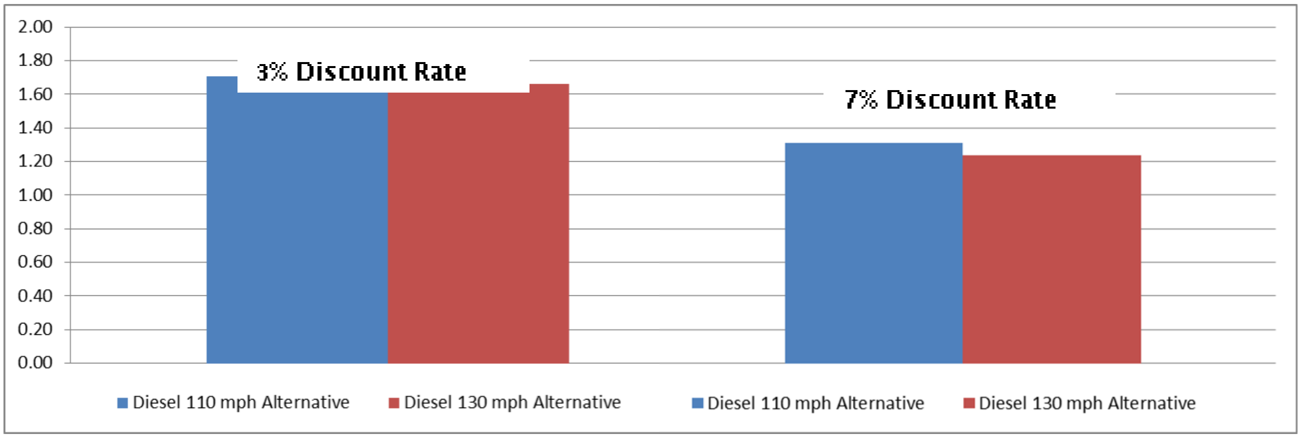


Exhibit 8-2: Comparing the Alternatives Operating Ratios at the 3% and 7% Discount rates

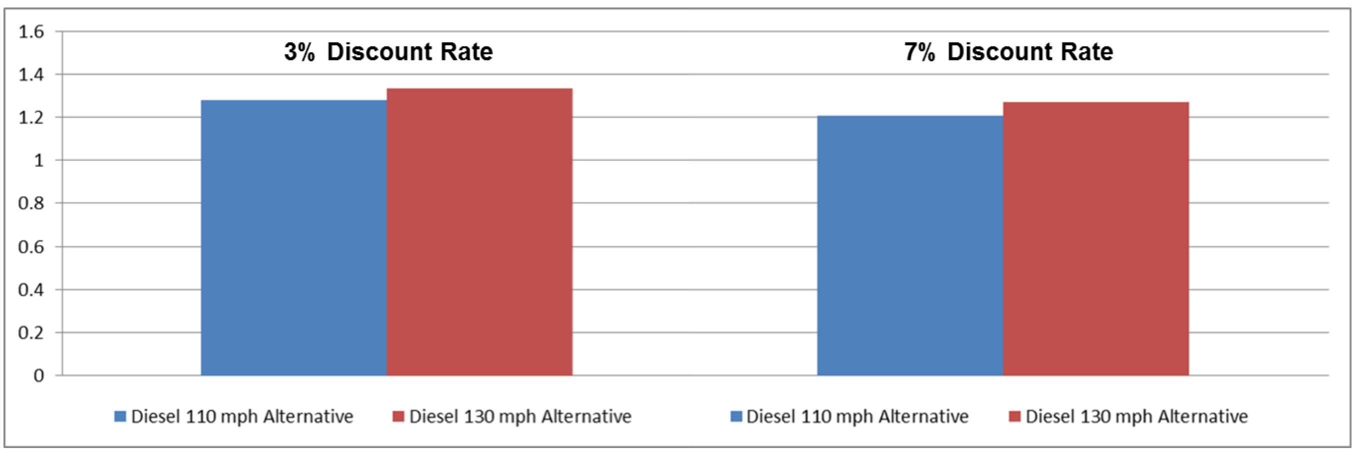
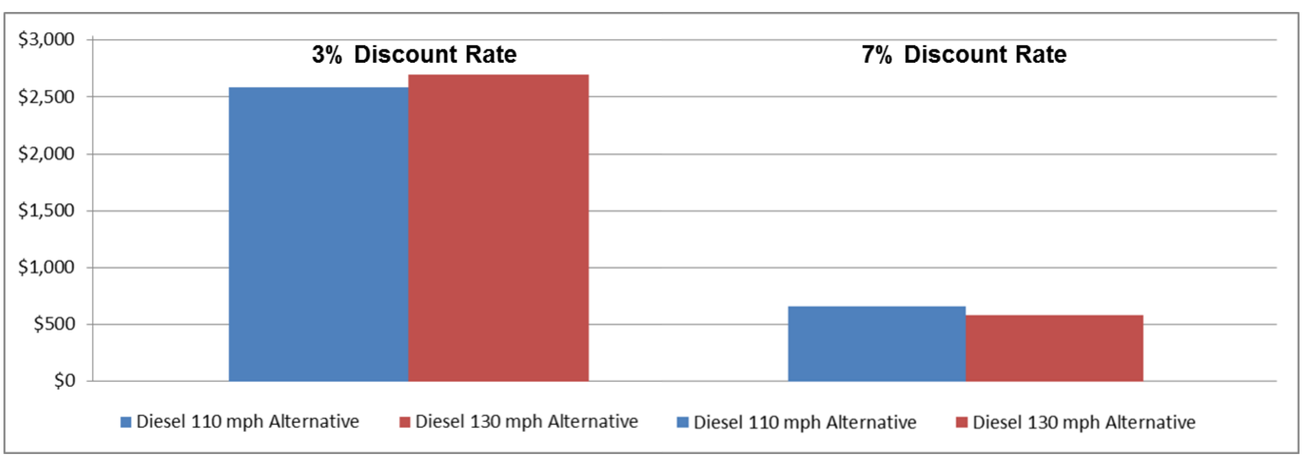


Exhibit 8-3: Comparing the alternatives NPV Economic Surplus at the 3% and 7% Discount rates



- Another key aspect to the current proposal for 110 mph or 130 mph options, is that the 130 mph option can be layered on top of the 110 mph and might be considered as a Phase 2. In ten years the 130 mph will show better financial and economic returns than 110 mph just because of the continued growth of the region and the continued increase in highway congestion and energy prices.
- Furthermore, as shown in Exhibit 8-4 if the Chicago-Fort Wayne-Columbus corridor is linked to Toledo, Detroit, Cleveland, as proposed in the Ohio Hub, and to Lafayette, Indianapolis, Cincinnati, and Louisville, the sharing of fixed costs, and increased frequency of service particularly from Fort Wayne to Gary, and Dunkirk to Columbus would tip the financial and economic results towards an immediate upgrade of train speed to 130 mph. (See Exhibit 8-5)

Exhibit 8-4: Indiana/Ohio Extended Network

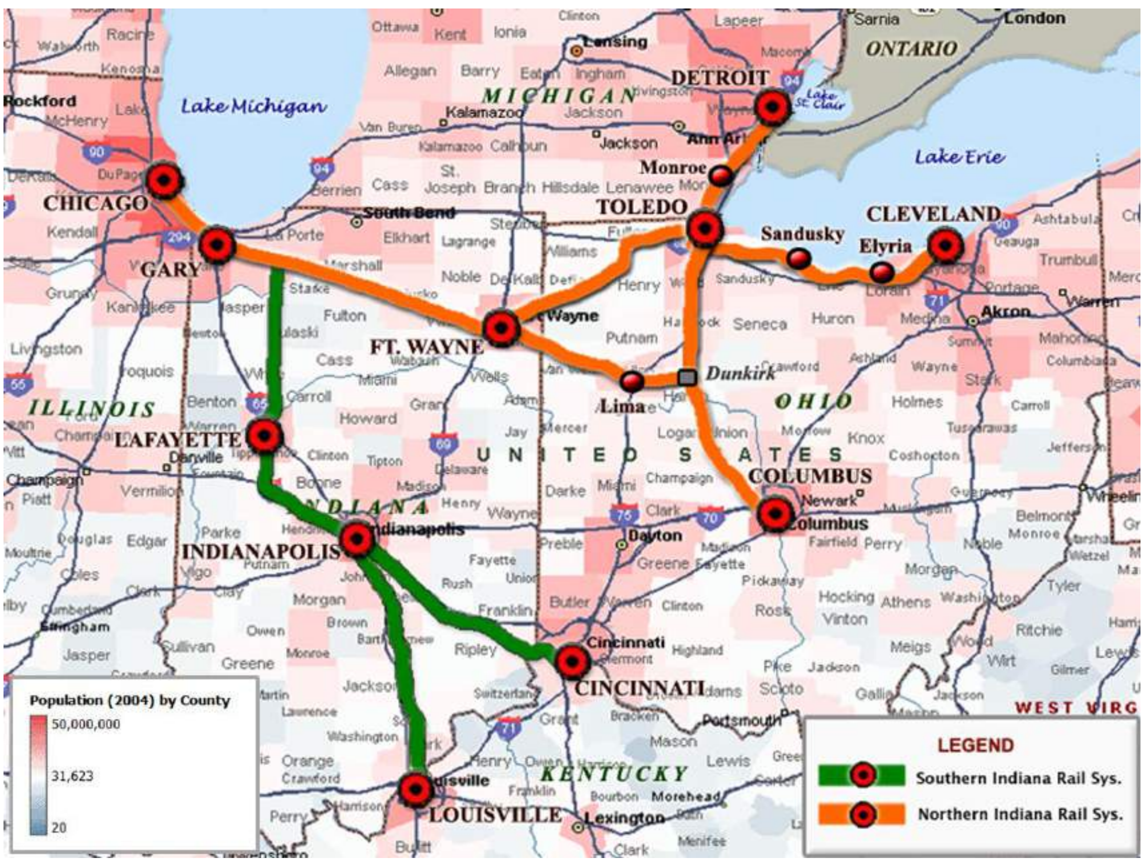


Exhibit 8-5: Comparing the Alternatives Benefit-Cost results at the 3% and 7% Discount rates

Benefit Cost Ratio	Diesel 110	Diesel 130	Diesel 130 Shared Cost
3% Discount Rate	1.71	1.66	1.73
7% Discount Rate	1.31	1.24	1.32

- In addition to the ability to upgrade the corridor over time from 110 mph to 130 mph, the corridor is remarkable in that the route is so straight that it can in time be upgraded to even higher speed (150 mph to 220 mph) by adding electrification. A third phase might be to electrify the route at a cost of $2-3 million per mile (2012 dollars) and operate trains at speeds that would reduce the time from Columbus to Fort Wayne to Chicago to 2:30 hours, rather than the 4:00 hours of the 110 mph technology or the 3:30 hours of the 130 mph technology. In this corridor unlike most others the curves are so few and so gradual that very high-speed service can be achieved at very low cost. This includes corridors in California, Florida, the Northeast, and even the Midwest Chicago-Minneapolis-Tristate corridor.

8.2 FINANCIAL BENEFITS

It is forecasted that the 110 mph Option will lead to ridership and revenue results that will ensure that the project covers its operating costs –

- $2.93 Billion is anticipated from ticket sales and ancillary revenues at a 3% discount rate.
- $2.29 Billion is forecast for the operation of trains and maintenance of infrastructure at 3% discount rate.

This gives an operating ratio of 1.28 and a project life surplus of $639 million. This is a strong indication of the sustainability of the project and the ability to franchise the route.

8.3 BENEFIT COST

Demandside Benefit Cost Analysis which evaluates the benefits to travelers in the corridor against costs has the following results at a 3% discount rate –

- A total Benefit of $6.24 Billion, including $2.93 Billion in revenues, $1.67 Billion in user benefits (consumer surplus), and $1.65 Billion in congestion, emission, and safety benefits.
- A total Cost of $3.66 Billion; including $1.13 Billion of Capital Cost, $2.3 Billion of Operating and Maintenance costs.

This provides a Benefit Cost Ratio of 1.71 with a $2.59 Billion Net Present Surplus.

8.4 ECONOMIC IMPACT ANALYSIS (SUPPLYSIDE)

The Supplyside Analysis identified the impact on the economy of the corridors communities in terms of productivity improvements. These include –

- $7.1 Billion increase in Income.
- 806,000 person years of work largely in the business and service sectors.
- Property Value increase of $2.6 Billion along the corridor.
- The temporary construction jobs are estimated around 12,000 person years of work for the period of construction.

As a Transfer Payment the project generates –

- An additional $1.25 Billion in Federal and State Income Tax.
- An additional $679 Million in Property Tax Base.

The increase in the tax base revenues are about the same as the cost of the project, i.e., Net Present Value of $1.92 Billion in extra tax, compared to Net Present Value of $1.13 Billion in Capital Cost.

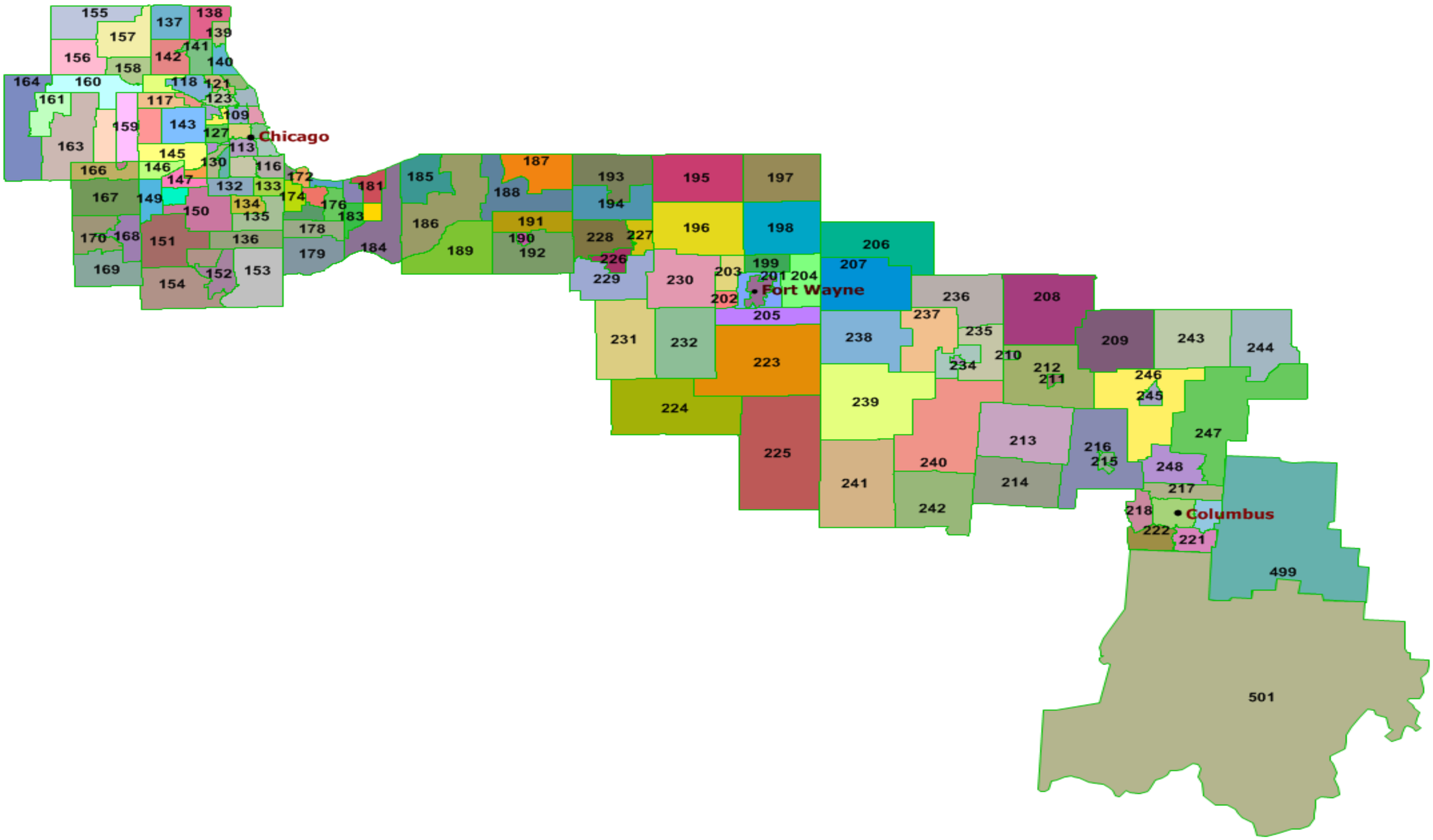
The project will result in benefits to government, business community, and residents of the corridor. These benefits are in terms of increased income and property values, more jobs in service industries (finance, banking, insurance, Scientific, professional, educational and health care, and retail) as well as manufacturing and construction; together with a significant improvement in regional mobility.

APPENDICES

APPENDIX 1: ZONE SYSTEM AND SOCIOECONOMIC DATA

1 ZONE SYSTEM AND SOCIOECONOMIC DATA

The study area is divided into 142 zones:



1.1 POPULATION DATA AND FORECASTS

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
1	171	Whiting, IN	18,866	19,240	19,240	19,646	20,070	20,495	20,918	21,133	21,470
2	172	East Chicago, IN	23,601	24,068	24,068	24,576	25,107	25,638	26,167	26,436	26,857
3	173	Gary, IN	14,020	14,297	14,297	14,600	14,915	15,231	15,545	15,704	15,955
4	174	Hammond, IN	170,053	173,411	173,411	177,076	180,897	184,729	188,539	190,475	193,510
5	175	Gary, IN	78,357	79,910	79,910	81,599	83,360	85,125	86,881	87,774	89,173
6	176	Hobart, IN	49,272	50,248	50,248	51,310	52,417	53,527	54,631	55,193	56,073
7	177	Schererville, IN	67,114	68,443	68,443	69,890	71,398	72,910	74,414	75,178	76,377
8	178	Crown Point, IN	54,267	55,342	55,342	56,512	57,731	58,954	60,170	60,788	61,757
9	179	Lowell, IN	20,597	21,004	21,004	21,448	21,911	22,375	22,837	23,071	23,439
10	180	Portage, IN	47,145	49,903	49,903	52,762	55,681	58,618	61,562	63,124	65,489
11	181	Chesterton, IN	28,744	30,430	30,430	32,173	33,953	35,744	37,539	38,492	39,934
12	182	Valparaiso, IN	43,291	45,829	45,829	48,454	51,135	53,832	56,536	57,971	60,143
13	183	Valparaiso, IN	16,019	16,958	16,958	17,930	18,922	19,920	20,920	21,452	22,255
14	184	Valparaiso, IN	29,358	31,078	31,078	32,859	34,677	36,506	38,339	39,312	40,785
15	185	La Porte, IN	84,509	84,950	84,950	85,529	86,174	86,814	87,435	87,706	88,188
16	186	La Porte, IN	26,970	27,111	27,111	27,296	27,501	27,706	27,904	27,990	28,144
17	187	South Bend, IN	245,776	249,909	249,909	254,529	259,402	264,315	269,220	271,589	275,437
18	188	South Bend, IN	21,102	21,459	21,459	21,856	22,274	22,696	23,117	23,321	23,651
19	189	Knox, IN	23,378	24,162	24,162	24,990	25,841	26,695	27,548	27,996	28,680
20	190	Plymouth, IN	11,927	12,187	12,187	12,470	12,765	13,061	13,357	13,506	13,740
21	191	Bremen, IN	16,039	16,388	16,388	16,768	17,164	17,563	17,961	18,160	18,476
22	192	Plymouth, IN	19,060	19,475	19,475	19,927	20,397	20,871	21,344	21,581	21,956
23	193	Elkhart, IN	172,595	177,937	177,937	183,601	189,440	195,303	201,156	204,207	208,894
24	194	Goshen, IN	24,969	25,743	25,743	26,563	27,408	28,256	29,103	29,544	30,223

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
25	195	Lagrange, IN	37,146	38,008	38,008	38,940	39,909	40,885	41,858	42,351	43,124
26	196	Albion, IN	47,507	49,500	49,500	51,588	53,733	55,891	58,053	59,182	60,911
27	197	Angola, IN	34,140	34,972	34,972	35,865	36,794	37,727	38,659	39,134	39,875
28	198	Waterloo, IN	42,259	44,543	44,543	46,917	49,345	51,791	54,245	55,536	57,501
29	199	Huntertown, IN	41,782	43,358	43,358	45,014	46,718	48,434	50,151	51,044	52,416
30	200	Fort Wayne, IN	166,554	172,833	172,833	179,436	186,229	193,066	199,910	203,471	208,941
31	201	Fort Wayne, IN	77,720	80,652	80,652	83,733	86,903	90,093	93,287	94,949	97,502
32	202	Fort Wayne, IN	35,811	37,162	37,162	38,582	40,042	41,512	42,984	43,750	44,926
33	203	Huntertown, IN	5,921	6,144	6,144	6,379	6,620	6,863	7,107	7,233	7,428
34	204	Grabill, IN	13,765	14,282	14,282	14,827	15,389	15,954	16,519	16,813	17,265
35	205	Fort Wayne, IN	14,241	14,778	14,778	15,342	15,923	16,507	17,093	17,397	17,865
36	223	Bluffton, IN	27,659	28,101	28,101	28,592	29,109	29,627	30,142	30,397	30,804
37	224	Gas City, IN	70,003	69,562	69,562	69,234	68,954	68,667	68,360	68,131	67,864
38	225	Winchester, IN	26,157	25,886	25,886	25,667	25,475	25,289	25,101	24,948	24,775
39	226	Warsaw, IN	30,126	30,869	30,869	31,665	32,492	33,324	34,154	34,577	35,237
40	227	North Webster, IN	14,548	14,906	14,906	15,290	15,690	16,091	16,492	16,696	17,015
41	228	Warsaw, IN	14,971	15,338	15,338	15,734	16,145	16,558	16,970	17,180	17,508
42	229	Claypool, IN	17,702	18,137	18,137	18,605	19,091	19,579	20,067	20,315	20,703
43	230	Columbia City, IN	33,348	34,668	34,668	36,056	37,481	38,917	40,354	41,103	42,252
44	231	Wabash, IN	32,850	32,923	32,923	33,050	33,203	33,354	33,499	33,548	33,655
45	232	Huntington, IN	37,113	37,665	37,665	38,292	38,952	39,614	40,273	40,595	41,114
46	206	Defiance, OH	39,012	39,181	39,181	39,424	39,705	39,991	40,275	40,374	40,581
47	207	Defiance, OH	19,589	19,667	19,667	19,782	19,917	20,054	20,190	20,235	20,334
48	208	Findlay, OH	74,740	76,001	76,001	77,420	78,918	80,430	81,942	82,665	83,848
49	209	Upper Sandusky, OH	22,613	22,695	22,695	22,819	22,965	23,115	23,262	23,310	23,417
50	210	Ada, OH	6,660	6,680	6,680	6,715	6,758	6,803	6,849	6,860	6,891

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
51	211	Kenton, OH	8,823	8,849	8,849	8,895	8,952	9,011	9,072	9,086	9,127
52	212	Kenton, OH	16,620	16,670	16,670	16,758	16,865	16,976	17,090	17,118	17,195
53	213	Bellefontaine, OH	45,835	47,229	47,229	48,739	50,299	51,869	53,440	54,242	55,492
54	214	Urbana, OH	40,011	40,899	40,899	41,860	42,861	43,868	44,873	45,380	46,178
55	215	Marysville, OH	19,004	20,247	20,247	21,524	22,820	24,118	25,415	26,123	27,176
56	216	Marysville, OH	33,369	35,554	35,554	37,796	40,072	42,352	44,628	45,873	47,720
57	217	Columbus, OH	285,713	294,227	294,227	303,289	312,668	322,112	331,562	336,394	343,913
58	218	Hilliard, OH	112,912	116,278	116,278	119,859	123,566	127,298	131,033	132,942	135,914
59	219	Columbus, OH	429,695	442,500	442,500	456,129	470,234	484,437	498,650	505,918	517,225
60	220	Columbus, OH	179,754	185,111	185,111	190,813	196,714	202,655	208,601	211,641	216,372
61	221	Groveport, OH	75,200	77,441	77,441	79,826	82,294	84,780	87,268	88,539	90,518
62	222	Grove City, OH	82,524	84,983	84,983	87,601	90,309	93,037	95,767	97,162	99,334
63	233	Lima, OH	36,493	36,590	36,590	36,756	36,958	37,164	37,369	37,427	37,570
64	234	Lima, OH	50,233	50,366	50,366	50,594	50,872	51,156	51,437	51,517	51,715
65	235	Lima, OH	19,516	19,568	19,568	19,656	19,764	19,875	19,984	20,015	20,092
66	236	Ottawa, OH	18,124	18,212	18,212	18,337	18,479	18,624	18,767	18,820	18,926
67	237	Delphos, OH	16,325	16,406	16,406	16,518	16,647	16,777	16,906	16,954	17,049
68	238	Van Wert, OH	28,692	28,538	28,538	28,437	28,364	28,295	28,223	28,138	28,061
69	239	Celina, OH	40,817	41,130	41,130	41,517	41,944	42,377	42,806	42,986	43,312
70	240	Jackson Center, OH	49,362	50,047	50,047	50,825	51,652	52,485	53,315	53,708	54,357
71	241	Greenville, OH	52,993	53,308	53,308	53,720	54,185	54,656	55,125	55,308	55,657
72	242	Troy, OH	102,493	103,294	103,294	104,286	105,381	106,488	107,590	108,052	108,889
73	243	Bucyrus, OH	43,754	43,264	43,264	42,857	42,490	42,129	41,764	41,489	41,163
74	244	Mansfield, OH	124,264	123,702	123,702	123,374	123,166	122,973	122,772	122,462	122,218
75	245	Marion, OH	40,369	40,310	40,310	40,336	40,410	40,498	40,590	40,551	40,587
76	246	Marion, OH	26,108	26,069	26,069	26,086	26,134	26,191	26,250	26,225	26,248

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
77	247	Mt Gilead, OH	34,788	36,480	36,480	38,196	39,950	41,710	43,468	44,416	45,836
78	248	Delaware, OH	175,245	198,470	198,470	221,916	245,498	269,068	292,586	305,836	325,095
79	499	Newark, OH	353,962	374,052	399,772	425,763	451,610	477,207	502,918	528,572	554,271
80	501	Chillicothe, OH	530,090	536,304	545,384	554,936	564,377	573,592	583,016	591,876	601,053
81	109	Chicago, IL	474,777	485,235	498,632	512,399	526,546	541,083	556,022	571,374	587,149
82	110	Chicago, IL	468,389	482,292	500,252	518,882	538,205	558,247	579,037	600,600	622,966
83	111	Chicago, IL	424,296	436,797	452,941	469,682	487,041	505,042	523,709	543,066	563,137
84	112	Chicago, IL	314,538	325,889	340,657	356,094	372,230	389,097	406,729	425,160	444,426
85	113	Chicago, IL	442,188	447,234	453,621	460,100	466,671	473,336	480,096	486,952	493,907
86	114	Chicago, IL	291,657	302,240	316,010	330,408	345,462	361,201	377,658	394,865	412,855
87	115	Chicago, IL	271,736	274,544	278,095	281,692	285,335	289,026	292,764	296,551	300,386
88	116	Chicago, IL	309,515	318,180	329,354	340,920	352,893	365,286	378,114	391,392	405,137
89	117	Streamwood, IL	237,393	240,973	245,523	250,160	254,883	259,696	264,600	269,597	274,688
90	118	Arlington Heights, IL	308,821	314,561	321,887	329,383	337,053	344,902	352,934	361,153	369,563
91	119	Schaumburg, IL	28,196	29,187	30,475	31,819	33,224	34,689	36,220	37,818	39,487
92	120	Elk Grove Village, IL	26,135	26,660	27,331	28,018	28,724	29,446	30,187	30,947	31,726
93	121	Glenview, IL	78,241	81,386	85,496	89,814	94,350	99,114	104,120	109,378	114,901
94	122	Winnetka, IL	43,621	45,744	48,543	51,513	54,666	58,011	61,560	65,327	69,325
95	123	Niles, IL	188,518	193,637	200,232	207,051	214,103	221,395	228,935	236,732	244,795
96	124	Skokie, IL	279,701	289,049	301,174	313,808	326,972	340,688	354,979	369,870	385,386
97	125	Schiller Park, IL	18,331	18,682	19,130	19,588	20,058	20,539	21,031	21,535	22,051
98	126	Schiller Park, IL	141,429	143,415	145,938	148,504	151,116	153,774	156,478	159,230	162,031
99	127	Bellwood, IL	185,129	187,882	191,380	194,944	198,574	202,272	206,038	209,875	213,783
100	128	La Grange, IL	56,452	57,150	58,034	58,931	59,842	60,768	61,707	62,662	63,631
101	129	Hickory Hills, IL	89,689	91,342	93,451	95,609	97,816	100,075	102,386	104,750	107,169
102	130	Willow Springs, IL	18,416	19,220	20,274	21,385	22,558	23,795	25,100	26,476	27,928

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
103	131	Lemont, IL	21,468	22,397	23,615	24,899	26,253	27,681	29,186	30,773	32,446
104	132	Orland Park, IL	211,831	219,163	228,686	238,622	248,991	259,810	271,099	282,879	295,170
105	133	South Holland, IL	171,646	175,431	180,280	185,264	190,385	195,647	201,056	206,613	212,325
106	134	Matteson, IL	130,557	137,575	146,880	156,813	167,419	178,742	190,831	203,737	217,517
107	135	Chicago Heights, IL	77,376	84,932	95,424	107,211	120,454	135,333	152,050	170,833	191,935
108	136	Peotone, IL	12,096	13,161	14,625	16,252	18,059	20,068	22,300	24,780	27,536
109	137	Lake Villa, IL	162,499	170,822	181,828	193,542	206,012	219,285	233,413	248,451	264,458
110	138	Gurnee, IL	116,530	120,564	125,803	131,270	136,974	142,926	149,137	155,618	162,380
111	139	Waukegan, IL	113,497	118,256	124,486	131,045	137,949	145,217	152,868	160,923	169,401
112	140	Highwood, IL	83,423	88,542	95,384	102,754	110,694	119,248	128,463	138,390	149,084
113	141	Vernon Hills, IL	138,287	143,984	151,437	159,275	167,520	176,191	185,311	194,903	204,992
114	142	Wauconda, IL	97,991	101,883	106,967	112,305	117,909	123,793	129,971	136,456	143,265
115	143	Lombard, IL	444,177	456,626	472,681	489,299	506,502	524,310	542,744	561,826	581,579
116	144	West Chicago, IL	113,987	117,103	121,117	125,270	129,564	134,006	138,601	143,352	148,267
117	145	Woodridge, IL	367,188	381,883	401,082	421,246	442,424	464,666	488,027	512,562	538,330
118	146	Bolingbrook, IL	149,868	158,986	171,167	184,282	198,402	213,604	229,970	247,590	266,561
119	147	Lockport, IL	63,805	68,650	75,225	82,431	90,327	98,980	108,461	118,850	130,235
120	148	Joliet, IL	108,933	115,751	124,876	134,722	145,343	156,802	169,164	182,501	196,889
121	149	Joliet, IL	129,275	139,957	154,560	170,687	188,496	208,164	229,883	253,869	280,357
122	150	New Lenox, IL	125,390	138,458	156,725	177,402	200,806	227,299	257,286	291,230	329,653
123	151	Wilmington, IL	25,316	27,628	30,817	34,375	38,343	42,769	47,706	53,213	59,356
124	152	Bourbonnais, IL	81,408	83,505	83,505	86,266	89,109	91,967	94,820	96,215	98,464
125	153	Momence, IL	17,070	17,621	17,621	18,203	18,803	19,406	20,008	20,322	20,804
126	154	Herscher, IL	15,550	16,052	16,052	16,582	17,129	17,678	18,227	18,513	18,952
127	155	Harvard, IL	20,160	21,992	24,517	27,332	30,470	33,968	37,869	42,216	47,064
128	156	Union, IL	19,597	20,781	22,362	24,064	25,895	27,865	29,985	32,266	34,721

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
129	157	McHenry, IL	112,960	122,378	135,262	149,503	165,244	182,642	201,871	223,125	246,617
130	158	Lake in the Hills, IL	161,869	171,833	185,155	199,510	214,978	231,645	249,605	268,956	289,808
131	159	Geneva, IL	405,853	424,696	449,486	475,722	503,490	532,879	563,983	596,903	631,744
132	160	Hampshire, IL	58,742	66,353	77,268	89,978	104,779	122,015	142,086	165,458	192,676
133	161	Sycamore, IL	82,217	87,268	87,268	92,497	97,832	103,201	108,583	111,442	115,766
134	162	Elburn, IL	59,275	64,109	70,710	77,991	86,022	94,880	104,649	115,425	127,310
135	163	Hinckley, IL	9,339	10,541	12,262	14,266	16,596	19,308	22,462	26,131	30,400
136	164	DeKalb, IL	13,919	14,775	14,775	15,661	16,564	17,473	18,384	18,868	19,601
137	165	Montgomery, IL	20,715	22,974	26,147	29,759	33,870	38,549	43,875	49,935	56,834
138	166	Yorkville, IL	72,433	78,565	86,964	96,262	106,554	117,946	130,556	144,515	159,965
139	167	Yorkville, IL	24,369	25,574	27,164	28,853	30,646	32,552	34,575	36,725	39,008
140	168	Coal City, IL	32,935	32,887	32,827	32,767	32,707	32,647	32,588	32,528	32,469
141	169	Dwight, IL	17,165	18,744	18,744	20,364	22,010	23,669	25,334	26,225	27,564
142	170	Morris, IL	19	26	37	53	77	111	161	232	335

1.2 EMPLOYMENT DATA AND FORECASTS

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
1	171	Whiting, IN	9,020	9,131	9,268	9,436	9,629	9,845	10,081	10,186	10,360
2	172	East Chicago, IN	11,283	11,422	11,594	11,804	12,045	12,315	12,611	12,743	12,960
3	173	Gary, IN	6,703	6,785	6,888	7,012	7,156	7,316	7,492	7,570	7,699
4	174	Hammond, IN	81,297	82,296	83,538	85,047	86,788	88,735	90,865	91,813	93,376
5	175	Gary, IN	37,463	37,923	38,495	39,191	39,993	40,890	41,871	42,308	43,029
6	176	Hobart, IN	23,557	23,846	24,206	24,644	25,148	25,712	26,329	26,604	27,057
7	177	Schererville, IN	32,087	32,481	32,971	33,567	34,254	35,022	35,863	36,237	36,854
8	178	Crown Point, IN	25,945	26,264	26,660	27,142	27,698	28,319	28,998	29,301	29,800
9	179	Lowell, IN	9,847	9,968	10,119	10,301	10,512	10,748	11,006	11,121	11,310
10	180	Portage, IN	21,119	22,531	24,389	26,508	28,947	31,775	35,078	36,396	38,687
11	181	Chesterton, IN	12,878	13,739	14,872	16,164	17,651	19,375	21,389	22,193	23,590
12	182	Valparaiso, IN	19,395	20,691	22,397	24,344	26,584	29,180	32,214	33,424	35,528
13	183	Valparaiso, IN	7,177	7,657	8,288	9,008	9,837	10,798	11,920	12,368	13,147
14	184	Valparaiso, IN	13,152	14,031	15,189	16,508	18,027	19,788	21,845	22,666	24,093
15	185	La Porte, IN	41,687	42,432	43,216	44,063	44,958	45,897	46,872	47,657	48,536
16	186	La Porte, IN	13,304	13,542	13,792	14,062	14,348	14,648	14,959	15,209	15,489
17	187	South Bend, IN	136,760	143,075	151,386	159,950	168,770	177,849	187,193	194,783	203,306
18	188	South Bend, IN	11,743	12,285	12,999	13,734	14,492	15,271	16,074	16,725	17,457
19	189	Knox, IN	6,366	6,533	6,754	6,972	7,185	7,401	7,607	7,823	8,036
20	190	Plymouth, IN	5,960	6,252	6,632	7,011	7,390	7,763	8,130	8,512	8,888
21	191	Bremen, IN	8,015	8,407	8,918	9,428	9,936	10,439	10,933	11,446	11,952
22	192	Plymouth, IN	9,525	9,990	10,598	11,204	11,808	12,405	12,992	13,602	14,203
23	193	Elkhart, IN	118,761	123,966	130,830	137,951	145,373	153,131	161,275	168,449	175,999

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
24	194	Goshen, IN	17,182	17,935	18,928	19,958	21,032	22,155	23,333	24,371	25,463
25	195	Lagrange, IN	16,490	17,276	18,327	19,413	20,534	21,692	22,886	23,972	25,102
26	196	Albion, IN	23,989	25,203	26,813	28,485	30,222	32,028	33,903	35,517	37,251
27	197	Angola, IN	18,723	20,206	22,283	24,603	27,195	30,088	33,315	35,024	37,483
28	198	Waterloo, IN	25,799	27,458	29,746	32,239	34,956	37,923	41,159	43,170	45,785
29	199	Huntertown, IN	26,159	27,298	28,800	30,324	31,866	33,420	34,980	36,477	38,006
30	200	Fort Wayne, IN	104,274	108,816	114,802	120,878	127,024	133,219	139,438	145,403	151,501
31	201	Fort Wayne, IN	48,659	50,778	53,572	56,407	59,275	62,166	65,068	67,852	70,697
32	202	Fort Wayne, IN	22,421	23,397	24,684	25,991	27,312	28,644	29,982	31,264	32,575
33	203	Huntertown, IN	3,707	3,868	4,081	4,297	4,516	4,736	4,957	5,169	5,386
34	204	Grabill, IN	8,617	8,992	9,487	9,989	10,496	11,008	11,522	12,015	12,519
35	205	Fort Wayne, IN	8,916	9,304	9,816	10,335	10,861	11,390	11,922	12,432	12,954
36	223	Bluffton, IN	14,079	14,408	14,837	15,261	15,670	16,073	16,455	16,916	17,337
37	224	Gas City, IN	35,487	37,338	40,082	43,262	46,928	51,133	55,927	57,936	61,335
38	225	Winchester, IN	10,297	10,166	9,995	9,835	9,682	9,531	9,378	9,234	9,084
39	226	Warsaw, IN	17,454	18,300	19,429	20,588	21,780	23,011	24,286	25,378	26,559
40	227	North Webster, IN	8,428	8,836	9,382	9,941	10,517	11,111	11,727	12,255	12,825
41	228	Warsaw, IN	8,673	9,093	9,654	10,230	10,822	11,434	12,067	12,610	13,197
42	229	Claypool, IN	10,255	10,752	11,416	12,096	12,797	13,520	14,269	14,911	15,605
43	230	Columbia City, IN	13,724	14,277	14,993	15,714	16,432	17,151	17,872	18,622	19,352
44	231	Wabash, IN	17,234	17,862	18,700	19,595	20,564	21,615	22,764	23,484	24,416
45	232	Huntington, IN	18,994	19,467	20,085	20,738	21,423	22,147	22,917	23,531	24,216
46	206	Defiance, OH	21,405	22,091	22,984	23,889	24,801	25,726	26,664	27,531	28,435
47	207	Defiance, OH	7,172	7,344	7,568	7,791	8,007	8,216	8,417	8,615	8,819
48	208	Findlay, OH	53,602	57,292	62,280	67,525	73,031	78,781	84,773	89,445	94,788

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
49	209	Upper Sandusky, OH	10,255	10,572	10,976	11,375	11,759	12,139	12,509	12,926	13,319
50	210	Ada, OH	2,572	2,576	2,581	2,582	2,578	2,570	2,559	2,572	2,572
51	211	Kenton, OH	3,407	3,412	3,419	3,420	3,415	3,405	3,390	3,407	3,407
52	212	Kenton, OH	6,419	6,428	6,440	6,443	6,433	6,414	6,386	6,418	6,418
53	213	Bellefontaine, OH	23,229	23,946	24,861	25,756	26,618	27,445	28,228	29,212	30,095
54	214	Urbana, OH	15,260	15,724	16,339	16,956	17,569	18,169	18,740	19,356	19,957
55	215	Marysville, OH	12,160	12,899	13,943	15,109	16,410	17,861	19,470	20,367	21,613
56	216	Marysville, OH	21,352	22,651	24,484	26,531	28,816	31,363	34,189	35,764	37,952
57	217	Columbus, OH	203,224	217,355	236,428	256,616	277,880	300,156	323,343	340,264	360,497
58	218	Hilliard, OH	80,314	85,898	93,436	101,414	109,818	118,621	127,784	134,472	142,468
59	219	Columbus, OH	305,636	326,889	355,573	385,936	417,916	451,418	486,289	511,738	542,167
60	220	Columbus, OH	127,857	136,748	148,747	161,449	174,827	188,842	203,430	214,076	226,805
61	221	Groveport, OH	53,489	57,208	62,228	67,542	73,138	79,001	85,104	89,558	94,883
62	222	Grove City, OH	58,698	62,780	68,289	74,120	80,262	86,696	93,393	98,280	104,124
63	233	Lima, OH	22,026	22,534	23,200	23,878	24,564	25,257	25,951	26,623	27,306
64	234	Lima, OH	30,318	31,017	31,935	32,868	33,812	34,765	35,721	36,646	37,586
65	235	Lima, OH	11,779	12,050	12,407	12,770	13,136	13,507	13,878	14,237	14,603
66	236	Ottawa, OH	7,990	8,183	8,440	8,690	8,932	9,156	9,360	9,614	9,849
67	237	Delphos, OH	7,198	7,372	7,603	7,828	8,046	8,248	8,431	8,661	8,872
68	238	Van Wert, OH	13,163	13,334	13,577	13,820	14,074	14,334	14,600	14,825	15,072
69	239	Celina, OH	23,926	24,118	24,387	24,629	24,838	25,004	25,112	25,557	25,822
70	240	Jackson Center, OH	31,408	32,618	34,194	35,759	37,306	38,811	40,252	41,979	43,559
71	241	Greenville, OH	26,295	27,324	28,679	30,042	31,393	32,725	34,020	35,297	36,603
72	242	Troy, OH	50,889	52,961	55,708	58,487	61,260	64,005	66,674	69,409	72,135

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
73	243	Bucyrus, OH	18,775	19,009	19,207	19,392	19,561	19,721	19,869	20,087	20,269
74	244	Mansfield, OH	63,513	64,639	65,964	67,390	68,924	70,576	72,361	73,564	75,053
75	245	Marion, OH	19,701	19,706	19,736	19,754	19,762	19,754	19,734	19,773	19,783
76	246	Marion, OH	12,741	12,744	12,764	12,776	12,780	12,775	12,763	12,788	12,794
77	247	Mt Gilead, OH	10,163	10,498	10,942	11,394	11,856	12,326	12,801	13,212	13,660
78	248	Delaware, OH	118,587	131,673	150,892	173,872	201,510	234,907	275,416	286,661	312,207
79	499	Newark, OH	96,569	101,413	108,692	116,405	124,537	133,079	141,997	148,643	156,464
80	501	Chillicothe, OH	143,001	145,249	152,407	159,891	167,717	175,906	184,459	190,106	197,344
81	109	Chicago, IL	121,750	125,417	130,156	135,074	140,178	145,475	150,972	156,677	162,598
82	110	Chicago, IL	160,232	163,052	166,647	170,320	174,075	177,913	181,835	185,843	189,940
83	111	Chicago, IL	99,976	102,304	105,291	108,366	111,530	114,787	118,138	121,588	125,138
84	112	Chicago, IL	967,760	995,886	1,032,196	1,069,829	1,108,835	1,149,263	1,191,165	1,234,595	1,279,608
85	113	Chicago, IL	131,658	135,887	141,366	147,065	152,993	159,161	165,578	172,253	179,197
86	114	Chicago, IL	90,147	92,373	95,232	98,181	101,221	104,354	107,585	110,916	114,350
87	115	Chicago, IL	104,178	104,751	105,471	106,196	106,927	107,662	108,402	109,147	109,898
88	116	Chicago, IL	44,020	48,480	54,696	61,709	69,622	78,549	88,620	99,983	112,802
89	117	Streamwood, IL	92,769	97,087	102,767	108,781	115,146	121,884	129,015	136,565	144,556
90	118	Arlington Heights, IL	181,797	184,536	188,019	191,567	195,182	198,865	202,618	206,442	210,338
91	119	Schaumburg, IL	28,962	30,459	32,439	34,548	36,794	39,186	41,734	44,447	47,337
92	120	Elk Grove Village, IL	108,773	116,565	127,095	138,576	151,094	164,743	179,625	195,851	213,543
93	121	Glenview, IL	107,772	111,844	117,151	122,710	128,532	134,631	141,019	147,711	154,719
94	122	Winnetka, IL	43,378	44,412	45,740	47,108	48,517	49,968	51,463	53,002	54,587
95	123	Niles, IL	147,488	149,531	152,124	154,762	157,446	160,176	162,954	165,780	168,654
96	124	Skokie, IL	163,472	164,565	165,941	167,329	168,729	170,140	171,563	172,997	174,444
97	125	Schiller Park, IL	90,124	87,875	85,142	82,494	79,929	77,443	75,035	72,701	70,440

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
98	126	Schiller Park, IL	96,468	98,519	101,144	103,839	106,606	109,447	112,363	115,357	118,431
99	127	Bellwood, IL	113,952	115,692	117,904	120,159	122,456	124,798	127,184	129,616	132,094
100	128	La Grange, IL	32,310	32,874	33,591	34,325	35,074	35,840	36,622	37,422	38,239
101	129	Hickory Hills, IL	44,648	46,001	47,750	49,566	51,450	53,406	55,437	57,545	59,733
102	130	Willow Springs, IL	34,817	33,733	32,426	31,170	29,962	28,801	27,685	26,613	25,582
103	131	Lemont, IL	8,602	9,023	9,579	10,168	10,794	11,459	12,164	12,913	13,708
104	132	Orland Park, IL	87,418	91,391	96,612	102,132	107,967	114,135	120,656	127,549	134,836
105	133	South Holland, IL	74,264	77,078	80,747	84,590	88,616	92,834	97,253	101,882	106,731
106	134	Matteson, IL	47,471	50,590	54,780	59,316	64,228	69,547	75,307	81,543	88,296
107	135	Chicago Heights, IL	28,272	32,252	38,024	44,830	52,854	62,314	73,467	86,616	102,118
108	136	Peotone, IL	3,290	4,273	5,924	8,214	11,388	15,790	21,893	30,355	42,087
109	137	Lake Villa, IL	41,909	45,065	49,347	54,036	59,170	64,792	70,948	77,690	85,071
110	138	Gurnee, IL	52,239	56,233	61,659	67,609	74,132	81,285	89,128	97,728	107,158
111	139	Waukegan, IL	68,241	66,928	65,323	63,756	62,227	60,734	59,277	57,856	56,468
112	140	Highwood, IL	81,614	88,019	96,737	106,318	116,848	128,422	141,141	155,120	170,484
113	141	Vernon Hills, IL	141,300	146,244	152,669	159,377	166,378	173,688	181,319	189,284	197,600
114	142	Wauconda, IL	53,644	58,268	64,612	71,647	79,448	88,098	97,690	108,326	120,121
115	143	Lombard, IL	417,714	426,276	437,225	448,456	459,976	471,791	483,910	496,340	509,090
116	144	West Chicago, IL	39,993	42,247	45,244	48,454	51,892	55,573	59,516	63,738	68,260
117	145	Woodridge, IL	241,952	253,062	267,669	283,120	299,462	316,748	335,031	354,370	374,825
118	146	Bolingbrook, IL	36,777	41,921	49,374	58,151	68,490	80,666	95,006	111,896	131,789
119	147	Lockport, IL	35,931	38,984	43,167	47,799	52,928	58,608	64,897	71,860	79,572
120	148	Joliet, IL	48,161	49,519	51,271	53,084	54,962	56,906	58,918	61,002	63,160
121	149	Joliet, IL	41,341	45,148	50,402	56,268	62,816	70,126	78,288	87,399	97,570
122	150	New Lenox, IL	59,165	68,362	81,894	98,104	117,523	140,786	168,654	202,038	242,030

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
123	151	Wilmington, IL	10,382	12,800	16,627	21,599	28,058	36,449	47,349	61,508	79,901
124	152	Bourbonnais, IL	38,966	40,021	41,175	42,370	43,593	44,832	46,079	47,362	48,614
125	153	Momence, IL	8,222	8,445	8,688	8,941	9,199	9,460	9,723	9,994	10,258
126	154	Herscher, IL	7,490	7,693	7,915	8,145	8,380	8,618	8,858	9,104	9,345
127	155	Harvard, IL	8,023	8,892	10,114	11,502	13,082	14,878	16,921	19,245	21,888
128	156	Union, IL	6,850	7,583	8,610	9,777	11,102	12,607	14,316	16,256	18,459
129	157	McHenry, IL	58,695	64,837	73,427	83,155	94,172	106,648	120,777	136,778	154,899
130	158	Lake in the Hills, IL	51,060	56,110	63,130	71,029	79,915	89,914	101,163	113,820	128,061
131	159	Geneva, IL	210,984	225,394	244,797	265,870	288,758	313,616	340,614	369,936	401,783
132	160	Hampshire, IL	40,532	46,583	55,431	65,961	78,491	93,401	111,143	132,255	157,378
133	161	Sycamore, IL	39,272	40,759	42,557	44,499	46,585	48,816	51,188	52,710	54,674
134	162	Elburn, IL	10,332	12,284	15,251	18,934	23,506	29,183	36,232	44,982	55,846
135	163	Hinckley, IL	5,834	6,613	7,734	9,045	10,578	12,372	14,469	16,922	19,791
136	164	DeKalb, IL	6,649	6,901	7,205	7,534	7,887	8,265	8,667	8,924	9,257
137	165	Montgomery, IL	6,578	7,684	9,331	11,331	13,761	16,710	20,293	24,643	29,925
138	166	Yorkville, IL	23,378	27,115	32,638	39,286	47,287	56,919	68,512	82,467	99,263
139	167	Yorkville, IL	4,629	5,729	7,479	9,764	12,746	16,640	21,723	28,359	37,022
140	168	Coal City, IL	11,002	12,952	15,883	19,477	23,884	29,289	35,917	44,044	54,011
141	169	Dwight, IL	11,554	12,004	12,535	13,098	13,693	14,319	14,979	15,466	16,041
142	170	Morris, IL	-	-	-	-	-	-	-	-	-

1.3 AVERAGE INCOME DATA AND FORECASTS (2011$)

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
1	171	Whiting, IN	34,805	36,151	37,920	40,215	42,991	46,220	49,916	53,092	56,470
2	172	East Chicago, IN	34,774	36,120	37,887	40,180	42,954	46,180	49,872	53,045	56,420
3	173	Gary, IN	34,765	36,110	37,877	40,169	42,942	46,168	49,859	53,031	56,405
4	174	Hammond, IN	34,739	36,083	37,848	40,139	42,910	46,133	49,822	52,992	56,363
5	175	Gary, IN	34,747	36,092	37,857	40,149	42,921	46,144	49,834	53,005	56,377
6	176	Hobart, IN	34,744	36,088	37,854	40,145	42,916	46,140	49,829	52,999	56,371
7	177	Schererville, IN	34,783	36,129	37,897	40,191	42,965	46,192	49,886	53,060	56,435
8	178	Crown Point, IN	34,759	36,104	37,870	40,162	42,935	46,160	49,851	53,022	56,396
9	179	Lowell, IN	34,740	36,085	37,850	40,141	42,912	46,135	49,824	52,994	56,366
10	180	Portage, IN	42,145	43,297	45,728	49,030	53,244	58,445	64,101	68,819	73,884
11	181	Chesterton, IN	42,175	43,328	45,762	49,066	53,283	58,488	64,148	68,869	73,938
12	182	Valparaiso, IN	42,192	43,345	45,780	49,085	53,304	58,511	64,173	68,896	73,967
13	183	Valparaiso, IN	42,163	43,316	45,748	49,052	53,267	58,471	64,129	68,849	73,916
14	184	Valparaiso, IN	42,155	43,307	45,739	49,042	53,257	58,459	64,117	68,836	73,902
15	185	La Porte, IN	30,143	31,317	32,850	34,779	37,054	39,646	42,611	45,214	47,976
16	186	La Porte, IN	30,140	31,314	32,847	34,776	37,051	39,643	42,608	45,210	47,972
17	187	South Bend, IN	36,064	38,308	41,729	45,803	50,501	55,825	61,716	67,668	74,193
18	188	South Bend, IN	36,110	38,357	41,783	45,862	50,566	55,897	61,796	67,755	74,288
19	189	Knox, IN	28,925	29,892	31,895	34,239	36,894	39,835	42,841	45,802	48,968
20	190	Plymouth, IN	28,905	29,872	31,873	34,215	36,869	39,808	42,812	45,771	48,935
21	191	Bremen, IN	28,916	29,882	31,884	34,228	36,882	39,822	42,827	45,787	48,952
22	192	Plymouth, IN	28,925	29,891	31,894	34,238	36,894	39,834	42,841	45,802	48,968
23	193	Elkhart, IN	34,472	35,424	37,548	40,197	43,301	46,832	50,513	53,896	57,505

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
24	194	Goshen, IN	34,418	35,368	37,488	40,133	43,233	46,758	50,434	53,811	57,414
25	195	Lagrange, IN	27,244	28,581	30,451	32,665	35,199	38,037	40,896	43,849	47,014
26	196	Albion, IN	27,245	28,581	30,451	32,666	35,200	38,038	40,897	43,849	47,015
27	197	Angola, IN	31,673	32,700	35,073	38,008	41,470	45,460	49,601	53,522	57,753
28	198	Waterloo, IN	31,734	32,763	35,140	38,081	41,550	45,547	49,696	53,625	57,864
29	199	Huntertown, IN	35,979	37,802	40,161	43,030	46,338	50,050	53,913	57,791	61,948
30	200	Fort Wayne, IN	35,984	37,808	40,167	43,036	46,345	50,057	53,921	57,800	61,957
31	201	Fort Wayne, IN	35,942	37,763	40,119	42,985	46,290	49,998	53,857	57,731	61,884
32	202	Fort Wayne, IN	35,973	37,795	40,154	43,022	46,330	50,041	53,903	57,781	61,937
33	203	Huntertown, IN	35,981	37,804	40,163	43,031	46,340	50,052	53,915	57,793	61,951
34	204	Grabill, IN	35,991	37,814	40,174	43,044	46,353	50,066	53,930	57,810	61,968
35	205	Fort Wayne, IN	35,986	37,809	40,168	43,037	46,346	50,059	53,922	57,801	61,959
36	223	Bluffton, IN	30,512	32,373	34,762	37,668	41,089	45,042	49,622	53,944	58,643
37	224	Gas City, IN	30,530	32,393	34,784	37,691	41,114	45,069	49,652	53,977	58,679
38	225	Winchester, IN	30,522	32,384	34,775	37,681	41,103	45,057	49,639	53,963	58,663
39	226	Warsaw, IN	33,882	35,465	38,059	41,142	44,678	48,655	52,896	57,081	61,597
40	227	North Webster, IN	33,897	35,479	38,075	41,159	44,696	48,675	52,919	57,105	61,623
41	228	Warsaw, IN	33,916	35,500	38,097	41,183	44,722	48,703	52,949	57,138	61,658
42	229	Claypool, IN	33,887	35,469	38,063	41,147	44,683	48,661	52,903	57,088	61,605
43	230	Columbia City, IN	33,911	35,495	38,091	41,177	44,716	48,696	52,942	57,130	61,650
44	231	Wabash, IN	33,909	35,493	38,089	41,175	44,713	48,694	52,939	57,127	61,646
45	232	Huntington, IN	33,896	35,479	38,074	41,159	44,696	48,674	52,918	57,104	61,622
46	206	Defiance, OH	32,873	34,341	36,889	39,849	43,186	46,881	50,950	54,910	59,178
47	207	Defiance, OH	32,885	34,352	36,902	39,863	43,201	46,897	50,968	54,929	59,199
48	208	Findlay, OH	33,894	35,749	38,326	41,370	44,838	48,699	52,860	57,050	61,573
49	209	Upper Sandusky, OH	33,878	35,732	38,308	41,351	44,817	48,676	52,835	57,023	61,544

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
50	210	Ada, OH	33,897	35,752	38,329	41,373	44,841	48,703	52,864	57,054	61,577
51	211	Kenton, OH	33,926	35,782	38,362	41,409	44,879	48,745	52,909	57,103	61,630
52	212	Kenton, OH	33,904	35,759	38,337	41,382	44,851	48,713	52,875	57,067	61,590
53	213	Bellefontaine, OH	33,865	35,718	38,292	41,334	44,798	48,656	52,813	57,000	61,518
54	214	Urbana, OH	33,911	35,767	38,345	41,391	44,860	48,724	52,887	57,079	61,604
55	215	Marysville, OH	33,910	35,766	38,344	41,389	44,858	48,722	52,884	57,076	61,601
56	216	Marysville, OH	33,894	35,749	38,326	41,370	44,837	48,699	52,860	57,050	61,572
57	217	Columbus, OH	40,052	41,973	45,173	49,035	53,486	58,486	63,647	68,889	74,563
58	218	Hilliard, OH	40,069	41,991	45,192	49,055	53,508	58,510	63,673	68,917	74,594
59	219	Columbus, OH	40,108	42,032	45,236	49,103	53,561	58,568	63,735	68,985	74,667
60	220	Columbus, OH	40,053	41,975	45,175	49,037	53,488	58,488	63,649	68,891	74,566
61	221	Groveport, OH	40,077	42,000	45,202	49,066	53,520	58,523	63,687	68,932	74,610
62	222	Grove City, OH	40,071	41,994	45,195	49,059	53,512	58,515	63,678	68,922	74,599
63	233	Lima, OH	32,229	33,747	35,924	38,524	41,497	44,816	48,525	52,050	55,830
64	234	Lima, OH	32,249	33,768	35,947	38,548	41,523	44,843	48,555	52,082	55,865
65	235	Lima, OH	32,229	33,748	35,925	38,525	41,498	44,817	48,526	52,051	55,832
66	236	Ottawa, OH	32,248	33,768	35,946	38,548	41,523	44,843	48,555	52,082	55,865
67	237	Delphos, OH	32,238	33,757	35,935	38,535	41,509	44,829	48,539	52,065	55,847
68	238	Van Wert, OH	32,243	33,762	35,940	38,541	41,516	44,836	48,547	52,073	55,855
69	239	Celina, OH	35,660	37,749	40,720	44,177	48,078	52,388	57,117	61,929	67,147
70	240	Jackson Center, OH	35,678	37,768	40,740	44,199	48,101	52,414	57,146	61,960	67,180
71	241	Greenville, OH	35,708	37,799	40,774	44,236	48,142	52,458	57,194	62,012	67,236
72	242	Troy, OH	35,660	37,749	40,719	44,177	48,078	52,388	57,117	61,929	67,146
73	243	Bucyrus, OH	39,421	40,894	43,434	46,978	51,596	57,416	63,836	69,281	75,191
74	244	Mansfield, OH	39,413	40,885	43,425	46,968	51,585	57,404	63,822	69,267	75,176
75	245	Marion, OH	39,443	40,916	43,458	47,003	51,624	57,447	63,870	69,319	75,232

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
76	246	Marion, OH	39,471	40,946	43,489	47,037	51,661	57,489	63,916	69,369	75,287
77	247	Mt Gilead, OH	39,459	40,934	43,476	47,023	51,646	57,472	63,897	69,348	75,264
78	248	Delaware, OH	39,431	40,904	43,445	46,989	51,609	57,430	63,851	69,298	75,210
79	499	Newark, OH	33,802	34,965	36,701	38,877	41,476	44,477	47,453	50,284	53,284
80	501	Chillicothe, OH	27,970	29,076	31,214	33,714	36,561	39,755	43,245	46,578	50,167
81	109	Chicago, IL	49,192	51,725	55,357	59,835	65,061	71,005	77,719	84,050	90,897
82	110	Chicago, IL	49,267	51,803	55,441	59,926	65,159	71,112	77,836	84,178	91,035
83	111	Chicago, IL	49,186	51,719	55,351	59,829	65,053	70,997	77,710	84,041	90,887
84	112	Chicago, IL	49,204	51,737	55,370	59,849	65,076	71,021	77,737	84,070	90,919
85	113	Chicago, IL	49,255	51,791	55,428	59,912	65,144	71,096	77,818	84,158	91,014
86	114	Chicago, IL	49,219	51,753	55,388	59,868	65,097	71,044	77,761	84,097	90,948
87	115	Chicago, IL	49,242	51,777	55,413	59,896	65,126	71,076	77,797	84,135	90,989
88	116	Chicago, IL	49,205	51,739	55,372	59,852	65,078	71,024	77,739	84,073	90,922
89	117	Streamwood, IL	49,193	51,726	55,359	59,837	65,063	71,006	77,721	84,052	90,900
90	118	Arlington Heights, IL	49,194	51,727	55,360	59,838	65,064	71,008	77,722	84,054	90,902
91	119	Schaumburg, IL	49,176	51,708	55,339	59,816	65,039	70,981	77,693	84,023	90,868
92	120	Elk Grove Village, IL	49,177	51,709	55,340	59,817	65,041	70,983	77,695	84,024	90,869
93	121	Glenview, IL	49,267	51,803	55,441	59,926	65,160	71,112	77,837	84,178	91,035
94	122	Winnetka, IL	49,251	51,787	55,423	59,907	65,139	71,089	77,811	84,151	91,006
95	123	Niles, IL	49,175	51,707	55,339	59,815	65,039	70,981	77,692	84,022	90,867
96	124	Skokie, IL	49,257	51,793	55,430	59,915	65,147	71,098	77,821	84,161	91,018
97	125	Schiller Park, IL	49,259	51,795	55,433	59,917	65,149	71,101	77,824	84,164	91,021
98	126	Schiller Park, IL	49,208	51,742	55,376	59,855	65,082	71,028	77,744	84,078	90,928
99	127	Bellwood, IL	49,220	51,754	55,389	59,869	65,098	71,045	77,763	84,098	90,949
100	128	La Grange, IL	49,183	51,715	55,347	59,824	65,049	70,991	77,704	84,034	90,880
101	129	Hickory Hills, IL	49,223	51,757	55,392	59,873	65,101	71,049	77,767	84,102	90,954

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
102	130	Willow Springs, IL	49,213	51,747	55,381	59,861	65,089	71,035	77,752	84,086	90,937
103	131	Lemont, IL	49,209	51,743	55,377	59,857	65,084	71,030	77,746	84,080	90,929
104	132	Orland Park, IL	49,185	51,718	55,350	59,827	65,052	70,995	77,708	84,039	90,885
105	133	South Holland, IL	49,261	51,797	55,434	59,919	65,151	71,103	77,827	84,167	91,024
106	134	Matteson, IL	49,176	51,708	55,339	59,816	65,039	70,981	77,693	84,022	90,868
107	135	Chicago Heights, IL	49,259	51,796	55,433	59,917	65,150	71,102	77,825	84,165	91,022
108	136	Peotone, IL	49,246	51,782	55,418	59,901	65,132	71,083	77,804	84,142	90,997
109	137	Lake Villa, IL	55,251	57,635	62,000	67,512	74,101	81,765	89,806	97,551	105,963
110	138	Gurnee, IL	55,269	57,653	62,020	67,534	74,124	81,791	89,835	97,582	105,997
111	139	Waukegan, IL	55,201	57,582	61,943	67,450	74,033	81,690	89,724	97,461	105,866
112	140	Highwood, IL	55,231	57,613	61,976	67,487	74,073	81,734	89,772	97,514	105,923
113	141	Vernon Hills, IL	55,266	57,650	62,016	67,530	74,120	81,787	89,830	97,576	105,991
114	142	Wauconda, IL	55,225	57,608	61,971	67,481	74,066	81,727	89,764	97,505	105,913
115	143	Lombard, IL	56,277	58,526	62,939	68,369	74,707	81,915	89,380	96,702	104,623
116	144	West Chicago, IL	56,309	58,559	62,975	68,408	74,749	81,962	89,431	96,757	104,683
117	145	Woodridge, IL	56,287	58,536	62,950	68,380	74,719	81,929	89,395	96,718	104,641
118	146	Bolingbrook, IL	42,009	43,729	45,409	47,637	50,384	53,614	56,809	59,839	63,031
119	147	Lockport, IL	41,977	43,695	45,374	47,601	50,345	53,574	56,765	59,793	62,983
120	148	Joliet, IL	41,982	43,700	45,379	47,606	50,351	53,579	56,771	59,800	62,990
121	149	Joliet, IL	42,010	43,729	45,409	47,638	50,384	53,615	56,809	59,840	63,032
122	150	New Lenox, IL	42,012	43,732	45,412	47,641	50,387	53,618	56,813	59,843	63,035
123	151	Wilmington, IL	42,016	43,735	45,415	47,644	50,391	53,622	56,817	59,848	63,040
124	152	Bourbonnais, IL	33,112	34,884	36,666	38,843	41,360	44,181	47,347	50,364	53,573
125	153	Momence, IL	33,103	34,875	36,657	38,833	41,350	44,170	47,335	50,351	53,560
126	154	Herscher, IL	33,144	34,918	36,702	38,881	41,401	44,224	47,393	50,413	53,626
127	155	Harvard, IL	38,195	39,937	42,316	45,384	49,117	53,515	58,111	62,436	67,084

Seq. No.	TEMS No.	Zone Description	2011	2015	2020	2025	2030	2035	2040	2045	2050
128	156	Union, IL	38,179	39,921	42,298	45,365	49,097	53,494	58,087	62,411	67,057
129	157	McHenry, IL	38,205	39,947	42,327	45,395	49,129	53,529	58,126	62,452	67,101
130	158	Lake in the Hills, IL	38,172	39,913	42,290	45,356	49,087	53,483	58,076	62,399	67,044
131	159	Geneva, IL	38,235	39,979	42,360	45,431	49,168	53,572	58,172	62,502	67,155
132	160	Hampshire, IL	38,211	39,954	42,334	45,403	49,138	53,538	58,135	62,463	67,113
133	161	Sycamore, IL	38,218	39,962	42,342	45,412	49,147	53,548	58,147	62,475	67,126
134	162	Elburn, IL	38,208	39,951	42,330	45,399	49,134	53,534	58,131	62,458	67,107
135	163	Hinckley, IL	38,234	39,978	42,359	45,430	49,167	53,570	58,170	62,500	67,153
136	164	DeKalb, IL	38,176	39,917	42,295	45,361	49,093	53,489	58,082	62,406	67,051
137	165	Montgomery, IL	35,294	36,238	36,727	37,880	39,633	41,932	44,181	45,917	47,720
138	166	Yorkville, IL	35,272	36,216	36,704	37,857	39,609	41,906	44,154	45,888	47,691
139	167	Yorkville, IL	35,336	36,281	36,770	37,925	39,680	41,982	44,233	45,971	47,777
140	168	Coal City, IL	35,192	36,809	38,568	40,784	43,395	46,374	49,560	52,568	55,760
141	169	Dwight, IL	35,169	36,785	38,543	40,757	43,366	46,344	49,527	52,534	55,723
142	170	Morris, IL	35,182	36,799	38,556	40,772	43,382	46,360	49,545	52,553	55,743

APPENDIX 2: COMPASS™ MODEL

2 COMPASS™ MODEL

The COMPASS™ Model System is a flexible multimodal demand-forecasting tool that provides comparative evaluations of alternative socioeconomic and network scenarios. It also allows input variables to be modified to test the sensitivity of demand to various parameters such as elasticities, values of time, and values of frequency. This section describes in detail the model methodology and process used in the study.

2.1 DESCRIPTION OF THE COMPASS™ MODEL SYSTEM

The COMPASS™ model is structured on two principal models: Total Demand Model and Hierarchical Modal Split Model. For this study, these two models were calibrated separately for two trip purposes, which are Business and Non-Business. For each market segment, the models were calibrated on base year origin-destination trip data, existing network characteristics and base year socioeconomic data.

Since the models were calibrated on the base year data, when applying the models for forecasting, an incremental approach known as the "pivot point" method is used. By applying model growth rates to the base data observations, the "pivot point" method is able to preserve the unique travel flows present in the base data that are not captured by the model variables. Details on how this method is implemented are described below.

2.2 TOTAL DEMAND MODEL

The Total Demand Model, shown in Equation 1, provides a mechanism for assessing overall growth in the travel market.

Equation 1:

$$T_{ijp} = e^{\beta_{0p}}(SE_{ijp})^{\beta_{1p}} e^{\beta_{2p} U_{ijp}}$$

Where,

T_{ijp} = Number of trips between zones *i* and *j* for trip purpose *p*
SE_{ijp} = Socioeconomic variables for zones *i* and *j* for trip purpose *p*
U_{ijp} = Total utility of the transportation system for zones *i* to *j* for trip purpose *p*
$\beta_{0p}, \beta_{1p}, \beta_{2p}$ = Coefficients for trip purpose *p*

As shown in Equation 1, the total number of trips between any two zones for all modes of travel, segmented by trip purpose, is a function of the socioeconomic characteristics of the zones and the total utility of the transportation system that exists between the two zones. For this study, trip purposes include Business and Non-Business. The socioeconomic characteristics consist of population, employment and average income. The utility function provides a measure of the quality of the transportation system in terms of the times, costs, reliability and level of service provided by all modes for a given trip purpose. The Total Demand Model equation may be interpreted as meaning that travel between zones will increase as socioeconomic factors such as population and income rise or as the utility (or quality) of the transportation system is improved by providing new facilities and services that reduce travel times and/or costs. The Total Demand Model can therefore be used to evaluate the effect of changes in both socioeconomic and travel characteristics on the total demand for travel.

2.2.1 SOCIOECONOMIC VARIABLES

The socioeconomic variables in the Total Demand Model show the impact of economic growth on travel demand. The COMPASS™ Model System, in line with most intercity modeling systems, uses three variables (population, employment, and average income) to represent the socioeconomic characteristics of a zone. Different combinations were tested in the calibration process and it was found, as is typically found elsewhere, that the most reasonable and statistically stable relationships consists of the following formulations –

Trip Purpose	***Socioeconomic Variable***
Business	$E_i E_j (I_i + I_j) / 2$
Non-Business	$(P_iE_j+P_jE_i) / 2 (I_i+I_j) / 2$

The Business formulation consists of a product of employment in the origin zone, employment in the destination zone, and the average income of the two zones. Since business trips are usually made between places of work, the presence of employment in the formulation is reasonable. While the income factor is correlated to the type of employment, higher income levels generate more Business trips. The Non-Business formulation consists of all socioeconomic factors, this is because commuter trips are between homes and places of work, which are closely related to population and employment, and income factor is related to the wealth of the origin zone and the type of employment in the destination zone, leisure and social trip are correlated to population in the origin zone and destination zone and the average income of the two zones.

2.2.2 TRAVEL UTILITY

Estimates of travel utility for a transportation network are generated as a function of generalized cost (GC), as shown in Equation 2 –

Equation 2:

$$U_{ijp} = f(GC_{ijp})$$

where,

GC_{ijp} = Generalized Cost of travel between zones *i* and *j* for trip purpose *p*

Because the generalized cost variable is used to estimate the impact of improvements in the transportation system on the overall level of trip making, it needs to incorporate all the key attributes that affect an individual's decision to make trips. For the public modes (i.e., rail and bus), the generalized cost of travel includes all aspects of travel time (access, egress, in-vehicle times), travel cost (fares), and schedule convenience (frequency of service, convenience of arrival/departure times). For auto travel, full average cost of operating a car is used for Business, while only the marginal cost is used for Commuter and Other trips. In addition, tolls and parking charges are used where appropriate.

The generalized cost of travel is typically defined in travel time (i.e., minutes) rather than dollars. Costs are converted to time by applying appropriate conversion factors, as shown in Equation 3. The generalized cost (GC) of travel between zones i and j for mode m and trip purpose p is calculated as follows –

Equation 3:

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

Where,

TT_{ijm} = Travel Time between zones *i* and *j* for mode *m* (in-vehicle time + station wait time + connection wait time + access/egress time + interchange penalty), with waiting, connect and access/egress time multiplied by a factor (greater than 1) to account for the additional disutility felt by travelers for these activities

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

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

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

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

OH = Operating hours per week

Station wait time is the time spent at the station before departure and after arrival. On trips with connections, there would be additional wait times incurred at the connecting station. Wait times are weighted higher than in-vehicle time in the generalized cost formula to reflect their higher disutility as found from previous studies. Wait times are weighted 70 percent higher than in-vehicle time.

Similarly, access/egress time has a higher disutility than in-vehicle time. Access time tends to be more stressful for the traveler than in-vehicle time because of the uncertainty created by trying to catch the flight or train. Based on previous work, access time is weighted 80 percent higher for rail and bus travel.

The third term in the generalized cost function converts the frequency attribute into time units. Operating hours divided by frequency is a measure of the headway or time between departures. Tradeoffs are made in the stated preference surveys resulting in the value of frequencies on this measure. Although there may appear to some double counting because the station wait time in the first term of the generalized cost function is included in this headway measure, it is not the headway time itself that is being added to the generalized cost. The third term represents the impact of perceived frequency valuations on generalized cost. TEMS has found it very effective to measure this impact as a function of the headway.

2.2.3 CALIBRATION OF THE TOTAL DEMAND MODEL

In order to calibrate the Total Demand Model, the coefficients are estimated using linear regression techniques. Equation 1, the equation for the Total Demand Model, is transformed by taking the natural logarithm of both sides, as shown in Equation 4 –

Equation 4:

$$\log(T_{ijp}) = \beta_{0p} + \beta_{1p}\log(SE_{ijp}) + \beta_{2p}(U_{ijp})$$

Equation 4 provides the linear specification of the model necessary for regression analysis.

The segmentation of the database by trip purpose resulted in two sets of models. The results of the calibration for the Total Demand Models are displayed in Exhibit 1.

Exhibit 1: Total Demand Model Coefficients (1)

Business	$\log(T_{ij})$	=	-9.5680	+	0.3589	$\log(SE_{ij})$	+	0.6813	U_{ij}	R^2=	0.76
			(-109.70)		(127.44)			(280.56)			
	where U_{ij}=Log[Exp(		-2.4897	+	0.9945	U_{Public})	+	Exp(-0.0076 GC_{Auto})]			
Non-Business	$\log(T_{ij})$	=	-9.7955	+	0.3646	$\log(SE_{ij})$	+	0.7588	U_{ij}	R^2=	0.80
			(-90.26)		(108.63)			(343.76)			
	where U_{ij} =Log[Exp(		-3.8765	+	0.9607	U_{Public})	+	Exp(-0.0059 GC_{Auto})]			

(1) *t-statistics are given in parentheses.*

In evaluating the validity of a statistical calibration, there are two key statistical measures: t-statistics and R^2. The t-statistics are a measure of the significance of the model's coefficients; values of 1.95 and above are considered "good" and imply that the variable has significant explanatory power in estimating the level of trips. R^2 is a statistical measure of the "goodness of fit" of the model to the data; any data point that deviates from the model will reduce this measure. It has a range from 0 to a perfect 1, with 0.3 and above considered "good" for large data sets. Based on these two measures, the total demand calibrations are good. The t-statistics are high, aided by the large size of the data set. The R^2 values imply good fits of the equations to the data.

As shown in Exhibit 1, the socioeconomic elasticity value for the Total Demand Model is 0.36, meaning that each one percent growth in the socioeconomic term generates approximately a 0.36 percent growth in the total travel market.

The coefficient on the utility term is not strictly elasticity, but it can be considered an approximation. The utility term is related to the scale of the generalized costs, for example, utility elasticity can be high if the absolute value of transportation utility improvement is significant. This is not untypical when new transportation systems are built. In these cases, a 20 percent reduction in utility is not unusual and may impact more heavily on longer origin-destination pairs than shorter origin-destination pairs.

2.2.4 INCREMENTAL FORM OF THE TOTAL DEMAND MODEL

The calibrated Total Demand Models could be used to estimate the total travel market for any zone pair using the population, employment, per household income, and the total utility of all the modes. However, there would be significant differences between estimated and observed levels of trip making for many zone pairs despite the good fit of the models to the data. To preserve the unique travel patterns contained in the base data, the incremental approach or "pivot point" method is used for forecasting. In the incremental approach, the base travel data assembled in the database are used as pivot points, and forecasts are made by applying trends to the base data. The total demand equation as described in Equation 1 can be rewritten into the following incremental form that can be used for forecasting (Equation 5):

Equation 5:

$$\frac{T_{ijp}{}^{f}}{T_{ijp}{}^{b}} = \left(\frac{SE_{ijp}{}^{f}}{SE_{ijp}{}^{b}}\right)^{\beta_{1p}} \exp(\beta_{2p}\,(U_{ijp}{}^{f} - U_{ijp}{}^{b}))$$

Where,

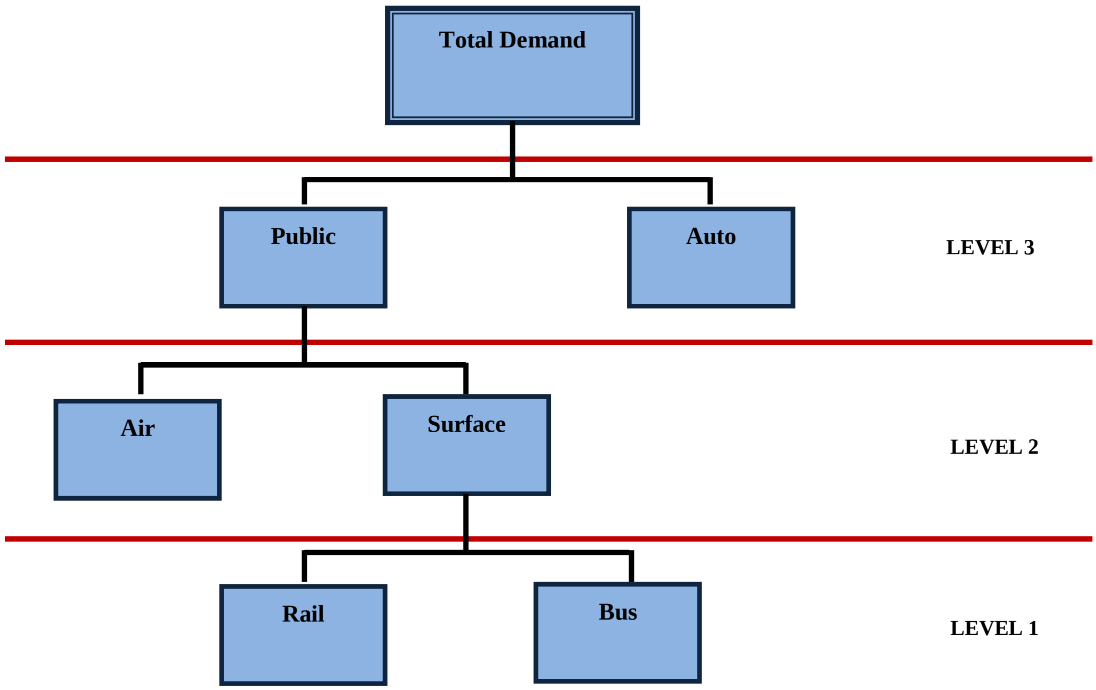
T^{f}_{ijp}	=	Number of Trips between zones *i* and *j* for trip purpose *p* in forecast year *f*
T^{b}_{ijp}	=	Number of Trips between zones *i* and *j* for trip purpose *p* in base year *b*
SE^{f}_{ijp}	=	Socioeconomic variables for zones *i* and *j* for trip purpose *p* in forecast year *f*
SE^{b}_{ijp}	=	Socioeconomic variables for zones *i* and *j* for trip purpose *p* in base year *b*
U^{f}_{ijp}	=	Total utility of the transportation system for zones *i* to *j* for trip purpose *p* in forecast year *f*
U^{b}_{ijp}	=	Total utility of the transportation system for zones *i* to *j* for trip purpose *p* in base year *b*

In the incremental form, the constant term disappears and only the elasticities are important.

2.3 HIERARCHICAL MODAL SPLIT MODEL

The role of the Hierarchical Modal Split Model is to estimate relative modal shares, given the Total Demand Model estimate of the total market that consists of different travel modes available to travelers. The relative modal shares are derived by comparing the relative levels of service offered by each of the travel modes. The COMPASS™ Hierarchical Modal Split Model uses a nested logit structure, which has been adapted to model the interurban modal choices available in the study area. The hierarchical modal split model is shown in Exhibit 2.

Exhibit 2: Hierarchical Structure of the Modal Split Model

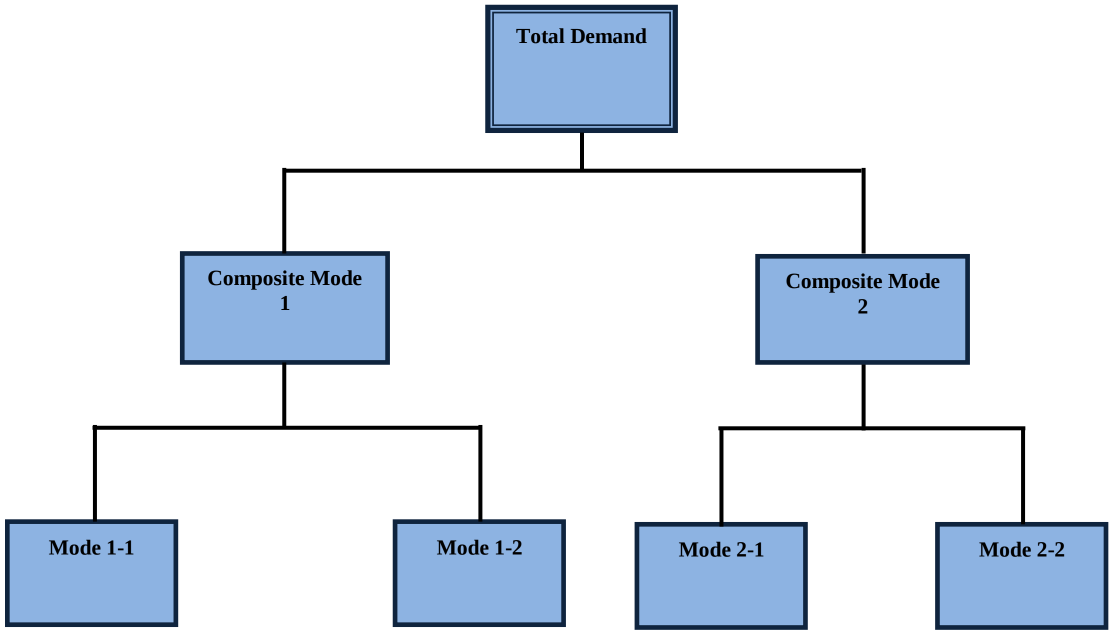


The main feature of the Hierarchical Modal Split Model structure is the increasing commonality of travel characteristics as the structure descends. The upper level of the hierarchy separates private auto travel – with its spontaneous frequency, low access/egress times, low costs and highly personalized characteristics – from the public modes. The lower separates high-speed rail – a faster and more comfortable public mode from bus, which provides slower conventional transit services within the corridor.

2.3.1 BACKGROUND OF THE HIERARCHICAL MODAL SPLIT THEORY

The modal split models used by TEMS derived from the standard nested logit model. Exhibit 3 shows a typical two-level standard nested model. In the nested model shown in Exhibit 3, there are four travel modes that are grouped into two composite modes, namely, Composite Mode 1 and Composite Mode 2.

Exhibit 3: A Typical Standard Nested Logit Model



Each travel mode in the above model has a utility function of Uj, j = 1, 2, 3, 4. To assess modal split behavior, the logsum utility function, which is derived from travel utility theory, has been adopted for the composite modes in the model. As the modal split hierarchy ascends, the logsum utility values are derived by combining the utility of lower-level modes. The composite utility is calculated by

$$U_{N_k} = \alpha_{N_k} + \beta_{N_k} \log \sum_{i \in N_k} \exp(\rho U_i)$$

Where

N_k is composite mode k in the modal split model,
i is the travel mode in each nest,
U_i is the utility of each travel mode in the nest,
ρ is the nesting coefficient.

The probability that composite mode *k* is chosen by a traveler is given by

$$P(N_k) = \frac{\exp(U_{N_k} / \rho)}{\sum_{N_l \in N} \exp(U_{N_l} / \rho)}$$

The probability of mode *i* in composite mode *k* being chosen is

$$P_{N_k}(i) = \frac{\exp(\rho U_i)}{\sum_{j \in N_k} \exp(\rho U_j)}$$

A key feature of these models is a use of utility. Typically in transportation modeling, the utility of travel between zones i and j by mode m for purpose p is a function of all the components of travel time, travel cost, terminal wait time and cost, parking cost, etc. This is measured by generalized cost developed for each origin-destination zone pair on a mode and purpose basis. In the model application, the utility for each mode is estimated by calibrating a utility function against the revealed base year mode choice and generalized cost.

Using logsum functions, the generalized cost is then transformed into a composite utility for the composite mode (e.g. Public modes in Exhibit 2). This is then used at the next level of the hierarchy to compare the next most similar mode choice (e.g. in Exhibit 2, Public mode is compared with Auto mode).

2.3.2 CALIBRATION OF THE HIERARCHICAL MODAL SPLIT MODEL

Working from the lower level of the hierarchy to the upper level, the first analysis is that of the Rail mode versus the Bus mode. As shown in Exhibit 4, the model was effectively calibrated for the two trip purposes, with reasonable parameters and R^2 and t values. All the coefficients have the correct signs such that demand increases or decreases in the correct direction as travel times or costs are increased or decreased, and all the coefficients appear to be reasonable in terms of the size of their impact.

Exhibit 4: Rail versus Bus Modal Split Model Coefficients [(1)]

Business	$\log(P_{Rail}/P_{Bus})$	=	0.9332	-	0.0049	GC_{Rail}	+	0.0012	GC_{Bus}	R^2= 0.85
			(28.29)		(-221.53)			(367.79)		
Non-Business	$\log(P_{Rail}/P_{Bus})$	=	0.5619	-	0.0039	GC_{Rail}	+	0.0011	GC_{Bus}	R^2= 0.84
			(-19.15)		(-224.95)			(363.44)		

(1) *t-statistics are given in parentheses.*

The coefficients for the upper levels of the hierarchy of Surface mode versus Air mode and Public versus Auto mode are given in Exhibits 5 and 6 respectively. The utility of the composite modes is obtained by deriving the logsum of the utilities of lower level modes from the model. The model calibrations for both trip purposes are statistically significant, with good R^2 and t values, and reasonable coefficients.

Exhibit 5: Surface versus Air Modal Split Model Coefficients (1)

Business	$\log(P_{Surface}/P_{Air})$ =	-6.0037	+	0.5732	U_{Surf}	+	0.0031	GC_{Air}	R^2=	0.95
		(-40.87)		(9.48)			(803.06)			
	where U_{Surf} = Log[Exp(	0.9332	-	0.0049	GC_{Rail})	+	Exp(-0.0012	GC_{Bus})]		
Non-Business	$\log(P_{Surface}/P_{Air})$ =	-3.2281	+	0.4100	U_{Surf}	+	0.0024	GC_{Air}	R^2=	0.95
		(-26.67)		(8.49)			(779.79)			
	where U_{Surf} = Log[Exp(	0.5619	-	0.0039	GC_{Rail})	+	Exp(-0.0011	GC_{Bus})]		

(1) *t-statistics are given in parentheses.*

Exhibit 6: Public versus Auto Modal Split Model Coefficients (1)

Business	$\log(P_{Public}/P_{Auto})$ =	-2.4897	+	0.9945	U_{Public}	+	0.0076	GC_{Auto}	R^2=	0.93
		(-136.93)		(174.47)			(635.47)			
	where U_{public} = Log[Exp(	-6.0037	+	0.5732	U_{Surf})	+	Exp(-0.0031	GC_{Air})]		
Non-Business	$\log(P_{Public}/P_{Auto})$ =	-3.8765	+	0.9607	U_{Public}	+	0.0059	GC_{Auto}	R^2=	0.85
		(-127.54)		(78.87)			(419.44)			
	where U_{public} = Log[Exp(	-3.2281	+	0.4100	U_{Surf})	+	Exp(-0.0024	GC_{Air})]		

(1) *t-statistics are given in parentheses.*

2.3.3 INCREMENTAL FORM OF THE MODAL SPLIT MODEL

Using the same reasoning as previously described, the modal split models are applied incrementally to the base data rather than imposing the model estimated modal shares. Different regions of the corridor may have certain biases toward one form of travel over another and these differences cannot be captured with a single model for the entire system. Using the "pivot point" method, many of these differences can be retained. To apply the modal split models incrementally, the following reformulation of the hierarchical modal split models is used (Equation 6):

Equation 6:

$$\frac{\left(\frac{P_A^f}{P_B^f}\right)}{\left(\frac{P_A^b}{P_B^b}\right)} = e^{\beta(GC_A^f - GC_B^b) + \gamma(GC_B^f - GC_B^b)}$$

For hierarchical modal split models that involve composite utilities instead of generalized costs, the composite utilities would be used in the above formula in place of generalized costs. Once again, the constant term is not used and the drivers for modal shifts are changed in generalized cost from base conditions. Another consequence of the pivot point method is that it prevents possible extreme modal changes from current trip-making levels as a result of the calibrated modal split model, thus that avoid over- or under- estimating future demand for each mode.

2.4 INDUCED DEMAND MODEL

Induced demand refers to changes in travel demand related to improvements in a transportation system, as opposed to changes in socioeconomic factors that contribute to growth in demand. The quality or utility of the transportation system is measured in terms of total travel time, travel cost, and worth of travel by all modes for a given trip purpose. The induced demand model used the increased utility resulting from system changes to estimate the amount of new (latent) demand that will result from the implementation of the new system adjustments. The model works simultaneously with the mode split model coefficients to determine the magnitude of the modal induced demand based on the total utility changes in the system. It should be noted that the model will also forecast a reduction in trips if the quality of travel falls due to increased congestions, higher car operating costs, or increased tolls. The utility function is acting like a demand curve increasing or decreasing travel based on changes in price (utility) for travel. It assumes travel is a normal good and subject to the laws of supply and demand.

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APPENDIX 3: DETAILED CAPITAL COSTS

110 OPTION

Chicago to Columbus (via Fort Wayne)

Revised on 12/10/12

Item		Unit	YR 2012 Unit Cost (1000s)	Chicago Terminal Area Limit		Tolleston - Wanatah - Fort Wayne				Fort Wayne - Dunkirk - Columbus							
			Segment No.	Segment 1		Segment 2		Segment 3		Segment 4		Segment 5		Segment 6		Total	
			From - To	Chicago to Tolleston		Tolleston to Wanatah		Wanatah to Fort Wayne		Fort Wayne to Dunkirk		Dunkirk to CP Mounds		CP Mounds to Columbus			
			Host Carrier	South-of-the-Lake		CSX		CSX & NS		CSXT Ft. Wayne Line		CSXT Scottslawn Subdivision		Buckeye/CSXT Scotslawn			
			Mileposts	Corridor Study		MP 442.5 - MP 414.9		SX MP 414.9 - NS MP 146		MP 236.4 to MP 319.2		MP 126.4 to MP 61.2		CP128 to MP126.4			
			Track Miles	26.6 miles		27.6 miles		95.6 miles		82.9 miles		65.2 miles		7.0 miles		304.9 miles	
			Maximum Authorized Speed			110 mph		110 mph		110 mph		110 mph		35/50/110 mph		110 mph	
Item		Unit	YR 2012 Unit Cost (1000s)	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
Trackwork																	
1.1	HSR on Existing Roadbed	per mile	$ 1,424			5.00	7,120	20	28,479	22.0	31,327	-	-	3.2	4,557	50.2	71,483
1.2a	HSR on New Roadbed	per mile	$ 1,519				-		-	-	-	-	-	3.8	5,771	3.8	5,771
1.2b	HSR on New Roadbed & New Embankment	per mile	$ 2,140				-		-	-	-	65.8	140,781	-	-	65.8	140,781
1.2c	HSR on New Roadbed & New Embankment (Double Track)	per mile	$ 3,835				-		-	-	-	-	-	-	-	-	-
1.3	Timber & Surface w/ 33% Tie replacement	per mile	$ 318				-		-	0.0	-	63.8	20,311	0.0	-	63.8	20,311
1.4	Timber & Surface w/ 66% Tie Replacement	per mile	$ 475			27.60	13,100	95.60	45,377	81.8	38,827	-	-	5.1	2,421	210.1	99,725
1.5	Relay Track w/ 136# CWR	per mile	$ 508				-		-	40.8	20,712	-	-	-	-	40.8	20,712
1.6	Freight Siding	per mile	$ 1,308				-		-	-	-	-	-	-	-	-	-
1.65	Passenger Siding	per mile	$ 1,973			-	-	-	-	-	-	-	-	-	-	-	-
1.71	Fencing, 4 ft Woven Wire (both sides)	per mile	$ 73			22.08	1,615	76.48	5,593	30.9	2,260	33.2	2,428	-	-	162.7	11,896
1.72	Fencing, 6 ft Chain Link (both sides)	per mile	$ 219			4.14	908	14.34	3,146	52	11,409	32.0	7,021	7.0	1,536	109.5	24,020
1.73	Fencing, 10 ft Chain Link (both sides)	per mile	$ 251				-		-	-	-	-	-	-	-	-	-
1.74	Decorative Fencing (both sides)	per mile	$ 565			1.38	780	4.78	2,701	-	-	-	-	-	-	6.2	3,480
Total Track Costs					-		23,523		85,297		104,534		170,541		14,284		398,179
Turnouts																	
4.1	#24 High Speed Turnout	each	$ 645			2	1,291	10	6,453	4.0	2,581	4	2,581	-	-	20.0	12,906
4.2	#20 Turnout Timber	each	$ 178			2	356	8	1,423	2.0	356	1	178	5	889	18.0	3,201
4.3	#10 Turnout Timber	each	$ 99			3	297	23	2,276	4.0	396	-	-	-	-	30.0	2,968
4.4	#20 Turnout Concrete	each	$ 357				-		-	-	-	-	-	-	-	-	-
4.5	#10 Turnout Concrete	each	$ 169				-		-	-	-	-	-	-	-	-	-
Total Turnouts Cost					-		1,943		10,151		3,333		2,759		889		19,075
Curves																	
9.1	Elevate & Surface Curves	per mile	$ 83		-		-		-	0.7	55	3	225	-	-	3.4	280
9.2	Curvature Reduction	per mile	$ 564		-		-		-	-	-	-	-	-	-	-	-
9.3	Elastic Fasteners	per mile	$ 118		-		-		-	-	-	-	-	-	-	-	-
9.5	Realign Track for Curves	lump sum	varies							-	190	-	2,083.61	-	-	-	2,274
Total Curves Cost					-		-		-		245		2,309		-		2,554
Signals																	
8.1	Signals for Siding w/ High Speed Turnout	each	$ 1,818		-	1	1,818	4	7,273	4.0	7,273	2	3,637	-	-	11.0	20,001
8.2	Install CTC System (Single Track)	per mile	$ 262		-	27.6	7,243	95.6	25,088	60.9	15,982	55.2	14,486	2	499	241.2	63,296
8.21	Install CTC System (Double Track)	per mile	$ 430		-		-		-	22.0	9,464	10.0	4,302	5.1	2,194	37.1	15,960
8.3	Install PTC System	per mile	$ 282			27.6	7,797	95.6	27,007	82.9	23,419	65.2	18,419	-	-	271.3	76,642
8.4	Electric Lock for Industry Turnout	each	$ 148		-	3	443	23	3,397	27.0	3,988	22.0	3,249	2	295	77.0	11,373
8.5	Signals for Crossover	each	$ 1,004		-		-		-	-	-	-	-	1	1,004	1.0	1,004
8.6	Signals for Turnout	each	$ 574		-		-		-	2.0	1,147	1.0	574	3	1,721	6.0	3,442
Total Signals Cost					-		17,301		62,765		61,274		44,666		5,713		191,719

				Chicago Terminal Area Limit		Tolleston - Wanatah - Fort Wayne				Fort Wayne - Dunkirk - Columbus							
			Segment No.	Segment 1		Segment 2		Segment 3		Segment 4		Segment 5		Segment 6			
			From - To	Chicago to Tolleston		Tolleston to Wanatah		Wanatah to Fort Wayne		Fort Wayne to Dunkirk		Dunkirk to CP Mounds		CP Mounds to Columbus		Total	
			Host Carrier	South-of-the-Lake		CSX		CSX & NS		CSXT Ft. Wayne Line		CSXT Scottslawn Subdivision		Buckeye/CSXT Scotslawn			
			Mileposts	Corridor Study		MP 442.5 - MP 414.9		SX MP 414.9 - NS MP 146		MP 236.4 to MP 319.2		MP 126.4 to MP 61.2		CP128 to MP126.4			
			Track Miles	26.6 miles		27.6 miles		95.6 miles		82.9 miles		65.2 miles		7.0 miles		304.9 miles	
			Maximum Authorized Speed			110 mph		110 mph		110 mph		110 mph		35/50/110 mph		110 mph	
Item		Unit	YR 2012 Unit Cost (1000s)	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
Stations / Facilities																	
2.1	Full Service - New	each	$ 1,434		-		-	2	2,868	-	-	2	2,868	-	-	4.0	5,736
2.2	Full Service - Renovated	each	$ 717		-		-		-	-	-	-	-	-	-	-	-
2.3	Terminal - New	each	$ 2,868		-		-	1	2,868	1.0	2,868	1	2,868	1	2,868	4.0	11,472
2.4	Terminal - Renovated	each	$ 1,434		-	1	1,434	-	-	-	-	-	-	-	-	1.0	1,434
2.6	Layover Facility	lump sum	-							-		-					-
2.7	Service & Inspection Facility in Columbus	lump sum	$ 27,207							-	-	-	-	1	27,207	1.0	27,207
Total Station Cost					-		1,434		5,736		2,868		5,736		30,075		45,849
Bridges-under																	
5.1	Four Lane Urban Expressway	each	$ 6,933		-		-		-	-	-	-	-	-	-	-	-
5.2	Four Lane Rural Expressway	each	$ 5,772		-		-		-	-	-	-	-	-	-	-	-
5.3	Two Lane Highway	each	$ 4,379		-		-		-	-	-	-	-	4	17,518	4.0	17,518
5.4	Rail	each	$ 4,379		-		-		-	-	-	-	-	-	-	-	-
5.5	Minor river	each	$ 1,162		-		-		-	-	-	25	29,039	-	-	25.0	29,039
5.6	Major River	each	$ 11,613		-		-		-	-	-	-	-	-	-	-	-
5.65	Bridge Rehabilitation	each	$ 287		-		-		-	-	-	-	-	-	-	-	-
5.71	Convert open deck bridge to ballast deck (single track)	per LF	$ 6.7		-		-		-	2,300.0	15,425	500	3,353	-	-	2,800.0	18,778
5.72	Convert open deck bridge to ballast deck (double track)	per LF	$ 13.4		-		-		-	-	-	-	-	-	-	-	-
5.73	Single Track on Flyover Structure	per LF	$ 8.6		-		-		-	1,700.0	14,627	-	-	-	-	1,700.0	14,627
5.8	Single Track on Approach Embankment w/ Retaining Wall	per LF	$ 4.3		-		-		-	2,500.0	10,755	-	-	-	-	2,500.0	10,755
Total Bridges-under Cost					-		-		-		40,807		32,392		17,518		90,716
Bridges-over																	
6.1	Four Lane Urban Expressway	each	$ 2,993		-		-		-	-	-	2	5,986	-	-	2.0	5,986
6.2	Four Lane Rural Expressway	each	$ 4,200		-		-		-	-	-	-	-	-	-	-	-
6.3	Two Lane Highway	each	$ 2,729		-		-		-	-	-	-	-	-	-	-	-
6.4	Rail	each	$ 8,762		-		-		-	-	-	-	-	-	-	-	-
Total Bridges-over Cost					-		-		-		-		5,986		-		5,986
Crossings																	
7.1	Private Closure	each	$ 119		-	2	238	6.00	714	6.0	714	7	833	-	-	21.0	2,499
7.2	Four Quadrant Gates w/ Trapped Vehicle Detector	each	$ 706		-	11	7,761	15.00	10,583	-	-	-	-	-	-	26.0	18,344
7.3	Four Quadrant Gates	each	$ 413		-	17	7,021	14	5,782	75.0	30,974	46	18,998	-	-	152.0	62,775
7.31	Convert Dual Gates to Quad Gates	each	$ 215		-		-		-	18.0	3,872	6	1,291	-	-	24.0	5,162
7.4a	Conventional Gates single mainline track	each	$ 238		-	15	3,571	76	18,091	23.0	5,475	30	7,141	-	-	144.0	34,278
7.4b	Conventional Gates double mainline track	each	$ 294		-		-		-	-	-	-	-	3	882	3.0	882
7.41	Convert Flashers Only to Dual Gate	each	$ 72		-	5	359	7	502	2.0	143	4	287	-	-	18.0	1,291
7.5a	Single Gate with Median Barrier	each	$ 258		-		-		-	-	-	-	-	-	-	-	-
7.5b	Convert Single Gate to Extended Arm	each	$ 22		-		-		-	-	-	-	-	-	-	-	-
7.71	Precast Panels without Rdway Improvements	each	$ 115		-		-		-	133.0	15,258	29	3,327	3	344	165.0	18,929
7.72	Precast Panels with Rdway Improvements	each	$ 215		-	43	9,249	105	22,586	-	-	64	13,766	-	-	212.0	45,601
7.8	Michigan Type Grade Crossing Surface	each	$ 22		-		-		-	-	-	-	-	-	-	-	-
7.9	Install CWT system	each	$ 108		-		-		-	14.0	1,506	7	753	-	-	21.0	2,259
Total Crossings Cost					-		28,198		58,258		57,942		46,396		1,226		192,020

			Chicago Terminal Area Limit		Tolleston - Wanatah - Fort Wayne				Fort Wayne - Dunkirk - Columbus						TEMS	
Segment No.			Segment 1		Segment 2		Segment 3		Segment 4		Segment 5		Segment 6			
From - To			Chicago to Tolleston		Tolleston to Wanatah		Wanatah to Fort Wayne		Fort Wayne to Dunkirk		Dunkirk to CP Mounds		CP Mounds to Columbus		Total	
Host Carrier			South-of-the-Lake		CSX		CSX & NS		CSXT Ft. Wayne Line		CSXT Scottslawn Subdivision		Buckeye/CSXT Scotslawn			
Mileposts			Corridor Study		MP 442.5 - MP 414.9		SX MP 414.9 - NS MP 146		MP 236.4 to MP 319.2		MP 126.4 to MP 61.2		CP128 to MP126.4			
Track Miles			26.6 miles		27.6 miles		95.6 miles		82.9 miles		65.2 miles		7.0 miles		304.9 miles	
Maximum Authorized Speed					110 mph		110 mph		110 mph		110 mph		35/50/110 mph		110 mph	
Item	Unit	YR 2012 Unit Cost (1000s)	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
Segment Totals				0		72,400		222,207		271,003		310,784		69,705		946,098
Placeholders																
Longitudinal Drainage Improvements	per mile	$ 72			27.6	1,979	95.6	6,855		-		-		-	123.2	8,833
Land Acquisition Urban	per mile	$ 420				-		-		-		-		-	-	-
Land Acquisition Rural	per mile	$ 140				-		-		-	2.1	294		-	2.1	294
Bridge Rehabilitation	each	$ 287			8	2,294	34	9,751		-		-		-	42.0	12,046
CSXT Scotslawn Flyover at Ridgeway	lump sum	$ 57,360				-		-	-	-	1	57,360	-	-	1.0	57,360
NS Flyover at Mike (Fort Wayne) Modifications	lump sum	$ 28,680				-		-	1	28,680	-	-	-	-	1.0	28,680
Diamonds and Signals at Hannah	lump sum	$ 1,434			1.0	1,434	0.0	-	0.0	-	-	-		-	1.0	1,434
Diamonds and Signals at Plymouth	lump sum	$ 1,434				-	1.0	1,434		-		-	-	-	1.0	1,434
Diamonds and Signals at Van wart	lump sum	$ 1,434				-		-	1	1,434		-		-	1.0	1,434
Diamonds and Signals at Mounds	lump sum	$ 1,434				-		-	-	-	-	-	1	1,434	1.0	1,434
						-		-		-					-	-
TOTAL				-		**78,107**		**240,247**		**301,117**		**368,439**		**71,139**		**1,059,048**

NOTES

Assume 26' offset for new mainline track construction for speeds above 79 mph
Installation of PTC system does not include locomotive equipment and dispatch equipment.
Corridor access with freight railroads to be negotiated; costs not included
Station costs are MWRRS allocation amounts
Close 25% of all private crossings where speeds are above 79 mph; remainder are Conventional Gate
Four Quandrant Gates all public crossings at speeds > 79mph
Conventional Gates all public crossings at speeds </= 79mph
Precast Panels with Roadway Improvements installed where track embankment is replaced
Precast Panels without Roadway Improvements installed where track embankment is not replaced

ASSUMED STATION LOCATIONS

Chicago
Gary Airport
Valparaiso
Plymouth
Warsaw
Fort Wayne
Lima
Kenton
Marysville
Hillard
Columbus

The original MWRRS flyover was $12 million in $2002 from the Mike to New Haven Segment. It will now be found in Segment 4 (Dunkirk to Ft. Wayne) under Bridges-under item (5.73 & 5.8)----->Segment 4 also includes a 28.7 million Placeholder for modifications to the proposed MWRRS flyover structure. These modifications are needed to build the 2nd leg of the bridge structure for the Columbus trains to use.

Tolleston is the end of South-of-the-lake project
Wanatah is the proposed junction to the Indianapolis line.
The Kansas City to Detroit NS Mainline crosses at Fort Wayne.
The CSX mainline from Cleveland to Indianapolis crosses at Ridgeway.
At Dunkirk out of the three possible connection tracks (high speed, medium speed, and low speed) the high speed connection track option was selected.

130 OPTION

Chicago to Columbus (via Fort Wayne)

Revised on 12/10/12

				Chicago Terminal Area Limit		Tolleston - Wanatah - Fort Wayne				Fort Wayne - Dunkirk - Columbus							
			Segment No.	Segment 1		Segment 2		Segment 3		Segment 4		Segment 5		Segment 6		Total	
			From - To	Chicago to Tolleston		Tolleston to Wanatah		Wanatah to Fort Wayne		Fort Wayne to Dunkirk		Dunkirk to CP Mounds		CP Mounds to Columbus			
			Host Carrier	South-of-the-Lake		CSX		CSX & NS		CSXT Ft. Wayne Line		CSXT Scottslawn Subdivision		Buckeye/CSXT Scotslawn			
			Mileposts	Corridor Study		MP 442.5 - MP 414.9		SX MP 414.9 - NS MP 146		MP 236.4 to MP 319.2		MP 126.4 to MP 61.2		CP128 to MP126.4			
			Track Miles	26.6 miles		27.6 miles		95.6 miles		82.9 miles		65.2 miles		7.0 miles		304.9 miles	
			Maximum Authorized Speed			110 mph		110 mph		110 mph		110 mph		35/50/110 mph		110 mph	
Item		Unit	YR 2012 Unit Cost (1000s)	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
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1.2a	HSR on New Roadbed	per mile	$ 1,519				-		-	-	-	-	-	3.8	5,771	3.8	5,771
1.2b	HSR on New Roadbed & New Embankment	per mile	$ 2,140				-		-	-	-	65.8	140,781	-	-	65.8	140,781
1.2c	HSR on New Roadbed & New Embankment (Double Track)	per mile	$ 3,835				-		-	-	-	-	-	-	-	-	-
1.3	Timber & Surface w/ 33% Tie replacement	per mile	$ 318				-		-	0.0	-	63.8	20,311	0.0	-	63.8	20,311
1.4	Timber & Surface w/ 66% Tie Replacement	per mile	$ 475			27.60	13,100	95.60	45,377	81.8	38,827	-	-	5.1	2,421	210.1	99,725
1.5	Relay Track w/ 136# CWR	per mile	$ 508				-		-	40.8	20,712	-	-	-	-	40.8	20,712
1.6	Freight Siding	per mile	$ 1,308				-		-	-	-	-	-	-	-	-	-
1.65	Passenger Siding	per mile	$ 1,973			-	-	-	-	-	-	-	-	-	-	-	-
1.71	Fencing, 4 ft Woven Wire (both sides)	per mile	$ 73			22.08	1,615	76.48	5,593	30.9	2,260	33.2	2,428	-	-	162.7	11,896
1.72	Fencing, 6 ft Chain Link (both sides)	per mile	$ 219			4.14	908	14.34	3,146	52	11,409	32.0	7,021	7.0	1,536	109.5	24,020
1.73	Fencing, 10 ft Chain Link (both sides)	per mile	$ 251				-		-	-	-	-	-	-	-	-	-
1.74	Decorative Fencing (both sides)	per mile	$ 565			1.38	780	4.78	2,701	-	-	-	-	-	-	6.2	3,480
Total Track Costs					-		23,523		85,297		104,534		170,541		14,284		398,179
Turnouts																	
4.1	#24 High Speed Turnout	each	$ 645			2	1,291	10	6,453	4.0	2,581	4	2,581	-	-	20.0	12,906
4.2	#20 Turnout Timber	each	$ 178			2	356	8	1,423	2.0	356	1	178	5	889	18.0	3,201
4.3	#10 Turnout Timber	each	$ 99			3	297	23	2,276	4.0	396	-	-	-	-	30.0	2,968
4.4	#20 Turnout Concrete	each	$ 357				-		-	-	-	-	-	-	-	-	-
4.5	#10 Turnout Concrete	each	$ 169				-		-	-	-	-	-	-	-	-	-
Total Turnouts Cost					-		1,943		10,151		3,333		2,759		889		19,075
Curves																	
9.1	Elevate & Surface Curves	per mile	$ 83		-		-		-	0.7	55	3	225	-	-	3.4	280
9.2	Curvature Reduction	per mile	$ 564		-		-		-	-	-	-	-	-	-	-	-
9.3	Elastic Fasteners	per mile	$ 118		-		-		-	-	-	-	-	-	-	-	-
9.5	Realign Track for Curves	lump sum	varies							-	190	-	2,083.61	-	-	-	2,274
Total Curves Cost					-		-		-		245		2,309		-		2,554
Signals																	
8.1	Signals for Siding w/ High Speed Turnout	each	$ 1,818		-	1	1,818	4	7,273	4.0	7,273	2	3,637	-	-	11.0	20,001
8.2	Install CTC System (Single Track)	per mile	$ 262		-	27.6	7,243	95.6	25,088	60.9	15,982	55.2	14,486	2	499	241.2	63,296
8.21	Install CTC System (Double Track)	per mile	$ 430		-		-		-	22.0	9,464	10.0	4,302	5.1	2,194	37.1	15,960
8.3	Install PTC System	per mile	$ 282		-	27.6	7,797	95.6	27,007	82.9	23,419	65.2	18,419	-	-	271.3	76,642
8.4	Electric Lock for Industry Turnout	each	$ 148		-	3	443	23	3,397	27.0	3,988	22.0	3,249	2	295	77.0	11,373
8.5	Signals for Crossover	each	$ 1,004		-		-		-	-	-	-	-	1	1,004	1.0	1,004
8.6	Signals for Turnout	each	$ 574		-		-		-	2.0	1,147	1.0	574	3	1,721	6.0	3,442
Total Signals Cost					-		17,301		62,765		61,274		44,666		5,713		191,719

				Chicago Terminal Area Limit		Tolleston - Wanatah - Fort Wayne				Fort Wayne - Dunkirk - Columbus							
			Segment No.	Segment 1		Segment 2		Segment 3		Segment 4		Segment 5		Segment 6			
			From - To	Chicago to Tolleston		Tolleston to Wanatah		Wanatah to Fort Wayne		Fort Wayne to Dunkirk		Dunkirk to CP Mounds		CP Mounds to Columbus		Total	
			Host Carrier	South-of-the-Lake		CSX		CSX & NS		CSXT Ft. Wayne Line		CSXT Scottslawn Subdivision		Buckeye/CSXT Scotslawn			
			Mileposts	Corridor Study		MP 442.5 - MP 414.9		SX MP 414.9 - NS MP 146		MP 236.4 to MP 319.2		MP 126.4 to MP 61.2		CP128 to MP126.4			
			Track Miles	26.6 miles		27.6 miles		95.6 miles		82.9 miles		65.2 miles		7.0 miles		304.9 miles	
			Maximum Authorized Speed			110 mph		110 mph		110 mph		110 mph		35/50/110 mph		110 mph	
	Item	Unit	YR 2012 Unit Cost (1000s)	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
Stations / Facilities																	
2.1	Full Service - New	each	$ 1,434		-		-	2	2,868	-	-	2	2,868	-	-	4.0	5,736
2.2	Full Service - Renovated	each	$ 717		-		-		-	-	-	-	-	-	-	-	-
2.3	Terminal - New	each	$ 2,868		-		-	1	2,868	1.0	2,868	1	2,868	1	2,868	4.0	11,472
2.4	Terminal - Renovated	each	$ 1,434		-	1	1,434	-	-	-	-	-	-	-	-	1.0	1,434
2.6	Layover Facility	lump sum	-							-		-				-	
2.7	Service & Inspection Facility in Columbus	lump sum	$ 27,207							-	-	-	-	1	27,207	1.0	27,207
Total Station Cost					-		1,434		5,736		2,868		5,736		30,075		45,849
Bridges-under																	
5.1	Four Lane Urban Expressway	each	$ 6,933		-		-		-	-	-	-	-	-	-	-	-
5.2	Four Lane Rural Expressway	each	$ 5,772		-		-		-	-	-	-	-	-	-	-	-
5.3	Two Lane Highway	each	$ 4,379		-		-		-	-	-	-	-	4	17,518	4.0	17,518
5.4	Rail	each	$ 4,379		-		-		-	-	-	-	-	-	-	-	-
5.5	Minor river	each	$ 1,162		-		-		-	-	-	25	29,039	-	-	25.0	29,039
5.6	Major River	each	$ 11,613		-		-		-	-	-	-	-	-	-	-	-
5.65	Bridge Rehabilitation	each	$ 287		-		-		-	-	-	-	-	-	-	-	-
5.71	Convert open deck bridge to ballast deck (single track)	per LF	$ 6.7		-		-		-	2,300.0	15,425	500	3,353	-	-	2,800.0	18,778
5.72	Convert open deck bridge to ballast deck (double track)	per LF	$ 13.4		-		-		-	-	-	-	-	-	-	-	-
5.73	Single Track on Flyover Structure	per LF	$ 8.6		-		-		-	1,700.0	14,627	-	-	-	-	1,700.0	14,627
5.8	Single Track on Approach Embankment w/ Retaining Wall	per LF	$ 4.3		-		-		-	2,500.0	10,755	-	-	-	-	2,500.0	10,755
Total Bridges-under Cost					-		-		-		40,807		32,392		17,518		90,716
Bridges-over																	
6.1	Four Lane Urban Expressway	each	$ 2,993		-		-		-	-	-	2	5,986	-	-	2.0	5,986
6.2	Four Lane Rural Expressway	each	$ 4,200		-		-		-	-	-	-	-	-	-	-	-
6.3	Two Lane Highway	each	$ 2,729		-	43.00	117,343	105.00	286,536	-	-	-	-	-	-	148.0	403,879
6.4	Rail	each	$ 8,762		-		-		-	-	-	-	-	-	-	-	-
Total Bridges-over Cost					-		117,343		286,536		-		5,986		-		409,864
Crossings																	
7.1	Private Closure	each	$ 119		-	0	-	0.00	-	6.0	714	7	833	-	-	13.0	1,547
7.2	Four Quadrant Gates w/ Trapped Vehicle Detector	each	$ 706		-	0	-	0.00	-	-	-	-	-	-	-	-	-
7.3	Four Quadrant Gates	each	$ 413		-	0	-	0	-	75.0	30,974	46	18,998	-	-	121.0	49,972
7.31	Convert Dual Gates to Quad Gates	each	$ 215		-	0	-	0	-	18.0	3,872	6	1,291	-	-	24.0	5,162
7.4a	Conventional Gates single mainline track	each	$ 238		-	0	-	0	-	23.0	5,475	30	7,141	-	-	53.0	12,616
7.4b	Conventional Gates double mainline track	each	$ 294		-	0	-	0	-	-	-	-	-	3	882	3.0	882
7.41	Convert Flashers Only to Dual Gate	each	$ 72		-	0	-	0	-	2.0	143	4	287	-	-	6.0	430
7.5a	Single Gate with Median Barrier	each	$ 258		-	0	-	0.00	-	-	-	-	-	-	-	-	-
7.5b	Convert Single Gate to Extended Arm	each	$ 22		-	0	-	0.00	-	-	-	-	-	-	-	-	-
7.71	Precast Panels without Rdway Improvements	each	$ 115		-	0	-	0	-	133.0	15,258	29	3,327	3	344	165.0	18,929
7.72	Precast Panels with Rdway Improvements	each	$ 215		-	0	-	0	-	-	-	64	13,766	-	-	64.0	13,766
7.8	Michigan Type Grade Crossing Surface	each	$ 22		-		-		-	-	-	-	-	-	-	-	-
7.9	Install CWT system	each	$ 108		-		-		-	14.0	1,506	7	753	-	-	21.0	2,259
Total Crossings Cost					-		-		-		57,942		46,396		1,226		105,564
Segment Totals					**0**		**161,545**		**450,484**		**271,003**		**310,784**		**69,705**		**1,263,521**

			Chicago Terminal Area Limit		Tolleston - Wanatah - Fort Wayne				Fort Wayne - Dunkirk - Columbus							
Segment No.			Segment 1		Segment 2		Segment 3		Segment 4		Segment 5		Segment 6			
From - To			Chicago to Tolleston		Tolleston to Wanatah		Wanatah to Fort Wayne		Fort Wayne to Dunkirk		Dunkirk to CP Mounds		CP Mounds to Columbus		Total	
Host Carrier			South-of-the-Lake		CSX		CSX & NS		CSXT Ft. Wayne Line		CSXT Scottslawn Subdivision		Buckeye/CSXT Scotslawn			
Mileposts			Corridor Study		MP 442.5 - MP 414.9		SX MP 414.9 - NS MP 146		MP 236.4 to MP 319.2		MP 126.4 to MP 61.2		CP128 to MP126.4			
Track Miles			26.6 miles		27.6 miles		95.6 miles		82.9 miles		65.2 miles		7.0 miles		304.9 miles	
Maximum Authorized Speed					110 mph		110 mph		110 mph		110 mph		35/50/110 mph		110 mph	
Item	Unit	YR 2012 Unit Cost (1000s)	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
Placeholders																
Longitudinal Drainage Improvements	per mile	$ 72			27.6	1,979	95.6	6,855		-		-		-	123.2	8,833
Land Acquisition Urban	per mile	$ 420			1.3	547	3.9	1,640		-		-		-	5.2	2,186
Land Acquisition Rural	per mile	$ 140				-		-		-	2	294		-	2.1	294
Bridge Rehabilitation	each	$ 287			8	2,294	34	9,751		-		-		-	42.0	12,046
CSXT Scotslawn Flyover at Ridgeway	lump sum	$ 57,360							-	-	1	57,360	-	-	1.0	57,360
NS Flyover at Mike (Fort Wayne) Modifications	lump sum	$ 28,680							1	28,680	-	-	-	-	1.0	28,680
Diamonds and Signals at Hannah	lump sum	$ 1,434			1.0	1,434	0.0	-	0.0	-	-	-	-	-	1.0	1,434
Diamonds and Signals at Plymouth	lump sum	$ 1,434					1.0	1,434							1.0	1,434
Diamonds and Signals at Van wart	lump sum	$ 1,434							1.0	1,434					1.0	1,434
Diamonds and Signals at Mounds	lump sum	$ 1,434											1	1,434	1.0	1,434
CN flyover at Spriggsboro						25,370									-	25,370.0
CN flyover at Warsaw, IN						-		25,370							-	25,370.0
High Speed Curve Easements		$ 3,835			1.30	4,985	3.9	14,955	-		-		-		5.2	19,940
						-									-	-
TOTAL				-		**198,153**		**510,488**		**301,117**		**368,439**		**71,139**		**1,449,336**

NOTES

Assume 26' offset for new mainline track construction for speeds above 79 mph
Installation of PTC system does not include locomotive equipment and dispatch equipment.
Corridor access with freight railroads to be negotiated; costs not included
Station costs are MWRRS allocation amounts
Close 25% of all private crossings where speeds are above 79 mph; remainder are Conventional Gate
Four Quandrant Gates all public crossings at speeds > 79mph
Conventional Gates all public crossings at speeds </= 79mph
Precast Panels with Roadway Improvements installed where track embankment is replaced
Precast Panels without Roadway Improvements installed where track embankment is not replaced

The original MWRRS flyover was $12 million in $2002 from the Mike to New Haven Segment. It will now be found in Segment 4 (Dunkirk to Ft. Wayne) under Bridges-under item (5.73 & 5.8)----->Segment 4 also includes a 28.7 million Placeholder for modifications to the proposed MWRRS flyover structure. These modifications are needed to build the 2nd leg of the bridge structure for the Columbus trains to use.

Tolleston is the end of South-of-the-lake project
Wanatah is the proposed junction to the Indianapolis line.
The Kansas City to Detroit NS Mainline crosses at Fort Wayne.
The CSX mainline from Cleveland to Indianapolis crosses at Ridgeway.
At Dunkirk out of the three possible connection tracks (high speed, medium speed, and low speed) the high speed connection track option was selected.

ASSUMED STATION LOCATIONS

Chicago
Gary Airport
Valparaiso
Plymouth
Warsaw
Fort Wayne
Lima
Kenton
Marysville
Hillard
Columbus

Construction Cost Indices and Forecast

Source >>	DES-OE		DES-Structures OE		Global Insight (GI)[1]		ENR[2]		UCLA[3]	DOF[4]	UCLA[3]	GI[5]	UCLA[6]	GI[7]
Annual >> Indices & %Changes	CHCCI California Highway Construction Cost Index	% Change from previous year	Bridge Construction Cost Index	% Change from previous year	Highway & Street Construction Cost Index	% Change from previous year	Construction Cost Index	% Change from previous year	CPI CA % Change	CPI Urban CA % Change	CPI % Change	CPI All Urban % Change	PPI Finished Goods % Change	PPI Finished Consumer Goods % Change
Year	State		State		National		National		State		National		National	
2007	**100.0**	-3.9	**100.0**	-2.1	**1.00**	3.9	**1.00**	2.8	3.3	3.3	2.9	2.9	4.8	4.5
2008	95.0	-5.0	99.8	-0.2	1.08	7.8	1.04	4.3	3.4	3.4	3.8	3.8	9.8	7.4
2009	78.4	-17.5	78.3	-21.5	1.05	-2.7	1.08	3.1	-0.3	-0.3	-0.3	-0.3	-8.7	-3.8
2010	76.8	-2.0	73.7	-5.9	1.09	3.9	1.10	2.7	1.3	1.3	1.6	1.6	6.8	5.6
2011*	84.0	9.4	75.6	2.6	1.14	5.0	1.14	3.1	2.7	2.7	3.1	3.1	8.9	7.6
2012F					*1.18*	*3.5*	*1.17*	*2.4*	*1.7*	*1.8*	*2.3*	*2.2*	*1.4*	*1.9*
2013F					*1.21*	*2.0*	*1.20*	*3.2*	*2.2*	*2.1*	*1.7*	*1.6*	*1.3*	*0.9*
2014F					*1.23*	*2.2*	*1.26*	*4.5*	*2.3*	*2.2*	*1.9*	*1.9*	*1.7*	*1.5*
2015F					*1.27*	*3.0*	*1.30*	*3.7*		*2.3*		*2.0*		*1.4*
2016F					*1.30*	*2.5*	*1.33*	*1.8*				*1.9*		*1.4*
2017F					*1.33*	*1.6*	*1.36*	*2.3*				*1.8*		*1.0*
2018F					*1.34*	*1.5*	*1.39*	*2.3*				*1.8*		*0.9*

Note: All cost indices are normalized to 2007 and are cumulative from the base year.

*Current year indices are based on the previous quarter or past 12 month data were available and are updated every quarter.

Last updated: 3/23/2012

F: Forecast numbers are italicized.

(1) IHS Global Insight Highway and Street Construction Cost Index
(2) ENR Construction Cost Index, U.S. 20 City Average Source: ENR/Global Insight
(3) UCLA Anderson Forecast, Economic Outlook - The UCLA Anderson Forecast is a unit of The UCLA Anderson School of Management,
(4) California Department of Finance (DOF), Consumer Price Index. DOF also publishes Economic Outlook report once annually as part of May Revision.
(5) IHS Global Insight Consumer Price Index - All Urban, Source: BLS
(6) UCLA Anderson Forecast, Publications, Economic Outlook
(7) IHS Global Insight Producer Price Index - Finished Consumer Goods, Source: BLS

According to Bureau of Labor Statistics (BLS): (http://www.bls.gov)

Consumer Price Index (CPI)

A consumer price index is a measure of the average price of consumer goods and services purchased by households. A consumer price index measures a price change for a constant market basket of goods and services from one period to the next within the same area (city, region, or nation). The percent change in the CPI is a measure of inflation.

Producer Price Index (PPI)

A producer price index is a family of indexes that measure the average change over time in selling prices received by domestic producers of goods and services. PPIs measure price change from the perspective of the seller. This contrasts with other measures that measure price change from the purchaser's perspective, such as the Consumer Price Index (CPI). Sellers' and purchasers' prices may differ due to government subsidies, sales and excise taxes, and distribution costs.

Contract Escalation

Producer Price Index (PPI) data are commonly used in escalating purchase and sales contracts. These contracts typically specify dollar amounts to be paid at some point in the future. It is often desirable to include an escalation clause that accounts for changes in input prices. For example, a long-term contract for bread may be escalated for changes in wheat prices by applying the percent change in the PPI for wheat to the contracted price for bread. Consumer Price Index (CPI) data can also be used in escalation. For example, the CPI may be used to escalate lease payments or child support payments.

Construction Cost Index History - As of August 2011

View all Historical Indices »

Text size: A A

HOW ENR BUILDS THE INDEX: 200 hours of common labor at the 20-city average of common labor rates, plus 25 cwt of standard structural steel shapes at the mill price prior to 1996 and the fabricated 20-city price from 1996, plus 1.128 tons of portland cement at the 20-city price, plus 1,088 board ft of 2 x 4 lumber at the 20-city price.

ENR'S CONSTRUCTION COST INDEX HISTORY (1908-2011)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVG.
2011	8938	8998	9011	9027	9035	9053	9080	9088					
2010	8660	8672	8671	8677	8761	8805	8865	8858	8836	8921	8951	8952	8802
2009	8549	8533	8534	8528	8574	8578	8566	8564	8586	8596	8592	8641	8570
2008	8090	8094	8109	8112	8141	8185	8293	8362	8557	8623	8602	8551	8310
2007	7880	7880	7856	7865	7942	7939	7959	8007	8050	8045	8092	8089	7966
2006	7660	7689	7692	7695	7691	7700	7721	7722	7763	7883	7911	7888	7751
2005	7297	7298	7309	7355	7398	7415	7422	7479	7540	7563	7630	7647	7446
2004	6825	6862	6957	7017	7065	7109	7126	7188	7298	7314	7312	7308	7115
2003	6581	6640	6627	6635	6642	6694	6695	6733	6741	6771	6794	6782	6694
2002	6462	6462	6502	6480	6512	6532	6605	6592	6589	6579	6578	6563	6538
2001	6281	6272	6279	6286	6288	6318	6404	6389	6391	6397	6410	6390	6343
2000	6130	6160	6202	6201	6233	6238	6225	6233	6224	6259	6266	6283	6221
1999	6000	5992	5986	6008	6006	6039	6076	6091	6128	6134	6127	6127	6059
1998	5852	5874	5875	5883	5881	5895	5921	5929	5963	5986	5995	5991	5920
1997	5765	5769	5759	5799	5837	5860	5863	5854	5851	5848	5838	5858	5826
1996	5523	5532	5537	5550	5572	5597	5617	5652	5683	5719	5740	5744	5620
1995	5443	5444	5435	5432	5433	5432	5484	5506	5491	5511	5519	5524	5471
1994	5336	5371	5381	5405	5405	5408	5409	5424	5437	5437	5439	5439	5408
1993	5071	5070	5106	5167	5262	5260	5252	5230	5255	5264	5278	5310	5210
1992	4888	4884	4927	4946	4965	4973	4992	5032	5042	5052	5058	5059	4985
1991	4777	4773	4772	4766	4801	4818	4854	4892	4891	4892	4896	4889	4835
1990	4680	4685	4691	4693	4707	4732	4734	4752	4774	4771	4787	4777	4732

SOURCE FOR THE DATA HERE

ANNUAL AVERAGE

YEAR	AVG	YEAR	AVG	YEAR	AVG	YEAR	AVG
1989	4615	**1988**	4519	**1987**	4406	**1986**	4295
1985	4195	**1984**	4146	**1983**	4066	**1982**	3825
1981	3535	**1980**	3237	**1979**	3003	**1978**	2776
1977	2576	**1976**	2401	**1975**	2212	**1974**	2020
1973	1895	**1972**	1753	**1971**	1581	**1970**	1381
1969	1269	**1968**	1155	**1967**	1074	**1966**	1019
1965	971	**1964**	936	**1963**	901	**1962**	872

1961	847	**1960**	824	**1959**	797	**1958**	759
1957	724	**1956**	692	**1955**	660	**1954**	628
1953	600	**1952**	569	**1951**	543	**1950**	510
1949	477	**1948**	461	**1947**	413	**1946**	346
1945	308	**1944**	299	**1943**	290	**1942**	276
1941	258	**1940**	242	**1939**	236	**1938**	236
1937	235	**1936**	206	**1935**	196	**1934**	198
1933	170	**1932**	157	**1931**	181	**1930**	203
1929	207	**1928**	207	**1927**	206	**1926**	208
1925	207	**1924**	215	**1923**	214	**1922**	174
1921	202	**1920**	251	**1919**	198	**1918**	189
1917	181	**1916**	130	**1915**	93	**1914**	89
1913	100	**1912**	91	**1911**	93	**1910**	96
1909	91	**1908**	97				

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APPENDIX 4: TRAIN SCHEDULES

Chicago, IL to Columbus, OH: Diesel 110 Option

All times are CST; UPDATED for FT WAYNE STUDY 12/17/2012

Station - Read Down	Miles	300	302	304	306	308	310	312	314	316	318	320	322
CHICAGO, IL - UNION STATION	0.0	5:00	6:00	7:00	9:25	10:00	11:30	14:30	16:00	17:00	18:30	19:00	21:00
Gary, IN - Regional Airport	23.0	5:24	6:24	7:24	9:49	10:24	11:54	14:54	16:24	17:24	18:54	19:24	21:24
Valparaiso, IN	44.3	5:38	-	-	10:03	-	12:08	-	16:38	-	19:08	-	21:38
Plymouth, IN	84.7	6:01	-	-	10:26	-	12:31	-	17:01	-	19:31	-	22:01
Warsaw, IN	109.8	6:18	-	-	10:43	-	12:48	-	17:18	-	19:48	-	22:18
Fort Wayne, IN	148.7	6:47	7:38	8:38	11:12	11:38	13:17	16:08	17:47	18:38	20:17	20:38	22:47
Lima, OH	208.1	7:31	8:22	9:22	11:56	12:22	14:01	16:52	18:31	19:22	21:01	21:22	23:31
Kenton, OH	243.2	7:54	-	-	12:19	-	14:24	-	18:54	-	21:24	-	23:54
Marysville, OH	275.2	8:26	-	-	12:51	-	14:56	-	19:26	-	21:56	-	0:26
Hilliard, OH	294.5	8:45	9:31	10:31	13:10	-	15:15	18:01	19:45	20:31	22:15	-	0:45
Columbus, OH (Arr)	303.7	9:00	9:45	10:45	13:25	-	15:30	18:15	20:00	20:45	22:30	-	1:00

Station - Read Down	Miles	301	303	305	307	309	311	313	315	317	319	321	323
Columbus, OH (Dep)	0.0	4:55	-	6:00	9:30	10:30	11:30	14:00	-	16:30	19:45	20:30	21:30
Hilliard, OH	9.2	5:10	-	6:14	9:45	10:44	11:45	14:14	-	16:44	20:00	20:44	21:45
Marysville, OH	28.5	5:29	-	-	10:04	-	12:04	-	-	-	20:19	-	22:04
Kenton, OH	60.5	6:01	-	-	10:36	-	12:36	-	-	-	20:51	-	22:36
Lima, OH	95.6	6:24	6:48	7:23	10:59	11:53	12:59	15:23	15:59	17:53	21:14	21:53	22:59
Fort Wayne, IN	155.0	7:08	7:32	8:07	11:43	12:37	13:43	16:07	16:43	18:37	21:58	22:37	23:43
Warsaw, IN	193.9	7:37	-	-	12:12	-	14:12	-	17:12	-	22:27	-	0:12
Plymouth, IN	219.0	7:54	-	-	12:29	-	14:29	-	17:29	-	22:44	-	0:29
Varparaiso, IN	259.4	8:17	-	-	12:52	-	14:52	-	17:52	-	23:07	-	0:52
Gary, IN - Regional Airport	280.7	8:31	8:46	9:21	13:06	13:51	15:06	17:21	18:06	19:51	23:21	23:51	1:06
CHICAGO, IL -UNION STATION	303.7	8:55	9:10	9:45	13:30	14:15	15:30	17:45	18:30	20:15	23:45	0:15	1:30

Chicago, IL to Columbus, OH: Diesel 130 Option

All times are CST; UPDATED for FT WAYNE STUDY 12/17/2012

Station - Read Down	Miles	300	302	304	306	308	310	312	314	316	318	320	322
CHICAGO, IL - UNION STATION	0.0	5:00	6:00	7:00	9:25	10:00	11:30	14:30	16:00	17:00	18:30	19:00	21:00
Gary, IN - Regional Airport	23.0	5:23	6:23	7:23	9:48	10:23	11:53	14:53	16:23	17:23	18:53	19:23	21:23
Valparaiso, IN	44.3	5:36	-	-	10:01	-	12:06	-	16:36	-	19:06	-	21:36
Plymouth, IN	84.7	5:57	-	-	10:22	-	12:27	-	16:57	-	19:27	-	21:57
Warsaw, IN	109.8	6:13	-	-	10:38	-	12:43	-	17:13	-	19:43	-	22:13
Fort Wayne, IN	148.7	6:39	7:30	8:30	11:04	11:30	13:09	16:00	17:39	18:30	20:09	20:30	22:39
Lima, OH	208.1	7:20	8:11	9:11	11:45	12:11	13:50	16:41	18:20	19:11	20:50	21:11	23:20
Kenton, OH	243.2	7:40	-	-	12:05	-	14:10	-	18:40	-	21:10	-	23:40
Marysville, OH	275.2	8:07	-	-	12:32	-	14:37	-	19:07	-	21:37	-	0:07
Hilliard, OH	294.5	8:23	9:09	10:09	12:48	-	14:53	17:39	19:23	20:09	21:53	-	0:23
Columbus, OH (Arr)	303.7	8:34	9:20	10:20	12:59	-	15:04	17:50	19:34	20:20	22:04	-	0:34

Station - Read Down	Miles	301	303	305	307	309	311	313	315	317	319	321	323
Columbus, OH (Dep)	0.0	4:55	-	6:00	9:30	10:30	11:30	14:00	-	16:30	19:45	20:30	21:30
Hilliard, OH	9.2	5:06	-	6:11	9:41	10:41	11:41	14:11	-	16:41	19:56	20:41	21:41
Marysville, OH	28.5	5:22	-	-	9:57	-	11:57	-	-	-	20:12	-	21:57
Kenton, OH	60.5	5:49	-	-	10:24	-	12:24	-	-	-	20:39	-	22:24
Lima, OH	95.6	6:09	6:48	7:09	10:44	11:39	12:44	15:09	15:59	17:39	20:59	21:39	22:44
Fort Wayne, IN	155.0	6:50	7:29	7:50	11:25	12:20	13:25	15:50	16:40	18:20	21:40	22:20	23:25
Warsaw, IN	193.9	7:16	-	-	11:51	-	13:51	-	17:06	-	22:06	-	23:51
Plymouth, IN	219.0	7:32	-	-	12:07	-	14:07	-	17:22	-	22:22	-	0:07
Varparaiso, IN	259.4	7:53	-	-	12:28	-	14:28	-	17:43	-	22:43	-	0:28
Gary, IN - Regional Airport	280.7	8:06	8:36	8:57	12:41	13:27	14:41	16:57	17:56	19:27	22:56	23:27	0:41
CHICAGO, IL -UNION STATION	303.7	8:29	8:59	9:20	13:04	13:50	15:04	17:20	18:19	19:50	23:19	23:50	1:04

APPENDIX 5: FORT WAYNE FREIGHT REROUTING POTENTIALS – CONTEXT FOR RAIL GRADE SEPARATION ALTERNATIVES

5 FORT WAYNE GRADE SEPARATION ALTERNATIVES

The need for a rail grade separation in Fort Wayne – as described in Exhibit 4-6: *Passenger Flyover at CP Mike* – as well as the City of Fort Wayne's own proposed Anthony Boulevard grade separation - has raised a number of questions regarding the need for, and both potential conflicts and synergies, between these projects. It should be noted that the need for rail grade separations in Fort Wayne was identified as early as 2004, as part of the original MWRRS study, for eliminating conflicts between freight and proposed passenger trains. The plan was refined by the 2007 Ohio Hub study, to take into account the need for Fort Wayne-Columbus as well as Fort Wayne-Toledo-Cleveland passenger service. Both highway and rail grade crossings are key concerns in planning the implementation of passenger rail systems:

- For highway crossings the goal is to minimize delay to motorists, as well as to mitigate both safety and noise impacts related to highway grade crossings. It is customary to review corridors to develop plans for improving highway grade crossing protections (e.g. through Constant Warning Time devices, quad gates, fencing, pedestrian improvements or quiet zones) or in the ultimate, to eliminate crossings through either closure or grade separations.

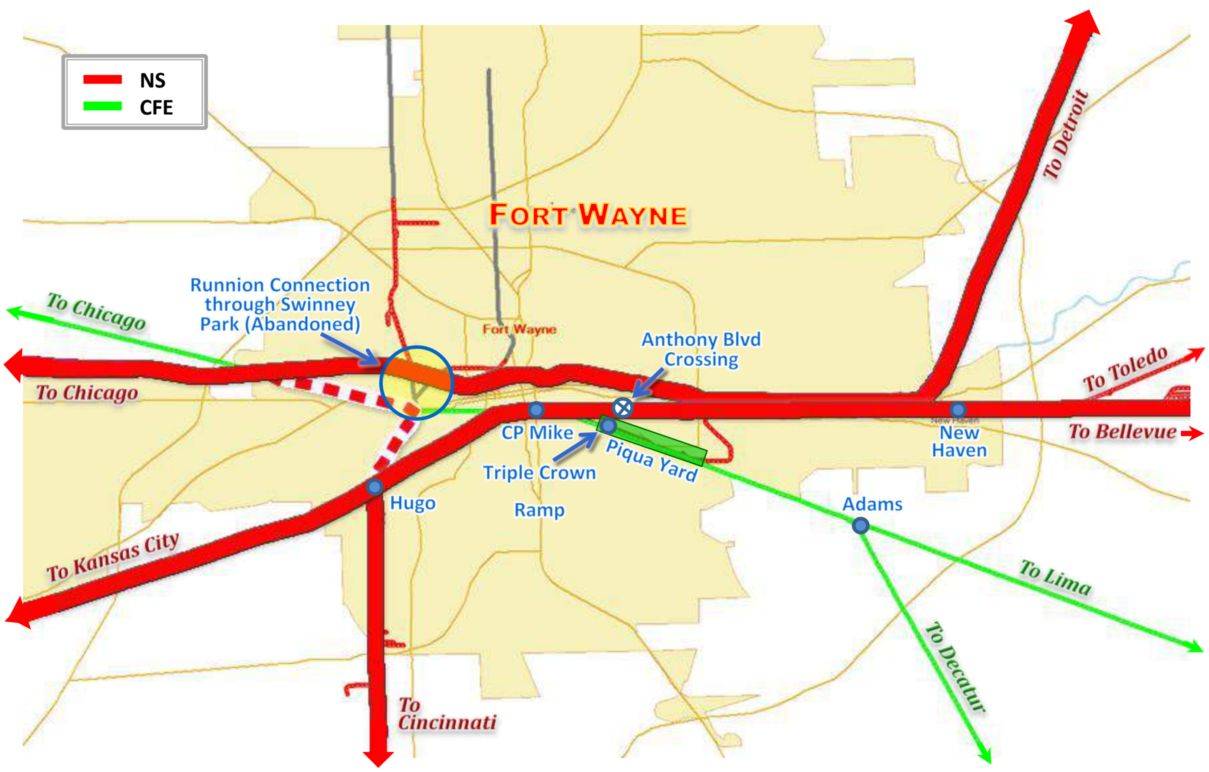
- For rail crossings the goal is to minimize delay both to passenger and freight trains, as well as to improve safety, and remove speed restrictions associated with at-grade "diamond" or crossings of other rail tracks. Possible solutions include signaling to ensure priority of passenger trains, the replacement of traditional crossing "diamonds" with either switches or One-Way-Low-Speed (OWLS) diamonds to eliminate speed restriction, or in the ultimate, to eliminate rail crossings through either closure of the crossing rail line, or grade separations.

When planning grade crossing improvements, it is customary for railroads to propose to improve certain strategic crossings, and simultaneously close other nearby or adjacent crossings. For example if there are three existing highway grade crossings in close proximity, then one would be grade separated and the other two would be closed. This encourages maximum utilization of the grade separation, and minimizes risk exposure to highway and rail vehicles, eliminating unnecessary at-grade crossings of rail tracks. It also reduces capital and operating costs by avoiding the need for investing in grade crossings or for maintaining redundant grade crossings.

For understanding why grade separations are needed, Exhibit 1 shows the current pattern of Norfolk Southern (NS) freight traffic through Fort Wayne.

- On the east side of town, three NS lines head towards Detroit, Toledo and Bellevue. The Toledo line is only a lightly-used branch line – it has been sold to the Maumee & Western short line. However, the other two NS lines are heavily used mainlines.
- On the west side of town, three NS lines head towards Chicago, Kansas City and Cincinnati. All three are heavily used mainlines. A few trains coming from Cincinnati turn directly west towards Chicago. These use a new connection track and a short segment of the CSX (Chicago, Fort Wayne & Eastern, CFE) line. However, the vast majority of NS trains pass through downtown Fort Wayne on one of two NS double-tracked alignments through the city.

Exhibit 1: Current Norfolk Southern Traffic Pattern through Fort Wayne



As shown in Exhibit 1, from the east side of town, trains to Chicago take the former Nickel Plate mainline that loops around the north side of Fort Wayne:

> *Part of the line was built atop the old Wabash & Erie canal through downtown Fort Wayne. West of New Haven the line is known as the Chicago District, while east of New Haven it is called the Fostoria District. It enters Fort Wayne on the west side at Runnion and runs east, basically paralleling the Maumee River to New Haven and is double track between Hadley and Four Mile. It is elevated between Van Buren St. and W. Berry St. This line serves two primary purposes in the area; one being Norfolk Southern's primary routing for Chicago trains to and from the southern part of the United States. The line east of New Haven is used predominately as a connecting route between St. Louis and Bellevue, Ohio as well as to the East Coast. The line is fairly busy west of Fort Wayne and sees several intermodal trains, roadrailers, coal trains, as well as regular freights. East of Fort Wayne it is dominated by auto parts trains and road freights.* ***Just a handful of trains run on the line through the city[1].***

Trains to Cincinnati and Kansas City take the former Wabash mainline through the south side of Fort Wayne:

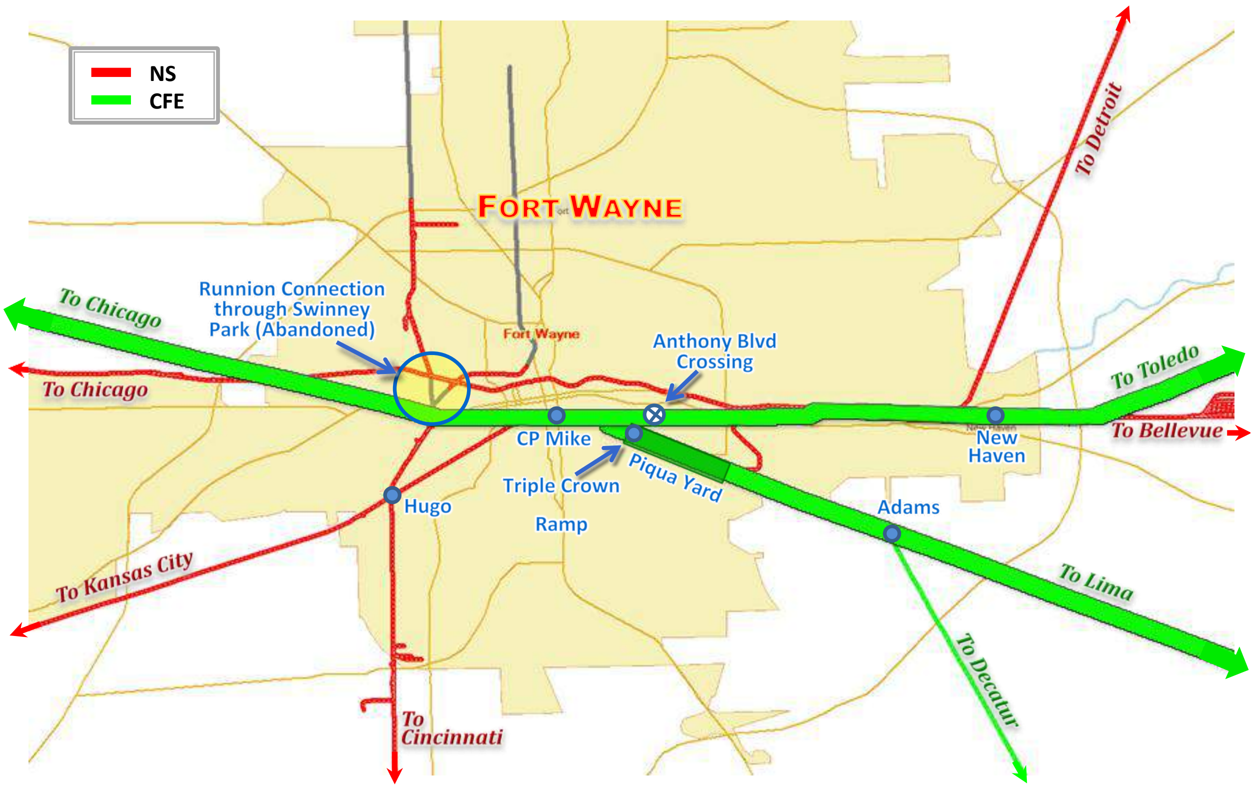
> *This is the former Wabash mainline between Detroit and Kansas City. The portion from Peru, Indiana to Montpelier, Ohio is known as the Huntington District. East of Montpelier it becomes the Detroit District. The Huntington District enters Fort Wayne from the west at Hugo and runs northeast into the city, running elevated along the southern edge of downtown. The line meets the RailAmerica CFE line at Fairfield Ave., crossing it at CP Mike on elevated track. From Fairfield Ave. the line runs completely straight to NE interlocking in New Haven where it makes a sharp turn north to cross the Maumee River. Auto parts are the primary cargo on this line.* ***NS runs many roadrailers on the line and also a few intermodal trains. This line is by far the busiest line through Fort Wayne and the section between Hugo and New Haven is one of the busiest sections of rail in Indiana.***

This traffic pattern has only been amplified since the ConRail division. Since Norfolk Southern acquired ConRail's former NYC Chicago line via Toledo, they have routed most Chicago freight that way. As a result, the number of NS trains headed towards Chicago has decreased, while the number headed toward Cincinnati and Kansas City has increased.

1 These two descriptions are from http://www.fwarailfan.net/fortwayne_rail.htm

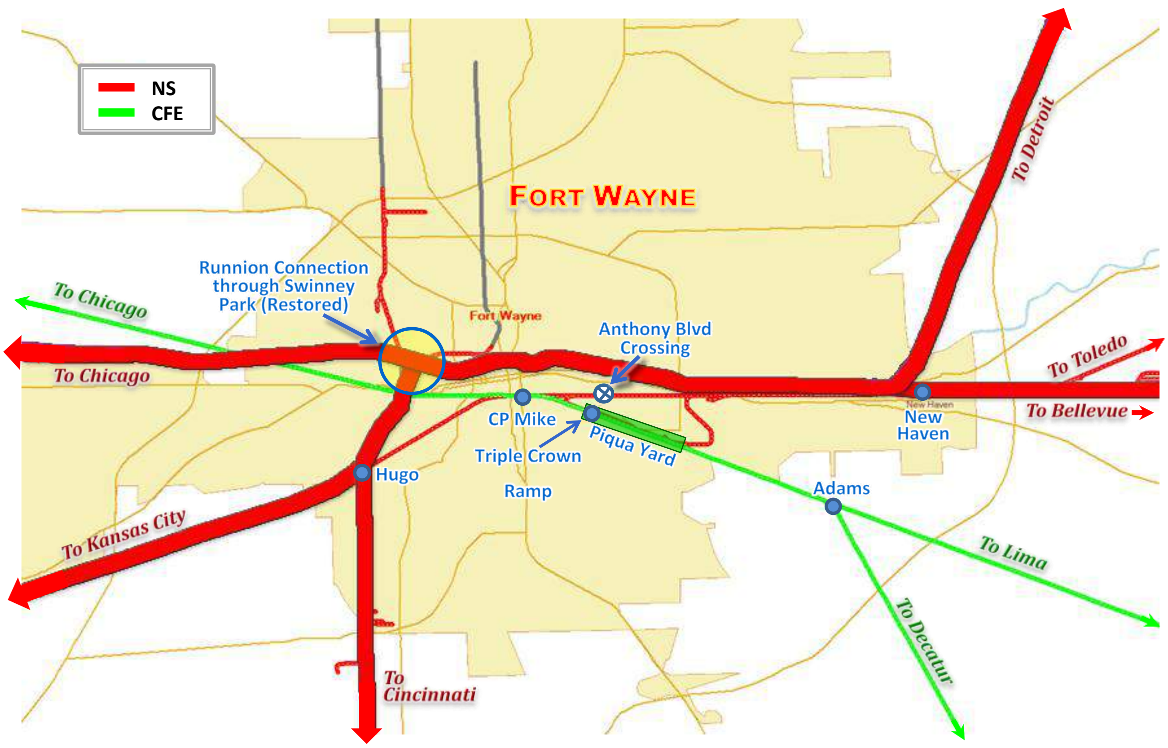
Against this backdrop of heavy freight activity through CP Mike, the MWRRS and Ohio Hub have proposed to develop two separate passenger routes through Fort Wayne. The original MWRRS route passes east and north towards Toledo and Cleveland through New Haven; the Ohio Hub route to Lima and Columbus heads southeast from CP Mike through Adams. See Exhibit 2.

Exhibit 2: Proposed MWRRS and Ohio Hub Passenger Routes through Fort Wayne



Comparing Exhibits 1 and 2, it can be seen that there is a major crossing conflict at CP Mike where the passenger trains would need to cross the main NS freight mainline. This conflict would be alleviated by constructing a grade separation at CP Mike. Not only that, but the rail corridor would have to be shared by freight and passenger trains between CP Mike and New Haven. However, there exists an alternative way to eliminate the conflict by rerouting most of the NS freight trains away from CP Mike. This could be done by developing a new fully grade separated Runnion Connection through Swinney Park. The freight trains could then be rerouted to the northern NS main line and away from the CP Mike crossing, as shown in Exhibit 3.

Exhibit 3: Prospective Future Norfolk Southern Traffic Pattern through Fort Wayne

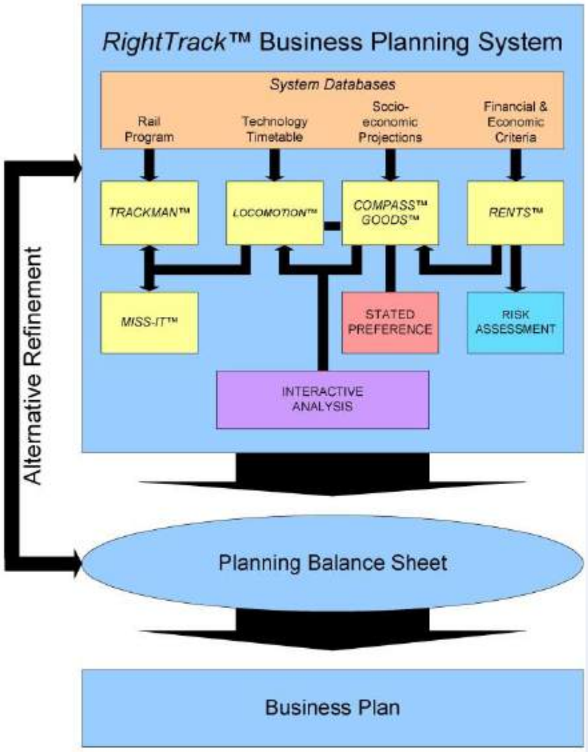


This reroute would not only eliminate the crossing conflict at CP Mike, but would move the heavy freight volumes to different tracks that are completely separated from the ones that the passenger trains would use. NS and CFE local freight could of course, continue to use the tracks through CP Mike but at reduced traffic levels that would not pose a serious problem at the existing level crossing of the tracks.

It can be seen that implementing this freight reroute would also have the effect of removing most freight trains from the current Anthony Boulevard crossing. Of course, local freight trains and new MWRRS passenger trains would continue to use the line, so the city may still wish to proceed with the project. In conjunction with this, it would be recommended that the nearby Winter Street, Fletcher Avenue and Wabash Avenue crossings be evaluated for closure.

If freight is not rerouted it would be important to assess the Anthony Boulevard project for possible physical conflict with the proposed rail grade separation structure at CP Mike. It is also important to ensure that the grade separation provides room to add a dedicated passenger track to the NS right of way from CP Mike to New Haven, as called for by the MWRRS plan.

APPENDIX 6: TEMS SOFTWARE



RIGHTTRACK™: HIGH-SPEED RAIL PLANNING SYSTEM

TEMS is an innovator in systems and software design. TEMS uses its extensive industry experience to develop systems that provide an interface between tactical, day-to-day management problems and overall corporate and public goals of the industry. TEMS' systems are user-friendly and easily accessible by engineers and planners with little or no computer expertise. They prioritize the decision-making process and interact directly with both existing and developing databases.

TEMS designed the **RightTrack™ Business Planning System**, a suite of software that operates interactively to formulate alternative scenarios in order to optimize outcomes by balancing capital investment and projected ridership and revenue. TEMS' team of experienced specialists analyze the output generated by the system and make informed recommendations to clients from federal, state, and local government agencies; railroad companies; international development organizations; banks; and a wide range of industrial and commercial companies.

The **RightTrack™** system is designed to interface with condensed profiles, timetables, track condition, and other databases already in existence. The system incorporates an "Interactive Analysis" that allows a wide range of demand, revenue, technology, service levels, capital investment, and right-of-way condition issues to be assessed by a "what if" evaluation of possible options. In this way, "fatal flaws" can be identified and more favorable options developed.

RightTrack™ enables transportation planners to:

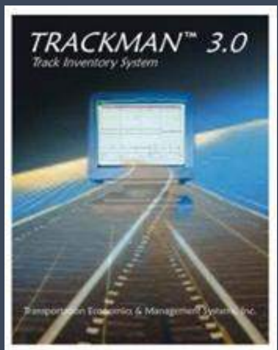
Develop realistic operating strategies that relate ridership and revenues to a specific level and quality of service. Rapidly evaluate and re-evaluate different route (speed), technology (speed), operations (service levels), and ridership (fare) options. Identify the capital investment needed to maintain track and other infrastructure at the optimum level for a given rail service. Interpret traveler behavior to determine the level and quality of service that create incentives for train use. Maximize ridership and revenues while minimizing costs by achieving a balance among service, operations, and infrastructure investment. Evaluate projects in terms of their financial return, user benefits, and the increase in jobs, income, and development opportunities.

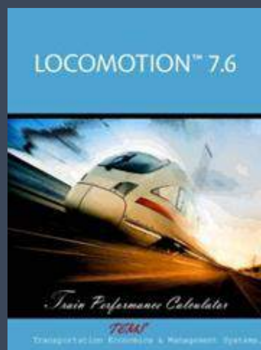
TEMS uses the *RightTrack*™ software in its own consulting business, and offers *RightTrack*™ system components as well for license individually, or as a package to qualified prospects. Typical clients include railroads, state agencies, and engineering firms.

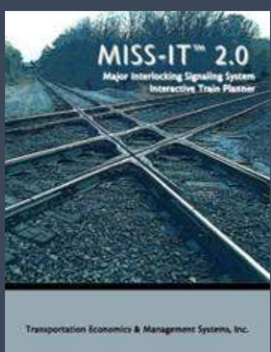
Typically the price quoted for the software includes some software installation, training and/or set-up services. For example, the *TRACKMAN™* software typically comes with a library of rail lines preloaded so that the client can focus immediately on completing the analysis task at hand, rather than getting bogged down trying to enter all the data and learn new software at the same time.

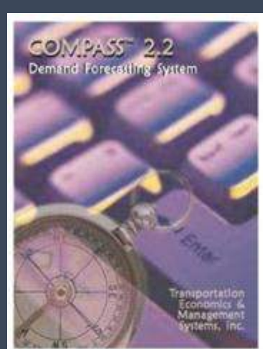
COST-EFFECTIVE BUSINESS PLANNING SOFTWARE

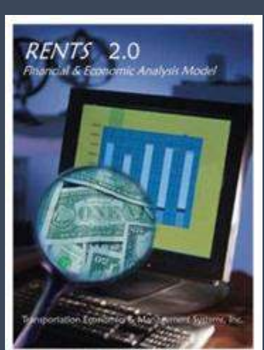
RIGHTTRACK™ SYSTEM

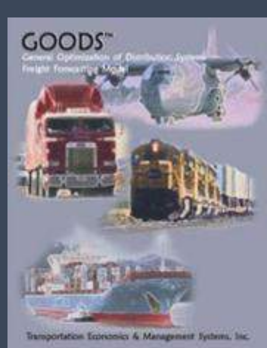












TRACKMAN™ (Track Inventory System) is a corridor track inventory and assessment system that analyzes track infrastructure and estimates the cost of upgrading for various scenarios. It stores, on a milepost-by-milepost basis, data on track condition and track geometry such as curvature, gradient, and turnouts; structures such as bridges, crossings, and stations; maximum operating speeds; and unit costs for engineering improvements.

LOCOMOTION™ (Train Performance Calculator) provides the rail operations planner with a highly sophisticated, yet easy-to-use tool for creating and analyzing rail operations schedules. **LOCOMOTION™** also provides a single, easily accessible source of detailed information on rail corridor characteristics and attainable train speeds. The system creating and altering train technologies enables users to describe their acceleration and deceleration profiles. With **LOCOMOTION™,** it is possible to model rail corridors, create timetables for different train technologies, and produce speed profile and operating diagrams. **LOCOMOTION™** interfaces with **TRACKMAN™,** producing a complete graph profile for a given route.

MISS-IT™ (Major Interlocking Signaling System-Interactive Train Planner) is an event-based conflict resolution model designed to increase rail system efficiency. The system draws together track infrastructure data stored in **TRACKMAN™** and the timetables generated with **LOCOMOTION™** to determine the interaction of trains on a specified corridor. **MISS-IT™** uses data on existing infrastructure, such as sidings and double-track, and makes decisions regarding delays and procedures based on given priorities. **MISS-IT™** tests the effects of additional infrastructure on a given route and determines whether these changes create or alleviate bottlenecks within the system. The system is capable of displaying outputs in an animated graphics mode.

COMPASS™ (Demand Forecasting System) is a comprehensive strategic policy planning tool that assists rail, highway, air, and transit management in planning their systems. **COMPASS™** generates ridership forecasts; revenue estimates; and rail, highway, air, and transit market shares over a given timeframe for a variety of conditions. Forecasts are made over a 25 year time frame and fares can be optimized using revenue yield analysis. **COMPASS™** provides both sensitivity and risk analysis.

RENTS™ (Financial & Economic Analysis Model) uses output from **COMPASS™** to estimate the financial and economic benefits of a project. This includes financial return (operating ratio, NPV and IRR), economic return (gross and net consumer surplus, NPV, and cost benefit ratio), and community benefits (changes in household income, employment by sector, property values, and population) that result from infrastructure and technology improvements or train and fare modifications.

GOODS™ (General Optimization of Distribution Systems) is a modeling framework designed to support the analysis of freight traffic flows at the regional or urban level. The model uses data on current traffic flows, regional economic growth potentials, and specific industrial development proposals to develop total freight traffic flows and forecasts.