RDU-22
BLEE

Implementation Plan for High Speed Rail in Ohio

October 1991

Prepared for

OHIO HIGH SPEED RAIL AUTHORITY

Prepared by
Ohio Railway Organization, Inc.

Implementation Plan for High Speed Rail in Ohio

October 1991

Prepared for

OHIO HIGH SPEED RAIL AUTHORITY

Prepared by
Ohio Railway Organization, Inc.

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

Chapter 1
INTRODUCTION

1.1 GENERAL

For the past year, the Ohio Railway Organization, Inc. (ORO) has at its own expense been preparing an action plan to implement a high speed rail passenger system to link Cleveland, Columbus and Cincinnati, Ohio.

The Ohio Railway Organization, Inc. has combined the technical, financial, and corporate resources of several of the world's most prestigious engineering, planning, and financial organizations. Individually, the ORO firms have built their reputations on the strength of a number of successful public and private sector transportation development ventures. The team is comprised of:

- Parsons Brinckerhoff, Inc.
- URS Consultants
- Wilbur Smith Associates, Inc.
- Public Financial Management, Inc.
- Credit Lyonnais
- Andrew J. Burin Associates
- Transportation Investments, Ltd.
- J.F. Pearce Associates

ORO has divided the Ohio high speed rail project into five phases with this report concluding the initial phase. The phases which correlate with specific decision points in the planning and implementation process are:

- Phase 1 - Implementation Plan
- Phase 2 - Pre-Construction
- Phase 3 - Construction
- Phase 4 - System Testing and Start-up
- Phase 5 - Revenue Service

The high speed rail system will link Cleveland, Columbus and Cincinnati following what is known as the 3-C Corridor . The major cities will have downtown stations and suburban stations. Intermediate stations will serve Mansfield, Springfield and Dayton.

Under current planning, the trains will be electrified and will incorporate the latest advances in high speed rail technology. The system will provide safe and comfortable travel at speeds up to 185 miles per hour. Travel between Columbus and Cleveland will take approximately 68 minutes. The trip time between Columbus and Cincinnati will be about 94 minutes.

Current planning will have 16 round trips daily between Cleveland and Cincinnati or a departure approximately every hour from each station. The trains will operate from 6:00 am to about 1:30 am the following morning.

High speed rail in the 3-C Corridor would maintain Ohio's role as a leader in the development of America's transportation systems. In addition, it would bring major economic benefits to the state from its construction and operation. Benefits include fuel savings, cleaner air, less risk of accident or injury and reduction by nearly half of travel times between Ohio's major cities.

1.3 HIGH SPEED RAIL IMPLEMENTATION PLAN

On August 1, 1989, OHSRA issued a competitive Request for Proposals to the private sector to develop a planning process to finance, design, construct, and operate a high speed rail system in the 3-C Corridor.

The Ohio Railway Organization, Inc. was selected in February 1990 to perform these services at no cost to the State of Ohio. The agreement between OHSRA and ORO for planning a high speed rail system was finalized effective September 1, 1990.

During the contract period, ORO has provided quarterly progress reports to OHSRA. These status reports were supplemented by formal briefings to OHSRA and informal reports to members of the Authority.

1.4 KEY PLAN ELEMENTS

Key elements of the implementation plan, as documented in subsequent chapters of this report, are:

- a description of the alignment and station locations.
- infrastructure requirements.
- a discussion of high speed rail technologies, candidate high speed trains, U.S. regulatory requirements.
- service concepts for the high speed rail system, trip times.
- an environmental evaluation.
- estimates of the capital cost and operations and maintenance cost.
- travel demand and revenue estimates.
- an investment analysis.
- financing options.
- an economic analysis.
- institutional considerations.
- an implementation plan.
- immediate action plan.

Chapter 2
ROUTE LOCATION

2.1 INTRODUCTION

This chapter describes the proposed route location for the Ohio High Speed Rail Project. The route, as shown in Figure 2.1, is described in order from Cincinnati to Cleveland. In addition to the preferred route, two alternative segments were considered, one near Springfield (Springfield Bypass) and the other near Mansfield (Mansfield East). These alternatives are described in this chapter and a list of proposed station locations is included.

2.2 CINCINNATI - DAYTON

The route starts at a downtown Cincinnati station in the vicinity of Plum Street, just south of Third Street. This site is adjacent to the Central Business District northwest of Riverfront Stadium and requires further investigation and coordination particularly regarding other development plans for the area.

A dedicated single track will head west through the northern portion of the produce terminal area and pass under the I-71/I-75 highway interchange. Here the track rises and becomes elevated as it parallels the existing CSX viaduct. A new structure will carry the track over Gest Street and Third Street. The new line will join existing CSX trackage several hundred feet west of Third Street (about 0.6 miles from Plum Street) at an existing railroad junction. This will be accomplished by reconfiguring the existing stub-end side track and viaduct (which carries it over Gest Street) to meet the new elevated structure.

Existing CSX main trackage (Cincinnati Terminal Subdivision) will be utilized from this point. This double track main line turns north to skirt the east side of the Queensgate railroad yard, passing behind Cincinnati Union Terminal. Joint trackage will continue to Winton Place, about seven miles from Plum Street. No new grade separated or at-grade crossings with other rail lines are required unless an additional section of dedicated trackage is desired south of Winton Place. Just north of the junction with the CSX main line to Dayton, the high speed line will enter dedicated trackage on the west side of the CSX main line to Ivorydale Junction. At this junction, the Conrail Cincinnati-Columbus main line diverges on the north side of the CSX line. The high speed line continues as dedicated trackage, now on the west side of the Conrail line main tracks.

Beech St. in Ivorydale (eight miles from Plum St.) is the first highway grade crossing. The dedicated trackage continues on the west side of the Conrail main line to a point south of Sharonville. From the southerly end of the Sharonville Yard, the proposed high speed rail line will use trackage in the westerly section of the yard known as Gano Yard. Where the Gano Yard trackage rejoins the main tracks north of the main portion of the yard (near the Hamilton County-Butler County line), the high speed rail line will be on the west side of the Conrail line for about 7 miles. A north suburban Cincinnati station will be located near Kemper Rd. south of I-275 and east of I-75.

North of the suburban station the high speed line will be grade separated, but still on Conrail right-of-way with the exception of a half-mile-long curve realignment.

At the Maud Hughes Road overpass, the high speed rail line will leave the Conrail right-of-way and for about 7 miles will be on new right-of-way. The route will head in a northerly direction, following Gregory Creek, then crossing over S.R. 4 and the Great Miami River before joining the CSX (Toledo Subdivision) right-of-way about 1.5 miles north of Trenton.

For the next 24 miles, the high speed rail line will be dedicated trackage on existing CSX right-of-way, except for a half-mile-long curve realignment four miles north of Miamisburg. Grade crossings will be encountered. For the most part, the westerly track of this formerly double track CSX line has been removed. The high speed rail line will occupy the easterly portion of the right-of-way. Some realignment of the existing CSX trackage will be necessary for this orientation.

Northeast of Miami Junction, a new bridge over the Great Miami River will be constructed parallel to and north of the existing railroad bridge. This new bridge will carry CSX traffic to the Dayton station area. The high speed rail traffic will use the northwesterly track of the existing structure to reach the passenger station in Dayton. Station trackage will be between the two existing through freight tracks.

2.3 DAYTON - SOUTHWEST COLUMBUS

From the Dayton station, the dedicated double track high speed line will occupy the northwesterly half of the existing Conrail right-of-way for about 13 miles. This wide right-of-way is comprised of the former double-track parallel lines of the Erie and New York Central railroads. Since the former Erie tracks have been removed in most locations, the available space may be usable for the double-tracks of the high speed rail line.

The alignment will continue to occupy the space available due to the removal of the Erie Railroad double tracks. At "Cold Springs Station", the line will continue along the existing active Conrail right-of-way, which diverges from the former Erie route. The single dedicated track will run about 10.5 miles to the I-70 overpass, about 4.5 miles east of the Springfield Station. The station will be located in downtown Springfield near Fountain and Limestone streets. Near the station, the high speed rail line crosses the existing Conrail track from the north to the south side. An alternative route near Springfield is described in Section 2.7.

At the I-70 overpass, the high speed line will become double-track, and parallels the existing Conrail line about 9.5 miles to a point about 4.8 miles west of London. Then it will diverge to the southeast with a 4-mile-long reverse curve to a location near S.R. 38, about 1.5 miles south of London.

South of London, near the crossing of S.R. 38, the line turns to the northeast, and with a reverse curve will join the abandoned right-of-way of the London-Lilly Chapel Conrail line, about 3 miles east of London. About 1.8 miles west of Lilly Chapel, the high speed line will diverge to the northeast, and with another reverse curve is parallel with the Conrail line about 0.75 mile to the north. About 0.5 mile east of the Big Darby Creek crossing, the line will turn northeast again, bypassing Galloway about 1,000 ft. to the north. The dedicated trackage then joins the right-of-way of the existing Conrail Camp Chase Industrial Track at the Norton Road crossing in southwest Columbus.

2.4 SOUTHWEST COLUMBUS - COLUMBUS

The high speed line will parallel the Conrail Camp Chase Industrial Track on the south side. The line would be largely grade separated, though three highway crossings currently exist. Near the I-70 overpass, this line joins the Conrail Cincinnati main line. The dedicated high speed line continues east along this line, and becomes elevated to pass over the busy railroad crossings at Scioto Tower, just west of the Scioto River. A new bridge would carry the high speed line over the river. Joint trackage would begin east of the river, and continue about 1/2 mile to the Columbus Station near the Ohio Center.

2.7 SPRINGFIELD BYPASS ALTERNATIVE

An alternative alignment that bypasses downtown Springfield was examined for feasibility and capital cost. This alternative route in the vicinity of the city would run south of Springfield with a station located several miles south of Central Business District. From a technical viewpoint, the alignment is feasible and would save several minutes in travel time between Columbus and Cincinnati. But this option has not been recommended because of the significantly higher capital cost compared to the benefits, as explained in Section 7.8.

Northeast of Dayton, about 1,000 ft. northeast from the I-675 overpass, the high speed rail line would leave the Conrail right-of-way on a fly-over above the existing tracks. It would become grade separated, and head in an easterly direction for about 2.5 miles, bypassing the new housing developments south of Enon. Near the crossing of Mud Road, the proposed alignment would turn in a northeasterly direction for 5 miles before shifting to the east near the crossing of U.S. 68. The Springfield Station for this alternative would be on the easterly side of this crossing, which is about 2 miles south of Interchange 52 of Interstate 70.

From the proposed alternative Springfield Station, the alignment would follow an easterly direction for about four miles. Near the crossing of the North Fork of the Little Miami River, the proposed line would shift to a northeasterly direction for another 4 miles to a grade-separated crossing with the Grand Trunk Western Railroad, near S.R. 41. From that point, the new high speed rail line would follow an easterly direction to a location south of London for about 13 miles, paralleling the existing Springfield-Columbus Conrail line about 1.35 miles to the south of London, where the alternative route would join the previously described line to Columbus.

2.8 EAST MANSFIELD ALTERNATIVE

An alignment east of Mansfield was examined as an alternative to the route west of the city. Technically, the east alignment is feasible with essentially no difference in travel time between Columbus and Cleveland. The route east of Mansfield is not recommended based on the higher capital cost as discussed in Chapter 7.

Near the point where the route crosses S.R. 61, about 2 miles southeast of Mount Gilead, the East Mansfield alternative would curve to the east, and continue in a northeasterly direction for about 18.5 miles. Near the radio tower, about 1.3 miles southwest of Interchange 169 of I-71, the alignment would turn slightly to the left for 1.5 miles. Then, near the S.R. 13 crossing, there would be a reverse curve to the right for another 1.5 miles. The proposed double-track line would cross over S.R. 13 about 0.6 mile north of the I-71/S.R. 13 intersection (Interchange 169), measured along S.R. 13. The alternative Mansfield Station would be located near the S.R. 13 interchange with I-71, north of the interstate.

Northeast of the proposed station, the alternative high speed rail line, with a series of reverse curves, would parallel I-71 about 1,000 ft. to the northwest for about 3 miles. About 1 mile south of S.R. 430, the alignment would make a long curve to the left, passing between Laver Road and Reed Road. The line would cross over S.R. 30 about 1.3 miles west of Interchange 176 of I-71.

North of S.R. 30, the proposed line would turn to the right, heading northeasterly, and join the existing right-of-way of the Ashland Railway (the former Erie line) at S.R. 42. Utilizing that right-of-way for about 3.5 miles, the high speed line would turn due north to a point where it crosses U.S. Route 250, then pass between Mud Lake and Spring Lake. The line would follow a northerly direction, then with a long curve to the right rejoin the primary route and crossing of the CSX main line about 1.2 miles northwest of Nova.

Chapter 3
INFRASTRUCTURE REQUIREMENTS

3.1 GENERAL

This Chapter describes requirements for components of the infrastructure for the Ohio High Speed Rail Project.

The design standards currently applied in the United States for the railroad components (e.g., power distribution, track, signals, and structures) generally reflect the requirements of railroad freight operations. High speed rail passenger operations with higher speeds and lower axle loads have design criteria that differ from freight operations. Thus, the design requirements for high speed passenger operations in Ohio outlined here must be further examined. Appropriate modifications can be expected to insure the system is feasible, practical, and complies with FRA and other regulatory requirements. The infrastructure requirements are an integral part of the train system design and both designs must be closely coordinated. The following description of the infrastructure requirements are preliminary and their design will be fully integrated with the train system selected.

3.2 TRACK AND TRACKBED

The purpose of the track structure is to distribute the train load down through the rail, ties, ballast, and subballast to the subgrade. The magnitude of the force generated by a train increases significantly with increased velocity. Therefore, track structure designs for high speed rail is heavy-duty construction that provides a resilient structure to absorb the increased forces without unacceptable stress or deflection.

With higher speeds, the requirements become more stringent to maintain a smooth, stable track for the rail vehicle. The design of ballasted track has improved continuously through the introduction of new materials and construction techniques. For example, reinforced concrete ties have been introduced. Spring clip systems to attach the rail to the ties have replaced the rail spike. The ballast sections are deeper and wider to absorb and distribute the load better. An alternative to using ties and ballast is concrete slab track. The rail in this system is directly attached to a concrete slab. New turnouts have been developed that permit train operations at significantly higher speed than previously possible.

The following is a preliminary listing of requirements for the Ohio system. The track system will comply with applicable American Railway Engineering Association (AREA) standards.

- Rail - 115 RE (115 pounds per yard) continuously welded rail
- Ties - Prestressed mono-bloc concrete tie, 8'6" long
- Fasteners - Resilient spring clip type with pads
- Ballast - Minimum depth of 12" under ties, 16" depth on structures. Ballast will be a hard, angular crushed stone

3.4 ELECTRIFICATION

High speed rail systems currently operating at speeds above 125 miles per hour are electrically powered. The trains draw power through pantographs mounted on the power units from an overhead wire or catenary system. The catenary system obtains its power from substations spaced at regular intervals along the right-of-way. Commercial sources supply power to the substations where it is converted to the voltage and frequency required by the train's power units.

The substation equipment includes autotransformers, high voltage protection, transformers to step down the supply voltage to 25 kV, and high speed circuit breaker protection. The commercial power supplied and the power delivered to the catenary will be metered at each substation. Close coordination will be required with the companies supplying power to the system.

The design of the catenary system must be tailored to the technology of the train system selected. It is essential that the train's pantograph maintains full contact with the catenary at all speeds and under all weather conditions.

High speed operations introduce dynamic forces in the catenary system. The catenary hangers and supports are subject to stress which results in wear and the requirement for periodic adjustment and repair. Forces at the contact point between the pantograph and overhead wire also result in wear and both require periodic maintenance. The design of the catenary system will focus on measures to limit the dynamic forces and reduce the maintenance requirements.

The basic catenary requirements for a high speed system are uniformity of elasticity and high tension. Uniform vertical elasticity is essential to preclude any "hard" or "soft" spots which would impact the pantograph maintaining contact with the overhead wire. The system is under high tension to resist the impact of wind and minimize vibration induced by the passage of trains.

Basic design criteria for the catenary system are:

- Voltage: 25 kV, 60 Hz
- Type: Compound (tangent-chord, fixed termination, variable tension to avoid the need for ice melting apparatus)
- Contact Wire Height: 16 to 24 feet (dependent on the train's pantograph design)
- Maximum Span: 160 to 180 feet between supports

The catenary design criteria will be subject to detailed engineering during the design stage. The design will insure the usable portion of the train's pantograph collector head maintains contact on tangent and curved track considering wind velocity and vehicle dynamics.

3.5 TRAIN CONTROL AND COMMUNICATIONS

Emphasis will be placed on operational safety with a state-of-the-art train contol and communications system. The system will be centrally operated by a Central Traffic Control (CTC) facility near Columbus.

An automatic train control (ATC) system will provide train protection, supervision, operation, and communication.

- Heating, ventilation and air conditioning
- Electrical requirements to include emergency backup systems and solar power where appropriate
- Lighting to include emergency lighting
- Site selection - proper location, access for public and private vehicles, long and short-term parking, utilities

All structures will be designed in accord with the Ohio Basic Building Code and applicable local requirements. The buildings will be energy efficient and cost effective. Interior and exterior lighting will be attractive and provide security and safety. Lighting of maintenance areas will maximize the efficiency and safety of the work crews. The selection of building materials will consider attractiveness and the ease of cleaning and maintenance. The design of structures will consider aesthetics and consistency with the architecture of the surrounding area.

Chapter 4
ROLLING STOCK

4.1 GENERAL

The development of high speed rail power units and passenger cars over the last 150 years has been a gradual, evolutionary process. High speed rail is not new. For example in 1893, a New York Central & Hudson River locomotive reached a speed of 115 miles per hour and on June 12, 1905, a special Pennsylvania Railroad train achieved a speed of 132 miles per hour. Ohio boasts the North American rail speed record set at 183.85 mph near the village of Melborn, by a jet-powered New York Central rail car on July 23, 1966.

Over the past 25 years there have been significant improvements in railroad vehicles and their performance characteristics. The rail technological advances provide the traveling public with a high speed alternative to highway and air transportation. Compared to other transport modes, the major advantages of high speed rail are that it is safe, comfortable, cost effective, energy efficient and environmentally acceptable.

High speed rail has been operating successfully in Japan for almost 30 years. France has operated its Train a Grande Vitesse (TGV) for nine years and has introduced a newer model, the TGV - Atlantique (TGV - A). Germany has developed the Intercity Express (ICE), which started regular service on new high speed rail lines in June 1991. Japan, France and Germany all have long-range plans to continue the development and expansion of their high speed rail systems.

A high speed rail system has been approved by the Republic of China (Taiwan) and its implementation program is in the detailed planning phase. A system is also under development in South Korea.

In the United States, Amtrak is currently operating trains on the Northeast Corridor, Washington, D.C. to Boston, at speeds up to 125 miles per hour. High speed rail systems are under varying degrees of consideration at a number of locations in the United States. In addition to Ohio, high speed rail initiatives are underway in New York, Florida, Texas, Illinois, Minnesota, Wisconsin, Nevada and California. A high level of interest in high speed rail has been expressed in Pennsylvania, Missouri and Washington State.

4.2 HIGH SPEED RAIL VEHICLES

High speed rail vehicles are typically lightweight, relative to freight vehicles, streamlined and electrically powered. The light weight of the trains reduces the power required to achieve high acceleration rates and reduces wheel wear and the track maintenance requirements resulting in lower maintenance costs.

The electricity consumed to operate a train is a function of its weight, the route terrain, speed, distance between stops, and the energy conversion efficiency of the power units. Energy requirements are estimated at the point of delivery or at the pantograph for electrified vehicles. This ignores the losses in the generation, substation and transmission lines for electric traction power systems. The power consumption is increased if there are numerous speed changes that require accelerations and decelerations. Speed changes are required approaching stations, at grade crossings, locations with civil speed restrictions, and where track curvature dictates slower speed. The power consumption of the generic train used in the study is estimated based on the experience of operating high speed rail systems. For this phase of the study, it is estimated that the trains will consume an average of 20 kWh per train mile for one power unit.

4.4.2 Japanese Shinkansen

The Japan Railway's Shinkansen or "bullet train" started operations in 1964 and was the world's first high speed rail system. The Tokaido Shinkansen line opened on October 1, 1964, with service between Tokyo and Shin Osaka. The maximum speed on this line was 130 miles per hour.

In October 1985, a new trainset was introduced, the series 100 Shinkansen consisting of 16 permanently coupled units. The series 100 has 12 motor cars and four non-motorized coaches Two of the non-motorized coaches are double deck cars. The top running speed of the series 100 Shinkansen is 162 miles per hour.

Japan Railway's long term goal is to achieve speeds of 186 miles per hour on the Sanyo, Tohoku and Joetsu lines. In 1986, design started on the next generation of the Shinkansen, the series 300, to achieve speeds of 186 miles per hour. The train will be constructed of lightweight aluminum and preliminary estimates are the axle load will be about 14 tons.

In its 27 years of operation the Shinkansen system has had an unmatched safety record. Almost three billion passengers have been transported without a single passenger fatality.

4.4.3 French Train a Grande Vitesse (TGV)

The French National Railways (SCNF) designed, constructed and placed in operation the first high speed rail in Europe. On September 30, 1981, revenue service started on the first section of a new rail line between Paris and Lyon using the Train a Grande Vitesse (TGV). Since September 1983, the TGV has been operating on the 260-mile route between Paris and Lyon. The trains on this line operate at a maximum speed of 168 miles per hour.

The second generation TGV is designated the TGV - Atlantique (TGV - A) and incorporates the lessons learned from the operation of the first TGV trains. This train operates at speeds up to 186 miles per hour. In test runs, the TGV - A has reached speeds in excess of 300 miles per hour.

The TGV - A is a push-pull articulated train consisting of 12 vehicles (2 power units and 10 center coaches). The length of the train is 780 feet. Power bogies are mounted only under the power units. The center coaches share a set of bogies except at the ends of the trainset where the coaches have two bogies. Each trainset is "permanently" coupled. Two trainsets can be coupled to form one revenue service operating unit or for recovery of a disabled train.

On-board computers monitor and troubleshoot the train's systems. A data network provides a continuous flow of information to the operator, the conductor's station, and Central Traffic Control (CTC). Train operators and the CTC are also linked by radio.

The data system provides information for slip-slide control, brake monitoring, climate control, and automatic door control. The computer system automatically issues train preparation commands to check all systems prior to departure. This system identifies and reports any mechanical or electrical problem that develops during operations. This early identification of malfunctions speeds repairs and reduces maintenance costs.

The normal configuration of the TGV-A with 10 center coaches has 485 seats plus 37 folding seats. All seats have fabric upholstery. The first-class cars have club-style compartments. Each train has three first-class cars with a total of 116 seats and six second-class cars seating 369 people. One of the center coaches is a restaurant-bar car that is equipped with a video system. Meals are served at the passengers' seats.

The ICE has a system, similar to one proposed for the Ohio high speed rail system, called "Park & Rail" which provides passengers with reserved automobile parking space near the platform. A space can be reserved at the time of ticket purchase or by telephone. A "Rail & Road" system also reserves rental cars at the passengers' destinations.

ICE stations are spaced approximately every 60 miles. The network includes high speed rail and track sections where speeds of 125 miles per hour or less are dictated by traffic and track conditions. On some routes, the track is shared with conventional passenger and freight trains. With lower speeds dictated by the relatively short distance between stations and using track not dedicated to high speed rail, the power consumption of the ICE is less than the 186 mile per hour trains.

Driving and braking is controlled by micro-processors and the operation can be fully automatic. Speed control automatically applies the brakes when authorized speed is exceeded. The automatic train control system provides the operator with information on track conditions six miles ahead of the train.

The ICE rail network is being expanded and new lines will be opened as trainsets become available.

4.4.5 European Inter-railway Cooperation

The future of European high speed rail does not stop at the borders. The "Community of the European Railways" consists of the 12 railways of the European Economic Community member states and the Federal Railways of Austria and Switzerland. In January 1989, a proposal was adopted for a cross-border high speed rail system. The first stage will link the high speed rail systems now in operation. When the system is complete, it will cover some 18,600 miles. High speed rail in Germany, France, Great Britain, and Italy and fast train systems in Spain, Sweden, Switzerland, and Austria will be linked in the final system.

The ultimate rail network will link Frankfurt and Cologne with Brussels, Amsterdam, London, and Paris, This system will serve the 325 million people in Europe and divert traffic from the currently congested highways and air routes.

4.5 MODIFICATION OF FOREIGN EQUIPMENT

Under the safety standards of the Federal Railroad Administration (FRA), foreign high speed rail equipment placed in service in the United States may require modification.

Power units are subject to the FRA's Locomotive Safety Standards. They must meet or exceed established standards for mechanical and structural components.

Standards are also established for wheels and axles in terms of stress or fatigue cracking and wear. They also address braking, suspension, coupling, and electrical systems. A major factor is the crash worthiness of the vehicles. Additionally, the FRA requires specific testing and inspection procedures that may vary from foreign practices.

There are six basis areas that may require modifications prior to operating a foreign manufactured vehicle in Ohio. These are:

- Structural reinforcement
- Propulsion equipment modification for use of 25 kV, 60 Hz power
- Modification of signaling, communications and train control systems
- Modification of doors and steps for platform heights
- Modification of carbodies and/or trucks to meet clearance restrictions

Chapter 5
HIGH SPEED RAIL SERVICE CONCEPTS

5.1 GENERAL

This Chapter describes the service concepts for the Ohio High Speed Rail system. The frequency of service, trip times, fleet size, supervision and operations, and inspection and servicing of the vehicles are discussed. Services at the stations to include concessions are addressed. The marketing of the services is outlined.

5.2 TRAIN SERVICE

To provide a high-quality service to the traveling public, high speed rail will operate 16 round trips per day on the 3-C Corridor. The service will start at 6:00 AM and continue until about 1:30 AM or nineteen and a half hours of operations daily. Trains will depart each station at intervals of approximately one hour.

Market conditions will dictate the frequency of service, hours of operation, station stop patterns, and the size of the train consists. For the morning and evening peak travel times, the frequency of service may be increased based on demand. Express service between major stations may be offered in the peak travel hours. Special trains will be scheduled for sports or other special events.

5.3 TRIP TIME ESTIMATES

5.3.1 Train Simulation Program

The travel time between stations in the 3-C Corridor was estimated using a train simulation program.

The train simulation program was used to examine the travel time impact of varying the train's maximum speed, acceleration, deceleration, and the track superelevation. For each segment of curvature and grade, the program calculates the travel time in seconds.

The progam used does not decrease the acceleration rate of the train as the speed of the train increases. A high speed train, such as the TGV - A, has a maximum acceleration rate of 2.24 mph/second. For the travel time estimates, an acceleration rate of 1.1 mph/second (less than half the maximum rate of the TGV - A) was used to compensate for the program's lack of acceleration adjustment.

A service braking or deceleration rate of 1.57 mph/second was used without adjustment.

To simulate actual conditions, a civil speed restriction of 30 mph was used for the track segments approaching stations. Civil speed restrictions were also used at all grade crossings and through towns where restrictions currently exist.

In the next phase of the study, a more sophisticated train simulation program will be used. It considers changes in the maximum acceleration rate based on the train's speed. This program also calculates power consumption and considers the spacing of signal blocks.

The speed on the southern alignment is restricted by track curvature, highway corssings, crossing other railroads, and reduced speed due to limited sight distances. For example, from Dayton to north of Springfield there are 40 road crossings and 5 railroad crossings where lower speeds are required. In some of the areas, topography and/or development result in increased train speed being expensive to achieve as a minimum and perhaps infeasible based on local restrictions. The travel time from the Cincinnati North Station to Cincinnati, a distance of 16.65 miles, is the slowest in the 3-C Corridor. The low speed in this section is the result of the number of at-grade road crossings that require civil speed restrictions. Further analysis of costs, community and environmental impacts, travel times and ridership are required to achieve ORO's objective of service between Columbus and Cincinnati in close to an hour.

The high average speed from the Cleveland Station to the Columbus Station is the result of several factors. The majority of the track in this segment will be new and dedicated to high speed rail traffic. On the new dedicated track, the trains can reach and maintain the maximum speed of 185 mph for considerable distances. The distances between stations are also the longest with the least number of speed restrictions. The trains can make maximum use of their performance capabilities.

5.4 FLEET SIZE

To provide service in the 3-C Corridor with train departures from each city approximately every hour, eight trains will be required. Six of the trains will operate daily to provide the sixteen round trips or thirty-two train runs. One trainset will be on stand-by for replacement of any disabled operating train. The second trainset will be in the shops for routine inspections, maintenance, and cleaning.

The number of passenger cars per train will be based on the passenger demand. Based on current ridership projections, each train will consist of one power unit, one business class car, and two custom coaches. Each three-coach train seats 200 passengers. The number of passenger coaches per train will be increased as necessary to meet passenger demand.

5.5 TRAIN SUPERVISION AND OPERATIONS

Each train crew consists of an operator, a conductor, an assistant conductor, and a caterer for food and beverage service. Normally, each crew will work five eight hour shifts per week. No train crew will work more than four ten hour shifts per week.

Particular attention will be paid to safety in those locations where track is shared with freight traffic. The passenger train cab signaling system identifies occupied track ahead of the train and automatically orders an appropriate speed command. Where freight traffic crosses the passenger track, special operating procedures will insure there are no conflicting movements.

Where highways cross the track at-grade, crossing protection will include full gates, flashing lights, and audible warnings. The crossing protection will be designed to discourage highway traffic from attempting to defeat the system and strict enforcement will be pursued.

Train supervision and operational systems will be state-of-the-art to provide safety for passengers, trains and the communities along the high speed rail line..

5.6.3 Routine Repair Shop Maintenance

The Repair Shop is responsible for running repairs and insures the trains are safe to operate.

Maintenance performed in the Repair Shop is:

- Unscheduled repair of power units and coaches.
- Major overhauls every nine years dedicated to internal and external appearance.
- Major overhauls every 15 years for internal and external appearance plus exterior body work.
- Major overhauls every 23 years for internal and external appearance.

5.6.4 Maintenance of Way

5.6.4.1 Inspections

Track and systems inspections are continually made by the maintenance crews during their daily work.

Scheduled inspections are:

- Each mile of track is visually inspected by trackwalkers a minimum of twice a week as required by the Federal Railroad Administration.
- An acceleration recording is made every week.
- A track geometry recording is made every three months.
- Rail defect detection is performed after the first year of operations, after seven years of operations, and then every two years starting with the ninth year of operations.
- Detailed catenary inspections are made twice each year.

5.6.4.2 Track Maintenance

Track maintenance is performed as required. Scheduled maintenance activities are:

- Tamping and stabilization every two years.
- Rail grinding as required but as a minimum at least every eight years.

5.6.4.3 Track Renewal

Planned track renewal is based on the tonnage of traffic over the track.

General guidelines are:

- Ballast renewed as required but as a minimum at least after 250 to 300 million tons of traffic.
- Rail and fastenings renewed as required but as a minimum at least after 500 to 600 million tons of traffic.

The major marketing tool for the high speed rail system will be the train and the service provided. Passengers will be able to book their entire trip through the high speed rail reservation services. Ticket reservations, hotel rooms, and travel to and from the rail stations can be arranged with a single call. Additionally, if required, reserved long term parking at the departure station and rental cars at the destination will be organized by the reservation service.

Ohio's 21st century transportation system is to be far more than trains linking Cleveland, Columbus at Cincinnati at speeds up to 186 miles per hour. On the system proposed by ORO, the traveller's entire trip from origin to destination is to be planned so it will be safe, comfortable and cost effective.

For example, a traveller living in Cleveland's eastern suburbs might telephone 1-800-ORO-RAIL to inquire about travel to Dayton. The agent who receives the call can advise the customer on train departure/arrival times for the trip to Dayton and for the return trip. In addition, because he/she will know the location of the caller's telephone, the trip to ORO's nearest station can be planned. It may be by CTA - ORO can advise the line number, fare, schedule and time to board the CTA bus or rail service to allow for the connection. It may be by taxi - ORO can book the cab and include the fare in the total charge for the trip. The traveller may wish to drive to the station - the agent can assure the way is known. Parking fees can be included in the trip cost. The traveller's train, car and seat number will be determined to meet his requirements and the ticket prepared for pick up at the station. Payment may be by cash, check or credit card.

For arrival at Dayton the agent will determine if a cab or rental car is needed. If so, arrangements will be confirmed.

The purpose of this trip planning is to provide the standard of travel service which contemporary technology allows and to make travelling by ORO's trains a safe, secure and pleasant experience.

Chapter 6
ENVIRONMENTAL EVALUATION

6.1 REGULATORY REQUIREMENTS

Although environmentally desirable, the high speed rail system described in the preceding chapters will be required to meet contemporary environmental regulations and standards. The Federal and State regulatory requirements listed in Appendix A reflect an overview of regulations that are known to address the high speed rail project. The list will be expanded as further refinement to the railway plans take place. In particular, within the broad policy acts at either the federal or state level, more specific subsections may be identified later that also pertain to the high speed rail system. Similarly, regulations are continually being revised and will be reassessed for appropriateness and/or additions prior to the initiation of a project.

6.2 ENVIRONMENTAL CONSIDERATIONS

6.2.1 Land Use

Virtually every land use type is likely to be encountered by the proposed high speed rail system. The corridor includes 15 counties, seven urbanized areas, numerous additional small municipalities, as well as expanses of rural land. The extensive rural property along the proposed corridor includes orchards, cropland, forested land, ten named rivers (and of these, several are crossed more than once), over 200 streams, and at least five wetland areas (for listings of counties, rivers, and mileposts of wetlands see Tables 6-1 and 6-2). The Ohio Capability Analysis Program (OCAP) of the Ohio Department of Natural Resources has mapped land uses for the majority of property falling within the proposed corridor. These maps would be invaluable for a much closer approximation of actual land uses within the proposed corridor and would assist in identification of areas where additional studies may be appropriate for such things as: land-fill areas, cemeteries (in regard to historical preservation issues), parks and recreation areas, and wetlands. National Wetland Inventory maps will also be consulted to identify potential wetland areas as discussed further in Section 6.2.8. Natural areas and preserves are discussed in Section 6.2.9.

Rural parks and recreational areas have, for the most part, been avoided by the proposed corridor although the rail line would pass within two miles of Buck Creek State Park just east of Springfield, and within one-half mile of Mt. Gilead State Park near Mt. Gilead. Proximity to the Buck Creek State Park could be avoided if the Springfield bypass route is chosen over the downtown Springfield alternative. There are no federal or state forests along the proposed corridor.

For those portions of the proposed corridor passing through rural areas, prime and unique farmland must be identified. Soil Conservation Service offices responsible for properties along the proposed route must be consulted regarding the location of any prime and unique farmland.

Despite these concerns, it should be acknowledged that extensive use of existing rail rights-of-way by the high-speed system results in a minimal amount of environmental disruption.

6.2.2 Aesthetics

Much of the high speed rail route will follow existing railroad rights-of-way, and in some cases will use existing trackage, primarily in urbanized areas. For these portions of the corridor aesthetics should not be an important issue.

6.2.3 Noise and Vibration

Noise and vibration impacts may result from construction of the proposed rail system as well as its long-term operation. In general, the potential adversity of impacts will depend on two considerations: 1) the degree to which project-derived noise and vibration levels exceed local noise ordinances or Federal Railroad Administration standards contained in 49 CFR Part 210, if applicable; and 2) the relative change in ambient noise and vibration levels between existing conditions and the expected post-construction situation. Thus, an impact may occur not only if any applicable standards are exceeded but also when a project causes a significant change from existing conditions, even though standards may not be exceeded. An important factor in determining level of impact will obviously involve evaluation of the existing noise and vibration environment along the rail route. The evaluation must take into consideration not only the measured ambient noise and vibration levels but also the character of the area in which the measurements are made, including the type of land use present, proximity of noise and/or vibration sensitive features, and future plans that may involve changes in land use or development patterns.

During project construction, potential noise and vibration impacts will depend on types of equipment in use, how the equipment is being used (usage factors), and site sensitivity considerations as discussed above. Some typical noise emission levels and usage factors for construction equipment are shown in Table 6-3. Certain types of equipment have the potential to generate severe noise impacts, depending on how they are operated. However, low or intermittent usage factors ameliorate potential adverse impacts. In addition, the short-term nature of construction activities will minimize the severity of impacts. If construction is planned for areas with high sensitivity to noise and vibration, various mitigation measures may be required of the contractor, including:

- Limiting construction to normal daytime hours (7:00 a.m. to 6:00 p.m.);
- Ensuring that all diesel-powered equipment is properly muffled;
- Erecting temporary noise or vibration barriers between sensitive receptors and construction operations; and
- Providing specific routes for truck movement to and from construction sites to avoid streets with sensitive receptors.

Specific recommendations or requirements cannot be determined until site-specific project details become available.

In terms of long-term project operations, potential noise impacts will depend on train-derived noise levels (locomotive and cars) and the nature of the surrounding land uses. Measurements of noise emissions from TGV trains in France indicate that, at a distance of 82 feet from the track, a train passing at 170 miles per hour will generate a noise level of 100 dB(A) from the locomotive and 98 dB(A) from the trailing cars. At 1000 feet, the maximum noise level was estimated to be 78 dB(A). While these are significant levels of noise emission, it is unlikely that the trains will be passing through the most noise-sensitive types of land uses at this operating speed. In developed urban areas, the proposed project will generally operate at lower speeds, which should reduce noise emissions from the measured results mentioned above. In specific cases, noise barriers can be effective in reducing noise impacts.

At speeds below approximately 50 miles per hour, an electrified train operates with noise emissions comparable to that of a typical urban bus. By comparison, turbine-powered trains, however, emit higher levels of noise.

conducting research involving measurements of electromagnetic fields and investigations of the possible effects of EMI on the biological (including human) community. The results of this research may lead to future legislation. At present, projects such as the high speed rail system that may be funded in part by the federal government are required to demonstrate that the managers and planners of the project are sensitive to the issues related to EMI as reflected in any environmental impact statement prepared for the project. There are no requirements at the Ohio state level to evaluate EMI impacts; however eight states do currently require some level of analysis of EMI impacts and more states are likely to follow suit as EMI gains further publicity.

6.2.5 Air Quality

Short term air quality impacts may occur during the construction phase of the project during which time construction vehicle fumes and construction dust would be generated. More importantly, the proposed high speed rail system is planned to be electrically powered. Currently, there are no air quality regulations at the state or federal level that regulate the railway industry. If electricity is used as the only energy source, long term air quality impacts of the rail system would derive from emission from the stationary electricity generators providing the electricity for the rail system. However, evidence accumulated in studies for high speed systems in other states establishes that reduced emissions result in any shift in usage away from petroleum-burning motor vehicle and aircraft usage.

6.2.6 Energy Consumption

As indicated above, it is currently envisioned that the high speed rail system will use electricity as its primary energy source. Tradeoffs in energy consumption between petroleum fuels used by vehicles making the same trip and the coal and oil used in generating the electricity to power the train would depend on current and projected traffic between the principal cities along the rail corridor and the projection would depend on patronage of the train system by those currently using their personal vehicles. Comparisons would also have to take into account vehicle occupancy. Having stated that, however, it should be noted that high speed electrified trains are significantly more energy efficient that autos or jetliners, as determined in a number of studies conducted in other states.

6.2.7 Drainage and Erosion Control

Construction of new trackage, or additions to existing trackage, for the rail system will influence drainage to surrounding areas, and necessitate erosion control measures. Construction requiring attention to drainage questions includes: expansion in current track rights-of-way, changes to grade crossings, new railbed location, and construction or demolition of auxiliary structures. The Soil and Water Conservation Division of the ODNR requires a review for surface or subsurface disturbances of new or relocated projects. State standards for erosion control must also be met. Reference to county soils maps from the Soil Conservation Service would be imperative prior to initiation of this project to get a preliminary assessment of whether appropriate conditions for laying track are present along the proposed route. Actual field surveys in questionable areas would follow.

6.2.8 Water Resources

Surface Water Quality: There are 10 named rivers (refer to Table 6-1) and over 200 streams that will be crossed by the proposed rail route. At each of these crossings during the construction phase, there will be some disruption to the existing aquatic ecosystem associated with the river or stream in question. In Ohio, surface water reaches are designated by the Ohio Environmental Protection Agency (OEPA) to be of a certain aquatic, public and/or industrial use category. The rivers and streams to be

There are other locations outside of designated preserves that could also necessitate a close examination regarding exact location of tracks. High quality plant communities, rare plants and animals and/or important geologic features need to be considered along the rail corridor. Identification of these rare or significant natural features can be provided through a search done by the Natural Heritage Program of the ODNR Division of Natural Areas and Preserves. On-site surveys for identified sensitive areas would be necessary for a full environmental assessment.

Additionally, three rivers that will be crossed by the proposed high speed rail system are designated as scenic rivers by the State of Ohio: the north fork of the Little Miami River, Little Darby Creek and Big Darby Creek. Any crossings of scenic rivers must be reviewed and approved by the Director of the Ohio Department of Natural Resources (through the Division of Natural Areas and Preserves). It should be noted also that in addition to state designation as a scenic river, Little Darby Creek has also been nominated for national recognition as a scenic river. Should the national registry be granted, additional review and approval for crossing the river would be required from the National Park Service.

Table 6-4 lists the State's nature preserves potentially affected by the high speed rail route location.

Table 6-4
STATE NATURE PRESERVES POTENTIALLY AFFECTED BY THE OHIO HIGH SPEED RAIL

Name of Preserve	Code*	County
Fowler Woods	I	Richland
Seymour Woods		Delaware
Highbanks	SC	Delaware
E.S. Thomas	SC	Franklin
Spring Beauty Dell	SC	Hamilton
Trillium Trails	I	Hamilton
Greenbelt	I	Hamilton
Prairie Road Fen		Clark
Zimmerman Prairie		Montgomery
Springfield Fen		Clark

* Code Legend: I = interpretive
SC = scenic

6.2.10 Historic Preservation

The proposed high speed rail corridor crosses fifteen counties, each of which has at least one or more historical or archaeological sites that may be impacted either directly or indirectly by the rail system. Some examples of known historical or archaeological sites within a 1 to 2 mile radius of the proposed rail are: The birthplace of former President Harding (Morrow County - West Mansfield Alternative), more than a dozen locations related to the Ansberger Amish - Mennonite Settlement (Butler County near Trenton), and Crittenden Farm (Ashland County near Savannah). Each of these examples of historical locations is near to proposed new trackage for the rail system. Historical or archaeological sites influenced by existing tracks or rights-of-way are less likely to experience a significant impact by the high speed rail line, although these sites cannot be eliminated from the review process. Particularly in the southwestern portion of the rail corridor (south of Columbus) where several mound areas have been identified (Enon

Solid wastes generated by the high speed rail project will be disposed of properly as required by applicable State and Federal Regulations.

6.3 SUMMARY

A broad overview of environmental regulations and environmental concerns that will affect the proposed high speed rail project has been presented above. Beyond this overview there lies ahead a considerable effort to define the environmental community and address the corresponding issues before the final design engineering can get fully underway. Particularly, those environmental concerns (and associated regulations) that will directly impact the final routing of the rail, or require special engineering of the train itself (for noise and vibration impacts, for example) should be addressed as soon as further refinements of the route location begin. Environmental categories most likely to be of immediate concern with regard to the design engineering of the project include: historical and archaeological impacts, wetland area impacts, and other ecologically sensitive area impacts. The Cincinnati-Columbus portion of the corridor, for example, is rich in each of these categories; most of the nature preserves are in this portion of the state, the three scenic rivers occur in this part of the corridor, and this area has a wealth of historically and archaeologically sensitive sites.

In the 15 counties and numerous municipalities that will be affected by the proposed system. Local ordinances as well as local environmental groups will play lead roles in either helping or hindering the reality of this rail system. To diminish the impacts and/or consequences of the potential environmental concerns that may result from the initiation of this project, it is vital that the project begin as soon as possible to collect substantive information on ecologically and environmentally sensitive areas so that they can efficiently and expertly address environmental concerns as they arise. Environmental professionals must coordinate their efforts with project engineers to obtain the clearest view possible on proposed alignments and technology on which they will be addressing environmental issues. Along with being able to address the public, and public agencies responsible for environmental issues, these initial, substantive investigations will also save the project costly design changes and delays.

Much of the environmental data for this project will be site-specific; however, it is not appropriate to begin amassing this type of detailed information at this stage of the project. A more effective course of action will involve the participation of environmental planners, scientists, and design engineers to work iteratively to define a rail alignment that satisfies design criteria and minimizes environmental impacts to the maximum extent possible. While preliminary designs are under preparation, environmental specialists should inspect the locations of the proposed alignment to verify data from secondary sources and to collect original data needed to identify environmentally-sensitive features of the project area. Ideally, these data can be used to determine whether any possible refinements in the rail routing can be made to avoid sensitive areas or potential issues. This process will assist in minimizing the level of environmental impacts associated with the project and perhaps the amount of environmental processing and procedural requirements that will have to be addressed.

Chapter 7
COST ESTIMATES

7.1 GENERAL

The capital and operations and maintenance cost estimates are presented in this Chapter.

7.2 CAPITAL COST ESTIMATES

The capital cost is based on the recommended high speed rail technology, plan and profile data for the 3-C Corridor route developed from 1:25,000 scale maps, and design criteria for stations, structures and ancillary facilities.

7.3 CAPITAL COST DEVELOPMENT

The capital cost estimate for the preferred route is based on prices as of mid-1991. Unit costs are from recent engineering studies and actual bid experience for various types of construction. Additionally, knowledge of the railroad construction industry and regional variations in construction costs were used in developing the estimate.

Costs were developed by pricing the components of individual work items. The component prices were combined to develop unit costs for the construction elements. The unit costs were applied to the construction requirements to develop a total system cost.

Major system cost items are:

- Right-of-way
- Sitework
- Track structure
- Structures
- Road and rail crossings
- Stations
- Yard and shops
- Maintenance-of-way facilities
- Administration building
- Track maintenance road
- Traction power
- Signals and train control
- Communications

These cost items are defined in the following section.

7.4 CAPITAL COST ELEMENTS

Capital cost was calculated for each system element. The system elements and their sub-elements are:

The main yard and shops, located north of Columbus, will perform scheduled maintenance, major and minor repair, and train cleaning. The shops have service facilities for vehicle inspection, preventive maintenance, and running repair. Space is provided for storage of track materials, repair parts, maintenance vehicles and employee parking. Yard tracks store trains not in revenue service.

Eight maintenance-of-way bases are equally spaced along the right-of-way. The maintenance crews and track inspectors operate of out these facilities. Secure space is provided for the storage of repair parts, maintenance vehicles, and employee parking.

The administration building is collocated with the main yard and shops. Central Traffic Control is in the administration building which provides a central location for administration and operations.

7.4.6 Maintenance Road

A gravel road is parallel to the track inside the security fencing. This road provides access to the track for maintenance crews.

7.4.7 Electrification

Electrification costs include the catenary poles, overhead wire system, substations, feeder lines, switchgear, and power transmission lines. Costs have not been estimated for the extension of local power company distribution systems.

Catenary poles are located on the outside of each track. This permits maintenance on one track without interfering with operations on the second track. The catenary system includes cantilevers, steady arms, insulators, messenger and contact wires, hangers, overhead and feeder wires, tensioning equipment, cables for grounding, and connections to substations.

Traction power substations are located approximately every 15 miles along the right-of-way. Spacing of these unmanned substations may vary based on the requirements of the vehicle selected. Power will be supplied by local utility companies. Substation costs include the structures and installed equipment. The equipment includes a high-voltage bus bar, main isolating breaker, transformer, auxiliary transformer, bus tie breaker, feeder breaker and relay, and supervisory control systems. Each substation has a security fence or wall around it. Intrusion alarm systems will be installed.

7.4.8 Signals

The signal and train control systems provide automatic train protection and track circuits for cab signals and train speed monitoring. The system has continuous wayside-to-train data transmission. The CTC system controls and monitors train operations, the status of traction power equipment, and system data at the stations and substations.

7.4.9 Communications

Communications costs are for telephone, radio and data transmission systems. The telephone system connects the CTC facility with the stations, substations, and all maintenance facilities. A radio system also provides direct communications between the CTC and the trains.

Table 7-1
ESTIMATED CAPITAL COSTS
OHIO HIGH SPEED RAIL SYSTEM

	Cost (in Millions of 1991 $)
RIGHT-OF-WAY	$ 243
TRACK AND STRUCTURES	1,245
ELECTRIFICATION	440
SIGNALS AND COMMUNICATION	166
STATIONS	44
YARDS AND SHOPS	46
Subtotal	$ 2,184
ROLLING STOCK COST	75
Subtotal	$ 2,259
CONTINGENCY - 20%	452
DESIGN AND MANAGEMENT	407
TOTAL	$ 3,118

7.11 SYSTEM OPERATIONS

- Equipment

Number of train-sets	8
Power units per train	1
Passenger cars per train	3
Type of power	Electrified
Top commercial speed	185 mph
Power consumption kWh/train mile	20

- Infrastructure

Length of right-of-way	260 miles
Percentage of double-track	99%
Track-miles (ROW + 4 for yard)	520 miles
Number of stations	9

- Operations

Train-set miles per year	3,036,800
Trains per day - both directions	32
Running time - end-to-end	166 minutes
Light cleaning at turn backs	15 minutes

7.12 LABOR AND WAGE CALCULATIONS

Labor and wages are based on the following assumptions:

- Work days per employee per year - 230 day with an allowance of 30 days for vacation, holidays, training and sick leave.
- Employees work a forty-hour week.
- Station employees work a ten-hour day, four-day week.
- Fringe Benefits are 40% of base salary.

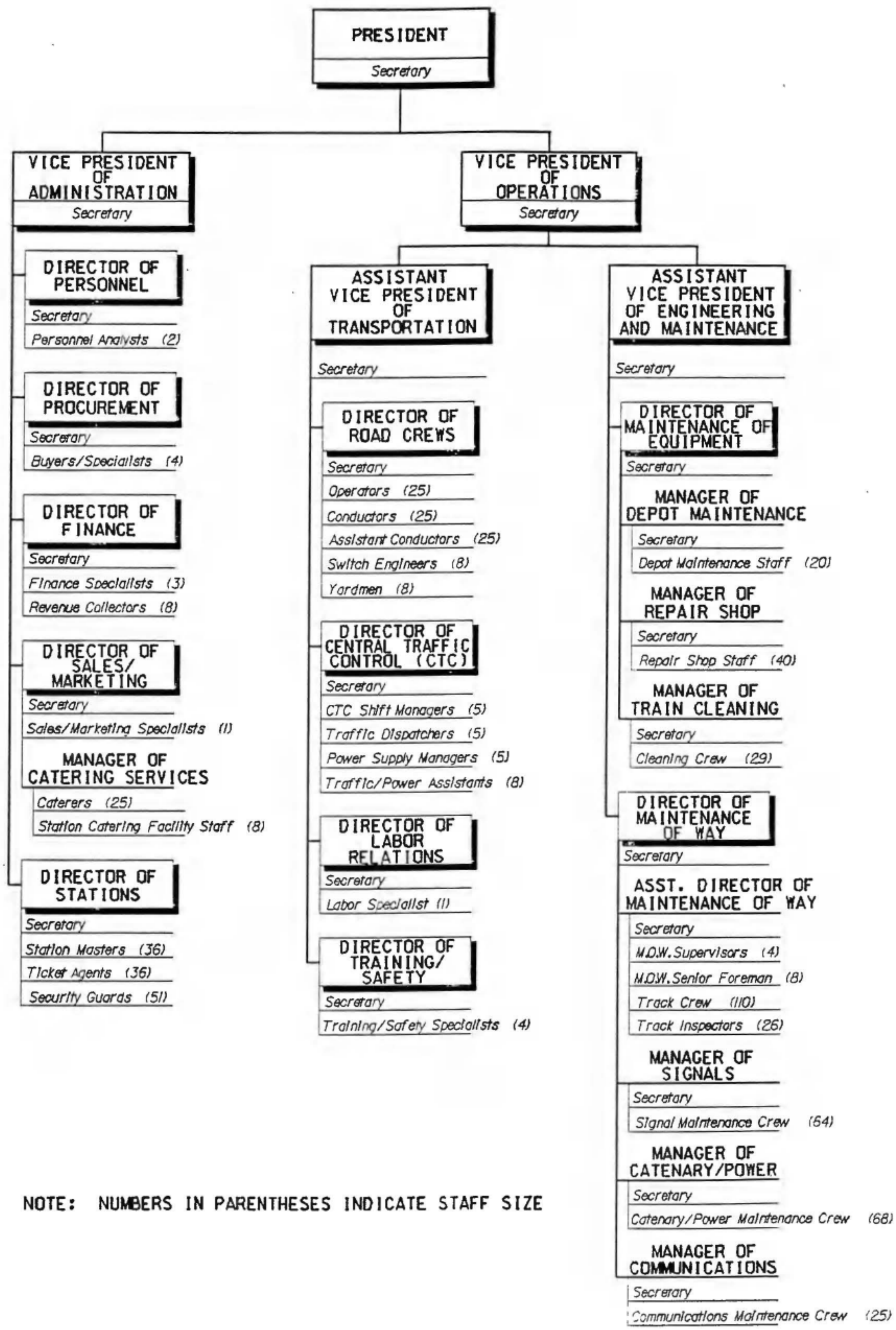
7.13 STAFF REQUIREMENTS AND COSTS

An Operations and Maintenance organization chart is presented in Figure 7.1. The organization has a total of 732 personnel. Administration including the President's office has 191 personnel with 541 personnel under the Vice President for Operations. The Assistant Vice President for Transportation has 129 personnel and there are 410 personnel under the Assistant Vice President for Engineering and Maintenance.

The personnel costs for Administration, including the President's office, are $7,740,400 annually. The estimated annual cost for the personnel under the Assistant Vice President for Transportation is $8,757,000 and the cost for the Engineering and Maintenance staff is $21,803,600. The total annual personnel cost including fringe benefits is $38,301,000.

A description of the responsibilities for each element of the organization is at Appendix B.

Figure 7.1
OPERATIONS & MAINTENANCE ORGANIZATION



NOTE: NUMBERS IN PARENTHESES INDICATE STAFF SIZE

7.15 SUMMARY

The annual personnel costs are $38,301,000. The maintenance material and other costs total $22,901,000 annually. The total annual operations and maintenance cost is $61,202,000.

Table 7-3
SUMMARY OF OPERATION AND MAINTENANCE COSTS

	Annual Cost (in Millions of 1991 $)
PERSONNEL COSTS	
Administration	$ 7.7
Transportation	8.8
Engineering and Maintenance	21.8
Total Personnel Costs	$ 38.3
MATERIAL COSTS	
Equipment Maintenance	$ 3.8
Maintenance-of-Way	8.5
Electric Power	4.1
Other Costs	6.5
Total Material Costs	$ 22.9
TOTAL O&M COSTS	$ 61.2

Chapter 8
RIDERSHIP AND REVENUES ESTIMATES

8.1 GENERAL

In order to prepare ridership estimates for a high speed rail line in Ohio, the models developed by Peat Marwick in association with Frank Koppelman for the Ohio High Speed Rail Authority (OHSRA models) in 1988 were reviewed and revised. These models are documented in the 1989 "High Speed Rail Ridership Study" report. Only modifications made as part of this project and some of the major assumptions are described in this chapter.

The OHSRA models are capable of estimating both the total amount of future travel in the 3-C Corridor and the modal shares of that travel.

8.2 TOTAL TRAVEL MODEL

The total travel model used for the Ohio 3-C Corridor is a model developed by Frank Koppelman using 1977 National Passenger Transportation Survey (NPTS) data. This model relates the change in travel between a future year and a base year to the corresponding changes in population, per capita income, and transportation service.

The numerical relationships between these variables were estimated separately for business and non-business based on studies conducted in areas other than Ohio in the 70's.

The original model predicted an average annual growth rate of 0.9 percent for business and 0.6 percent for non-business between year 1988 and year 2010. Such an average annual growth seems low even considering that the population is estimated to decrease very slightly (0.05 percent annually). During the same period, per capita income is assumed to increase by 2.01 percent annually (see Table 8-1).

There has been a general trend in the United States of increased vehicle miles of travel (VMT) on rural highways (intercity travel) even with no population growth. This trend was even more noticeable during the 1980's which also saw the deregulation of the airline industry and increased air travel.

While a continuous growth in travel cannot be sustained indefinitely without socio-economic changes, the growth in travel estimated by the OHSRA model might underestimate potential travel in the 3-C Corridor.

The validity of the total travel model for Ohio was checked for reasonableness by comparing the growth in travel the model estimated between 1980 and 1988 with the growth in rural vehicle miles of travel (VMT) reported by the Federal Highway Administration during the same period. Table 8-2 shows the growth in vehicle miles of travel. Non-local Rural VMT, which can be considered as the best indicator of intercity travel grew 15.4 percent in Ohio between 1980 and 1988. Applying the OHSRA total demand model between city pairs in Ohio would show only a 2.5 percent growth in travel between 1980 and 1988 (see Table 8-3).

The discrepancy is due to the fact that the model as presently structured, cannot represent the increased rate of trip making observed in national VMT statistics. While the underlying reasons for increased per capita rates of travel are complex, one of the factors is a trend toward smaller family sizes (more households for the same population). By simply changing the "growth in population" in the OHSRA model to "growth in number of households", the model would have predicted an 11.2 percent increase in travel between 1980 and 1988 (see Table 8-3).

Table 8-2
OHIO
ANNUAL VEHICLE MILES OF TRAVEL
(Millions)

	1980	1988	Total Growth 1980 - 1988 (Percent)	Average Annual Growth (Percent)
All Roads	72,000	81,990	13.9	1.64
Rural Roads	30,636	35,023	14.3	1.69
Non-Local Rural Roads	24,305	28,036	15.4	1.80

SOURCE: "Highway Statistics", Federal Highway Administration.

Table 8-3
ANNUAL TRIPS IN 3-C CORRIDOR
(Thousands)

	1980 (1)	1988 (1)	Total Growth 1980 - 1988 (Percent)	Average Annual Growth (Percent)
OSHRA Model (using Population)	37,696 (3)	38,644 (2)	2.5	0.31
Alternative Model (using No. of Household)	34,754 (4)	38,644 (2)	11.2	1.34

NOTE:
(1) Trips between major city pairs only.
(2) From OHSRA study 1988 Trip Table (based on survey data).
(3) Calculated by applying original OHSRA Total Demand Model which uses population as one of the variables.
(4) Calculated by applying revised OHSRA Total Demand Model replacing the population variable by number of households.

8.3.1 Selection of Stations and Airports

Resource Systems Group suggested that rail boarding and alighting stations be selected based on closeness (time) to the trip origin and destination but did not change the selection of airports. The argument for not changing the airport selection method was that, unlike rail, "air service is highly variable across the airports and it is likely that travelers will incur higher access costs in order to reach an airport with better service."

This argument may be true for air trips in a corridor where one of the airports is a dominant hub but not in the 3-C Corridor. The major city pairs with existing air service in the corridor all have between 9 and 13 flights daily during the week. While air fares vary between city pairs, they are high (indicating a high value of time) and vary only slightly between airports. This suggests that it is unlikely that air travelers would want to incur higher access or egress time to obtain fare benefits. Therefore, the selection of airports and stations was modified as follows:

> Select the station or airport pairs which result in the lowest total trip time where access and egress times are penalized by a factor of 1.25.

For air, this methodology is equivalent to choosing the closest airports as all flying times in the corridor are very close (in the 45 minutes to 1 hour range). For rail, this methodology is also equivalent to choosing the closest station in most cases. However, for trips whose true origin or destination is between two stations, it discourages choosing a station further away from the final destination (adding linehaul time).

8.3.2 Selection of Trips Candidate for Rail and Air Services

As suggested by Resource Systems Group, any potential rail trip for which the sum of access and egress time is higher than the auto-only trip time was eliminated. This criterion was extended to air trips too.

In addition, rail or air trips for which total travel time is higher than the auto only trip time and for which the in-vehicle time (rail or air) represents only a small portion of the total travel time were also eliminated. The intent was to eliminate as potential trips for rail those rail trips which would consist of a long access and egress time and a short in-vehicle time when the total auto-only travel time is shorter than the overall rail travel time. Following several logic tests, the following methodology was retained:

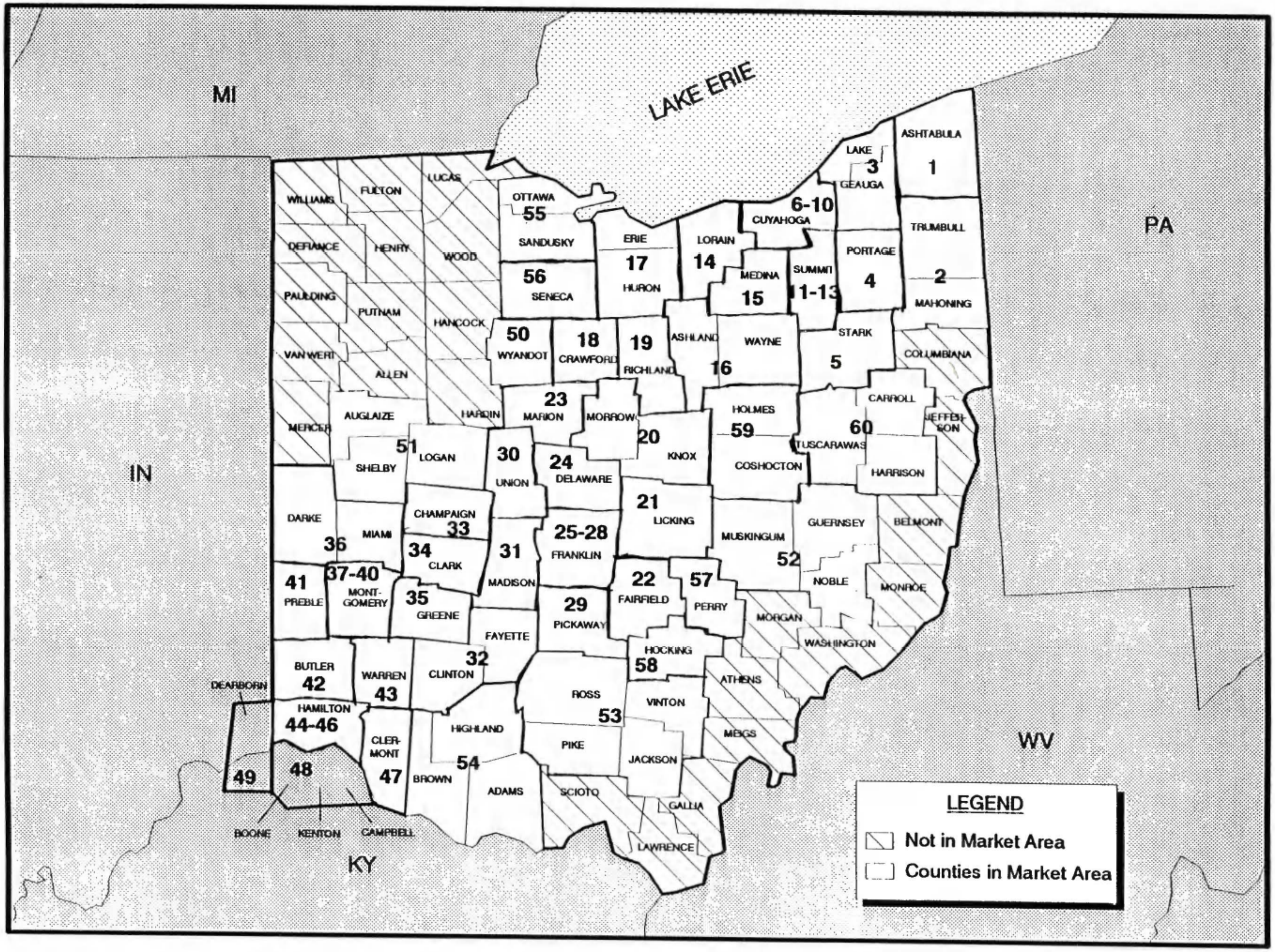
1. Eliminate as potential rail or air trip any trip for which:

   Access plus Egress Time (including terminal time) > Total Driving Time

2. Eliminate as potential rail or air trip any remaining trip for which:

   Total Traveling Time (by air or rail) > Total Driving Time
   and
   (Access Time + Egress Time + 1/3 (Terminal Time)) > (Total Driving Time/2)

The second test is to eliminate as potential common carrier trips, those trips which would result in longer travel time than the total highway time and for which the total access and egress time (not including terminal time) was higher than the In-Vehicle Time. However, if applied like this, the test would have had the illogical results of increasing potential ridership as the rail time increases (for some zone pairs the access plus egress time could become lower than the in-vehicle time as the rail time increases). The second test as described above leads to similar results without this inconsistency.



OHIO NEW ZONE SYSTEM

Figure 8.1

As a first step, the air class bias constants were recalculated. While the new model could replicate reasonably the overall air market share in the corridor, simulated air trips for individual city pairs were too different from observed air trips to be acceptable. The Cleveland-Cincinnati air market was underestimated while Cleveland-Columbus or Columbus-Cincinnati was overestimated. In other words, the model would understate long trips and overstate short trips.

As a second step, the air class bias constants were estimated as a linear function of the overall length of the trip. The reasoning for such an adjustment was that in real life many people do not consider air as an alternative mode of transportation for short distances (less than 150 miles) regardless of cost unless it is for air connection purpose. The resulting model was able to simulate air trips for individual city pairs which were much closer to observed air trips.

Since rail did not exist in 1988 in the corridor, the rail bias constants could not be adjusted using existing Ohio travel data. Instead the rail bias parameters in the main mode share models were adjusted as follows:

- The rail bias parameters were kept as a constant and not a function of the overall trip length. While travelers may be disinclined to use the air mode for relatively short trips less than 150 miles, such reluctance would only be applicable to rail for even shorter trips. Such trips did not represent a significant portion of the 3-C Corridor trips analyzed in this study.

- For business travel, the rail bias constant was adjusted so that the relative difference between the rail and air constants in the Koppelman model was maintained in the adjusted models. The reason for this adjustment was that if business travelers in Ohio are more reluctant to use the air mode than in other parts of the country, they would also be more reluctant to use the rail mode.

- Because the air market share for non-business is so small (less than 1 percent for all city pairs except Cleveland to Cincinnati where it is less than 4 percent) adjusting the rail bias constant based on the adjusted air bias constant was considered too unreliable. Therefore, the rail bias constant of the Koppelman model was kept in the new model. This model may appear to have the potential for overestimating the rail share of non-business travelers in the 3-C Corridor. However, application of the model resulted in non-business rail ridership which was considered as reasonable to conservative.

8.4 RIDERSHIP FORECASTS ASSUMPTIONS

The main forecasting assumptions used to forecast the ridership and revenue of a high speed rail system in Ohio are:

- Socioeconomic characteristics. Present and future values for number of households and per capita income, are the socioeconomic variables used by the model as previously discussed.

- Competitive mode service characteristics. The existing 1988 conditions were assumed to remain constant between 1988 and 2010 for both competitive modes considered (highway and air).

- High speed rail service characteristics.

Table 8-4
SELECTED HIGHWAY SERVICE CHARACTERISTICS

From (Zone)	To (Zone)	Highway Distance (Miles)	Highway Time (Minutes)
Downtown Cleveland (7)	Downtown Columbus (26)	144	172
Downtown Cleveland (7)	Mansfield (19)	83	108
Downtown Cleveland (7)	Downtown Cincinnati (45)	248	284
Mansfield (19)	Downtown Columbus (26)	78	99
Downtown Columbus (26)	Springfield (34)	57	76
Downtown Columbus (26)	Downtown Dayton (38)	71	92
Downtown Columbus (26)	Downtown Cincinnati (45)	112	133
Springfield (34)	Downtown Cincinnati (45)	85	111
Downtown Dayton (38)	Downtown Cincinnati (45)	53	65

Note: Highway trip time includes time reflecting stops and other travel delays at a rate of six minutes per hour of trip time (or ten percent).

Table 8-6
HIGH SPEED RAIL OPERATING TIME ASSUMPTIONS

Station	Time Between Stations (Minutes)
Cleveland Downtown	
	9
Cleveland Southwest	
	26
Mansfield	
	19
Columbus North	
	8
Columbus Downtown	
	27
Springfield	
	20
Dayton	
	22
Cincinnati North	
	19
Cincinnati Downtown	

NOTE: All times exclude dwell time. The following dwell times were added:

- 4 minutes Columbus Downtown
- 2 minutes all other intermediate stations

Rail Fare - Two types of fare, business class and coach class were assumed to be available. The business class fare schedule was developed on a per-mile basis as follows:

Business Class Fare = \$10 + \$0.40/Mile

This roughly corresponds to 60 percent of the air fare for the longer distance trips. The following exceptions applied:

- The same fare was used for downtown and suburban stations (for example the same fare applies to a trip between Mansfield and Cincinnati North and Mansfield and downtown Cincinnati).
- Suburban to Downtown fares for the major cities were set to \$5.

Coach Class fares were set to 60 percent of business class fare with the same exceptions as mentioned above. The resulting fare schedule is presented in Table 8-7.

Finally, a rail service frequency of 16 round trip trains per day was assumed in the forecast.

8.5 RIDERSHIP FORECAST RESULTS

Using the revised OHSRA model and the various assumptions described in the previous section, ridership forecasts were prepared for 1991 and 2010.

Tables 8-8 'present's the estimates of rail ridership for business, non-business, and total markets, respectively for year 1991 and 2010. Total rail ridership estimates grow from 1.778 million trips in 1991 to 2.174 million trips in 2010, a 22.2 percent total increase or 1.1 percent annual increase. These ridership estimates are presented in more detail in Apppendix E.

Rail market shares vary between the business market and the nonbusiness market from 8 percent to 3 percent. This difference is due in part to the fairly high fare assumptions. Business travelers with higher values of time are more willing to pay these fares. Another reason is that non-business travelers are typically less willing to travel without their car.

Rail market shares also vary by district pairs. For example, 18 percent of the business market between Cleveland and Columbus would be captured by the high speed rail system but only 15 percent of the business market between Columbus and Cincinnati.

These variations are due to various factors. First, the average operating speed of the rail system varies along the 3-C Corridor (lower between Columbus and Cincinnati than between Cleveland and Columbus, for example). Second, there is no real air mode alternative between some district pairs (the rail system only competes with the highway alternative). Third, the longer the rail trip, the more time advantage the rail mode can accumulate (if competitive) vis-a-vis the highway mode. Other factors such as access/egress time or overall cost of the various modes available also contribute to this variation in market share.

At 5 percent, the total market share for rail may appear low. However, one must remember that the total market for this study has been defined broadly. As shown in Figure 8.2, many of the counties included in the potential market are relatively far from the proposed rail line. Because of their large access or egress time they contribute only marginally to the rail ridership but are included in the total market. Also, one of the largest markets, Dayton to Cincinnati, is estimated to contribute only one percent of its total market to the rail mode because there is neither time advantage nor cost advantage in using the proposed rail mode between Dayton and Cincinnati.

The estimate for average rail trip length is 93 miles in 1991 and in 2010. This is nearly twice the OHSRA study estimate and more in line with the trip length to be expected for a high speed rail from Cleveland to Cincinnati.

Table 8-9 presents the estimated rail trips by source. In year 1991, 82 percent of the rail trips for business are diverted from auto while two percent come from the air market. This low proportion of rail trips from the air market (even more noticeable for nonbusiness) is due to the fact that the air market is fairly small in the 3-C Corridor compared to other parts of the country. Also, the proposed rail time of 2 hours and 40 minutes between Cleveland and Cincinnati, where the most significant air market exists, is only marginally competitive with the air travel time.

Induced traffic represents more than thirteen percent of the business rail trips and four percent of the nonbusiness rail trips. The lower percentage of induced traffic for the nonbusiness market is due to the fact that the relatively high fares assumed for the rail system do not induce many additional trips for the cost conscious non-business market.

Table 8-9
ESTIMATED RAIL TRIPS BY SOURCE

YEAR 1991

	BUSINESS		NONBUSINESS		TOTAL	
	Trips	Percent	Trips	Percent	Trips	Percent
From Auto	1,049,833	82.1	461,632	92.3	1,511,465	85.0
From Air	22,888	1.8	2,616	0.5	25,504	1.4
From Growth	33,338	2.6	15,754	3.2	49,092	2.8
Induced	172,363	13.5	20,070	4.0	192,433	10.8
Total	1,278,422	100.0	500,072	100.0	1,778,494	100.0

YEAR 2010

	BUSINESS		NONBUSINESS		TOTAL	
	Trips	Percent	Trips	Percent	Trips	Percent
From Auto	1,049,832	67.6	461,585	74.5	1,511,417	69.5
From Air	22,885	1.5	2,614	0.4	25,499	1.2
From Growth	271,656	17.5	130,668	21.1	402,324	18.5
Induced	209,418	13.5	25,002	4.0	234,420	10.8
Total	1,553,791	100.0	619,869	100.0	2,173,660	100.0

Table 8-10
OHIO HIGH SPEED RAIL
ANNUAL RIDERSHIP REVENUES

	YEAR 1991		YEAR 2010	
	Riders	Revenue ($)	Riders	Revenue ($)
Business Fare	1,357,214	73,822,743	1,658,089	84,606,249
Coach Fare	421,280	14,534,414	515,571	17,662,054
Total	7,778,494	88,357,158	2,173,660	107,268,303

Note: Revenues are in 1991 constant dollars. A factor of 1.1251 derived from the transportation CPI was used to translate 1988 constant dollars to 1991 constant dollars.

Chapter 9
INVESTMENT ANALYSIS

9.1 INTRODUCTION

This chapter describes efforts to model financially the results of the development and operation of the high speed rail system and the results that were obtained using the key components of the financial plan system cost, revenues and operating expenses.

9.2 METHODOLOGY

9.2.1 Cash Flow Projections

The initial efforts to assess the quality and liklihood of investment in the rail system centered on the development of a financial model to assess the operating results of the system and, from these net operating results, the availability of financial funds sufficient to finance the development costs of the system itself. The model was formulated to allow for sensitivity in the input parameters so as to test the differing degrees of revenues and expense and the impact each had on the financial net results. Annual projections of cash flows were planned in the model to forecast the future based on present assumptions of future events.

The following were the identified criteria for developing a financial model for the Ohio High Speed Rail System. Financial modeling was planned to encompass not only the operational criteria for the system but also the development criteria or, more precisely, the means, timing and resources required during development to bring the system and its components to a state of operational readiness.

9.3 DEVELOPMENTAL CRITERIA

During the development of the rail system, there are two major categories of costs/revenues requiring input into the cash flow projections for the model. These are the development costs themselves and the sources of funding for the development . Development costs include the following:

Preliminary Engineering
Economic Studies
Detailed Design
Right-of-way acquisition
Construction and Procurement
Rolling stock, Traction Power and Equipment
Construction Management
Insurance
Capitalized Interest and
Contingency

9.4.1.3 Other Operating Revenues

Other sources of operating revenues were considered by ORO, but each appears to offer very limited margin between cost and revenue. At the present level of investigation they were considered unlikely to add much to net operating margins needed to attract investment.

9.4.1.4 Non-Operating Revenues

The following are presently identified as the sources of non-operating revenues of the system:

- Financing Proceeds
- Investment Income
- Governmental Sourced Revenues
  - Dedicated
  - Periodic
- Lease Income
  - Air Rights
  - Communications
  - Other
- Grant Receipts
  - Federal
  - State
  - Other

9.5 OPERATING COSTS

To round out the modeling effort for the cash flow projections, the following operating cost elements were incorporated into the cash flow analyses

- Labor
- Benefits
- Repairs and Maintenance
- Power
- Other fuel charges
- Insurance
- Provisions for Injuries and Damages
- Other

9.6 NON-OPERATING COSTS

In addition to the Operating Costs, certain non-operating costs of the system were identified for incorporation. The predominant cost here was debt service while other identified costs included franchise fees and royalties. Additionally, to the extent that there is private ownership of all or a portion of the system, there is the potential for taxes becoming an additional non-operating cost.

9.7 INVESTMENT ANALYSIS

For a predominately private sector development and funding effort, the private sector participants would need to be shown a return for their contributed capital that would equate to other investment returns available in the marketplace. In addition to the overall return on investment, the risk of achieving this return would also be subject to quantification. On an overall basis, net operating revenues of the system were desired to cover operating expenses, provide for debt service and generate a return to the investors

Assuming coverage of 1.5, an amortization period of 20 years and interest at 10.5%, the estimated net operating revenue can be expected to finance about $150 million of investment. This could, for example, include the rolling stock as well as other selected elements of the project.

9.8 RISK/RETURN ASSESSMENT

From the standpoint of obtaining private sector contributions in the form of contributed capital, in-kind contributions, or supplier credits, the return on investment referenced earlier must be met for the investment of time, money or assets to compete with alternative investment opportunities. Considering solely the $27.2 million of net revenues as being available to provide a return on $1.0 billion of contributed capital, this investment return is only 2.72%, far below the 15% to 30% that would be necessary. Furthermore, the project is sensitive to the ability to attract and retain ridership over differing economic conditions, with passenger revenue being the key revenue of the system. Given that there is no recent history of rail service and receptivity to rail service in this corridor, projections are prospective. Although conservative, these projections will be further scrutinized and could be more conservatively portrayed when it comes time to actually finance a portion of the project. This portrayal will likely come in one of two forms, both reflective of the perceived risk in the project. One form will be for a heightened coverage requirement on any debt issued to mitigate the risk of being wrong on the projections. The other form would be reflected in a much larger return on investment being sought by any contributors to the project. Based on risk assessment this return could approach levels exceeding 30+% during earlier phases of development.

9.9 CONCLUSIONS

Based on the foregoing, the high speed rail system does not appear likely to be financed solely on a private basis. Based on the reality of this assessment, the ability to develop the system will rely much more heavily than was originally planned on public resources enhanced by the private sector to offset a certain portion of the development costs.

Table 9-3
REVENUE REQUIREMENTS TO COVER $60.9 MILLION OF O & M COSTS PLUS DEBT SERVICE

CAPITAL COSTS - $3.1 BILLION

INTEREST RATE - 12%

COVERAGE REQUIREMENTS
($ in $1,000)

Amortization (Yrs)	1.00	1.05	1.10	1.15	1.20	1.25	1.30
20	475,924	496,675	517,427	538,178	558,929	579,680	600,431
25	456,150	475,912	495,673	515,437	535,200	554,962	574,725
30	445,745	464,988	484,230	503,472	522,714	541,957	561,199
35	440,082	459,041	478,000	496,959	515,918	534,877	553,836
40	436,941	395,443	414,243	433,047	451,849	470,652	489,454

Table 9-4
REVENUE REQUIREMENTS TO COVER $60.9 MILLION OF O & M COSTS PLUS DEBT SERVICE

CAPITAL COSTS - $1.0 BILLION

INTEREST RATE - 12%

COVERAGE REQUIREMENTS
($ in $1,000)

Amortization (Yrs)	1.00	1.05	1.10	1.15	1.20	1.25	1.30
20	194,779	201,473	208,167	214,861	221,553	228,248	234,942
25	188,400	194,775	201,150	207,525	213,900	220,275	226,650
30	185,044	191,251	197,458	203,665	209,872	216,080	222,287
35	183,217	189,332	195,448	201,564	207,680	213,796	219,912
40	182,204	188,269	194,334	200,399	206,464	212,530	218,593

Chapter 10
FINANCING

10.1 FINANCING OPTIONS

As an outgrowth of the conclusions in Chapter 9; "Investment Analysis", ORO considers it unlikely that private investment alone will suffice to design, develop, finance and construct the high speed rail system in the 3-C Corridor. Based on the present projections for net operating revenues, the ability of these results to leverage significant capital costs is remote, thus putting a greater burden of funding the costs of development on public resources. However, there are roles for the private sector to continue to play in the design, development, financing, construction and operation of the system.

First and foremost, the current projections of revenues and expenses indicate that the system will generate an operating surplus of approximately $27 million annually in 1991 dollars. This source of funds could be used to leverage private sector contributions and reduce the amount of public sector resources required to develop the system. For example, the private sector would be willing (and has undertaken or committed to undertake in the past) to guarantee the operating costs of the system within certain sets of parameters. What the private sector has been unwilling to undertake in the past is the guarantee of revenues or ridership risk. In return for guaranteeing the operating costs, the private sector would desire to participate in a portion of the net operating revenues of the system.

Given that a major portion of the costs of the system will fall on the public sector, the ability to have the private sector fund any of the development costs reduces the portion of the development costs required to be borne by the public sector. If tax-exempt financing is utilized by the public sector, then the nature of the payment or delineation of the funding source of the private sector benefits from the operation of the system will need to be carefully crafted.

10.1.1 Private Financing

To the extent that a portion of the net operating results of the system can be garnered for allocation to the private sector, the private sector can use these funds to secure private financing for a portion of the system costs. Assuming the $27 million of net operating results (1991 dollars) would accrue to the private sector, it could then leverage these funds to finance nearly $150 million of system costs assuming a 10.5% interest rate and 20 year amortization with 1.5 times coverage.

Leveraging the net operating results in another fashion, the private sector could secure otherwise marketable capital assets to be leased to the public owner. Using the rail cars as an example, the private sector could secure the vehicles on behalf of a public sector owner and lease them to the public sector thereby turning the capital asset into an operating expense covered by the net operating revenue that would otherwise be generated by the system. Coupling this with differing forms of vendor participation could lower costs to the public sector as compared to utilizing more traditional competitive bidding procurement methods.

10.1.4 Tax Increment Financing

The development of the system will spur additional development around stations although this is not contemplated to be of the magnitude nor of the extent that development occurs around stations in an urban commuter rail environment. To the extent that development is expected, the local jurisdictions having taxing authority where this development is likely to occur could implement some form of tax increment financing or benefit assessment district to capture the value that might be created. While taxes would generally accrue to the taxing jurisdiction from development anyway, implementing a more specific form of tax or district or both provides for certain opportunities. First, it can provide a source of revenue to offset the other municipal services that may have to be increased by virtue of the presence of a rail station. Secondly, it can be used as a vehicle for capturing a benefit from allowing more dense development or other deviation from established zoning requirements. Thirdly, it can be used as source of funding for the system itself under the philosophy that the system will spur development and economic growth and a portion of this should be returned to pay for the system and its maintenance.

Tax benefits of the nature envisioned here would most likely accrue following the development of the system and would not likely be in sufficient magnitude nor sufficiently early in the program to assist with the system's development costs.

10.1.5 Value Capture and Land Development

This form of financing is much like that of tax increment financing. That is, it will be closely aligned with development potential in the urban centers touched by the rail system. There will not be much potential for development in those large areas of the system that will cross Ohio between stations. To the extent that development potential will exist, the system should preserve its rights in the early stages of system development and fight for the legal authority to do so. This would definitely include the system's right to retain the air rights to lands acquired for the system.

Similarly with tax benefits, land development will generally trail system development and can not be counted on directly for providing a large source of capital to offset system development costs. Much of its potential will involve the generation of revenue from sale or leasing of air rights. The one area, however, where substantial monies could be garnered up front in the system development effort would be through the donation of land or station sites or the actual construction of the stations themselves. This would be possible where the siting of the station could be modified to take advantage of business interests that would be advanced by being in a closer proximity to the rail station itself.

10.1.6 Grants and Subsidies

Grants and subsidies to the system are the lowest cost financing options available. To the extent that grants are secured with matching share requirements, the system and owner will have to have the wherewithal of providing the local share on a timely basis. The grant funds themselves are "free" of financing cost to the system although not necessarily "free" to the provider of the grant. Given the conclusions reached in the investment analysis, the system should proceed to secure all the grant monies possible to lessen the requirement on other financing sources for system development capital.

Grants to the system are presently viewed as available from the federal government, Ohio state government and local jurisdictions that would benefit from the system.

Table 10-1
ANNUAL REVENUE REQUIREMENTS TO FINANCE SYSTEM CAPITAL COSTS
(Excludes Projected Net Operating Revenue)

Interest Rate - 7.00%
Amortization - 20 yrs

COVERAGE REQUIREMENTS
($ in M)

System Capital	1.00	1.05	1.10	1.15	1.20	1.25	1.30
4000	377.6	396.5	415.4	434.2	453.1	472.0	490.9
3800	358.7	376.6	394.6	412.5	430.4	448.4	466.3
3600	339.8	356.8	373.8	390.8	407.8	424.8	441.7
3400	320.9	336.7	353.0	369.0	385.1	401.1	417.2
3200	302.1	317.2	332.3	347.4	362.5	377.6	392.7
3100	292.6	307.2	321.9	336.5	351.1	365.8	380.4
3000	283.2	297.3	311.5	325.7	339.8	354.0	368.1
2800	264.3	277.5	290.7	303.9	317.2	330.4	343.6
2600	245.4	257.7	270.0	282.2	294.5	306.8	319.0
2400	226.5	237.9	249.2	260.5	271.9	283.2	294.5
2200	207.7	218.0	228.4	238.8	249.2	259.6	270.0
2000	188.8	198.2	207.7	217.1	226.5	236.0	245.4
1800	169.9	178.4	186.9	195.4	203.9	212.4	220.9
1600	151.0	158.6	166.1	173.7	181.2	188.8	196.3
1400	132.2	138.8	145.4	152.0	158.6	165.2	171.8
1200	113.3	118.9	124.6	130.3	135.9	141.6	147.3
1000	94.4	99.1	103.8	108.6	113.3	118.0	122.7

Table 10-3
ANNUAL REVENUE REQUIREMENTS TO FINANCE SYSTEM CAPITAL COSTS
(Excludes Projected Net Operating Revenue)

Interest Rate - 7.50%
Amortization - 20 yrs

COVERAGE REQUIREMENTS
($ in M)

System Capital	1.00	1.05	1.10	1.15	1.20	1.25	1.30
4000	392.4	412.0	431.6	451.3	470.9	490.5	510.1
3800	372.8	391.4	410.1	428.7	447.4	466.0	484.6
3600	353.1	370.8	388.4	406.1	423.7	441.4	459.0
3400	333.5	350.2	366.9	383.5	400.2	416.9	433.6
3200	313.9	329.6	345.3	361.0	376.7	392.4	408.1
3100	304.1	319.3	334.5	349.7	364.9	380.1	395.3
3000	294.3	309.0	323.7	338.4	353.1	367.8	382.6
2800	274.7	288.4	302.1	315.9	329.6	343.3	357.1
2600	255.0	267.8	280.5	293.3	306.0	318.8	331.6
2400	235.4	247.2	259.0	270.7	282.5	294.3	306.0
2200	215.8	226.6	237.4	248.2	259.0	269.8	280.5
2000	196.2	206.0	215.8	225.6	235.4	245.2	255.0
1800	176.6	185.4	194.2	203.1	211.9	220.7	229.5
1600	156.9	164.8	172.6	180.5	188.3	196.2	204.0
1400	137.3	144.2	151.1	157.9	164.8	171.7	178.5
1200	117.7	123.6	129.5	135.4	141.3	147.1	153.0
1000	98.1	103.0	107.9	112.8	117.7	122.6	127.5

The difference in costs for tax-exempt versus taxable financing can be seen in comparing these tables with those shown in Chapter 9, Investment Analysis. From Table 10-4, the annual cost for $3.1 billion of system cost financed over 30 years at 7.50% with a coverage requirement of 1.25 times is $328.1 million. The same cost for a taxable financing (Chapter 9, Table 9-1) would be $471.9 million, less the Operation and Maintenance requirement of $61.2 million, resulting in $410.7 million annually. This is $82.6 million annually more than the tax-exempt financing scenario with a total pay out differential over thirty years of almost $2.5 billion.

10.2 POTENTIAL TAX-EXEMPT REVENUE SOURCES

Stable and predictable tax-exempt revenue sources can take any form and will result in lower interest rates by virtue of the underlying revenues having a higher credit quality. Generically, tax exempt revenues could be income taxes, property taxes, motor fuel taxes, sales taxes, excise taxes, impact fees, franchise fees and the like. The difficulty with these revenue sources is that they are generally, and more specifically in today's economic climate, pledged for alternate purposes. To rededicate them to the high speed rail system will leave some other programs wanting for a funding source. The alternative becomes the politically charged decision of raising taxes or implementing an additional revenue source for dedication to the system. In this light, it becomes more expedient and more saleable to the public to implement the revenue source for the shortest period of time. This is especially true for those revenue sources that would require a referendum of the electorate wherein a specific tax for an unlimited period of time is less desirable than putting a definitive sunset provision on it. Many California jurisdictions have been successful in implementing new sales tax programs for funding transportation infrastructure by limiting the tax to twenty years.

In ORO's review of tax-based revenue sources, income taxes and property taxes were considered as potentially too difficult to implement or allocate. Fuel taxes, sales taxes and excise taxes seemed to provide the greatest return in total dollars for the smallest incremental levy. Clearly, the search is for a revenue source or combination of sources that would provide for annual revenues in the range $200 to $300 million although the project's development phase could be financed at about $20 to $30 million annually.

Increasingly, motor vehicle fuels taxes are used for all ground transportation programs. In Ohio the present tax rate is 21 cents per gallon. Each penny of tax raises about $55 million of revenue per year for transportation purposes. The tax is established by the Ohio constitution, Article XII, Section 5a and is essentially dedicated to highway use. Although a constitutional change would be a major effort, Ohio may wish to review this requirement which has been in effect for over forty years and may no longer serve well the state's need for a multi-modal transportation system. In Florida through fiscal year 1999/2000, a minimum of 14.3 percent of all state revenues deposited into the State Transportation Trust Fund must be committed annually by the Department of Transportation for public transportation projects. These may include high speed rail projects. Voters in California recently approved use of motor vehicle fuel taxes for intercity rail programs.

Another taxing source related to the project's construction could be sales taxes. The State of Ohio currently imposes a 5% sales tax with counties having the option to impose additional taxes on their own. State law was not researched as to the purposes for which sales taxes can be imposed but, clearly, public transportation is one purpose since four counties presently have varying levels of sales tax currently in place for such activities. Based on this information, Table 10-5 was prepared. It shows the optional sales tax (apart from the state tax and transit related taxes) currently imposed in each county in Ohio with the collections received for 1990. Because differing counties impose differing levels (from 0.50% to 1.50%), a running rate per 1.00% of imposed tax was computed. Elasticity was not a factor considered with respect to raising or lowering of the level of tax imposed, but rather trying to develop a base figure.

Based on a running rate of 1.00%, the statewide collections for an additional 1.00% of imposed tax would approximate $629.5 million. Assuming that debt service and coverage at 125% would require $328.1 million of revenue annually to fund all $3.1 billion of the system cost, this figure could be achieved with a statewide imposition of an additional 0.5% of sales tax.

A possible tax source that could be applied during project development as well as share in support of construction was also considered -- the Ohio railroad excise tax. This tax raised approximately $5.5 million in 1990 and could, if dedicated to development of high speed rail service, be used to match federal grants or to support project development on a pay-as-you-go or leveraged basis. Other special transportation related excise taxes may also deserve consideration. For example, Pennsylvania recently levied taxes on tires and car rentals to assist with funding public transportation.

10.3 EXAMPLE FINANCING PACKAGES

Of numerous financing plans that have been tested to determine project feasibility, two were chosen for illustrative purposes based on a tax-exempt financing plan predicated on a dedicated tax. First, tax was presumed to be levied in those counties that would benefit by the high speed rail system. This tax was assumed to be imposed for a period of only ten years and generate $228 million annually beginning in the first year, escalating by 3.00% for each year thereafter. Secondly, the system was presumed to cost $3.1 billion with 100 million of capital offset coming from vendor finance, cross-borders leases and the ability of the private sector to finance a portion of the costs by allowing them to retain a portion of the net operating income in an amount sufficient to apply for their debt service and retain a profit or return on capital. Net operating income in excess of these requirements could accrue to the public entity owning the system. This leaves a balance of $3.0 billion of project cost to be financed. This $3.0 billion of project cost was assumed to be incurred in the following amounts each year:

Year 1	5.00%
Year 2	15.00%
Year 3	20.00%
Year 4	25.00%
Year 5	25.00%
Year 6	10.00%

Based on these assumptions, Table 10-6 and 10-7 reflect two financing scenarios. Table 10-6 assumes that coverage on the debt service will not fall below 125% in any of the ten years that tax would be in place. Capital costs then become the variable to be solved. At $1.98 billion, incurred in the above percentages, the first two years of capital can be funded out of cash flow. Debt is then assumed to be issued to fund the balance of the capital at an assumed rate of 7.50% with a final maturity not to extend beyond the terms of the tax. With current rates approximately 1.00% below these rates, this was viewed as a conservative assumption. The balance of the capital costs of $1.02 billion are assumed to be funded with grant monies.

Table 10-7 assumes that grant monies will be received in amounts and timing to pay for 50% of the cost of the system. This amounts to $1.5 billion after the aforementioned $100 million of alternative financing. Based on the financing assumptions, the majority of the system costs can be paid from cash flows from the tax, requiring only $195 million in debt. After the system is built, substantial cash flows emanate from the tax which can be used for other purposes or allow for the tax to be repealed earlier. The nominal maturity for the tax to repay the debt would be approximately seven years.

Table 10-7
OHIO RAILWAY ORGANIZATION
DEBT FINANCING LEVERAGING 10 YEAR MAXIMUM TAX PROGRAM

Public (Non-grant Development Requirement ($ in 000's) 1,500,000

Interest Rate 7.50%

Year	Expenditures as % of Total Cost	Development Requirements by Year	Tax Revenue	Cash Flow Annual Shortfall	Cash Flow Cumulative Shortfall	Net Financing Requirement	Principal Amount of Debt Issued	Debt Service	Cumulative Debt Service	Coverage
1	5.00%	75,000.0	228,000.0	153,000.0	153,000.0	0.0				
2	15.00%	225,000.0	234,840.0	9,840.0	162,840.0	0.0	0.0	0.0	0.0	ERR
3	20.00%	300,000.0	241,885.2	(58,114.8)	104,725.2	0.0	0.0	0.0	0.0	ERR
4	25.00%	375,000.0	249,141.8	(125,858.2)	(21,133.0)	21,133.0	30,000.0	5,664.0	5,664.0	43.99
5	25.00%	375,000.0	256,616.0	(118,384.0)	(139,517.0)	118,384.0	165,000.0	35,152.4	40,816.4	6.29
6	10.00%	150,000.0	264,314.5	114,314.5	(25,202.5)	0.0	0.0	0.0	40,816.4	6.48
7			272,243.9	272,243.9	247,041.4	0.0	0.0	0.0	40,816.4	6.67
8			280,411.2	280,411.2	527,452.6	0.0	0.0	0.0	40,816.4	6.87
9			288,823.6	288,823.6	816,276.2	0.0	0.0	0.0	40,816.4	7.08
10			297,488.3	297,488.3	1,113,764.5	0.0	0.0	0.0	40,816.4	7.29
Total	100.00%	1,500,000.0					195,000.0			

Year	Beginning Balance	Tax Proceeds	Development Requirement	Financing Proceeds	Debt Service	Ending Balance
1	0	228,000.0	(75,000.0)	0.0	0.0	153,000.0
2	153,000.0	234,840.0	(225,000.0)	0.0	0.0	162,840.0
3	162,840.0	241,885.2	(300,000.0)	0.0	0.0	104,725.2
4	104,725.2	249,141.8	(375,000.0)	29,250.0	(5,664.0)	2,452.9
5	2,452.9	256,616.0	(375,000.0)	160,875.0	(40,816.4)	4,127.5
6	4,127.5	264,314.5	(150,000.0)	0.0	(40,816.4)	77,625.6
7	77,625.6	272,243.9	0.0	0.0	(40,816.4)	309,053.1
8	309,053.1	280,411.2	0.0	0.0	(40,816.4)	548,647.9
9	548,647.9	288,823.6	0.0	0.0	(40,816.4)	796,655.1
10	796,655.1	297,488.3	0.0	0.0	(40,816.4)	1,053,327.0

Chapter 11
ECONOMIC BENEFITS

11.1 INTRODUCTION

Although the costs of developing and operating the high speed rail system are substantial, the system will generate significant operational and passenger benefits, in addition to societal, environmental and economic benefits that would accrue to the Ohio region. Particularly since the spending of funds to construct and operate the system will occur at about the time the economy is recovering from a recessionary period, the high speed rail system will generate enough development to improve the Ohio economy at a rate faster than that of the neighboring states, resulting in the attraction and infusion of additional capital resources from outside the state. Key conclusion are as follows:

- Constructing the high speed rail system would result in over $5.5 billion in direct economic output for the state, increasing household earnings by over $1.7 billion and creating 71,000 jobs;

- Ongoing operations activities will result in over $3.2 billion in economic output for the state over a 25-year period following construction of the system, increasing household earnings in Ohio by over $1.2 billion and creating 79,000 jobs;

- Users of the high speed rail system will save the equivalent of $400 million through reduced travel times by not having to use their automobiles for their journeys along this corridor;

- As travellers divert to high speed rail, fewer automobile accidents, injuries and fatalities will result in a total savings to society of $200 million;

- Diverting to high speed rail would save the Ohio environment over 57 million kilograms of hydrocarbons, carbon monoxide and nitrogen oxides;

- Using high speed rail for trips would save over 220 million gallons of fuel that otherwise would have been consumed by private automobiles;

- The total economic benefits of developing and operating the Ohio high speed rail system about to $11.1 billion in 1991 dollars.

11.2 ECONOMIC BENEFITS TO THE STATE OF OHIO

Economic benefits for the state of Ohio will first emanate from constructing the system and the multiplier effects of spending these construction dollars on business and employment activities within the state. Second, continuing economic benefits will accrue from operating and maintaining the system and the economic spin-offs of the expenditures on operating costs, the multiplier effects of these expenditures, and the business and jobs created as a result of the ongoing operations and maintenance of the system.

The initial economic benefits will occur from constructing the high speed rail system, which will require substantial infusions of capital resources. The current estimate for developing the system between Cleveland and Cincinnati is approximately $3.1 billion (1991 dollars), inclusive of contingencies. This includes the trackwork, structures, electrification, signalization, right-of-way, rolling stock and fencing. The direct benefits will be the creation of jobs for the construction of the system, and the business expansion to provide the materials and equipment that need to be purchased.

Table 11-1
TOTAL IMPACTS ON OHIO OUTPUT, HOUSEHOLD INCOME AND EMPLOYMENT FROM CONSTRUCTING THE OHIO HIGH SPEED RAIL PROJECT

Cost Element	Construction Cost (1991 Dollars)	Cost w/ 20% Cont (1991 Dollars)	% of Exp. In Ohio	Ohio Cost (1991 Dollars)	Total Output for Ohio Economy (1991 Dollars)	Household Income (1991 Dollars)	Employment (person years)
Track work	781,874,186	938,249,024	68%	638,009,336	1,582,901,163	496,179,861	20,672
Roadway Preparation	71,608,730	85,930,476	95%	81,633,953	202,533,837	63,486,725	2,645
Structures	304,676,712	365,612,054	97%	354,643,693	879,871,002	275,806,400	11,490
Fencing	52,202,570	62,643,084	100%	62,643,084	155,417,493	48,717,527	2,030
Crossing Protection	36,095,458	43,314,549	0%	0	0	0	0
Yards	44,440,106	53,328,128	68%	36,263,127	89,968,818	28,201,834	1,175
Stations	43,469,798	52,163,758	90%	46,947,382	116,476,455	36,510,979	1,521
Electrification	444,983,249	533,979,899	50%	266,989,949	662,402,064	207,638,084	8,650
Signalization	161,265,190	193,518,228	30%	58,055,468	144,035,617	45,149,738	1,881
Rolling Stock	74,741,000	89,689,200	16%	14,350,272	35,603,025	11,160,207	465
RoW	242,481,000	290,977,200	100%	290,977,200	721,914,433	226,292,968	9,428
Engineering/Management		406,410,840	85%	345,449,214	857,059,500	268,655,854	11,193
TOTALS	**$2,257,838,000**	**$3,115,816,440**		**$2,195,962,679**	**$5,448,183,406**	**$1,707,800,175**	**71,149**

Our projections show that business and non-business travellers alike will save over half a million hours per year by using the high speed rail system in Ohio as opposed to using their automobiles during the first year of operations. These time savings are projected to grow to almost 650,000 hours per year by 2014. These substantial time savings are valued by users, and economic benefits can thus be attributed to the value of the time savings themselves. Using a value of $50 an hour for business travel in Ohio, and $30 an hour for non-business travel, the time savings for the first year of operations will be worth over $24 million. This grows to almost $30 million annually by 2014. On a present value basis, the accumulated time savings for the period between 1996 and 2014 amount to almost $400 million.

By using the high speed rail system, business and non-business travellers will benefit from not having to operate their automobiles. The operating costs of a private automobile include vehicle fuel costs, maintenance, repair, depreciation, insurance, tolls and other operating costs such as vehicle registration fees. We have projected that by the first year of operations, high speed rail users would be saving over $87 million annually by virtue of not having to use their automobiles. These savings grow to over $165 annually by 2014. On a present value basis, the accumulated savings for the period between 1996 and 2014 are projected to amount to over $1.6 billion for business and non-business users.

11.4 SOCIETAL AND ENVIRONMENTAL BENEFITS

Highway traffic, much like air traffic, is vulnerable to adverse weather conditions, reduced visibility and congestion. High speed rail service does not typically suffer under these conditions. Trains are rarely delayed and continue to operate under fog, rain, snow, windy conditions and traffic congestion.

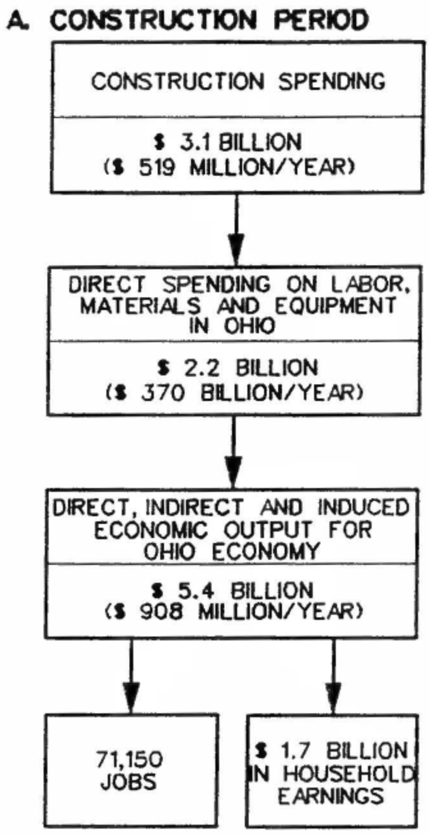
As business and non-business travellers divert to using the high speed rail service away from highway travel, the rail system is expected to save numerous lives along the corridor. The state of Ohio has an average accident rate of 2.1 fatalities per hundred million vehicle miles travelled on interstate highways. If the high speed rail system can divert, as we have predicted, over 198 million vehicle miles away from Ohio's highways, there would be between 4.4 and 5.2 lives saved annually between 1996 and 2014 respectively, close to 50 lives in total. Highway accidents causing property damage occur at a rate of approximately one per 100,000 miles driven. One in ten results in personal injury. Thus, high speed train ridership could also result in an expected reduction of 1,980 accidents and close to 200 injuries annually for the first year of operations; and over 40,950 accidents and 4,095 injuries over the period between 1996 and 2014.

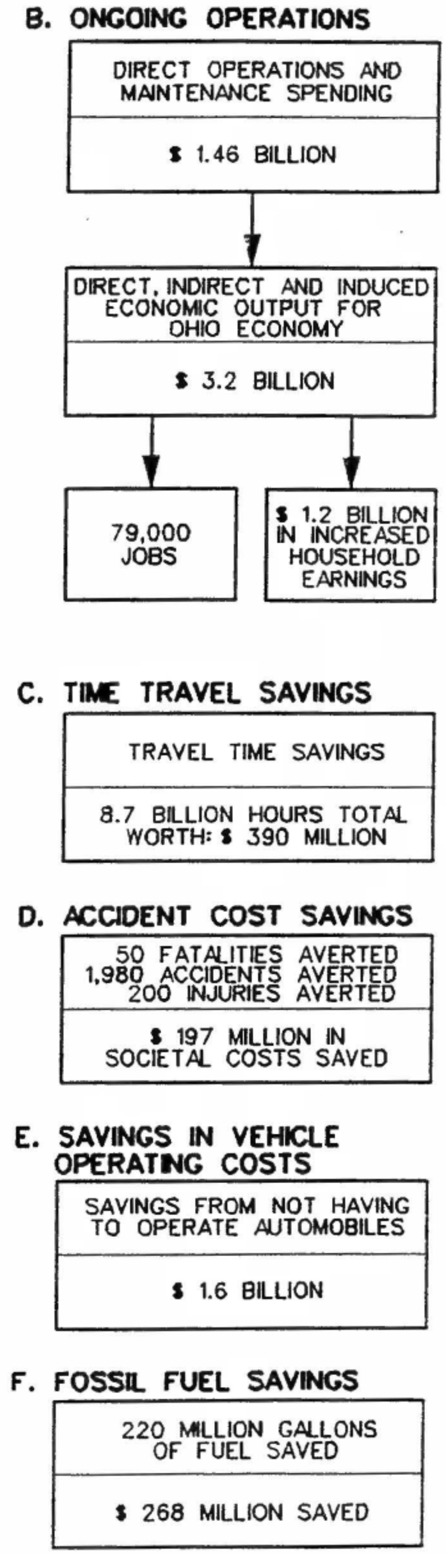
Using the NHTSA's societal cost of motor vehicle fatal accidents (these include medical and legal costs, court awards and property losses), each fatality costs $654,311 in 1991 dollars; each injury $20,000 and each accident involving property damage $2,000. The total costs of fatal accidents averted amount to over $33 million; of injuries, $81.9 million; of accidents, $81.9 million. These savings total $196.8 million in 1991 dollars for the period between 1996 and 2014.

Finally, high speed rail results in substantial environmental savings as an energy efficient mode of surface transportation over certain distances. The state of Ohio can achieve substantial pollution reduction by developing a reliable, high speed rail service. With most of the rail passengers, business and non-business alike, diverted from highway travel, substantial reductions in vehicular emissions will result. Using the figures estimated by the American Public Transit Association for typical commuting trips in the US, and using the national average vehicle occupancy rate, we compared the pollution emitted by rail (measured at the power plants) versus the passenger automobile with the following results: Ohio high speed rail users will save the environment over 6.3 billion grams of hydrocarbons, 45.5 billion grams of carbon monoxide and 4.8 billion grams of nitrogen oxides for the period between 1996 and 2014 by diverting from their automobiles.

We projected the savings in operating costs for users of high speed rail to include the savings of not having to pay for the fuel costs of driving passenger vehicles. From society's standpoint, the savings of

Figure 11.1
SUMMARY OF ECONOMIC BENEFITS OF OHIO HIGH SPEED RAIL





SUMMARY TOTALS

	1991 $'S
A. CONSTRUCTION PERIOD	$ 5.4 BILLION
B. ONGOING OPERATIONS	$ 3.1 BILLION
C. TIME TRAVEL SAVINGS	$ 0.4 BILLION
D. ACCIDENT COST SAVINGS	$ 0.2 BILLION
E. SAVINGS IN VEHICLE OPERATING COSTS	$ 1.6 BILLION
F. FOSSIL FUEL SAVINGS	$ 0.3 BILLION
TOTAL BENEFITS OF OHIO HIGH SPEED RAIL	**$ 11.1 BILLION**

Chapter 12
INSTITUTIONAL CONSIDERATIONS

12.1 INTRODUCTION

High-speed train technologies are proven and an intercity travel market exists for the trains on selected corridors in the United States, corridors such as Cleveland-Cincinnati. In this country, the impediments to high-speed trains are institutional. An effort must be undertaken to modify policies and practices in various levels of government.

Further, implementation of Ohio's high speed rail will require creation of new organizations or major changes to existing ones. These changes will, in time, affect the project's relationships with other institutions. This chapter explores some of the changes which might occur, first in terms of how ownership and management might be structured, then in terms of relationships to various governmental and private institutions.

12.2 OWNERSHIP

The predominance of public funding required for this project suggests that ownership should be vested primarily in a public entity and the intra-state focus of the project suggests an agency of the State of Ohio. Although a new agency could be created by the legislature, it would appear that the Ohio High Speed Rail Authority may be the most appropriate existing public body. Significant expansion of the Authority's staff would be required but, in general, appropriate powers are already available to the Authority to implement high speed passenger rail service. Another alternative may be the Ohio Department of Transportation, but a dedicated Rail Authority appears more likely to focus on the project's advancement.

The preliminary estimates in this report suggest that some elements of the project might be financed privately from project revenues. The most likely candidate for this is the rolling stock although other major elements such as the traction power system, signals and communication systems, stations, and maintenance facility could be privately owned. In considering such options, care must be taken to protect the tax exempt status of as much of the project as possible. Tax exemption and other ownership issues for the rolling stock merit particular attention.

12.3 MANAGEMENT

Related to, but quite distinct from ownership, are the issues of management. For a project which involves investment of three to four billion dollars over a period of ten years, a dedicated, experienced, skillful management team for project design and construction is essential. It must be emphasized, however, that even such a major undertaking has a finite duration which suggests that use of a special purpose organization will facilitate its downstaffing at the completion of construction.

For the decades of high speed rail operation, a multi-year operations contract may be the most cost effective choice. Amtrak has expressed interest in being considered for such a contract and there are other railroad operators and airlines who could be expected to compete. ORO is a possible contender.

For the design and construction phases of the project, ORO is well prepared to assist OHSRA or other owners with total program management and provision of all the services necessary for project implementation. The company knows the project well and includes firms and individuals among the industry leaders for project implementation.

As with the federal government, the support of the legislature as well as departments in the Executive Branch of state government will be essential. It will be important to keep key members of the Assembly and the Senate well informed about the project.

12.6 LOCAL GOVERNMENT AGENCIES

At the local level it is quite clear that all counties, cities and municipalities traversed or served by the project will have important inputs into its planning, design, construction and operation. Some of these inputs relate to mitigation of community impacts, others to such items as coordination of emergency services and maintenance of traffic. ORO has met with representatives of Cincinnati, Dayton, Springfield, Columbus, Mansfield, Brookpark and Cleveland and responded to numerous requests for information. Extensive additional contract with local governments is envisioned.

12.7 ORGANIZED LABOR

Organized labor during construction and operation will be another set of key stakeholders in the project. During construction, operating engineers and many of the construction trades will be called upon for project roles. During preparation of this plan ORO met with representatives of the Brotherhood of Locomotive Engineers, the United Transportation Union and the Brotherhood of Maintenance of Way Employees to explore collaboration for cost-effective operations and maintenance.

Preliminary discussions with organized labor indicates that they are strongly supportive of ORO and will assist, as possible, to make high speed rail in Ohio a reality.

12.8 PRIVATE INSTITUTIONS

Agencies of major private bodies related to the project will be Amtrak and the three private freight railroads impacted by Ohio's high speed rail system -- Conrail, CSX and Norfolk Southern. ORO has met with senior executives of all but Norfolk Southern and verified their interest in/and support of the project. One key interface will be acquisition of right-of-way and/or operating rights from each of the three freight railroads. In addition, these railroads and Amtrak have or are developing track, rolling stock, signal, communication and other technology that may be of use to the project. Thus, continuing relationships at management and technical levels will be vital to the project's success. Amtrak has also expressed a strong desire to be considered a candidate organization for operating the service.

There are in Ohio numerous industry and trade associations, Chambers of Commerce, and service organizations, that will have roles and interests in the project. Each of these will need attention during all phases of project development and operation if the full resources of Ohio are to contribute to the project's success.

Chapter 13
IMPLEMENTATION PLAN

13.1 GENERAL

This chapter outlines major elements of the plan for project implementation in terms of the organizational structure required and in terms of the following four principal activities:

- Design
- Finance
- Construction
- Commissioning

A preliminary construction schedule is shown in Figure 13.1 on the next page. The phasing of major activities and estimated durations are shown. Annual expenditures expressed as a percentage of the total capital cost are shown on the schedule.

13.2 ORGANIZATION

13.2.1 Project Development

When ORO's business plan is accepted by the Ohio High Speed Rail Authority, further project development will be initiated. Although this development will focus primarily on design, environmental, financial, legislative and right-of-way issues to be resolved before construction, this will be done keeping in mind always the ultimate goal: to provide a quality rail transportation service for the 3-C Corridor. Thus even during project development the seeds of organizations for construction, commissioning and operations will be nurtured.

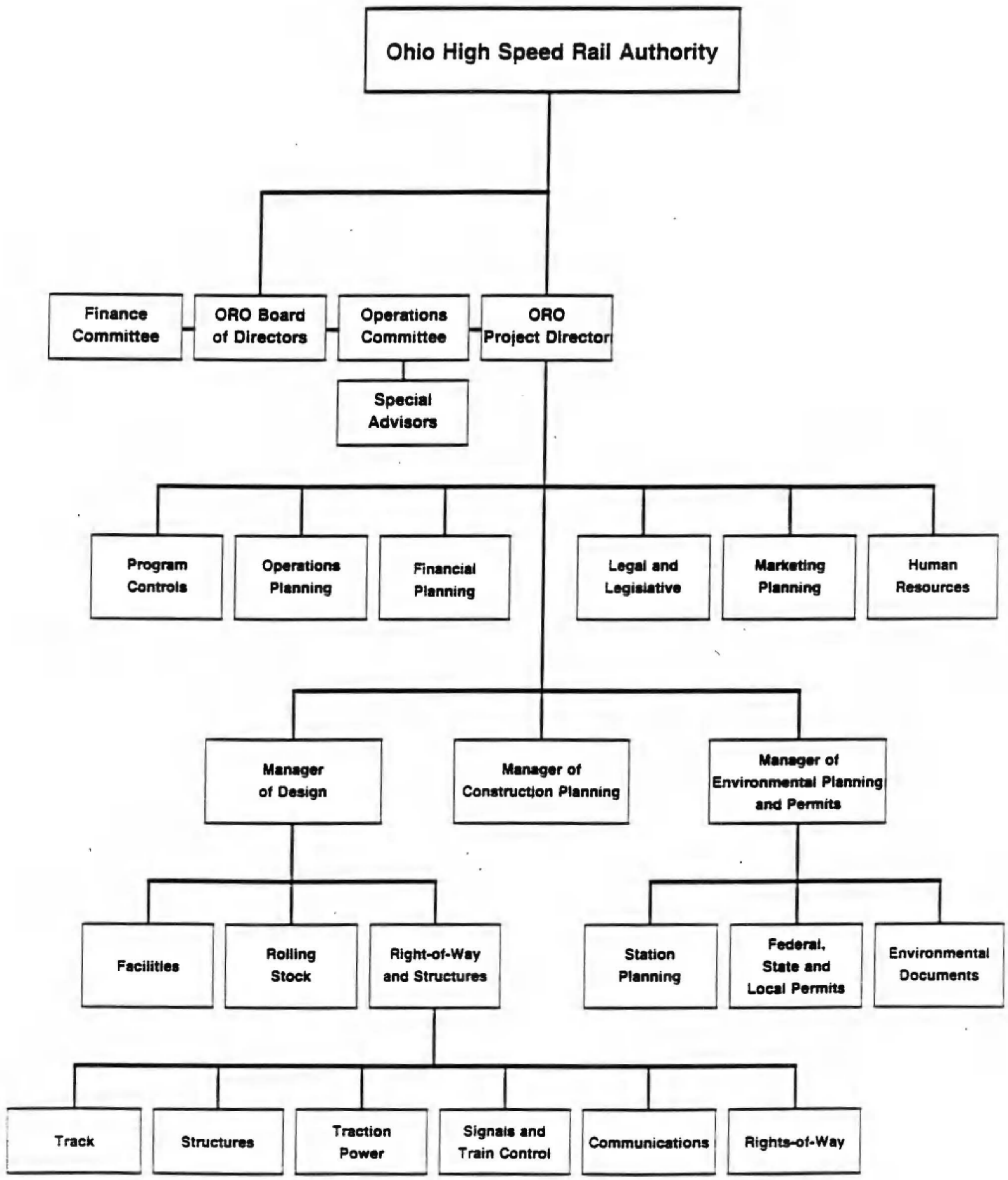
ORO has a key role to play in the development of a public/private project. Because ORO has been instrumental in the project's definition and evolution for several years, has key members ready to advance the project further, and can draw upon its shareholders for rapid deployment of needed resources, it can serve well as the vehicle for both publicly and privately funded project elements.

For publicly funded parts of the project, ORO can serve OHSRA as general program manager in charge of all activities necessary for development of the project. For the privately financed part of the project, ORO can establish the operating entity which must then arrange acquisition of rolling stock and other key operating sub-systems. The essential consideration is that the entire project advance as an integrated enterprise so that the service objectives are achieved timely, yet within budget, to the levels of quality sought for the traveling public.

During design, finance, construction and commissioning, the organization will focus primarily on project management. Figures 13.2 and 13.3 Illustrate organizational structures that can manage the design and construction of a $3 billion project effectively and utilize both public and private resources. Essential ingredients include:

- Configuration management
- Project control -- scope, schedule, budgets
- Quality assurance

Figure 13.2
DESIGN ORGANIZATION



From the point of view of the overall project these are the key functions. Design, finance, construction and commissioning would be defined and controlled by the project management.

Key advisors during this stage of the project include representatives of riders, operators, maintainers of vehicles and track, marketers of the service and owners. The interests of these future "stakeholders" will be represented by various advisory panels and/or individuals to be sure that the project serves primarily the needs of those who will use it for decades rather then the desires of the designers and builders.

During the project's operational life a different organization will be used as represented by Figure 7.1 in Chapter 7. ORO has defined this organization not only as a basis of the O&M estimates, but also to indicate the type and range of skills which will be needed. Many of these skills will need to be developed during the design and construction phase of the project in order to be in place when operations commence.

From the foregoing, it can be seen that ORO's organization will be flexible and continually evolving during the project to meet changing needs. The evolution will be orderly and planned to minimize cost and disruption.

13.3 DESIGN

13.3.1 Mapping

The basis for any further planning, environmental and design development of Ohio's high speed rail system must be up-to-date mapping. Work to date has been based on United States Geological Survey (USGS) maps at a scale of 1:25,000 or about 1"=2000. Although adequate for preliminary planning, these maps are not appropriate for future activities which may require scales of 1"=10' or 1:120 although 1:480 may suffice generally. A computer based geographic information system (GIS) should be developed for the project's alignment as a basis for a series of overlays to represent such things as topography, geology, soils, surface hydrology, development, archeology and historic sites, property boundaries, and various utilities.

These inventories can then be used in various combinations for planning, environmental and design activities.

13.3.2 Design Development

Based on an up-to-date GIS, design can advance for the track and structures as well as for power, signals and communication. Criteria for each of these need to be further defined and then the design and specification advanced. Concurrently, the rolling stock must be designed and industry comment sought on the practicability of alternative methods of procurement. In general, the rolling stock and other designs must advance at the same time with rigorous control of configuration, scope, schedule, budget and quality to be sure of an integrated result. However, it should be remembered that virtually all of the project's elements have already been designed and built somewhere so that the major challenges become communications within the team and between it and the community. Design would typically be advanced to the 25% to 35% stage of development to provide the documentation necessary for evaluation of environmental impacts.

13.5 CONSTRUCTION

13.5.1 Construction Management

Construction management will include the management of specific procurement and construction packages from the time of award to successful completion of the work. This will include the activities of resident engineers, inspectors and associated staff.

To build up a construction management team, its formation will begin early in the design phase of the project to assist in constructability reviews and realistic scheduling for construction.

Matters of configuration management, project control and quality assurance will remain with the program management team.

It is anticipated that the long distance over which construction will occur will require six area managers working within roughly a 25 mile radius of an office as well as specialist managers for procurements such as power, signals, and communications. Rolling stock procurement will also require a specialized organization.

13.5.2 Structures

Structures will include approximately 149 grade separations with roads, 63 cut and cover boxes under roads, 124 medium to major bridges over streams and rivers, 1.1 miles of elevated wetland crossing, 17 railroad grade separated crossings, 72 culverts at minor streams and other minor structures. The total cost of these structures is approximately $300 million.

Because these are discrete project elements, they lend themselves to rapid design by a number of design firms working simultaneously. Structures are expected to be designed and built as soon as right-of-way can be made available so that continuous access along the railroad can be provided. This should minimize disruption to adjacent communities during the remainder of construction and establish early and forcefully Ohio's commitment to high speed rail.

13.5.3 Earthwork

The project's major earthworks will be related to some structures, and its completion will be coordinated with the completion of the structures. ORO's objective is to design the earthwork to be unobtrusive and to arrange for the movement of borrow and fill along the property rather than adjacent public roads and highways. Some 59,000,000 cubic yards of earth and rock are expected to be moved at a cost of roughly $270 million.

13.5.4 Trackwork

Trackwork involves procurement of ballast, ties, rail, fasteners, and special track such as turnouts and their installation. In view of the project's large scale, it will be prudent to procure and store, or schedule delivery times and places for ties, rail, fasteners, special track and other long lead time material. Separate contracts are envisioned for track construction using material supplied by the project. Trackwork standards will be exceptionally demanding and capable contractors and intensive inspection will be required. Trackwork procurements can be made at the same time structures and earthworks are underway so that track installation can follow immediately the completion of earthwork.

In addition to the lengthy procurement process for rolling stock, the rolling stock specification is essential to define a number of track, power, station and signal issues early in the design phase and reduce uncertainty in these interfaces.

Full accessibility to the coaches and appropriate seating arrangements under the Americans with Disabilities Act (ADA) will be required.

13.6 COMMISSIONING

13.6.1 Train Operations and Maintenance

About two years before revenue operations begin, ORO plans to establish the operations and maintenance organization described earlier. This will allow for a careful selection, training and build-up of key operating personnel. Training will include participation in acceptance testing for various project elements. Also required of these key personnel will be final development of operating and maintenance plans and procedures. A series of operations drills, peer reviews, safety reviews and other exercises will also be conducted. These may include brief assignments for ORO employees to Amtrak, TGV, ICE or other high speed rail operators to observe and participate in routine and emergency operations.

13.6.2 Pre-Revenue Testing

The final six months of the construction phase are reserved for pre-revenue testing of each element of the project and for integrated testing of the entire operation. This will include certifications for safety and operations as well as a few days of "open house" to exercise customer relations skills and familiarize the public with the stations, trains and service. Testing and certification will be in accordance with written, carefully designed procedures and will use appropriate industry standards.

Should all go well with the testing phase, revenue service could commence ahead of schedule. However, ORO is committed to have all reasonable assurances of a safe and reliable system before revenue service begins.

13.6.3 Revenue Service

The final step of commissioning will be commencement of revenue service. At this stage, the program management functions of ORO and the organizations for design and construction become essentially part of the project's maintenance team. The objectives for ORO become service to patrons, revenue maximization, service of debt, and maintenance of rolling stock and facilities in top condition.

13.7 COMMUNITY RELATIONS

Throughout project implementation, ORO is committed to pro-active community relations to explain what the project is, why it is needed for Ohio, and how it will be designed, built and financed. ORO invites inquiries from individuals, organizations and the media. When a commitment is made to move forward with the project, a full-time community relations program will be established. During construction and pre-revenue testing, this function will evolve into the marketing and community relations activities of the operating company.

CHAPTER 14
IMMEDIATE ACTION PLAN

14.1 INTRODUCTION

This chapter discusses the next steps required for further development of Ohio's high speed rail project. These immediate actions fall into two groups. First, there are governmental actions to be taken at the state and federal levels. Second, there are technical and private development actions that can be advanced by ORO.

14.2 GOVERNMENTAL ACTIONS

Continued development of high speed rail in Ohio will require renewal of the State's commitment since 1975 to implementation of this quality transportation service. Although it may be premature to commit to the project's construction, the time has come for Ohio to agree in principle to go forward with high speed rail subject to further advancement of the design. Such agreement must include willingness to invest substantial public funds in the activities necessary for project development up to the point of a decision whether to proceed with construction. ORO estimates that three to five years and forty to sixty million dollars may be needed to complete the design, environmental, financial and other investigations which must necessarily precede construction. Not all of the cost must necessarily be borne by the state, but a substantial share can be expected to be derived from Ohio sources. ORO has suggested a minimal sales tax or dedication of railroad excise tax revenues as two possible funding sources.

The other key governmental participant in realization of high speed rail in Ohio is the federal government. In 1990 and 1991 the US Congress in both houses has indicated strong support for establishment of high speed rail in the United States This support has, in turn, provided to the Federal Railroad Administration funds and encouragement that were not in evidence in Ohio's earlier efforts to implement high speed rail service. The current highly supportive thrust of federal participation in high speed rail offers Ohio a great opportunity to seek and define federal partnership for the development and perhaps for the construction of the project. ORO has suggested federal participation in the form of grants, loans, loan guarantees and tax exemptions as options for consideration.

In essence, the majority of the resources for high speed rail in Ohio must come from the state and federal governments. Only with their commitment can the project be implemented and high speed rail become a vital part of Ohio's 21st century transportation system.

14.3 TECHNICAL AND PRIVATE SECTOR ACTIONS

14.3.1 General Approach

In ORO's approach to the major project activities -- design, construction, operations, marketing, management, financing -- must occur simultaneously. For example, at the commencement of design, advice from seasoned specialists in operations and marketing is required to be sure that appropriate designs are prepared. Although the level of activity will vary in each major element over the life of the project, the integration of all of them is essential to the high speed rail system's success.

14.3.2.4 Preliminary Design - System Components, Support Facilities and Stations

Concurrent with the finalization of the alignment and design of the track, design must proceed on a number of other system components and support facilities. The design effort for all systems and facilities must interface closely with the alignment and be coordinated with the train vehicle system. These system components and support facilities which are an integral part of the design include:

- Train control
- Electrification
- Communications
- Maintenance and repair facilities
- Storage yards
- Maintenance of way facilities

For stations, coordination is needed with the communities served, to include community leaders, public interest groups, transit agencies, developers, and utilities. Preliminary designs of the stations will be prepared and coordinated with all interested parties.

The scale, layout, size and style of the stations will be determined. In addition to the functional layout and architectural treatment, preliminary designs will include the structural, mechanical and electrical requirements of the stations. Parking, access roadways and utilities will also be considered.

When preliminary station sites have been identified, all station locations need to be reviewed. In general, the suburban station sites have more flexibility as to the locations. The potential for long-term development in the vicinity of the stations will be identified.

14.3.2.5 Environmental Documents

Environmental report documents to meet federal and state requirements already identified will be prepared. These reports will include a data base that will characterize those components of the natural environment likely to be impacted by the construction and operation of the high speed passenger rail system. Impact areas include those in the immediate vicinity of the rights-of-way and station areas as well as those affected by secondary developmental activities, i.e., new development induced by the system. The assessment will also identify and evaluate areas of particular sensitivity. Component areas will include:

- Ecological resources
- Cultural resources
- Groundwater resources
- Hazardous wastes
- Disposal sites
- Noise-sensitive areas
- Air quality resource inventory

The economic impact of a program of this magnitude will be significant -- affecting virtually all Ohioans. Accordingly, it will be essential to conduct further, more detailed analysis of the economic costs and benefits of the high speed rail system. The economic evaluation will address the following areas:

- Project life-cycle costs
- User costs
- Direct benefits to industry
- Indirect economic impacts/benefits
- Fiscal impacts/benefits
- Induced changes in the structure of Ohio's economy
- Induced development impacts

each preliminary design package. Specialists will be drawn from operating high speed rail organizations, other railroads, consultants, government agencies, and universities. These review sessions will be open to OHSRA members and staff.

14.3.7 Financing

Further development of financing plans will be accomplished concurrent with design, environmental and marketing work. This will require close co-ordination with state and federal entities to refine the mix of public and private resources to be applied to the project. The scheduling of work will also allow more refined estimates of cash flows and judgements about the needs for new revenue sources.

14.4 PRELIMINARY DESIGN SCHEDULE

Two to three years will be required for preliminary design and environmental permit activities. Figure 14.1 illustrates the duration and interrelationship of major elements of the work. The critical path is expected to be mapping, design, right-of-way definition, environmental impact statements, and granting of permits. The alternative critical path may be specification, development and testing of the vehicles.

14.5 STAFFING

For the preliminary design, ORO will establish a project office in Columbus, An average staff size of about 100 people will be required for the work. Consultants will be engaged throughout Ohio to assist with the work and its timely completion.

APPENDIX A

ENVIRONMENTAL REGULATORY REQUIREMENTS

Appendix A
ENVIRONMENTAL REGULATORY REQUIREMENTS

The federal and State of Ohio regulatory requirements that will apply to the high speed rail project are discussed in this section. The listed environmental requirements will be reviewed and any new requirements considered for appropriateness at the time of project initiation.

A.1 FEDERAL REQUIREMENTS

A. National Environmental Policy Act (NEPA)

Under NEPA (42 U.S.C. Section 4332) environmental review is triggered when any "major federal action" will significantly affect the human environment. A "major federal action" includes procedures that require federal permitting, for example: crossing of navigable waters, highway crossings, wetland disruption or when any federal funding is involved in a program or project. NEPA requires that an environmental impact statement (EIS) be prepared and reviewed. Environmental impacts cover a broad range of topics including, historical, cultural, economic, social and ecological review. The proposed railway's application for federal funding would trigger the need for environmental review of the study corridor under this act. Following are several acts which cover NEPA-related concerns.

1. National Historic Preservation Act of 1966

The National Historic Preservation Act of 1966 (16 U.S.C. Section 470) calls upon the Advisory Council on Historic Preservation to advise the President and Congress on matters involving historic preservation. The Council reviews and comments upon activities licensed by the federal government that will have an effect upon properties listed in the National Register of Historic Places, or eligible for such listing. The Archaeological and Historical Preservation Act of 1974 (16 U.S.C. Section 469 et seq.), further defines action to be taken by granting power to the Secretary of the Interior to recover and preserve significant historical or archaeological data threatened by a federal construction project or federally licensed project, activity, or program prior to the commencement of the project.

2. The Endangered Species Act

The Endangered Species Act (16 U.S.C. Section 1531 et seq.) determines the intention of the Congress to conserve threatened and endangered species and the ecosystems on which those species depend. It requires that federal agencies, in conjunction with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service, carry out programs for the conservation of endangered or threatened species. Federal agencies must take necessary actions to insure that projects that are authorized, funded, or carried out by a federal agency are not likely to jeopardize the continued existence of threatened or endangered species, or result in the destruction or adverse modification of critical habitat of such species (50 CFR Parts 17 and 402.)

3. The Wild and Scenic Rivers Act

The Wild and Scenic Rivers Act (16 U.S.C. Section 1271 et seq.) designates certain rivers for preservation. The Act provides that no federal department or agency shall assist by loan, grant, license, or otherwise in the construction of any water resources project that would have a direct adverse effect on the values for which such a river was established, 16 U.S.C. Section 1278.

where less than one acre is affected (where one to ten acres is affected, notification is required and the Corps has discretion whether to require an individual permit) (Section 330.5(a)(26), 330.7). Any activities undertaken during railway construction which fall into these categories are permitted generally under Section 404. Any other construction, grading or filling in or around wetlands, rivers and other water bodies may require an individual Section 404 permit from the Corps of Engineers.

C. Rivers & Harbors Act of 1899, Section 1D

The U.S. Army Corps of Engineers also regulates structures or work in or affecting navigable waters, 33 U.S.C. Section 403; 33 C.F.R. Part 322. The term "navigable waters" is limited to coastal waters and waters used, susceptible to use, or used in the past to transport interstate or foreign commerce, 33 C.F.R. Section 322.2(a). The high speed rail crosses three navigable rivers: the Cuyahoga, the Scioto, and the Great Miami. Construction of a new bridge over a navigable waterway requires a Section 10 permit. Section 10 general permits are similar to Section 404 general permits except that number (4) above, covering structural concrete forms, is not applicable under Section 10, 33 C.F.R. Section 330.5(a)(3), (14), (18), (25) & (26).

The Rivers and Harbors Act of 1899 also delegates authority to the U.S. Coast Guard to regulate construction of bridges over navigable waters under Section 9 of the Act. The Coast Guard exercises its jurisdiction through a permit system. The definition of navigable waterway under Section 9 is generally interpreted much more narrowly by the Coast Guard than by the Corps of Engineers' definition under Section 20. Based on actual use for commercial navigation purposes, the Coast Guard may waive its jurisdiction under Section 9 over all or part of a navigable waterway.

Consequently, because the high speed rail alignment requires bridging over one or more waterways, the project will be coordinated with the appropriate district office of the Coast Guard to determine if jurisdiction has been waived over each affected waterway. If Section 9 is determined to be applicable, the permit application will have to be accompanied by an environmental evaluation discussing alternatives to the proposed project as well as project effects on potential Section 4(f) sites, wetlands, floodplains, threatened or endangered species, wild/scenic/recreational rivers, prime and unique farmland soils, air quality, ambient noise levels, and displacements of residences or businesses. There will also be a need for a water quality (Section 401) certification from the Ohio EPA.

D. Noise Control Act of 1972

Section 17(a) of the Noise Control Act of 1972 (42 U.S.C. Section 4916(a)), establishes decibel-specific noise standards for locomotives and rail cars operated by "carriers." "Carrier" is defined as follows: A common carrier by railroad, or partly by railroad and partly by water, within the continental United States, subject to the Interstate Commerce Act, as amended, excluding street, suburban, and inter-urban electric railways unless operated as a part of a general railroad system of transportation. 40 C.F.R. Section 201.1(c), 49 C.F.R. Section 210.3(b)(2). Depending on the technical system chosen, an argument for exclusion from these noise standards might exist under the above definition.

Should the standards apply, they will require specific maximum noise levels for locomotive operations, rail car operations, car coupling operations, and load cell test stands. These maxima are summarized in table form at 49 C.F.R. Part 210, App. A (see Figure 1). Noise-defective equipment can be moved only as far as the nearest facility where the condition can be eliminated, 49 C.F.R. Section 210.9 and 210.21-.33.

NPDES permit regulations cover only discharges from "point sources" which are defined as "any discernible, confined and discrete conveyances," and include "any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, rolling stock...." O.A.C. Section 3745-33-01(O). Regulated pollutants include those from sewage, industrial waste, and "other waste." O.A.C. Section 3745-33-01(T). NPDES permits would probably pertain to the proposed high speed rail system in terms of discharges of sewage waste from train station terminals or coaches, or liquid wastes generated in cleaning and maintenance of trains if they are discharged directly to state waters.

Should waste disposal be discharged to a existing Publicly Owned Treatment Works (POTW) then OEPA regulations would require an indirect discharger permit instead of the NPDES permit, O.A.C. Section 3745-36-03. POTW's having approved pretreatment programs will issue their own indirect discharger permit instead of the OEPA, O.A.C. 3745-3.

Additionally, O.A.C. Section 3745-31-02(A) requires a permit to install a new disposal system whether the discharge will be directly to state waters or through a POTW. The applicant must install best available technology (BAT) and meet other criteria of O.A.C. Section 3745-31-05 to be issued the permit to install.

C. Hazardous Waste Generator Requirements

Section 3010 of the Resource Conservation and Recovery Act (RCRA) requires generators of hazardous waste to notify U.S. EPA of such activity and to obtain an identification number. 42 U.S.C. Section 6930, 40 C.F.R. Section 262.12. Ohio EPA has been delegated authority to implement the federal RCRA Program in Ohio, O.A.C. Chapter 3745-52.

Waste is considered hazardous if it meets any of the following criteria:

a. if the material exhibits any characteristics of hazardous waste such as ignitability, corrosivity, reactivity or EP toxicity, (soon to be replaced by TCLP analytical method for detection of metals, organics and pesticides) O.A.C. Section 3745-51- 21 thru 24;

b. if the material is listed in 40 C.F.R. Section 261.31-33 as hazardous;

c. if the material is listed in the Ohio Administrative Code as hazardous;

d. if the material is a mixture of waste and hazardous waste listed in (b) and (c) unless the resultant mixture no longer exhibits hazardous waste characteristics or is subject to regulation under Section 402 or Section 307(b) of the Clean Water Act.

It is important to note that O.A.C. Section 3745-51-03(E) places the burden of proving that the waste is not hazardous on the organization or person making the claim.

If any waste resulting from the operation of the proposed rail system is determined to be hazardous, the railroad must comply with O.A.C. Section 3745-52-12. If the railroad generates less than 1000 kg. of a hazardous waste not listed as "acutely hazardous" in a month, the railroad is a "small quantity generator" of that waste for that month. O.A.C. Section 3745-51- 05. As such, the railroad is exempt from the generator rules so long as it observes the conditions of the exemption contained in O.A.C. Section 37435-51-05(a).

If the proposed rail system stores hazardous waste for more than 90 days, or treats or disposes of it, a hazardous waste permit will also be needed.

these requirements only "imperative and unavoidable" circumstances will allow a designated nature preserve to be given an alternate use. State nature preserves potentially affected by the Ohio Speed Rail are shown in Chapter 6, Table 6.4.

H. Soil and Water Conservation

Any projects requiring new or relocated structures that will disturb or change the surface or subsurface of the land must submit a plan to the ODNR Division of Real Estate and Management, and the Soil & Water Conservation Division for review. O.R.C. Section 1511.02. This review will include analysis of project impacts on erosion and drainage.

I. Historic Preservation

The State of Ohio addresses the National Historic Preservation Act of 1966 by conducting a thorough review of potential impacts on historical and archaeological sites for a planned project under 36 CFR Part 800 (Section 106 Review). All projects potentially impacting historical or archaeological sites, such as the proposed High Speed Rail, must coordinate the project with the State Historic Preservation Office (in Ohio, this is the Ohio Historical Society).

APPENDIX B

OPERATIONS AND MAINTENANCE

STAFF REQUIREMENTS AND RESPONSIBILITIES

Appendix B
OPERATIONS AND MAINTENANCE STAFF REQUIREMENTS AND RESPONSIBILITIES

The operations and maintenance staff positions and the responsibilities are discussed in this section. The operations and maintenance organization chart is in Chapter 7, Figure 7.1.

B.1 PRESIDENT

The President directs all aspects of system operations and administration. One secretary is assigned to the President's office.

B.2 VICE PRESIDENT FOR ADMINISTRATION

The Vice President for Administration supervises personnel operations, procurement, finance, sales and marketing, and station operations. One secretary is assigned to this office.

B.2.1 Director for Personnel

The Director for Personnel is responsible for supervising benefits and the hiring of staff; assisted by two personnel analysts and a secretary.

B.2.2 Director for Procurement

The Director for Procurement is responsible for contracting services such as elevator and escalator maintenance, specialized personnel training, and safety training and inspections; also manages contracts for station cleaning services, automotive vehicle maintenance, the purchase of consumables, and material for the operations and maintenance organizations. The director has a staff of four procurement specialists and one secretary.

B.2.3 Director for Finance

The Director for Finance is responsible for the payroll and revenue collection; disburses funds for contract services and material purchases; audits financial operations. The staff consists of three financial specialists, eight revenue collectors and a secretary.

B.2.4 Director for Sales/Marketing

The Director for Sales/Marketing supervises advertising; the sale of advertising space in the stations; coordination of ticket sales by travel agents; and supervises the catering operations. The director is assisted by a sales and marketing specialist, a Manager for Catering Service, and a secretary.

operators' home stations, which eliminates providing overnight accommodations and premium pay. Six trainsets will operate from 0600 hours to 0130 hours. Two of the trains will operate only during the peak travel periods. For 365-day operations, 25 operators are required.

- One conductor and one assistant conductor are assigned to each train. They work the same runs as the operators. Twenty-five conductors and 25 assistant conductors are required for 365-day operations.
- Two switch engineers are assigned at the yard on the first and second shifts. One switch engineer is on the third shift. To staff this operation 365 days, eight switch engineers are required.
- Two yardmen are assigned on the first and second shifts. One yardman is on the third shift. To staff this operation 365 days, eight yardmen are required.

B.4.2 Director for Central Traffic Control

The Director for Central Traffic Control (CTC) supervises the CTC Managers, Traffic Dispatchers, Power Supply Managers, and their assistants and is assigned one secretary.

- One CTC Manager, Traffic Dispatcher, and Power Supply Manager is assigned on each eight hour shift (three shifts) with the CTC operational 24 hours daily. Five personnel are required for each position for 365-day operations.
- One assistant works with the Traffic Dispatcher and one with the Power Supply Manager on the first two shifts (primary periods of revenue service). One assistant is assigned to support both positions on the third shift. Eight assistants are required for 365-day operations.

B.4.3 Director for Labor Relations

The Director for Labor Relations works with all elements of the organization; assisted by a labor relations specialist and a secretary.

B.4.4 Director for Training and Safety

The Director for Training and Safety directs the development and conduct of safety training and inspections. The staff consists of four training/safety specialists and a secretary.

B.5 ASSISTANT VICE PRESIDENT FOR ENGINEERING AND MAINTENANCE

The Vice President for Engineering and Maintenance supervises the maintenance of equipment and the maintenance-of-way operations; assisted by two Directors and a secretary.

Appendix C

MAINTENANCE MATERIAL

AND OTHER COSTS COMPUTATIONS

Appendix C
MAINTENANCE MATERIAL AND OTHER COSTS COMPUTATIONS

The annual material costs for rolling stock is based on the train miles operated for depot maintenance and the capital cost for the repair shop. Coach rebuilding is calculated as a percentage of the initial capital cost. The structures and systems maintenance costs are calculated as a percentage of the initial capital cost.

Other costs are based on the experience of operating railroads and estimated costs for the Ohio high speed rail system.

C.1 MAINTENANCE OF EQUIPMENT (M.O.E.)

C.1.1 Depot Maintenance

Material costs are based on a factor of 0.0069% of the purchase cost of the rolling stock per each 1,000 miles of train operations plus 6% of the total for warehouse and supply charges. The annual cost is ([0.000069 x $74,741,400] x [3,036,800/1000] / 8) x 1.06 = $2,075,116 or $2,075,000 annually.

C.1.2 Repair Shop

Annual material costs are based on 1% of purchase cost of the rolling stock including maintenance-of-way equipment. The cost is (0.01 x $74,741,400) = $747,414 or $747,000 annually

C.1.3 Coach Rebuilding/Refurbishing

The coaches will be rebuilt/refurbished every nine years at a cost estimated at 25% of the original cost. The funds set aside annually to rebuild the 24 coaches are ([$1,400,000 x .25} x 24 / 9) = $933,333 or $933,000. Maintenance of the power units is performed as required and incorporated in the depot and repair shop funding.

C.2 MAINTENANCE-OF-WAY (M.O.W)

The cost to maintain the system is based on the initial capital cost, projected service life, and the percentage of each system component to be renewed during its service life. An overhead rate is applied to the annual maintenance cost for each component of the infrastructure.

C.2.6 Building/Stations

The material cost for buildings and stations renewed during the service life is \$51,000,000 x .20 x 1.06 = \$10,812,000. The average annual material cost for buildings/stations is \$10,812,000/50 years = \$216,240 or \$216,000.

C.2.7 Drainage/Roads/Fences

The material cost for drainage, roads and fences renewed during the service life is \$106,000,000 x .15 x 1.20 = \$19,080,000. The average annual material cost for drainage/roads/fences and miscellaneous items is \$19,080,000 / 30 years = \$636,000.

C.3 OTHER COSTS

C.3.1 Contract Services

Services will be contracted for the maintenance of elevators, escalators, and automobiles. Other services such as legal representation, advertising and track geometry inspections which do not justify a permanent staff will be contracted. An allowance of \$2,000,000 is provided for these contracts.

C.3.2 Energy

The energy cost calculation assumes the use of 20 kWh trainset miles at an average cost of \$0.06 per kWh. An additional 1.5% is added for shunting of train-sets during non-revenue service hours. An annual allowance of \$400,000 for house power for the stations and yard and shops is provided. The estimated annual energy cost is (3,036,800 x 20 x 0.06) x 1.015 + 400,000 = \$4,098,822 or \$4,100,000.

C.3.3 Station Cleaning

Station cleaning will be performed under contract with janitorial service companies. The estimated cost for this service is \$50,000 per year for each of the large stations (Cleveland, Columbus and Cincinnati). An annual cost of \$35,000 is estimated for each of the other six stations. The total annual cost for janitorial service is \$360,000.

The cost of operating, cleaning and maintaining parking lots at the stations is assumed to be offset by revenue from the lots.

C.3.4 Commissions to Travel Agents

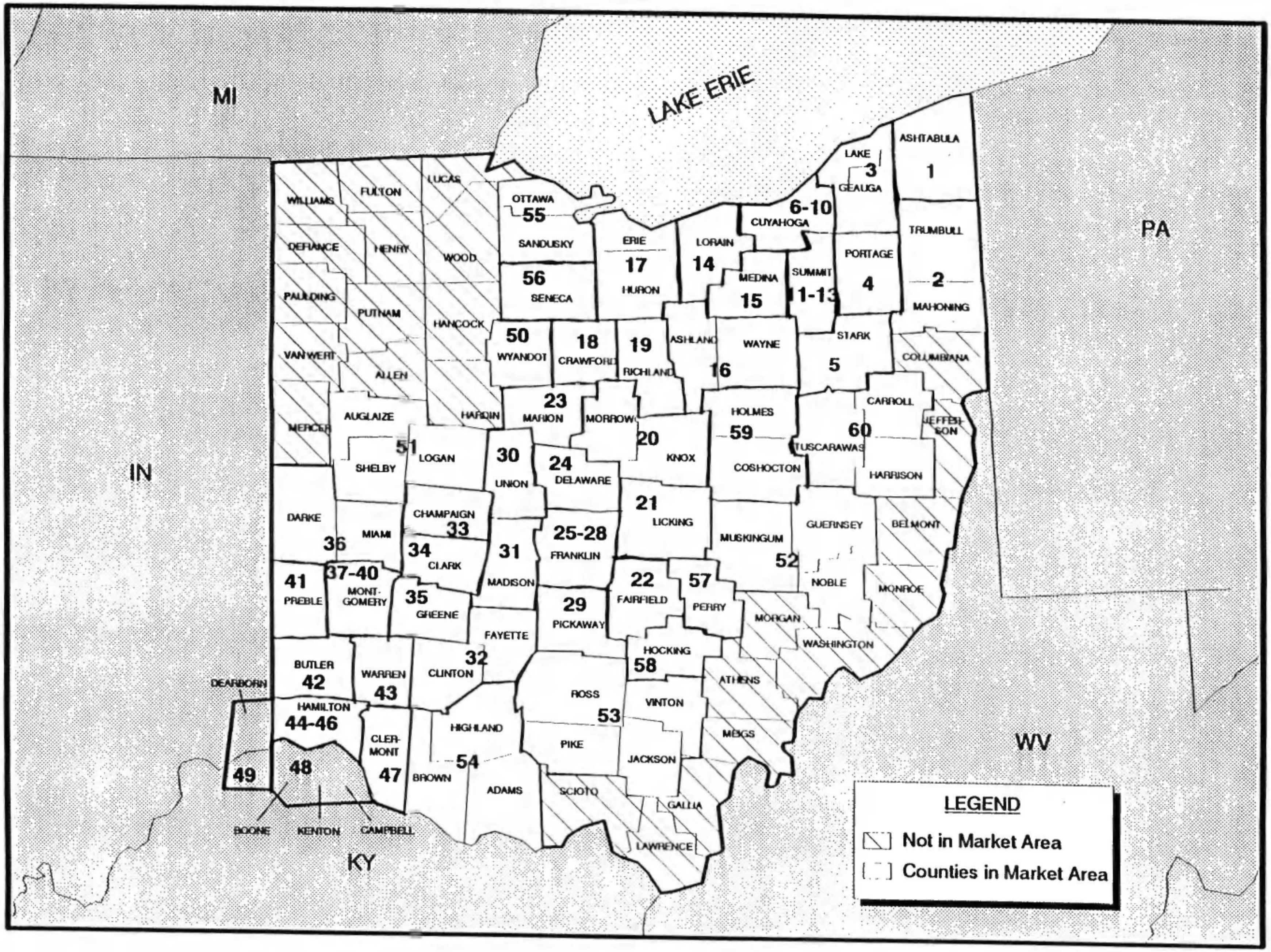
Travel agents will receive a 10% commission on the cost of tickets sold. The annual commissions paid travel agents are estimated as \$2,000,000.

C.3.5 Train Cleaning Supplies

Consumable cleaning supplies are estimated to cost \$100,000 per year.

APPENDIX D

OHIO SOCIO-ECONOMIC DATA



OHIO NEW ZONE SYSTEM

FIGURE D.1

OHIO SOCIO-ECONOMIC DATA

ZONE	1988 HH	1988PCI	2010 HH	2010PCI
1	36315	10315	37770	17580
2	187050	11615	190754	18118
3	105938	14267	135022	24181
4	48998	11670	59395	20397
5	140026	12074	165994	19575
6	302459	14883	296906	21376
7	3032	14883	2977	21376
8	76322	14883	74920	21376
9	19119	14883	18768	21376
10	162437	14883	159455	21376
11	118779	13393	120582	20521
12	7558	13393	7673	20521
13	71855	13393	72946	20521
14	96551	11638	109301	18655
15	40812	13556	56102	24520
16	52719	11699	59741	20332
17	49798	12246	56865	20482
18	18729	10484	20276	18364
19	47419	12048	45969	19704
20	26689	10505	32389	19177
21	46836	12031	56750	19688
22	35698	12182	44614	21310
23	24045	10203	25041	16809
24	22079	13554	33418	23749
25	143941	13766	180875	21431
26	9012	13766	11324	21431
27	71088	13766	89328	21431
28	144832	13766	181994	21431
29	15254	10440	18034	17736
30	11472	12125	16459	19553
31	12632	10802	16021	19626
32	23550	10987	28258	19687
33	12836	10714	14978	19460
34	55831	11940	59901	18997
35	46816	12826	52429	20085
36	54419	12242	61915	21530
37	33241	13400	36424	20145
38	529	13400	579	20145
39	101427	13400	111141	20145
40	86996	13400	95327	20145
41	14263	11254	17907	21939
42	100661	12683	118934	20131
43	36970	12150	46426	22477
44	108045	14452	116799	20913
45	2181	14452	2358	20913
46	228431	14452	246939	20913
47	50467	11721	76278	20680
48	101024	11845	134762	20572
49	14046	11575	21220	19308
50	8167	11992	9237	22004
51	47148	11499	59652	20098
52	50102	10338	55812	17917
53	48396	9381	59314	15831
54	34593	9097	45832	18219
55	37708	13176	42354	22363
56	21444	10843	21522	17968
57	11455	8893	15391	16541
58	9679	9382	12318	17070
59	23529	9330	29922	17449
60	47709	10499	54538	18598

HH = Households
PCI = Per Capita Income

Appendix E

STATION TO STATION ANNUAL RIDERSHIP AND REVENUE

Table E-1
OHIO HIGH SPEED RAIL
SUMMARY TRIP TABLE
ANNUAL BUSINESS TRIPS - YEAR 1991

DISTRICT PAIR		AUTO TRIPS	AUTO SHARE	AIR TRIPS	AIR SHARE	RAIL TRIPS	RAIL SHARE	TOTAL TRIPS
Cleveland	-Mansfield	351442	.89	0	.00	44629	.11	396071
Cleveland	-Columbus	816387	.80	21925	.02	188077	.18	126389
Cleveland	-Springfield	103825	.69	13700	.09	32538	.22	150063
Cleveland	-Dayton	13669	.77	956	.05	3234	.18	17859
Cleveland	-Cincinnati	169344	.59	75094	.26	43075	.15	287513
Cleveland	-Other Ohio	586857	.94	2454	.00	36275	.06	625586
Akron/Canton	-Columbus	505256	.91	5598	.01	42875	.08	553729
Akron/Canton	-Springfield	1321	.85	129	.08	109	.07	1559
Akron/Canton	-Dayton	35226	.70	6548	.13	8363	.17	50137
Akron/Canton	-Cincinnati	68412	.66	18691	.18	16417	.16	103520
Akron/Canton	-Other Ohio	48525	.96	991	.02	825	.02	50341
Mansfield	-Columbus	555035	.83	0	.00	111728	.17	666763
Mansfield	-Springfield	6233	.82	0	.00	1396	.18	7629
Mansfield	-Dayton	8061	.82	0	.00	1787	.18	9848
Mansfield	-Cincinnati	24180	.77	142	.00	7285	.23	31607
Mansfield	-Other Ohio	35727	.96	6	.00	1296	.03	37029
Columbus	-Springfield	901048	.90	0	.00	100252	.10	1001300
Columbus	-Dayton	1889297	.92	184	.00	160720	.08	2050201
Columbus	-Cincinnati	1423811	.85	7082	.00	245040	.15	1675933
Columbus	-Other Ohio	17986467	.96	8255	.00	67621	.04	1872343
Springfield	-Cincinnati	304768	.85	0	.00	53377	.15	358145
Springfield	-Other Ohio	33903	.76	487	.01	10225	.23	44615
Dayton	-Cincinnati	4069058	.98	0	.00	62933	.02	4131991
Dayton	-Other Ohio	88823	.80	6454	.06	16381	.15	111658
Cincinnati	-Other Ohio	227627	.86	14713	.06	21313	.08	263653
Other Ohio	-Other Ohio	13031	.94	229	.02	651	.05	13911
TOTAL		**14077333**	**.91**	**183638**	**.01**	**1278422**	**.08**	**15539393**