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**Federal Railroad
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Final Programmatic Environmental Impact Statement

Maglev Deployment Program
Volume I

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13. ABSTRACT (Maximum 200 words)
The Maglev Deployment Program, as authorized by Congress in the Transportation Equity Act of the 21st Century (TEA 21), encourages the development and construction of an operating transportation system employing magnetic levitation. Magnetic levitation (Maglev) is an advanced transportation technology in which magnetic forces lift, propel, and guide a vehicle over a specially designed guideway with cruising speeds of up to 483 km/h (300 mph). In order to comply with the TEA 21 legislation, the Federal Railroad Administration (FRA) is conducting a competition among seven state participants for the purpose of demonstrating the use of Maglev. To satisfy the requirements of the National Environmental Policy Act, FRA with the assistance of the John A. Volpe National Transportation Systems Center has prepared and distributed a Draft Programmatic Environmental Impact Statement (DPEIS). In response to the public and agency comment on the DPEIS, FRA has refined the DPEIS that is now considered the Final Programmatic Environmental Impact Statement (PEIS). The PEIS is comprised of two volumes. Volume I is the DPEIS as revised by FRA in light of agency and public comment. Volume II contains the agency and public comments and FRA's specific responses to those comments.

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Final Programmatic Environmental Impact Statement

Maglev Deployment Program

Office of Railroad Development
Washington, D.C. 20590

Date

S. Mark Lindsey
Acting Deputy Administrator
Federal Railroad Administration
U.S. Department of Transportation

This Final Programmatic Environmental Impact Statement (PEIS) has been prepared in two volumes to satisfy the requirements of the National Environmental Policy Act (NEPA) for the Maglev Deployment Program. The Program encourages the development and construction of a public transportation system using magnetic levitation, capable of safe speeds in excess of 386 kilometers/hour (240 miles/hour). Magnetic levitation (Maglev) is an advanced transportation technology in which magnetic forces lift, propel, and guide a vehicle over a specially designed guideway. Through a nation-wide competition, FRA selected seven states or state designated authorities, from a pool of eleven, to receive grants for pre-construction planning. Those seven state projects are considered the Action Alternatives in this PEIS. This document presents the purpose and need, alternatives, a description of the affected natural and human environments, and an assessment of the consequences with potential mitigation for each of the sub-alternatives as well as for the No-Action Alternative.

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EXECUTIVE SUMMARY

INTRODUCTION

The Maglev Deployment Program (the Program), as authorized by Congress in the Transportation Equity Act of the 21st Century (TEA 21), encourages the development and construction of an operating transportation system employing magnetic levitation, capable of safe use by the public at a speed in excess of 386 kilometer/hour (km/h) (240 miles/hour (mph)). Magnetic levitation (Maglev) is an advanced transportation technology in which magnetic forces lift, propel, and guide a vehicle over a specially designed guideway. Utilizing state-of-the-art electric power and control systems, this configuration eliminates contact between vehicle and guideway, and permits cruising speeds of up to 483 km/h (300 mph), or almost two times the speed of conventional high-speed rail passenger service.

In order to comply with the TEA 21 legislation (see Appendix B), the Federal Railroad Administration (FRA) is conducting a competition to select a project for the purpose of demonstrating the use of Maglev to the American public. In mid-1999, the Secretary of Transportation selected seven states or state-designated authorities from a pool of eleven applicants to receive grants for pre-construction planning of their Maglev Alternatives. The seven sponsoring participants are located in California, Florida, Georgia, Louisiana, Maryland, Nevada, and Pennsylvania.

To satisfy the requirements of the National Environmental Policy Act (NEPA), FRA, as lead agency, has determined that the Program constitutes a major Federal action with the potential to have a significant effect on the environment. Accordingly, FRA prepared and distributed a Draft Programmatic Environmental Impact Statement (DPEIS) that described the Program and the environmental impacts associated with its possible implementation. The DPEIS also served to encourage public involvement and to address agency and public concerns. FRA required each of the seven participants to prepare an environmental assessment and these environmental studies formed the baseline data in the FRA's preparation of the DPEIS. In response to the public and agency comment on the DPEIS, FRA has refined the DPEIS that is now considered the Final Programmatic Environmental Impact Statement (PEIS). The PEIS is comprised of two volumes. Volume I is the DPEIS as revised by FRA in light of agency and public comment. Volume II contains the agency and public comments and FRA's specific responses to those comments. FRA very much appreciates the time and effort and the comments and suggestions that were provided by various federal, state and local agencies and the general public.

As a programmatic environmental impact statement, the PEIS analyzes the environmental and related impacts associated with the Maglev Deployment at a level of detail commensurate with the program level decisions about the program that are being made at this stage. After completing this PEIS, FRA will administer a selection process that could lead to the selection of one project to receive authorized construction funding. FRA will prepare a project-specific environmental impact statement for any Maglev

Alternative proposed for construction with Federal funding provided through the FRA.

PURPOSE AND NEED FOR THE ACTION

The FRA's mission is to promote railroad transportation that meets both current and future needs of the Nation. The Program is intended to demonstrate Maglev technology as a next generation of America's high-speed ground transportation by identifying a viable Maglev project in the U.S., and assisting a public/private partnership formed to plan, finance, construct, and operate the project.

The deployment of Maglev systems would partially address several of the main problems associated with inter- and intra-regional transportation in the U.S. Maglev would serve as an alternative transportation system, alleviating the congestion in airway and automotive corridors that results from increasing travel demand, and would extend the usefulness of existing airport and highway infrastructure.

Associated benefits could include:

- Regional economic development
- Joint development at stations
- Support of comprehensive land use planning
- Improved air quality
- Reduced consumption of non-renewable resources
- Increased productivity of business travelers

The high performance of Maglev transportation would provide air-competitive trip times at longer trip distances than other high-speed ground transportation (HSGT) alternatives. In addition, Maglev technology would potentially maximize the utilization of airports' potential, by providing inter-modal connections between airports and business districts, thereby supporting airports as centers for inter-modal transfer and travel. By providing a high-speed link connecting two or more airports serving a single region, additional air travel demand can be shifted to under-used airports with additional capacity instead of requiring the expansion of existing airports.

PUBLIC INVOLVEMENT

The success of the Maglev Deployment Program hinges on involving the affected public and incorporating their input. Each of the seven participants has initiated public involvement programs, and the scope of their programs are described in each participant's environmental assessment.

FRA published a Notice of Intent to prepare a PEIS on December 29, 1999. The FRA published a Maglev Deployment Program webpage on the agency's internet site (http://www.fra.dot.gov/o/hsgt/maglev.htm). This PEIS is available on an accompanying webpage (http://www.fra.dot.gov/s/env/MagPEIS).

The DPEIS was approved by the Federal Railroad Admnistration on June 29,2000 and made available at (http://www.fra.dot.gov/s/env/MagPEIS.htm). The DPEIS was also sent to major stakeholders, identified by the states, for review and comment. In addition, copies have been sent to libraries within the each of the seven alternatives.

An official comment period commenced after distribution of the DPEIS, and closed September 19, 2000. Interested parties were invited to submit comments on the DPEIS and could send them to the Federal Docket Management System or to the FRA (see Volume II of this FEIS).

After release of the DPEIS, public information meetings were held in the vicinity of each of the seven Maglev Altenatives. Locations and dates of the public information meetings were advertised locally. FRA held a public hearing on the DPEIS on August 24, 2000, in Washington, D.C. Comments received during the public information meetings, public hearing, and the Docket Management System were incorporated in this PEIS, and are addressed in Volume II of this PEIS.

ALTERNATIVES

High-Speed Ground Transportation (HSGT) Background. FRA has been evaluating rail and Maglev realated HSGT systems that could satisfy city-to-city transport for a number of years. Options that FRA has elvaluated include:

- **Accelerail.** Accelerail consists of upgrading intercity rail on existing rail corridors, which mostly share rights-of-way with freight traffic. Top speeds are in the range of 145 to 241 km/h (90 to 150 mph). One Accelerail example is the Empire Regional service between New York City and Albany, NY.
- **New High-Speed Rail (HSR).** New HSR systems represent the advanced steel-wheel-on-rail sytems that operate on almost exclusive rights-of-way. Using electric propulsion, these systems achieve revenue service operating speeds of 300 km/h (186 mph) and have achieved a record speed of 515 km/h (320 mph). HSR examples include Japan's *Shinkansen*, France's *train a grande vitesse* (or TGV), and Germany's Intercity Express (ICE). At the higher speeds, maintaining HSR systems becomes more costly than Accelerail. However, information from the French TGV manufacturers suggest that this system could be used on new projects in sustained revenue service speeds of up to 350 km/h (217 mph).
- **Maglev.** Magnetic levitation (Maglev) uses magnetic forces to lift, propel, and guide the train over a special guideway. The power to propel the train is provided in the guideway. Maglev does not require wheels or other mechanical parts at higher speeds for support or propulsion. Without wheels or other components to cause resistance, cruising speeds up to 500 km/h (310 mph) are practical. This speed would allow Maglev to achieve air-competitive trip times at longer trip distances than other HSGT options (FRA, 1997).

FRA has identified a number of factors that are relevant to transportation planners in deciding which type of HSGT will satisfy the transportation needs of particular corridors. These include:

- Faster Trip Times.
- High Reliability During Peak Demand
- Convenience
- Shared Corridors
- High Capacity

- Safety
- Petroleum and Independence

ALTERNATIVE MAGLEV TECHNOLOGIES

The concept of magnetically levitated trains was first identified almost 100 years ago. In 1968, two Americans (Danby and Powell) were granted patents on their Maglev design. Since then, extensive research on Maglev technologies has been conducted in several countries, including the U.S., Germany, and Japan have the most experience in technology development. Both have test tracks and have performed extensive testing of vehicles, systems, and guideways.

There are two Maglev technologies being proposed for the Maglev Deployment Program. Of the seven participants, all but one chose the German-developed Transrapid International (TRI) TR08 system (see Appendix C). Florida DOT chose the Maglev 2000 technology, which is based on the original Danby/Powell design. There are significant differences between the two technologies. The major technical characteristics of the two Maglev technologies are summarized below.

Transrapid International (TRI) Maglev System

Suspension and Guidance - The TRI train vehicle wraps around the guideway to securely hold and guide the vehicle. The vehicle is supported and guided by electromagnetic forces between electromagnets attached to the guideway and permanent magnets housed on the underside of the vehicle. The gap between the top of the guideway and the underside of the vehicle is electronically maintained at about 1 cm (0.4 in).

Propulsion - Unlike conventional trains, the TRI propulsion system is in the guideway, not the vehicle. A traveling magnetic field in the guideway propels the vehicle. By adjusting the frequency of the electric current in the guideway, speed is controlled.

Guideway - The guideway structure is usually a continuous “T” shape that can be elevated on typical bridge style columns, mounted at grade on a continuous foundation, or using other configurations. The guideway structure can be fabricated from steel or concrete. A unique steel guideway crossover has been developed to enable switching to adjacent guideway.

Train - Train consists comprise two or more vehicles. Seating capacity depends on consist length and can be approximately 240, 340, and 440 seats respectively for the 3-, 4-, and 5-section TRI train sets. A three-section train weighs 189 metric tons (416,674 lbs), when loaded.

Control/Communications/Electric Substations - Trains are controlled and monitored from a central operations center, and the system is fully automated.

The guideway is powered from electric substations located along the guideway structure.

Stations/Maintenance Facility - Stations could resemble conventional rail stations. However, for safety considerations, doors on platforms would prevent access to the guideway, opening only when passengers are accessing the train. A maintenance facility is required for vehicle servicing, maintenance, and storage.

Safety - The system is inherently safe as the vehicle carriage wraps around the "T" shaped guideway, severely restricting derailment. The train's location is monitored from the control center at all times, and on-board attendants can assist in emergencies. In the event of an unscheduled stop, the train will have the capability to continue to an auxiliary stopping area, from where passengers can disembark. The TRI design will be required to satisfy the requirements pertaining to fire safety, emergency planning, emergency exits, special lighting, and signage in the FRA's Passenger Equipment Safety Standards (49 C.F.R. Part 238).

Maglev 2000 System

Suspension and Guidance - The Maglev 2000 vehicle is supported and guided by electromagnetic forces induced in the guideway. The repulsive forces levitate the vehicle to a substantial gap of 15 cm (6 in) above the guideway.

Propulsion - The Maglev 2000 system employs a linear synchronous motor, in which electric current introduced into the propulsion windings on the guideway interacts with the high field strength superconducting magnets on the vehicle to produce a longitudinal thrust that keeps the vehicle moving.

Guideway - The guideway structure is composed of a single hollow reinforced concrete box-beam. Attached to the sides of this structure are thin panels of polymer concrete in which are imbedded aluminum wire loops that act to levitate, guide, and propel the vehicle. The M2000 guideway is designed with a high-speed electronic switch that enables movement between tracks without mechanical means.

Train - The vehicle carries 92 passengers and has four wheelchair positions. The vehicles are designed to operate as single units, but can be coupled into 2 or 3 car consists, allowing for a passenger carrying capacity of up to 276 people. The system has been designed to allow for freight carrying capability in vehicles designed to transport containers or truck trailers.

Control/Communications/Electric Substations – Movement of the M-2000 vehicles on the Maglev 2000 system would be controlled from a central traffic facility and not by operators on the individual vehicles. Sensors on the guideway will instantaneously determine the location and speed of all vehicles, and transmit the data back to the central facility. A 69 kv alternating current (AC) power line running the length of the guideway provides power to the system, and transformers spaced about every 10 km (6 mi) reduce the voltage to 6 kv direct current (DC).

Stations/Maintenance Facility - The Maglev 2000 train stations would resemble conventional rail stations. The operations control facility will be located at the maintenance facility.

Safety - The guideway is elevated above grade to restrict access, and all portions of the guideway are continuously monitored by the central control facility, both by video cameras and guideway sensors. If levitation were to fail due to an event such as the collision of the vehicle with an external object on the guideway, the system is designed so that the vehicle would come down safely on the guideway and slide to a controlled, non-injurious stop. The Maglev 2000 will be required to satisfy the requirements pertaining to fire safety, emergency planning, emergency exits, special lighting, and signage in the FRA's Passenger Equipment Safety Standards (49 C.F.R. Part 238).

ALTERNATIVES IDENTIFIED FOR FURTHER ANALYSIS

Action Alternative. The action alternative includes seven location alternatives as follows:

California - The California Maglev Alternative corridor extends between Los Angeles International Airport (LAX) through to Union Station in downtown Los Angeles (LA) (and further east to Ontario International Airport (ONT) and then March Air Reserve Base, a distance of approximately 133 km (83 mi). The area is mostly developed. The project is planned to be a part of and compatible with, the larger north-south high-speed rail system proposed to serve the entire state. The California Business, Transportation, and Housing Agency is developing this project.

Florida - A 29 km (18 mi) corridor linking Port Canaveral to the Kennedy Space Center (KSC) and the Space Coast Regional Airport is the Florida Maglev Alternative. The area is lightly developed. This alternative can link to a future extension along the Beeline Expressway connecting to Orlando International Airport. The Florida Department of Transportation (FDOT) is the project sponsor.

Georgia - The Georgia Maglev Alternative is a 50 km (31 mi) corridor extending from Hartsfield-Atlanta International Airport to a multi-modal station north of the airport. The exact location of the northern station has not been finalized. The area is mostly developed. The alternative could be extended in the future to a larger 178 km (110 mi) corridor serving the cities of Atlanta and Chattanooga. The project sponsor is the Atlanta Regional Commission.

Louisiana - The Louisiana Maglev Alternative traverses the central section of the Gulf Coast High Speed Ground Transportation Corridor. The alternative extends from downtown New Orleans through to the New Orleans International Airport (NOIA), across Lake Pontchartrain, and ends on the northern side of the lake, a distance of approximately 78 km (48 mi). The area consists of approximately half developed area and half lake crossing. The Greater New Orleans Expressway Commission is the project sponsor.

Maryland - The Maryland Maglev Alternative is approximately 64 km (40 mi) in length, and extends from Washington, D.C. north, to the Baltimore-Washington International Airport (BWI) and the City of Baltimore. In addition to the two larger cities, several suburban communities are located within the alternative. The area contains several large tracts of land owned by the Federal Government. The alternative could be extended north to Boston and south to Charlotte, creating an Eastern Seaboard Maglev system. The Maryland Mass Transit Administration is the project sponsor.

Nevada - The 56 km (35 mi) Nevada Maglev Alternative links Primm, located on the Nevada-California state border, with downtown Las Vegas. The majority of the alternative is located within the Nevada Department of Transportation (NDOT) right-of-way for I-15 and traverses an area of sparse development and gentle topography. The alternative could be extended in the future to complete the California-Nevada Interstate Maglev Project linking Las Vegas with Anaheim. The California-Nevada Super Speed Train Commission is the project sponsor.

Pennsylvania - The Pennsylvania Maglev Alternative extends from Pittsburgh International Airport (PIT) to the City of Greensburg, passing through downtown Pittsburgh and Monroeville, a distance of about 76 km (47 mi). The alternative consists hilly topography bisected by numerous watercourses. Elevations range between 213 - 457 m (700 - 1,500 ft). The alternative could be extended in the future to be part of a larger corridor connecting Pittsburgh and Philadelphia, and continuing to Washington, D.C. to the east; West Virginia to the south; Cleveland to the west, and New York to the north. The Port Authority of Allegheny County is the project sponsor.

No-Action Alternative. The Maglev Deployment Program has been established as a way to demonstrate an alternative transportation system to alleviate the congestion in airway and automotive corridors resulting from increasing demand for travel. Under the No-Action Alternative, the Maglev Deployment Program would not proceed. Economic and population growth will continue around the country, causing associated increases in inter-city travel demand and congestion, and inducing additional airport, railway, and highway expansion projects. It is uncertain what actions, if any, would be taken to develop advanced high-speed ground transportation to improve inter- and intra-regional transportation within the United States whether or not the Maglev program proceeds. If the program does not proceed, it is less likely that Maglev would be seriously considered in future transportation corridor planning. This may forclose the fastest high-speed ground transportation technology currently available not only in the candidate corridors, but throughout the Nation.

PREFERED ALTERNATIVE

After publication of the DPEIS, the seven project teams submitted project descriptions concluding phase three of the Maglev Deployment Program. FRA evaluated the seven project descriptions for strengths and weaknesses according to factors reflecting standards and criteria established in The Maglev Deployment Program Final Rule (65 Fed. Reg. 2342, January 20, 2000), using a multidisciplinary evaluation team of Department of Transportation professionals. Upon consideration of this evaluation, and after carefully analyzing all of the relevant factors, including environmental issues, the US Secretary of Transportation selected the Action Alternative as the agency's preferred alternative, (See Appendix M) and identified the Maryland and Pennsylvania projects for continued evaluation and initial project development, including engineering design and analysis. The Secretary of Transportation may select from these projects for design and construction based on more detailed project information. Any decision to proceed with the construction phase of the program would be contingent on receipt of Congressional appropriations and completion of additional environmental documentation in the form of a site-specific environmental impact statement.

SUMMARY OF IMPACTS AND MITIGATION

Tables ES-1 (a-c) summarize and compare the potential impacts for each of the seven Maglev Alternatives and the No-Action Alternative.

As a requirement of the Maglev Deployment Program and cooperative agreements established between FRA and the selected states, a technical review of the affected environment and potential environmental consequences was prepared by each participant (MTA(a), 2000; FDOT(a), 2000; GNOEC(a), 2000; ARC(a), 2000; CNSSTC(a), 2000; CM, 2000; PAAC(a), 2000). The purpose of these technical documents was to provide the baseline environmental data used by FRA in the preparation of this PEIS. In addition, the alternatives developed Project Description documents that were used as reference where necessary (MTA (b), 2000; FDOT(b), 2000; GNOEC(b), 2000; ARC(b), 2000; CNSSTC(b), 2000; CM(a), 2000; PAAC(b), 2000). The following is a summary of the environmental consequences and mitigation for each of the alternatives based upon information provided by each participant.

Topography, Geology And Soils. Construction and operation of a well-sited and properly constructed Maglev system in any of the seven proposed locations would result in insignificant adverse impacts to the physical setting of topography, geology, and soils. Minor changes in topography and soils would occur from blasting, excavation and grading within the immediate corridor of the selected alternative. There is potential for erosion during construction of any of the alternatives, with potentially higher risks for the

California, Florida, and Louisiana Alternatives due to their locations in flood-prone and/or erosion-prone regions.

There is a small risk of potential loss or damage to coal deposits in the vicinity of the proposed Pennsylvania Maglev Alernative, and a small potential for impacts to oil and gas exploration in the vicinity of the Pennsylvania and Louisiana Maglev Alternatives. Seismic activity is a risk for most of the Maglev Alternatives, but only a high risk for the California and Nevada Alternatives.

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be built. It is anticipated that economic and population growth will continue around the country, increasing motor vehicle travel that could lead to road expansion. The construction of new roads and highways is likely to result in permanent disruption of drainage patterns to a greater extent than the elevated Maglev guideway system. However, it is expected that the No-Action Alternative could result in impacts similar to those for the Maglev Alternatives – erosion and sedimentation, loss or damage to mineral deposits. Thus, the No-Action Alternative would likely have insignificant adverse impacts on topography, geology, and soils.

Climate. The construction of a Maglev system could have long-term benefits or impacts to climate from changes in CO_2 emissions. At the preliminary stage of design, it is expected that the California, Louisiana, Maryland, and Pennsylvania Alternatives would decrease the production of greenhouse gas, while the Florida, Georgia, and Nevada Alternatives would cause an increase.

Climate, however, could have impacts on the operations, service schedule, or maintenance requirements of the Maglev infrastructure. Excessive temperature variations and sandstorms may occur in the Nevada Alternative, potentially resulting in distortion of the steel guideway and reduced visibility, respectively, which could interrupt service or necessitate frequent maintenance/repair. In the California Alternative, there is a risk of damaging mudslides from torrential rains on steep slopes. The Florida and Louisiana Maglev Alternatives could potentially be subject to damage from strong hurricanes, tornados, and associated flooding. For the Georgia Altenative, there is a similar but lesser potential for damage from tornados and hurricanes. In Maryland and Pennsylvania, the Maglev infrastructure could be damaged or impaired by northeasters, blizzards, ice storms, tornadoes (Pennsylvania), or weakened tropical storms (Maryland).

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be built. It is anticipated that economic and population growth will continue around the country, increasing motor vehicle travel that could lead to road expansion. The increase in motor vehicle travel could result in increased greenhouse gas production thus contributing to potential climate change.

Table ES-1(a) - Summary of Potential Impacts and Mitigation

Resource	Alternative		
	No-Action	California	Florida
Topography, Geology, and Soils	Insignificant adverse impact .	Potential insignificant adverse impact to topography, geology, and soil. Maglev commonly constructed along disturbed utility and transportation corridors. Impact is considered to be minimal and localized.	
Climate	Potential increase in greenhouse gas.	Potential decrease in greenhouse gas production and benefit to climate.	Potential increase in greenhouse gas production and impact on climate.
Vegetation, Wildlife & Wetlands	Potential impact.	Potential insignificant adverse impact. Potential impact to 0.61 hectares (1.51 acres) wetlands.	Potential significant adverse impact. Potential impact to 47.8 hectares (118.1 acres) of wetlands.
Endangered Species	Potential impact.	Potential significant adverse impact. 25 species identified within the study corridor.	Potential significant adverse impact. 63 species identified within the study corridor.
Water Quality	Potential impact.	Potential insignificant adverse impact. Maglev propulsion results in few emissions that could impact water quality.	
Flood Hazard	Potential impact.	Potential insignificant adverse impact. The study corridor crosses 0.5 - 1.5 km (0.3 - 0.9 mi) of floodplains.	Potential significant adverse impact. The study corridor crosses 11 – 26 km (7 - 16 mi) of floodplains.
Coastal Zone Management	Potential impact.	No significant adverse impact. Alternatives within the coastal zone are expected to be consistent with state coastal zone management plans.	
Air Quality	Potential impact.	Potential benefits from the reduction of petroleum related emissions.	
Solid and Hazardous Waste	Potential impact.	Potential insignificant adverse impacts. Private contractor to use nearest available disposal facility.	
Socioeconomic, Environmental Justice, and Elderly and Disabled	Potential impact.	Maglev can follow existing transportation and utility corridors, some taking may occur. Overall should not have a significant adverse impact.	
Land Use, Farmlands & 4(f) Resources	Potential impact.	Potential moderate adverse impacts from farmland and park concerns.	Potential significant adverse impact from land use, farmland and park concerns.
Aesthetics	Potential impact.	Potential significant adverse impact. Elevated guideway could impact open space, residential and open water vistas.	
Historical, Archaeological, and Cultural Resources	Potential impact.	Potential significant adverse impact.	Potential insignificant adverse impact.
Transportation	Congestion and delays anticipated increasing.	Potential insignificant adverse impact to local traffic. Potential significant benefit to regional traffic and transportation.	Potential insignificant adverse impact to local traffic. Potential moderate benefit to regional traffic and transportation.
Energy	Petroleum dependant transportation increasing.	Potential moderate beneficial impact. Net reduction in regional energy consumption of 3,305 - 3,823 billion BTU per year.	Potential moderate negative impact. Net increase in regional energy consumption of 32.79 billion BTU per year.
Public Health (EMF/EMR) and Safety	Potential impact.	Potential insignificant adverse impact to physical safety. Maglev vehicles, guideways, facilities and operation are designed to achieve or exceed all safety and EMF/EMR standards. Minimal at grade crossings.	
Noise and Vibration	Potential impact.	Potential insignificant adverse impact from facilities noise/vibration and operational vibration. Potential significant impact from operational noise (2903 impacts, 1976 severe impacts).	Potential insignificant adverse impact from facilities noise/vibration and operational vibration. Potential significant impact from operational noise (11 impacts, 5 severe impacts).
Electromagnetic Environment	Potential impact	Interference unlikely from the common communication equipment, unintentional emissions from Maglev operation should have insignificant adverse impact to other radio wave users.	

Table ES-1(b) - Summary of Potential Impacts and Mitigation, Continued

Resource	Alternative		
	Georgia	Louisiana	Maryland
Topography, Geology, and Soils	Potential insignificant adverse impact to topography, geology, and soil. Maglev commonly constructed along disturbed utility and transportation corridors. Impact is considered to be minimal and localized.		
Climate	Potential increase in greenhouse gas production and impact on climate	Potential decrease in greenhouse gas production and benefit to climate.	
Vegetation, Wildlife & Wetlands	Potential insignificant adverse impact. Potential impact to 4 hectares (10 acres) of wetlands.	Potential significant adverse impact. Potential impact to 42.0 hectares (103.8 acres) of wetlands.	Potential significant adverse impact. Potential impact to 10 hectares (25 acres) – 25 hectares (62 acres) of wetlands.
Endangered Species	Potential significant adverse impact. 9 species identified within the study corridor.	Potential significant adverse impact. 9 species identified within the study corridor.	Potential significant adverse impact. 10 species identified within the study corridor.
Water Quality	Potential insignificant adverse impact. Maglev propulsion results in few emissions that could impact water quality.		
Flood Hazard	Potential insignificant adverse impact. The study corridor crosses 0.7 - 1.0 km (0.4 - 0.6 mi) of floodplains.	Potential significant adverse impact. The study corridor crosses 16 - 28 km (10 - 17 mi) of floodplains.	Potential insignificant adverse impact. The study corridor crosses 7.0 - 8.0 km (4.3 - 5.0 mi) of floodplains.
Coastal Zone Management	No significant adverse impact. Alternatives within the coastal zone are expected to be consistent with state coastal zone management plans.		
Air Quality	Potential benefits from the reduction of petroleum related emissions.		
Solid and Hazardous Waste	Potential insignificant adverse impacts. Private contractor to use nearest available disposal facility.		
Socioeconomic, Environmental Justice, and Elderly and Disabled	Maglev can follow existing transportation and utility corridors, some taking may occur. Potential significant adverse impact.		
Land Use, Farmlands & 4(f) Resources	Potential moderate adverse impact to farmland and parks.	Potential minor adverse impact to farmland and recreation.	Potential moderate adverse impact to farmland.
Aesthetics	Potential significant adverse impact. Elevated guideway could impact open space and residential vistas.		
Historical, Archaeological, and Cultural Resources	Potential significant adverse impact.	Potential moderate adverse impact.	Potential moderate adverse impact.
Transportation	Potential insignificant adverse impact to local traffic. Potential moderate benefit to regional traffic and transportation.	Potential insignificant adverse impact to local traffic. Potential significant benefit to regional traffic and transportation.	
Energy	Potential insignificant adverse impact. Net increase in regional energy consumption of 134.8 billion BTU per year.	Potential moderate positive impact. Net reduction in regional energy consumption of 691 billion BTU per year.	Potential moderate positive impact. Net decrease in regional energy consumption of 1,536.6 billion BTU per year
Public Health (EMF/EMR) and Safety	Potential insignificant adverse impact to physical safety. Maglev vehicles, guideways, facilities and operation are designed to achieve or exceed all safety and EMF/EMR standards. Minimal at grade crossings.		
Noise and Vibration	Potential insignificant adverse impact from facilities noise/vibration and operational vibration. Potential significant impact from operational noise (115 impacts, 42 severe impacts).	Potential insignificant adverse impact from facilities noise/vibration and operational vibration. Potential significant impact from operational noise (401 impacts, 271 severe impacts).	Potential insignificant adverse impact from facilities noise/vibration and operational vibration. Potential significant impact from operational noise (115-446 impacts, 52-316 severe impacts).
Electromagnetic Environment	Interference unlikely from the common communication equipment, unintentional emissions from Maglev operation should have insignificant adverse impact to other radio wave users.		

Table ES-1(c) - Summary of Potential Impacts and Mitigation, Continued

Resource	Alternative	
	Nevada	Pennsylvania
Topography, Geology, and Soils	Potential insignificant adverse impact to topography, geology, and soil. Maglev commonly constructed along disturbed utility and transportation corridors. Impact is considered to be minimal and localized.	
Climate	Potential increase in greenhouse gas production and impact on climate.	Potential decrease in greenhouse gas production and benefit to climate.
Vegetation, Wildlife & Wetlands	Potential insignificant adverse impact. Potential impact to 0.45 ha (1.1 ac) of federal waters.	Potential insignificant adverse impact. Potential impact to 4.9 hectares (12.1 acres) of wetlands.
Endangered Species	Potential significant adverse impact. 7 species identified within the study corridor.	Potential significant adverse impact. 1 specie identified within study corridor.
Water Quality	Potential insignificant adverse impact. Maglev propulsion results in few emissions that could impact water quality.	
Flood Hazard	Potential insignificant adverse impact. The study corridor crosses 4.0 – 5.0 km (2.5 - 3.1 mi) of floodplains.	Potential significant adverse impact. The study corridor crosses 1.2 - 17.5 km (0.7 - 10.9 mi) of floodplains.
Coastal Zone Management	No significant adverse impact. Alternatives within the coastal zone are expected to be consistent with state coastal zone management plans.	
Air Quality	Potential benefits from the reduction of petroleum related emissions.	
Solid and Hazardous Waste	Potential insignificant adverse impacts. Private contractor to use nearest available disposal facility.	
Socioeconomic, Environmental Justice, and Elderly and Disabled	Maglev can follow existing transportation and utility corridors, some taking may occur. Overall should not have a significant adverse impact.	
Land Use, Farmlands & 4(f) Resources	Potential insignificant adverse impact to land use.	Potential significant adverse impact to farmland and recreation.
Aesthetics	Potential significant adverse impact. Elevated guideway could impact open space and residential vistas.	
Historical, Archaeological, and Cultural Resources	Potential insignificant adverse impact.	Potential significant adverse impact.
Transportation	Potential insignificant adverse impact to local traffic. Potential moderate benefit to regional traffic and transportation.	Potential insignificant adverse impact to local traffic. Potential significant benefit to regional traffic and transportation.
Energy	Potential insignificant adverse impact. Net increase in regional energy consumption of 1,387 billion BTU per year.	Potential moderate beneficial impact. Net reduction in regional energy consumption of 6,485 billion BTU per year.
Public Health (EMF/EMR) and Safety	Potential insignificant adverse impact to physical safety. Maglev vehicles, guideways, facilities and operation are designed to achieve or exceed all safety and EMF/EMR standards. Minimal at grade crossings.	
Noise and Vibration	Potential insignificant adverse impact from facilities noise/vibration and operational vibration. Potential significant impact from operational noise (1 impact, 3 severe impacts).	Potential insignificant adverse impact from facilities noise/vibration and operational vibration. Potential significant impact from operational noise (225-937 impacts, 0 severe impacts).
Electromagnetic Environment	Interference unlikely from the common communication equipment, unintentional emissions from Maglev operation should have insignificant adverse impact to other radio wave users.	

Natural Ecosystems And Wetlands. Maglev emits radio waves, particularly at extremely low frequency (ELF), and produces electromagnetic fields (EMF). Little is known about the effects of ELF and EMF on wildlife and natural environments. A literature review of available studies found no effects on wildlife attributable to electric and magnetic fields. As such, there would likely be no significant adverse impacts on wildlife due to EMF.

All of the Maglev Alternatives would have some impact on natural ecosystems and/or wetlands. The California Alternative is primarily developed, and no important habitats would be crossed; wetland impacts would range between 0.07 to 0.61 ha (0.17 to 1.51 ac.) The Florida Alternative traverses large expanses of estuarine habitat, up to 47.8 ha (118.1 ac) of wetlands, a national wildlife refuge, large areas of undisturbed habitat, and critical and unique habitats. The Georgia Alternative is highly developed and has many existing rights-of-way; wetland impacts would range between 2 and 4 ha (5 and 10 ac.) The Louisiana Alternative would cross sensitive pine savanna habitat, habitat of protected bird species, up to approximately 42 ha (103.8 ac) of wetlands, a federal wetland restoration area, and a large brackish estuary. In Maryland, the alternative passes through large forest tracts containing sensitive species, up to 11 crossings of wetlands of state concern, and a total potentially affected wetland area of up to 10 to 25 ha (25 to 62 ac.) The Nevada Alternative is partially located within a developed urban area, and the desert habitat to be disturbed is not unique or rare; up to 0.45 ha (1.1 ac.) of federal waters could be impacted. The Pennsylvania Alternative includes urban areas, forests, rangeland, and open water, none of which are noted to be rare or unique; wetland impacts would be up to 4.9 ha (12.1 ac.)

Based on these findings, there would likely be no significant adverse impact from the California, Georgia, Nevada, or Pennsylvania Alternatives, whereas the Florida, Louisiana, and Maryland Alternatives could each have a significant adverse impact on natural ecosystems and wetlands.

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be built. It is anticipated that economic and population growth will continue around the country, increasing motor vehicle travel that could lead to transportation infrastructure expansion. The construction of additional infrastructure could have considerable impacts to ecological resources (vegetation, wildlife, and wetlands) from habitat fragmentation and destruction, and wetlands contamination and loss. In addition, the increased motor vehicle travel could have negative affects on air quality potentially causing particulate deposition and acid rain, thus further impacting ecological resources.

Endangered Species. Threatened or endangered species have been identified as potentially occurring within the corridors of all of the Alternatives. For any of the Alternatives, the potential for a significant adverse impact exists. The specific locations of the species in relation to the alternatives have not been fully investigated at this stage of project planning, so specific impacts, if any, cannot be identified.

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be built. It is anticipated that economic and population growth will continue around the country, increasing motor vehicle travel that could lead to transportation infrastructure expansion. The construction of additional infrastructure could have considerable impacts on endangered species including encroachment, habitat fragmentation, and destruction. The significance of the impacts would have to be determined on a local and regional basis.

Water Quality. All of the Maglev action alternatives will utilize elevated guideways, so support structures would occupy a minimal amount of surface area, grading would be minimized, and drainage patterns are expected to remain the same. However, the addition of impervious surface at operations and maintenance facilities, parking lots, and other user support facilities has the potential to increase runoff and associated sediment and contaminant loads into adjacent waters, for any of the alternatives. With the use of best management practices during construction and implementation of a stormwater pollution prevention plan, these potential adverse effects on water quality are anticipated to be minor.

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be built. It is anticipated that economic and population growth will continue around the country, increasing motor vehicle travel that could lead to transportation infrastructure expansion. This infrastructure development has the potential to increase impervious surfaces to a greater extent than the development associated with Maglev implementation. Runoff from impervious surfaces is a regulatory issue related to water quality. Drainage patterns would also be impacted by potential new construction. The potential impairment of air quality could also raise concerns over potential negative effects derived from particulate deposition and acid rain effects. Therefore, the No-Action Alternative could have a potential moderate impact on water quality.

Flood Hazard. All of the seven Maglev Alternatives have some estimated impacts to floodplains, based on their proposed alignments. Maximum estimated lengths in the floodplain for the alternatives are the following, from greatest to least: Louisiana (27 km/17 mi); Florida (26 km/16 mi); Pennsylvania (17.5 km/10.9 mi); Maryland (8 km/5 mi); Nevada (5 km/3 mi); California (1.4 km/0.9 mi); and Georgia (1 km/0.6 mi).

The specific effects of these floodplain encroachments on the local potential for flooding would depend on the particular location and design of the alternative Maglev system's guideways, stations and other support facilities, which would be identified during the final design stage. However, based on these relative impacts, there may be potential significant adverse impacts to floodplains for the Louisiana, Florida and Pennsylvania Alternatives, and potential insignificant adverse impacts from the remaining alternatives.

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be built. It is anticipated that economic and population growth will continue around the country, increasing motor vehicle travel that could lead to transportation infrastructure expansion. This infrastructure development has the potential to encroach on floodplains, causing increased floodplain elevation and expansion, potentially leading to more property damage. Therefore, the No-Action Alternative could have a potential impact on floodplains.

Coastal Zone Management. The three Maglev Alternatives in the coastal zone -- Florida, Louisiana, and Maryland -- were evaluated for consistency with their respective state coastal management programs, and are expected to be in compliance. There would therefore be no significant adverse impacts to coastal zones from any of the Alternatives,

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be built. It is anticipated that economic and population growth will continue around the country, increasing motor vehicle travel that could lead to transportation infrastructure expansion. This infrastructure development has the potential to impact a coastal zone.

Air Quality. Air quality emissions analysis is done on a microscale (local) or mesoscale (regional) basis. A microscale analysis was not conducted for any of the proposed Maglev Alternatives because the location and design of site-specific Maglev system elements have not been finalized. However, a microscale analysis will be conducted upon advanced planning and design of the preferred Maglev corridor.

A mesoscale analysis was conducted for each of the proposed Maglev corridors. Increased air emissions from regional power plants that generate power for the Maglev system were compared to decreased air emissions from the anticipated reduction in vehicle miles traveled as a consequence of Maglev implementation. In most cases, a net benefit, or a reduction in criteria pollutant emissions, would occur with the implementation of an operational Maglev system. However, this conclusion could vary with the type of power plants used to supply power to the Maglev system. Fossil fuel, natural gas and coal plants produce significantly more air emissions than nuclear, wind, or hydroelectric plants. Overall, no significant impacts or exceedances of National Ambient Air Quality Standards (NAAQS) are anticipated for any of the Maglev Alternatives.

Under the No-Action Alternative, the Maglev Deployment Program would not proceed. It is anticipated that economic and population growth will continue around the country. This expansion could result in increased intercity travel demand and ensuing congestion. The increased operational congestion could also lead to greater air-pollutant emissions.

Solid And Hazardous Waste. The Maglev operation is not considered a substantial producer of solid or hazardous waste. However, construction and operation of a Maglev system in any of the seven alternatives would generate solid waste requiring removal, transport, and disposal. Solid waste from operating stations, user support facilities and administrative offices would consist of conventional waste such as paper, office supplies, food products, and food packaging materials. Solid waste from track maintenance facilities would include office wastes as well as industrial wastes, including materials containing petroleum products, solvents, batteries, scrap metals, and other used components. Commercial contractors would dispose of conventional and hazardous solid waste at the nearest landfill or hazardous waste disposal facility. No significant adverse direct or indirect impacts to local solid waste capacity are anticipated.

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be built. It is anticipated that economic and population growth will continue around the country, increasing motor vehicle travel that could lead to transportation infrastructure expansion. The construction of additional infrastructure could have impacts on solid waste. The extent of the solid waste impacts and the ability of existing facilities to handle additional waste would have to be evaluated at the local and regional levels.

Socioeconomic. Construction and operation of a Maglev system in any of the seven porposed Locations would result in both positive and negative impacts on the adjacent communities. Beneficial impacts include the creation of new jobs associated with the construction and operation of the actual Maglev system, increased accessibility to job markets along the Maglev corridor, and new jobs created by future development in the vicinity of proposed Maglev stations. Adverse impacts include the displacement of people and businesses as a consequence of property acquisitions for the various components of the Maglev system.

Actual property acquisitions associated with each Maglev Alternative could not be determined based on the level of planning and design used to assess impacts in this PEIS. Further analysis would be needed to identify the number of facilities and the land-area requirements for each of the Maglev Alternatives and any potential mitigation for adverse impacts to persons or businesses.

The proposed Maglev Alternatives were studied in relation to Executive Order 12898, Environmental Justice in Minority and Low-Income Populations. Census data (1990) indicate that minority and low-income populations exist in higher proportions in the California, Georgia, and Nevada Alernatives. Impacts to these populations are considered marginal, since these proposed Maglev corridors are located within or immediately adjacent to existing transportation corridors and/or utility and drainage rights-of-way, such that property acquisitions and displacements would be minimized. However, public involvement raised significant concern regarding impact of the Georgia Alternative.

The design of the Maglev system alternatives would affect the ability of elderly, infirmed, and/or disabled persons to access the system for transportation. In order to provide the minimum standards for accessibility by individuals with disabilities or elderly persons, any of the alternative Maglev transportation systems would be designed and constructed in compliance with the Americans with Disabilities Act (ADA) and any applicable state and local accessibility/building codes that require accommodation for those with disabilities.

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be built. It is anticipated that economic and population growth will continue around the country, increasing motor vehicle travel that could lead to transportation infrastructure expansion. The construction of additional infrastructure could have negative socioeconomic impacts such as property acquisitions and displacement of residential and business populations. In addition, transportation infrastructure expansion could result in disproportionate adverse impacts to minority or low-income populations, as well as effects to elderly and disabled populations. The nature and extent of the impacts would have to be determined on a local basis.

Land Use. Construction of any of the Maglev Alternatives would entail direct land use changes in the path of the guideway and support facilities, as well as possible secondary effects, as nearby land uses may redevelop to serve the new market of Maglev users. It is expected that some residential and commercial relocations would be required. There will also be effects on adjacent land uses from Maglev-associated conditions such as noise and commuter traffic. It is likely that land use changes or rezoning may be needed to reduce conflicts with existing land uses.

Site-specific land use impacts could not be evaluated for the PEIS, given the current conceptual stage of planning and design. The alternatives were assessed, however, for their relative potential to affect overall land use, which took into account general land use (e.g., development/redevelopment pressure), farmlands, parklands, and recreation. The Florida and Pennsylvania Alternatives were assessed to have potential for significant adverse impacts to land use. The California, Georgia and Maryland Alternatives have potential to cause moderate adverse impacts, the Louisiana Alternative has potential to cause a minor adverse impact, and the Nevada Alternative was estimated to have an insignificant impact on land use.

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be built. It is anticipated that economic and population growth will continue around the country, increasing motor vehicle travel that could lead to transportation infrastructure expansion. The construction of additional infrastructure could have considerable impacts to land use (general, farmlands, and recreation areas and parklands) from alteration and conversion. The impacts would need to be examined on a local and regional basis.

Visual And Aesthetic Resources. Any of the Maglev Alternatives would cause visual impacts due to the introduction of elevated guideway elements, elevated stations, parking lots, power substations, and other ancillary system facilities. Individual locations where visual impacts may be significant have not yet been identified, and relative impacts among the alternatives cannot be determined. The severity of impacts would vary with topography, the sensitivity of adjoining land uses, the proximity of historic sites, the visual complexity of the existing environment, and the specific placement of Maglev facilities within the landscape. At the current preliminary stage of design, all of the Maglev Alternatives can be considered to have potential for significant adverse visual impacts.

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be built. It is anticipated that economic and population growth will continue around the country, increasing motor vehicle travel that could lead to transportation infrastructure expansion. The added transportation infrastructure elements have the potential for creating visual impacts associated with structures such as airports, stations/terminals, parking, and maintenance facilities, support structures such as bridges, as well as from railroad and highway networks. These impacts would need to be examined on a local and regional basis, and could potentially be greater than those incurred under the Maglev Alternatives.

Historic, Archaeological And Cultural Resources. Maglev design has not yet sufficiently advanced to assess site-specific impacts to historic, architectural, archaeological, and cultural resources. A variety of prehistoric and historic sites or resources could potentially be impacted by every action alternative. Most of these impacts would be physical, resulting from construction, and include those associated with noise mitigation, such as installing insulation in historic buildings. After construction, the operational phases of the project would likely have negligible impacts, so long as maintenance activities occur within previously-disturbed areas. Further consultation with each State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation is necessary for the identification of all eligible historic properties, assessment of impacts, and development of mitigation measures.

At the current preliminary stage of design, all alternatives have the potential for significant adverse impacts on historic architectural, archaeological and cultural resources. The California, Georgia, and Pennsylvania Alternatives were assessed to have potential to cause significant adverse impact. The Louisiana and Maryland Alternatives were assessed to have potential to cause moderate adverse impact. The Florida and Nevada Alternatives were assessed to have potential significant adverse impact on historical. archaelogical and cultural resources.

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be built. It is anticipated that economic and population growth will continue around the country, increasing motor vehicle travel that could lead to transportation infrastructure expansion. The construction of additional infrastructure could have considerable impacts on historic, archaeological and cultural resources. There is potential to disturb known sites as well as intrude on currently unknown sites if ground-disturbing activities, such as excavation, occur in their vicinity. These impacts would have to be examined on a local basis, and could potentially be greater than those incurred under the Maglev Alternatives.

Transportation. Maglev stations, parking lots, and maintenance facilities could have a potential impact on local traffic and transportation, increasing traffic within specific locations. In the vicinity of stations, Maglev may contribute to intersection congestion and vehicle delay because of the additional traffic proceeding to and from station parking and drop-off and pick-up areas. At this time, the location and design of the Maglev facilities have not been finalized, so site-specific traffic and transportation impacts cannot be fully identified and addressed at this planning stage. It should be assumed, therefore, that there is the potential for a significant adverse impact on local transportation from any of the Maglev action alternatives.

Impacts to regional transportation were assessed for each Maglev Alternative. It is anticipated that all of the Maglev action alternatives could have a beneficial impact on regional transportation by relieving congestion, reducing overall trip times, reducing accidents and reducing delays. The extent of the benefit was estimated through analysis of the reduction in vehicle kilometers traveled (VKT)/vehicle miles traveled (VMT) expected from implementation of the Maglev system. Reductions in daily VKT (VMT) for each alterative, as calculated by the project participants would be as follows:

- California: 3,408,538 VKT (2,117,961 VMT)
- Florida: 487 VKT (303 VMT)
- Georgia: 196,153 VKT (110,650 VMT)
- Louisiana: 992,965 VKT (618,000 VMT)
- Maryland: 1,287,475 VKT (800,000 VMT)
- Nevada: 417,719 VKT (259,559 VMT)
- Pennsylvania: 5,256,120 VKT (3,266,000 VMT)

These beneficial impacts were assessed to be significant for California, Louisiana, Maryland, and Pennsylvania, and moderate for Florida, Georgia, and Nevada.

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be built. It is anticipated that economic and population growth will continue around the country. This growth could result in increased intercity travel demand and ensuing congestion. Roadways would continue to operate at a lower level of service and airports would continue to experience delays. The increased operational congestion could also lead to safety deficiencies of transportation systems. Thus, the No-Action Alternative could have a significant adverse impact on transportation and traffic.

Energy. Maglev technology is an energy efficient technology, consuming 30 percent less energy than a modern high-speed train traveling at the same speed. Compared with road and air travel, Maglev is even more energy efficient per passenger: for equal distances, the specific energy consumption of Maglev would be three times lower than automobile travel and five times lower than air travel. However, the energy efficiency of the Maglev is affected by the number of stops, varying speeds, hills and curves.

Construction and operation of a Maglev system at any of the seven proposed alternatives would result in an increased electrical-energy demand on utility companies that supply these areas. However, the increased electrical-energy demand is not expected to adversely constrain the distribution of electric power nor increase energy costs and availability to other users within any of the alternatives.

Some operational Maglev systems would reduce regional vehicular travel, thereby reducing fossil fuel consumption, while others would induce travel to a greater degree. For each of the Maglev Alternatives, the regional energy savings were calculated and compared to the electrical-energy demand of the proposed Maglev system. For the California, Louisiana, Maryland, and Pennsylvania Alternatives, an overall energy savings (beneficial energy impact) would be realized if Maglev were implemented. Conversely, an overall energy demand increase (adverse energy impact) is anticipated for the Florida, Georgia, and Nevada Alternatives. However, in all instances, the energy demand and/or savings is considered to be minimal. Based on these results, no significant adverse impacts on energy resources are anticipated for any of the proposed Maglev Alternatives.

Under the No-Action Alternative, there would be no additional effects on regional electric power supply and distribution systems, but there would be continued increases in fossil-fuel-based energy demand.

Public Safety And Health. Before any of the alternatives are implemented, at the time of final design the FRA will analyze the safety and health performance of the proposed action during the site-specific EIS process. The construction and operation of any of the proposed Maglev systems may affect the environment by incrementally raising current levels of Electromagnetic fields (EMF) as the Maglev vehicle pases and along electric power transmission and distribution lines. Maglev sources of electromagnetic radiation (EMR) would also add to the broad-band non-ionizing electromagnetic radiation background. The Maglev system and operation does not differ from well accepted electric rail or transit in this repect.

At present, health risk from EMF is still uncertain and ambiguous after two decades of research. However, there are national and international EMF and EMR human exposure safety standards applicable to Maglev. Individuals with electronic medical devices (such as pacemakers) are susceptible to electromagnetic interference from static, power frequency and radio-frequency fields. The FRA may require posted warnings to protect workers and passengers who use electronic medical implants.

The design and operation of the Maglev systems would have to be in compliance with the most protective applicable EMF/EMR health guidelines and standards. If so, it is unlikely that the proposed Maglev Alternatives would have any significant adverse safety, health or environmental impacts from EMF/EMR.

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be built. It is anticipated that economic and population growth will continue around the country. If additional transportation infrastructures are not constructed in response to the growth, the increased operational congestion could lead to safety deficiencies on current transportation systems. If additional transportation infrastructures are constructed, safety impacts would have to be examined on a local and regional basis, and could potentially be greater than those incurred under the Maglev Alternatives.

Noise & Vibration. Based on the level of planning and design data available for this PEIS, each of the proposed Maglev Alternatives may result in potentially significant adverse noise impacts to nearby sensitive receptors. Impacted and severely impacted receptors include single-family and multi-family residences, schools, hotels, motels, trailer parks, churches and recreational and community centers.

Considering the number of affected sensitive receptors in the vicinity of the Maglev Alternative, the California system would have the greatest noise impact of all the alternatives (2903 impacted, 1976 severely impacted). Next would be Louisiana (401 impacted, 271 severely impacted), followed by Pennsylvania (225-937 impacted, 0 severely impacted), then Maryland (115-446 impacted, 52-316 severely impacted), and Georgia (115 impacted, 42 severely impacted). Fewer impacts would result from the remaining alternatives: Florida (11 impacted, 5 severely impacted) and Nevada (1 impacted, 3 severely impacted).

Based on FRA criteria for vibration impacts, no human-annoyance vibration impacts are expected for the Florida, Georgia, Louisiana, or Pennsylvania Alternatives. A comprehensive analysis of building-damage vibration was not possible at the current preliminary stage of design, since detailed site-specific data are required. Analysis of vibration impacts could be undertaken during future design stages.

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be built. It is anticipated that economic and population growth will continue around the country, increasing motor vehicle travel that could lead to transportation infrastructure expansion. Consequently, as traffic volume increases and transportation infrastructure is developed, the associated, potentially adverse noise and vibration effects will continue to escalate. Thus, it is expected that the No-Action Alternative could result in more significant noise and vibration impacts than those associated with the Maglev Alternatives.

Electromagnetic Radio Frequency Radiation And Interference. The potential impacts of any Maglev system on electronic devices along the right-of-way or on-board are expected to be minimal, as are the potential impacts of surrounding electronics on the Maglev system, given the rapid decay of the magnetic field with distance from the guideway. To manage potential electromagnetic interference (EMI), shielding or other EMI prevention and control options would be established within the selected Maglev Alternative.

The inventory of potential electronic emitters and receivers that could be interfered with by Maglev has not yet been completed for any of the alternatives. The potential impact from EMI would be thoroughly evaluated during site-specific environmental review if the Maglev Deployment Program proceeds. However, EMI is considered a greater potential impact to the operation of the Maglev system than to the surrounding environment. If proper EMI standards are adopted, there is no potential significant adverse impact from Maglev deployment to other adjacent electromagnetic sources.

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be built. It is anticipated that economic and population growth will continue around the country, increasing motor vehicle travel that could lead to transportation infrastructure expansion. As new transportation infrastructure and operating systems are implemented to meet the increasing travel demand, new sources of EMI would be added to those currently present. These impacts would need to be examined on a local and regional basis, and could potentially be greater than those incurred under the Maglev Alternatives.

Construction Impacts. Construction of any of the seven proposed Maglev Alternatives may result in localized short-term air, noise, vibration, water quality, traffic, visual, utility and public safety impacts. These potential impacts, enumerated below, would be minimized through a number of measures including dust control measures, construction staging and sequencing, best management practices, a storm water pollution prevention plan, and a plan for maintenance and protection of traffic, among others.

- Air quality impacts from construction activities would be temporary and are primarily associated with the operation of diesel powered equipment and the generation of fugitive dust from haul roads, excavation and earth moving activities.
- Diesel engines and pile driving would likely produce the majority of noise impacts associated with Maglev system construction, particulary as construction of the guideway support columns may require the use of an impact pile driver. The installation of the prefabricated guideway assembly is not anticipated to generate substantial noise.
- Vibration would result in varying degrees from construction equipment operation, impact pile driving, and blasting. Construction of the Maglev guideway support columns would require extensive pile driving, which may produce vibration levels damaging to foundations of buildings near the construction site. Blasting may be required where large areas of bedrock need to be removed.
- Water quality impacts may result from erosion of exposed soils and dewatering of excavation sites.
- Construction of any of the Maglev Alternatives could potentially result in temporary interruptions to local traffic patterns, traffic delays, road closures, and detours.
- Temporary visual impacts to adjacent properties would occur during construction, due to views of heavy equipment, material stockpiles, and fugitive dust.
- Utility relocations would likely be required for construction of any of the Maglev Alternatives. Temporary service disruptions may be experienced during the relocation process.
- Public safety and limiting access to construction sites would be a concern during the duration of construction.

The No-Action Alternative would not involve construction, so there would be no construction impacts.

Irreversible Or Irretrievable Use Of Resources. Implementation of the Maglev Deployment Program involves a commitment of a range of natural, physical, human, and fiscal resources, including land, fossil fuel, construction materials, state and federal monies, labor, wetlands, floodplains, mineral sources, historic sites, and others. While these commitments are irretrievable, they are not unusual in the development of a large transportation project that benefits a large public, and losses or expenditures would be minimized or compensated through a variety of implementation and mitigation measures.

The Maglev system represents a safe, rapid, energy efficient, environmentally sound, and convenient transportation technology. The benefits of the system are anticipated to justify and outweigh the commitment of the resources used for its construction and operation.

Local Short-Term Uses Of The Environment And Enhancement Of Long-Term Productivity. The environmental impacts associated with the Maglev Deployment Program would result in both short and long-term impacts. Potential short-term construction effects, including localized noise, air and water pollution, would be minimized through standard environmental specifications and Best Management Practices (BMPs), and would not have a lasting impact on the environment. Over the long term, the Maglev system would serve as a viable alternative to existing, congested airway and automotive corridors. Long-term socioeconomic and environmental benefits of the Maglev system include regional economic development, transit-oriented development, reduced air emissions, energy efficiency, and comparatively reduced consumption of non-renewable resources such as fossil fuels. The Maglev initiative is an advanced transportation technology that would contribute considerably to the maintenance and enhancement of long-term productivity nationwide.

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1 PURPOSE AND NEED FOR ACTION

1.1 BACKGROUND

The National National Policy Act (NEPA) establishes policies and procedures that ensure environmental information is available to decision makers, regulatory agencies, and the public before Federal actions are implemented. To satisfy NEPA requirements for the Magnetic Levitation Transportation Technology Deployment Program (Maglev Deployment Program), the Federal Railroad Administration (FRA), Lead Agency for this Program, determined that the Program constitutes a major Federal action under NEPA. As such, the FRA prepared and distributed a Draft Programmatic Environmental Impact Statement (DPEIS) to encourage public involvement and to address public concerns. In response to the public correspondence, the FRA refined the DPEIS and prepared this the Final Programmatic Environmental Impact Statement (PEIS). The PEIS is comprised of two volumes. Volume I is the DPEIS as refined by the FRA based on public comments. Volume II contains the public comments and the FRA's specific responses to those comments.

The John A. Volpe National Transportation Systems Center (Volpe Center), part of the Research and Special Programs Administration (RSPA) of the Department of Transportation (DOT), has provided technical support to the FRA in the preparation of this document. This PEIS addresses the consequences of the proposed action on the human and natural environments, suggests potential mitigation of adverse impacts, and analyzes the no-action alternative to the proposed action. This PEIS has been prepared in accordance with the Council on Environmental Quality (CEQ) regulations (40 CFR 1500 *et seq.*), NEPA (42 USC 4321 *et seq.*), and FRA's Procedures for Considering Environmental Impacts, (64 Fed. Reg. 28545, May 26, 1999).

The CEQ Regulations encourage federal agencies to tier their environmental impact statements to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental review (40 CFR §1502.20). The PEIS will be used by the FRA decision makers to assist the agency in making certain program level decisions about the Maglev Deployment Program. FRA will prepare additional site specific environmental analyses before a particular project is constructed.

The PEIS is not intended to be a scientific document, but is written in plain language as a decision tool supported by scientific analysis. The FRA will use the PEIS to make an informed decision and to fully understand the environmental ramifications of the decision. Detailed scientific studies used to support the PEIS are incorporated by reference and are summarized in the document. The CEQ Regulations provide that NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail (40 CFR. §1500.1(b)). The depth and length of the analysis should be commensurate with the importance of the issues involved.

1.2 INTRODUCTION

As authorized by Congress in the Transportation Equity Act for the 21st Century (TEA 21) (Pub. L. No. 105-178, 112 Stat. 107, 216), the Maglev Deployment Program encourages the development and construction of an operating transportation system employing magnetic levitation, capable of safe use by the public at a speed in excess of 386 kilometers/hour (km/h) (240 miles/hour (mph)). Magnetic levitation (Maglev) is an advanced transportation technology in which magnetic forces lift, propel, and guide a vehicle over a specially designed guideway. Utilizing state-of-the-art electric power and control systems, this configuration eliminates contact between vehicle and guideway, and is expected to permit cruising speeds of up to 500 km/h (310 mph), which would be twice the speed capabilityof Acela.

TEA 21 added a new section 322 to title 23 of the United States Code. Section 322 provides a total of $55 million in contract authority from the Highway Trust Fund for Fiscal Years 1999 through 2001 for pre-construction planning of transportation systems employing Maglev. Section 322 requires FRA to establish project selection criteria, to solicit applications for funding, to select one or more projects to receive financial assistance for preconstruction planning activities and after completion of such activities, to select one of the projects to receive financial assistance for final design, engineering, and construction activities. Section 322 authorizes but does not appropriate additional federal funds of $950 million for final design and construction of the most promising project. Section 322 also provides that the portion of the project not covered by funds provided under Section 322 may be covered by any non-federal funding sources, including private debt and/or equity, state, local, regional, and other public or private entities, as well as by federally provided Surface Transportation Program (STP), and Congestion Mitigation and Air Quality Improvement Program (CMAQ) funds, and from other forms of financial assistance under TEA 21, such as loans and loan guarantees.

The FRA established the rules governing the Maglev Deployment Program through a final rule published in the Federal Register on January 14, 2000 (65 FR 2342). The final rule provides for a five phase process: Phase I involves a competition for planning grants; Phase II includes project description development; Phase III includes the project selection process; Phase IV involves project development and completion of a site specific environmental impact statement; and Phase V involves the completion of detailed engineering and construction, and the financing, construction, and operation of the project in revenue service. As directed by the enabling legislation, the FRA has initiated a competition to select a project for the purpose of demonstrating the use of maglev technology to the American public. After receiving and evaluating eleven initial applications, the Secretary of Transportation on May 24, 1999 announced financial assistance grants to seven participants (California, Florida, Georgia, Louisiana, Maryland, Nevada, and Pennsylvania) for pre-construction planning for Maglev high-speed ground transportation (HSGT). FRA entered into cooperative agreements with each of the selected states. These agreements required each participating state or authority to prepare and submit to the FRA a technical review of environmental considerations affecting their proposed project. The participants incorporated the results of these technical reviews into individual documents referred to as Environmental Assessments (EAs). The purpose of these technical documents was to provide the baseline environmental data to be used by FRA in the preparation of the DPEIS (for further information on the Environmental Assessments refer to Appendix A for each state participants' point of contact). These documents were analyzed and synthesized by the FRA in the DPEIS. After completing the PEIS, FRA will administer a selection process to pick a project for authorized construction funding. FRA will prepare a project-specific environmental impact statement for any Maglev system proposed for construction.

1.3 PURPOSE AND NEED FOR THE ACTION

The mission of the FRA is to promote safe, environmentally sound, successful railroad transportation to meet current and future needs of the Nation. FRA encourages investment in infrastructure and technology to enable rail to realize its full potential. The Maglev Deployment Program is a program that was established by Congress and directed to the FRA for implementation. The purpose of the Maglev Deployment Program is to identify a viable maglev project in the U.S., and assist a public/private partnership organized for the purpose to plan, finance, construct and operate the identified project. The program is intended to demonstrate that Maglev technology can be successfully deployed as one of the next generation of America's high-speed ground transportation.

The deployment of an operating transportation system employing magnetic levitation would demonstrate that Maglev technology could play a role in helping to address several of the main problems associated with inter and intra-regional transportation in the United States (FRA, 1993). Continued economic and population (resident and visitor) growth in major metropolitan areas around the country will result in increased demand for capacity (mobility), greater operational congestion (time-delays), and increased safety deficiencies of transportation systems. The development of Maglev would provide an alternative transportation option to federal, state, and local transportation decision makers who are seeking to alleviate congestion in airway and automotive corridors that results from increasing travel demand. Maglev systems could also extend the usefulness of existing airport and highway infrastructure (FRA, 1997). Associated benefits would include increased productivity of business travelers, regional economic development partly as a result of joint development at stations, support to comprehensive land use planning based on transit-oriented development to address urban sprawl, reduced emissions resulting in enhanced air quality, and reduced consumption of non-renewable resources. The high performance of Maglev transportation systems would provide air-competitive trip times at longer trip distances than other HSGT alternatives. In addition, Maglev technology would potentially maximize the utilization of airports' potential as centers for inter-modal transfer and travel by providing inter-modal connections between airports and business districts. By providing a high-speed link connecting two or more airports serving a single region, additional air travel demand can be shifted to under-used airports with additional capacity instead of requiring the expansion of existing airports.

1.4 PUBLIC INVOLVEMENT

Public and regulatory agency involvement is critical to the success of the Maglev Deployment Program, particularly with regard to NEPA. Since the enactment of TEA-21 in June 1998, FRA has pursued a number of paths for informing and involving the public in the Maglev Deployment Program. On July 23, 1998, FRA, in cooperation with the High-Speed Ground Transportation Association and Amtrak, held an all day meeting in Washington, D.C. to explain the TEA 21 rail-related programs including explanation of the Maglev Deployment Program. Other meetings to inform the public and solicit concerns on the program were held in Dallas, Harrisburg, Los Angeles, and New Orleans.

A pre-application meeting for prospective participants for pre-construction planning grants for the Maglev Deployment Program was held on November 4, 1998 at the Federal Railroad Administration, 1120 Vermont Avenue, NW, Washington, D.C. In attendance were 49 interested parties. The meeting consisted of a series of presentations by FRA and Federal Transit Administration (FTA) officials interspersed with questions from the audience that were informally answered by FRA staff. The questions that were raised by the audience and written questions submitted previously, provided the basis for a more complete presentation of questions and answers regarding the administration of the Magnetic Levitation Transportation Technology Deployment Program. The material that was prepared by FRA was included in the Docket, mailed to all attendees and was electronically posted on the FRA website.

The Maglev Deployment Program cooperative agreements between FRA and the seven selected state participants require each state to develop and implement a comprehensive public involvement program during the planning and design stages. Each state has initiated public and regulatory agency involvement programs that included local meetings, websites, fact sheets, and informational brochures. These programs are summarized in each state's Environmental Assessment. Additional information on these activities can be obtained by contacting the state Maglev Alternative representative identified in Appendix A, assessing available alternative internet sites, and by reviewing the state's EA.

FRA published a Notice of Intent to prepare a PEIS in the Federal Register on December 29, 1999 (see Appendix E). The notice solicited public and agency input into the development of the scope of the PEIS, and advised the public that outreach activities conducted by the program participants would be considered in the preparation of the PEIS. Furthermore, FRA established a Maglev Deployment Program website. (http://www.fra.dot.gov/o/hsgt/maglev.htm) on the agency's Internet site where the public could obtain additional information related to the Maglev Deployment Program.

The FRA received several direct repsonses to the Notice of Intent and the state EA's that identified issues to be addressed in the PEIS (see Appendix J). In addition, each of the state EA's also identified issues of concern used in establishing the scope of the DPEIS.

With the approval of the DPEIS by the FRA Administrator on June 29, 2000 and its public release, FRA published an accompanying Internet website at (http://www.fra.dot.gov/s/env/MagPEIS.htm) that made the document available for download. The DPEIS (see the Appendix in the PEIS Volume II) was sent to major stakeholders, identified by the states, for review and comment. In addition, copies were sent to libraries located within the area that would be served by each of the alternatives. An official comment period commenced following the issuance of the DPEIS, and closed on September 19, 2000

All written comments on the DPEIS were placed in the Department of Transportation's electronic Docket Management System. This system makes electronic submission and viewing of comments and other submissions, using the docket number "*7472*," available on the Internet at http://dms.dot.gov/. Comments on the DPEIS and FRA responses to appropriate concerns can be found in Volume II of this PEIS.

After the DPEIS was released for public comment, public information meetings were held in the vicinity of each of the seven Maglev Program proposals during August 2000. These meetings provided information to the affected public about the PEIS and the Maglev program and provided the public with an opportunity to comment on the DPEIS. Locations and dates of the public information meetings were posted on FRA's website, advertised locally, and made available by the participants listed in Appendix A. In addition to the public information meetings, FRA held a public hearing on the DPEIS in Washington, D.C. on August 24, 2000 which provided interested parties an opportunity to make oral presentations. The transcript of the public hearing is included in Volume II of this PEIS. The distribution list of the PEIS (see Appendix F) includes the list presented in the DPEIS plus attendees at the public meetings and public hearing, and those individuals who provided a mailing address in the comments to the Document Management System.

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2 ALTERNATIVES

2.1 HIGH-SPEED GROUND TRANSPORTATION BACKGROUND

Transportation between cities in the United States is essential to the economy and vitality of the nation. Travel demand is growing and intercity transportation by air and auto continue to suffer from congestion and delay. This condition is particularly evident within large metropolitan areas, surrounding airports, and during weekends, holiday and bad-weather periods. Domestic intercity air traffic has outpaced the growth in airport capacity. "The FAA considers High-Speed Ground Transport (HSGT) to be a potential means of relieving the pressure on short haul traffic by diverting air trips of 800 kilometers (500 miles) or less" (FAA, 1994). Our ability to construct additional highway capacity (i.e., additional lanes) is proving difficult in a number of locations across the country. In light of concerns about dependence on petroleum based vehicles, there is particular interest in non-petroleum powered intercity HSGT systems that have the capability to provide immediate access to airports with stations inside air passenger terminals.

FRA has been evaluating rail and maglev related HSGT systems that could satisfy city-to-city transport for a number of years. Below are some examples of related reports:

> *Report to Congress, Assessment of the Potential for Magnetic Levitation Transportation Systems in the United States, Moving America, New Directions, New Opportunities (DOT, 1990).*
>
> *MAGLEV 93: 13th International Conference on Magnetically Levitated Systems and Linear Drives* (ANL, 1993).
>
> *Maglev Vehicles and Superconducting Technology Integration of High Speed Ground Transportation into the Air Travel System* (ANL, 1989).
>
> *Benefits of Magnetically Levitated High Speed Transportation for the United States, Volume 1 Executive Report* (Grumman 1989).
>
> *U.S. Congress, Office of Technology Assessment, New Ways: Tiltrotor Aircraft & Magnetically Levitated Vehicles* (OTA 1991).
>
> *High-Speed Ground Transportation for America* (DOT 1997).

Systems that FRA has evaluated include:

- Accelerated Rail Service (Accelerail).
- New High-Speed Rail (HSR) Systems.
- Magnetic Levitation (Maglev).

Accelerail. Accelerail consists of upgrading intercity rail passenger service on existing railroad corridors. Most of these options share existing rights-of-way (ROW) with the freight railroad owners of the corridors. These options have top speeds of 145 to 241 km/h (90 to 150 mph). The higher speed systems comprise both electrified and non-electrified motive power. In the electric systems, the power is usually obtained from overhead catenary wires. One Accelerail example is the *Empire Regional* service between New York City and Albany, NY. Accelerail success often depends on the ability of the passenger service providers to secure the cooperation of freight line owners.

New High-Speed Rail. New HSR Systems represent the advanced steel-wheel-on-rail passenger systems that operate on almost completely new rights-of-way. These systems use a combination of electric power and other advanced components. HSR systems that have been developed in Japan, France, and Germany obtain practical operating speeds of approximately 300 km/h (186 mph). Japan has claim to the first HSR, the *Shinkansen* (or bullet train). France has the *Train à Grande Vitesse* referred to as TGV, and Germany has its *Intercity Express* (ICE). Unlike Accelerail, the HSR option utilizes exclusively built rail corridors. Because of high top speeds, the cost of maintaining and operating HSR systems is higher than Accelerail.

Maglev. Magnetic levitation (Maglev) uses magnetic forces to lift, propel, and guide the train over a special guideway. The power to propel the train is provided in the guideway. Maglev does not require wheels or other mechanical parts at higher speeds for support or propulsion. Without wheels or other components to cause resistance, cruising speeds up to 500 km/h (310 mph) are practical. This speed would allow Maglev to achieve air-competitive trip times at longer trip distances than other HSGT options (FRA, 1997). Over the past three decades, research and development programs in maglev technology have been conducted by several countries including: United States, Great Britain, Canada, Germany, and Japan. Germany and Japan have the most experience with demonstrated Maglev technology. Maglev requires its own guideway that can be elevated or placed in tunnels, thus generally avoiding the safety concerns of grade crossings and access to the tracks which exist for Accelerail systems.

FRA has identified a number of factors that are relevant to transportation planners in deciding which type of HSGT will satisfy the transportation needs of particular corridors. These include:

- Faster Trip Times.
- High Reliability During Peak Demand.
- Convenience.
- Shared Corridors.
- High Capacity.
- Safety.
- Petroleum Independence.

Faster Trip Times. This feature is one of the most desirable characteristics to attract passengers. To be competitive with airplanes, high peak speed and high acceleration/braking are necessary. Cruising speeds of approximately 400 to 500 km/h (250 to 310 mph) and higher are preferable (FRA, 1993) for trips of about 483 km (300 mi).

High Reliability During Peak Demand. Reliability of service is critical to satisfy consumer demand. Achieving closer headways with precise schedule reliability results in travel time savngs from connection and transfer times of a few minutes rather than the more common half-hour or more with existing transportation systems.

Convenience. The ability to provide frequent service to central business districts, airports, and other major metropolitan area travel nodes is necessary to provide a valuable service that satisfies customers. The success of any intercity passenger transport service depends upon its ability to attract customers with convenient service.

Shared Corridors. Co-locating guideway or track with existing utility or transportation corridors reduces costs, requires less land, and minizes impacts. Using existing track or right-of-way could be a disadvantage to maintaining higher speeds as grade crossings and other constraints are encountered. If the proposed technology could use the existing corridor effectively, costs can be reduced. Freight and other operations should not be disturbed when sharing common facilities. Gaining the cooperation of owners and users of existing corridors is desirable and depends on the degree of disruption caused by the proposed system.

High Capacity. Sufficient capacity must be provided to accommodate fluctuations experienced during travel demand peaks and traffic growth well into the twenty-first century. Headways of as little as several minutes would be necessary during periods of – peak travel to provide high capacity.

Safety. The proposed system must have acceptable safety characteristics. Grade crossings and inappropriate pedestrian access to tracks are safety concerns at higher speeds. A design that minimizes grade crossings and track access can substantially reduce this critical safety concern.

Petroleum Independence. Air and auto modes of travel require petroleum for power. With supplies of non-renewable energy resources subject to depletion and disruption, the ability to use varied power sources is a significant advantage. In addition, the use of more efficient and renewable modes of power generation that reduce air emissions is desirable for environmental quality and sustainablity.

Maglev systems appear to meet all of these factors. Maglev systems can achieve speeds of over 402 km/h (250 mph) on regularly scheduled service and satisfy the criterion for speed. Maglev can achieve very close headways between trains and provide the needed capacity during peak travel periods and into the future, thus satisfying the criteria for reliability, convenience, and high capacity. Maglev would require its own separate guideway. However, it would be elevated or grade separated and can be co-located with utility corridors and some existing transportation corridors satisfying the shared corridor criterion. With integral system safety controls and a grade-separated guideway, there are no at-grade crossings and the safety criterion is satisfied. Maglev uses electric power to operate, thus the criterion for petroleum independence is achieved.

2.2 MAGLEV ALTERNATIVES

In 1998, Congress enacted the Transportation Equity Act for the 21st Century (Pub. L. No. 105-178, 112 Stat. 107). This comprehensive piece of transportation legislation focuses on highways, transit, railroads and inter-modal transportation planning and development. Focusing on future transportation solutions, Congress created the Maglev Transportation Technology Deployment Program to provide an opportunity for the Department working with the private sector to evaluate and demonstrate the feasibility of a new technology with the potential to address some of the nation's most pressing transportation needs. The Program is unusual in that it was established to achieve two separate goals: demonstrating the feasibility of an entirely new transportation technology while at the same time addressing the transportation needs of a particular area of the country.

In establishing the Program, Congress required the Secretary to establish project selection criteria prior to soliciting applications for financial assistance. The Secretary has done so in an interim final rule published in the Federal Register on October 13, 1998 (63 Fed. Reg. 54600) and a final rule published in the Federal Register on January 14, 2000 (65 Fed. Reg. 2342). The statute requires the project selection criteria to include among other things the extent to which a project is nationally significant, including the extent to which the project will demonstrate the feasibility of deployment of Maglev technology throughout the United States, and the extent to which timely implementation of the project will reduce congestion in other modes of transportation and reduce the need for additional highway or airport construction. Additional selection criteria include the extent to which the project will augment Maglev networks identified as having partnership potential, and the extent to which financial assistance would foster public and private partnerships for infrastructure development and attract private debt or equity. The clear statutory goal is for the program not only to solve a particular transportation need but to do so in a way that establishes the feasibility of the technology over the long-run. The statute does not authorize the agency to use the funding provided for the Maglev Deployment Program to pursue other non-Maglev technologies, including either accelerail or high-speed rail options and these other technologies would not address the primary purpose of the program which is to demonstrate the feasibility of Maglev in addressing certain identified transportation needs.

In preparing this PEIS, FRA has evaluated two basic alternatives: the Build Alternative in which the Secretary would select from the seven proposed Maglev Deployment alternatives for the final design and construction phases, and the No-Action Alternative in which transportation problems would continue to grow and actions to address those problems would be taken outside the Maglev Deployment Program. Within the Build Alternative are seven sub-alternatives reflecting the seven applications for financial assistance in the program: California, Florida, Georgia, Louisiana, Maryland, Nevada, and Pennsylvania. FRA evaluated the environmental impacts associated with a decision on whether to proceed with a Maglev Deployment Program and a comparison of environmental impacts associated with each of the seven alternative locations at a level of detail appropriate for the programmatic decisions being made at this stage.

2.2.1 Initial Maglev Alternatives

Initially, FRA began the process of assessing Maglev Alternatives in 1998 by soliciting proposals for financial assistance for pre-construction planning activities including the consideration of environmental concerns. The one critical technical criterion that was established was that each applicant's proposed Maglev Program is to be a segment or segments of a high-speed ground transportation corridor. Thus, each proposal is for a segment or segments of a longer designated corridor that could be considered for future Maglev deployment. There were no other geographical or technical restrictions on considering Maglev alternatives. FRA received eleven Maglev Alternative projects for consideration.

2.2.2 Initial Maglev Alternative Screening

A committee appointed by the FRA Administrator evaluated each application to determine whether the proposed project would likely meet specified Project Elegibility Standards. Applications were also assessed to determine if, upon completion of the planning process, they would likely lead to a project that can be financed, built, and operated by a public/private partnership. On May 24, 1999, the Secretary of the Department of Transportation selected seven of the eleven Maglev Alternative Projects as participants in the Maglev Development Program. The seven Alternatives, located in California, Florida, Georgia, Louisiana, Maryland, Nevada, and Pennsylvania, are the Action alternatives identified for further analysis in this PEIS as described in Section 2.4. During this initial phase of the competition, each participant is to prepare project descriptions, supporting pre-construction planning reports, and environmental documentation EAs. This pre-construction documentation phase is expected to continue through 2001. Based on the information in the Environmental Assessments, each participant chose one of two alternative Maglev technologies. Six states chose the Transrapid International TR08 system, while Florida chose Maglev 2000 technology. Both of these technologies are described in Section 2.3 Alternative Maglev Technologies.

2.3 ALTERNATIVE MAGLEV TECHNOLOGIES

Maglev is a transportation technology in which vehicles travel safely at speeds of 400 km/h to 500 km/h (250 to 310 mph) or higher while suspended, guided, and propelled above a guideway using common magnetic forces. The guideway is the physical structure along which maglev vehicles are levitated, guided, and propelled. The guideway can be installed elevated or at-grade heights and supported by conventional concrete or steel columns.

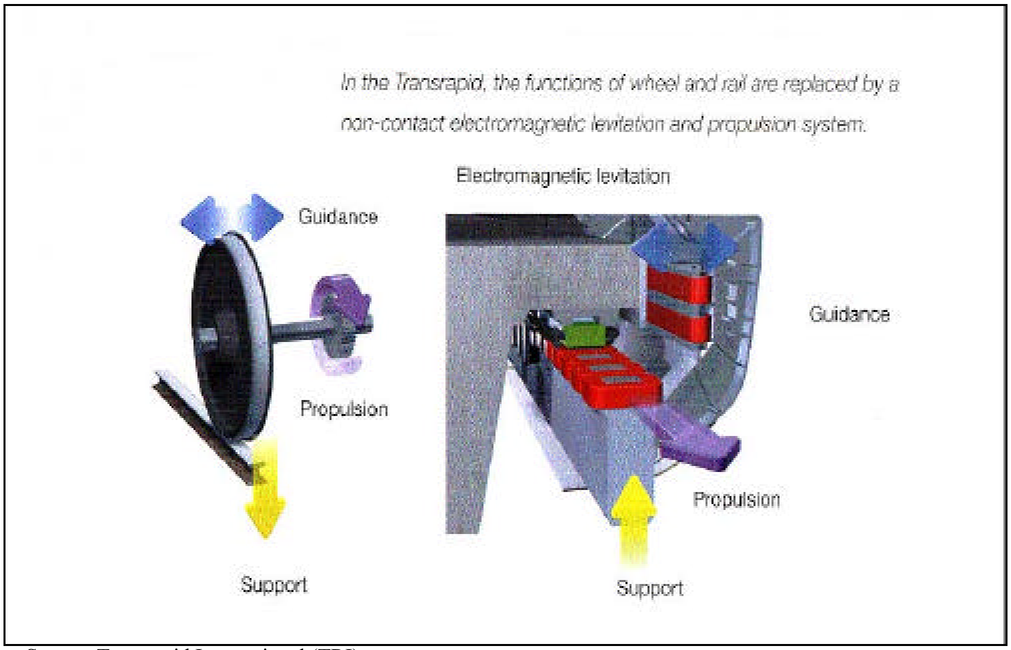
Two Americans, Robert Goddard and Emile Bachelet first identified the concept of magnetically levitated trains at the turn of the 20th century. By the 1930s, Germany's Hermann Kemper was developing a concept and demonstrating the use of magnetic fields to combine the advantages of trains and airplanes. In 1968, Americans James Powell and Gordon Danby were granted a patent on their design for a magnetic levitation train. Over the past three decades, extensive alternative Maglev technology research and development programs have been conducted by several countries including: the United States, Great Britain, Canada, Germany, and Japan. Germany and Japan have the most experience with demonstrating Maglev technology; both have test tracks and have achieved extensive testing of their concepts and vehicles. However, only the German Transrapid International (TRI) Maglev technology system alternative is ready for commercial passenger service at high speeds. The public can pay to ride the test system, and it is part of the World Exposition (Expo 2000) centered in Hanover, Germany from June 1 to October 30, 2000. With continued ongoing development on American Maglev technology, Maglev 2000 service is imminent.

Six of the seven states under consideration for the Maglev Deployment Program competition are proposing to use the TRI system. Florida is the only state that is proposing to use a different concept of Maglev technology. Although the Florida technology, referred to as Maglev 2000, is similar to the TRI system it has unique technical differences. These two alternative Maglev technologies are summarized below.

2.3.1 Transrapid International Maglev System

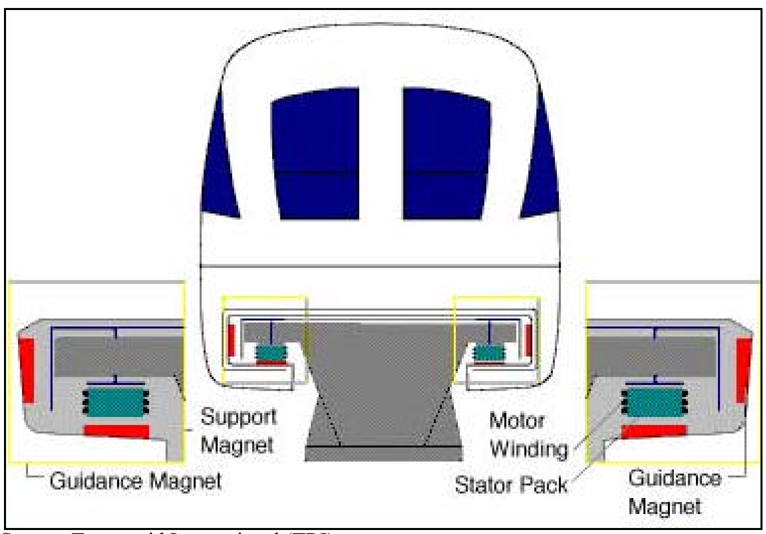
The Transrapid Maglev System has been demonstrated and tested at the Transrapid Test Facility in Emslan, Germany (TVE) for more than 15 years and a total mileage of approximately 700,000 km (434,959.9 mi) has been achieved. With an improved operation control system, an extended propulsion system (two substations), a variety of guideway types, and the 3-section pre-series vehicle TR08 replacing the 2-section prototype vehicle TR07, the TVE represents the state-of-the-art of the Transrapid International Maglev System. The German Federal Railroad Authority (Eisenbahn Bundesamt) has already approved most of the maglev-specific components Although some measurements still need to be completed, the new components (such as the TR08 vehicle) were desigend to have better performance qualities than the version they replaced. Significant differences in measured information/data are therefore not expected. For the site-specific EIS work, the most recent technical information/data will obviously need to be utilized. Figure 2.3-1 depicts the three primary functions typical to the TRI Maglev technology: (1) levitation or suspension; (2) propulsion; and (3) guidance. In most current designs, magnetic forces are used to perform all three functions.

Suspension and Guidance Systems. The TRI Maglev train carriage system wraps around the guideway to securely hold and guide the vehicle. There is a very slight space, about 1 cm (0.4 in), between the carriage system and the guideway to allow levitation and minor lateral movement. The vehicle is supported and guided by the principle of electromagnetism. Attractive forces between electromagnets located in the Maglev carriage system that surrounds the guideway and the stator packs installed on the underside of the guideway allows the vehicle to levitate. The TRI vehicle can levitate about 1 cm (0.4 in) above the guideway. Other magnets on the interior sides of the carriage hold the vehicle laterally in place. Figure 2.3-2 show the details of the support and guidance systems.



Source: Transrapid International (TRI)

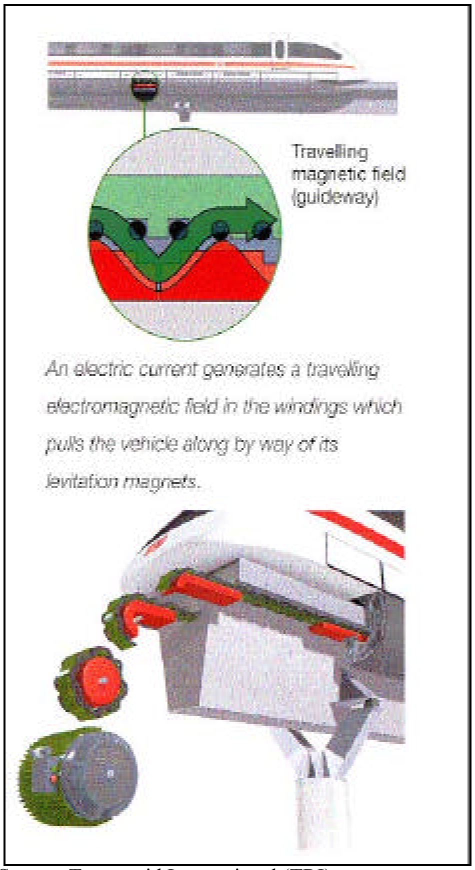
Figure 2.3-1 - Transrapid Maglev Components



Source: Transrapid International (TRI)

Figure 2.3-2 - Transrapid Support and Guidance Systems

Propulsion Systems. Maglev propulsion uses the same electrical principle that causes an electrical motor to spin. Electricity is introduced into the windings of the motor causing the interior of the motor to spin. Instead of the rotating magnetic field in the motor, Maglev places the electric motor's components horizontally to produce a traveling magnetic field along the guideway. Unlike conventional rail systems the vehicle's propulsion is provided in the guideway. For Maglev propulsion, the center part of the motor is stretched horizontally in the bottom of the vehicle's carriage while the outer wire wrappings of the motor are placed horizontally on the underside of the guideway. As an electrical current is placed over the wires an electromagnetic field is produced and the resulting horizontal force pulls the vehicle along the guideway. Adjusting the frequency of the three-phase current can alter the speed of the vehicle. If the direction of the traveling field is reversed, the propulsion system changes into a generator. Thus, braking the vehicle without the typical friction contact of orthodox brakes. Figure 2.3-3 shows a simplified concept of how the electrical motor concept is applied to Maglev.

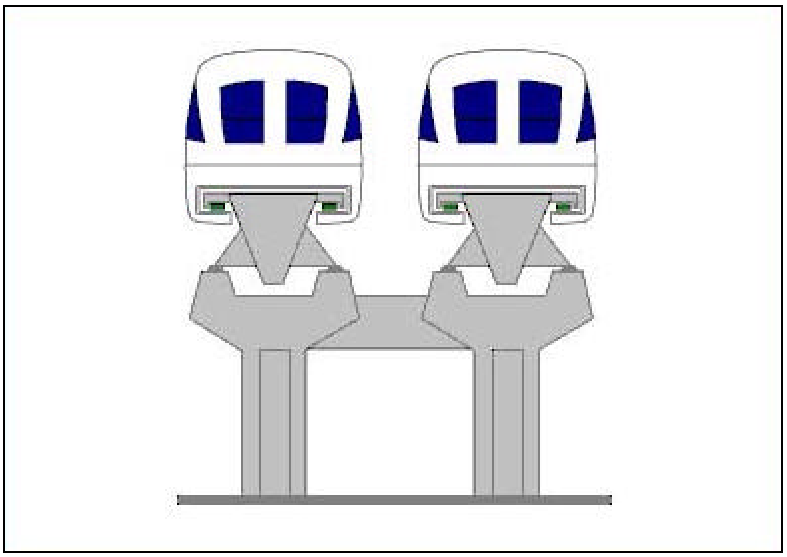


Source: Transrapid International (TRI)

Figure 2.3-3 - Transrapid Propulsion

Guideway. The guideway is usually a continuous “T” shape that can be elevated on typical bridge style columns, mounted at grade on a continuous foundation, or using other configurations. The guideway beam structure can be fabricated from steel or concrete. Typically, the bottom of the “T” is hollow. To change tracks a unique steel guideway crossover section is used. The steel guideway crossover is held stationary at one end and the other end is elastically bent (taking seconds) to reroute the Maglev to another track. Positive locking devices are used to secure the steel track into the desired position. There are no restraints to the height of the guideway, so elevating the guideway results in the obvious added benefit of no at-grade crossings (see Figure 2.3-4).

Train. Vehicle interior design is left to the operator's desire. For example four across first-class seating could be installed along with six across second-class passenger seating. Interior carpeting, overhead storage and other amenities are easily installed. The trains are built with two or more consists. Each train consist is independently constructed and cannot be "piggy-backed" once constructed. Seating capacity depends on consist length and can be approximately 240, 340 and 440 seats, respectively, for the 3-, 4- and 5-section Transrapid vehicles. Vehicle lengths are 78.8 m (258.5 ft), 103.5 m (339.5 ft), and 128.3 m (420.9 ft), respectively. A three section train weighs 189 metric tons (416,674 lbs), when loaded. Longer consists are possible. Disabled seating space and bathrooms are installed. Exterior colors and detail are at the operator's discretion. Figure 2.3-5 shows a typical exterior profile and interior plan.



Source: Transrapid International (TRI)

Figure 2.3-4 - Transrapid Guideway

Control/Communication/Electric Substations. Maglev trains are controlled and monitored from a central operations center and the system is fully automated. Although the actual vehicle control is from the operations center, each train has an attendant. The control center is responsible for all communications, information, control and operating tasks for the entire system. Train information is through a redundant radio data transmission along the guideway and mobile communications from within the vehicles. In addition, data transmissions are also provided by means of fiber optic cables along the base of the guideway support columns. Power to the Maglev system is supplied by substations along the length of the track which are connected to the public grid via dead-end feeders.

Source: Transrapid International (TRI)

Figure 2.3-5 - Transrapid Interior Plan

Stations/Maintenance Facility. In addition to the two end point stations, there could be additional stations with park and ride facilities along the corridor. The stations would resemble typical train stations. However, for safety considerations platforms would likely have doors to keep waiting riders away from the guideway. A maintenance facility for the system is planned where all vehicle servicing, maintenance and vehicle storage will take place. Final location of the maintenance facility will be determined based on site-specific final system design considerations.

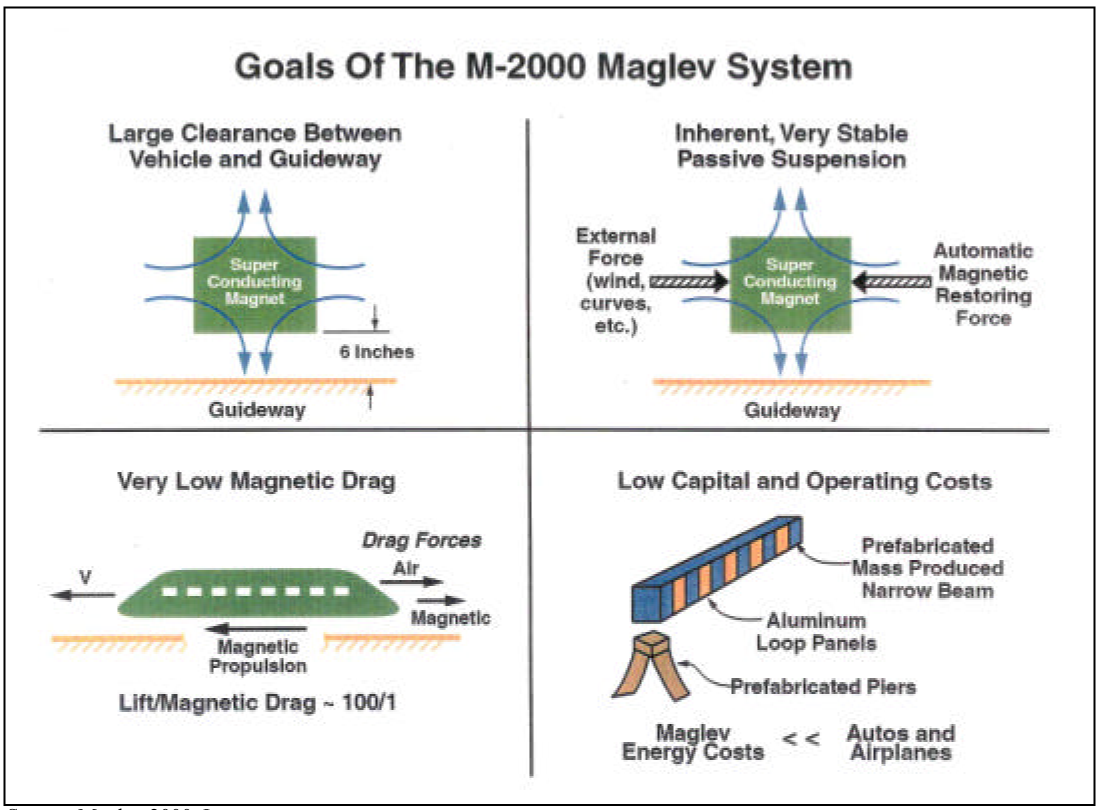
Safety. Maglev design is inherently safe with the vehicles carriage wrapped around the "T" shaped guideway. This design prevents inadvertent derailing of the vehicle. The vehicle's location is monitored by on-board and guideway sensors providing redundancy if one should malfunction. In the event of a non-scheduled stop, the Maglev train will automatically continue to one of the auxiliary stopping areas located along the route. At the auxiliary stopping area passengers can depart the vehicle to a platform leading to the ground. If the emergency requires immediate escape, an onboard evacuation chute or tube is proposed. In addition to the operations center monitoring and controlling the vehicle, an on-board attendant can assist in an emergency situation.

Additional information on the TRI Maglev can be found at www.transrapid-international.de/english/home.html.

2.3.2 Maglev 2000 System

The Maglev 2000 (M-2000) technology incorporates the most recent refinements of the magnetic levitation system originally invented in 1966 by Drs. Gordon Danby and James Powell. The Danby/Powell system has proved to be operational by the Japanese National Railroads that adopted the Danby/Powell system. Drs. Danby and Powell have continued the refinement of their magnetic levitation system to match the unique transportation conditions found in the United States, characterized by longer travel distances and lower density of development, even in urban areas. In response to the need to achieve major cost reductions, M2000 has developed two newly patented solutions: reduced-cost guideways and high-speed switches. The following paragraphs explain the Maglev 2000 technology alternative (FRH, 2000).

Suspension and Guidance. Each M-2000 Maglev vehicle carries a set of lightweight, strong superconducting magnets. As the vehicle moves along a linear guideway, its magnets induce transient electrical currents in a sequence of discrete aluminum wire loops positioned on the guideway. The strong magnetic repulsion forces between the vehicle magnets and the induced currents underneath them levitate the vehicle 15 cm (6 in) above the guideway. The levitation is inherent and automatic as long as the vehicle travels along the guideway at a speed of 32 km/h (20 mph) or above. At lower speeds, the induced currents are too weak to levitate and auxiliary wheels support the vehicle. As illustrated in Figure 2.3-6 not only is the moving M-2000 vehicle automatically and inherently levitated with a large clearance above the guideway, it is also automatically guided and stabilized.

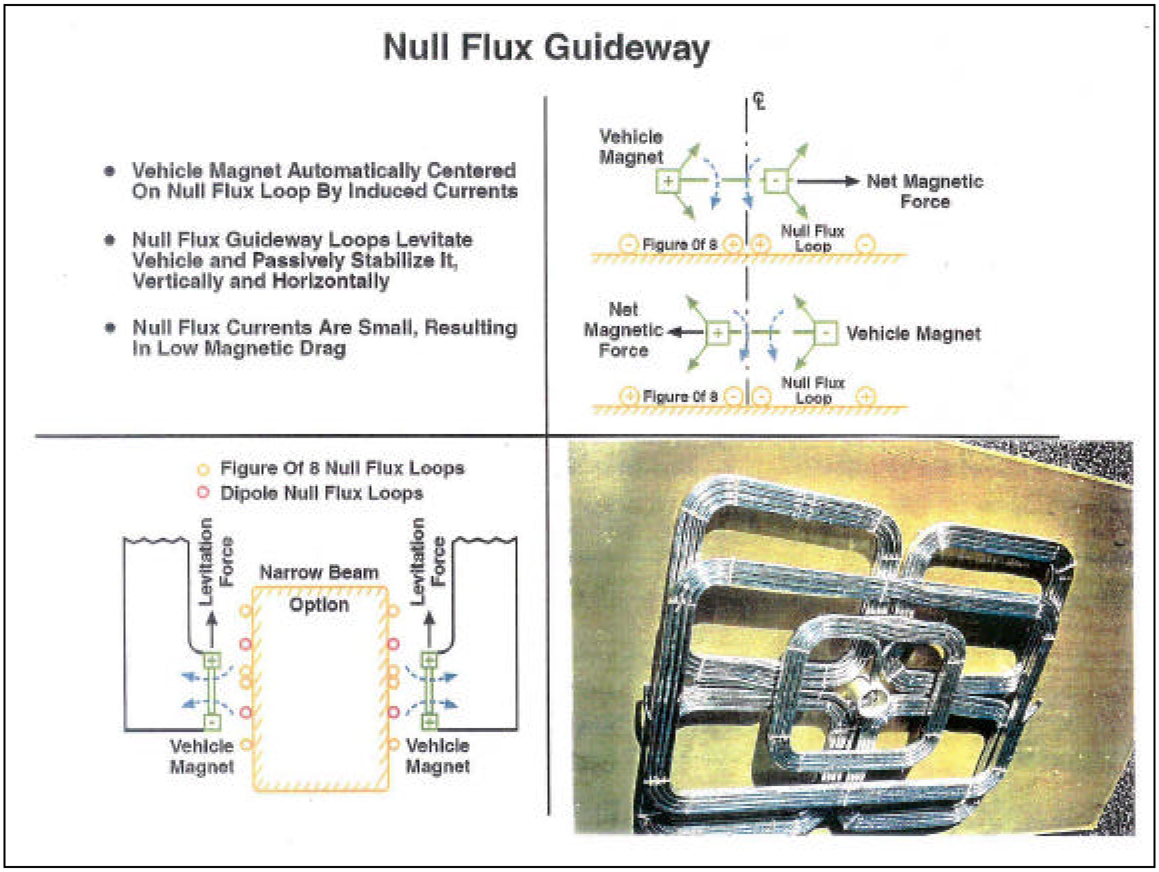


Source: Maglev 2000, Inc.

Figure 2.3-6 - M-2000 System

The figure-of-8 loop, shown in Figure 2.3-7 provides lateral stability, while the dipole loop provides vertical lift and stability. These automatic guidance forces stabilize the vehicle against vertical and lateral displacements, as well as pitch, yaw, and roll movements. The guidance forces are so strong - over twice the weight of the vehicle at their full value - that no conceivable external force can make the vehicle contact the guideway. The vehicle, however, moves freely along the guideway without hindrance.

This ability to switch at high speed using electronic, non-mechanical switches to control which line of guideway loops the vehicle will follow, enables M-2000 vehicles to bypass stations at high speed if desired, without slowing down the vehicles on the main guideway. As a result, the M-2000 system can have close station spacing to conveniently serve dispersed metropolitan regions, while at the same time retaining high average speed capability.



Source: Maglev 2000, Inc.

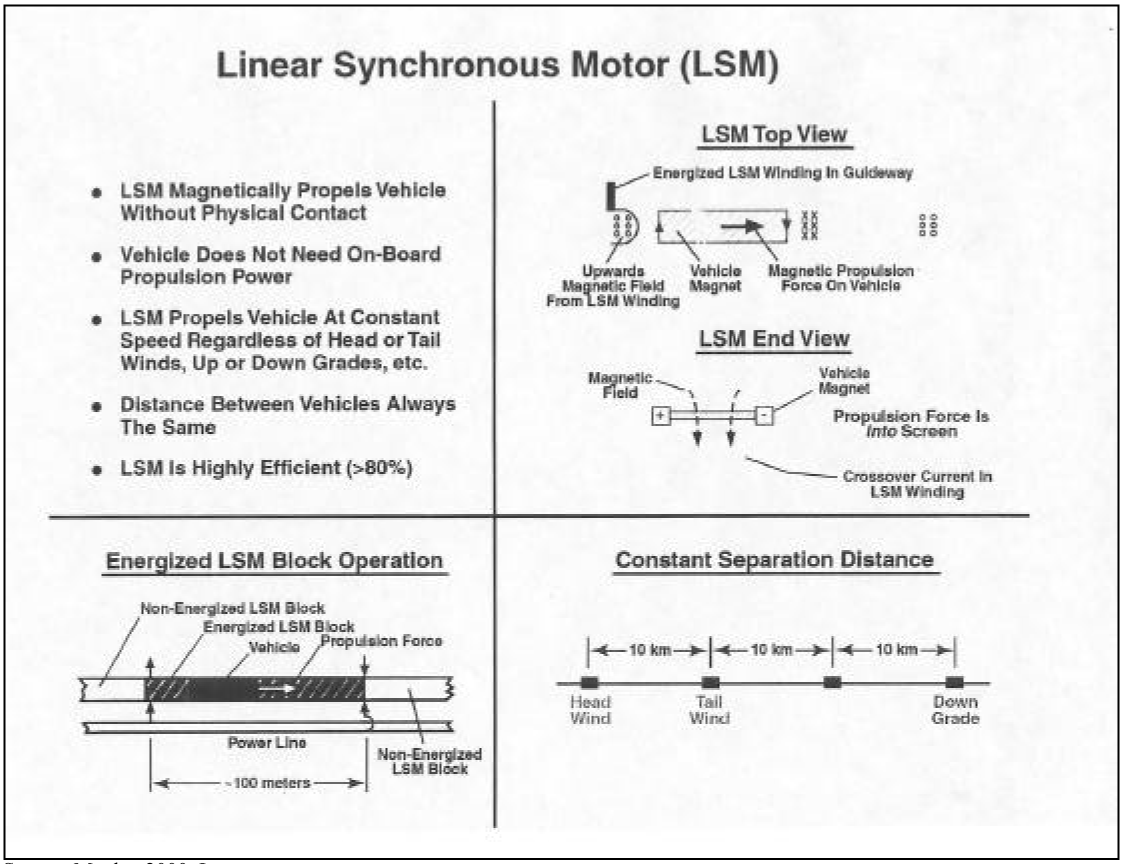
Figure 2.3-7 - M-2000 Null Flux Guideway

Propulsion Systems. The M-2000 Maglev System employs the linear synchronous motor (LSM) propulsion system, in which a relatively-small alternating current (AC) in a set of propulsion windings on the guideway interacts with the high field strength superconducting magnets on the vehicle to produce a longitudinal thrust force that keeps the vehicle moving. The basic principles of the superconducting LSM propulsion system, which was invented by Powell and Danby in 1969, are illustrated in Figure 2.3-8.

Because of the high field strength of the superconducting magnets on the M-2000 vehicle, the magnetic thrust forces are very strong and can propel the vehicle at 483 km/h (300 mph), even though there is a large physical clearance – i.e., 15.24 cm (6.0 in) –

between the superconducting magnets and the LSM windings on the guideway at any given location on the guideway.

Thus, the vehicle magnets and AC LSM windings are always in phase, so that the longitudinal thrust force is always in the same direction – i.e., in the direction of vehicle motion. This synchronous type of operation is very important, since the LSM propulsion system keeps all vehicles moving at a fixed speed regardless of variations in external force. An individual vehicle can still maintain its fixed speed and distance of separation from other vehicles, regardless of head or tail winds, or up or down grades not experienced by the other vehicles. As illustrated in Figure 2.3-8, this fixed separation distance will be a minimum of 10 km (6.2 mi), even at very high traffic loadings.

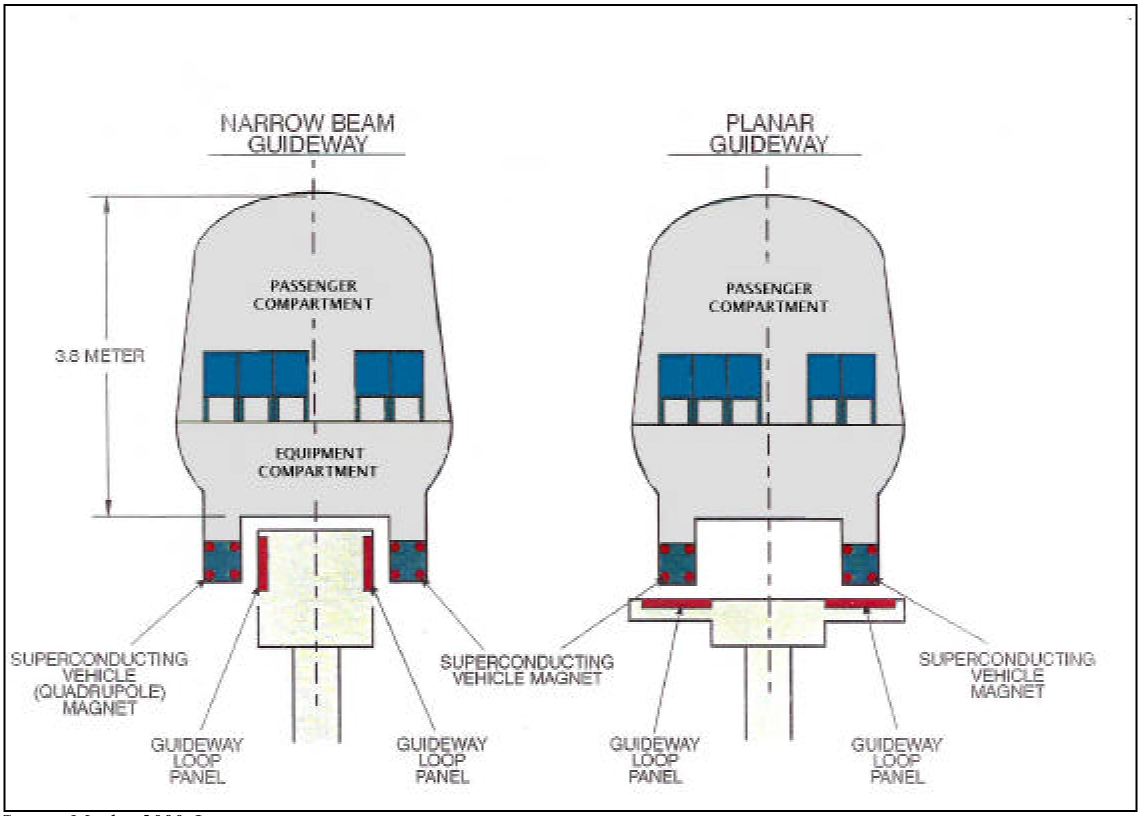


Source: Maglev 2000, Inc.

Figure 2.3-8 - M-2000 Propulsion System

In the M-2000 LSM propulsion system, the whole guideway is not continuously energized. This increases electrical efficiency, since the portions of the guideway that do not have vehicles on them are not energized.

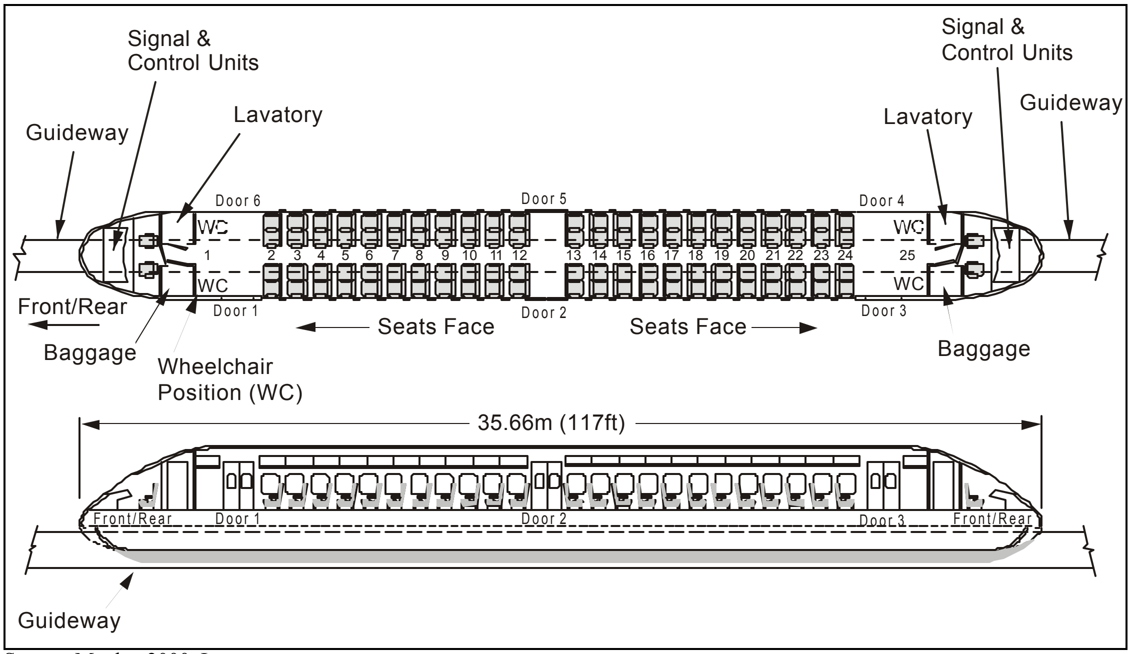
Guideway. The M-2000 vehicles operate on either a narrow-beam guideway or a planar guideway, with the latter primarily used for switching to off-line stations, (see Figure 2.3-9). The narrow-beam guideway is a single hollow reinforced concrete box-beam structure to the sides of which are attached thin panels, 102 cm (40 in) in width, 7.6 cm (3 in) in depth, of polymer concrete in which are imbedded aluminum wire loops that act to levitate, guide, and propel the M-2000 vehicle along the guideway. The particular loop configurations used for the narrow-beam guideway, the figure of 8, the dipole, and the LSM loop, are illustrated in Figures 2.3-7 and 2.3-8. The planar guideway uses the same types of guideway loops, but the plane of the assembly is rotated by 90º (degrees) so that the loops are oriented in a horizontal plane, instead of the vertical plane used for the narrow-beam guideway. Based on fabrication experience with beam and guideway prototypes, the total cost for the 2-way M-2000 guideway is projected to be $10 million per mile.



Source: Maglev 2000, Inc.

Figure 2.3-9 - M-2000 Guideway Loops

Train. The M-2000 vehicle is aerodynamically shaped so that it can move in either direction along the guideway with the same aerodynamic and magnetic drag forces. The M-2000 passenger vehicle is shown in Figure 2.3-10. It can carry 100 passengers and has a total weight of 40 metric tons (88,000 lbs). All seating would be equivalent to first-class airline seating, with 25 rows of 4 seats per row. The vehicles are designed to operate as individual independent units on the guideway. For portions of the maglev route where traffic loading is extremely heavy – e.g., greater than 12,000 passengers per hour of 2-way traffic – the individual vehicles can be coupled together in 2 or 3 car sets to further increase traffic capacity.



Source: Maglev 2000, Inc.

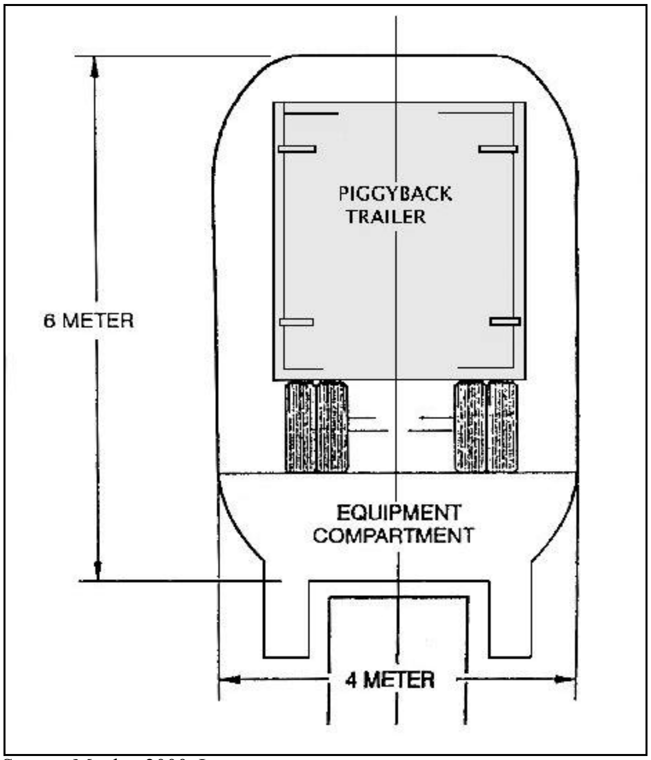
Notes: Bi-directional vehicle, 3 doors each side. Overall length 35.66 (117 ft).
Passenger exit from end doors and enter center doors.
92 passengers accommodated in 23 rows of 2/2 first class seating.
Seats face away from middle of car. Rows 2-12 face the front. Rows 13-24 face the rear.
4 wheelchair stations –2 on each end of the vehicle, at rows 1 & 25.
Enhanced capacity (A-320 style) overhead and under-seat baggage capacity.
One accessible lavatory on each end of the car, but both on the same side of car.
Overflow carry-on luggage space (strollers, etc.) on each end of car.
Attendant seat, signal & control, communications compartments.
Automatic (electric, "no hands") couplers on each end of car.

Figure 2.3-10 - M-2000 Passenger Vehicle

The M-2000 guideway is designed for dual-use capability to carry both passengers and freight transport vehicles. The freight vehicles can carry either containers or truck trailers as illustrated in Figure 2.3-11.

Control/Communication/Electrical Substation. Movement of the M-2000 vehicles on the Maglev system would be controlled by a central control facility and not by operators on the individual vehicles. The central facility would have a real-time display of the speed, location, and operational conditions of all vehicles traveling on the system, together with real-time monitoring of the operating conditions at all points on the guideway. This ability plus the ability to control the speed of the vehicles by the alternating current frequency of the LSM power fed to the guideway, make the central traffic facility able to ensure safe operation of the system.

A two-way communication link between the moving vehicles and the traffic control facility would be maintained at all times. The vehicles would transmit in real time detailed data on the operational "health" of the guideway and various sub-systems including: guideway loop performance, the position and mechanical response of the guideway structure, the temperature of the individual superconducting magnets, and their current levels.



Source: Maglev 2000, Inc.

Figure 2.3-11 - M-2000 Freight Vehicle

A 69 kv AC power line that runs alongside the Maglev guideway provides the electrical power for the LSM propulsion system. At intervals of approximately 10 km (6 mi), step-down transformers reduce the AC voltage to 6kv and rectify it to direct current (DC). Between the step-down points, the DC is carried along the guideway by an aluminum-conductor/polyethylene-insulated cable distribution line. Electronic silicon controlled rectifier (SCR) switches then energize the local section the M-2000 vehicle is currently traveling on, creating a chopped AC wave in the LSM winding that propels the vehicle.

Stations/Maintenance Facilities. The operations control center would be located at the maintenance facility and will house state-of-the-art computers, closed-circuit TV, communications and signaling equipment. The operations control center will monitor the operational parameters of the entire Maglev system and its sub-systems, including the guideway, vehicles and stations. The stations will resemble typical modern train stations. Final location of the maintenance facility has not been determined and will be based on site-specific final-system design considerations.

Safety. The M-2000 Maglev system is designed and engineered to maximize safety and reliability through the use of design approaches that minimize risk, multiple redundant components that eliminate the chances of single-point and common-mode failures, back-up systems, and continuous, real-time monitoring of the operating health of the M-2000 guideway and vehicles.

The M-2000 guideways, both-narrow beam and planar, are elevated well above grade so that access to the guideway is restricted. This minimizes the possibility of deliberate or accidental damage to the guideway, and the emplacement of hazardous objects. All portions of the guideway would be continuously monitored in real time by the central traffic control facility, using both zoom video cameras mounted on poles and sensors to detect when hazardous objects are present. In addition, every time a vehicle travels every location of the guideway, its sensors will detect whether the local guideway loops are functioning correctly or not. The central traffic control facility can then specify corrective or maintenance actions to ensure safe operation.

The M-2000 vehicle body has been designed using high-strength composite materials to minimize the possibility of and damage due to the potential collision of the vehicle with external objects, both those on the guideway and airborne objects – e.g., tree branches in a high wind situation. Even if levitation were to fail due to an event such as the collision of the vehicle with an external object on the guideway, the M-2000 system is designed so that the vehicle would come down safely on the guideway and slide to a controlled stop.

The M-2000 levitation and guidance system is designed to withstand extremely strong external forces that act on the vehicle without causing it to contact the guideway. For example, very strong crosswind gusts acting on a 483 km/h (300 mph) vehicle could produce a lateral (sideways) force approaching 1 g. In fact, the guidance stability is so strong that it would take an external force of well over 2 g to make the vehicle contact the guideway – a much larger force than ever could occur in actual operation.

2.4 ALTERNATIVES IDENTIFIED FOR FURTHER ANALYSIS

The build alternative includes seven location alternatives as follows:

California: A 133 km (83 mi) system connecting Los Angeles International Airport (LAX) to Union Station in downtown Los Angeles (LA) to Ontario International Airport (ONT) and further east into Riverside County. The Southern California Association of Governments (SCAG) chose TRI Maglev technology for their operating system. The California website is htttp://www.calmaglev.org

Florida: A 29 km (18 mi) project linking Port Canaveral to the Space Center and the Titusville Regional Airport. The State Department of Transportation chose Maglev 2000 technology for their operating system. No website listed at this time.

Georgia: A 50 km (31 mi) project linking Hartsfield Atlanta International Airport and Kennesaw in Cobb County chose TRI Maglev technology for their operating system. The Georgia website is http://www.acmaglev.com

Louisiana: A 78 km (48 mi) project linking New Orleans Union Passenger Terminal to the airport and across Lake Ponchartrain to the fast-growing northern suburbs. The Greater New Orleans Expressway Commission chose TRI Maglev technology for their operating system. The Louisiana website is http://www.gulfcoastmaglev.com

Maryland: A 64 km (40 mi) project linking downtown Baltimore and Baltimore-Washington International Airport (BWI) to Union Station in Washington, D.C. The Maryland Mass Transit Administration (MTA) chose TRI Maglev technology for their operating system. The Maryland website is http://www.bwmaglev.com

Nevada: A 56 km (47 mi) project linking Las Vegas to Primm, Nevada. The California-Nevada Super Speed Train Commission chose TRI Maglev technology for their operating system. The Nevada website is http://www.ci.las-vegas.nv.us/super_speed_train.htm

Pennsylvania: A 76 km (47 mi) project linking Pittsburgh International Airport (PIT) to Pittsburgh and its eastern suburbs. The Port Authority of Allegheny County chose TRI Maglev technology for their operating system. The Pennsylvania website is Http://www.maglevpa.com

The following sections contain a brief description of the seven build alternatives and the No-Action Alternative that are analyzed in this PEIS. For further information on each of the alternatives, or a copy of the State's Environmental Assessment, Appendix A identifies the contact person.

Within each of the alternatives, several routes were analyzed for their technical, economic and environmental attributes. In addition, alternative station and maintenance facility locations were considered. The routes and facility locations are at the initial planning stages of design and the siting process is only beginning. Each location will undergo public review and comment. Furthermore, if FRA selects an alternative for detailed design and possible implementation, a site-specific environmental review will be required. This review will assure public input and that site specific environmental conditions will be considered. Preliminary routes are shown in Figures in each section. Each of the preliminary routes and station/maintenance locations is discussed in further detail in the supporting Environmental Assessment (copies can be obtained by contacting the individuals identified in Appendix A).

2.4.1 California

The Community Link21 1998 Regional Transportation Plan (RTP) published by the SCAG identifies a broad cross-section of various modes of transportation projects to be implemented between 1996 and 2020. Included with the highway, transit, and commuter rail projects, SCAG has identified high-speed rail as a viable transportation program for the region. Through RTP, SCAG is proposing an Intra-Regional Maglev System (CM, 2000) that will connect major regional activity centers and significant multi-modal transportation facilities in Los Angles, Orange, Riverside, and San Bernardino counties (see Figure 2.4-1). The three local sponsors of the project are California Business, Transportation and Housing Agency, California High-Speed Rail Authority, and Southern California Association of Governments.

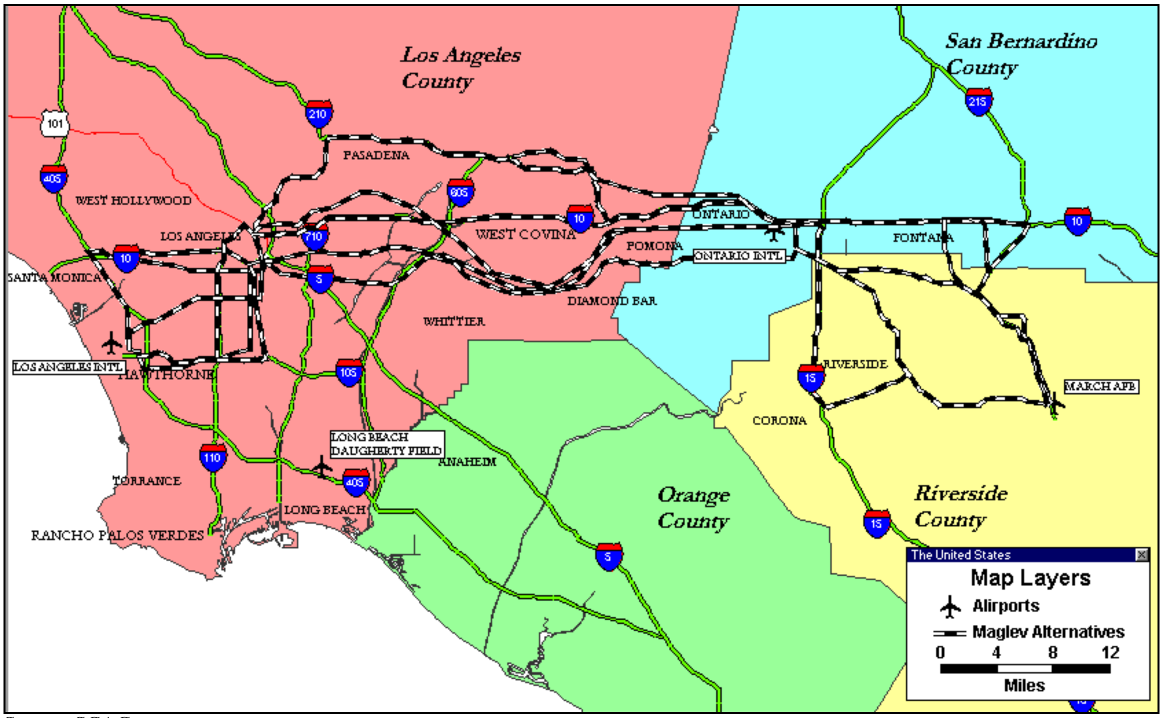
The California Maglev Alternative extends between LAX through Union Station in downtown Los Angeles and through ONT to March Air Reserve Base (March Field), a distance of approximately 133 km (83 mi). The area is mostly developed and substantial growth is expected in both population and employment between 1994 and 2020. The California Alernative is planned to be a part of and compatible with, the larger north south high-speed rail system proposed to serve the entire state. If selected for construction under the Maglev Deployment Program, SCAG envisions the system to be in operation by 2010. Preliminary route alternatives are shown in Figure 2.4-2.

A future expanded system would connect to the San Diego region and could be part of, or serve as a collection system for the state's proposed high-speed rail system extending to northern California. It would also provide for future corridor expansion into the high desert portions of Los Angles and San Bernardino counties.

The California Alternative proposes to use the Transrapid International Maglev technology. The proponents of this alternative do not have a website established at the time of this printing.

Source: SCAG

Figure 2.4-1 - California Alternative – Locus Map



Source: SCAG

Figure 2.4-2 - California Alternative – Proposed Routes

2.4.2 Florida

Transportation problems that currently exist, and are projected to exist in the near future, within the Florida alternative study area, centered on the movement of visitors to Kennedy Space Center (KSC) and passengers at Port Canaveral. Currently, the KSC Visitors Center attracts approximately 2.8 million visitors per year and 1.5 million cruise passengers embark from Port Canaveral annually. Each of these destinations is connected to the mainland by a narrow road causeway and each has a rapidly-growing number of visitors/passengers.

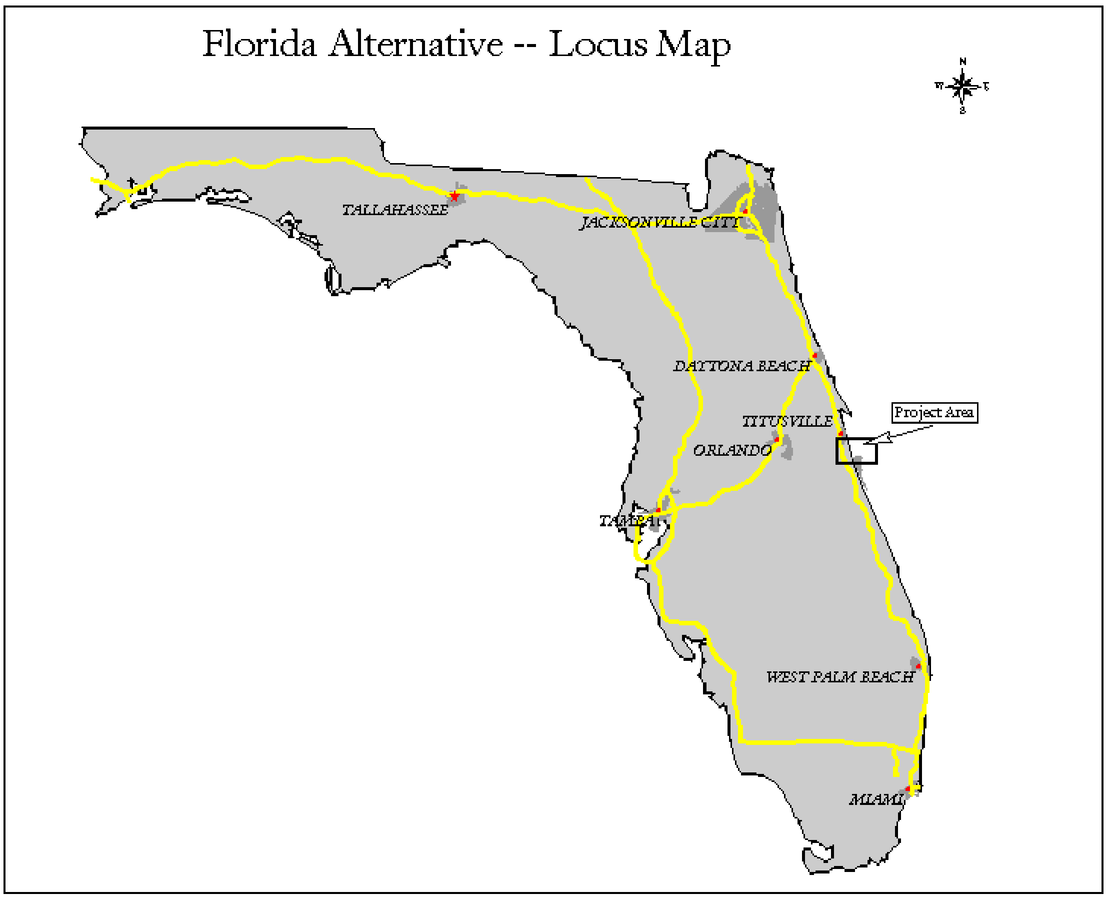
As part of a future statewide Maglev system, the Florida Department of Transportation (FDOT) performed a statewide trade study to determine the best location for a regional transportation system (see Figure 2.4-3). As a result, a route connecting the Space Coast Regional Airport (SCRA), the KSC, and Port Canaveral was identified to yield one of the highest ridership and operating revenues within the State. FDOT along with Maglev 2000 of Florida Corporation is proposing an initial corridor of 32 km (20 mi) long for the Maglev Deployment Program (FDOT, 2000). If this initial corridor is successful, a planned future extension could be in the direction of the Beeline Expressway connecting to Orlando International Airport and points west.

Located in central Brevard County on the east coast of Florida, the proposed study area is generally bounded by Port Canaveral to the southeast, the National Aeronautics and Space Administration (NASA) Parkway West to the north, the SCRA to the northwest and SR 528 (Beeline Expressway) at the I-95 to the southwest. The project study area includes the municipal jurisdictions of Brevard County, the City of Titusville, the City of

Merritt Island, the City of Cape Canaveral, Port Canaveral, and KSC. The Indian River Lagoon and the Banana River are the two major water bodies found within the project study areas.

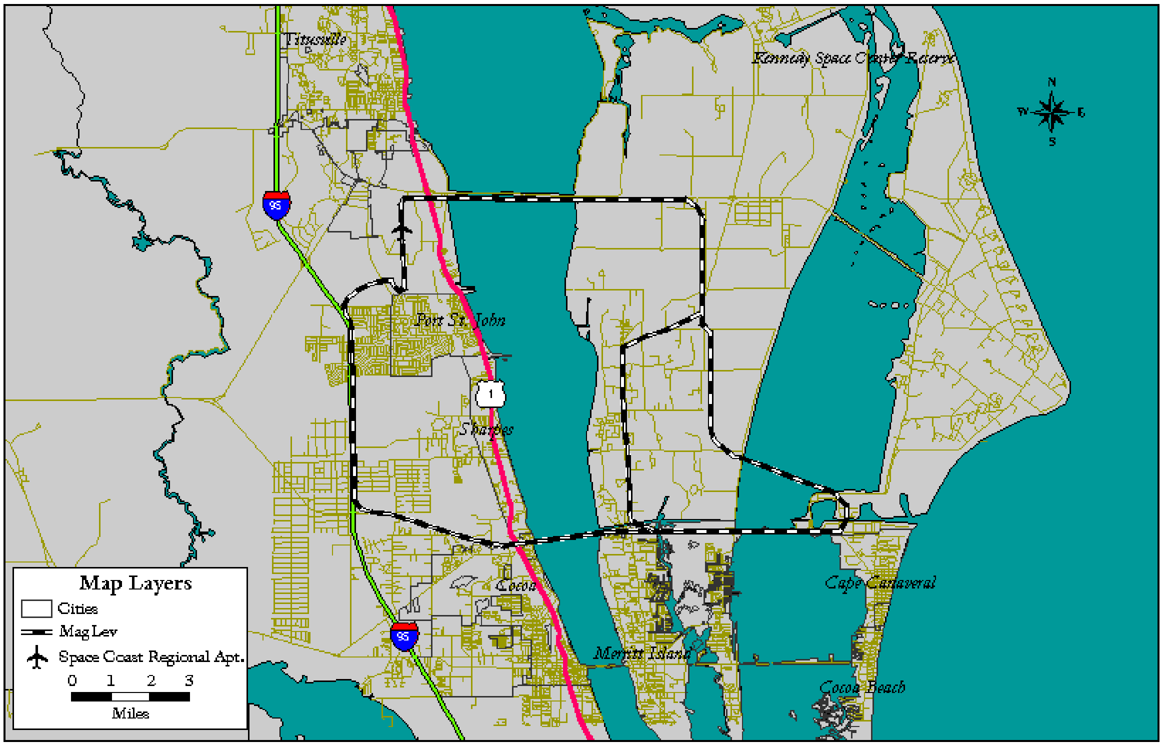
Within the corridor, several alternative routes were analyzed for their technical, economic and environmental attributes. In addition, alternative station and maintenance facility locations were also considered. The routes and facility locations are at the initial planning stages of design and the siting process is only beginning. Each alternative location will undergo public review and comment. Furthermore, if FRA selects this alternative for detailed design and possible implementation, a site-specific environmental review will be required. This review will assure public input and that site-specific environmental conditions will be considered. Preliminary route alternatives are shown in Figure 2.4-4. Each of the preliminary alternative routes and station/maintenance locations is discussed in further detail in each of the supporting Environmental Assessments (copies of these can be obtained by contacting the individuals identified in Appendix A).

The Florida Alternative is proposing to develop and use the M-2000 technology. FDOT along with Maglev 2000 of Florida Corporation do not have a website established at the time of this printing.



Source: FDOT

Figure 2.4-3 - Florida Alternative – Locus Map



Source: FDOT

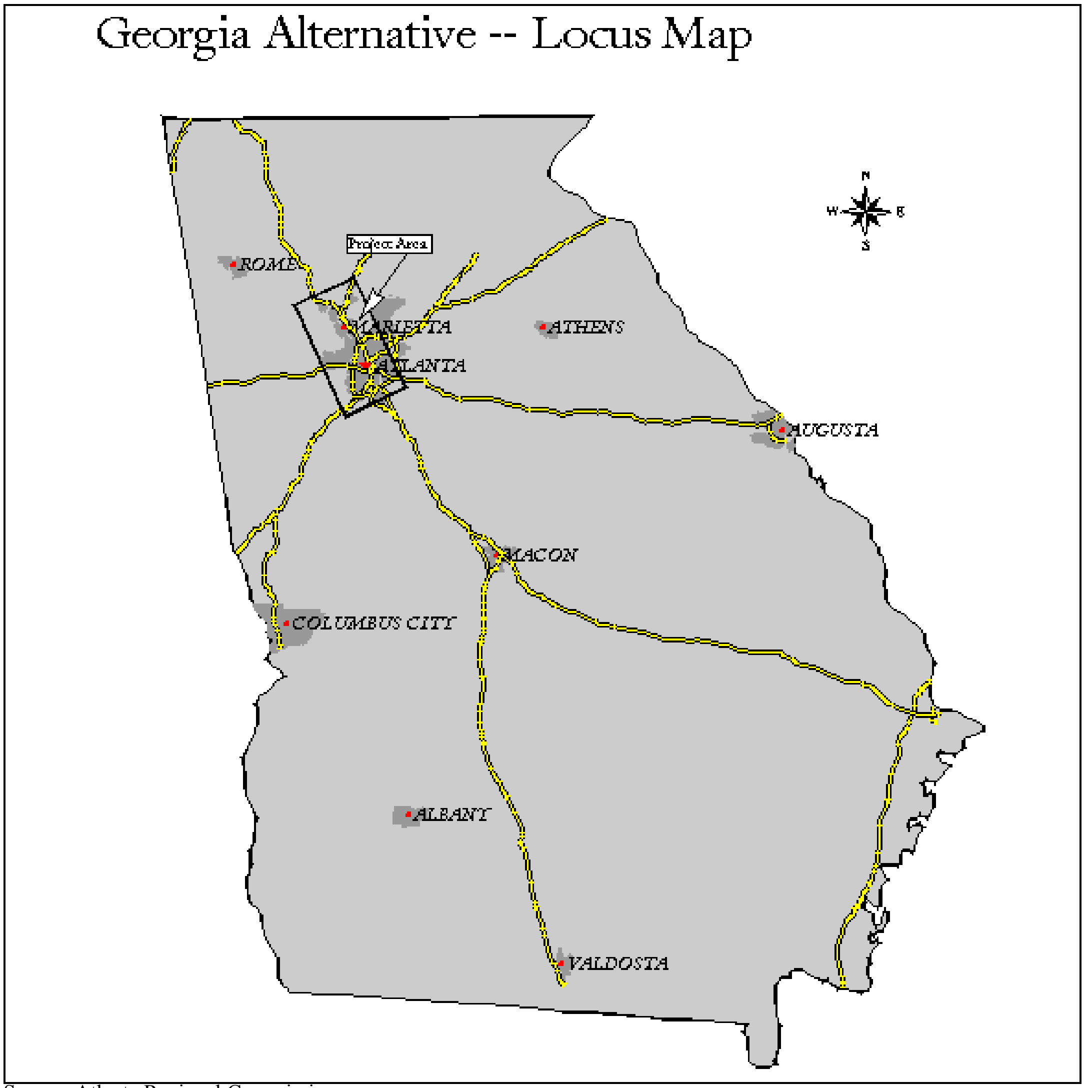
Figure 2.4-4 - Florida Alternative – Proposed Routes

2.4.3 Georgia

Atlanta is facing ever-increasing ground- and air-traffic congestion, with associated reduction in mobility and economic opportunity. The current traffic volumes on I-75 greatly exceed the capacity of the facility in some areas and create long delays and unsafe operating conditions for several hours of each day. The high growth estimates along the I-75 corridor represent expectations for a loss in mobility for the region's residents, businesses and visitors unless significant improvements and expansion to the travel alternatives are completed consistent with the growth. The Hartsfield Atlanta International Airport is officially recognized today as the busiest airport in the world based on its 73.5 million passengers in 1998. Projections of up to 121 million passengers in 2015 have led the City of Atlanta and the Airport Authority to embark upon a ten-year, $5.4 billion expansion plan to meet these demands. Even so, the indications are that the current plans will not entirely meet the increases expected in airline travel in the next 25 years and beyond.

The States of Georgia and Tennessee have joined in partnership to study and implement a high-speed ground transportation system that could eventually serve the 177 km (110 mi) coridor connecting the major airports for the cities of Atlanta and Chattanooga (see Figure 2.4-5). To be successful as an alternative to automobile and air travel within the corridor, the system must provide a relatively economical trip that is both convenient and time efficient. Geography and urban development limit the opportunities for conventional transportation modes to serve this need.

The Atlanta Maglev Project is being administered under a tri-party agreement (ARC, 2000). The Atlanta Regional Commission has responsibility for project administration, the Georgia Regional Transportation Authority will be the implementing authority, and the Georgia Department of Transportation assists in a number of roles from planning to financial support. This tri-party group is proposing an initial corridor between Hartsfield-Atlanta International Airport to a multi-modal station located approximately 51 km (32 mi) north of the airport terminal. The exact location of the end stations will be determined by consideration of many factors. The study corridor is primarily characterized by urban and suburban development with some medium, high, and very high densities of commercial, office, and residential areas.

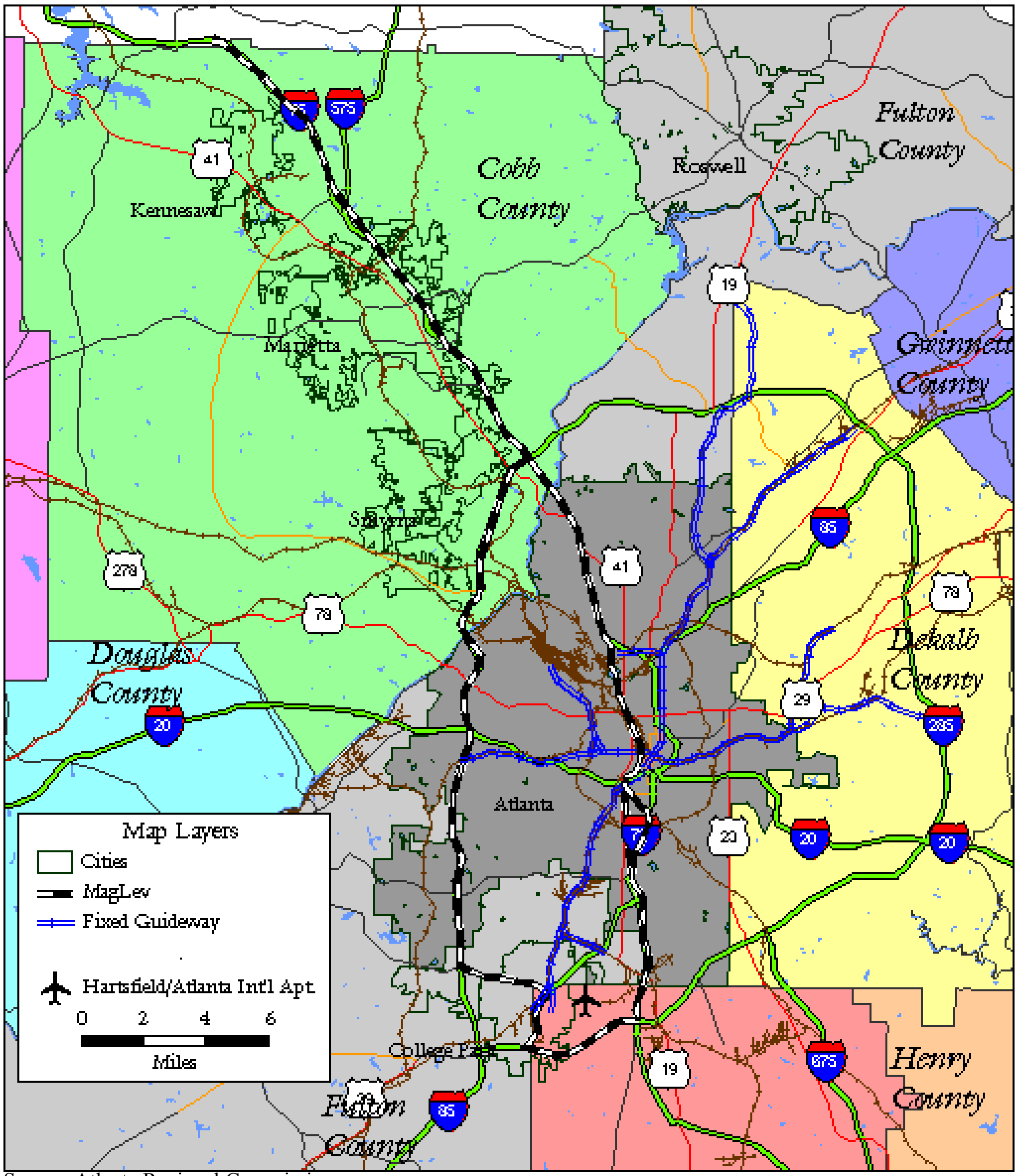


Source: Atlanta Regional Commission

Figure 2.4-5 - Georgia Alternative – Locus Map

If FRA selects this alternative for detailed design and possible implementation, a site-specific environmental review will be required. This review will assure public input and that site-specific environmental conditions will be considered. Preliminary route alternatives are shown in Figure 2.4-6. Each of the preliminary alternative routes and station/maintenance locations is discussed in further detail in each of the supporting Environmental Assessments (copies of these can be obtained by contacting the individuals identified in Appendix A).

The Georgia Alternative proposes to use the Transrapid International Maglev technology. The Atlanta Regional Commission, Georgia Regional Transportation Authority and the Georgia Department of Transportation have established the following website where additional information can be obtained on this alternative: www.acmaglev.com.



Source: Atlanta Regional Commission

Figure 2.4-6 - Georgia Alternative – Proposed Routes

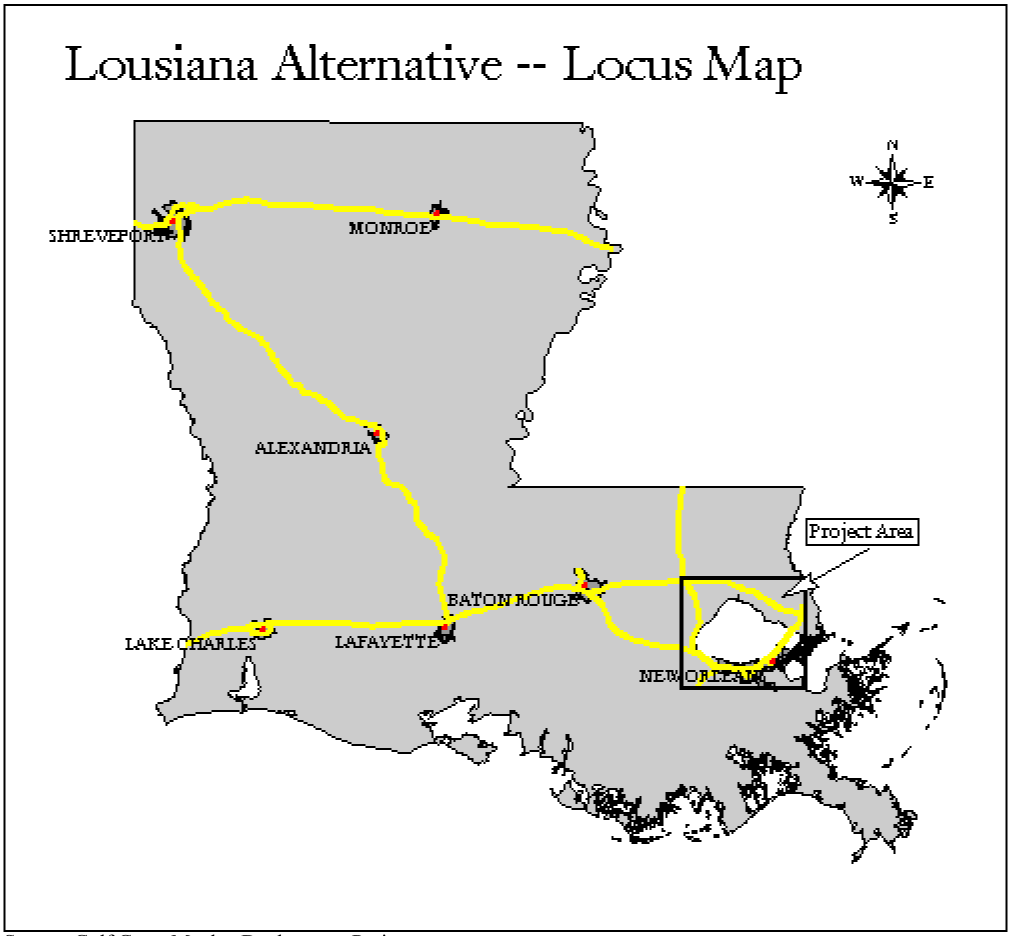
2.4.4 Louisiana

The New Orleans area contains the most highly congested segment of I-10 in the nation. Despite a proposed widening of I-10 to eight- to ten-lanes, the maximum feasible build-out of this facility, the level-of-service (LOS) on this highway is expected to be less than optimum during the peak hours for a large share of the next twenty years. Furthermore, the Causeway across Lake Pontchartrain has existing Average Daily Traffic of nearly 29,000 vehicles. Traffic projections developed in conjunction with ridership estimation for this project indicate that year 2020 volumes will approach 70,000 vehicles per day. Peak-hour traffic volumes currently exceed the capacity of both the north and southern approaches to the bridge. Accidents on the Causeway can delay traffic for hours, with no alternative route. A study of the role of the Lake Pontchartrain Causeway in hurricane evacuation of the New Orleans region identified the need for additional capacity.

The Gulf Coast High-Speed Rail Corridor, an area paralleling the Gulf of Mexico from Texas to Florida, is designated as part of the national network of high-speed ground transportation corridors to be developed in the United States. The Greater New Orleans Expressway Commission, a member of the Gulf Coast High-Speed Ground Transportation Coalition, is the Louisiana lead participant for the Maglev Deployment Program (GNOEC, 2000). In addition, the Greater New Orleans Expressway Commission and the New Orleans Aviation Board are working partners to the Louisiana Maglev Project. The proposed Gulf Coast MagLev Demonstration Project provides for the implementation of the central section of the Gulf Coast High-Speed Ground Transportation Corridor, as an initial study corridor (see Figure 2.4-7).

The proposed Louisiana corridor for the Maglev Deployment Program extends from the Central Business District of New Orleans through the New Orleans International Airport, across Lake Pontchartrain, and ends to the north, a distance of approximately 77 km (48 mi). The study corridor consists of approximately half developed area and half lake crossing.

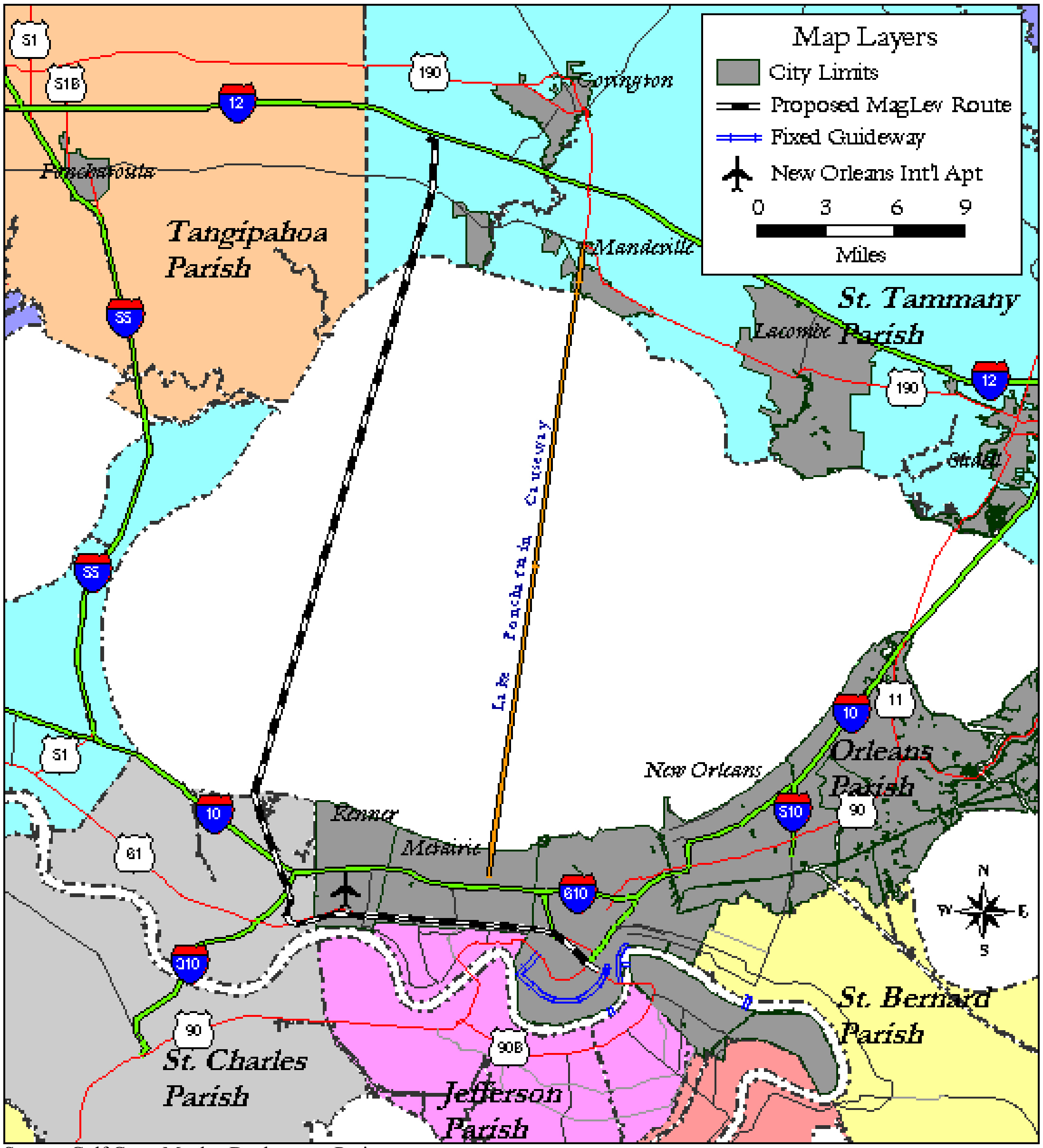
Within the corridor several alternative routes were analyzed for their technical, economic and environmental attributes. In addition, alternative station and maintenance facility locations were also considered. The routes and facility locations are at the initial planning stages of design and the siting process is only beginning. Each alternative location will undergo public review and comment. Furthermore, if FRA selects this Alternative for detailed design and possible implementation, a site-specific environmental review will be required. This review will assure public input and that site specific environmental conditions will be considered. Preliminary route alternatives are shown in Figure 2.4-8. Each of the preliminary alternative routes and station/maintenance locations is discussed in further detail in each of the supporting Environmental Assessments (copies of these can be obtained by contacting the individuals identified in Appendix A).



Source: Gulf Coast Maglev Deployment Project

Figure 2.4-7 - Louisiana Alternative – Locus Map

The National Weather Service has named the New Orleans Metropolitan Area as the number one area in the nation at risk for catastrophic loss of life due to a direct hit from a hurricane. The Emergency Preparedness Directors and public officials estimate the number of individuals in the New Orleans Metropolitan Area without access to private vehicles to be over 250,000. In case of a severe hurricane and forced evacuation, officials will be faced with the task of transporting these individuals in school buses and other public vehicles on a transportation system that will already be loaded with another 650,000 individuals with access to private vehicles. The existing transportation system is primarily three main roads: the Causeway across Lake Pontchartrain, Interstate 10 to the east and Interstate 10 to the west. The proposed Maglev system will be able to evacuate 3700 people per hour and can operate at full speed in winds of 100 km per hour (62 mph), providing full service beyond the limits of the surface transportation system. The south shore stations will be used as passenger collection points and the North Shore station would serve as a passenger transportation hub and ultimately as a refuge. Working with the local Parish, State and Federal Emergency Preparedness Directors, the five story-parking garage could be designed to accommodate approximately 40,000 people as an emergency shelter.



Source: Gulf Coast Maglev Deployment Project

Figure 2.4-8 - Louisiana Alternative – Proposed Routes

The Louisiana Alternative proposes to use the Transrapid International Maglev technology. The Greater New Orleans Expressway Commission has established the following website for further information on the Louisiana Alternative: www.gulfcoastmaglev.com.

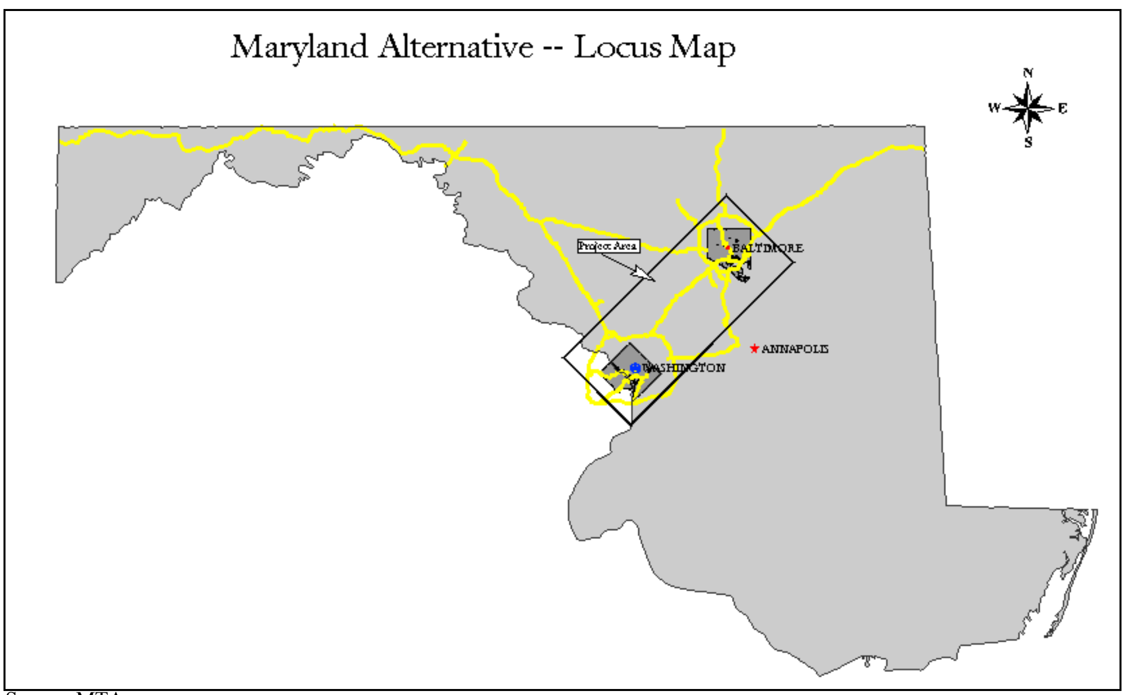
2.4.5 Maryland

The Washington, D.C. and Baltimore Metropolitan areas have highway congestion with Washington-area roadways representing the second-most-congested in the nation. In the Washington, D.C. metropolitan area, travel times on the roadways during peak periods were 41 percent higher than under free flow conditions. The equivalent measure in the

Baltimore area is 23 percent. For all measures of congestion, the Washington, D.C. area ranks 1st, 2nd, 3rd, or 4th in the nation while Baltimore ranks 14th, 15th, or 16th in the nation Maryland Mass Transit Administration (MTA, 2000).

The MTA, in cooperation with the City of Baltimore, Baltimore County and the District of Columbia, is undertaking the study of a magnetic levitation transportation system between Baltimore and Washington, D.C. This system would be an initial link of a Northeast Corridor (NEC) system that could extend to the Southeast.

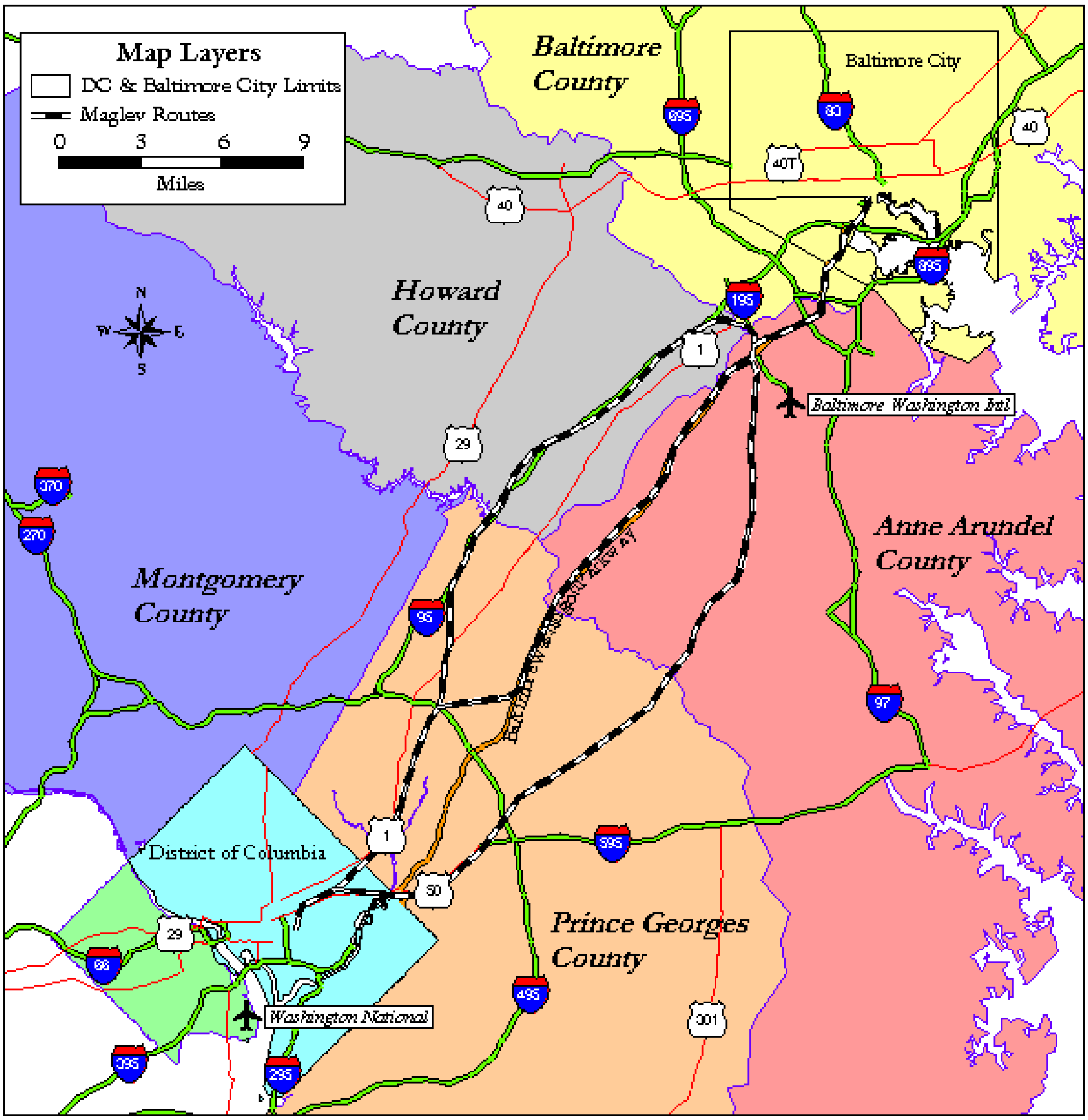
The Baltimore-Washington Maglev study corridor considered for the Maglev Deployment Program is approximately 64 km (40 mi) in length and 12.1 km (7.5 mi) wide and extends north from Washington, D.C. to the City of Baltimore (see Figure 2.4-9). The study corridor is bounded on the west by Interstate 95 and on the east by the Amtrak rail line serving the Northeast Corridor and connecting Baltimore with Washington, D.C. The study corridor contains portions of Washington, D.C., Prince George's County in Maryland, Anne Arundel County, Howard County, Baltimore County, and Baltimore City. In addition to the two large cities and adjacent suburban communities at either terminus, the suburban communities of Savage, Ft. Meade, Greenbelt, Odenton, Bowie, Columbia and Laurel are located within the corridor. The study corridor contains several large tracts of land owned by the Federal Government, including Fort George G. Meade, the Patuxent Wildlife Research Center (PWRC) and the National (Beltsville) Agricultural Research Center (BARC).



Source: MTA

Figure 2.4-9 - Maryland Alternative – Locus Map

Within the corridor several alternative routes were analyzed for their technical, economic and environmental attributes. In addition, alternative station and maintenance facility locations were also considered. The routes and facility locations are at the initial planning stages of design and the siting process is only beginning. Each alternative location will undergo public review and comment. Furthermore, if FRA selects this alternative for detailed design and possible implementation, a site-specific environmental review will be required. This review will assure public input and that site-specific environmental conditions will be considered. Preliminary route alternatives are shown in Figure 2.4-10. Each of the preliminary alternative routes and station/maintenance locations is discussed in further detail in each of the supporting environmental assessments (copies of these can be obtained by contacting the individuals identified in Appendix A).



Source: MTA

Figure 2.4-10 - Maryland Alternative – Proposed Routes

The Maryland Alternative proposes to use the Transrapid International Maglev technology. Maryland Mass Transit Administration and the City of Baltimore have established the following website for additional information: www.bwmaglev.com.

2.4.6 Nevada

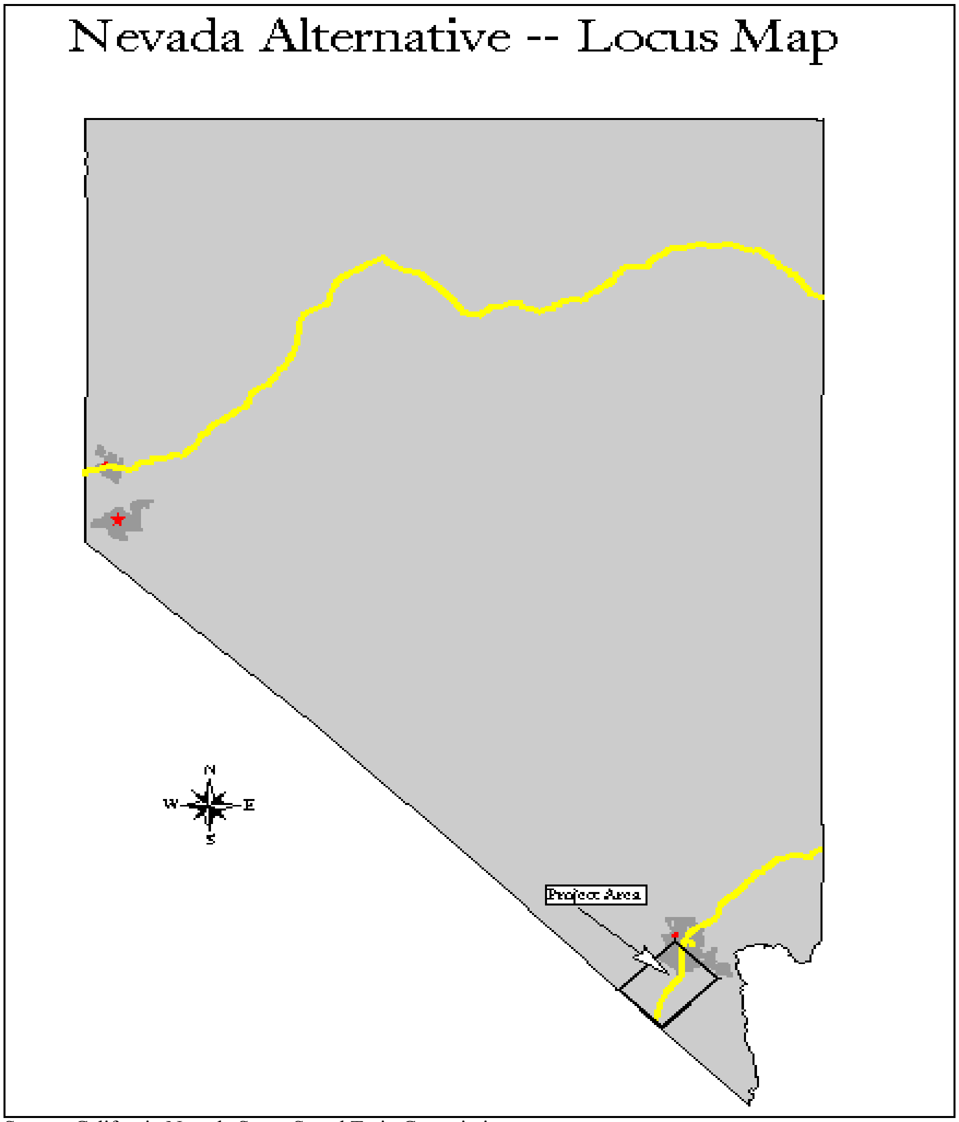
An 83 percent increase in highway and air travel in the Las Vegas-Southern California corridor is anticipated between 1995 and 2015. Within the next 15 to 20 years, McCarran International Airport terminals and runways will be approaching capacity, and opportunity for further expansion is severely constrained. Southern California airports are expected to be over-capacity in ten years. Las Vegas does not meet federal ambient air-quality standards for CO and PM10, due in large part to auto exhaust and vehicle congestion.

The proposed California-Nevada Interstate Maglev Project would be implemented in three phases spanning the distance between Las Vegas, Nevada and Anaheim, California (CNSSTC, 2000). For the Maglev Deployment Program, an initial study corridor in regional Las Vegas is being proposed by the California-Nevada Super Speed Train Commission (see Figure 2.4-11).

The 56 km (35 mi) initial study corridor for the Maglev Project is intended to transport passengers between Primm and Las Vegas, Nevada. The majority of the initial corridor is located within the Nevada Department of Transportation (NDOT) right-of-way for Interstate 15 and traverses an area of sparse development and gentle topography. The right-of-way is primarily desert between Primm and Las Vegas.

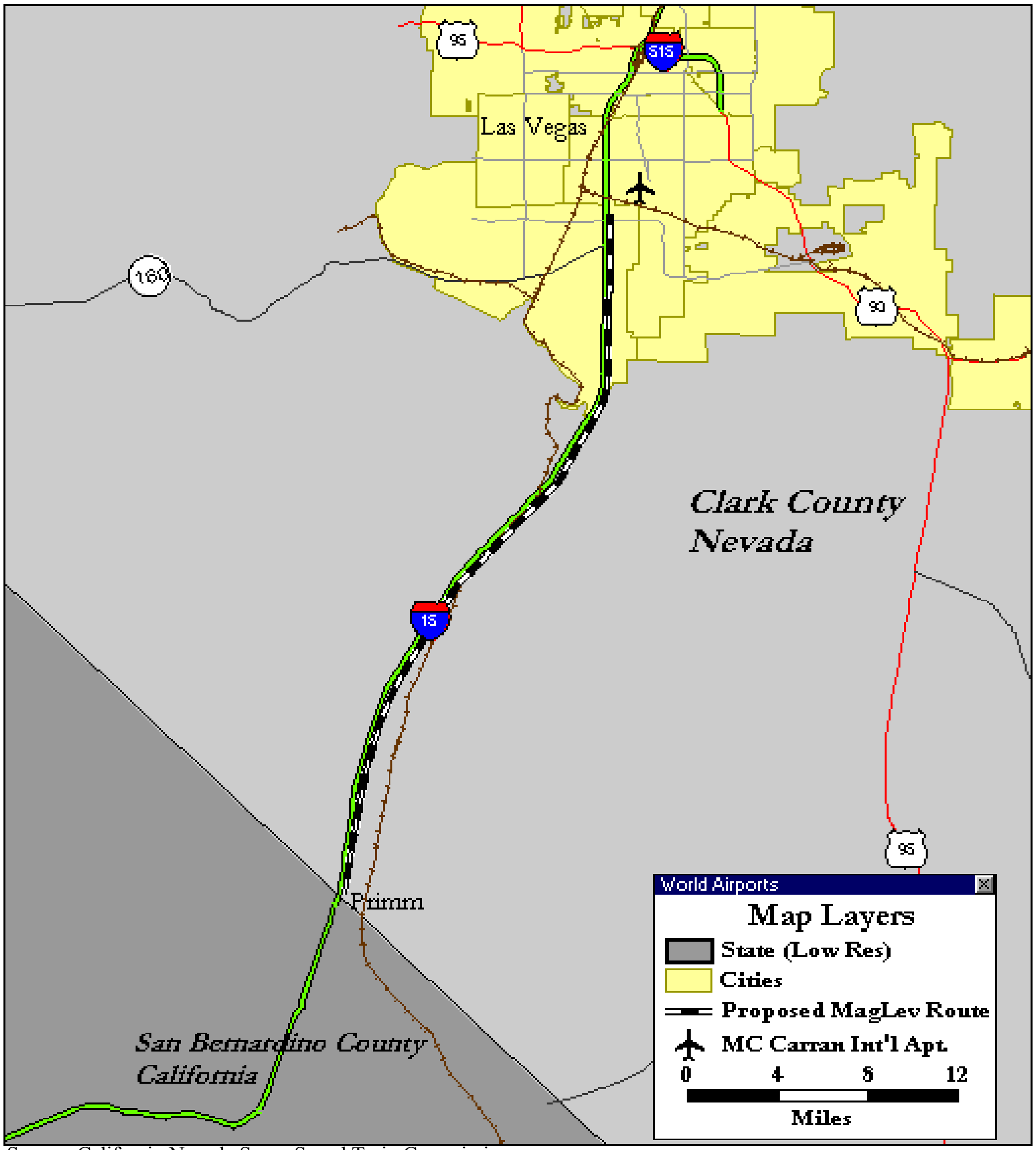
Within the corridor, several alternative routes were analyzed for their technical, economic and environmental attributes. In addition, alternative station and maintenance facility locations were also considered. The routes and facility locations are at the initial planning stages of design and the siting process is only beginning. Each alternative location will undergo public review and comment. Furthermore, if FRA selects this Alternative for detailed design and possible implementation, a site-specific environmental review will be required. This review will assure public input and that site specific environmental conditions will be considered. Preliminary route alternatives are shown in Figure 2.4-12. Each of the preliminary alternative routes and station/maintenance locations is discussed in further detail in each of the supporting Environmental Assessments (copies of these can be obtained by contacting the individuals identified in Appendix A).

The Nevada Alternative proposes to use the Transrapid International Maglev technology. The Caliofrnia-Nevada Super Speed Train Commission have established the following website for additional information: www.ci-LasVegas.nvus/supper_speed_train.htm.



Source: California-Nevada Super Speed Train Commission

Figure 2.4-11 - Nevada Alternative – Locus Map



Source: California-Nevada Super Speed Train Commission

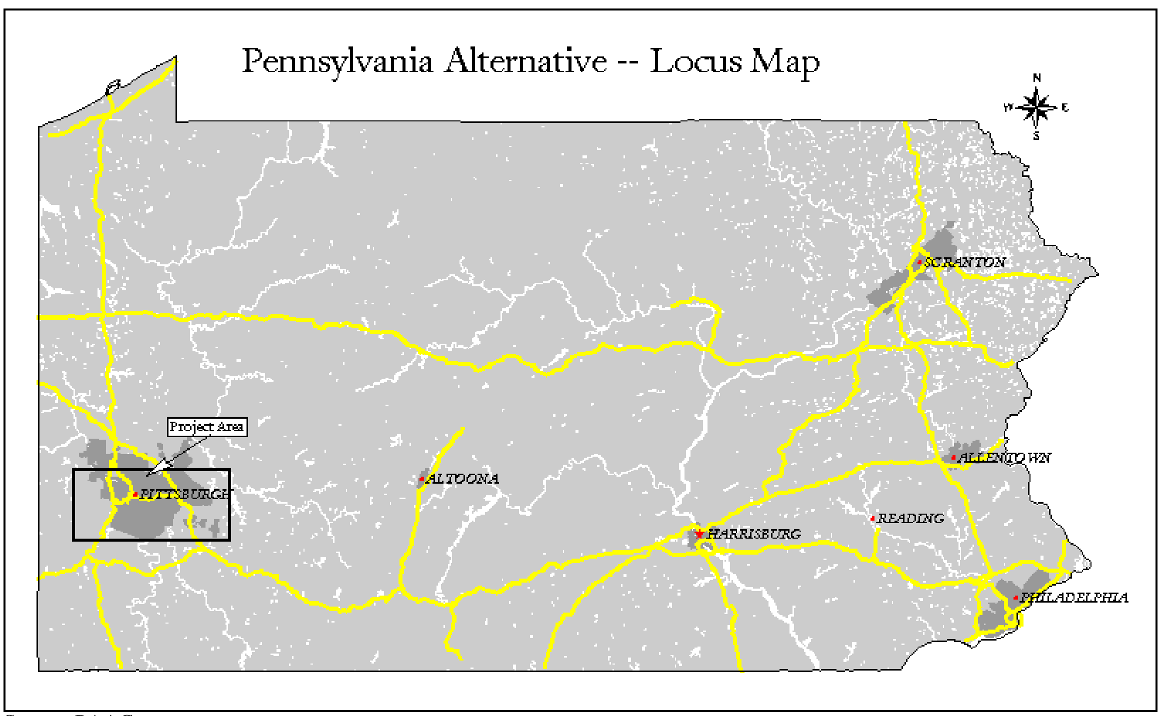
Figure 2.4-12 - Nevada Alternative – Proposed Routes

2.4.7 Pennsylvania

In a 1997 study by the Texas Transportation Institute that quantified congestion levels and the economic impact of congestion on motorists, Pittsburgh ranked 46th in congestion severity in 1993. This represents a 4 percent increase in congestion between 1987 and 1993. The 1993 cost of congestion for the region was estimated at $510 million for delay, $450 million for excess fuel costs and estimated at $290 per capita for 1993. Increasing these costs to year-2000 dollars based on an annual 2 percent inflation rate, results in 2000 figures of $580 million for delay, $510 million for excess fuel costs and $330 per capita. The principal modes of transportation for intercity travelers in the United States are the automobile and aircraft. In the Pittsburgh region, the principal mode is the automobile. Regional highway systems currently suffer from congestion, especially during rush hours, and are projected to become more congested in the future.

As part of a potential national Maglev System, the Port Authority of Allegheny County in association with Maglev Inc. envision a Pittsburgh Regional System providing Maglev service between Pittsburgh and Philadelphia, with extensions to Baltimore and Washington, D.C. to the east; Morgantown, Clarksburg and Charleston, West Virginia, to the south; Wheeling, West Virginia, Columbus and Cleveland, Ohio to the west; and Erie, Pennsylvania and Buffalo, New York to the north (PAAC, 2000). This regional system would provide service to approximately 20 other cities within these proposed corridors. The proposed demonstration project and initial study area considered for the Maglev Deployment Program would be the first metropolitan Pittsburgh section of the route to Philadelphia (see Figure 2.4-13).

The initial study area for the proposed Pennsylvania Maglev Demonstration Project is located in southwestern Pennsylvania in Allegheny and Westmoreland Counties. The study area extends east from PIT to the City of Greensburg, passing through the City of Pittsburgh's downtown section and the Municipality of Monroeville along the way. The study area is part of the Appalachian Plateaus Province and consists of a hilly topography bisected by numerous streams and rivers with elevations between 213-457 m (700-1,500 ft). Areas of steep slopes can be found along many of the watercourses, especially along the major rivers, with local relief in these areas up to 152 m (500 ft). The total corridor length is approximately 72 km (45 mi).

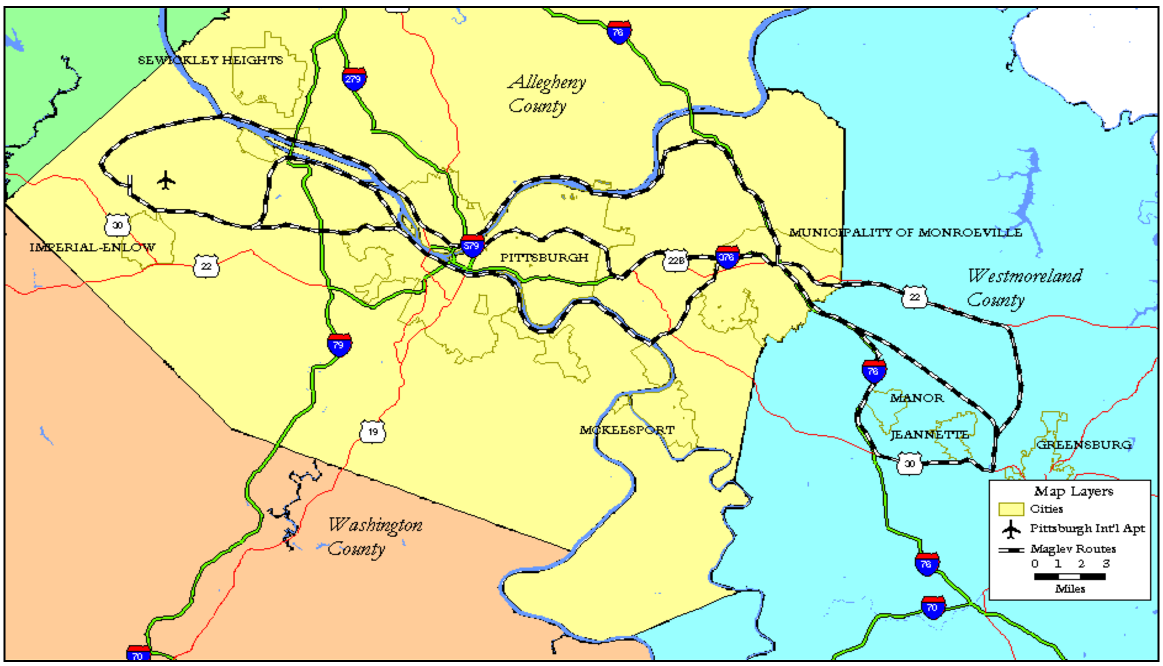


Source: PAAC

Figure 2.4-13 - Pennsylvania Alternative – Locus Map

Within the corridor, several alternative routes were analyzed for their technical, economic and environmental attributes. In addition, alternative station and maintenance facility locations were also considered. The routes and facility locations are at the initial planning stages of design and the siting process is only beginning. Each alternative location will undergo public review and comment. Furthermore, if FRA selects this Alternative for detailed design and possible implementation, a site-specific environmental review will be required. This review will assure public input and that site specific environmental conditions will be considered. Preliminary route alternatives are shown in Figure 2.4-14. Each of the preliminary alternative routes and station/maintenance locations is discussed in further detail in each of the supporting Environmental Assessments (copies of these can be obtained by contacting the individuals identified in Appendix A).

The Pennsylvania Alternative proposes to use the Transrapid International Maglev technology. The website for additional information on the Pennsylvania Maglev Alternative is www.maglevpa.com.



Source: PAAC

Figure 2.4-14 - Pennsylvania Alternative – Proposed Routes

2.5 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, the Maglev Deployment Program would not proceed. Economic and population growth will continue around the country and this expansion will likely result in increased inter-city travel demand and increased congestion. The increased operational congestion could also lead to safety deficiencies in existing transportation systems.

The Maglev Deployment Program has been created by Congress as an alternative transportation program designed to demonstrate a way to alleviate the congestion in airway and automotive corridors that results from increasing demand for travel. Hence, in order to analyze the implications of the No-Action Alternative, it is important to address the preclusion of potential transportation and other related benefits associated with the Maglev Deployment Program. Under the No-Action alternative, it is expected that the demand for transportation-infrastructure-development actions, including airport, railway, and highway expansion projects, would be elevated to meet the increasing commuter travel demand. Possible actions under the No-Action Alternative include construction of additional highway or airport capacity or implementation of other high speed rail alternatives including accelerated rail service (upgrading intercity rail passenger service on existing railroad corridors) or new high-speed rail systems (new steel-wheel-on-rail passenger systems that operate almost completely on new rights-of-way). None of these options are eligible under the Maglev Deployment Program and decisions on whether and what transportation options would be implemented would be taken largely outside the FRA and outside the Department of Transportation. As a result, it is extremely difficult to predict with any degree of assurance what solutions transportation planners would select in the absence of the Maglev Deployment Program.

2.6 PREFERRED ALTERNATIVE

Following issuance of the DPEIS and the close of the public comment period, FRA reviewed all of the public comments on the DPEIS and made appropriate revisions to the text of this PEIS. In addition, over the past several months FRA has continued to gather additional information from the seven program applicants through data submissions and meetings with each of the seven project teams. This information gathering effort has focused primarily on: engineering; operating and service characteristics; estimated project benefits and costs; sources of potential financing; composition of potential public/private partnerships organized to finance, construct and operate the project; and other related material. FRA and the Department of Transportation evaluated the Action Alternative, including the seven proposed projects, and the No-Action Alternative according to criteria established in the Maglev Deployment Program Final Rule (65 Fed. Reg. 2342, January 14, 2000). The evaluation considered a number of factors including: state and community support, the purpose and significance of the project, the service characteristics, the environmental impact, construction financing, the financing of ongoing operations, total project benefits and costs, the technical readiness and implementation schedule, and the status of the public/private partnership.

After carefully analyzing all of the relevant factors, including environmental issues, the Secretary of Transportation has selected the Action Alternative as the agency’s preferred alternative (see appendix M). The Secretary has concluded that construction of a Maglev system would have substantial transportation benefits for the areas served by the selected alternatives and would demonstrate a promising new technology that could provide transportation benefits to many areas of the country in the future. Moreover, the Secretary concluded that at the program level there were no inherent aspects of the proposed Maglev technology deployment that would raise environmental concerns to the level that would suggest that the program not advance to the next phase of design development.

To allow the Department of Transportation to focus its limited resources, only two projects were identified by the Secretary to participate in the next stage of the program. After considering the strengths and weaknesses of each project, he concluded that the Maryland project or Pennsylvania project could be financed and constructed in a timely manner and would provide the best demonstration of the technology. The Maryland Project and the Pennsylvania Project both presented proposals that included strong service characteristics, a strong financing plan, and appeared well on their way to putting together an effective public/private partnership. The Pennsylvania Project also has unique plans to use the plant needed to build the project as a platform for developing a high technology steel fabrication industry in the Pittsburgh area.

In identifying the Action Alternative as the agency's preferred alternative, the Secretary would eliminate five projects, California, Florida, Georgia, Louisiana, and Nevada, from further consideration. While these projects all showed promise, they were not selected because the Secretary, informed by the evaluation team, judged they were not as strong as the two that were selected.

Following the publication of this PEIS, the agency will consider any additional public concerns and issues in its Record of Decision a minimum of thirty days after the availability of this PEIS is published by the Environmental Protection Agency in the Federal Register, as provided for in the CEQ Regulations and FRA's Environmental Procedures. Any decision to proceed with the construction phase of the program would be contingent on receipt of Congressional appropriations and completion of additional environmental documentation in the form of a site-specific environmental impact statement.

3 AFFECTED ENVIRONMENT

As a requirement of the Maglev Deployment Program and cooperative agreements established between FRA and the selected state alternatives, a technical review of the affected environment and potential environmental consequences was prepared by each alternative. The purpose of these technical documents was to provide the baseline environmental data used by FRA in the preparation of this PEIS (MTA, 2000; FDOT, 2000; GNOEC, 2000; ARC, 2000; CNSSTC, 2000; CM, 2000; PAAC, 2000). The affected environment section of this PEIS is based almost solely on the information contained within each alternative's environmental review document. That information is incorporated by reference for this PEIS and summarized accordingly below. These documents have been incorporated by reference to reduce the volume of this PEIS. Only the climate and topography subsection were developed independently from those documents. If further information on the affected environment is desired, Appendix A identifies the person to contact for copies of the alternative's environmental assessments. The participants also developed Project Description documents that include a description of the project its significance, and information regarding engineering design and technology, operational and economic factors, local and regional benefits, projected ridership, costs, partnership potential, implementation schedule, and financial planning (MTA(b), 2000; FDOT(b), 2000; GNOEC(b), 2000; ARC(b),2000; CNSSTC(b), 2000; CM(a), 2000; PAAC(b), 2000. These documents also have been incorporated by reference for the Final PEIS; inquiry on the availability of these documents should be made by contacting the people listed in Appendix A. Additional information can be obtained by viewing the alternative's website also identified in Appendix A. The following is a summary of the affected environments for each of the alternatives.

3.1 TOPOGRAPHY, GEOLOGY AND SOILS

Geologic and soil resources within the United States may be divided into nine regions based on geologic history and geomorphology. The seven Maglev Alternatives fall within the four regions listed below (DOD, 1995):

- Appalachian Region (New England, New York, Pennsylvania, West Virginia, and parts of Ohio, Virginia, Kentucky, Tennessee, North and South Carolina, Georgia, and Alabama) - the Pennsylvania and Georgia Alternatives lie within this region, and the Maryland Alternative lies partially within this region.
- Atlantic and Gulf Coastal Plains (New Jersey south through Florida, Florida west through Texas) - the Maryland, Florida and Louisiana Alternatives lie within this region.
- Basin and Range Region (Oregon southeast through Arizona) - the Nevada Alternative falls within this region.
- Coast Ranges (Washington south through California) - the California Alternative lies in this region.

This section describes the general topography, geology and soil conditions associated with the aforementioned regions. Potential hazards including seismic and volcanic activity, flooding, and soil erosion are briefly described. Because the regions are extensive, the information provided contains only broad generalizations. Where relevant, geologic and soils resources that are especially site specific, such as mineral, fossil, and agricultural resources are identified.

3.1.1 Appalachian Region

The Appalachian Region generally consists of the roots of old mountain ranges formed millions of years ago. Elevations range from 213 to 457 m (700 to 1,500 ft) above mean sea level. Rounded hills and ridges among steep narrow valleys characterize the region with gently sloping topography near the Allegheny, Monongahela, and Ohio Rivers. The gently sloping topography near these three Rivers is prone to flooding. Although the region is comprised of six subregions, only two of these subregions are affected by proposed Maglev Alternatives.

The Pennsylvania Maglev Alternative is located in the Appalachian Plateau, which is the western most subregion. Soils in the Appalachian Plateau subregion primarily belong to the suborder Ochrepts. Some of these soils, which developed mainly in glacial deposits, contain hard packed layers that slow percolation of water and restrict root development. The area has a history of coal mining, as evidenced by several strip and underground mines in the vicinity of the proposed Maglev Alternative. In some areas, the coal deposit (seam) is up to 3.6 m (12 ft) thick. Oil and gas exploration also exists in the vicinity of the proposed Maglev Alternative. Despite numerous small inactive faults, the seismic hazard for this subregion is minor.

The Georgia Maglev Alternative is located primarily within the Piedmont subregion of the Appalachian Region. The Piedmont subregion comprises the area along the eastern face of the Appalachian mountains and is characterized by low, linear, parallel ridges separated by broad, open valleys and gently rolling hills. The terrain generally slopes to the east, south, and west. The geology of this subregion is complicated by intensive folding and over-thrust faulting. A large fault zone known as the Brevard Fault Zone, is a regional topographic feature that extends from Alabama to North Carolina and that bisects the Maglev Alternative. This fault zone has been inactive for 195 million years; therefore, the seismic hazard for this subregion is minor. Soils in this subregion generally belong to the taxonomic suborder Udults, which are mainly free draining and have very little organic matter, as they formed predominantly from weathered rocks. The Maryland Alternative also lies partially within this region.

3.1.2 Atlantic and Gulf Coast Plains

This area typically consists of relatively flat plains with gentle slopes along both the Atlantic Ocean and Gulf of Mexico. The potential for flooding is significant in some low lying areas and areas adjacent to major river systems and the coast. The Florida, Maryland, and Louisiana Alternatives are located primarily in this geomorphic region. Seismic activity in this region is minor, although the coast of Louisiana contains an area of mud volcanoes. These formations are not true volcanoes, but areas where high-pressure gas seepages occur, discharging water, mud, sand, fragments of rock, and occasionally oil. Oil and gas explorations exist in this area. Soils in this region are primarily Utisols, usually found in areas where groundwater is relatively close to the surface during part of each year, are formed mainly in alluvium and marine deposits and are intensely weathered. The soils include varying amounts of organic matter, but are characterized by a horizon of clay accumulation.

3.1.3 Basin and Range Region

The Nevada Maglev Alternative resides within this geomorphic region. Geologic features produced by faulting dominate the topography of this region. Ranges formed by thrust faults are separated by relatively flat expanses of desert, dry lake beds and ephemeral washes. Thermal springs and geysers are also common. Infrequent but heavy rainstorms contribute to flash flooding and heavy erosion in stream side locations in this arid region. Faulting and seismic risk are significant in this region. These hazards are site specific and can be minimized by proper siting and design of the Maglev system. Soils in this region are predominantly Mollisols and Argids. Mollisols are characterized by high surface organic matter content. Argid soils typically have a low soil moisture content and occur in arid climates.

3.1.4 Coast Ranges

The California Maglev Alternative is located within the most geologically complex region in the United States. Although the California Maglev Altenative is relatively flat, elongated north-south mountain ranges and valleys are prominent topographic features outside the alternative. Soils include Ultisols, Inceptisols, Xeralfs, and Orthents. Utisols are described above in Section 3.1.2. Inceptisols are usually found on steep mountain slopes and are characterized by little soil development. Xeralfs are reddish soils that are dry for extended periods during the summer months. Orthents are typically found on recent erosional surfaces, and show even less soil development than Inceptisols. Similar to the Basin and Range region, flash flooding and erosion are common problems due to relatively steep topography and infrequent but intense rainstorms. This problem is compounded by the high frequency of forest and chaparral fires that denude the landscape of vegetation, thereby increasing the possibility of mud flows. Seismic activity is heavy in this region, thus the seismic hazard is significant. The region is broken by hundreds of active faults, including the 966 km (600 mi) long San Andreas Fault, which is the largest fault system in the United States. Volcanic cones also exist in this region, although not in the immediate vicinity of the proposed Maglev Alternative. Mud volcanoes similar to those described in Section 3.1.2 occur near the coast and thermal springs are also present in this region.

3.2 CLIMATE

The Maglev Deployment Program involves seven potential alternatives nationwide. Each of these locations may be impacted by climatic events such as extreme high and low temperatures, humidity, and by more serious weather conditions, including hurricanes, tornados, northeasters, ice storms, blizzards, sandstorms, and torrential rains. Table 3.2-1 summarizes the typical climatic conditions associated with each alternative.

Table 3.2-1 - Typical Climate for Proposed Maglev System Locations

	California	Florida	Georgia	Louisiana	Maryland	Nevada	Pennsylvania
Avg. Temp. °C (°F)	18.9 (66.0)	22.4 (72.3)	18.0 (64.4)	20.1 (68.1)	12.1 (53.8)	19.5 (67.1)	10.2 (50.3)
Avg. High °C (°F)	23.9 (75.1)	28.1 (82.6)	24.6 (76.3)	25.3 (77.6)	18.4 (65.1)	26.9 (80.5)	15.5 (59.9)
Avg. Low °C °F)	13.8 (56.8)	16.7 (62.0)	11.3 (52.4)	14.7 (58.5)	5.9 (42.6)	12.1 (53.7)	4.8 (40.7)
Highest Recorded Temp. °C (°F)	44 (112.0)	38.9 (102.0)	42.2 (108.0)	38.9 (102.0)	40.0 (104.0)	46.7 (116.0)	39.4 (103.0)
Lowest Recorded Temp. °C (°F)	-2.2 (28.0)	-7.2 (19.0)	-21.1 (-6.0)	-11.7 (11.0)	-27.8 (-18.0)	-13.3 (8.0)	-27.8 (-18.0)
Mean No. of Days Below 32°F	0	3	45	13	115	32	122
Avg. Rainfall cm (in.)	37.6 (14.8)	122.2 (48.1)	113.3 (44.6)	157.2 (61.9)	102.1 (40.2)	10.4 (4.1)	93.7 (36.9)
Avg. Snowfall cm (in.)	0	0	2.5 (1.0)	0.5 (0.2)	57.4 (22.6)	3.3 (1.3)	109.5 (43.1)
Avg. No. Days withPrecip.	35	116	110	114	117	26	153
Avg. Wind Speed km/h (mph)	10.0 (6.2)	13.8 (8.6)	12.1 (7.5)	13.2 (8.2)	11.9 (7.4)	15.0 (9.3)	14.6 (9.1)

Data source: http:\\www.washingtonpost.com\weatherpost

Temperature/Humidity. Based on the data presented in the table, several conclusions can be drawn regarding temperature conditions at the proposed Maglev Alternatives Alternatives that are subjected to the coldest temperatures include Pennsylvania and Maryland. Both of these alternatives report an average annual low temperature in the 4°C (40°F) range and experience over 110 days each year with temperatures below 0°C (32°F). This is more than twice the number of below freezing days per year than that recorded for the Georgia Alternative (45 days below freezing annually). Conversely, the Alternatives that are subjected to the warmest temperatures include Nevada and Florida. Both of these alternatives report an average annual high temperature in the 27°C (80°F) range. In the summer months, Nevada frequently experiences temperatures above 38°C (100°F), with the highest reported temperature reaching 44°C (116°F). Florida experiences its share of 38°C (100°F) days during the summer but temperatures typically fall in the 32°C (90°F) range. Historically, California has experienced days with temperatures above the 38°C (100°F) mark, with 45°C (112°F) being the highest recorded temperature. However, the California Maglev Alternative is proposed for Los Angeles, an area that typically experiences temperatures that range from the 10°C (50°F) to the high 27°C (80°F) range. Louisiana and Georgia also experience warm summers, but to a lesser degree than Nevada and Florida. Florida, Louisiana, Georgia and Maryland, respectively, have the highest humidity during the summer months.

Tropical Weather Systems. Tropical weather systems including hurricanes and tropical storms and depressions often strike regions along the Atlantic seaboard and Gulf Coast. Of the potential Maglev Alternatives, Louisiana and Florida are the most susceptible to this threat, as these areas could receive a direct hit from a powerful hurricane. The Maryland Maglev Alternative is also at risk, but to a slightly lesser degree, since tropical systems tend to weaken in intensity as they travel northward up the Atlantic Coast. Georgia also can be affected at times by tropical systems; however, these systems usually weaken in intensity as they travel over land. Tropical storm systems do not typically affect California, Nevada and Pennsylvania locations.

Tornados are another dangerous weather phenomenon that can affect some of the proposed Maglev Alternative locations. Georgia, Florida and Louisiana are the three Alternatives most at risk to these unpredictable systems. Pennsylvania is also susceptible to tornadic activity, but to a lesser degree. The California, Nevada and Maryland alternatives typically are not affected by tornados.

Snow and Ice. A northeaster is a strong low pressure system that normally develops off the coast of the mid-Atlantic states, typically in the winter months, and then accelerates up the northeastern seaboard. These systems are characterized by high winds that can be as powerful as the winds associated with a weak hurricane. In addition to the high winds, a northeaster produces large amounts of snow and ice. These systems can paralyze the northeast region for days. Maryland and Pennsylvania are the only two alternatives that can be affected by this weather event.

Ice storms are also a possible occurrence in Pennsylvania and Maryland. During these storms, the temperature conditions are conducive to rain freezing on exposed surfaces and forming thick layers of ice. These types of storms cause tremendous amounts of damage primarily caused by the shear weight of the ice on trees, power lines, and other objects. The Pennsylvania and Maryland Alternatives can also be affected by a blizzard. A blizzard produces huge amounts of snowfall and is accompanied by high winds that contribute to blowing and drifting snow and wind chills well below zero. Like ice storms and northeasters, blizzards can virtually paralyze a region for days.

Sandstorms. Sandstorms typical occur in the desert southwest during monsoon season. Temperature and pressure gradients cause high winds to rush across a dry desert valley floor, resulting in the formation of massive dust clouds. The dust clouds severely impair visibility and cover exposed objects with a thin layer of dust and sand. These weather conditions would only affect the proposed Nevada Maglev Alternative.

Rain and Lightning. All of the proposed alternatives will at one time or another be affected by torrential rainstorms and lightening. Rain storms tend to cause the greatest impact in those areas where rainfall is less prevalent, the topography is steep, and ground cover vegetation is relatively sparse. California is the most susceptible to flash flooding, mudslides and landslides during periods of torrential rains. Nevada is also at risk, although such events are few and far between at this location, which only receives slightly more than 10 cm (4 in) of precipitation annually. Flooding can also affect the other alternatives as well. In these areas, floods occur with greater frequency, but the damage is typically less severe given the topography and vegetative cover of these areas. Major floods and lightening can occur anywhere.

3.3 NATURAL ECOSYSTEMS AND WETLANDS

This section describes the ecological resources present in each of the seven alternatives under study. The main focus will be on vegetation, wildlife, and wetland resources, and on the relationship between organisms and their environments. Special attention will be given to the identification of unique species, habitats, and wetlands within each of the alternatives.

The biological resources of the United States may be divided into seven major terrestrial biomes or climatic regions: desert, grassland, scrub forest, taiga, temperate deciduous forest, tropical forest, and tundra (DOD, 1995). The seven alternatives are representative of the desert, grassland, scrub forest, and temperate deciduous forest biomes. Biome classification is based on the complex interactions between latitude, topography, altitude, geology, water resources, temperature, wind, and humidity. Unique ecological resources, including differences in vegetation, wildlife, and wetland resources, characterize each biome. Analysis of specific ecological resources is presented below under each of the alternative subsections.

Habitat and vegetation resources within the alternatives vary with climatic and physical conditions. Vegetation in the alternative includes a wide range of broad-leaved deciduous trees, multi-stemmed trees, grasses and herbaceous plants, and grassland and desert shrubs. The vegetation composition of the regions plays a determinant role in the occurrence and abundance of wildlife resources. A list of critical vegetation resources by alternative is presented in Appendix I.

The wildlife-resource distribution is determined to a great extent by the climatic and physical conditions, and consequent habitat and vegetation resources present in any given region. The habitats represented by the seven alternatives include a wide variety of small and large mammals, reptiles, amphibians, birds and waterfowl, insects, and aquatic organisms, including a wide diversity of fish and invertebrate organisms. Specific species composition and relative abundances vary across alternatives. A list of critical wildlife resources by alternative is presented in Appendix I.

Wetlands are jointly defined by the Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (COE) as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil conditions" (EPA, 40 CFR 230.3 and COE, 33 CFR 328.3). Wetlands may be divided into two broad categories: estuarine/coastal wetlands subject to tidal influxes of seawater; and palustrine, inland freshwater wetlands. Wetlands generally include swamps, marshes, bogs and similar areas. They are highly productive areas that provide habitat for many species of plants, fish and waterfowl.

The wide variety of functional values exhibited by wetlands make them valuable environmental and economic resources. They enhance water quality and supply; provide flood storage, ground water recharge and discharge, and shoreline anchoring and dissipation of erosive forces. They retain and remove sediments, nutrients, and pollutants; provide unique habitat for wetland-dependant flora and for aquatic life, waterfowl and wildlife. They provide passive and active recreation; and other scientific, cultural and commercial benefits and heritage value. Wetlands are one of the most productive ecosystems in the world.

Jurisdiction over the wetlands falls within the Federal regulatory and permit authority of the United States Army Corps of Engineers under the Clean Water Act, Section 404 permit requirements. To help slow and minimize wetland loss nationwide, Executive Order 11990 (E.O. 11990, May 1977), entitled Protection of Wetlands, established a national policy to "avoid to the extent possible the long-term and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative."

3.3.1 California

The California Maglev Alternative is predominantly comprised of residential, commercial, and industrial developed areas. Such development provides little habitat that would support ecological communities. In the western portion of the alternative, there is a California walnut woodland habitat. In the eastern Section, the alternative crosses the Santa Ana River, which provides habitat for numerous ecological communities. Other sensitive biological habitat within the study area include Delhi sands, Coastal sage scrub, and Riversidean alluvial sage scrub.

The California walnut woodland habitat is described by the California Natural Diversity Database (NDDB) as an open tree canopy and a mostly-grassy understory. This woodland is generally found on moist, fine-textured soils of valley slopes and bottoms. The California Walnut Woodland is considered rare but lacks specific protected status. It has been threatened by urbanization and grazing.

The Santa Ana River area is listed on the NDDB as a riparian forest supportive of a wide variety of vegetation and wildlife resources. The forest typically contains a shrub and herb layer. Riparian corridors are considered sensitive in Southern California due to their rarity.

The California Maglev Alternative crosses the Santa Ana River in an area where it is contained by levees. The alternative crosses several other waterbodies over its 129 km (80 mi) length, many of which are concrete-lined. The Los Angeles and Rio Hondo rivers are both concrete-lined and contain no wetlands. The San Gabriel River is partially rectified, but retains a soft bottom that can support wetland species. The washes, creeks and other drainage ways that feed into the Los Angeles, Rio Hondo, and San Gabriel Rivers are channelized and do not have associated wetlands. The area with the greatest amount of wetlands is the Santa Ana River, which is a wide, braided stream within a levee border. There may also be incidental wetlands associated with drainage ditches within the alternative, but these have not been surveyed or evaluated.

Wetlands that may occur within the San Gabriel and Santa Ana Rivers are seasonal, rather than perennial. Because water flows in the San Gabriel and Santa Ana River channels vary greatly from year to year, and within each year, the potential for wetlands to exist in these rivers also varies. Water flows are greatest during Southern California's rainy season (generally November to March). During this period, the rivers can fully occupy their levee-bound channels and transport large amounts of run-off materials that form temporary sandbars. These temporary sandbars may support wetland plant species, but are subject to annual relocation or even eradication, depending on subsequent rainfall amounts and the velocity of water movement. Sandbars may remain in the same locations for a few weeks, or a few years. During the dry season, water volumes are greatly decreased, affecting the ability to support vegetation. Both rivers are highly subject to changes in the locations of flowing water and areas of inundation. These continual changes affect the types, health, and duration of species that can exist in such an environment.

3.3.2 Florida

The Florida Maglev Alternative is characterized as a coastal environment with extensive linkages between the estuarine, freshwater, and upland habitat systems. The upland topography and habitats within most of the Florida Alternative are a result of shallow water and coastal land forming during periods of higher sea level. Much of the region is underlain by saline or brackish aquifers, so that the shallow aquifer on Merritt Island and parts of the adjoining mainland exists essentially as a floating lens on the more dense salt water. As a result, small variations in topography and hydrology result in significantly different vegetation and habitats.

The Indian River Lagoon (IRL) and Banana River are part of a large lagoon system that extends along most of Florida's east coast, separated from the Atlantic Ocean by low barrier islands. This system historically has been one of the most productive estuarine resources in North America and has been labeled as the most diverse in the country due to its length and latitudinal range (Indian River Lagoon National Estuary Program, 1994). According to the Florida Department of Environmental Protection, the diversity and productivity of the Indian River Lagoon system translates in high commercial and recreational value. Extensive development in the watershed and along the shorelines has resulted in degradation of water quality and a probable reduction in adjacent wetlands and seagrass beds, which provide food resources and water quality buffering for the estuary. There are no inlets near the alternative, so tidal amplitude is generally low, with limited interchange between lagoon and oceanic water. Water level and quality, therefore, are influenced greatly by rainfall and runoff from the watershed.

Largely because of the presence of the Merritt Island National Wildlife Refuge (MINWR), much of the shoreline of the Indian River Lagoon and Banana River within the alternative retains its natural character. The seagrass beds in the Banana River are among the most vigorous in the Indian River Lagoon system. As a result, the Banana River, in particular, contains large numbers of West Indian manatees, migratory waterfowl, and other animal species. Coastal wetlands on much of Merritt Island are also managed to provide habitat for wading birds and migratory waterfowl.

The Florida Maglev Alternative's primary wetland types include lagoons/estuaries with either unvegetated bottoms or seagrass beds; brackish water marshes and mangrove swamps; and freshwater forested (swamp) and herbaceous (marsh) wetlands. The estuarine portions of the IRL and Banana River with unvegetated bottoms represent about 57 percent of the total surface water/wetlands within the alternative. Submerged seagrass beds in the lagoons are only about 3 percent of the total wetlands. Freshwater swamps represent about 15 percent, and freshwater/ brackish herbaceous marshes are about 25 percent of the total wetlands.

The estuarine system includes the IRL and Banana River. The major resource is the IRL, which serves as an important marine nursery area due to extensive seagrass beds. Brackish wetlands occur only occasionally adjacent to the IRL and Banana River in the alternative. These include very narrow bands of mangrove swamp, mainly along the shoreline of Merritt Island. Brackish marshes are well developed only along the shore of Sykes Creek on Merritt Island. In most areas, the marshes and mangrove swamps have been altered by construction of mosquito-control impoundments, which has significantly changed the functions and conditions of these wetlands. Impounded wetlands are present on the east side of the IRL; these impoundments are managed by MINWR for both mosquito control and habitat for migratory waterfowl and wading birds.

The most abundant freshwater wetlands are emergent marshes and scrub-shrub wetlands, with smaller amounts of forested swamps. Most freshwater wetlands on Merritt Island are wet prairies and scrub shrub swamps in a complex mosaic of upland habitats and small wetland swales extending in a generally north to south direction Some larger freshwater swamps and deeper freshwater marshes exist in the northwest portion of Merritt Island. Wetlands within the MINWR provide habitat for approximately 200,000 individual waterfowl, including blue herons, egrets, wood storks, cormorants, and brown pelicans.

Areas on the mainland are characterized by high, sandy, dry soils with wetlands in depression areas. Almost all freshwater wetlands in the study area are isolated palustrine wetland systems, and there are no wetlands associated with large streams or rivers. The mainland wetlands include an approximately equal proportion of freshwater marshes, freshwater swamps, and shrub swamps. These generally are similar to the Merritt Island wetlands, but the forested wetlands tend to be more mature. The largest wetlands are swamps north and southwest of the Space Coast Regional Airport. Many of the wetlands within the alternative, especially on Merritt Island, contain extensive amounts of nuisance exotic species such as Brazilian pepper.

The Indian River Lagoon and Banana River, all wetlands within an Outstanding Florida Waters (OFW) designated area and State and Federal refuges and conservation lands, and the forested wetlands within the corridor, are considered to be high-quality wetlands. The Florida Department of Environmental Protection designates the Banana River as an Outstanding Florida Water requiring 50 percent more stormwater treatment pursuant to Chapter 62-25, FAC.. This group includes most of the wetlands in the project area. There are no federally designated Wild and Scenic Rivers in the vicinity of the Florida Maglev Alternative.

3.3.3 Georgia

Habitats within the Georgia Maglev Alternative include open areas (i.e., agricultural lands, grasslands, and rights-of-way), woodland habitats (i.e., mostly oak/hickory forest and pine-hardwood forest, and a smaller amount of mesic hardwoods and alluvial forests), open water (i.e., lakes, rivers and ponds), wetlands (i.e., forested, scrub-shrub, and emergent), and developed areas (i.e., residential, commercial, and industrial). No particularly valuable ecological communities have been recorded along the proposed alternative. This was confirmed through correspondence with the United States Fish and Wildlife Service (U.S. FWS) (Atlanta Regional Commission, 2000).

The vegetative types present within the alternative include forests, scrub, and emergent. Forest habitats include hardwood, pine-hardwood, and forested wetlands. Within the alternative, ponds are typically highly disturbed, man-made drainage basins dredged periodically to keep siltation and vegetation to a minimum. As such, they have limited value for wildlife and aquatic species. Vegetation within developed areas generally consists of planted grasses and shrubs. Native or naturalized species are also found in developed areas. Agricultural areas are usually planted with field crops or fescue/winter grasses, and active pastures are inhabited by herbaceous species. Right-of-way and open areas (fallow fields) are typically dominated by remnant pasture grasses or early successional species such as fescue, broomsedge, ragweed, dog fennel, goldenrod, and sheep sorrel, with thickets of blackberry and Japanese honeysuckle, as well as scattered pine and hardwood seedlings and saplings.

Woodlands provide varying values to wildlife for food and/or cover, and as roosting, foraging, and nesting habitants for a variety of birds, depending on the species composition and successional age of the vegetation. Species present in the alternative include white-tailed deer, gray and red squirrels, mice, and birds such as wild turkeys, warblers, and woodpeckers. Additionally, the shrub layer and brush piles may provide cover for small to medium-sized mammals. Raptors, including red-shouldered hawks, Cooper’s hawks, red-tailed hawks, barred owls, and screech owls also utilize wooded areas for nesting and foraging. Wooded areas, especially moist woods, also provide habitat for reptiles such as salamanders.

Wildlife that relies heavily on streams and wetlands may include wading birds, waterfowl, and a few mammals. Many species of reptiles and amphibians also use this habitat. Forested wetlands provide habitat for species similar to those described for upland woodland habitat. Some species of birds, however, prefer forested wetland habitat to forested uplands. Scrub-shrub and emergent wetlands provide foraging habitat for wading birds and waterfowl, as well as for reptiles and amphibians. Agricultural cropland may provide a food source for many opportunistic species such as white-tailed deer, turkey, and migrating waterfowl. In addition to providing a food source, active cropland may also provide cover for species. Open lands may provide food and cover for numerous small mammals, some larger mammals, and seed- and insect-eating birds and bats. Grasslands, including pastureland and cropland gone fallow, may also provide foraging habitat and cover for a variety of grassland bird species. Most reptiles prefer wetter habitats; however, snakes whose diets include small mammals may be found in open-area habitats. Open areas bordered by woodland habitats increase their value by providing additional adjacent cover for all wildlife. Open areas characterized by fences or hedgerows provide additional cover and are frequently used by bird for nesting and roosting. Developed land, maintained areas, and residential, commercial, and industrial areas generally provide poor wildlife habitat. Some opportunistic species, especially birds, have adapted to development more readily than other species.

The wetland assessment of the alternative included an evaluation of wetland types, area, and functions and values of the wetland systems identified. Wetland area was calculated using existing National Wetland Inventory (NWI) maps. Functions and values were based on professional judgment and available literature for each habitat. Hydrology, flora, usefulness in the environment, and its relative socioeconomic worth were used in the evaluation process. Pursuant to the Fish and Wildlife Coordination Act, U.S. FW and the Georgia Natural Heritage Program have been contacted (ARC, 2000).

Preliminary site reconnaissance of wetlands was conducted in November 1999; however, the reconnaissance methods used did not include the level of detail required to meet the standards of the 1987 U.S. Army Corps of Engineers Wetlands Delineation Manual. The site wetland reconnaissance was limited to those areas identified on NWI maps. A total of 57 NWI-mapped wetlands encompassing 106 hectares (ha) (261.7 acres (ac)) were identified in the Georgia Maglev Alternative; however, five of these wetlands could not be surveyed because of access limitations. Wetlands within the alternative were classified based on NWI classification and modified as a result of field observations. Six types of wetlands were found within the alternative; palustrine forested, palustrine emergent, palustrine scrub-shrub, palustrine unconsolidated bottom, lacustrine, and riverine.

3.3.4 Louisiana

The major landforms encountered in the Louisiana Maglev Alternative are urban developed lands, marsh/swamp, lakeshore, lake open water, riverine, and upland. The State of Louisiana Department of Wildlife and Fisheries does not have Wildlife Management Areas (WMA) near or within the 1.3 km (4,000 ft) corridor. The State of Louisiana Department of Natural Resources does not have any existing or potential areas of special designation Gulf Coast Ecological Management Sites (GEMS) involved or in the vicinity of the corridor.

Two large wetland areas of marsh and swamp are found within the alternative. The alternative traverses tidally influenced marsh, water bottoms in Lake Pontchartrain supportive of submerged aquatic vegetation, and the site of a wetland-restoration project authorized under the auspices of the Coastal Wetlands Planning, Protection and Restoration Act (NOAA, 2000). In the northwestern portion, the alternative includes part of an unnamed swamp and marsh area at and along the north shore of Lake Pontchartrain. This area also includes isolated wetlands and wetlands associated or interconnected with the Black River and its tributaries.

The western portion of the alternative includes the eastern edge of the La Branche wetlands, traversing several canals. Within this area, the National Marine Fisheries Service sponsors the La Branche Wetlands Restoration Plan project that encompasses approximately 1,025 ha (2,533 ac) of intermediate wetlands and 703 ha (1,738 ac) of brackish wetlands. The objectives of the project are to reduce emergent-marsh loss along the southern Lake Pontchartrain shoreline and within interior fringing marshes, to create emergent marsh, and to improve habitat quality using vegetative plantings and herbivore control. Significant features within and near the alternative limits for the La Branche Wetlands Restoration Plan project include shoreline protection, marsh terraces, vegetation planting, and herbivore control.

Wetlands of freshwater bayous, canals, and swamps in the western portion of the corridor provide habitat for a variety of vegetation and fishes. Freshwater marshes and small portions of brackish-water marshes extend into the Maglev Alternative. There are no wetlands or natural hydrologic flow remaining in the urbanized portion of the alternative. The natural hydrology has been completely modified by an integrated system of canals, ditches, subsurface drainage and pumping stations, levees, and other water control structures. Natural water bodies, wetlands, and flow patterns do occur in the western and northwestern Section of the alternative. However, the flow patterns in the western areas have been significantly altered by the installation of levees, bridges, canals, highways, and new roads.

The National Marine Fisheries Service has identified the presence of Essential Fish Habitat (EFH) within the alternative. The alternative is located in an area identified as EFS for post larval, juvenile, and adult stages of brown shrimp, white shrimp, and red drum. Categories of EFH in the alternative and surrounding areas include estuarine emergent wetlands, submerged aquatic vegetation, estuarine water column, and mud, sand, and shell substrates. In addition, the NMFS states that the alternative, and specifically the Lake Pontchartrain estuary and surrounding marshes, provide nursery, foraging, and refuge habitats for a wide variety of fishery assemblages, including gulf menhaden, southern flounder, blue crab, and black drum.

Functional values define the quality of the wetlands within the Louisiana Maglev Alternative. However, each functional value will likely have varying levels of magnitude and importance in different areas. In general, the wetlands between Lake Pontchartrain and New Orleans International Airport (NOIA) provide benefits in their ability to buffer against flooding, provide habitat for urban wildlife, recreational opportunities for viewing wildlife, as well as potential breeding habitat for birds, fish, and other aquatic life. The wetlands on the North shore provide a buffer against flooding, shoreline anchoring, erosion control, ground water discharge and recharge, filtering agricultural runoff, habitat for wildlife, recreational opportunities for viewing wildlife, as well as various potential breeding habitat for birds, fish, and other aquatic life.

3.3.5 Maryland

The Maryland Maglev Alternative contains several large natural resources, including the Beltsville Agricultural Research Center (BARC) and the Patuxent Wildlife Research Center (PWRC). The alternative is located near the Chesapeake Bay estuary and its tributaries. There are five general types of habitat within the alternative: developed areas, small woodland tracts, agricultural or pasture fields, forested wetlands adjacent to streams, and large tracts of forest. The first four habitat types provide habitat for generalist species. Many wildlife species such as white-tailed deer, raccoons, Canada geese, and groundhog prefer the open and edge habitat that has been created by development. Within the alternative, the PWRC and the BARC provide large tracts of forest habitat for more specialized species.

In the State of Maryland, wetlands are protected under the Maryland Non-Tidal Wetlands Protection Act. An extensive network of streams and rivers drains into the Chesapeake Bay and wetlands occur throughout the alternative. NWI maps from the U.S. FWS were used to identify wetlands within the alternative. The Wetlands of Special State Concern digital data set was developed by the Maryland Department of Natural Resources (MD DNR) using 1998 NWI maps as a base map.

In Maryland, wetlands with rare, threatened or endangered species, and wetlands with unique habitat values receive special protection under Maryland law. The Code of Maryland Regulations (COMAR) identifies these as Wetlands of Special State Concern (WSSC). The NWI was initially used to identify the WSSC. Some WSSC boundaries may be the same as NWI boundaries. The majority of the WSSC within the alternative are located near the river systems and their larger tributaries. Critical Areas are all land and water areas within 305 m (1,000 ft) landward of the state tidal boundary of the shoreline of the Chesapeake Bay and its tributaries. Within the alternative, all of the Critical Areas are located along the Middle Branch, the Patapsco River, and the smaller tributaries of the Patapsco River. These areas are subject to tidal influences due to their proximity to the Chesapeake Bay. NWI wetlands are predominately located near the three river systems contained within the alternative. Along the Patuxent River system and Anacostia River system, the majority of NWI wetlands are classified as palustrine forested (PFO). In the northern Section of the alternative along the Patapsco River, NWI wetlands are largely estuarine sub-tidal emergent (E1EM) or estuarine inter-tidal emergent (E2EM).

3.3.6 Nevada

The southern Section of the Nevada Maglev Alternative crosses a low pass through a series of hills for about 4.5 km (2.8 mi). As a result of the slightly increased elevation and more rocky terrain, the vegetation in this area is a Mojave mixed-scrub vegetation community, which is also common throughout the Mojave on slopes, in washes, or in upland areas. South of Las Vegas to Primm, the alternative is mostly composed of relatively undisturbed desert. The majority of the undisturbed desert is characterized as a bursage vegetation community, common in the valleys of the northern Mojave Desert in California and Nevada, above the dry lakebeds and below the foothills. Common small mammals, lizards, and larger mammals are among the species that inhabit the region. Solely urbanized areas of the city of Las Vegas devoid of native vegetation compose the northernmost section of the alternative.

Based on information from the Bureau of Land Management Las Vegas District Resource Management Plan, the alternative crosses no unique habitats or ecosystems such as mesquite bosques, sand dunes, rock piles or outcrops, or wetlands.

The Mojave Desert has limited precipitation and relatively deep water tables; thus areas classified as wetlands under the Clean Water Act are limited to springs and the pools or drainages they produce. These springs primarily occur in or at the base of mountain ranges, or at rare locations where the geologic features cause ground water to reach the surface. Based on reviews of National Wetlands Inventory maps produced by the U.S. FWS, and visual observation, there are no areas that would be classified as wetlands within the alternative. There are no federally delineated wetlands in the Nevada Maglev Alternative. Wetlands are not classified or granted unique protection under State of Nevada laws or regulations.

3.3.7 Pennsylvania

The Pennsylvania Maglev Alternative is located in the Appalachian Plateau Province of Pennsylvania. Narrow, steep-sided valleys dissect the plateau. Elevations range from 213 m (700 ft) to over 460 m (1,500 ft). Originally a dense cover of trees covered the area; however, clearing for urban development, agricultural uses, mining activities, and timbering have eliminated much of that forestland. Presently, all the forested cover within the alternative is a mosaic of second- and third-growth woodland communities. Eight broad community types were identified within the alternative and include urban or built-up land, cropland and pasture, rangeland, forestland, large streams and rivers, open water, wetlands, and barren land. Rangeland includes open land (herbaceous), shrub and brush, and mixed rangeland. Forestlands include deciduous and evergreen forests.

The Oak/Hickory forest-type group is the most common and mature forest type within the alternative. The next-most-dominant forest-type group is the Northern Hardwoods. Eastern Hemlock is found in the cooler, wetter areas characteristic of higher elevations in the eastern section of the alternative. Wildlife communities are important ecological, economical, and recreational resources of the project area. A diverse array of wildlife species occurs within the forested habitats described above, as well as many other habitat types, including big game, small game, fur-bearing species, other small and large mammals, forest songbirds and raptors, and amphibians and reptiles. The presence of forest-floor litter such as decayed logs, flat rocks, fallen limbs, and leaf material is an important habitat component, providing foraging cover and daytime refuge for many species.

Rangeland communities provide habitat for a number of wildlife species adapted to open space and early successional vegetation. In addition, these communities can create surrounding edge environments where they abut with one or more habitat types such as forests or wetlands. The edge environment often provides greater habitat diversity and attracts a greater number of species than the individual communities by themselves, including many common shrub species that are beneficial to wildlife. However, forest-edge habitat can also be viewed as undesirable. Certain nest-parasitic bird species have their greatest impact on other native species in areas where edge habitat is common. Small mammals essentially dominate wildlife species typically found in rangeland. Larger predators hunt for small mammals in these areas where multiple habitat types are interspersed and interconnected.

A variety of bird species forage in open field areas and use the shrubby edge habitat for nesting and cover. In addition, these areas are utilized as foraging habitat by raptor species. The openness and lack of adequate ground cover within these habitats generally result in poor species diversity and population numbers for most reptile and amphibian species. However, some reptile species prey on the resident small-mammal and insect populations. Wildlife use of cropland is largely dependent on the crop being grown and the season. Crops such as ear corn and soybeans provide cover and food for a number of birds and small mammals. After harvest, waste materials attract many migrating and wintering waterfowl species.

Emergent wetlands within the Pennsylvania Maglev Alternative occur on land that was previously cleared for development, including agricultural. Herbaceous wetland vegetation typically found in southwestern Pennsylvania consists of a mixture of grasses, sedges, and rushes. Scrub-shrub wetlands within the 183 m (600 ft) wide corridors occur along stream and river systems and often provide a transition zone between herbaceous and forested wetlands. Forested wetlands are located mainly in the floodplains of the larger stream and river valleys. The majority of forested wetlands have been logged and now primarily consists of second- or third-growth trees.

A variety of plant and animal species use wetlands, which are essential for feeding, breeding, nesting, and refuge. Many threatened or endangered species in Pennsylvania depend on wetlands at least some time in their life cycle. Wetlands are generally diverse vegetative communities that provide habitat for a wide array of vertebrate species. Waterfowl and wading birds are the most recognized group of animals that occupy wetlands, as well as other fishing birds. Common reptiles and amphibians that require wetland habitat for survival include toads and frogs, salamanders, water snakes, and turtles such as the Snapping Turtle and Painted Turtle.

The high amount of urban development within the alternative restricts wetland development. Within the alternative, isolated wetlands are generally located in depressional areas, or on broad upland flats between mountain ridges. Soils associated with these wetlands generally consist of silty clays that reduce soil permeability and result in poor drainage. Due to these soil conditions, wetland areas remain inundated or saturated for long periods after storm events. However, most of the wetlands identified within the alternative are located adjacent to streams or rivers. Hydrology to these wetlands is typically provided by flooding events or from the water table being located very near to the surface.

3.4 ENDANGERED SPECIES

The Endangered Species Act of 1973 (16 USC §1531-1543) declares the intention of Congress to protect all federally-listed threatened and endangered species, both flora and fauna, and designated critical habitat of such species in the United States and abroad. Section 7 of the Endangered Species Act requires that federal agencies ensure that any action authorized, funded or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. Critical habitat, as defined in the Endangered Species Act (16 USC 1532 (5) (A)) is the specific location within the geographic area occupied by the species essential to the conservation of the species, which may require special management considerations or protection. Critical habitat does not include the entire geographic area that can be occupied by the threatened or endangered species (16 USC 1532 (5) (C)). The U.S. FWS is the primary regulatory agency responsible for compliance of the Act. The U.S. FWS maintains additional categories that are not legally protected, but should be considered during the planning process for any federal project. These additional categories are Proposed Threatened, Proposed Endangered, and Candidate Species.

The threatened and endangered species identified within each alternative are listed in Table 3.4-1. This information was developed by direct contact with the regions U.S. FWS. Each state also has unique programs, methodologies, and lists identifying threatened or endangered species. Each state's fish and game agency was contacted in the development of the table. This does not necessarily mean that each threatened or endangered species will be found within the corridor alternative, it only identifies the likelihood of the threatened or endangered species being there or that the habitat is available to support the species.

Table 3.4-1 - Potential Threatened or Endangered Species Within the Alternative*

Alternative	Potential Threatened or Endangered Species		
California	Coastal California gnatcatcher	Arroyo chub	
	Southern tarplant	San Diego horned lizard	
	Coulter's goldfields	Stephen's kangaroo rat	
	Davidson's saltscale	Parish's desert-thorn	
	Intermediate mariposa lily	Parry's spineflower	
	Many-stemmed dudleya	Smooth tarplant	
	Parish's gooseberry	Robinson's pepper-grass	
	Southern skullcap	Western spadefoot	
	Western yellow-billed cuckoo	Southern cottonwood willow riparian forest	
	California walnut woodland	Southern sycamore alder riparian woodland	
	Santa Ana sucker	Southwestern willow fly-catcher	
	Delhi sands flower-loving fly	El Segundo blue butterfly	
	Least Bell's vireo		
Florida	Atlantic sturgeon	Piping plover	Large-flowered rosemary
	Common snook	Least tern	Lakala's mint
	Gopher frog	Roseate tern	Wild coco
	Sand skink	Black skimmer	Nodding pinwood
	Blue-tailed mole skink	American oystercatcher	Small-leaved melanthera
	Eastern indigo snake	Brown pelican	Hand fern
	Florida pine snake	Florida grasshopper sparrow	Shell mound prickly pear cactus
	Atlantic salt marsh snake	Arctic peregrine falcon	Cinnamon fern
	Short-tailed snake	Southeastern American kestrel	Royal fern
	American alligator	Southern bald eagle	Terrestrial peperomia
	Gopher tortoise	Florida burrowing owl	Blunt-leaved peperomia
	Atlantic green turtle	Red-cockaded woodpecker	Blue butterwort
	Atlantic loggerhead turtle	Florida scrub-jay	Yellow butterwort
	Roseate spoonbill	Florida mouse	Snowy orchid
	Limpkin	West indian manatee	Tiny polygala
	Little blue heron	Giant leatherfern	Brown-haired snoutbean
	Reddish egret	Curtiss' milkweed	Queen's delight
	Snowy egret	Many-flowered grass pink	Wild pine (balbisiana)
	Tricolored heron	Sand-dune spurge	Wild pine (utriculata)
	White ibis	Satinleaf	Tampa vervain
	Wood stork		Blodgett's ironweed
			Rain lily
Georgia	Cherokee darter	Indian olive	
	Bachman's sparrow	Michaux's sumac	
	Bay starvine	Monkeyface orchid	
	Broadleaf bunchflower	Mountain witch-adler	
	Georgia aster		
Louisiana	Pallid sturgeon	Piping plover	
	Gulf sturgeon	Interior least terns	
	Brown pelicans	West indian manatees	
	Southern bald eagles	Ringed sawback turtle	
	Peregrine falcon		
Maryland	Peregrine falcon	Great blue heron	
	Swamp pink	Glassy darter	
	Giant cane	Bog fern	
	Leavenworth's sedge	Clammyweed	
	Bachman's sparrow	Short-fruited rush	
Nevada	Desert tortoise	California/Las Vegas bearpoppy	
	Rosy twotone beardtongue	White-margined beardtongue	
	Yellow twotone beardtongue	Desert/White bearpoppy	
	Banded gila monster		
Pennsylvania	Indiana bat		

Source: (CM, 2000); (FDOT, 2000); (ARC, 2000); (GNOEC, 2000); (MTA, 2000); (CNSSTC, 2000); (PAAC, 2000)
Species listed include all Federal, State, Regional, and Local listed species in the study areas.

3.5 WATER QUALITY

This section identifies and describes the current hydrological conditions at potential Maglev Alternatives in terms of surface-water and groundwater system characteristics.

Federal water quality standards set specific criteria for the levels of parameters that must be maintained to protect water quality and water uses. There are two primary regulations dealing with water quality, the Safe Drinking Water Act (SDWA) and the Clean Water Act (CWA). The SDWA emphasizes pollution prevention to ensure safe drinking water, focusing on the protection of water resources. The objective of the CWA is to eliminate or control the discharge of pollutants into source waters. EPA drinking water quality standards are health-based and enforceable for all public drinking water supply systems (primary standards). Secondary standards control substances that affect aesthetic qualities (such as taste, odor, and color). They are not Federally enforceable and, if exceeded, would generally not cause health problems. In addition, state and local ordinances may regulate construction activity in watershed or water supply aquifer areas. These local considerations will be addressed during the final design and engineering environmental review process.

Important characteristics of the groundwater system include recharge zones (areas where water infiltrates from the surface and reaches the saturated zone), discharge points (locations were groundwater reaches the surface), unsaturated zones (the portion of the groundwater system above the water table), saturated zones (the portion of the groundwater system below the water table), and aquifers (water bearing layers of rock or sediment that provide water in usable quantities to a well or spring). In combination these characteristics define the quantity and quality of the available groundwater.

Appropriate mitigation measures must be applied to all bodies of water and water resources that are negatively impacted by the Maglev Program. Surface water and groundwater are two potential regions of influence of the Maglev Program on water quality. Surface water concerns include construction areas that would be susceptible to erosion, areas affected by permanent changes in flow, and areas downstream of the project site that would be affected by eroded soil or potential spills of construction contaminants. Groundwater issues include aquifers that would underlie areas of construction and operation, aquifers that could be sources of water for construction, and aquifers downstream of the project site that use, or long-term releases from that project, could affect.

3.5.1 California

The California Maglev Alternative is underlain by several aquifers: the West Coast Basin, the Central Basin, the Main San Gabriel Basin and the Upper Santa Ana Basin. The West Coast Basin, the Central Basin and the Main San Gabriel Basin are currently designated potable sources. The Upper Santa Ana Basin is designated as a potential water supply.

Within the California Alternative, there are several surface water bodies: the Los Angeles River, the Rio Hondo, the San Gabriel River, the Santa Ana River, the Ballona Creek and Centinela Creek. The Los Angeles River and the Rio Hondo are fully channelized. The

San Gabriel River is partially rectified, but retains a soft bottom. The Santa Ana River is a meandering, soft bottom stream with an extensive band of associated wetlands. There are no wetlands associated with the Los Angeles River and the Rio Hondo, but the San Gabriel has wetland characteristics.

3.5.2 Florida

The Florida Maglev Alternative is underlain by the Floridian aquifer system, and other intermediate and shallow surficial aquifer systems. The Floridian aquifer system is saline and not used for potable purposes within the study area. Shallow surficial aquifer wells produce water for heat-pump air conditioning and lawn irrigation. Aquifer recharge areas are west of the Banana River.

There are many surface water bodies within the Florida Alternative, including rivers, shallow estuarine lagoons, tidal creeks, fresh water creeks, canals, and small natural and excavated ponds. The most significant water bodies in the area are the Banana and Indian Rivers.

3.5.3 Georgia

Due to irregular rock formations, the aquifers in the Georgia Maglev Alternative are poorly defined, and are not mapped. Consequently, there are no specifically named aquifers. Wells drilled in random locations yield low amounts of water, enough for domestic use only.

The Georgia Alternative includes rivers, streams, tributaries, and lakes. The watersheds within the are the Upper Flint, Upper Ocmulgee, Upper Middle Chattahoochee, Upper Chattahoochee and Etowah.

There are three public well water supplies and one public drinking water intake within the Georgia Alternative. The drinking water intake occurs at the Hemphill Water Treatment Plant, which draws water from the Atlanta Reservoir. The Chattahoochee River and Lake Allatoona are used as public drinking water supplies, but the intakes are outside of the alternative. The Chattahoochee River intake is approximately 9.6 km (6 mi) to the east. The Lake Allatoona intake is approximately 16 km (10 mi) to the north.

The Chattahoochee River and the Atlanta Reservoir are the project area's two water bodies with the highest water quality. There are six stream segments within the alternative that do not meet the regulated standard criteria and are considered low quality, and do not support their designated use: part of the Chattahoochee River, Peachtree Creek, Nancy Creek, Rottenwood Creek, Slope Creek, Noonday Creek.

3.5.4 Louisiana

The Louisiana/Mississippi Southern Hills Aquifer System and a sole source aquifer are located in the northern portion of the Louisiana Maglev Alternative. A sole source aquifer is an aquifer designated as the "sole or principal source" of drinking water for a given service area; that is, an aquifer which is needed to supply 50 percent of more of the drinking water for the service area with no reasonably available alternative sources should the aquifer become contaminated.

No natural hydrologic flow remains in the New Orleans urbanized area. The natural hydrology has been completely modified by an integrated system of canals, ditches, and subsurface drainage, pumping stations, levees and other surface storm water control structures.

The open bodies of water located within the Louisiana Alternative include the Mississippi River (fresh), Lake Pontchartrain (brackish), and the Black River (fresh). Potable water is obtained from the Mississippi River in the southern portion of the alternative.

3.5.5 Maryland

Ten distinct watersheds are contained within the Maryland Maglev Alternative: Anacostia River, Western Branch, Patuxent River Upper, Rocky Gorge Dam, Little Patuxent River, Middle Patuxent River, Severn River, Patapsco River Lower North Branch, Gwynns Falls, Baltimore Harbor, and Jones Falls.

The Anacostia River in the southern portion of the Maryland alternative study corridor is fed by two tributaries, the Northwest Branch, and the Northeast Branch. These two tributaries converge to form the Anacostia River before flowing south into Washington, D.C. and ultimately the Potomac River. The Patuxent River and the Little Patuxent River flow through the center of the alternative. These two rivers converge outside the alternative to the southeast to form one major river, the Patuxent River. Two major stream tributaries located in the northern portion of the Maryland Alternative, Deep Run and Stony Run, feed the Patapsco River.

3.5.6 Nevada

Within the Las Vegas portion of the Nevada Maglev Alternative is a deep aquifer, more than 60 m (200 ft) below ground level containing potable water. A surface aquifer, containing non-potable water is also located in this area.

The alternative encompasses through three basins; the Ivanpah Valley Basin, the Jean Lake Valley Basin, and the Las Vegas Basin. The Ivanpah Valley Basin flows to the south-southwest into Roach Lake, a dry lakebed. Flow within this portion of the Jean Lake Valley Basin is to the south, into Jean Lake, which is also a dry lakebed. The Las Vegas Basin flows north and then east to the Las Vegas Wash, which subsequently flows into Lake Mead and the Colorado River.

Due to the desert climate of the Nevada Alternative, there are essentially no surface water resources. All streams and washes within the alternative contain water only after significant precipitation events within the watersheds.

3.5.7 Pennsylvania

Aquifers within the Pennsylvania Alternative include the Appalachian Basin and a narrow surficial aquifer located along the valleys of the Ohio, Allegheny, and Monongahela Rivers.

The alternative traverses three major river basins or watersheds: the Ohio, Allegheny, and Monongahela Rivers. Within these major watersheds are many sub-watersheds.

Surface water is an important source of public water supplies within the alternative. Surface water intakes are located along each of the three major rivers. Five surface water supply sources are located within the alternative.

3.6 FLOOD HAZARD

Flooding is a natural process that consists of the rising and overflowing of a body of water onto normally dry land. The area of normally dry land that becomes flooded is typically referred to as a floodplain. Floodplains lie adjacent to existing waterways and are characterized by relatively large expanses of land with gradual topographic gradients.

During periods of flooding, floodplains naturally moderate flood flow, contribute to human safety, provide water quality maintenance, act as areas for ground water recharge, and serve as temporary habitat for a number of plants and animals. Any structure that is built in the floodplain will take up part of the space normally flooded. The result is floodwaters will increase in height and encroach beyond the normal floodplain. Base floodplain is the area at risk that has a one percent or greater chance of flood elevations being exceeded in any given year; also referred to as the base or 100-year flood (i.e., once every 100 years on the average).

The protection of floodplains and floodways is required by Executive Order 11988, *Floodplain Management* of 1977 (44 CFR 9), as amended, National Flood Insurance Act of 1968 (42 USC 4124), as amended, and U.S. Department of Transportation Order 5650.2, *Floodplain Management and Protection*. The National Flood Insurance Program (NFIP) is managed by the Federal Emergency Management Agency (FEMA), which oversees floodplain management for the program. The intent of these regulations is to avoid or minimize encroachments within the base floodplains, where practicable, and to avoid supporting land use development that is incompatible with floodplain values.

Boundaries of 100-year floodplains are determined from studies performed by FEMA. FEMA has prepared Flood Hazard Boundary Maps (FHBM) and Flood Insurance Rate Maps (FIRMs) which are the basis for regulating floodplain development.

Floodplain boundaries for the seven Maglev Alternatives are identified in the individual site EAs. Contact the person(s) listed in Appendix A to obtain copies of these EAs.

3.7 COASTAL ZONE MANAGEMENT

The National Coastal Zone Management (CZM) Program is a voluntary partnership between the Federal government and U.S. coastal states. State compliance to the National CZM Program usually results in a Coastal Zone Management Plan (CMP) that sets standards and develops procedures to help guide coastal development. The state plans are generally similar to land use planning tools. The purpose of the plans are to preserve, protect, develop, restore and enhance the resources of the Nation's coastal zone for this and succeeding generations. Reflecting on the diverse natural environment of the coastal zone and the varied uses of coastal lands and waters, the CZM Program focuses on balancing competing land and water uses while protecting shrinking sensitive resources.

Each of the Maglev Alternatives was reviewed to determine if they were within the jurisdiction of a designated CZM district. Table 3.7-1 identifies which alternatives are within coastal zone district and thus, responsible for considering CMPs. Upon review of the individual alternatives, it was found that the Florida, Louisiana and Maryland Alternatives lie within a coastal zone district.

Table 3.7-1 - Coastal Zone District Jurisdiction

Alternative	Lies Within Coastal Zone District
California	No
Florida	Yes
Georgia	No
Louisiana	Yes
Maryland	Yes
Nevada	No
Pennsylvania	No

Source: (CM, 2000); (FDOT, 2000); (ARC, 2000); (GNOEC, 2000); (MTA, 2000); (CNSSTC, 2000); (PAAC, 2000)

3.8 AIR QUALITY

In accordance with EPA, the impacts from air pollutants must be quantified in two ways. The first is by the total mass of pollutants emitted, generally called an emission inventory. The second is by the concentration of the pollutants in the air we breathe. To determine these impacts, it is first necessary to establish a baseline. This is done by analyzing the existing environment so that magnitude of impacts from a proposed action can be determined.

The determination of the total mass emitted allows direct comparisons to determine if additional burden will be placed on the surrounding air basin. These mass determinations also allow impacts to be analyzed on secondary pollutants (those that form from primary precursor gases in the atmosphere) and regional impacts.

While the total mass emission calculation provides insight into proposed actions, the effect on human health and public welfare cannot be determined with these calculations. The regulatory setting delineates if impacts occur by the use of established standards. Air quality standards may be applied at the Federal, State or local level. However, State and local standards cannot be less stringent than the Federal standards and all projects must consider the Federal standards.

The Clean Air Act and subsequent amendments have determined the regulatory requirements. National Ambient Air Quality Standards (NAAQS) were required in the 1977 Clean Air Act Amendments and although altered, are still valid under the current legislation, the 1990 Clean Air Act Amendments. EPA's Office of Air Quality Planning and Standards (OAQPS) has promulgated these standards. The primary NAAQS are to protect the public health with an adequate margin of safety including the health of "sensitive" populations such as asthmatics, children, and the elderly. The secondary NAAQS are to protect the public welfare including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. Six pollutants, described as "criteria" pollutants, are included in the NAAQS and presented in Table 3.8-1. Units of measure for the standards are parts per million (ppm), milligrams per cubic meter of air (mg/m^3), and micrograms per cubic meter of air ($\mu g/m^3$).

Ozone concentration generally peaks in the mid afternoon when release of Volatile Organic Compounds (VOCs) and NOx turn into afternoon ozone. Also, ozone concentrations tend to be greater in the summer when solar radiation is greater, providing more energy for the secondary pollutant to form. Carbon monoxide concentrations are generally greater during winter months because of the lower mixing heights (more shallow atmospheric mixing) and are most often related to peak hour traffic.

Table 3.8-1 – National Ambient Air Quality Standards*

POLLUTANT	STANDARD VALUE		STANDARD TYPE
Carbon Monoxide (CO)			
8-hour Average	9 ppm	(10 mg/m^3)	Primary
1-hour Average	35 ppm	(40 mg/m^3)	Primary
Nitrogen Dioxide (NO_2)			
Annual Arithmetic Mean	0.053 ppm	(100 $\mu g/m^3$)	Primary & Secondary
Ozone (O_3)			
1-hour Average*	0.12 ppm	(235 $\mu g/m^3$)	Primary & Secondary
8-hour Average*	0.08 ppm	(157 $\mu g/m^3$)	Primary & Secondary
Lead (Pb)			
Quarterly Average		1.5 $\mu g/m^3$	Primary & Secondary
Particulate <10 micrometers (PM10)			
Annual Arithmetic Mean		50 $\mu g/m^3$	Primary & Secondary
24-hour Average		150 $\mu g/m^3$	Primary & Secondary
Particulate <2.5 micrometers (PM2.5)			
Annual Arithmetic Mean		15 $\mu g/m^3$	Primary & Secondary
24-hour Average		65 $\mu g/m^3$	Primary & Secondary
Sulfur Dioxide (SO_2)			
Annual Arithmetic Mean	0.03 ppm	(80 $\mu g/m^3$)	Primary
24-hour Average	0.14 ppm	(365 $\mu g/m^3$)	Primary
3-hour Average	0.50 ppm	(1300 $\mu g/m^3$)	Secondary

* The ozone 1-hour standard applies only to areas that were designated non-attainment when the ozone 8-hour standard was adopted in July 1997. This provision allows a smooth, legal, and practical transition to the 8-hour standard.
Source: http//:www.epa.gov/airprogm/oar/oaqps/greenbk/criteria.html

The Clean Air Act Amendments of 1990 also further formalized the concept of Non-Attainment Areas (NAA). A NAA is an area that does not meet one or more of the NAAQS. For some pollutants, classifications of NAAs have been determined. For ozone there are five classifications: marginal, moderate, serious, severe, and extreme. Carbon monoxide and PM10 NAA are classified as moderate or serious. Each classification has different requirements and time scales for achieving the NAAQS. To insure states comply with these requirements and time lines, a State Implementation Plan (SIP) is required. Actions must conform with the SIP; this process is called conformity. The Maglev Program would fall under the requirements of 40 CFR 51, Subpart T, Transportation Conformity. Each state designates agencies that develop and monitor such plans. In the case of transportation projects or actions, control measures may be required by the SIP. These control measures, or abatement plans, help to insure attainment of the NAAQS is not delayed and accedences of the NAAQS are not exacerbated. In addition, Long Range Plans and Transportation Improvement Projects are analyzed and adopted after approval. If a project is in the Transportation Improvement Plan it is considered to be in conformity. If not, a conformity analysis must be accomplished.

Additional guidance to determine if air quality impacts are significant is supplied by the Federal Transit Administration and is entitled "Technical Guidance on Section 5309 New Starts Criteria," dated September 1999. Greenhouse gas considerations are contained in this guidance.

3.8.1 California

In addition to the NAAQS, the state of California also has air quality standards that are more stringent for all of the criteria pollutants and includes sulfates and hydrogen sulfide.

In California, the agency responsible for SIP development and implementation is the California Air Resources Board (CARB), a part of the California Environmental Protection Agency. The agency with local jurisdiction is the South Coast Air Quality Management District (SCAQMD), as the California Maglev Alternative is in the South Coast Air Basin. Control measures for stationary sources and mobile sources are included in the SIP. The basin is bounded by the San Jacinto Mountains on the north and east and the Pacific Ocean on the west. The mountains and sea breeze hinder dispersion in the area.

The most representative monitoring sites within the alternative consist of the Hawthorne, downtown Los Angeles, Pomona, Riverside, and Perris monitoring locations. In 1998, the peak one-hour ozone average concentrations varied from 0.089 to 0.195 ppm, which caused exceedences of the NAAQS. Peak 8-hour measured CO concentrations were obtained at the Hawthorne site in 1998 and reached 9.5 ppm, which again exceed the NAAQS. The peak 24-hour PM10 concentrations in the area were 116 $\mu g/m^3$ and occurred at the Riverside monitoring station, while the annual geometric mean measured at the Riverside location was 49 $\mu g/m^3$. These values for particulate matter also exceed State standards, although they meet Federal ones. In general, the PM10 concentrations are worse in the inland area and in the fall and winter months. All other criteria pollutant NAAQS or State standards are not exceeded. Based on these measurements, the basin is an extreme NAA for ozone (both Federal and State), Los Angeles County is an extreme NAA for carbon monoxide (both Federal and State), and the basin is a serious NAA for particulate matter.

3.8.2 Florida

The Florida Maglev Alternative is in compliance for all NAAQS.

3.8.3 Georgia

Fourteen monitoring stations are operated by the Georgia Maglev Alternative, of which seven monitor ozone, in the greater Atlanta area. From these collected data, it is shown that the project area is in attainment for all pollutants except ozone. The Georgia alternative is in a serious NAA for ozone and must comply with the Georgia SIP. Attainment of the ozone standard is planned in the SIP to occur by the year 2003. The Georgia Department of Natural Resources, Environmental Protection Division, (Georgia Maglev Alternative) is the responsible agency. If control measures are implemented, they must comply with the State Air Quality Regulations, Chapter 391-3-1. Control strategies are included in the SIP to reduce VOCs and NOx, primary ozone precursor gases. These control measures include NOx reductions from regional power plants, a 30 ppm limit of sulfur content of gasoline, and enhanced vehicle inspection and maintenance (I/M) programs in the 13-county non-attainment area.

The Georgia EPD also requires analysis of the PM10 and NOx pollutants during the construction phase of a project. State Rule 391-3-1-02.(2)(n) applies for PM10 (fugitive dust). The rule requires that all caution be taken to prevent fugitive dust for any operation, handling, transportation or storage facility associated with the project. A comprehensive construction management plan may be required for the use of water or chemicals to control the dust during construction operations, grading of roads or clearing of land.

Other State rules that apply to the Georgia project are 391-3-1-.02(b) Provisions - Visible Emissions, 391-3-1-.02(4) Ambient Air Quality Standards, and 391-3-1.03(6) that is used to determine exemptions for air quality permits. The visible emission rule applies to direct sources and prohibits emissions from any such source with an opacity greater than or equal to 40 percent. The ambient air quality rule echoes the NAAQS and specifies standard methods for determining the concentration of the criteria pollutants. The permit rule exempts sources that are combustion sources with fuel input less than 10 million BTU/hour that burn natural gas, liquid petroleum gas (LPG), and/or distillate fuel containing 0.5 percent or less by weight of sulfur. Emergency generators that operate less than 500 hours per year using natural gas, LPG, dual fuel, or diesel fuel are also exempt.

3.8.4 Louisiana

The Louisiana Maglev Alternative has been a NAA for ozone in the past, but was redesignated as an attainment area in 1995. Because of this past history, the area is currently designated a maintenance area for ozone.

3.8.5 Maryland

In addition to the Federal requirements, the state of Maryland has “Regulations Governing the Control of Air Pollution in the State of Maryland.” Fugitive dusts are also covered under “Standard Specifications for Construction and Materials.”

The Maryland Maglev Alternative is classified as a NAA for ozone. The Baltimore region (Baltimore City, Baltimore County, Anne Arundel County and Howard County) are classified as a severe NAA for ozone. The Washington, D.C. area (Montgomery County, Prince George's County and the District of Columbia) is designated as serious NAA for ozone. All areas have a target of the year 2005 to come into compliance. The areas are in compliance for all other criteria pollutants.

3.8.6 Nevada

The Nevada Department of Conservation and Natural Resources, Division of Environmental Protection, Bureau of Air Quality does air monitoring in Nevada, except in Clark and Washoe Counties. In these two counties the local health departments are in charge of monitoring. Las Vegas is the greatest area of concern for the project due to population density; nineteen monitoring sites are present. Of these nineteen sites, six measure carbon monoxide and eleven monitor PM10. The Las Vegas Valley is in attainment for all criteria pollutants, with the exception of carbon monoxide and PM10, and is close to being categorized as non-attainment for ozone. The valley is designated as a serious NAA for both of these criteria pollutants.

In addition to the NAAQS, a dust control permit must be obtained from the Air Pollution Control Division (APCD) of the Clark County Health District. This permit requires that construction activities must control handling, storing or transporting of materials. Requirements are also in place, requiring contractors to implement measures to immobilize soil and other particles that may become airborne. Section 45 of the APCD regulations specifies that diesel powered motor vehicles cannot idle more than 15 consecutive minutes. Additionally, any emergency standby power generators used for the Maglev system would need an operating permit and conditions would be placed on the use of the generators for visible air emissions.

3.8.7 Pennsylvania

Currently, air monitoring and air quality issues related to NAAQS pollutants are conducted through the Pennsylvania Department of Environmental Protection and the Allegheny County Health Department. Based on historical monitoring data and as of this report writing, the Pennsylvania Maglev Alternative is designated as being unclassified for CO and moderate non-attainment for O_3, the pollutants most normally associated with mobile source emissions. (Portions of the City of Pittsburgh that are not classified as CO non-attainment are subject to the CO conformity criteria until officially redesignated to attainment. However, there has not been a CO impact in over a decade.)

The Pennsylvania Maglev Alternative is included in the Southwestern Pennsylvania Commission's (SPS) approved and conforming Long Range Plan (LRP). It was adopted and approved in July 2000. Therefore, the proposed project is conforming for O_3.

3.9 SOLID AND HAZARDOUS WASTE

Operation of the Maglev will generate solid waste and will require the removal, transportation, and disposal of solid waste products. Sources of waste from Maglev operations will be from administrative offices, passenger stations, and other user support facilities such as parking lots and maintenance facilities. The type and amount of solid waste generated by Maglev will affect local landfills and other waste disposition facilities. There will be several kinds and sources of solid waste, each requiring different kinds of landfills or disposal sites. Guidance for defining solid waste is in the Resource Conservation and Recovery Act of 1976 (RCRA). This guidance, in this context, establishes two categories of solid waste: 1) Conventional or non-hazardous wastes, including construction debris, trash, garbage, and other refuse; and 2) Hazardous wastes, including petroleum products, contaminated spoils, heavy and or special metals, etc. These categories of wastes dictate the kind or class of landfill or disposal site required. The final locations of the stations and maintenance facilities have not been identified at this early stage of planning, thus the local landfills and contractors cannot be identified at this time. However, it is likely that commercial contractors will be used to manage solid waste disposal, including method of disposal and the identification of appropriate landfills. When final location and design is completed, the local municipal landfill and commercial contractors will be identified for appropriate methods, capacity and disposal options.

3.10 SOCIOECONOMIC, ENVIRONMENTAL JUSTICE AND ELDERLY AND DISABLED

The populations' businesses and residences of the immediate area around the construction and operation of the Maglev system are the affected environment. Potential impacts to populations along the corridor include the displacement of people and businesses along the route due to property acquisitions necessary for Maglev system construction. Immediate area in this context is 610 m (2,000 ft) of clearance on each side of the Maglev track or the 1,219 m (4,000 ft) wide Maglev Program.

Pending specific design, all conduits, passenger stations and other operational facilities are assumed to be within this corridor. The 1990 U.S. Census data is used to describe baseline populations for each of the alternatives. Because of the age of the data, and the potential change in populations since the census, many alternatives used various statistical methods to extrapolate population data, particularly in the regions of influence. The region of influence is states, counties, cities, communities, neighborhoods, and other residences upon which the Maglev system will have some impact.

Other aspects of the affected environment are the public ways including sidewalks and other transitions from existing infrastructure used by the aged and disabled to the Maglev facilities and vehicles.

Many of the alternatives propose the Maglev system to be located along existing transportation corridors including rail lines and highways. In these situations, the affected environment may be subject to marginal impact, or the difference between existing disturbances and those changes resulting from the Maglev Program.

3.10.1 Socioeconomic

A summary of the baseline population data used to describe the affected environment associated with each alternative is shown in Table 3.10-1 below. Population estimates are based on the 1990 Census with various statistical models used to generate a more accurate current-day estimate to account for potential changes in populations since the census.

Table 3.10-1 - Population

Alternative	Total Population in Corridor
California	945,572
Florida	2,539-34,673[1]
Georgia	64,696
Louisiana	47,306-54,549[1]
Maryland	84,618 - 107,478[1]
Nevada	13,202
Pennsylvania	251.845-345,202[1]

Ranges of numbers represent alternative route alignments;
[1] Population by route alignment
Source: (CM, 2000); (FDOT, 2000); (ARC, 2000); (GNOEC, 2000); (MTA, 2000); (CNSSTC, 2000); (PAAC, 2000)

3.10.2 Environmental Justice

The proposed Maglev Alternatives were studied to determine their effects on the populations of concern according to Title VI of the Civil Rights Act of 1964, and Executive Order 12898 of February 11, 1994, Federal Actions to Address Environmental Justice (EJ) in Minority and Low-Income Populations.

Title VI requires that no person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subject to discrimination under any program or activity receiving Federal financial assistance.

Executive Order 12898, directs Federal agencies to "promote nondiscrimination in Federal programs substantially affecting human health and the environment, and provide minority and low-income communities access to public information on, and an opportunity for public participation in, matters relating to human health or the environment." The Order directs agencies to use existing law to ensure that when they act, they:

- Do not discriminate on the basis of race, color, or national origin.
- Identify and address disproportionately-high and adverse human health or environmental effects of their actions on minority and low-income communities.
- Provide opportunities for community input in the NEPA process, including input on potential effects and mitigation measures.

Executive Order 12898 requires a compilation of information about the race, national origin, and income of populations in close proximity to proposed federal projects and their programs, policies, and activities that may have a disproportionately-high and adverse human health or environmental effects on minority and low-income populations.

The distribution of benefits vs. burdens should be equitable. Some neighborhoods, communities, and regions would receive direct benefits from Maglev system, such as jobs and tax revenues, while the costs, such as the burdens of residential and business relocation are experienced elsewhere. Communities hosting station facilities receive access, while those impacted by guideways and substations have the same adverse noise impacts, but are not serviced by the Maglev system. There are many factors that should be considered when identifying and evaluating environmental justice concerns:

- Demographic Factors (population age, population density, population literacy, population / economic growth).
- Geographic Factors (climate, geomorphic features, hydrophic features).
- Economic Factors (individual economic conditions such as income level/health care access, infrastructure conditions, distribution of costs, community economic base, and natural resources).
- Human Health and Risk Factors (emissions and exposures).
- Factors Related to Cultural and Ethnic Differences and Communications Concerns (public access, cultural expectations, meaningful information).

Factors which should be considered as Maglev design progresses include: the quantity and quality of service, fare structures, impacts of potential economic investments as well as disinvestment and abandonment, social isolation, housing and residential patterns, and competing taxing structures. alternative

Table 3.10-2 presents populations for each of the Maglev s that are subject to protection under environmental justice considerations.

Table 3.10-2 - Protected Populations

Alternative	Protected Population
California	728,000
Florida	118 to 3,589
Georgia	34,935
Louisiana	29,658-33,328[1]
Maryland	55,116 to 26,514
Nevada	4,033
Pennsylvania	42,515-130,938

Ranges of numbers represent alternative route alignments
[1] 29,658-33,328 minority; 5,661-5,712 below poverty
Source: (CM, 2000); (FDOT, 2000); (ARC, 2000); (GNOEC, 2000); (MTA, 2000); (CNSSTC, 2000); (PAAC, 2000)

Table 3.10-3 provides the race/ethnic profile for each of the Maglev Alternatives. Data presented show the comparative protected populations as a percent of the total affected population.

Table 3.10-3 - Racial Composition of the Affected Population

	Total Population (Percent of Total Population)					
	White	**African American**	**Native America**	**Asian / Pacific Islanders**	**Hispanic American**	**Other**
California	14-56 (8%-56%)[1, 2]	7-16 (4%-37%)[1, 2]	1 (<1%)[1, 2]	4-14 (4%-18%)[1, 2]	28-56 (27%-60%)[1, 2]	NA
Florida[2]	2,421-31,084 (90%-95%)	40-2,038 (2%-7%)	78-1,551 (4%-5%)			NA
Georgia[5]	(47%)	(50%)	(<1%)	(1%)	(2%)	NA
Louisiana[2]	18,710-22,615 (39%-42%)	27,988-31,110 (57%-9.2%)	68-77 (<1%)	264-338 (1%)	1,334-2,017 (3%-4%)	NA
Maryland[2]	52,362 – 63,586 (49%-71%)	19,707-48,068 (22%-45%)	258-317 (<1%)	2,641-3,545 (3%)	2,376-3,066 (2%-4%)	810-1,234 (1%-2%)
Nevada[4]	9,235 (70%)	739 (6%)	99 (1%)	487 (4%)	2,622 (20%)	20 (<1%)
Pennsylvania[6]	(74%-92%)	(7%-23%)	(<1%)	(<1%-2%)	(<1%-1%)	NA

[1]Preferred Alignment Only
[2]by route
[3]by county in corridor
[4]by corridor
[5]Only percentages provided in A
[6]183m/600 ft wide corridor
NA – Not Applicable
Range of number represent alternative route alignments

Source: (CM, 2000); (FDOT, 2000); (ARC, 2000); (GNOEC, 2000); (MTA, 2000); (CNSSTC, 2000); (PAAC, 2000)

3.10.3 Elderly and Disabled

The affected environment includes elderly and disabled persons who: use Maglev services, reside in the immediate area of Maglev construction and operation, and are Maglev workers. Every alternative has potentially affected elderly and disabled populations.

The elderly-and-disabled accessibility focuses on infrastructure requirements. Multiple features of the Maglev Alternatives could affect aged, infirmed, and/or disabled persons. Aspects of the affected environment include all access pathways to and from the immediate area around the stations and any other system elements which transition from existing infrastructure to the Maglev facilities and vehicles used by the aged and disabled. These pathways include public ways to the passenger stations/terminal facilities, offices, maintenance facilities, and power substations. Maglev vehicle access includes the transition from platform to train, doors, wheelchair spaces and seating on the train, mobility on the train, and other considerations.

All alternatives have identified the need for transitional infrastructure and compliance with appropriate rules. In order to provide the minimum standards for accessibility to the stations and their site access by individuals with disabilities or elderly persons, the entire Maglev transportation system (parking, vehicles, stations, and other supporting facilities) for all alternatives should be designed and constructed to be in compliance with the Americans with Disabilities Act (ADA) accessibility guidelines. The ADA protects individuals from discrimination on the basis of disability and requires provisions for handicap accessibility in transportation and public accommodations. In addition, each alternative should also comply with applicable state and local accessibility and building codes that require accommodation for those with disabilities. For all of the Maglev

Alternatives, these requirements would focus on ensuring proper access and accommodations at stations and on the Maglev vehicles.

The Department of Justice's regulation implementing Title II, Subtitle A of the ADA (July 26, 1991) prohibits discrimination on the basis of disability in all services, programs, and activities provided to the public by state and local governments, except public transportation services. The Department of Justice's regulation implementing Title III of the ADA (July 1, 1994) prohibits discrimination on the basis of disability in "places of public accommodation" (businesses and non-profit agencies that serve the public) and "commercial facilities" (other businesses).

The Federal Equal Employment Opportunity Commission (EEOC) has issued a proposed regulation generally protecting the right of a worker to challenge the validity of a waiver or release under the Age Discrimination in Employment Act (ADEA), 29 USC 621 (April 23, 1999).

Given these regulations and requirements, each of the Maglev Alternatives is committed to providing access to the system, stations, offices, and employment opportunities to all potential patrons, regardless of physical or mental ability, age, race, religion, sex (gender or orientation), or ethnic background.

3.11 LAND USE, FARMLAND AND 4(f) RESOURCES

All of the proposed Maglev Alternatives are located in or near highly populated urban areas. However, due to the length of these proposed transportation systems, most cross less developed, non-urban lands as well. The alternatives, therefore, exhibit a wide variety of land uses. This section includes a description of the general land-use characteristics of each of the proposed Maglev Alternatives.

In general, the land uses identified in the alternatives include:

- Residential – low, medium, and high density.
- Parkland – public, private, conservation areas, recreation area, and wildlife refuges.
- Institutional – schools, churches, universities, governmental, and cultural resources.
- Commercial – retail and service.
- Office – specific professional service uses.
- Light industrial – food processing and other non-manufacturing industries.
- Heavy industrial – port activities, timber processing, manufacturing, and extractive.

The likelihood of encountering active farmlands or agricultural areas in heavily urbanized portions of the alternatives is small, since much of the land has been developed and/or disturbed. However, as one proceeds outward into the suburbs, active farms and areas of favorable farmland soils become more prevalent. This section includes a general description of active farmland, agricultural areas, and favorable farmland soil resources identified in the vicinity of each of the proposed Maglev Alternative.

All of the proposed Maglev Alternatives are located in or urban areas, in which a wide variety of active and passive recreational activities occur. These recreational activities vary with climate, topography, public interest, ease of access, and other factors. Finally, this section also includes a description of the general recreational resources in the vicinity of each of the proposed Maglev Alternatives.

3.11.1 California

The California Maglev Alternative traverses about 129 km (80 mi) of the highly urbanized Los Angeles metropolitan area. From west to east, the candidate route passes through fully developed areas of the City of Los Angeles and numerous suburban communities. In the eastern quarter of the alternative, the candidate route passes through areas where full urban development has not yet occurred. Land uses within the alternative include: single family residential (58.2 percent of the total corridor), industrial (19.9 percent), multi-family residential (8.3 percent), commercial (7.0 percent), institutional (5.3 percent), and parks (1.3 percent).

There are four categories of farmland recognized in California: prime farmland, prime farmland considered locally important, statewide-important farmland, and unique farmland. Within the California Maglev Alternative, there are approximately 273 ha (674 ac) of prime farmland, 84 ha (208 ac) of prime farmland considered locally important, 6 ha (14.8 ac) of statewide-important farmland, and no unique farmland areas. All of this farmland is located within Riverside County, with the exception of 38 ha (93 ac) of prime farmland and 2 ha (5 ac) of statewide important farmland located in San Bernardino County.

With respect to parklands, the alternative passes within 152 m (500 ft) of 15 parks over its 128 km (80 mi) length. These parks are primarily small recreation areas that contain playgrounds and athletic fields/courts for neighborhood use.

3.11.2 Florida

Land use associated with the Florida Maglev Alternative is generally described in the following paragraphs, starting in the northwest and moving counter-clock-wise in a southerly, easterly, northerly, and then westerly direction. Note the figures of the Florida Alternative in Chapter 2 of this PEIS.

The Space Coast Regional Airport immediately surrounds light industrial areas. Open space and conservation areas account for most of the remaining land use in this area. Smaller areas of residential uses are found along the western bank of the Indian River and west of State Route (SR) 407. Land use south of this location is comprised of approximately 50 percent residential land uses, 40 percent proposed state conservation lands, and 10 percent wetlands and agricultural lands. Institutional areas do occur throughout. Approaching the Indian River, the corridor is dominated by residential areas, large tracks of open space, and sparse wetlands. Some small areas of light-industrial and mixed-commercial uses are also present. One area of heavy industry is found in the northeast corner of this segment, adjacent to the Florida East Coast (FEC) Railroad. At the Indian River, mixed residential, commercial, and institutional lands lie to the west of the river, and residential, institutional, and proposed conservation lands to the east. The

Banana River and Merritt Island National Wildlife Refuge consist of open space. A golf-course community is immediately to the west of the refuge and the river, within an area that has approximately 60 percent wetlands and open lands, and 40 percent residential lands. Within the refuge and along the western bank of the Banana River is a Kennedy Space Center Employee Recreation Park. To the east of the river is Port Canaveral with its mixed-commercial, heavy industry, and tourist-related land uses. To the south of SR 528, the Banana River is a designated aquatic preserve. East of the Kennedy Space Center Employee Recreation Park is mainly residential and open land, with scattered institutional and commercial uses along SR 3, as well as some heavy industries and agriculture. The Merritt National Wildlife Refuge, which includes the John F. Kennedy Space Center (KSC), is dominated by open land, wetlands, and agriculture. Institutional land uses are found at the KSC Visitors Center southwest of the SR 405/SR 3 interchange and the KSC Industrial Center to the southeast of the same interchange. The Indian River is open water. East of the river is mainly within the Merritt National Wildlife refuge, but has some scattered residential and proposed or existing conservation lands.

Soil types are used to classify prime and unique farmlands in Florida. Prime farmlands are those whose value is derived from their general advantage as cropland due to soil and water conditions. Prime farmland soils are best suited for producing food, feed, fiber, forage, and oilseed crops, with favorable growing seasons and sufficient moisture to produce high yields 80 percent of the time. Unique farmlands are those lands whose value derives from their particular advantages for growing specialty crops such as citrus and certain vegetables.

Both prime and unique farmlands exist in the immediate vicinity of the Florida Maglev Alternative. In particular, unique farmlands (orange groves operated by the Kerr Foundation) are located to the west of SR 3 and south of the Kennedy Space Center Visitors Center. Prime farmlands exist south of the Space Coast Regional Airport and where the Maglev Alternative parallels I-95. The Kerr Foundation is a private non-profit group that conducts research on citrus trees utilizing organic technologies and none of the yield from the crops within the alternative are used for human consumption. A multitude of water-dependent recreational opportunities are associated with the Banana and Indian Rivers, and the refuges offer passive recreation.

3.11.3 Georgia

The Georgia Maglev Alternative land use includes significant commercial and service development surrounded by various levels and types of residential development. In addition, the alternative includes a few areas of industrial or office complexes typified by light industrial and warehousing facilities.

Residential land use occupies the greatest percentage (28.2 percent) of the total land area proposed for the Maglev Alternative. Commercial/office use occupies 26.6 percent, and parklands account for 24.4 percent. Of greatest significance is the Chattahoochee River National Recreation Area, occurring along a 77 km (48 mi) stretch of the Chattahoochee River. Other land uses encountered along the proposed Maglev Alternative include light industrial (10.7 percent), open space (5.6 percent), institutional (2.6 percent), open water (1.9 percent) and heavy industrial (0.4 percent).

The Georgia Maglev Alternative passes through a predominantly urban and suburban area from the Hartsfield-Atlanta International Airport to Town Center in Cobb County. There are no farmland resources along this segment of the alignment. From Town Center in Cobb County northward to Chattanooga, Tennessee, the area is less developed and farmland resources are present in the vicinity of the Maglev Alternative. In those counties through which the alternative passes, most of the adjacent farmland is considered to be "transitional." This transitional designation means that conversion of these farmland areas is anticipated in order to accommodate future planned developments.

There are over 311 ha (768 ac) of parklands and recreational areas located in the immediate vicinity of the alternative. The Chattahoochee River National Recreation Area, Palisades Unit, accounts for over 90 percent of the total parkland acres and represents a unique "urban" park, providing fishing, picnicking, hiking, and various river activities. The majority of the other parklands are small parks designed to support neighborhood based recreational opportunities. Golf courses are other recreational resources within the alternative.

3.11.4 Louisiana

The greatest land use component throughout the Louisiana Maglev Alternative is open space, comprising nearly two-thirds, or 64-67 percent. Roughly three quarters of the open space used by this alternative is in the segment that spans Lake Pontchartrain. This water crossing encompasses approximately one-half of the total corridor acreage. The second largest component is residential property, occupying approximately 17-19 percent of the total alternative area, almost one-third (20-34 percent) of which is very low density, on the north shore of Lake Pontchartrain. Light industrial uses occupy 6-7 percent of the overall corridor, while the combined categories of commercial, institutional, and office make up approximately 9-10 percent. Only about one percent of the alternative consists of parkland. There is no heavy industrial property within the alternative.

The southern portion of the proposed Maglev Alternative is heavily urbanized; land use is predominantly light industrial, commercial, and residential. There are existing highway corridors and vacant abandoned railroad ROW with adjacent fully developed areas containing numerous commercial retail establishments. The overall area is densely developed with a mix of residential, light-industrial, and institutional uses. Approaching Lake Pontchartrain from the south, the existing land use is predominantly open space, with lesser amounts of residential and light-industrial usage. The majority of the alternative along the north shore of Lake Pontchartrain traverses open space or very-low-density residential areas. Regionally, there are significant quantities of land capable of being developed. However, few opportunities exist for additional open space within the alternative.

There are no known or identified agricultural protection areas or active farms in the vicinity of the Louisiana Maglev Alternative. There are mapped areas of prime-farmland soils, but they are completely urbanized and incapable of supporting farms. Undisturbed prime-farmland soils also exist in the general vicinity of the alternative. These areas are not actively farmed and no plans exist to develop these areas as farms.

There are 12 parks totaling 34.3 ha (84.8 ac) within the alternative. All of these parks are located to the south of Lake Pontchartrain in Orleans and Jefferson Parishes.

3.11.5 Maryland

The Maryland Maglev Alternative is composed of a range of land uses, including open space, commercial, industrial, institutional, and residential. Development density decreases as distance from the beltway arterial highways increases. Baltimore and Washington, D.C. are characterized by high-density residential, industrial, and commercial development. Outward from these urban areas, development becomes more residential. The PWRC, the BARC Section of Fort George G. Meade, and major river floodplains provide large areas of undeveloped or sparsely developed land. Within the alternative of all classes of land use, open space has the highest acreage, due to the presence of the PWRC and the BARC.

As part of the State Comprehensive Plan, Maryland has implemented the *Neighborhood Conservation and Smart Growth* initiative. Each county in Maryland has designated special Priority Funding Areas (PFAs) where development is encouraged and where, generally, development already exists. The main objective of the Smart Growth Initiative is to preserve natural and rural areas by discouraging development in those areas. The availability of state funds for public development projects is tied to the PFAs. The majority of the Maglev Alternative is located within PFAs.

The Maryland Chesapeake Bay Critical Area Law regulates development activity within 304.8 m (1,000 ft) of tidal waters of the Chesapeake Bay. These restrictions were implemented to improve and protect water quality and conserve fish, wildlife, and plant habitats. Maryland's Maglev Alternative crosses land within the Chesapeake Bay Critical Area.

Farmland is not prevalent in the immediate vicinity of the alternative. The notable exception is the large assemblage of experimental farmlands and research facilities at the BARC in Prince Georges County just outside of the Capital Beltway.

There are several large county parks within the study corridor. Bordering the alternative along I-95 in Savage is Savage Park. Further south, also bordering I-95, is a large tract of land comprising T. Howard Duckett Watershed Park. In the southern portion of the alternative, on the border between Washington, D.C., and Prince Georges County, is Colmar Manor Community Park. In addition to these relatively large county parks, there are several smaller county parks throughout the Maryland Maglev Alternative.

The Patuxent Wildlife Research Center, a federally owned property, has a section open to the public, offering hiking and biking trails and hunting. There are other federally owned parcels in the vicinity of the alternative that also provide recreational opportunities to the public.

The Baltimore-Washington Parkway, a Section 4(f) resource, is located within the Maryland Alternative study corridor. The Parkway is under the administration of the

National Park Service and is listed on the National Register of Historic Places. The Parkway has also been nominated as a Scenic By-way in the State of Maryland. By late fall or early winter of 2001, the National Park Service will have completed a comprehensive rehabilitation of both the Parkway and extensive portions of the surrounding parklands. This 15-year project will ensure that the parkway will be perpetuated as a scenic parkway.

3.11.6 Nevada

Just over 10 percent of the Nevada Alternative is developed. The developed area primarily includes the easterly 8 km (5 mi) of the Maglev Alternative within the urban or urbanizing area of the Las Vegas Valley. Commercial land use occupies approximately 10 percent of the corridor, followed by residential (5 percent), industrial (3 percent), transportation/communication/utility corridors (1 percent), and non-profit community resources (1 percent). The remainder of the alternative is comprised of a healthy desert held in public ownership.

In addition to Las Vegas, nodes of development occur in the unincorporated communities of Primm, Jean, and Sloan. Primm is immediately east of the California-Nevada border. Development in Primm is almost entirely commercial, including three hotel/casinos and a discount shopping mall. Residential land use consists of one mobile home park. The remaining land is vacant and held in both public and private ownership. Jean is located 16 km (10 mi) east of Primm. Land use within the alternative is made up of two hotel/casinos and a correctional facility. There is an airstrip southwest of the correctional facility. Sloan is a small residential community between Jean and the Las Vegas Valley. Commercial uses are separated from the corridor by a 30 m (100 ft)-wide strip of vacant land. The nearest residential uses are approximately 457 m (1,500 ft) northwesterly of the centerline of the proposed alignment. Surrounding lands are predominantly federally owned and not planned for release.

The majority of the Nevada Maglev Alternative is either developed land in and around Las Vegas, or open desert. There are no known or identified farmlands within the alternative.

Recreational opportunities and parklands in the vicinity of the proposed Nevada Maglev corridor are limited primarily to golf courses and recreational trails. Clark County has formed the Southern Nevada Regional Trails Partnership to study and develop a comprehensive plan for recreational trails. One of the goals of the partnership is to develop trails that utilize the proposed alternative right-of-way and that incorporate the planned intermodal transfer station.

3.11.7 Pennsylvania

Land use within the Pennsylvania Maglev Alternative is approximately 60.8 percent open space. The next-most-prevalent land-use type within the alternative is residential, which occupies approximately 23.0 percent of the alternative. Commercial land use occupies 7.7 percent, followed by heavy industrial at 3.8 percent, parklands at 2.8 percent, light industrial at 1.5 percent, and, lastly, institutional at 0.2 percent.

Areas of prime-farmland soils and Agricultural Security Areas exist within the immediate vicinity of the proposed alternative. Agriculture Security Areas consist of agricultural land of at least 101.7 ha (250 ac) under the ownership of one or more persons. No unique or locally important farmland soils are located within the proposed alternative.

Recreational resources within the Pennsylvania Maglev Alternative include numerous small neighborhood parks and athletic fields, two amusement parks, recreational trails, a science center, several theaters, an amphitheater, and various recreational opportunities associated with the three rivers that flow through the center of the area.

3.12 VISUAL AND AESTHETIC RESOURCES

New objects in the urban and rural landscape necessarily change the visual characteristics of the surrounding environment. A Maglev system is a highly visible element that will have a visual impact on any environment in which it is built and operated. The futuristic image may be pleasing to some while others consider it an intrusion. The acceptability of the visual impact is based on the context of the site, i.e., neighborhood characteristics, historical and cultural values, people's perceptions and attitudes, and the criteria set forth by the Bureau of Land Management (BLM) that manages the vast majority of lands abutting the right-of-way in rural areas. The potential consequence is a matter of some subjective judgment as well as subjective measure as defined in rulemaking associated with federal and/or state historical preservations offices, the BLM, and to some extent, guidance on environmental justice. There are no Federal regulations that specifically regulate visual and aesthetic resources, nor have any State regulations been identified.

Several components of Maglev systems could potentially impact visual resources, including: guideway structures, stations, parking facilities, maintenance facilities, power substations, and other ancillary facilities. Each component has been assessed for their potential impact on visual and aesthetic resources.

There are several types of environments within the Maglev Alternatives that may be visually affected by the proposed action. Visually Sensitive Receptors (VSRs) are those residences, historic structures and districts, parks, scenic highways, or other public locations with existing views or vistas of the waterfront or other scenic areas. Architecturally sensitive areas (ASAs) are those in which the proposed facility may be significantly out of scale in height or mass, or out of character in style or substance, from existing structures of the neighborhood.

The affected environment includes any visual characteristics of the environment surrounding or within view of the Maglev system and its supporting facilities. This may include:

- The visual effects to the motoring public of the Maglev vehicle in operation.
- The visual effects of the guideway, stations, and fixed facilities on the general public and the landscape.
- The visual effects of the guideway, stations and fixed facilities on sensitive views, historic sites, and other special features.

In determining visual and architectural impacts that may require mitigation, several criteria/measures were used as follows:

- Permanently impaired or diminished existing views of waterfront or scenic area.
- Blockage of views (sight lines) from adjacent properties.
- Blockage of long distance views.
- Blockage of natural light (casting of shadows) on adjacent land uses.
- Compatibility with the visual resources management classes established by the BLM for the portions of land under jurisdiction.
- Incompatibility in terms of new structure scale in height or mass relative to context (existing neighborhood).
- Incompatibility of character (style or substance) with visual characteristics of context (context is similar to size and scale but also includes historic or thematic differences, e.g., modern Maglev in historic neighborhood adjacenct to historic structures).

Federally-assisted projects that have the potential to adversely affect historic properties, such as a change in the visual environment that would diminish the character-defining features of the resources that make it eligible for the National Register listing will be evaluated in accordance with established procedures. Section 4(f) Protection for Parks and Historic Properties also require an evaluation of whether changes in the visual environment would create an adverse effect to a degree that would compromise the integrity of those resources.

Below is a summary of the affected environment for each Maglev Alternative as well as some of the specific locations that could be visually impacted by the Maglev guideway system, stations and related facilities. Both desktop and field verification were used to identify VSRs and ASAs.

3.12.1 California

The California Maglev Alternative would share existing transportation infrastructure and be visible against the downtown Los Angeles backdrop that has high rise buildings and mountains. The route would traverse a wide variety of local visual settings. The range includes commercial and residential areas that adjoin major thoroughfares and freeways, industrial areas along railroad corridors, and the central business district. The route passes through some open areas, parks, and historic properties, including Union Station.

3.12.2 Florida

The Florida Maglev Alternative is a mosaic of land uses that vary from the Merritt Island National Wildlife Refuge, the Banana River, and the Indian River to the east of I-95 and residential development to the west. Light industry and commercial areas are scattered throughout the area. Finally, the futuristic and technological visual characteristics of the Kennedy Space Flight Center and its ancillary industries predominate the northern edge of the alternative. Significant vistas, yet undesignated, are along the NASA Parkway to the north over the Indian and Banana Rivers.

3.12.3 Georgia

The Georgia Maglev Alternative vicinity from the Hartsfield Atlanta International Airport northward to the Town Center area in Cobb County is comprised of commercial, service, and residential development with little vacant land present other than parkland.

The portion of the alternative, parallel to I-75 from north of Town Center, is primarily comprised of commercial and some residential development. The alternative does pass through several historic districts and passes several historic structures and views.

3.12.4 Louisiana

The Louisiana Maglev Alternative will pass through a variety of residential, commercial, and, undeveloped swamp areas. To the extent that the Maglev remains within existing railroad or power line corridors, the directly affected environment will exclude historical resources and architecturally significant buildings. The flat and open expanse of Lake Ponchatrain dominates the visual context of the alternative.

3.12.5 Maryland

Most of the Maryland Maglev Alternative will be adjacent to existing transportation infrastructure and may be visible by automobile drivers. Baltimore-Washington Parkway is designated as a National Park as well as a Maryland Historic Property. The alternative passes through relatively flat areas that have heavy vegetation and a mature pine forest. Closer to city centers, industrial, semi-industrial, commercial, and residential lands dominate the alternative. There is potential for the guideway to cross over historic resources.

3.12.6 Nevada

The Nevada Maglev Alternative passes through distinct visual contexts: healthy desert, an existing freeway corridor itself visually comparable to Maglev, behind house edges of major resort properties, industrial zones along a railroad corridor, and a clean-slate downtown urban redevelopment site. The range of visual resources is startling, from the Mojave desert to the lights and colors of the casinos from Primm to downtown Las Vegas. What is not visible, but of equal importance is the sense and self-image of Las Vegas as a young, dynamic, commercial, and highly experimental urban landscape.

3.12.7 Pennsylvania

The Pennsylvania Maglev Alternative will pass through prominent vistas and view sheds in the downtown Pittsburgh area. Amongst these views are the Ohio River, Allegheny River, and Pittsburgh's central business district. These vistas provide a view shed of sharp contours with the soft texture of vegetation. The alternative also includes a large number of cultural resources including historic districts, structures and view sheds.

3.13 HISTORIC, ARCHAEOLOGICAL AND CULTURAL RESOURCES

Table 3.13-1 presents a summary of the historical, architectural, archaeological and cultural resources for each of the Maglev Alternatives. A complete list of resources can be found in the State's EAs, contacts for which are provided in Appendix A. Following this table is a discussion of the potentially affected environment by alternative.

Table 3.13-1 - Summary of Historical, Archaeological and Cultural Resources

	Historic/Architectural Sites: NRHP Listed / Eligible / Potentially Eligible		Historic/Architectural Sites: Other	Archaeological Sites
CA	**4 NRHP Listed** ▪ Cantinela Adobe ▪ Los Angeles Union Passenger Station ▪ Philips Mansion ▪ March Field Historic District	**2 NRHP Eligible** **10 NRHP Potentially Eligible**		Few
FL	**1 NRHP Listed** ▪ St. Luke's Episcopal Church			**2 NRHP Potentially Eligible** **2 NRHP Non-Eligible**
GA	**14 NRHP Listed** ▪ Atlanta University Center Historic District ▪ Castleberry Hill Historic District ▪ Van Winkle, E. Gin and Machine Works ▪ Atlanta Waterworks Hemphill Avenue Station ▪ Ashby Street Car Barn ▪ King Plow Co. ▪ Davis H.B. Building – Hotel Roxy ▪ Atlanta Buggy Company and Warehouse – Hatcher Bros. Furniture Co. ▪ Atlanta Spring and Bed Company – Block Candy co. ▪ Cooledge, F.K., and Sons Company – Hastings Seed Co.	▪ Stone Hall, Atlanta University ▪ 63 Magum Street Industrial building ▪ Park Street Methodist Episcopal Church, South ▪ Gilbert, Jeremiah S. House **27 NRHP Potentially Eligible** ▪ 22 Pre-World War II Neighborhoods (as Hist. Dist. or Indiv.) ▪ Pittsburgh Historic District ▪ Mechanicsville Historic District ▪ Jones Avenue Historic District ▪ Stonewall Avenue Resource 1 ▪ Stonewall Avenue Resource 2	**1 Atlanta Urban Design District** ▪ Adair Park **3 Atlanta Urban Design Commission Buildings** ▪ Gilbert J House ▪ Herdon Home ▪ Fountain Hall **4 Surveyed sites of structures >50 years old** (CO-68, CO-71, COM-1572, COM-1575 (not NRHP eligible) **1 cemetery**	**2 NRHP Potentially Eligible** ▪ Earth Works ▪ Mill Site **NRHP Non-Eligible** ▪ Misc. Other Sites 9 recorded sites within the right of way 1 site per 10-12Hectares (25-30 Acres)
LA	**53 NRHP Listed**	**16 NRHP Potentially Eligible** ▪ 11 Buildings as part of historic district ▪ 4 Other buildings individually	147 historic structures >50 years old	Numerous

Table 3.13-1 - Summary of Historical, Archaeological and Cultural Resources (continued)

	Historic/Architectural Sites		Archaeological Sites
	NRHP Listed / Eligible / Potentially Eligible	Other	
MD	**3-12 NRHP Listed** ▪ Baltimore-Washington Parkway (National Park) ▪ Don S. S Goodloe House ▪ Howard Street Tunnel ▪ Hyattsville Historic District ▪ Mt. Rainer Historic District ▪ College Park Airport ▪ Lawyers Hill Historic District ▪ Ammendale Normal Institute ▪ The Lawn ▪ Washington Union Station	10 Historical Preservation Easements in study area 16-37 Maryland Historic Properties	27-35area with potential sites Potential for unidentified/ unmapped
NV	**5 NRHP Listed** ▪ R R Cottages ▪ West Side School ▪ US Court House and post Office ▪ Las Vegas High School ▪ J. Dayton Smith House		74 - 50 sites / 25 isolated artifacts (none NRHP listed)
PA	**NRHP Listed** ▪ Allegheny West Historic District ▪ Manchester Historic District ▪ Mexican War Streets Historic District ▪ Deutschtown Historic District ▪ Monongahela Incline ▪ Pittsburgh & Erie Railroad Complex ▪ Eberhardt & Ober Brewery ▪ 40th Street Bridge ▪ Schiller Elementary School ▪ Pennsylvania Railroad Station at Pittsburgh ▪ Clifford B. Connelley Trade School ▪ Letsche Elementary School ▪ Scheneley Farms Historic District ▪ Sixteenth Street Bridge ▪ Pennsylvania Railroad Station at Wilkinsburg ▪ East Carson Street Historic District ▪ Homestead High Level Bridge ▪ Pennsylvania Railroad Station at Homestead ▪ Kennywood Park ▪ Bushy Run Battlefield ▪ Brush Hill	About 215 historic (some listed) City of Pittsburgh designated historic sites	About 149 sites

Source: (CM, 2000); (FDOT, 2000); (ARC, 2000); (GNOEC, 2000); (MTA, 2000); (CNSSTC, 2000); (PAAC, 2000)

3.13.1 Historic and Architectural Resources

Any buildings, structures or sites that are on, or eligible for, the National Register of Historic Places (NRHP) and/or fit within the guidelines of the National Historic Preservation Act of 1966, and are within an area of direct disturbance from project development, are part of the affected environment. The Register is this country's basic inventory of historic resources and is maintained by the Secretary of the Interior. The list includes sites, districts, buildings, objects, and archaeological resources. Listees possess historic significance in one or more of the following areas:

- Have an association with events or trends significant to broad patterns of history.
- Are associated with persons significant in our past.
- Represent a type, period or method of construction, association with a master designer or distinguished group or collection of resources such as a historic district.
- Yield or have the potential to yield archaeological information important to history or pre-history.

The listed properties are not just of national importance, most are significant at the State or local level. It is important to note that the protection of Section 106 extends to properties that possess significance but have not yet been listed or formally determined eligible for listing. Even properties that have not yet been discovered (such as archaeological properties), but that possess significance are subject to Section 106 review.

Special protection for historic resources is provided by Section 106 of the National Historic Preservation Act of 1966 and Section 4(f) of the Department of Transportation Act of 1966. Section 106 requires an affirmative search for resources that may be historic, whether architectural or archaeological. The Advisory Council on Historic Preservation (ACHP) (36 CFR 800) guidelines prescribe the process required to identify properties on or eligible for the National Register of Historic Places, and to identify and implement mitigation measures that reduce or avoid impacts on those properties.

Section 4(f) of the Transportation Act (49 USC 303) precludes DOT funding of projects which use historic properties, unless a determination is made that there is no feasible and prudent alternative to such use, and the project includes all possible planning to minimize harm to the property resulting from such use. Use under Section 4(f) includes both direct impacts (acquisition of property) and substantial indirect impacts that greatly diminish the resources. Section 106 and/or Section 4(f) analysis will be initiated for Maglev alternatives as part of more detailed design and engineering.

In addition to Federally protected resources, each state has resources that are considered protected. These resources are identified on state lists and have similar protective covenants to allow for their identification and preservation. Although the consideration of impacts to these resources are not under Federal regulations they are none-the-less significant resources and do receive consideration within the planning process.

3.13.2 Archaeological Resources

The affected environment for archaeological sites consists of any place where the project will result in the surface and subsurface disturbance of the soil on which a property or site fits. This primarily applies to the areas that will require new right-of-way and the locations of the support piers. In addition, proposed passenger stations, substations, the maintenance facility, and potential staging areas all have the potential for having impacts to significant archaeological sites. These sites are identified at the National level and are protected. Similar to historical structures, there are archaeological resources that are significant at the State level. These State level resources are also considered in the planning process.

3.13.3 Cultural Resources

Cultural resources include any prehistoric or historic district, site building, structure, or object resulting from, or modified by, human activity. Cultural resources could also include potential traditional cultural properties, i.e., properties associated with the cultural practices or beliefs of a living community that are (1) rooted in that community's history, and (2) important in maintaining the cultural identity of the community.

Under Federal regulation, cultural resources designated as historic properties warrant consideration with regard to potential adverse impacts resulting from proposed Federal actions. A cultural resource is a historic property if its attributes make it eligible for listing or it is formally listed on the NRHP.

3.13.4 California

A very limited number of historic, architectural, and archaeological resources are within the California Maglev Alternative. There are sixteen historic resources that could be disturbed by the Maglev system. The most prominent is Union Station that is already a transportation site with existing and planned mass-transportation infrastructure and disturbance. There are a few archaeological resources known to exist along the route that are not displayed on maps to protect the location.

3.13.5 Florida

There is one site listed in the NRHP, a church on Merritt Island with historically significant context and features. There are two sites that are considered to be potentially eligible for listing in the National Register. Both sites, the Savannah's and an un-named site, each consist largely of a scatter of St. John's ceramic and sand-tempered shards.

3.13.6 Georgia

There are 14 NRHP-listed sites within the Georgia Maglev Alternative including two historic districts, 25 potentially eligible historic districts and two potentially eligible individual resources. In addition there are numerous State-recognized resources including one Atlanta Urban Design District and three Atlanta Urban Design Commission Buildings. While no intensive archaeological investigations have been performed for this program, site file research established that nine archaeological sites and a cemetery have been previously recorded within the proposed right-of-way. Of these nine sites, none that still exist are considered eligible for NRHP.

3.13.7 Louisiana

Downtown New Orleans has one of the densest clusters of historic building in the U.S. There are a total of 57 NRHP-listed sites/properties located within 1.6 km (1 mi) of the Louisiana Maglev Alternative. There are nine historic districts, two historic vessels, 35 historic buildings, four historic cemeteries, one historic housing project, one historic monument, one historic powder magazine, one set of historic row houses, one historic streetcar line and barn, and one lighthouse. There are 176 historic structures greater than 50 years old within the alternative; the great majority of these buildings are 1950 tract homes that are not eligible for inclusion in the Register. There are numerous previously recorded prehistoric and historic sites, including mound sites within one mile of the alternative.

3.13.8 Maryland

There are several historical sites within the Maryland Maglev Alternative that includes 23 NRHP listed sites. The study area includes the Baltimore-Washington Parkway, a registered site, which transects property along several historically significant districts, and passes historic structures, properties and facilities. Twenty-four Maryland historic properties and ten historical easements also exist within the area. Known archaeological sites (92) are fairly evenly distributed throughout the alternative and there is also a significant amount of acreage. The heaviest concentrations occur in the vicinity of BWI Airport, Fort George G. Meade, and the BARC.

3.13.9 Nevada

Historic resources in the Nevada Maglev Alternative include artifact scatters, numerous railroad camps, railroad berms, historic dumps, a pipeline, and five buildings on the NRHP. Only 19 of these sites are within 100 m (300 ft) of the alternative. There are a total of 54 sites and 25 isolated artifacts within 915 m (3,000 ft) of the alternative. These are a variety of prehistoric sites, including rock shelters, temporary campsites, a rock oven, an obsidian quarry, and a lithic workshop. It is likely that the alternative will also include areas of cultural value to the Native Americans whose ancestors inhabited the area. Several tribes that have cultural affiliation with the alternative have been identified. These tribes (and one pan-Indian organization) include the Las Vegas Paiute Tribe, Moapa Paiute Tribe, Pahrump Paiute Tribe, Colorado River Indian Tribes (Chemehuevi), and the Las Vegas Indian Center.

3.13.10 Pennsylvania

There are 215 previously recorded historic sites within the Pennsylvania Maglev Alternative. There are several large, listed, historic districts including Allegheny West, Manchester, Mexican War Streets, and Deutschtown Historic Districts. NRHP-listed properties in the alternative include the Monongahela Incline, the Pittsburgh and Lake Erie Railroad complex, the Eberhardt and Ober Brewery, the 40th Street Bridge, and the Schiller Elementary School. There are 149 previously recorded archaeological sites.

3.14 TRANSPORTATION

Through October 1999, according to the Federal Aviation Administration (FAA) as reported in the Wall Street Journal in December 1999, delays in U.S. airports have increased 22.6 percent compared to the same period in 1998. Passenger complaints have more than doubled in 1999 to record levels, according to DOT's Air Travel Consumer Report. Complaints filed with the government over delays and cancellations have more than tripled. Only one runway was built on a major east coast airport in the 1990s, and that opened December 3, 1999 in Philadelphia. "Just as we had an energy crisis, we now have an aviation crisis," says the president of United Airlines, which increased its flights at its Dulles hub by 60 percent this year.

Each alternative has a wide range of transportation resources. For convenience, these resources can be divided into roadways, airports, rail, and miscellaneous. Roadways include Federal and State roadways. Airports include only those that are significant to the area. Rail resources are defined as both passenger and freight facilities. Miscellaneous transportation resources encompass bus service and ports.

Each alternative addresses some local transportation-related problems. These problems include, but are not limited to, congestion, capacity issues, and air quality. The transportation related problems are discussed for each alternative.

3.14.1 California

Roadways

Major freeways cross all or portions of the California Maglev Alternative. Major east-west freeways include the Century Freeway (I-105), the Santa Monica Freeway (I-10), the Ventura and Foothill Freeways (SR 134/I-210), the San Bernardino Freeway (I-10), the Pomona Freeway (SR 60), and the Riverside Freeway (SR 91). Major north-south freeways include the San Diego Freeway (I-405), the Harbor/Pasadena Freeway (I-110/SR 110), the Glendale Freeway (SR 2), the San Gabriel River Freeway (I-605), the Orange Freeway (SR 57), the Chino Valley Freeway (SR 71), the Ontario Freeway (I-15), and I-215. Overall, the freeway network is approaching capacity and cannot keep pace with travel demand. Annual motor vehicle travel in the alternative is projected to range between 254 and 260 billion km (158 and 162 billion mi) in the year 2020, based on fuel consumption estimates included in the Energy section.

Airports

Two major regional airports are located within the California alternative: LAX and ONT. Both are under the jurisdiction of the Los Angeles World Airports, an agency of the City of Los Angeles. LAX is one of the busiest airports in the world and is expected to see a 75 percent growth in millions-of-air-passengers (MAP) by 2020. The MAP for ONT is expected to grow 139 perent by 2020. The former March Air Reserve Base is to be converted to an air-cargo facility, with an expected one million passengers by 2020.

Rail

Light-rail transit service is provided by the Green Line that traverses east-west through southern Los Angeles County from the LAX area, connecting with the north-south Blue

Line, which provides rail service from Long Beach south of the alternative area into Union Station. The Red Line subway intersects the Blue Line in downtown Los Angeles and serves the area from downtown northward to North Hollywood. Metrolink commuter rail service is provided on area railroad lines running from Union Station eastward to Riverside County; north through Burbank and Burbank Airport, to Santa Clarita, Ventura and Palmdale; eastward in the I-10 corridor to El Monte and San Bernardino; and south to Orange County. Intercity rail service leading north, south, and east is provided by Amtrak from Union Station.

Miscellaneous

Bus transit service is provided throughout the entire study area, including major Metropolitan Transportation Authority (MTA) services emanating from Union Station. Additional regional bus transit service within the alternative is provided by Foothill Transit in eastern Los Angeles County, Omnitrans in San Bernardino County, and Riverside Transit Authority in Riverside County. Municipal bus operators also provide transit service in portions of the alternative.

Transportation-related Problems

Substantial growth in employment and population is anticipated within the California Alternative. Much of this growth is projected to occur in the less urbanized areas of the region (e.g., in eastern San Bernardino and Riverside counties). These high population growth areas are not areas where major employment growth is projected. Therefore, a substantial increase in the number of intercounty home-to-work trips is expected. Work trips are expected to more than double between Los Angeles and San Bernardino counties, and increase three- to four-fold between Riverside and San Bernardino counties.

Peak period traffic congestion is severe in the LAX to March Field corridor along the major east-west freeways (I-105, I-10, SR 60, and I-210), and this congestion, according to SCAG forecasts, is projected to worsen by 2020. Travel delay as a percentage of total travel time is expected to range from 50 to 100 percent for all major freeways in the corridor, indicating that trips would reach an average speed of 23 km/h (14 mph) or less. Major portions of these freeways are expected to reach average trip speeds of less than 16 km/h (9 mph), with 70 percent or more of the trip delayed. Travel delay of 100 percent means that the entire trip would occur in severely congested conditions. These delays will lead to critical increases in commute times and greatly reduce the predictability of travel times between points.

Anticipated growth in the SCAG region of the air-passenger and air-cargo market will require expansion of existing airports and conversion of former military bases to commercial use. An air-capacity shortfall of one-third is anticipated in the region by 2020, and air cargo is expected to grow from 3 million tons in 1995 to 8.9 million tons in 2020. This growth will affect the ability of the airports to handle the demand, and will further exacerbate congestion on the streets and highways serving the airports.

LAX and ONT currently handle the bulk of the passengers and cargo transported by air to and from the region, and projected increases in these markets will require expansion in their capacity to handle passengers and cargo. Expansion of LAX is a highly sensitive issue for the communities that adjoin the airport.

An additional 6.8 million people driving automobiles in the region will increase congestion, slow auto- and transit-travel times, and lead to worsening air quality. The California Alternative lies within the South Coast Air Basin (the Basin), a 16,913 sq km (6,530 sq mi) area bounded by the Pacific Ocean on the west; the San Gabriel, San Bernardino, and San Jacinto mountains on the north and the east; and the San Diego County line on the south. The Basin includes all of Orange County, the non-desert portions of Los Angeles, and the western urban portions of Riverside and San Bernardino counties. The Basin generates about one-third of the state's total criteria pollutant air emissions.

3.14.2 Florida

Roadways

There are several roadways within the Florida Maglev Alternative including; Interstate I-95, .S. Highway U.S. 1, State Roads SR 528 (Beeline Expressway), SR A1A, SR 401, SR 407, SR 405, SR 50, and County Roads CR 515, CR 3, CR 401. Annual motor vehicle travel in the corridor is projected to be approximately 32.6 million km (20.2 million mi) in the year 2020.

Airports

The Space Coast Regional Airport is located in the northwest corner of the Florida Alternative.

Rail

Freight transport within the Florida Alternative occurs on the Florida East Coast (FEC) Railroad, immediately to the west of U.S. 1 and west of the Indian River Lagoon.

Miscellaneous

Port Canaveral is located in the southeast corner of the Florida Alternative.

Transportation-related Problems

Transportation problems that currently exist, and are projected to exist in the near future, within the Florida Maglev Alternative are centered on the movement of visitors to Kennedy Space Center and passengers at Port Canaveral. Currently, the KSC Visitors Center attracts approximately four million visitors per year and two million cruise passengers embark from Port Canaveral annually. Each of these destinations is connected to the mainland by a narrow road causeway and each has a rapidly growing number of visitors/passengers. Extensive traffic congestion and delays can be anticipated unless a fast and efficient transportation system is implemented. Major rebuilding and widening of the causeways and roads may solve the traffic congestion and delays at substantial cost; however, it does not provide relief from increasing future growth in visitors and passenger traffic. Additionally, KSC is a secured facility and would prefer to limit the access of the general population to a single centralized location.

3.14.3 Georgia

Roadways

The central feature of the transportation system in the Georgia Alternative is Interstate 75, which extends the full length of the corridor. Within the Atlanta metropolitan area, this facility is a ten- to twelve-lane limited-access expressway. Between the Atlanta metropolitan area and the Chattanooga area, the I-75 typical Section varies from four to six lanes divided with multiple major interchange and access points. A significant portion of I-75 within the Georgia Alternative operates under very congested conditions during peak travel periods. Annual motor vehicle travel in the corridor is projected to be approximately 80.3 billion km (49.9 billion mi) in the year 2020.

Airports

Hartsfield Atlanta International Airport is located within the Georgia Alternative. The Hartsfield Atlanta International Airport handles 73.5 million air passengers annually and is projected to grow to over 120 million by 2015.

Rail

The State of Georgia has a dense railroad network with direct routes between its major cities and adjoining states. With the exception of two Amtrak long-distance passenger services (New York-New Orleans via Atlanta, and New York-Florida via Savannah), the network is freight-only. There are two rail routes between Chattanooga and Atlanta: CSX via Cartersville and Dalton, and the Norfolk Southern via Rome.

Miscellaneous

There are several providers of transit services within the alternative. The Metropolitan Atlanta Rapid Transit Authority (MARTA) serves Fulton and Dekalb County, and Cobb Community Transit (CCT). Clayton County, adjacent to the Hartsfield Atlanta International Airport will initiate bus service in 2000.

Transportation-related Problems

The metropolitan centers of the South are facing ever-increasing ground- and air-traffic congestion, with associated reduction in mobility and economic opportunity

The air-quality problems associated with the region's rapid growth recently led to dramatic changes in greater Atlanta's planning process and strategy. In December 1998, a coalition of environmental and social organizations led by the Environmental Defense Fund (EDF) announced their intent to sue several Federal, State, and regional agencies in order to change transportation policies in the Atlanta region. The notice of intent to sue cited the region's heavy investment in highways, claiming that continuation of that pattern would violate the Clean Air Act and would be counter to the principles of Environmental Justice. The lawsuit drew national attention, and led to the appointment of a new oversight agency, the Georgia Regional Transportation Authority (GRTA).

The current traffic volumes on I-75 greatly exceed the capacity of the facility in some areas and create long delays (operational deficiencies) and unsafe operating conditions (safety deficiencies) for several hours of each day. The high growth estimates along the

I-75 corridor represent expectations for a loss in mobility (capacity deficiencies) for the region's residents, businesses and visitors unless significant improvements and expansion to the travel alternatives are completed consistent with the growth. Fast, reliable, and high-capacity transportation system additions will ensure the ability of the region to sustain its growth, and maintain the quality of life long associated with northwest Georgia.

There is currently no passenger-rail service between Atlanta and Chattanooga. The existing rail service consists of freight- and goods-movement services provided by the CSXT system operating at speeds between 57 km/h (35 mph) and 97 km/h (60 mph). Approximately 40 trains are operated daily. The rail line has many grade crossings. Several extensions of the MARTA rail system are proposed.

Hartsfield Atlanta International Airport is officially recognized today as the busiest airport in the world based on its 73.5 million passengers in 1998. Projections of up to 121 million passengers in 2015 have led the City of Atlanta and the Airport Authority to embark upon a ten-year, $5.4 billion expansion plan to meet these demands. Even so, the indications are that the current plans will not entirely meet the increases expected in airline travel in the next 25 years and beyond. In fact, the current expansion program is only expected to serve passengers effectively through 2010.

3.14.4 Louisiana

Roadways

Major highways that serve the Louisiana Maglev Alternative include Interstate highways such as I-10, I-610 and I-310, expressways including the Earhart Expressway and major arterial highways including Airline Highway.

In addition, I-12 serves to move traffic around the New Orleans area, north of Lake Pontchartrain. While most of the major roadways within the alternative are designed for east-west traffic, there is one very important facility that is oriented to move north-south traffic. This facility is the Lake Pontchartrain Causeway that provides access between the rapidly growing St. Tammany Parish on the Northshore of Lake Pontchartrain and the New Orleans urban area on the south shore. This Causeway provides the only effective link between these two areas. The average daily traffic on the Causeway is nearly 29,000 vehicles. Annual motor vehicle travel within the alternative is projected to be approximately 17.6 billion km (10.9 billion mi) in the year 2020.

Airports

The New Orleans International Airport (NOIA) is located within the Louisiana Alternative. The NOIA handles approximately 9.5 million air passengers annually. A dramatic increase in the number of air passengers is expected, growing to 12.3 million in 2006 and to 17 million by the year 2016.

Rail

The New Orleans area is served by Amtrak for intercity passenger rail. Amtrak provides three separate routes that serve New Orleans. The City of New Orleans provides service between Chicago and New Orleans. The Crescent City provides service between New

York and New Orleans. The Sunset Limited provides service to Los Angeles, San Antonio, New Orleans, and Orlando. Daily service is provided on each of these routes. The passenger station for Amtrak in New Orleans is the Union Pacific Terminal.

The New Orleans area is served by six Class-1 freight railroads, one regional shortline, and one public switching railroad. This makes New Orleans a major gateway for freight-rail operations in the United States. This is enhanced by the highly active seaport operations at the Port of New Orleans. The Class-1 railroads are the Union Pacific, Burlington Northern-Santa Fe, the Kansas City Southern, the Illinois Central, CSX, and Norfolk Southern. The New Orleans Gulf Coast Railroad is a shortline railroad and the New Orleans Public Belt Railroad is used to switch trains near the port. The Union Pacific is one of the most active railroads in the area, transporting grains, sugar, and petro-chemicals through the area.

The Illinois Central, Kansas City Southern, Norfolk Southern, and New Orleans Public Belt Railroads operate on east-west tracks through the study area. The tracks are generally located between Airline Highway and the Earhart Expressway. In addition, the Kansas City Southern has an intermodal yard and the Illinois Central has a switching yard in the study area.

Miscellaneous

There are two transit systems that provide service in the Louisiana Alternative. The Regional Transit Authority (RTA) provides bus service in the eastern portion of the study area and the Jefferson Transit (JeT) - East bank provides bus service in the western portion of the area. There is currently no transit service provided to the Northshore area, or across the Lake Pontchartrain Causeway with the exception of Coastline Transit, which provides service between the Northshore and NOIA.

The Port of New Orleans is the fourth-largest seaport in the United States and the twenty-third largest seaport in the world, with regard to cargo volume. The port handled over 81 million metric tonnes of cargo in 1997. The largest bulk of cargo imported through the port is steel and steel products, as well as rubber, copper, forest products, aluminum, and coffee. The greatest export volumes are in forest products (primarily paper and paperboard), synthetic resins, and fabrics (including raw cotton).

Transportation-related Problems

The I-10 corridor studies have identified that traffic is coming not only from the immediate urban areas but also from suburban and exurban areas in the New Orleans-Baton Rouge growth corridor. The New Orleans area contains the most-highly-congested segment of I-10 in the nation. Despite a proposed widening of I-10 to eight- to ten-lanes, the maximum feasible build-out of this facility, the level-of-service (LOS) on this highway is expected to operate at LOS F during the peak hour for a large share of the next twenty years.

The existing Average Daily Traffic on the Causeway is approximately 29,000 vehicles. Traffic projections developed in conjunction with ridership estimation for this project indicate that year 2020 volumes will approach 70,000 vehicles per day resulting in LOS F conditions. However, peak-hour traffic volumes currently exceed the capacity of both the north and southern approaches to the bridge. Traffic capacity on the north approach is constrained by the tollbooth for the bridge, as well as signalized intersections. Traffic capacity on the south approach is constrained by signalized intersections and traffic volumes are higher due to the attraction of adjacent land uses.

A shore-to-shore crossing of the causeway takes about 25 minutes, but the travel time along the approaches to I-10 and the connections to the central business district (CBD) add an additional 45 minutes-to-one hour to the commute between the Northshore and the CBD. Accidents on the Causeway can delay traffic for hours, with no alternative route.

Improvements to the Causeway are estimated to cost $500 million. Improvements to the north and south approaches and connections to the Interstate system would drive the cost much higher. Community organizations on both sides of the lake have voiced strong support for a non-highway solution to the commuting problem. Strong support for managed-growth concepts and the development of sustainable communities are driving support to evaluate alternative transportation modes.

Approximately 45 percent of all NOIA-air passengers are going to or from the New Orleans CBD. The 9.5 million passengers in 1999 are projected to increase to 17 million by 2016. The New Orleans Aviation Board (NOAB) is planning a significant expansion of the airport to address the increased capacity needs with consideration to move increasing numbers of passengers to and from the CBD.

A study of the role of the Lake Pontchartrain Causeway in hurricane evacuation of the New Orleans region identified the need for additional capacity (RPC, 1995). As a great portion of the New Orleans urban area lies below sea level, a major hurricane would create the need for a massive evacuation to the north. Adding additional highway capacity in the corridor proved to be inconsistent with local community goals and comprehensive planning efforts.

3.14.5 Maryland

Roadways

Arterial roadways connecting the Baltimore and Washington, D.C. areas are I-95, U.S. 29, MD 295 (Baltimore-Washington Parkway), and U.S. 1. All are owned by the Maryland Department of Transportation except the Parkway south of MD 175 that is owned by the U.S. National Park Service and operates as a parkway with restrictions on truck traffic. All of these highways are operating at a significant level of congestion. The congestion is expected to increase by one third over the next 20 years. Annual motor vehicle travel in the corridor is projected to be approximately 159.2 billion km (98.9 billion mi) in the year 2020, based on fuel consumption estimates included in the Energy section.

Airports

The area is currently served by BWI Airport that directly employs 10,000 workers. Other airports serving the Baltimore-Washington region are Ronald Reagan Washington National Airport (DCA), and the Dulles International Airport (IAD), both in Northern Virginia. In 1998 BWI served 15 million air passengers, BWI served 15.8 million air passengers and IAD served 15.6 million air passengers. The BWI is currently operating at capacity and is restricted by an act of Congress from expanding service or serving long-distance destinations.

Rail

Amtrak provides service in the Northeast Corridor from Boston to Washington D.C. Stops in the Baltimore-Washington corridor include Union Station, New Carrollton, BWI Airport and Baltimore-Penn Station.

The Maryland Rail Commuter (MARC) Penn line provides commuter service over the Amtrak line between Cecil County, Maryland and Union Station in Washington, D.C. Among the major stops in Maryland are stations at BWI Airport and Baltimore-Penn Station.

MARC Camden line commuter service between Washington's Union Station and Camden Station in downtown Baltimore is provided over CSX owned right-of-way. Class-1 rail-freight services are provided in Maryland by the CSX Railroad and the Norfolk Southern Railroad.

Average weekday boardings for the MARC Commuter Rail system between the Washington and Baltimore in 1999 were nearly 15,500 per day on both the Penn and Camden lines. An additional 5,300 riders are served on the MARC Brunswick line which operates between Washington D.C. and Martinsburg, West Virginia.

Miscellaneous

The Mass Transit Administration (MTA) serves the Baltimore, Maryland area with bus service. MTA operates approximately 800 buses on more than 60 routes. The Washington Metropolitan Area Transit Authority (WMATA) serves the Washington, D.C. area with an extensive subway system called Metrorail. WMATA also operates the Metrobus system with a fleet of over 1,300 buses on over 300 routes. The MTA and WMATA also are also responsible for light rail and subway operations and facilities in the alternative.

Transportation-related Problems

The Washington, D.C. and Baltimore Metropolitan areas suffer from chronic highway congestion with Washington-area roadways representing the second most congested in the nation. In the Washington, D.C. metropolitan area, travel times on the roadways during peak periods were 41 percent higher than under free flow conditions. The equivalent measure in the Baltimore area is 23 percent. As a result of congestion, an additional 1,238,000,000 liter (l) (327,000,000 gal) of fuel are consumed annually by vehicles on the Washington roadways, and additional 466,000,000 L (123,000,000 gal) are consumed per year in Baltimore. This equates to 439 L (116 gal) per year, per driver in the Washington area and about 273 L (72 gal) per year per driver in Baltimore. Based on the annual congestion cost and the number of drivers delayed by congested conditions, the annual cost of congestion per driver is $1,260 per year in Washington and $780 per driver, per year in Baltimore. For all measures of congestion, the Washington, D.C. area ranks 1st, 2nd, 3rd or 4th in the nation while Baltimore ranks 14th, 15th or 16th in the nation.

The effects of congestion are widespread and affect the mobility of people and goods. Congestion results in increased travel time, increased fuel consumption in stop-and-go traffic and lost productivity for passenger- and freight-moving vehicles. Congestion also means that goods shipped on the highways do not arrive in time, or businesses must keep more inventory to accommodate unreliable delivery schedules. All of this results in a higher cost for goods and services and the area being less competitive in the marketplace.

According to information obtained from the Metropolitan Washington Council of Government, the Washington Metropolitan region exceeds the Federal Air Quality Standards for one air pollutant: ground-level ozone or smog. The Washington, D.C. area is considered a serious non-attainment area.

On average, since 1990, the Washington metropolitan area has exceeded the one-hour ozone standard six days every summer. Federal law permits an average of one exceedance per summer at a monitor location. The Clean Air Act Amendments of 1990 required the Washington metropolitan area to reduce ozone levels and meet the one-hour health standard by November 1999. Ozone-causing pollutants from other areas of the country entering the Washington area have prevented the region from meeting the 1999 deadline. As a result, the U.S. Environmental Protection Agency (EPA) has allowed the region to request that the date for meeting the standard be changed. By the year 2005, measures taken locally by states outside the Washington area and by EPA are expected to reduce the ozone level to below the one-hour standard.

The Baltimore Metropolitan Council reports that under the 1990 Clean Air Act Amendments, the Baltimore region and Cecil County, Maryland were classified as severe non-attainment areas with respect to the National Ambient Air Quality Standard for ozone. Regional measures now underway, when combined with Federal, State and local measures already included in the Phase II Attainment Plan are likely to result in achieving compliance with the ozone standard in 2005.

3.14.6 Nevada

Roadways Interstate 15 is a four- to six-lane freeway that is the primary highway link between the Los Angeles basin (junction with I-10 and SR 91 in Ontario), the high desert (junction of I-40 and SR 58 in Barstow), and Las Vegas (U.S. 95). The Las Vegas urban area is served by an arterial street grid that is generally of one-mile spacing. North of McCarran International Airport, the four- to six-lane arterials cross and interchange with I-15 at one-mile intervals. Additional interchanges are planned for construction south of the airport as the urban area grows. I-15 is becoming increasingly congested, with motor vehicle travelers experiencing substantial delays during peak travel times. Current average daily traffic on I-15 just south of Las Vegas is around 60,000 vehicles and, in the segment through Primm, the average daily traffic is around 30,000. In the year 2020, traffic is projected to increase by more than 100 percent. Annual motor vehicle travel in the corridor is projected to be approximately 33.3 billion km (20.7 billion mi) in the year 2020, based on the Regional Transportation Plan model for Las Vegas.

Airports

The McCarran International Airport is located adjacent to "The Strip" (Las Vegas Boulevard) approximately 13 km (8 mi) south of downtown Las Vegas. Within the next 15 to 20 years McCarran International Airport terminals and runways will be approaching capacity.

Rail

The Union Pacific (UP) is the only rail link from the Los Angeles basin to Barstow and Las Vegas and is currently used for freight traffic only. Amtrak plans to initiate passenger-rail service with Spanish technology (Talgo) over the UP track between Los Angeles and downtown Las Vegas beginning in Summer 2000. While designed to operate at higher-than-normal speeds, the technology is constrained on the UPRR alignment by joint use of track with freight trains, tight curves, and conflicting freight operations in the urban areas.

Miscellaneous

The Las Vegas transit system operates routes over a mile-square grid system throughout the urbanized area. The Citizen's Area Transit (CAT) bus system focuses on transit centers downtown (existing) and south of the airport (planned).

An existing monorail system along Las Vegas Boulevard between Tropicana Avenue and Flamingo Road may be extended north to Sahara Avenue within the next several years. The regional plan calls for future extension of the monorail north through downtown Las Vegas and south to Sunset Road.

Transportation-related Problems

An 83 percent increase in highway and air travel in the Las Vegas-Southern California corridor including visitors and resident non-business and commuter trips is anticipated between 1995 and 2015. Within the next 15 to 20 years McCarran International Airport terminals and runways will be approaching capacity, and opportunity for further expansion is severely constrained. Southern California airports are expected to be over-capacity in ten years. Las Vegas does not meet federal ambient air-quality standards for CO and PM10, due in large part to auto exhaust and vehicle congestion.

3.14.7 Pennsylvania

Roadways

The highway system in southwestern Pennsylvania includes multi-lane, limited-access interstate highways; multilane unrestricted and restricted access Federal and State highways; two-lane U.S., State, and local highways; and county and local municipal roads and streets.

Three Interstate highways (I-70, I-76, and I-79) pass through the region, providing access to other regions in Pennsylvania and other states. In addition to the Interstate highways, the region is served by three multi-lane highways (I-279, I-376 and I-579) which function as the major commuter-access routes between downtown Pittsburgh and the north, east, and west suburban communities. I-70 traverses the area in an east-west direction. It passes south of Pittsburgh and Allegheny County through Westmoreland and Washington Counties from New Stanton, through Washington, Pennsylvania to Wheeling, West Virginia. At New Stanton, I-70 merges into I-76 and follows it east to Breezewood, Somerset County, Pennsylvania, where it splits from I-76 and continues east to Baltimore, Maryland. I-76 is another east-west interstate that runs through Pennsylvania from New Jersey to Ohio. I-76 in Pennsylvania is the Pennsylvania Turnpike, and as such is administered, operated and maintained by the Pennsylvania Turnpike Commission. I-76 splits from I-70 in New Stanton, Westmoreland County, passes east and north of Pittsburgh in Allegheny County, then passes through Butler, Beaver and Lawrence Counties into Ohio south of Youngstown.

I-79 is the major north-south Interstate in the region. It passes into Greene County near Morgantown, West Virginia, through Washington County, and west of Pittsburgh in Allegheny County, then north through Butler County and on to its terminus in Erie. It intersects with I-70 in central Washington County and I-76 in northern Allegheny and southern Butler Counties. I-279 provides access between downtown and both the western and northern suburbs. The western segment of I-279 (Parkway West) begins at the Fort Pitt Bridge and continues to its terminus at I-79. I-376 (Parkway East) provides access between downtown and the eastern suburbs of Forest Hills and Monroeville. I-579 consists of the multi-lane Veterans Bridge over the Allegheny River and a short section of expressway. It connects the eastern end of downtown Pittsburgh near the Civic Area with I-279 (Parkway North) on the north shore of the Allegheny River.

Major arterials in the region include both two and four lane U.S.- and SR-designated highways. There are numerous major arterials in the region. There are numerous major arterials in the region. Annual motor vehicle travel in the corridor is projected to be approximately 37.4 billion km (23.2 billion mi) in the year 2020, based on fuel consumption estimates included in the Energy section.

Airports

Two major airports offer scheduled passenger air service within the Pennsylvania Maglev Alternative. In Allegheny County, Pittsburgh International Airport (PIT) offers all the amenities of other international airports in the United States. The FAA classifies PIT as a large air traffic hub. In Westmoreland County, Arnold Palmer (Westmoreland County or Latrobe) Airport, located along U.S. Route 30 in Latrobe, Pennsylvania, provides scheduled commuter-airline service via U.S. Airways Express to PIT and other major and regional airports.

Rail

The Pittsburgh metropolitan area is served by 21 rail companies (mostly freight). Freight services are provided by numerous railroads, including Norfolk Southern and CSX Transportation, the predominant freight haulers. Freight rail lines owned and operated by numerous railroad companies are located throughout the region, especially along the shores of major streams and rivers. Amtrak provides limited passenger rail service (6 trains per day on a route between New York and Chicago) on lines owned by the freight railroads. The PAAC's Light-Rail Transit system operates on lines and operated by PAAC.

Miscellaneous

The Pittsburgh Port District encompasses 322 km (200 mi) of commercially navigable waterways in nine counties in southwestern Pennsylvania. The Port of Pittsburgh is the largest and busiest inland port in the United States, and the twelfth-busiest U.S. port overall.

Transportation-related Problems

As the Region's Metropolitan Planning Organization (MPO), the Southwestern Pennsylvania Commission (SPC) performs congestion-management system (CMS) monitoring on selected highways in the regional system, and, in August 1997, published their *Congestion Management System Analysis, Data Collection Report,* results for data collected through June 1996, as a supplement to their regional congestion-management system analysis.

As part of the 1997 report, SPC compared congestion in the Pittsburgh region to 50 other major metropolitan areas. A 1997 study by the Texas Transportation Institute quantified congestion levels and the economic impact of congestion on motorists in those 50 metropolitan areas. Pittsburgh ranked 46th in congestion severity in 1993, a 4 percent increase in congestion between 1987 and 1993. The region was estimated to incur 161 daily person-hours-of-delay in 1993, with annual per-capita hours-of-delay estimated at 21 hours. The 1993 cost of congestion for the region was estimated at $510 million for delay, $450 million for excess fuel costs and estimated at $290 per capita for 1993. Increasing these costs to year-2000 dollars based on an annual 2 percent inflation rate, results in 2000 figures of $580 million for delay, $510 million for excess fuel costs and $330 per capita.

The principal modes of transportation for intercity commuters in the United States are the automobile and aircraft. In the Pittsburgh region, the principal mode is the automobile. Regional highway systems currently suffer from congestion, especially during rush hours, and are projected to become more congested in the future. Pittsburgh International Airport is a major regional hub for U.S. Airways and handled over 20 million passengers in 1998. In the Demonstration, Design, and Development Plan, released in May 1994, the highway and air modes were described as congested, which was projected to increase through 2005.

SPC summarized the results of their CMS data-collection efforts through June 1996 in a report issued in August 1997. The data collected for the 1997 update included 50 of 91 corridors or 62 percent (470 km (292 mi)) of the SPC CMS network. It is the most up-to-date traffic congestion information available for the Pittsburgh Region. I-279 (Parkway West) and I-376 (Parkway East), the primary east-west highways through the region, were ranked as the most-congested corridors during both AM and PM peak hours. The Parkway East had a Total Vehicle Hour Delay during peak times of 2,733.64 hours, and a cost of $34,174 per weekday; the Parkway West was 2,806.54 hours, and a cost of $35,227 per weekday.

Examining I-376 and I-279 in combination, a trip between Monroeville and I-79 takes 24 minutes at the posted speed limit. During peak periods, this trip takes as long as 58 minutes on average, and can be much longer due to accidents and incidents. This 34 minute average delay is experienced by everyone traveling from Monroeville and points east to the airport.

3.15 ENERGY

This section describes the energy resources of each of the Maglev Alternatives. Power supply and distribution systems are identified, and information on current and forecast capacity is presented. Forecasts of energy consumption from motor vehicle travel for the year 2020 are developed to describe the predicted transportation related energy consumption in the corridor.

3.15.1 California

Electric energy in the region is provided primarily through the Southern California Edison and the Los Angeles Department of Water and Power distribution networks, along with three municipalities having their own power plants located in the region (Glendale, Burbank and Pasadena). In addition, the Imperial Irrigation District and San Diego Gas & Electric Company provide service to the southwestern sections of the California Maglev Alternative. Also, a significant portion of the electric energy used in the region is imported from coal-fired and hydroelectric generating facilities located elsewhere in California and out-of-state. There are 245 operational power plants that have a total on-line generating capacity of 16,922 megawatts (MW), which could provide power to the alternative. The California Energy Commission (CEC) is in charge of tracking and forecasting energy use according to predetermined Forecast Regions. The proposed California Maglev Alternative is located within the CEC forecast region comprised of the counties of Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura.

Eleven new power-generating facilities are planned for the region and are currently advancing through the permitting process. The majority of the energy used in the region is imported from coal-fired and hydroelectric generating facilities located elsewhere in California and out-of-state. Utilities in the area participate in power-sharing arrangements with other entities throughout the U.S.

Much of the energy consumed in the area is for residential, commercial, and transportation purposes. Transportation energy for motor vehicles is provided primarily by direct combustion of fossil fuels – gasoline and diesel, with smaller contributions from compressed natural gas. Electricity is used in a relatively small number of electric-powered vehicles. Assuming fuel efficiency ranging between 19.75 and 22.55 mpg, motor vehicle fuel use in the Los Angeles Forecast Region will reach a projected total of between 24.326 and 24.444 billion L (6.426 and 6.457 billion gal) of gasoline in 1999, which correspond to between 205.2 and 233.2 billion VKT (127.5 and 144.9 billion VMT). CEC data project natural gas use for transportation in 1999 to range between 10 and 19 million therms, diesel fuel use at 3.615 billion L (0.955 billion gal), and electricity use at between 68 and 94 million kWh.

Forecasts by the CEC indicate that gasoline use for transportation will continue to increase for at least the next 15 years, as a result of increases in population and VMT, lower than previously expected sales of natural gas-fueled vehicles, and sales of electric vehicles sufficient to meet California Air Resources Board zero emission vehicle fleet penetration mandates. Extrapolation of the CEC gasoline use forecast to 2020 yields future gasoline demand forecasts of between 26.542 and 31.177 billion L (7.012 and 8.236 billion gal) depending on the gasoline use scenario. Extrapolation of diesel fuel use to 2020 yields a forecast of 5.110 billion L (1.350 billion gal) for that year. Assuming that the energy content for gasoline is 34,342 BTU per liter (130,000 BTU per gal), and that for diesel is 36,456 BTU per L (138,000 BTU per gal), the transportation related energy consumption for the corridor for the year 2020 is between 1,616,740 billion BTU and 1,775,860 billion BTU per year (CM, 2000).

3.15.2 Florida

Florida Power and Light Company (FP&L) provides power to the region with two fossil-steam power generation units producing 395 and 405 MW, respectively. In addition to the FP&L owned and operated units, FP&L purchases power from several other power providers throughout Central Florida and the East Coast of Florida.

The participant estimated that motor vehicle travel will be approximately 32,569,341 VKT (20,237,650 VMT) per year in 2020. Using an assumed efficiency factor of 7.7 km/L (18 mpg) (FDOT, 2000), motor vehicle travel will account for a consumption of 4,255,991 L (1,124,314 gal) of gasoline consumed for transportation in that year. The Florida DOT Maglev 2000 Environmental Assessment reports a corresponding energy consumption of 226.53 billion BTU (FDOT, 2000), which implies an assumption for gasoline energy content at approximately 201,481 BTU per gallon.

3.15.3 Georgia

Georgia Power is the major power supplier to the region, with a current generating capacity of 126,468,120 MW-h/yr (14,437 MW x 8760 hr/yr). They have 9 fossil fuel generation plants that account for 75 percent of total generation capacity, 20 hydroelectric dams generating approximately 3 percent of total generation capacity, and 2 nuclear facilities that account for 21.8 percent of total generation capacity. Georgia Power currently serves 1.8 million customers.

The Atlanta Regional Commission has calculated daily private motor vehicle travel for the Georgia Maglev Alternative to be 181,100,900 VKT (112,530,900 VMT) for the year 2000. By applying an assumed factor for average fuel efficiency of 11.5 km/L (26.9 mpg) (PTG, 2000a) for all vehicle types, over all speed ranges, the participant estimated that vehicular traffic within the corridor requires approximately 15.9 million L (4.2 million gal) per day. By the year 2025, those numbers are expected to increase to 257,369,000 VKT (159,921,700 VMT), and 22.6 million L (5.97 million gal) per day. Assuming a gasoline energy content of 125,000 BTU's per gallon (PTG, 2000a), these daily volumes of gasoline correspond to approximately 522.9 billion BTU per day in 2000, and approximately 743.1 billion BTU's per day in 2025, which corresponds to 231,857 billion BTU per year for private vehicle transportation (assuming 312 average weekdays per year). Public passenger transportation operations in the region in 1996 consumed 374 billion BTU of electric energy (for Metropolitan Atlanta Rapid Transit Authority's (MARTA) rail transit system), and 1.182 trillion BTU of diesel and CNG fuels for local and intercity motorbus transportation. The total energy consumption of 1.556 trillion BTU for 1996 is estimated to grow to about 1.98 trillion in 2005. The total energy consumption for transportation related activity is estimated to be approximately 285,000 billion BTU per year in 2025.

3.15.4 Louisiana

Two companies, Entergy Corporation and Cleco Corporation, supply electrical energy to the Louisiana Maglev Alternative and surrounding area. Entergy supplies electrical power for the southern area of the alternative (south of Lake Pontchartrain), and has a generating capacity of nearly 30,000 megawatts. In 1998, Entergy sold over 111 million MW hours of electricity in the U.S. Cleco supplies electrical power to the northern area of the alternative (north of Lake Pontchartrain) and has a generating capacity of 2,384 MW. Natural gas and coal are the main fuel sources used by Cleco. An additional 750 MW power plant will be operational by June 2000. In 1998, Cleco sold over 8.2 million MW hours of electricity. Based on current energy use in the area, the participant estimated that approximately 69 percent of the electricity would be generated from natural and 14 percent from nuclear reactors.

Current motor vehicle travel within the alternative is approximately 22,852,680 VKT (14,200,000 VMT) per day, which corresponds to travel in the region by all vehicles, including automobiles, light trucks, and heavy trucks. This travel represents a fuel consumption of approximately 4,837,756 L (1,278,000 gal) per day, corresponding to approximately 162 billion BTU per day. The yearly energy consumption is approximately 59,130 billion BTU. These results imply an assumption for fuel economy of 4.75 km/L (11.11 mpg) and for fuel energy content of 126,760 BTU per gallon of fuel, considering a vehicle-fleet-mix of 90 percent gasoline vehicles and 10 percent diesel vehicles (PTG, 2000b). Projections of VMT for the forecast year 2020 yield approximately 48,149,960 km (29,919,000 mi) per day. Assuming the same vehicle mix and a fuel efficiency factor of 7.14 km/L (16.68 mpg) for 2020 implies fuel use of 1,794,170 gallons, which corresponds to an energy consumption of approximately 227.4 billion BTU per day in 2020. On a yearly basis, the projected fuel consumption for the corridor is 83,012 billion BTU.

3.15.5 Maryland

Electric energy in the Maryland Maglev Alternative area is provided primarily through the Baltimore Gas and Electric (BGE) distribution network and the Potomac Electric Power Company (PEPCO) distribution network. PEPCO presently serves the southern section of the alternative encompassing Prince George's County and the District of Columbia, while BGE provides for the roughly northern half of the alternative in the greater Baltimore area.

Within the BGE service area, there are eight operational power plants that have a total on-line generating capacity of 6,000 MW. Within PEPCO's service area, energy is provided from six power plants that have a total on-line capacity of 6,600 MW. Therefore, there is a regional capacity of approximately 12,600 MW. There are no new power generating facilities planned for the region. The majority of the energy used in the region is consumed for residential, commercial, industrial, and transportation purposes.

Transportation energy for motor vehicles is provided predominantly by direct combustion of fossil fuels (gasoline and diesel). Much smaller contributions are from compressed natural gas and electricity. Motor vehicle fuel use in the Baltimore-Washington Region was estimated to be approximately 13.2 billion L (3.5 billion gal) in 1999. Assuming a fuel efficiency factor of 8.9 km/L (20.6 mpg) (KCI Technologies, 2000), the fuel consumption estimate implies 72.1 billion VMT per year in 1999. Assuming fuel energy content of 125,000 BTU/gallon (KCI Technologies, 2000), the energy consumption for 1999 is 437,500 billion BTU per year. Forecasts indicate that gasoline use for transportation will continue to increase resulting from population growth. Using motor vehicle travel forecasts from the region's Metropolitan Planning Organizations, gasoline use predictions for 2020 are approximately 8.2 billion L (4.8 billion gal), which imply travel of 98.9 billion VMT per year and consumption of 600,000 billion BTU per year.

3.15.6 Nevada

Sierra Pacific Resources/Nevada Power Company (NPC) currently carries out distribution of electric power within the Nevada Maglev Alternative. Under the new deregulation environment, the Nevada Maglev system could purchase power from any of a number of power providers from throughout the United States.

NPC currently distributes electric power within the alternative. In 1998, the total MW hours sold by NPC were 2.9 million – both generated and purchased. Of company-generated MW hours sold in 1998, 67 percent were from coal-fueled facilities and 33 percent from natural gas facilities. Based on NPC projections on generated and purchased electric power, the energy mix breakdown is assumed to be 45.5 percent coal, 35.3 percent natural gas, and 19.2 percent hydroelectric and nuclear power.

Eight new power-generating facilities planned for the Southern Nevada/Arizona region are currently advancing through the permitting process. Power industry representatives expect that two or three new facilities will be built within the next 5-8 years. NPC projects the fuel-source base of company-generated power to shift from coal to natural gas in the future as purchase of power from outside suppliers increases.

Motor vehicles in the Las Vegas metropolitan area, according to projections prepared by the Clark County Regional Transportation Commission will generate on the order of 41.5 million VKT daily / 15.1 billion VKT annually (25.8 million VMT daily / 9.4 billion VMT annually) on area roadways in 2000. This is up from 19.2 million VMT in 1995, representing a 34 percent increase. Total daily gallons of gasoline and diesel fuel consumed in 2000, will amount to approximately 1.4 million, which implies a fuel economy factor of 7.84 km/L (18.43 mpg). Assuming fuel energy content of 132,000 BTU per gallon (PTG, 2000c), the total energy consumption from motor vehicle transportation is 67,452 billion BTU per year.

Using the Regional Transportation Plan model for Las Vegas, average daily VKT were estimated to be 91.4 million (56.8 million VMT) in the year 2020, which corresponds to 33.3 billion VKT (20.7 billion VMT) per year. This represents a 120 percent increase from 2000 levels. Total annual fuel consumed would be on the order of 7.15 million liters (1.89 million gal), assuming fuel efficiency of 13 km/L (30 mpg) (PTG, 2000c). Assuming 132,000 BTU per gallon, the total transportation energy consumption for 2020 was determined to be 250 billion BTU per day for the Las Vegas region, which corresponds to a yearly consumption of approximately 91,221 billion BTU.

3.15.7 Pennsylvania

Between the Pittsburgh International Airport and Greensburg, the Pennsylvania Maglev Alternative crosses the service territory of two electric utilities; the Duquesne Light Company serves the western portion of the corridor and Allegheny Power serves the eastern portion. Both of these companies are part of the very highly interconnected electric utility network of the Eastern Interconnection and regionally the East Central Area Coordination Region (ECAR) of the North American Electric Reliability Council (NERC). Beside the 2-138 kV interconnections between Duquesne and Allegheny, these utilities are also interconnected to American Electric Power, First Energy, Virginia Power, and the PJM pool. The transmission systems of Duquesne Light and Allegheny Power consist of 500 kV, 345 kV, and 138 kV transmission circuits. There is approximately 10,000 MW of installed generating capacity within the two service territories.

The SPC is the Metropolitan Planning Organization (MPO) for Southwestern Pennsylvania, and is in charge of the coordination of all transportation development activities in the region. The regional transportation model maintained by the SPC was used to project vehicle travel in the corridor for the year 2020. Projections of motor vehicle travel for 2020 yield approximately 115,792,290 km (71,950,000 mi) per day. Assuming fuel energy content of 33,022 BTU per L (125,000 BTU per gallon), motor vehicle travel will account for energy consumption of approximately 504 billion BTU per day in 2020. This result implies an assumed fuel efficiency factor of 7.64 km/L (17.85 mpg). On a yearly basis, the projected fuel consumption for the corridor is 183,906 billion BTU.

3.16 PUBLIC SAFETY AND HEALTH

The Federal Railroad Administration has responsibility for ensuring railroad safety throughout the Nation. The United States railroad system consists of over 600 railroads with more than 250,000 employees, 200,000 miles of track, 1.2 million freight cars, and 20,000 locomotives. To monitor railroad compliance with federally mandated safety standards, FRA employs 400 inspectors operating out of 47 offices throughout the country. Beginning in 1993, FRA reassessed its safety program to focus on results. The Safety Assurance and Compliance Program (SACP) complements FRA's traditional safety enforcement program with a comprehensive approach in which SACP participants work with FRA to identify and correct root causes of problems across an entire railroad system. FRA monitors its aggressive national safety improvement program through a variety of safety measures.

The operation of electrical and electronic communication systems (i.e., cellular telephones, police radios, television, and AM/FM radio) produces electromagnetic radiation (EMR). Maglev will produce electromagnetic fields and non-ionizing radiation emitted by electric communication systems that monitor, control, and communicate with the vehicles. In addition, the Maglev system could produce electromagnetic fields (EMF) and EMR, similar to those emitted by power and communications systems, to propel and levitate the Maglev train. The potential public safety and health risk from environmental and occupational exposures of the general public, workers, and passengers due to Maglev operation must be considered. Standards and guidelines to ensure human safety from such exposures have been established.

The following section on Public Safety and Health considers the safety of the Maglev technologies and potential EMF/EMR concerns.

3.16.1 Systems Safety

The Federal Railroad Administration (FRA) has jurisdiction over all aspects of the safety of Maglev systems in the United States. In the past, when confronted with a proposed railroad system, such as a Maglev system or a high-speed steel-wheel-on-steel-rail system, having characteristics not addressed or not adequately addressed by FRA's existing regulations, FRA has undertaken to issue a rule of particular applicability covering that proposed system. For example, when a Transrapid Maglev was proposed in Florida, FRA undertook to develop a rule of particular applicability governing the safety of that system. A significant body of work was completed before that Maglev project was terminated, at which time FRA ceased to work on the safety rule. The last draft was dated March 1993. If a Maglev system is built under this program, FRA may develop a rule of particular applicability covering that system only or a rule of general applicability covering all Maglev systems of the same type wherever they may be located or a rule of general applicability covering Maglev systems of all types. Any such rule would cover, among other things, the guideway, the vehicles, the signal system, the communications system, intrusion detection, a system safety plan, qualification and training of employees, operating rules, software reliability, guideway maintenance worker safety, and emergency preparedness. FRA's existing rule on the use of alcohol and drugs would apply.

3.16.2 Electromagnetic Fields (EMF) and Radiation (EMR) Impacts

Public environmental exposures to extremely low frequency (ELF) EMF are commonly associated with all electric power transmission and distribution (T&D) lines, with existing electric transportation systems and facilities, as well as with homes, industrial and office buildings, schools and the urbanized outdoors. The construction and operation of Maglev systems may affect the environment within the proposed alternatives by incrementally raising current levels of ELF/EMF from existing electric power transmission and distribution along the ROW corridor, or to operating transit, airport, ports, etc. Similarly, Maglev sources of EMR will add to the current broadband radiation background from operating broadcast, communication, navigation and emergency location utilities.

Because the public tends to scrutinize more the safety, health and environmental (SHE) characteristics of new Maglev technologies, demonstration of compliance by the Maglev developer and operator with the existing safety standards and guidelines for human exposure safety to alternating fields and radiation limits (EMF, EMR) and static (DC) fields listed in the Tables 3.16-1 through 3.16-4 will ensure that the public and occupational exposure concerns are adequately addressed. Maglev system owners and operators will have to assure the public and workers (cab engineers, electrical and maintenance workers, and control room dispatchers) that SHE issues have been considered. This will be accomplished if Maglev system operations are in full compliance with the most protective human exposure safety standards and guidelines and address related environmental concerns.

Table 3.16-1 - Applicable Static Magnetic Field and 60 Hz EMF Standards

Organization	Static (DC) Magnetic Field	Time-Varying (AC) Magnetic Field
German Radiation Protection Commission 1997 EMF Ordinance	----	1 G at 50 Hz 3 G at 16 2/3 Hz (E field: 5 and 10 KV/m)
IRPA (DC) and ICNIRP (50/60 Hz)	1 G (24 hrs/day) 10 G (few hours/day)	0.85-1 G
ACGIH-'99 (DC, 60 Hz)	5G (medical electronics wearers) 600 G (whole body, 8 hrs) 6,000 G (limbs); 10,000 G (ceiling)	B (G)= 600/f (1-300Hz) 10 G at 60 Hz 1 G (medical electronics wearers)

1 G (Gauss) = 10^{-4} Tesla = 0.1 milliTesla
Source: (BUNR, 1997; ACGIH, 1999;IRPA, 1994; ICNIRP, 1998)

Table 3.16-2 - WHO/ ICNIRP (1998) Guidelines for Limiting Exposure to Power Frequency and Harmonics Electric and Magnetic Fields (ELF/EMF)

ELF/EMF Exposure 50 Hz (60 Hz)	Electric Field (kV/m)	Magnetic Field (Gauss)
Occupational	10/f (8.3)	5 (4.2)
General Public	5 (4.2)	1 (0.83)

Source: (ICNIRP, 1998)

Table 3.16-3 - Occupational Exposure Limits Guidelines for Sub-Radio Frequency (SRF, 30 kHz and below) Magnetic and Electric Fields-ACGIH 1999 Threshold Limit Values (TLVs) based on IEEE C95.1-1999

Occupational Exposure (60 Hz) TLV	Electric Field (kV/m)	Magnetic Field (Gauss)
Whole working day (8 hrs)	25 (DC to 100 Hz) 2.5×10^6/f in V/m (100 Hz-4 kHz) 625 V/m (4-30 kHz)	10 G at 60 Hz 600/f (to 300 Hz) 2 (300 Hz to 30 kHz)
For workers with cardiac pacemakers	≤ 1	≤ 1 G
For SRF, 300 Hz-30 kHz partial and whole body	2.5×10^6/f (f in Hz) 100 Hz- 4 kHz 625 for 4-30 kHz	≤ 2 G (160 A/m)* 600/f (x5 for arms and legs) (x10 for hands and feet)

*80 A/m (amps/meter)~ 1 G; Source: (ACGIH, 1999)

Table 3.16-4 - FCC Public Exposure Limits (Maximum Permissible Public Exposure, MPE) for Radio Frequency Radiation, 300 kHz-100 GHz

Frequency Range MHz	Power Density (mW/cm^2)	Electric Field (V/m)	Magnetic Field (A/m)*	Averaging time (min)
0.3- 1.34	100	614	1.63	30
1.34-30	$180/f^2$	824/f	2.19/f	30
30-300	0.2	27.5	0.073	30
300-1,500	f/1500	--	--	30
1,500-100,000	1	--	--	30

*80 A/m~ 1 G; Source: (FCC, 1997a)

Knowledge of Health Effects

Despite allegations of adverse health effects from extremely low frequency EMF (ELF/EMF), no public health risk associated with environmental exposures has been clearly shown after two decades of U.S. and international research, now being continued by the World Health Organization's (WHO) EMF-Project (NIEHS, 1995; WHO, 1993 to 2000), although epidemiological evidence is stronger for occupationally exposed workers to higher levels of EMF.

Both adverse and beneficial effects of EMF have been claimed, for a range of field strengths from a few milli-Gauss (Earth's magnetic field is about 500-800 mG[1] for reference), but no biological coupling mechanism, safety thresholds for intensity or duration of exposure, nor specific dose metrics and dose-response relationships to specific health effects have been established to date. Some epidemiological studies on residential and on occupational EMF exposures in the power frequency range indicated linkage of EMF to a variety of adverse health effects, such as childhood leukemia, depression, Alzheimer's and MLS, reproductive effects and other types of cancers (brain as well as to see behavioral effects, prostate, breast and lung). Laboratory studies, however, have not been able to confirm the biological mechanism for the generally weak statistical associations reported for EMF exposures with excess health risk, namely: enhanced risk ratios of 1.2-3 (except for some reported higher but inconsistent ratios for electrical occupations). Recent studies reports by the National Academy of Sciences (1996), the National Cancer Institute (1998) and the NIEHS EMF-RAPID Working Group Report (1998) have considerably weakened a link between EMF residential exposures and childhood leukemia risk, but did not address nor resolve the potential health hazards from occupational exposures. The 1999 NIEHS report to Congress stated that ELF-EMF exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard.

There are different types of direct and indirect health effects linked to EMF and EMR exposures across the electromagnetic spectrum, as discussed in the exposure safety Standards referenced in Tables 3-16-1 through 3-16-4. These effects include: induced

[1] SI units of magnetic field strength are 1 Tesla = 10,000 Gauss, but the more familiar unit of Gauss and milliGauss is used instead of 0.1 milliTesla and 0.1 microTesla, respectively.

body currents at frequencies below 100 kHz, whole body heating from 20-300 MHz, partial body or localized skin heating due to EM radiation absorption at higher (microwave) frequencies. Indirect effects include radio-frequency (RF) shock and burns due to contact currents with metal objects, induced body and level currents and the potential for EMI with implanted or body-worn electronic implants, and for RF heating of metallic implants and prostheses. The human exposure safety standards developed by consensus or professional organizations identified sensing or physiological change thresholds, and then provided safety factors of order 5-10 for occupational routine or ceiling exposures, and greater than 10-50 for public exposure limits. However, these standards focus on short-term safety effects, rather than on the public health impacts form long term exposures to environmental low level fields and radiation, which are still uncertain. Therefore, at present, there are no science-based national EMF/EMR safety guidelines that address health effects due to chronic exposures to environmental nonionizing radiation and fields.

Although the Maglev system is not regulated by the FCC, it may include commercial electronic subsystems that are. In addition, since FCC limits are more protective (conservative) than the ANSI/IEEE (C9.5.1) standards, it is recommended that Maglev projects design and demonstrate compliance with the FCC RF standards.

The most recent consensus voluntary standards issued for both public uncontrolled exposures and occupational controlled exposures to RF radiation are: "*IEEE Standards for Safety Levels with Respect to Human Exposure to RF Electromagnetic Fields, 3 KHz to 300 GHz,*" C95.1, 1999 (IEEE, 1999). Companion IEEE standards and recommended practices exist for EM field measurement procedures: C95.3-1991 for RF and MW radiation (IEEE, 1992a) and ANSI/IEEE Std. 644-1987 for measuring Power Frequency Electric and Magnetic Fields from AC power lines (ANSI/IEEE, 1987). In addition, IEEE Std. 1308-1994 also recommends instrumentation practices for measuring magnetic flux density and electric fields in the ELF band (10 Hz-3 kHz) (IEEE, 1995).

The FCC issued in 1996 its own environmental public safety and occupational exposure limits for RF/MW commercial mobile and fixed devices and transmitters regulated by the FCC, which are more conservative than C95.1-1999 (FCC, 1997a and b; FCC, 1999).

Occupational exposures for EMR (100 kHz – 6GHz) are based on a safety factor of 10 below a threshold of absorbed energy <4W/kg for whole body, but 8 W/kg for limbs (i.e., 1.6 W/kg); while public limits are another 5 times lower (i.e., 0.08 W/kg).

There are annually updated exposure standards from the American Conference of Governmental Industrial Hygienists (ACGIH) for occupational static magnetic fields, EMF, and EMR as well as other applicable voluntary professional organization consensus standards (IEEE/ANSI). Power Line Limits of about 150-250 mG also exist in several states, which are not safety standards, but status quo rulings of public utility commissions, pertinent only to edge of right-of-way fields. These limits are intended to prevent shock and burns due to corresponding electric fields Rail and transit ROW frequently is shared with power lines and may add to ambient EMF levels.

The International Commission on Nonionizing Radiation Protection (ICNIRP), affiliated with the WHO issued health-based EMF and EMR guidelines in 1998 to address short-term public and worker exposures, based on the latest review of published scientific literature (ICNIRP, 1998). The frequency dependence of broadband exposure safety limits reflect different coupling mechanisms of EM fields to humans, and different health or safety effects.

ICNIRP (then called IRPA) also issued in 1994 Static Magnetic Fields (MF) International Guidelines based on biological effects: continuous public exposure is limited to 40 millitesla (mT) or 400 Gauss, but people with electronic implants (cardiac pacemakers, defibrillators, pain management stimulators, medication pumps) or metallic medical implants (prostheses, aneurysm clips, suture staples) are limited to 5 Gauss. The ACGIH (1999) specify annually voluntary guidelines for occupational safety and health: static field limits of 60 mT (600 G) whole body for 8 hours (2 T ceiling values), but 0.5 mT (5 Gauss) for sensitive wearers of medical electronics, metallic implants or pain device users.

Knowledge of Alternative Maglev EMF/EMR Characteristics

Transrapid Maglev. The EMF characteristsics for existing and advanced transportation systems, including the Transrapid Maglev TR07 test system and the associated public and worker exposures, have been extensively surveyed and documented by the DOT/RSPA Volpe Center and its contractors for the FRA and for the DOE in a series of reports over the past decade (DOT, 1992, 1993, 1994, and 1995).

The established FRA ELF/EMF survey protocol has focused on spatial, frequency and temporal variability of EMF at key locations: inside Maglev – the riders and operators; outside Maglev – with the vehicle present and absent; on station platforms; in the guideway vicinity, on overpasses and underpasses; in/near control and communication structures and subsystems (e.g., microwave antennae, central dispatch); and near power conditioning equipment (e.g., inverter substations, switch-gear), and near distribution and power-rail cabling to Maglev guideway and vehicles.

The rail and Maglev EMF environment is both complex and highly variable in space and time due to transients, and also rich in the frequency spectrum. Although cab engineers and workers in the maintenance yard may be exposed to still higher occupational EMF levels over the work day and work life, any adverse health effects are considered suggestive, but unproven. The National Institute of Occupational Safety and Health (NIOSH, 1997) has documented EMF exposures for rail maintenance workers on the Northeast Corridor (NEC).

Measurements of the current state of the Transrapid Maglev system still need to be completed; however, it is assumed that TR08 EMF and EMR levels are similar to those documented by FRA in 1992 for TR07, and comparable to, or below, those surveyed by the FRA in existing and advanced rail, transit and other transportation systems (see Figures 4.16-1 and 4.16-2). Measurements will be used to document and evaluate the system design and site-specific EMF and electromagnetic radiation/interference. The States should comply with current applicable U.S. and international human exposure safety standards and guidelines for static field, EMF and EMR, as listed in the Tables 3.16-1 through 3.16-4 as they develop their projects.

During a site specific EIS, the incremental impacts of TR08 Maglev system facilities and operation will be evaluated and compared to established EMF and EMR levels in existing transit and rail systems, and to common household and work exposures (see Figures 4.16-1 through 4.16-2 and Tables 4.16-1 and 4.16-2).

Superconducting Maglev Alternative. For the Florida M-2000 superconducting Maglev, the absence of a prototype and of quantitative static and AC field estimates and of RF radiation levels tied to specific sources requires consideration of comparable Maglev technology, namely the Japanese superconducting Maglev.

The FRA EMF test protocol and similar instrumentation (ERM's wave capture MultiWave system) were used to measure in-vehicle and environmental magnetic fields for the MLU and MLX Japanese Superconducting Electrodynamically Suspended (EDS) Maglev, which is similar to the Florida proposed alternative M-2000 concept. The RTRI Maglev vehicle was redesigned to reduce static magnetic fields to passengers using floor shielding to attain MFL from superconducting magnets below 20 Gauss (from earlier levels of 200 Gauss). The wayside levels of magnetic fields in areas where public access is allowed, also was reduced to about 2 Gauss. It is expected that the Florida Alternative will comply with current exposure safety standards for static, AC and RF fields, considering the potential for EMI with electronic medical implants worn by passengers or workers (see Tables 3.16-1 through 3.16-4).

3.17 NOISE AND VIBRATION

This section describes the noise and vibration affected environments for each alternative. The number and type of receptors that could be potentially impacted by noise and vibration are identified.

3.17.1 California

The California Maglev Alternative traverses areas of metropolitan Los Angeles between LA LAX and ONT. In an attempt to minimize noise and vibration impacts, a portion of the corridor will follow I-10 as well as existing rail lines. Adjoining structures primarily consist of single-family homes and industrial complexes. Additionally, multifamily homes, commercial and institutional buildings, as well as municipal parks, lie within and adjacent to the candidate corridor.

In the western portion of the alternative near LAX, the population density is between 10 and 50 people per acre, whereas in the eastern end near ONT the population density is much lower (between 0 and 10 people per acre). These two population densities make up approximately 55 and 10 percent, respectively, of the overall length of the alternative. The remaining 35 percent of the alternative length traverses the heavily populated metropolitan LA area. A total of 122 potentially noise-sensitive areas representing approximately 567 ha (1,400 ac) are within the alternative.

3.17.2 Florida

The Florida Maglev Alternative connects the Space Coast Regional Airport, Kennedy Space Center Visitor's Center and Port Canaveral. Parts of the alternative follow existing roadways, including I-95 and State Roads (SRs) 528 (the Beeline Expressway) and 405. Additionally, the corridor will cross at two rivers.

Population densities within the alternative range from unpopulated to medium density, with the majority consisting of low population density areas of less than 4.9 people per ha (2 people per ac). Potential noise sensitive receptors include predominantly residences and schools, as well as municipal parks. The total number of noise sensitive receptors is not identified at this early planning stage.

3.17.3 Georgia

The Georgia Maglev Alternative traverses a combination of residential, commercial, and industrial areas between Atlanta's Hartsfield International Airport and Kennesaw, Georgia. In an attempt to minimize noise and vibration impacts, portions of the alternative follow I-75.

The alternative is most densely populated in its southern (approximately one-quarter of the corridor, around the airport) and central portions. Further north the alternative traverses regions of low to moderate population densities. The alternative abuts a National Recreation Area. A total of 44 potentially noise sensitive areas representing 283 receptors are in the alternative.

3.17.4 Louisiana

The Louisiana Maglev Alternative connects towns north of Lake Pontchartrain with New Orleans International Airport and the downtown business district of New Orleans. The northern portion of the alternative traverses rural areas with between 0 and 2 people per sq km (0 - 5.1 people per sq mi) (approximately 10 percent of the total alternative area), while the center of the alternative crosses Lake Pontchartrain (70 percent), and the southeastern portion travels through urban areas of New Orleans (20 percent) with between 200.4 and 13,320 people per sq km (519 and 33,499 people per sq mi).

Noise sensitive receptors within the alternative include hospitals, nursing and retirement homes, schools, day care facilities, single and multifamily residences, auditorium/concert facilities, churches, and parks. The total number of noise sensitive receptors is not identified at this early planning stage.

3.17.5 Maryland

The Maryland Maglev Alternative traverses densely populated areas of metropolitan Washington, D.C. and Baltimore. In an attempt to minimize noise and vibration impacts, the alternative will primarily run parallel to existing rail lines, the Baltimore/Washington Parkway and I-95. The extreme southwest and northeast portions of the alternative (Washington, D.C. and Baltimore, respectively) include areas with population densities of greater than 15,444 people per sq km (40,000 people per sq mi), whereas the middle portion of the alternative traverses areas of moderate population density (several thousand people per square mile or less).

The alternative encompasses predominantly residential and industrial areas. Additionally, the study corridor includes large Federal holdings (PNWR, BARC, and Ft. Meade) and numerous properties on the National Register of Historic Places. Mapping was accomplished to indicate regions of potential impact. However, the total number of noise sensitive receptors is not identified at this early planning stage.

3.17.6 Nevada

The Nevada Maglev Alternative connects downtown Las Vegas to Primm, Nevada. Outside of these urban areas, the alternative runs parallel to I-15 and predominantly within Nevada DOT right-of-way. Approximately one-fifth of the alternative, at the northernmost section and within downtown Las Vegas, encompasses lands with population densities of greater than than 19.8 people per ha (8 people per ac). Beyond Las Vegas city limits, the alternative generally traverses unpopulated areas or areas with very low population density of less than 9.9 people per ha (4 people per ac). Primm is a very small-urbanized area with hotels and entertainment facilities.

The alternative encompasses 30 hotel/conference facilities and over 500 residencial areas in the northern portion. It also includes ten houses of worship, one school, and two municipal parks. Given the plethora of hotels in this area, however, the density of lodging guests is also worthy of consideration. Twenty-two potentially noise sensitive areas are within the alternative.

3.17.7 Pennsylvania

The Pennsylvania Maglev Alternative traverses both rural and urban areas, spanning from Pittsburgh International Airport in the west, through downtown Pittsburgh and Monroeville, to Greensburg in the southeast. Approximately one-third of the alternative, surrounding downtown Pittsburgh, is considered urban (more than 20 people per ha (8.1 people per acre)). The remaining portions of the alternative (approximately one-third each) are considered suburban (between 4 and 20 people per ha (1.6 and 8.1 people per acre)) and rural (less than 4 people per ha (1.6 people per acre)). The alternative encompasses predominantly residential and rural/suburban land uses. The range of noise sensitive receptors within the alternative includes 391-4169 residential dwelling units, 0-9 recreation areas, 0-5 churches, 0-3 schools, 0-1 hospitals, 0-7 historical sites, 1-7 parks, and 0-2 cemeteries.

3.18 ELECTROMAGNETIC RADIOFREQUENCY RADIATION (EMR)

This section discusses the existing natural and man-made sources that comprise the EMR exposure environment. The EMR environment is due to both man-made and natural sources across a broad range of frequencies. Thunderstorms, solar flares, and northern lights are all examples of natural contributors of noninonizing electomagnetic radiation (NIR). The intentional sources include local broadcast radio and television stations, satellite communication, military and civilian radars, and cellular telephones. Unintentional man-made sources are commonly referred to as radio noise or interference. Typical sources of unintentional electromagnetic energy are power lines, fluorescent lights, microwave ovens, household wiring, simple motors, computers and hand held calculators. One contributor that is often overlooked is the automobile ignition system.

It produces a pulse of energy over all the communication bands up to 150 kHz with each spark plug firing. These sources often mask man-made sources causing significant interference.

There are increasing numbers of EMR sources operating at similar frequencies, leading to "encroachment" and "EM clutter." A receiver could experience interference when a more powerful transmission at nearby frequency bands masks a weaker transmission. Interference can also occur if the frequencies are close and the emitters do not produce clean signals. These intentional or spurious emissions might cause EMI that impacts safe Maglev operation. It should be obvious that both man-made intentional and unintentional sources increase with human activity. Thus, "EM clutter" within the environment is greater in an urban region as compared to a rural region.

The Maglev system may contribute to both intentional and unintentional environmental EMR. Intentional EM transmitters are used to communicate information to and from the Maglev vehicle and the guideway. Unintentional EMR is produced as the Maglev train is propelled along the guideway (as leakage or stray fields and radiation). Some of the electromagnetic environment sources susceptible to EMI are located in close proximity of the guideway. Although none of the alternatives completed an inventory of potential EMR sources at the current planning level of design, some potential sources and their frequencies are listed in Table 3.18-1. If the Maglev Deployment Program proceeds, a site-specific investigation to locate and inventory appropriate sources will be needed for potential interference analysis. Table 3.18-2 lists EMI standards that may be applicable, depending on the system design and siting.

Electromagetic Interference (EMI) Issues. There is a continuum of SHE effects from potential EMI/EMC hazards for safety critical systems or pacemakers worn by passengers, to chronic human exposure health impacts due to environmental levels of fields and broadband radiation. Both EMI from Maglev systems to wayside facilities (such as airport or port communication systems and bank automated teller machines, (ATM)) and from wayside installations to Maglev (such as cellular phone ground stations and antenna farms for radio and TV) must be considered. There are also potential EMI hazards to rail safety-critical subsystems from on-board passengers personal electronic devices (computers and modems, satellite or cell phones). These might interfere with signal, control or data transmission integrity between the rail vehicle, wayside processors and central dispatch and operation centers. For instance, the operation of such electronic and digital data transmission devices is now prohibited during takeoff and landing of aircraft, to prevent EMI with safety-critical navigation and communication systems.

Standards that have been established to prevent EMI are listed in Table 3.18-2. The selected Maglev Alternative will be required to meet established standards, so that the developer/operator can prove during the site-specific environmental review process that the interference issue can be properly addressed.

Table 3.18-1 - Potential Electromagnetic Radiation Sources

Transmitters (Or Radiating Sources)	Approximate Frequency Range (MHz)
Cellular Telephone	870 - 890
Satellite Television	5,925 - 6,875 12,500 - 12,750
HF Communications	2.1 - 10 10 - 30
Television Broadcast	VHF-TV 54 - 216 UHF-TV 470 – 806
AM Radio Broadcast	0.535 - 1.7
FM Radio Broadcast	88 - 108
Avionics	GPS L1 - 1,575.42 and L2 - 1,227.6 VHF Radio 118 - 137 UHF Radio 960 - 1,125 VOR 115 - 116 ADF 0.25 - 0.40
Mobile VHF Radio	38 - 45 45 -161
Wildlife Trackers	30 - 45 45 - 222
Citizen Band Radio	26.9 - 27.4
Hand Held Transceivers	VHF 118 - 174 UHF 403 - 470
Radio Telephone	VHF 152 - 158 UHF 454 - 460
Terrestrial Microwave Communications	2,127 - 2,177 5,945 - 6,094
Marine LORAN C	90-110 kHz (LF)
Marine NDGPS	Reference Signal at 285-325 kHz + GPS (L1 and L2)

Source: (DOD/DOT, 1999) Not All Inclusive

Table 3.18-2 – Standards Relevant to Electromagnetic Interference (EMI) and Compatibility (EMC)

American National Standards Institute (ANSI) Standards

- ANSI C63.4 – Methods of Measurements of Radio Noise Emissions from Low Voltage Electrical and Electronic Equipment, 1 kHz to 1 GHz, 1980.
- ANSI C63.12 – ANSI Standard for Electromagnetic Compatibility Limits – Recommended Practice. 1987.

Institute of Electrical and Electronics Engineers (IEEE) Standards

- IEEE Std 1474.1-1999, IEEE Standard for Communications-Based Train Control (CBTC) Performance and Functional Requirements.
- IEEE P-1478, IEEE Environmental Standards for Transit Rail Car Electronic Equipment (preliminary)
- IEEE C37.90.2 – IEEE Standard for Trial Use Standard Withstand Capability of Relay Systems to Radiated Electromagnetic Interference From Transceivers. 1995.
- IEEE C62.47 – IEEE Guide on Electrostatic Discharge (ESD): Characterization of the ESD Environment. 1992.
- IEEE 518 – IEEE Guide for the Installation Of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources. 1982.

APTA (see also UMTA, 1987 references)

- APTA/PRESS: SS-E-010-98, Standard for the Development of an Electromagnetic Compatibility Plan. 1998.

DOD Standards (see http://asist.daps.mil/eAccess)

- MIL STD461E –Requirements for the Control of Electromagnetic Interference (Characteristics of Subsystems and Equipment). 1999.
- MIL-E-6051D – Electromagnetic Compatibility Requirements, Systems. 1997.
- MIL-HDBK237B – Electromagnetic Environmental Effects on Platforms, Systems and Equipment. 1997.
- MIL-HDBK 231A/1B – Electromagnetic (Radiated) Environment Considerations for Design and Procurement of Electrical and Electronic Equipment, Subsystems and Systems. 1993.

International Electrotechnical Commission (IEC) Standards

- IEC, 1995. Electromagnetic Compatibility, Part 4. Testing and Measuring Techniques, Section 2. Electrostatic Discharge Immunity Test. International Electrotechnical Commission (IEC). Standard: IEC-1000-4-2. 1995.
- IEC, 1998. Electromagnetic Compatibility, Part 4. Testing and Measuring Techniques, Section 3. Radiated Radio Frequency Electromagnetic Field Immunity Test. International Electrotechnical Commission (IEC). Standard: IEC-1000-4-3 1995 and Amendment 1998-1. 1998.
- IEC, 1995. Electromagnetic Compatibility, Part 4 Testing and Measuring Techniques, Section 4. Immunity to Electrical Fast Transient Burst. International Electrotechnical Commission (IEC). Standard: IEC-1000-4-4. 1995.
- IEC, 1995. Electromagnetic Compatibility, Part 4. Testing and Measuring Techniques, Section 5. Surge Immunity Test. International Electrotechnical Commission (IEC). Standard: IEC-1000-4-5. 1995.

European Committee for Electrotechnical Standardization (CENELEC) Standards (European Standards (EN) and Provisional Standards (prEn)

- EN55011, Limits and Methods of Measurement of Radio Disturbance Characteristics of Industrial Scientific and Medical (ISM) Radio Frequency Equipment, 1998.
- prEN 50121-1, Railway Applications – Electromagnetic Compatibility, Part 1. General. CENELEC Standard February 1998
- prEN 50121-2, Railway Applications – Electromagnetic Compatibility, Part 2. Emission of the whole railway system to the outside world. CENELEC Standard. February 1998
- prEN 50121-3-1, Railway Applications – Electromagnetic Compatibility, Part 3-1. Rolling stock - Train and Complete Vehicle. CENELEC Standard. February 1998
- prEN 50121-3-2, Railway Applications – Electromagnetic Compatibility, Part 3-2. Rolling stock – Apparatus. February 1998
- prEN 50121-4, Railway Applications – Electromagnetic Compatibility, Part 4. Emission and immunity of the signaling and telecommunications apparatus. February 1998
- prEN 50121-5, Railway Applications – Electromagnetic Compatibility, Part 5. Fixed power supply apparatus and installations. February 1998.

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4 ENVIRONMENTAL CONSEQUENCES AND MITIGATION

As a requirement of the Maglev Deployment Program and cooperative agreements established between FRA and the participants, each participant prepared a technical review of the affected environment and potential environmental consequences for its proposal (MTA, 2000; FDOT, 2000; GNOEC, 2000; ARC, 2000; CNSSTC, 2000; CM, 2000; PAAC, 2000). The purpose of these technical documents was to provide the baseline environmental data used by FRA in the preparation of this PEIS. The environmental consequences and mitigation section of this PEIS is based almost solely on the information contained within each alternative's environmental review document. That information is incorporated by reference for this PEIS and summarized accordingly below. These documents have been incorporated by reference to reduce the volume of this PEIS. Only the climate, topography, EMF/EMR, and radio waves subsections were developed independently from those documents. The potential environmental impacts for each of the alternatives were determined based on preliminary planning information, such as that provided in the participant's environmental assessments. This information is part of an ongoing planning process and is subject to refinement. For example, some of the Project Description documents developed by the alternatives contain some new or updated information (MTA(b), 2000; FDOT(b), 2000; GNOEC(b), 2000; ARC(b), 2000; CNSST(b), 2000; CM(a), 2000; PAAC(b), 2000. These and other nominal refinements have been incorporated in this Chapter.

Environmental consequences were found to be either similar in all the alternatives or specific to each alternative. Therefore, to reduce redundant discussion, presentation of the environmental consequences is discussed for all the alternatives when appropriate or for each of the alternatives when the consequences were found to be alternative-specific. A similar approach was established for discussion of the proposed mitigation. The following is a summary of the environmental consequences and mitigation for each of the alternatives. If further information on the environmental consequences and mitigation section is desired, Appendix A identifies the person to contact for copies of the alternative's environmental assessments website and additional information. Additional information can be obtained by viewing the alternative's website also identified in Appendix A.

4.1 TOPOGRAPHY, GEOLOGY AND SOILS

4.1.1 Topography

Potential impacts to topography in the areas of the proposed Maglev Alternatives are considered to be localized and minor. Construction of the Maglev Alternative may require blasting, excavating, grading and embankment formation, which would alter the existing local topography. The siting of each of the proposed Maglev Alternatives during the early planning stages of the Maglev Deployment Program likely considered avoidance of unsuitable topography, including but not limited to; mountainous areas, steep slopes, cliffs, ravines, and valleys. These areas were avoided in favor of relatively flat areas or areas with gradual topographic relief for various reasons including, among others, cost and ease of construction. The Pennsylvania Alternative, and to a lesser extent the Georgia Alternative, have significant gradient differences throughout the area. Those contour changes could require design mitigation measures such as bridges, tunnels, and higher elevated guideways. The impact from these mitigation measures will have an insignificant adverse impact to topography.

4.1.2 Geology

The Maglev structures are primarily built within a very short depth from the earth's surface. Guideways, stations and maintenance facilities may require piles to be built further down into the earth for support, possibly impacting the geology. However, the impact from these piles to geology would be minimal and localized. Another concern to geology is the impact from tunneling. The Pennsylvania and Georgia Alternatives may require tunnels as part of their design, thus potentially affecting local geology. However, the required tunneling design and construction techniques would minimize potential adverse impact to geology in these cases. Therefore, with the majority of the Maglev facilities built outside of geologic areas and with proper tunneling techniques the potential impact to geology from all of the build alternatives should be insignificant.

It should be noted, however, that the potential impact from unstable geologic areas could have a direct impact on Maglev. Seismic activity can cause shaking of a Maglev system, which can damage the guideway and other components of the system. Severe seismic shaking could potentially result in the collapse of the elevated guideway and the destruction of stations and power generating stations.

Seismic activity in the Basin and Range Region and the Coastal Ranges Region poses the most significant risk to the integrity of the overall Maglev system. Certainly, the tight tolerances that are required of the guideway within unstable seismic areas may present a design as well as operational challenge. To ensure seismic safety, the proposed California and Nevada Maglev Alternatives need to be designed in compliance with applicable building codes and engineering design standards that take into account seismic forces. Additionally, the operation control system for Maglev will be tied to local seismic monitoring stations. The potential for seismic risk in the Florida, Georgia, Louisiana, and Pennsylvania Maglev Alternatives (Appalachian Region and the Coastal Basin Regions) exists, but is minor in comparison to the western portion of the United States. Regardless, the design of these systems should also comply with seismic design and construction standards applicable to each location.

There is a small risk of potential loss or damage to mineral deposits (i.e., coal) in the vicinity of the proposed Pennsylvania Maglev Alternative. Additionally, there is potential for impacts to oil and gas exploration in the vicinity of both the Pennsylvania and the Louisiana Maglev Alternatives. By considering known mineral and fossil fuel resources in the siting and design of the selected Maglev Alternative, potential impacts can be avoided and/or substantially minimized.

4.1.3 Soils

Erosion is also a concern of any of the proposed Maglev facilities. The clearing of vegetation and interruption of natural drainage courses increases the rate of erosion. The rate and amount of soil erosion should be minimized to the greatest extent practicable; to avoid sedimentation of streams and waterbodies with associated impacts on flora and fauna. Construction of any of the proposed Maglev facilities will require the preparation and implementation of an approved Storm Water Pollution Prevention Plan (SWPPP) that will contribute considerably to the minimization of erosion and sedimentation impacts. The SWPPP also states that the depostion of storm water onto agricultural fiels is not acceptable.

The design of the California, Florida, Louisiana, and Nevada Maglev Alternatives in both the Basin and Range Region and Coastal Ranges Region must take into account that these regions are more prone to erosive forces than the other regions due to steep topography, lack of substantial ground cover vegetation, arid soils, and/or infrequent flash flooding by heavy rain events.

Potential impacts to agriculturally important soils may also occur with each of the proposed Maglev Alternatives. These impacts are discussed in the Land Use section of this PEIS.

4.1.4 Summary

Construction and operation of a Maglev system in any of the seven proposed locations would result in insignificant adverse impacts to existing topographic, geologic, and soils resources. However, seismic activity in the Basin and Range and Coastal Ranges geomorphic regions could result in significant adverse impacts to the California and Nevada Maglev Alternatives. Proper seismic construction techniques along with guideway integrity monitoring could help mitigate these impacts.

4.1.5 No-Action Alternative

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be constructed. Therefore, there would be no impacts on the topography, geology, or soils directly from a Maglev system. However, it is important to consider potential impacts from the No-Action Alternative that could arise from precluding the Maglev Deployment Program and the potential benefits of constructing a Maglev system.

Since a Maglev system would not be constructed under the No-Action Alternative, travel by motor vehicle is expected to be significantly higher than that under any of the Maglev Alternatives. The increase in motor vehicle travel could result in a variety of transportation problems that could lead to road expansion. The construction of additional infrastructure for long-distance motor vehicle travel to address these problems could have impacts to topography, geology and soils as locations for new roadways could require blasting, excavating, grading etc, which would alter existing local topography. In addition, the construction of new roads and highways is likely to result in permanent disruption of drainage patterns to a greater extent than the elevated Maglev guideway system. These impacts would need to be examined on a local and regional basis and be compared to those of the Maglev Alternatives. It is expected that the No-Action Alternative could result in impacts similar to those for the Maglev Alternatives – erosion and sedimentation, loss or damage to mineral deposits. Thus, the No-Action Alternative would likely have insignificant adverse impacts on topography, geology, and soils.

4.2 CLIMATE

One of the products of motor vehicle exhaust is carbon dioxide (CO_2). In recent years, the U.S. Environmental Protection Agency (EPA) has started to view CO_2 as a pollutant of concern. CO_2 does not directly impair human health, but it is a “greenhouse gas” that traps the earth’s heat and contributes to the potential for climate change. Implementation of the Maglev system has the potential to decrease or increase CO_2 emissions, depending on the net change in motor vehicle travel and energy consumption for Maglev operation. Thus, Maglev deployment could have long-term effect on climate. A decrease in CO_2 would benefit the environment and help prevent or slow climate change. An increase in CO_2 emissions would harm the environment and contribute to climate change.

The net change in carbon emissions was calculated by estimating and comparing the generation of emissions associated with electricity for Maglev operation, and the reduction in emissions associated with reduced motor vehicle travel. The energy use estimates developed for the Energy section were used as the basis for the calculation of the net change in carbon emissions for each of the alternatives. Calculations were developed by multiplying the energy consumption for each fuel type – in BTU – by an associated carbon emissions coefficient. The carbon emission coefficients were obtained from the *Emissions of Greenhouse Gases in the United States* 1998 report published by the Energy Information Administration (EIA, 1998). For those alternatives that have provided information on the Maglev operation energy source mix, the corresponding coefficients were used. In all other cases, it was assumed that all electric power is derived from coal, and the corresponding coal carbon emission coefficient (25.76 metric tons of carbon per billion BTU) was used. The value of this coefficient could change over time if more energy efficient technologies become available. It is assumed that there are no carbon emissions from hydroelectric and nuclear power generation. For motor vehicle travel, conversion factors of 19.33 metric tons (42,615 lbs) carbon per billion BTU of energy derived from gasoline and 19.95 metric tons (43,982 lbs) of carbon per billion BTU of energy derived from diesel was were used to determine potential carbon emission reductions from diverted motor vehicle travel resulting from Maglev operation. (EIA, 1998)

Climate could potentially affect the operational integrity, service schedule, and maintenance requirements of a Maglev transportation system at any of the proposed locations.

Extended periods of excessive temperatures could potentially distort the steel that comprises the Maglev guideway. Dramatic overnight temperature changes that occur in desert regions could result in unusual lateral movement of the guideway. This stretching and shrinking of the guideway may pose an operational concern for the tight tolerances of the Nevada Maglev Alternative. A heat wave in any region could potentially overburden electric utility companies that, in turn, could result in “brown out” conditions. Electric power under these conditions may not be adequate to efficiently run the Maglev system. Sandstorms can severely limit visibility and could potentially interrupt the Maglev service within the Nevada Alternative. Layers of accumulated dust on Maglev system equipment may need to be routinely removed to avoid compromising the efficiency of the system.

Extremely high winds associated with hurricanes and tropical storms could potentially damage the Maglev guideway or other system components in the southern and southeastern United States. Louisiana and Florida are at the most risk from these weather events. Georgia and Maryland can also be affected to a lesser degree. High winds from tornados could also potentially impact the Maglev system infrastructure. Georgia, Florida, and Louisiana are the locations with the greatest tornado and tropical storm risk. Pennsylvania can also be affected by these unpredictable springtime weather systems, but to a slightly lesser degree.

Since most of the systems will incorporate elevated guideways, torrential rains and associated flooding may only have a minimal impact on the Maglev system in most locations. The potential for excessive erosion around support structures exists especially for the California and Nevada Alternatives. Also, mudslides and/or landslides could be triggered in areas where slopes are steep and unstable.

Another climatic concern is lightning strikes. The Maglev system will be on an elevated guideway and in some instances could be a prominent landscape feature. This could attract lightning strikes to the guideway, communication systems, or electrical distribution system. The potential result could be destruction of equipment and disruption to service from the loss of power or communications. Each of the alternatives is within areas that have lightning strikes. However, the technology of avoiding and minimizing the impact from lightning strikes is already applied to existing transportation modes and should be applied to Maglev. Thus, the likely impact from lightning strikes for all of the alternatives is anticipated to be insignificant.

High winds coupled with heavy snow and ice typical of Northeasters could potentially affect Maglev operations in Maryland and Pennsylvania. These storms could knock out electricity and potentially damage the guideway or other components of the Maglev system. An ice storm affecting these cities could result in a heavy build-up of ice on the guideway, which could also pose operational, and maintenance problems. Blizzards also can affect these locations, causing widespread power outages and potential damage to the Maglev system.

4.2.1 California

Maglev energy consumption within the California Alternative was estimated to be approximately 918.2 billion BTU per year in 2020. Carbon dioxide emissions were calculated assuming the energy mix breakdown provided in the Air Quality section (20.7 percent coal, 32.1 percent natural gas, 1.8 percent biomass, and 45.4 percent hydroelectric and nuclear power). It is assumed that there are no carbon dioxide emissions from nuclear and hydroelectric power generation. Even though biomass is used as an energy source within the alternative, for the purposes of this analysis, the minor contribution of biomass to the energy mix is neglected and allocated to electricity generated from coal. Thus, the associated carbon emissions were calculated using the corresponding carbon emission coefficients for coal and natural gas (with coal generating 22.5 percent and natural gas 32.1 percent of the energy in the corridor), and estimated to be approximately 9,587 metric tons per year. Fuel reduction from diverted motor vehicle travel was estimated to reduce carbon emissions by between 81,993 to 92,001 metric tons per year. Thus, the net reduction in carbon emissions for the corridor from Maglev operation is estimated to range to be between 72,406 and 82,414 metric tons of carbon per year in 2020. This reduction constitutes a beneficial effect for the reduction of greenhouse gas emissions from transportation within the alternative.

The California Alternative could potentially be affected by torrential rains that could trigger mudslides and/or landslides, and by localized severe erosion that could damage the infrastructure of Maglev system. The anticipated impact from this alternative on these climatic conditions is anticipated to be insignificant.

4.2.2 Florida

Maglev energy consumption within the Florida Alternative was estimated to be approximately 34.03 billion BTU per year in 2020. Assuming that all energy used to power Maglev is derived from coal, carbon emissions from Maglev operation would be approximately 876 metric tons per year. Fuel reduction from diverted motor vehicle travel was estimated to reduce carbon emissions by 24 metric tons per year. Thus, the net increase in carbon emissions for the corridor from Maglev operation is estimated to be approximately 852 metric tons of carbon per year in 2020. This increase constitutes a negative effect for the reduction of greenhouse gas emissions from transportation within the alternative.

The Florida Alternative could potentially be impacted by strong hurricanes and tornados that could damage or even destroy the Maglev system's infrastructure. Torrential rains resulting in floods could also pose problems in this area due to the region's relatively flat topography. The impact to Maglev from these climatic events could be significant. However, the anticipated impact from this alternative on these climatic conditions is anticipated to be insignificant.

4.2.3 Georgia

Maglev energy consumption within the Georgia Alternative was estimated to be approximately 311.5 billion BTU per year in 2025. Carbon dioxide emissions were calculated assuming the current energy mix breakdown provided in the Energy section (75 percent fossil fuel, 22 percent nuclear, and 3 percent hydroelectric). It is assumed that there are no carbon dioxide emissions from nuclear and hydroelectric power. Thus, it is estimated that 75 percent of the total Maglev energy requirement (233.6 billion BTU) is derived from coal. The associated carbon emissions would be approximately 6,017.5 metric tons per year. Fuel reduction from diverted motor vehicle travel was estimated to reduce carbon emissions by 3,415.6 metric tons per year. Thus, the net increase in carbon emissions for the corridor from Maglev operation is estimated to be approximately 2,601.9 metric tons of carbon per year in 2025. This increase constitutes a negative effect for the reduction of greenhouse gas emissions from transportation in the alternative.

The Georgia Alternative could potentially be affected by tornados and weakened hurricanes. These weather systems could result in damage and/or destruction of the Maglev system's infrastructure. Impacts from hurricanes to this area are considerably less than hurricane impacts that could be experienced in Florida or Louisiana. The impact to Maglev from these climatic events could be significant. However, the anticipated impact from this alternative on these climatic conditions is anticipated to be insignificant.

4.2.4 Louisiana

Maglev energy consumption within the Louisiana Alternative was estimated to be approximately 1,021 billion BTU per year in 2020. Carbon dioxide emissions were calculated assuming the current energy mix breakdown provided in the Energy section (69 percent natural gas, 17 percent coal and 14 percent nuclear power providing the rest). It is assumed that there are no carbon dioxide emissions from nuclear power. The associated carbon emissions would be approximately 14,665.13 metric tons per year. Fuel reduction from diverted motor vehicle travel was estimated to reduce carbon emissions by 33,093 metric tons per year. Thus, the net reduction in carbon emissions for the alternative from Maglev operation is estimated to be approximately 18,427.8 metric tons of carbon per year in 2020. This reduction constitutes a positive effect for the reduction of greenhouse gas emissions from transportation within the alternative.

The Louisiana could potentially be impacted by strong hurricanes and tornadoes that could damage or even destroy the Maglev system's infrastructure. Torrential rains resulting in floods could also pose problems in this area due to the region's relatively flat topography. The impact to Maglev from these climatic events could be significant. However, the anticipated impact from this alternative on these climatic conditions is anticipated to be insignificant.

4.2.5 Maryland

Maglev energy consumption within the Maryland Alternative was estimated to be approximately 235.2 billion BTU per year in 2020. Assuming that all energy used to power Maglev is derived from coal, carbon emissions from Maglev operation would be approximately 6,058.8 metric tons per year. Fuel reduction from diverted motor vehicle travel was estimated to reduce carbon emissions by 34,248.9 metric tons per year. Thus, the net reduction in carbon emissions for the corridor from Maglev operation is estimated to be approximately 28,190.1 metric tons of carbon per year in 2020. This reduction constitutes a positive effect for the reduction of greenhouse gas emissions from transportation within the alternative.

The Maryland Alternative could potentially be impacted by several different weather phenomena, including northeasters, blizzards, ice storms, and weakened tropical systems. All of these weather conditions have the potential to cause damage to the Maglev system's infrastructure or could impair the operations of the system. The impact to Maglev from these climatic events could be significant. However, the anticipated impact from this alternative on these climatic conditions is anticipated to be insignificant.

4.2.6 Nevada

Maglev energy consumption within the Nevada Alternative was estimated to be approximately 1,840 billion BTU per year in 2020. Carbon dioxide emissions were calculated assuming the current energy mix breakdown provided in the Energy section (45.5 percent coal, 35.3 percent natural gas, and 19.2 percent from hydroelectric and nuclear power). Thus, it is estimated that 836.8 billion BTU and 648.8 billion BTU are derived from coal and natural gas, respectively. The overall associated carbon emissions (using the corresponding carbon emissions coefficients) would be approximately 30,944.7 metric tons per year. Fuel reduction from diverted motor vehicle travel was estimated to reduce carbon emissions by 8,072.2 metric tons per year from reduced gasoline consumption, and 708.2 metric tons per year from reduced diesel consumption. The overall carbon emissions from reduced vehicle travel are approximately 8,780.4 metric tons per year. Thus, the net increase in carbon emissions for the corridor from Maglev operation is estimated to be approximately 22,164.3 metric tons of carbon per year in 2020. This increase constitutes a negative effect for the reduction of greenhouse gas emissions from transportation within the alternative.

The Nevada Alternative could experience extended periods with temperatures above the 38°C (100°F) mark as well as dramatic daily temperature changes. This could potentially cause slight distortion to the steel that comprises the guideway. Infrequent but torrential rain events can also affect this area that could cause localized severe erosion that could potentially damage the guideway support structures. Also in Nevada, sandstorms can severely limit visibility during the duration of the storm. This could potentially interrupt Maglev service along this corridor. Layers of accumulated dust on Maglev system equipment may need to be routinely removed to avoid compromising the efficiency of the system. The impact to Maglev from these climate events could be significant. However, the anticipated impact from this alternative on these climatic conditions is anticipated to be insignificant.

4.2.7 Pennsylvania

Maglev energy consumption within the Pennsylvania Alternative was estimated to be approximately 376 billion BTU per year in 2020. Assuming that all energy used to power Maglev is derived from coal, carbon emissions from Maglev operation would be approximately 9,685.76 metric tons per year. Fuel reduction from diverted motor vehicle travel was estimated to reduce carbon emissions by 132,623.13 metric tons per year. Thus, the net reduction in carbon emissions for the corridor from Maglev operation is estimated to be approximately 122,937.37 metric tons of carbon per year in 2020. This reduction constitutes a positive effect for the reduction of greenhouse gas emissions from transportation within the alternative.

The Pennsylvania Alternative could potentially be impacted by several different weather phenomena, including northeasters, blizzards, and ice storms and tornados to a lesser degree. All of these weather conditions have the potential to cause damage to the Maglev system's infrastructure or could impair the operation of the system. The impact to Maglev from these climatic events could be significant. However, the anticipated impact from this alternative on these climatic conditions is anticipated to be insignificant.

4.2.8 Mitigation

The alternatives do not have a direct impact on climate, thus mitigation is not required. For Maglev Alternatives that would increase greenhouse gas emissions, policies can be developed to divert trips from other more polluting modes of transportation to the Maglev system as mitigation. However, it should be noted that climatic conditions in each of the alternatives could adversely impact Maglev operation. In order to avoid and/or minimize the potential impacts that could result from these weather phenomena, Maglev engineers should design the proposed system to withstand the climatic forces that are associated with the selected location. It is impossible to completely avoid potential climatic impacts as each area of the country is affected by different weather phenomena. However, constructing the planned system in an area that is least prone to severe weather conditions can substantially minimize impacts.

4.2.9 No-Action Alternative

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be constructed. Therefore, there would be no impacts on the climate directly from a Maglev system. However, it is important to consider potential impacts from the No-Action Alternative that could arise from precluding the Maglev Deployment Program and the potential benefits of constructing a Maglev system.

Travel by motor vehicle is expected to be significantly higher under the No-Action Alternative, than that under any of the Maglev Alternatives, promoting faster road infrastructure expansion. The increase in motor vehicle travel could result in increased greenhouse gas (CO_2) production thus contributing to potential climate change. Thus, the significance of the climate impacts associated with the No-Action Alternative need to be examined on a local and regional basis.

4.3 NATURAL ECOSYSTEM AND WETLANDS

This section addresses the potential effects of the implementation of the seven Maglev Alternatives and the No-Action Alternative on natural ecosystems and wetlands. The potential effects presented here include only those related to the Maglev guideway, and do not cover effects of electrical and passenger stations, and maintenance locations, since their design has not been finalized at this stage of the project. Potential effects from project implementation (and their significance) on habitat, vegetation, wildlife, and wetland resources are identified. Key potential impacts that may have large influences on the function of the local ecosystem and on natural habitats and species may include: direct effects of habitat loss; degradation in habitat quality through fragmentation and introduction of exotic species; impacts resulting from alteration of hydrologic conditions, runoff patterns, and water quality; effects on habitat management policies; potential for collisions and impacts with – and their effects on –bird populations; potential for injury to aquatic and terrestrial organisms during construction or operation; and effects of extremely-low-frequency radio waves and electromagnetic fields on wildlife.

4.3.1 ELF and EMF Effects on Wildlife

As in the case of all electrical machinery, Maglev emits radio waves (ELF in particular, for Maglev) and produces electromagnetic fields. Little is known about the effects of ELF radio waves and EMF on wildlife because they have not been studied in great detail. The following is a summary of current knowledge and understanding on the subject. Most research on wildlife has focused on possible alterations in foraging and migration patterns, and, although there are a limited number of studies, no effects attributable to electric and magnetic fields have been found. Some research on ongoing exposures to EMF from a 76-Hz communications system in the mid-western U.S. have reported no adverse impacts on wildlife, such as homing behavior of small birds and animals, metabolism of small birds, and the population size of birds and deer. In addition to studies in the wild, studies of domestic livestock and laboratory animals with regards to EMF impacts from power lines reported no adverse health, behavior, or other performance degradation for horses, sheep, swine, and dairy and beef cattle. Studies on impacts to the reproductive capacity of mammals to 60-Hz EMF have thus far indicated no adverse impacts. There are no regulatory standards at this time for EMF impacts on wildlife. Based on the available literature, there is likely to be no significant adverse impact on wildlife due to EMF. For a more detailed understanding of Maglev ELF radio waves and EMF, see the Public Safety and Health sections of this PEIS.

4.3.2 California

The California Maglev Alternative is composed for the most part of developed areas that do not provide supportive habitats. These developed areas have few valuable ecological resources. Hence, there would not be a significant adverse impact to the ecological resources present in the developed areas of the corridor. The alternative lies south of the California Walnut Woodland vegetation community shown on the California Natural Diversity Database, and is separated from the vegetation community by residential and industrial areas. Thus, there is no potential for a significant adverse impact to the California Walnut Woodland habitat.

Any impact to a wetland or listed species is considered significant by the environmental resource agencies with purview (i.e., U.S. COE, U.S. FWS, and California Department of Fish and Game, etc.). At the crossing of the Santa Ana and San Gabriel Rivers, there is a potential to affect wetland habitat. The wide spacing of the footings and support structure would not diminish the functionality of the river as a wildlife corridor. The small amount of surface area needed for footings should have minimal impact on the habitat. A detailed survey of resources within the river-crossing area has not yet been completed to determine if there are any specific vegetation communities that would need to be avoided. There would not be a significant adverse impact to the Santa Ana and San Gabriel River habitats from deployment of the Maglev Program.

The potentially affected wetlands area within the alternative ranges from 0.07 ha (0.17 ac) to 0.61 ha (1.51 ac), which represents the wetlands potentially impacted by the crossings of the Santa Ana and San Gabriel Rivers. The wetlands-disturbance area would range between 0.05 ha (0.12 ac) and 0.4 ha (1 ac) within the Santa Ana River crossing, and between 0.02 ha (0.05 ac) and 0.21 ha (0.52 ac) within the San Gabriel River crossing. The maximum values represent the total wetlands area within the crossings, whereas the minimum values are estimates based on preliminary design considerations of the actual footprint of the proposed Maglev structure. Due to the small amount of wetlands area affected by the guideway, there would not be a significant impact to wetland resources within the alternative.

Based on preliminary design, it is concluded that there would not be a significant adverse impact to natural ecosystems and wetlands within the alternative.

4.3.3 Florida

Based on preliminary design considerations, and assuming a 30.5 m (100 ft) wide right-of-way footprint for the proposed guideway, the Florida Alternative would cross approximately 21.5 ha (53 ac) to 32.8 ha (81 ac) of relatively-undisturbed natural upland habitat in the Titusville area, 23.9 ha (59 ac) to 32.4 ha (80 ac) of estuary, and 7.3 ha (18 ac) to 15.4 ha (38 ac) of wetlands. Because the alternative crosses these large areas of habitat, there is a potential for a significant impact from habitat loss and fragmentation. Impacts will be much smaller within the developed areas of the alternative if the guideway follows existing transportation corridors. Significant impacts would be most probable in the northwestern section of the alternative that traverses a portion of the Merritt Island National Wildlife Refuge, which contains critical habitat for several Federal- and State-listed threatened and endangered species. The alternative selected may cross areas of largely undisturbed habitat on NASA property in the Merritt Island National Wildlife Refuge, impacting approximately 20.2 ha (50 ac) of this area, and resulting in some habitat loss and fragmentation. The Florida Alternative may cross areas of largely undisturbed habitat on NASA property in the Merritt Island National Wildlife Refuge, impacting approximately 20.2 ha (50 ac) of this area, resulting in some habitat loss and fragmentation. In addition, the Florida Fish and Wildlife Conservation Commission states that the alternative would cross areas of the Enchanted Forest Conservation and Recreational Lands (CARL) Project, the Scrub Jay Refuge CARL Project, the Banana River Aquatic Preserve, the Indian River Lagoon, and other sensitive habitats, also resulting in habitat loss and fragmentation. This loss of habitat and habitat fragmentation could have an adverse impact on avian species. In addition, some species are dependant on fire for habitat enhancement. The presence of Maglev may preclude these prescribed habitat burns or the Maglev guideway could be damaged from these burns. Thus, species that are dependant on fire for habitat enhancement may be adversely impacted from the presence of Maglev. Since the alternative crosses large areas of critical and undisturbed habitat, it is concluded that the Maglev system could have a significant adverse impact on the ecological resources of the alternative. Furthermore, the Florida Fish and Wildlife Conservation Commission has expressed concern over the potential extensive environmental impacts associated with the Florida Alternative and recommends against implementation.

The potentially impacted wetlands area within the alternative may be reduced through the use of mitigation strategies and design techniques in the final system-design stage. For example, use of trestles, bridges, and elevated guideways will reduce the impacted area significantly. If these and other minimization techniques were utilized, the potential environmental consequences to the estuaries and wetlands, in terms of habitat loss, runoff generation, and hydrologic functioning, would be low. Potential impacts on water quality would also be low if stormwater management and best management practices are implemented during construction. Based on the assumption that elevated guideways be used in all wetlands and water crossings, that the distance between trestles would be 21.3 m (70 ft), and that the footprint of each trestle would be 46.5 m^2 (500 ft^2) (15.2 x 3.0 m) (50 x 10 ft), the wetland-area impacts between Titusville and Port Canaveral would range from 2.2 ha (5.4 ac) to 3.4 ha (8.4 ac). The footprint of the proposed Maglev structure is expected to be much smaller than the total area of the alternative. The total wetland area for a 30.5 m (100 ft) wide right-of-way footprint ranges from 31.3 ha (77.3 ac) to 47.8 ha (118.1 ac). The maximum potentially affected wetlands area within the 1,219.2 m (3,998 ft) -wide corridor ranges from 1,586 ha (3,919 ac) to 2,306.6 ha (5,699.6 ac). These estimates were derived using data from the U.S. FWS NWI maps. It should be noted that the affected wetlands could include approximately 1 ha (2.5 ac) of ecologically valuable seagrass beds in the productive Banana River. The impacts due to habitat loss could be significant on the local level and also on a regional level. Depending on the final guideway and system design, there could be a significant adverse impact to the wetland resources of the alternative, as a result of the concerns described above.

The Florida Alternative is comprised by a wide variety of unique ecological resources (vegetation, wildlife, and wetlands), some of which are of State and Federal importance. The overall impact to the ecosystems in the region will be greatly determined by the final system design and guideway selection. Given the abundance of natural habitat, estuaries, and wetlands within the alternative, there is a potential for a significant adverse impact to these natural ecosystems from Maglev implementation and operation.

4.3.4 Georgia

Approximately 12 percent of the land directly impacted within the Georgia Alternative would be characterized as park, water body, or open space (refer to the section on Land Use in this PEIS). Operation and maintenance of the right-of-way would include tree trimming and mowing; excessive vegetation would be removed from the permanent right-of-way by means of mechanical equipment so as to maintain a low vegetative cover, and trees would be permanently trimmed to a height just below the clearance envelope of the Maglev vehicle. The combined creation of new rights-of-way adjacent to an existing right-of-way may exacerbate impacts.

The alternative is comprised of many existing rights-of-way that have promoted forest fragmentation due to pre-existing disturbance. Compared with roadway projects, effects are minimal since the habitat may still be available for some wildlife utilization, if the guideway is elevated. Clearing of the right-of-way vegetation may reduce cover, nesting, and foraging habitat for some wildlife, which would result in temporary and permanent alteration of wildlife habitat. During construction, the more mobile species would be temporarily displaced from the right-of-way and would return to the area soon after construction is complete. Habitat for less-mobile species such as small mammals, reptiles, and amphibians, as well as bird nests located within the right-of-way could be destroyed. Similar effects, although much less extensive, could result from routine vegetation maintenance of the right-of-way. The overall potential impact on habitat and vegetation and wildlife resources is not considered to be significant since the alternative is highly developed; other regional projects (e.g., highways and private development) have a larger footprint on the environment than the proposed alternative; a major portion of the alternative is located along existing rights-of-way that have caused habitat fragmentation; and because the elevated design, if used, does not preclude the existence and success of flora and fauna in the right-of-way.

The Georgia Alternative encompasses 106 ha (261.9 ac) of wetlands. Of those 106 ha (261.9 ac) of wetlands, 11.9 ha (29.4 ac) are classified as forested wetlands and 94 ha (232.3 ac) are classified as non-forested wetlands. Wetland impacts from the Maglev system were calculated based on a permanent right-of-way ranging from 15 m (49 ft) to 30 m (98 ft). The total wetland area impacted would range between approximately 2 ha (5 ac) and 4 ha (10 ac). Disturbance of wetlands may negatively affect their capacity to control erosion and floods. Permanent impacts from substructure footprints would vary according to specific pier placement. Typical pier spacing is 31 m (102 ft), but longer spans are possible using more expensive structures. Non-forested wetlands include palustrine unconsolidated bottom wetlands, palustrine scrub-shrub wetlands, palustrine emergent wetlands, lacustrine wetlands, and riverine wetlands types. Approximately 1.9 ha (4.7 ac) of non-forested-wetland habitat may be impacted. The majority of this area is classified as riverine wetland, followed by palustrine unconsolidated bottom wetland, palustrine emergent wetland, and lacustrine wetland. Impact on these wetlands would be minor and short-term since they would be allowed to revert back to the pre-construction conditions. Approximately 0.1 ha (0.2 ac) of forested wetland may be impacted within the permanent right-of-way of the proposed alternative. Since forest vegetation would be permanently cleared to maintain these areas, impacts would be long term. However, emergent and scrub-shrub wetland communities may replace forest vegetation. Given the total wetland area potentially affected by the Maglev system, the overall impact to wetland resources within the alternative would not be a significant adverse impact.

Implementation and operation of the Maglev system would have some effects on habitat and wetlands within the alternative. However, based on preliminary design and the estimated ecological value and area of the affected resources, there would not be a significant adverse impact to natural ecosystems and wetlands within the alternative.

4.3.5 Louisiana

The island-like areas of pine savannas within the Louisiana Alternative are comprised of plant communities of local importance, which are sensitive to physical changes and changes in the water regimes that support their development and vitality. While removal of whole plant communities from the natural ecosystem is highly unlikely, there would be patches taken out of some community systems for Maglev-guideway construction and maintenance purposes. The impact on these communities will depend on the magnitude of the disturbance. Given the local importance and sensitivity of these plant communities, there is a potential for a significant adverse impact to these habitats. The State of Louisiana Department of Wildlife & Fisheries has indicated that there is a potential for adverse impact to the habitat of protected bird species within the alternative. Both the north and south shores of Lake Pontchartrain provide nesting sites for bald eagle and osprey that could be adversely impacted by implementation of the Maglev system. The National Marine Fisheries Service (NMFS) has indicated that there is potential for direct cumulative impacts of project implementation on Essential Fish Habitat (EFH) and other marine fishery resources in the alternative. Because this transportation project is located within an area identified as EFH, provisions of the Magnuson-Stevens Act require consultation with the NMFS regarding potential impacts to EFH.

Based on preliminary planning design, the right-of-way affected by placing the proposed elevated guideway across the marsh and swamp will be approximately 11 m (36 ft) wide with the actual structures (piers) physically occupying considerably less ground. It is estimated that of the total amount of wetlands in the northwestern portion of the alternative (approximately 69,917 ha (172,765 ac)), the guideway will occupy between 3.9 ha (9.6 ac) and 4.3 ha (10.6 ac) of the wetlands area in that section. Of the total amount of wetlands in the southwestern portion of the alternative (approximately 94,710 ha (234,028 ac)), the guideway will affect between 6.2 ha (15.3 ac) and 10.4 ha (25.7 ac) of the wetlands area in that section. The NMFS has also indicated that the project could have a significant and adverse impact on the wetland resources. The maximum potentially affected wetlands area within the alternative was calculated assuming a 30.5 m (100 ft) wide right-of-way footprint for the proposed guideway, and was estimated to be approximately 42 ha (103.8 ac).

There is a potential for impact to the general ecology of the La Branche Wetlands, potentially affecting the La Branche Wetlands Restoration Plan of the NMFS and Louisiana Department of Natural Resources, west of the New Orleans International Airport (NOIA). However, Lake Pontchartrain has a surface area of approximately 1,637 sq km (632 sq mi), and the right-of-way involvement in the lake would be of approximately 0.4 sq km (0.16 sq mi) of the lake surface area (about the same total surface area as is presently occupied by one of the two lane traffic roadway structures of the Lake Pontchartrain Causeway). The Louisiana Maglev Alternative traverses previously-disrupted wetland areas affected primarily by the intrusion of waters from Lake Pontchartrain penetrating into the La Branche wetlands, minimizing the impact of the project on the wetland resources of the alternative. In addition, with the planned elevated open structure of the Maglev guideway, the hydrology (sub-surface and surface flows) of the wetlands and Lake Pontchartrain would be left intact. The elevation of the guideway and minimum disturbance to the wetlands and Lake Pontchartrain reduces the probability of effects and compromise to the quality or functional values of the wetlands and the lake. The pier structures would fill portions of the wetlands and lake bottom, while construction will likely cause both permanent and temporary disruption within the 11 m (36 ft) width of the construction.

The small fraction of wetland area affected in the alternative under the proposed guideway design indicates that there is little potential for a significant adverse impact to wetland resources within the alternative. However, the maximum potential wetlands area affected is much more significant, and the actual impacts will be determined by the chosen design. Furthermore, the State of Louisiana Department of Wildlife & Fisheries has indicated that significant adverse impacts to wetlands located on both the north and south shores of Lake Pontchartrain are very likely, and that the method of construction will greatly determine the amount of direct and indirect impacts to these sensitive wetlands. Thus, the implementation of the Maglev Program could have a significant adverse impact on the wetlands of the alternative.

Based on the issues of concern raised by State agencies, and the sensitivity and magnitude of the potentially-affected areas, there is a potential for a significant adverse impact to natural ecosystems and wetlands resource within the alternative.

4.3.6 Maryland

The areas of the Maryland Alternative are comprised of developed areas, small woodland tracts, agricultural or pasture fields, and forested wetlands adjacent to streams and provide habitat for generalist species. Generalist species are more tolerant to disturbances such as the ones that could occur from implementation of the proposed alternative. The open space between the ground and the Maglev guideway may be restored to a combination of grassland, woodland, or agricultural land, based on the former and surrounding land use and the maintenance requirements of the structure. It is anticipated that these restoration measures will provide suitable habitat for generalist species. Therefore, in those areas suitable for generalist-species habitat, insignificant permanent or direct impacts are anticipated.

The Patuxent Wildlife Research Center (PWRC) and the Beltsville Agricultural Research Center (BARC) are comprised of large tracts of forest that provide habitat for specialized species. Based on a 183 m (600 ft) buffer corridor, it is estimated that the project would potentially cross between 99 ha (245 ac) and 132 ha (326 ac) of Sensitive Species Project Review Areas within these two large natural resources. The National Capital Planning Commission (NCPC) considers the PWRC a “highly valuable federal wildlife reserve.” Given the unique characteristic of these habitats and the areas potentially affected, there is a potential for a significant adverse impact to the ecological resources of the PWRC and the BARC.

Potential impacts to National Wetlands Inventory (NWI) and Department of Natural Resources (DNR) wetlands were identified using a 31 m (102 ft) wide corridor. A 183 m (600 ft) wide corridor was used to identify potential impacts to Wetlands of Special State Concern (WSSC). The larger study corridor was used to provide additional protective buffering for this sensitive habitat. Linear stream crossings, as well as palustrine forested or palustrine shrub/shrub wetland crossings, will result from the guideway. A distinction concerning the quality of wetlands shall be reserved for design-level analysis. All mapped wetlands are considered to be of equal quality until such time as functional assessments are appropriate, and only wetlands with the special designation of Wetlands of Special State Concern have an inherent distinction of exceptional quality. Based on a preliminary-planning design, and using Maryland DNR data, it is estimated that there would be between 31 and 85 wetland crossings within the alternative, accounting for a total potentially-affected-wetlands area ranging between 10 ha (25 ac) and 25 ha (62 ac). There could also be up to 11 crossings of WSSC, accounting for up to 28 ha (69 ac) of potentially impacted WSSC area. The actual impacted wetlands area in the alternative could be reduced from that estimated for the maximum impacts case described above, by the use of mitigation strategies and design techniques in the final system-design stage. Depending on final system design and guideway selection there could be a potential for a significant adverse impact to the wetland resources within the alternative.

Given the large areas of sensitive ecological resources, such as the PWRC and BARC, and wetlands potentially affected by the implementation of the proposed alternative, the

Maglev system has the potential to impose significant adverse impacts on the natural ecosystems and wetlands of the alternative.

4.3.7 Nevada

Outside of urban areas, development of the guideway would affect an area 49 km (30 mi) long and 12 m (39 ft) wide, resulting in disturbance or loss of approximately 59 ha (146 ac). If all proposed construction located outside of urban Las Vegas occurs within previously-undisturbed desert, approximately 58.75 ha (145 ac) of Mojave Desert habitat would be lost, and the plants and some of the animals within these areas would be destroyed during construction, including a small number of individuals considered sensitive or protected. The project will not impact wetlands or mesquite bosques, but will have some impacts on the Mojave Desert habitat. The Toiyabe Chapter of the Sierra Club stated that the Mojave Desert is a relatively undisturbed and healthy desert, with important ecological value for species such as the desert tortoise. Although the area of desert impacted by the project is expected to be small relative to the available habitat in the region, impacts must be considered not only in their own merit, but also as part of an accumulation of impacts from this and other projects. The majority of the plant and animal species likely to be destroyed or injured incidental to the project are widespread and common in the region. The sensitive animal species potentially found near the project area include the desert tortoise, the banded Gila monster and other reptiles, and other animals about which there is little scientific information. Although it is expected that their presence in the alternative region is infrequent, current gaps of information about their ranges and movement, and mating and foraging behavior need to be addressed before a final determination of impact is made. The sensitive plants potentially impacted are often species thought to be associated with particular soil types found infrequently and dispersed throughout the region, making surveys to assess the true status of these species difficult. However, based on currently available species information and on the preliminary planning information from the Nevada Alternative, it is expected that there would be a moderate adverse impact to the plant and animal species.

The abundance of plants and animals in this area is naturally low and has been reduced further by the presence of the adjacent interstate highways. The potential loss of a few small populations of a few uncommon plant species should be minimized if possible, but likely would not jeopardize the integrity of the ecosystem. The lack of migrating or dispersing large animals in this region indicates that there would not be a significant impact on habitat fragmentation. Based on the unlikely effects to vegetation and wildlife, and the species relative abundance in the region, there would be minor adverse impacts to the corridor vegetation and wildlife resources, and ecological processes and functions within the alternative.

No wetlands, as defined by either the State of Nevada or the Federal government, would be affected by construction and operation of the project within the alternative. Washes that may be classified as waters of the U.S. by the Army Corps of Engineers would likely be affected by this project. The corridor for the guideway may be up to 12 m (39 ft) wide over the washes described above; therefore approximately 0.45 ha (1.1 ac) of waters of the U.S. may be impacted. However, until the project design is completed and a formal delineation of waters of the U.S. is conducted, the degree or amount of impact cannot be determined. Still, because most of the guideway is downstream of Interstate 15, the flow of many of the washes to be crossed has already been channeled or otherwise altered. There would not be a significant adverse impact to the wetland resources within the alternative.

The alternative crosses a widespread and relatively undisturbed and healthy desert with important ecological value for some species. There are no wetlands in the alternative. Based on preliminary planning information, it is expected that there would be minor to moderate adverse impacts to natural ecosystems from implementation of this alternative.

4.3.8 Pennsylvania

Forest and urban land are the most common land-use types in the western portion of the corridor from the Pittsburgh International Airport to downtown Pittsburgh. The midsection of the alternative is comprised mostly of urban land and barren land (i.e., land in transition), and constitutes the most developed area of the alternative. The eastern section of the alternative is comprised of equivalent areas of urban land and forestlands. The area of impacted forestlands ranges between 84.5 ha (208.8 ac) and 234.1 ha (578.5 ac). The area of rangeland potentially affected ranges from 0.6 ha (1.5 ac) to 33.8 ha (83.5 ac), whereas the area of open water potentially is between 0.1 ha (0.2 ac) and 130.4 ha (322.2 ac).

Impacts to wildlife habitat have the potential to be greater in the forested and open areas of the eastern section of the alternative, and prior to final design a habitat evaluation would be conducted to determine more specific impacts to the ecology of the alternative. Forestland within the proposed alternative will be cut for project construction and operation. Herbaceous and shrub and brush habitat communities will be disturbed during construction, as well. However, where access is not required to the guideway, these communities could be re-planted with indigenous species and allowed to become re-established, thus minimizing impacts to wildlife habitat. Estimates of areas potentially impacted by the project were developed based on preliminary design planning. If elevated design were used for the guideway, wildlife movement would not be restricted. If portions of the Maglev system are designed at grade, potential restriction of wildlife movement will be addressed prior to final design. The United States Department of the Interior Fish and Wildlife Service has indicated that the mobility of some small or noise-sensitive species may be affected by the project operation, even with the use of the elevated design. Since the proposed guideway would be parallel to existing transportation corridors through mostly urbanized areas, the impacts to the overall ecological system are not expected to be significant. Thus, moderate negative impacts to habitat and some wildlife species could result from project implementation.

Permanent loss to wetlands will occur from the placement of the columns directly in the wetland area. Significant impacts could be minimized through project design, by placing the piers at different spans, allowing for most of the isolated wetlands to be left undisturbed. Wetland impacts were assessed using GIS to determine total wetland size, vegetative type, and the extent of wetland within the alternative. If the alternative dissects a wetland, only that portion within the alternative was considered an impact. During the final design phase, actual wetland impacts will be based on the wetland area within the alternative's construction limits. Most impacts would occur to forested wetlands, in both the number of individual wetlands and the total area, while emergent wetlands would be the least impacted, with the exception of one unconsolidated bottom wetland. In the western section of the alternative, between the airport and downtown Pittsburgh, there is a potential for impact to unconsolidated bottom, emergent, scrub/shrub, and forested wetlands. Utilizing secondary source data, no wetlands were identified within these alternatives. In the eastern section of the alternative, there is a potential for impact to scrub/shrub, forested, and palustrine wetlands. Based on preliminary planning, it is estimated that the total area of potentially impacted wetlands would be approximately 4.9 ha (12.1 ac). This estimate assures a very wide corridor of 183 m (600 ft). This corridor is substantially wider than the corridor of 31 m (102 ft) used for the other alternatives. Given the small area of potentially affected wetlands, no significant adverse impacts to wetland resources are anticipated.

Project implementation and operation would have some minor negative effects on habitat, wildlife, and wetlands within the alternative. However, based on the areas affected and their ecological value, there would not be a significant adverse impact to natural ecosystems and wetlands in the alternative.

4.3.9 Mitigation

Mitigation plans could be implemented as a strategy for avoiding and minimizing the potential impact of the deployment of the Maglev Program on natural ecosystems. Avoidance of adverse impacts through project selection and design is the preferred method to protect ecological resources. Where impacts cannot be avoided, minimization strategies should be developed and implemented, to protect the functions and health of ecological systems. Impacts on ecological systems that cannot be avoided or minimized should be addressed through restoration and compensation strategies that could help in the reestablishment of those ecological functions lost from the imposed disturbance. Once one or more alternatives are advanced to the detailed-design phase, consultation and coordination with Federal, State, and Local natural-resource agencies would be continued to ensure that impacts to natural ecosystems are avoided, minimized, or mitigated. Consultation with these agencies would be an integral part of the decision making process concerning the selection of a Maglev guideway, based on environmental constraints. The collaboration with these agencies will be critical to avoid and minimize disruption to sensitive ecosystems.

As an example, mitigation plans to compensate for the loss of baseline habitat in terms of habitat units (HUs) could be adopted. HU mitigation values would be developed for each land-use/land-cover type affected. The mitigation site would be of the same type (in-kind mitigation) and preferably adjacent to (on-site mitigation) the habitat which will be lost as a result of the action. Other considerations include any significant construction constraints, surrounding land-use compatibility, and availability of the property.

Potential mitigation strategies to minimize impacts on natural habitats and species could include adjustment of the guideway to better follow the outer edges of habitats, refuge boundary, or other disturbed areas such as roads and ditches. Efforts will be made to minimize dissection of contiguous forest habitats in order to protect forest-interior-dwelling species (FIDS) and minimize the creation of edge effect that allows introduction of invasive plant species. To this end, disruption to forest cover during construction could be mitigated by reforestation and specialized plantings at forest edges. Mitigation strategies for impacts on wildlife may include selection of project-design parameters to avoid, reduce, and minimize impacts on habitat fragmentation and animal-movement patterns to the extent practicable, and restoration and enhancement of forested habitats (wetland and upland) through timely restoration and annual monitoring of habitats.

Wetland impacts of the Maglev Deployment Program would be addressed by the implementation of mitigation strategies. Where impacts are anticipated, consultation with the U.S. COE, U.S. FWS, and other Federal, State, and Local agencies should be conducted. The primary strategy for reducing wetland impacts is through avoidance and minimization, including the maximization of the use of pre-existing transportation and utility corridors to avoid or minimize new impacts, and to concentrate impacts on previously disturbed, low-quality wetland habitat areas. Additional mitigation strategies could include the enhancement or creation of like wetland habitat at the impacted site, enhancement or creation of like habitat at a similar site in another area, or restoration of the affected wetland habitat. Offsite mitigation can include financial contributions to existing or planned wetland mitigation banks. A review process, involving all relevant agencies, would be completed before project deployment to determine the best combination of mitigation measures.

Compensatory mitigation is the process used by federal and state agencies for determining whether development on wetlands is justifiable and if so, under what conditions. If it is established that there is an unavoidable need to impact wetlands, then the process attempts to minimize the extent of the impact and sets up requirements to compensate for wetland losses. Restoration of a historic wetland area that has been converted to non-wetland is typically considered the most promising approach. Other forms of compensatory mitigation include creating wetlands from uplands, enhancement of degraded wetlands, purchase credits in a mitigation bank, and preservation of ecologically unique, -rare, or -valuable wetlands.

The replacement wetlands should be of the same type of wetland and include the minimum area to provide the same functions and values, which will be lost as a result of the action (in-kind mitigation). In-kind mitigation “reflects hydrological, structural, and functional equivalency of the lost wetland community” (EPA, 1994). If the reestablishment of wetland system functions cannot be met or exceeded, the replacement ratio requirements will be greater. Ideally, the replacement site should be located immediately adjacent to the wetland impacted (on-site mitigation). If this is not practicable or feasible, then the replacement area should be located along or adjacent to the waterbody that is part of the wetland system being impacted. The second-most-preferred on-site replacement area would be located within the same watershed, but not adjacent to the wetland lost. Only under extreme circumstances can a wetland replacement site be located in a watershed other than where the loss has occurred.

The final design of a Maglev system may provide the opportunity to further reduce the wetland impacts of the project. The use of bridging and elevated guideways could also be an effective option for minimizing wetland and water-body impacts. Use of vertical wall construction in place of side-sloped fill could also reduce impacts, and adequate bridges and culverts can prevent alteration of wetland hydrology.

4.3.10 No-Action Alternative

The No-Action Alternative consists of the non-deployment of the Maglev Program. It is important to consider potential effects from the No-Action Alternative that could arise from precluding the provision of transportation and other related benefits from the Maglev Deployment Program.

Under the No-Action Alternative, travel by motor vehicle is expected to be significantly higher than that under the Maglev Alternatives. The increase in motor-vehicle travel would result in a variety of transportation problems that may include, among others, increased congestion and road expansion. The construction of additional infrastructure for long-distance motor-vehicle travel could have considerable impacts to ecological resources (vegetation, wildlife, and wetlands) from habitat fragmentation and destruction, and wetlands contamination and loss. These impacts would need to be examined on a local and regional basis. These impacts could potentially be greater than those incurred under the construction alternative. In addition, increased motor-vehicle travel and congestion would have negative effects on air quality at the local, regional, and national level. The impairment of air quality would raise concerns over potential negative effects on ecological systems, including particulate deposition and acid-rain effects on vegetation and wetlands.

4.4 ENDANGERED SPECIES

The presence of threatened or endangered species cannot be identified without site-specific fieldwork. Because fieldwork to locate threatened and endangered species has not been accomplished for any of the alternatives, the impact to these species cannot be specifically verified at this planning stage. However, the likely presence of these species was identified in the Affected Environment section of this PEIS and the potential impact could be surmised from that information. This does not suggest that threatened or endangered species will be directly impacted if found in the alternative. The analysis only surmises, at this stage in the environmental review and planning process, the potential. After final design, mitigation, and fieldwork to verify habitat and presence of these resources, direct impact can be determined and mitigation plans considered.

The loss or alteration of suitable habitat could contribute to the decline of some species' populations. Because the distribution and abundance of threatened and endangered species are highly localized, any impact could affect the size or viability of these populations. Likely environmental impacts may include the following:

- Temporary to permanent displacement of threatened and endangered species from existing habitat.
- Habitat for threatened and endangered species may be temporarily or permanently modified or damaged.
- Finally, impacts may result in the incidental destruction of threatened and endangered species.

Because threatened or endangered species have been identified in the corridor, the potential of a significant adverse impact does exist. The actual location of endangered species has not been determined at this stage of the Maglev Deployment Program and specific impacts to threatened or endangered species cannot be identified.

4.4.1 California

Potential impact to some of the more significant threatened or endangered species have been identified. The western yellow-billed cuckoo, southern skullcap, and Brand's phacelia could be found along the San Gabriel River. The San Gabriel River is soft bottomed and is the only potential habitat for sensitive species in this portion of the alternative. The likelihood of the cuckoo or the two plant species being present is very low. The Santa Ana River woollystar, marsh sandwort, and slender-horned spineflower have been found in the Santa Ana River area, as well as the arroyo chub and the Santa Ana sucker. Riparian habitat, although not of great value here, is a critical concern downstream of this location.

4.4.2 Florida

Potential impact so some of the more significant threatened or endangered species have been identified. In the case of the Florida scrub jay (the species that potentially poses the greatest constraints for this alternative), the affected area is a complex mosaic of habitat types including true scrub and other types. The scrub jay may be restricted to nesting in the true scrub areas, but may require various portions of the other areas to provide a sufficient forage range and buffer zone for survival. Thus, the loss of some true scrub acreage may represent a large degree of impact, whereas the loss of the same amount of secondary habitat may be less detrimental and more-easily mitigated. Quality of habitat and degree of management are also important considerations.

Estuarine waters serve as habitat for the West Indian manatee and other species. However, it is highly probable that the guideway would be elevated across all of these areas and the amount of actual habitat loss will be restricted to insignificant amounts required for the support structures. In this case, the potential for impacts to the manatee population may be more directly related to potential construction impacts such as boat collisions with manatees or to effects of accidents during operation. The former can be essentially eliminated with proper construction management and monitoring, utilizing guidelines developed by the Florida Fish and Wildlife Conservation Commission and Florida Department of Transportation. Operational accidents would have a remote probability of occurrence and a risk assessment can be best evaluated during detailed design.

Finally, impacts associated with a project of this type may be related more to the effects on individuals other than direct loss of habitat. In the case of the Florida scrub jay, these potential impacts may include mortality from bird impacts during operation, increases in mortality through increased predator efficiency due to increased perching areas along the guideway, and to changes in habitat due to operational limitations on habitat management. All of these potential issues have been raised for the Merritt Island National Wildlife Refuge during meetings with the U.S. FWS.

Potential mitigation strategies include seasonal timing of construction, use of habitat-management alternatives to fire in scrub and flatwoods habitats, and habitat restoration.

Another possible strategy would be to coordinate with applicable agencies such as U.S. FWS or Brevard County in cooperative efforts or contributions for habitat restoration or research factors affecting survival of key listed species in the region. Such options would be applicable as mitigation for unavoidable impacts.

4.4.3 Georgia

Potential impact to some of the more significant threatened or endangered species have been identified. Bachman's sparrow can be found in open fields with thick brushy undergrowth, re-generating clear cuts, and old-growth pine stands with an open understory. Some open fields were identified within the alternative that might provide suitable habitat for the Bachman's sparrow. The Maglev project could adversely impact the habitat of these plant species.

Suitable habitat for one federally listed, three stated-listed, and three plants of special concern was identified in the project area. The Maglev project could potentially impact the habitat of these plant species.

4.4.4 Louisiana

Potential impact to some of the more significant threatened or endangered species have been identified. The likely impact on the bald eagles within the Louisiana Alternative would be from human disturbance during construction and operation, and some habitat alteration. The bald eagle habitat of wetland, marsh, and swamp that could be influenced by the elevated guideway would be approximately 11 m (36 ft) in width with the actual structures (piers) physically occupying considerably less terrain.

Gulf sturgeons have been reported in the Lake Pontchartrain area of the Louisiana Alternative. The likely impact from the Maglev would be disturbance of the water bottoms in the Lake Pontchartrain basin.

The manatee has declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect these animals. The likely impact from the Maglev would be from encounters with construction watercraft and equipment.

4.4.5 Maryland

Potential impact to some of the more significant threatened or endangered species have been identified. A peregrine falcon nest site is known to exist in Baltimore City within close linear proximity of the proposed alignments. Because the nest site is located on a tall building, no direct effects are anticipated.

An occurrence of the glassy darter has been recorded in the Little Patuxent River in the immediate area of the proposed BW Parkway. This species is listed as state endangered.

Two plant species, included in the 'species of concern' list are noteworthy because correspondence from the MD DNR suggests that, even though they may not be directly affected, these species exist in the corridor. Swamp pink and giant cane have been known to occur near Stony Run, west of BWI Airport. Swamp pink is listed as state endangered and federally threatened. Giant cane is listed as state threatened.

The Leavenworth's sedge is known to exist along the northeastern portion of the PWRC. This species is currently listed as endangered extirpated status (in Maryland) but is expected to change to state endangered, according to the DNR. An 'endangered extirpated' species is one that was thought to no longer exist in Maryland but recent occurrences have been recorded. A general location of this population of Leavenworth's sedge was provided by DNR.

Two species, the bog fern and clammyweed are known to occur along Stony Creek, west of BWI Airport. The bog fern is listed as state threatened. The *status* of clammyweed is expected to change from state endangered extirpated to state endangered. These two populations are along Stony Run.

The short-fruited rush has been historically identified in the area. This species is listed as state endangered extirpated. This occurrence was described by the state as a species of concern. The species may or may not actually occur within the alternative.

4.4.6 Nevada

Potential impact to some of the more significant threatened or endangered species have been identified. Potential impacts to the desert tortoise from the proposed project would be minimal but could include death or injury of individual tortoises, loss of a small amount of desert tortoise habitat, and additional fragmentation of desert tortoise habitat. Because of the substantially reduced density of tortoises adjacent to Interstate 15, the likelihood of encountering, and then killing or injuring, a tortoise during construction and operation is extremely low. Based on the best available information on the design and footprint of the alignment and the facilities, approximately 65 ha (161 ac) of desert tortoise habitat would be permanently disturbed. If fencing is used, it could have an impact on the desert tortoise habitat. Fragmentation may occur if the security fencing blocks passage of the desert tortoise. Potential fencing types including chain link and strand barbwire do allow tortoise passage. The guideway also allows tortoise passage so fragmentation is unlikely. Additionally, because the alignment parallels Interstate 15, a structure effectively fragmenting the habitat in this area, the minimal fragmentation effect of the project is overwhelmed by that of the Interstate.

Potential impacts to the banded Gila monster include death or injury during construction, habitat loss, and habitat fragmentation. Because of the extremely low densities of this species in the area, the potential for death or injury are minimal. As with the desert tortoise, habitat-impact surveys would reveal that a very small proportion of the available habitat is being impacted, so impacts on this species would be negligible. However, as with the tortoise, habitat fragmentation could occur as a result of this project, but Interstate 15 already provides a substantial barrier to movement of this species.

Individuals or small populations of the Las Vegas bearpoppy may be impacted by construction of the alignments and the facilities, if they are present within the proposed project areas. Field surveys would have to be conducted to fully understand the potential impacts on this species.

Potential impacts to the two additional BLM Special-Status Species likely to occur in the area (rosy two tone beardtongue [*Penstemon bicolor* ssp. *roseus*] and white-margined beardtongue) would include the loss of small populations or individuals of these species.

The degree or likelihood of these impacts cannot be quantified until field surveys are conducted. Other species considered to be special-status species by the BLM may also be found in the area during these surveys.

Potential impacts on the banded gecko, desert iguana, California kingsnake, and the Mojave green rattlesnake, would likely include the death or injury of some individuals and a loss of a relatively small proportion of available habitat.

4.4.7 Pennsylvania

Potential impact to some of the more significant threatened or endangered species have been identified.

The Pennsylvania Alternative is within the range of the Indiana bat, a species that is federally listed as endangered. In addition, a winter hibernaculum for this species exists approximately 40 miles from the area. Land clearing, especially of forested areas, may adversely affect this species by killing, injuring, or harassing bats, and by removing or reducing the quality of summer foraging and roosting habitat. A detailed field study would be conducted if this alternative is selected to continue.

4.4.8 Mitigation

Mitigation measures could include design changes that would avoid, minimize, or reduce potential impacts to acceptable levels; rectifying impacts by restoring the affected environment; and compensation of resources. Mitigation measures would be tailored to the individual species and its habitat. A review could be conducted to determine the most appropriate mitigation measures. This review could include coordination with state and federal officials for comment and approval.

4.4.9 No-Action Alternative

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be constructed. Therefore, there would be no impacts on endangered species directly from a Maglev system. However, it is important to consider potential impacts from the No-Action Alternative that could arise from precluding the Maglev Deployment Program and the potential benefits of constructing a Maglev system.

Travel by motor vehicle and airplane is expected to be significantly higher under the No-Action Alternative than that under any of the Maglev Alternatives. The increase in motor-vehicle travel would result in a variety of transportation problems that may include, among others, increased congestion and road expansion. The construction of additional infrastructure for long-distance motor vehicle and air travel could have considerable impacts to endangered species from encroachment, habitat fragmentation and destruction, and wetlands contamination and loss, among other things. In addition, increased air travel and motor-vehicle travel and congestion would have negative effects on air quality at the local, regional, and national level. The impairment of air quality would raise concerns over potential negative effects on the ecological systems in which endangered species live, including particulate deposition and acid rain effects on vegetation and wetlands. These impacts would need to be examined on a local and regional basis. Based on the stated concerns, it is expected that the No-Action Alternative could have an impact on threatened and endangered species based on this growing scenario; the significance of the impacts need to be determined on an alternative specific basis, but are expected to range from insignificant to moderate.

4.5 WATER QUALITY

If constructed, the routine operation and maintenance of the Maglev system would comply with state and federal environmental regulations in an effort to mitigate impacts. Regulatory issues related to water quality may include:

- Increased runoff and its associated pollutants from impervious surfaces.
- Hazardous materials storage and hazardous waste disposal.
- Spill potential of oil and other petroleum products.
- Washrack water.
- Disposal of dredged or fill material in waters of the U.S., including wetlands.

Within each of the alternatives, the Maglev guideway will be elevated and the support structures will occupy a minimal amount of surface area; therefore, drainage patterns are expected remain the same. However, new drainage patterns could occur at O&M facilities due to the creation of impervious surface, having the potential to carry additional sediment to water resources. The number of O&M facilities constructed would be minimal. Therefore, there could be a potentially insignificant adverse impact to the water quality within each of the alternatives. Mitigation would comply with Federal, state, and local water quality regulations.

4.5.1 No-Action Alternative

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be constructed. Therefore, there would be no impacts on water quality directly from a Maglev system. However, it is important to consider potential impacts from the No-Action Alternative that could arise from precluding the Maglev Deployment Program and the potential benefits of constructing a Maglev system.

In the No-Action Alternative, congestion would continue and air emissions would increase. As the population increases, congestion will increase on already burdened highways and airports. Consequently, public concern could convince legislators to increase the size of highways or airports. This infrastructure development has the potential to increase impervious surfaces to a greater extent than development associated with Maglev implementation. Runoff from impervious surfaces is a regulatory issue related to water quality. Drainage patterns would also be impacted by potential new roadway construction. In addition, increased air travel and motor-vehicle travel and congestion would have negative effects on air quality at the local, regional, and national level. The impairment of air quality would raise concerns over potential negative effects on water quality derived from particulate deposition and acid rain effects. Therefore, the No-Action Alternative could have a potential moderate impact on water quality.

4.6 FLOOD HAZARD

Flooding occurs when a body of water overflows into the floodplains. The floodplains moderate the flood flow, contribute to human safety and act as areas for ground water recharge. Any structure that is built in the floodplain will displace water during a flood and result in elevated floodwaters. Impacts from Maglev are from the construction of structures within the floodplain.

The Maglev guideway will be constructed with support structure in the shape of a column. Each column requires surface area of land for stability. If the required column is located within the floodplain, the construction will fill in the space normally used by the floodwaters. In other words, the support structure would displace floodwaters and cause the floodplains to expand.

In addition to the guideway, the Maglev stations, O&M, and other support facilities if located in floodplains could have a similar impact. The required area for construction of the facilities could displace floodwater and cause expansion of the floodplain. In addition, the stations and facilities could also increase the amount of impervious surface. The addition of impervious surface to the floodplains could increase the elevation of the floodwaters and the expansion of the floodplains.

The specific impact to the floodplains cannot be determined until the locations and design of these structures are decided during final design. However, the relative potential impact can be estimated at this time based on the length of the floodplain crossed by the guideway for each alternative. It should be noted that this analysis is the worst-case scenario since the guideway is elevated with just the support columns affecting the floodplains. For each of the alternatives, the length of floodplain crossing of the guideway is estimated in Table 4.6-1 based on preliminary design estimates.

Mitigation could be implemented if loss of floodplain capacity were an expected result of constructing the Maglev system. Mitigation could include avoidance of the floodplains, creation of compensatory flood storage, installation of an on-site detention pond with timed release of stormwater, and a reduction of impervious surfaces. Specific mitigation needs cannot be identified for each alternative until final design and location of the Maglev system components is complete.

Table 4.6-1 - Floodplain Crossing Lengths

Alternative	Potential Length of Floodplain Crossing (km/mile)	% of Corridor Crossing Floodplain
California	0.5 – 1.5 km / 0.3 – 0.9 mi	0.4 – 1.1%
Florida	11 – 26 km / 7 – 16 mi	34 – 81%
Georgia	0.7 – 1.0 km / 0.4 – 0.6 mi	1.4 – 2.0%
Louisiana	16 – 28 km / 10 – 17 mi	21 – 36%
Maryland	7.0 – 8.0 km / 4.3 – 5.0 mi	11 – 13%
Nevada	4.0 – 5.0 km / 2.5 – 3.1 mi	6.0 – 7.5%
Pennsylvania	1.2 – 17.5 km / 0.7 – 10.9 mi	1.7 – 35%

Source: (CM, 2000); (FDOT, 2000); (ARC, 2000); (GNOEC, 2000); (MTA, 2000); (CNSSTC, 2000); (PAAC, 2000)

4.6.1 No-Action Alternative

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be constructed. Therefore, there would be no impacts on flood hazard directly from a Maglev system. However, it is important to consider potential impacts from the No-Action Alternative that could arise from precluding the Maglev Deployment Program and the potential benefits of constructing a Maglev system.

Under the No-Action Alternative, congestion would continue to increase on already burdened highways and airports. Consequently, public concern could convince legislators to increase the size of highways or airports. This infrastructure development/expansion has the potential to encroach on floodplains. Water displacement from structures in the floodplain and the addition of impervious surfaces, both cause increased floodplain elevation and expansion, potentially leading to more property damage. Therefore, the No-Action Alternative could have a potential impact on floodplains.

4.7 COASTAL ZONE MANAGEMENT

A requirement of the CZM Program is federal consistency. Federal consistency ensures that federal actions that are reasonably likely to affect the coastal zone be consistent with the policies of a coastal state's approved coastal management program (CMP). The objective is to ensure that federal agencies and projects using federal funds adequately consider and comply with state CMPs.

As part of the Maglev Deployment Project, each of the seven alternatives that was within a coastal zone district was evaluated for consistency with the state CMPs. The results of this CMP review showed that Florida, Louisiana and Maryland were the only projects in a coastal zone district and all three are expected to be in compliance with local programs (see Table 4.7-1). Therefore, there would be no significant adverse impact to the coastal zones for all of the alternatives.

Table 4.7-1 - Alternative Consistency with State CMPs

Alternative	Lies Within Coastal Zone District	Consistent With CMP
California	No	N/A
Florida	Yes	Yes
Georgia	No	N/A
Louisiana	Yes	Yes
Maryland	Yes	Yes
Nevada	No	N/A
Pennsylvania	No	N/A

Source: (CM, 2000); (FDOT, 2000); (ARC, 2000); (GNOEC, 2000); (MTA, 2000); (CNSSTC, 2000); (PAAC, 2000)

4.8 AIR QUALITY

This section discusses: 1) the methodology that is used to determine air pollution emissions that would occur from each of the seven action alternatives, and 2) the significance of the impacts from all the alternatives as related to the NAAQS. In any non-attainment area (NAA), an increase in total mass of a pollutant for which that area is in non-attainment is significant. Violations of the NAAQS or exacerbation of these standards is also significant.

Analysis is done on a microscale (local) or mesoscale (regional) basis. Carbon monoxide, lead, sulfur-oxides, and particulate matter emissions are important in a microscale analysis because of the localized effect. Other pollutants, such as oxides of nitrogen (NOx) and Volatile Organic Compounds (VOCs), are more important in a regional analysis because they are precursors to the secondary pollutant ozone. The location and source of the pollutant release must also be considered. For example, remote power plants are needed to supply the electric power for the Maglev trains. Because these emissions are, in effect, displaced from one location to another, pollutants such as sulfur oxides that are directly associated with power plants could also be important on a regional basis. As such, different methodologies are used to analyze the various criteria pollutants.

Emission factors are used for both microscale and mesoscale analysis. These factors estimate the emission rate per activity of the particular source. The emission factors are needed to evaluate the existing emissions and for future alternatives, including the No-Action Alternative. Common sources of these factors are the EPA-promulgated MOBILE computer program for motor vehicles' gaseous releases of NOx, VOCs, and CO, and PART5 for motor-vehicle particulate matter and SO_2 releases. The EPA listing of factors is in the document, "A Compilation of Air Pollutant Emission Factors," (commonly called AP-42) for many types of sources, and the Federal Aviation Administration Program EDMS for aircraft emission factors.

During microscale analysis at the project level, dispersion models are used to determine local-area concentrations. Microscale analysis should be done in areas where large indirect sources exist. These indirect sources are facilities that do not themselves emit, but attract sources that do emit. For the Maglev evaluation, these indirect sources would include Maglev stations and airports. Because, the location and design of Maglev stations, parking lots, and maintenance facilities have not been finalized, the site-specific traffic and facilities air emission impact cannot be identified at this planning stage. However, for the Maglev Program Alternatives considered in further detail, the microscale analysis will be completed.

A regional inventory is usually sufficient for project purposes. This allows for the evaluation of overall pollutant mass emitted and the determination as to which alternative would result in pollution decreases. It follows that if less is emitted, air quality should improve. The emission inventory may also be used during large-scale regional modeling. The methodology used for an emission inventory is generally to multiply the emission factors (emission mass release rate per activity) by the level of activity and sum for all sources. For example, motor-vehicle emission factors are generally in grams/mile and grams/hour of idle. By multiplying by the vehicle-miles traveled and the hours of idle the total emissions can be determined. It should be noted that emission factors are specific for each pollutant.

As alluded to previously, the location of the pollution release and the type of source must be carefully evaluated. Criteria pollutant emissions from Maglev trains in themselves are quite small. However, the power must be generated to propel the vehicles, overcome line loss during transmission, and overcome inefficiencies of the system. This is done by one or more power plants that may be removed from the actual project location, which means emission may occur away from the project area. However, these emissions will still be important for the regional air quality.

Power plants may be hydro-, nuclear, or wind powered; burn natural gas, fuel oil, or coal; or use other less conventional fuels or energies. This requires that power-plant types be determined to analyze the pollutant emissions due to power generation. Of course for hydro-, nuclear- and wind- turbine generated power, the release of criteria pollutants is negligible. For coal-fired and fuel-oil power plants, particulate matter, sulfur oxides, nitrogen oxides and carbon monoxide are all important. For natural gas powered plants, only nitrogen oxides are important.

In the troposphere – the layer surrounding the earth's surface –ground level ozone is an air pollutant that affects human health, vegetation, and many common materials; it is a key ingredient of urban smog. Ozone can be generated by passing oxygen or dry air through a high-energy electrical field, where a portion of the oxygen is converted into ozone. Ozone is produced from the generation of an electrical arc, through ionization of the atmosphere from high-energy electrical fields, as in the case of lightning strikes. The magnitude of the electrical field is directly related to the potential for ozone generation.

Electricity is used to generate the electromagnetic forces that levitate propel Maglev trains along a guideway. Thus, the potential for ozone generation from the electrical fields in the guideway was considered. The voltage used for the electrical supply and distribution system for the Maglev system is low compared to that necessary for the ionization of the atmosphere to generate ozone. In addition, potential ozone generation sources along the guideway were considered, including the propulsion systems located along the guideway – which use solid-state devices that do not generate ozone, and the low-speed power pick-up rails. Based on this analysis, FRA concluded that the implementation of the Maglev Deployment Program would not contribute to ozone generation, since the magnitude of the electrical fields produced by the potential sources of ozone generation in the guideway – or its associated subsystems – is not sufficient to promote the ionization of the atmosphere and thus generate ozone.

Implementation of the Maglev trains should result in a reduction of other transportation sources in the corridor. The other modes of transportation that the Maglev train will replace represent an emission benefit and should be considered. These modes could be conventional or light rail, aircraft, or motor vehicles. Light rail are generally electrified lines and could be directly compared to the Maglev system. Conventional diesel rail, aircraft, and motor vehicles emit particulate matter, sulfur oxides, nitrogen oxides, and carbon monoxide. Lead is usually negligible, and in the case of fuel use other than diesel, sulfur oxides may be low as well.

4.8.1 California

Dispersion modeling planning has not progressed to the point of the planning stage to perform a meaningful quantitative CO "hot spots" analysis. Accordingly, there is no comparison to the NAAQS or State standards for sources such as the commuter stations.

The emission benefits for displaced on-road vehicles have been calculated for a low- and high- ridership estimate. The forcast year 2020 was used for the analysis.

Regional power plants were considered for the power needed by the Maglev system. This power is stated to be supplied by power plants using 20.7 percent coal, 32.1 percent natural gas, 1.8 percent biomass and waste, and 45.4 percent by hydro, nuclear, geothermal, solar, or wind for the entire grid. It was not apparent which plants existed in the South Coast Air Basin. Emission factors for the emitting plants were derived from AP-42. Power consumption (discussed in the Energy section) was based on 249 train hours of operation per day and an added factor of 10 percent of train propulsion energy to account for train station consumption. The reported energy use based on these assumptions was 968,772,993 MJ (918,219.5 million BTU) per year. The net changes in emissions for the project are shown in Table 4.8-1.

Table 4.8-1 - California Net Changes in Emissions (tons/year)

	TOG	CO	NO_x	PM10
Vehicle travel reduction	-76.06	-1670.0	-336.1	-21.3
Maglev energy consumption	1.98	13.97	26.29	83.7
Net Change in Emissions	-74.03	-1656.03	-309.81	62.4

Source: (CM, 2000)

Based on this analysis, reductions occur for TOG (total organic gases, including precursors to O_3) and all criteria pollutants with the exception of particulate matter. While impacts for SO_2 are not reported, an increase is likely for this criteria pollutant. Given that the basin is in attainment for CO and NO_x, the reductions in emissions will provide an added benefit for the retention of that status. Additionally, since the area is a NAA for particulate matter, a conformity analysis will be required. However, 91 percent of the added PM10 emissions would be from coal burning power plants and SO_2 outside of the basin area. This would result in a net benefit or a reduction in the particulate matter emitted in the basin.

Mitigation strategies include reducing the particulate impact outside of the basin by using more power from "clean" power plants using hydro, nuclear, geothermal, and wind power. For the station areas, siting, design, and revisions of geometry potential means for reducing delays and better managing traffic flows.

4.8.2 Florida

An emission inventory was completed for the year 2020 for motor vehicles. Emission factors from MOBILE5b, PART5 and the EPA website (http://www.epa.gov/oms/ann-emit.htm) were used. Input parameters were consistent with the Florida Department of Environmental Protection values. The participant estimated that M2000 operation will result in a reduction in motor vehicle travel of 178,074 km (110,650 mi), which will result in a decrease in fuel consumption that will reduce highway traffic emissions (see Table 4.8-2) and energy consumption by approximately 1.24 billion BTU per year. The annual power consumption for the M2000 operation was calculated to be 34.03 billion BTU. This power is expected to be derived from a combination of fossil fuels and nuclear sources.

Overall, M2000 operation will result in an increase in energy consumption of 32.79 billion BTU annually. Hence, although there would be beneficial effects from reduced highway traffic emissions, the overall increase in energy consumption from Maglev operation could lead to negative effects on the air quality of the alternative, if the motor vehicle emission reductions are offset by the emissions generated to provide power for the M2000 operation. Thus, the net effect of M2000 operation on air quality will be largely dependent on the mix of energy sources used to meet the power consumption demand of Maglev operation. Since the corridor area is in compliance for all NAAQS, the attainment status should be reviewed for those criteria pollutants, if any, for which emissions increase with M2000 implementation.

Table 4.8-2 - Florida Motor Vehicle-Related Air Emissions in Metric Tons/Tons Per Year

	VOC	CO	NOx	SO_2	PM10
Metric Tons					
No-Action	32.7926	271.9552	39.5737	2.3076	1.7611
Action	32.6133	270.4686	39.3573	2.2950	1.7514
Net	-0.1793	-1.4866	-0.2164	-0.0126	-0.0097
Tons					
No-Action	36.1470	299.7743	43.6218	2.5437	1.9412
Action	35.9494	298.1356	43.3833	2.5298	1.9306
Net [1]	-0.1976	-1.6387	-0.2385	-0.0139	-0.0106

[1] A negative number represents an emissions reduction attributable to the project. Source: (FDOT, 2000)

4.8.3 Georgia

The cases analyzed in the Georgia EA include the existing case, the future No-Action (year 2005) and the future action case (year 2005). For the action option, 50 Maglev train trips per day were assumed with 4 trips in the peak hour. This results in a total of 18,250 trips per year. The power requirement for the project is reported to be 5.4 million BTU per year and is assumed to be supplied by a mix of power plants (25 percent nuclear or hydroelectric and 75 percent fossil fuels).

If the project is built, the reduction of vehicle miles traveled is predicted to be 180,498 km (112,089 mi) per day. Calculations of motor vehicle emissions reductions (in kg/hr and day) were developed with these original estimates of motor vehicle travel reduction. The increase in emissions was calculated based on the Maglev power requirements. The total net changes in emissions were calculated and are presented in Table 4.8-3.

Table 4.8-3 - Georgia Net Changes in Emissions Based on Maglev Project

Pollutant	2005 Emissions [c]		2025 Emissions [c]	
	kg/hr (lb/hr) [a]	kg/day (lb/day) [a]	kg/hr (lb/hr) [a]	kg/day (lb/day) [a]
VOC	-3.0 (-6.6)	-30 (-66)	-3.7 (-8.2)	-36.7 (-80.9)
CO	-47.0 (-103.6)	-466 (-1,027)	-89.0 (-196.2)	-885 (-1,951)
NO_x	4.4 (9.7)	71 (157)	7.4 (16.3)	108 (238)
SO_2	68 (150)	917 (2,022)	86.5 (190.7)	1,167 (2,573)
PM10	2.4 (5.3)	32 (71)	2.9 (6.4)	39.9 (88)

(a) All lb/hr and lb/day emission estimates are based on summertime emission rates for all pollutants except CO that is based on wintertime emission rates.

(b) Annual emission estimates are based on an average of winter and summer emission rates.

(c) Based on Georgia Power's projected source mix. Further reductions in power plant emissions could reduce or eliminate any net Project-related pollutant increases.

Source: (ARC, 2000)

The overall emission inventory shows a decrease in VOCs and CO, but an increase in NOx, SO_2, and PM10.

Emission factors used for motor vehicles were determined using the MOBILE5a and PART5 computer models. Transportation control measures used in the Georgia SIP were used as partial input during the development of these emission factors. Based on Georgia's sulfur fuel requirement, a correction factor was used in the PART5 model analysis of SO_2.

The conclusions of the analysis are an environmental benefit for CO and VOCs and an increase in NOx, PM10, and SO_2. However, no significant adverse impacts or ambient levels that exceed the NAAQS are expected. Because of the power plant locations and the reduction in VOCs, it is likely that levels of ozone may not increase in the Metro-Atlanta area. This is especially important for NOx since the Atlanta area is a NAA for ozone.

Potential mitigation is not deemed necessary for the PM10 or SO_2 emission increases. For NOx, the most effective mitigation measure is to increase ridership without proportionally increasing the power requirements of the Maglev system. Other mitigation measures include increasing the percent of electric power supplied by nuclear- and hydro-powered plants, improvements to emission controls on existing power plants, completion of the corridor to Chattanooga to allow cargo shipments and increased efficiency of the route for the Maglev system, and transit incentives. For the transit incentives, reductions in single-occupancy vehicles (SOVs) by use of buses or shuttles would reduce traffic and cold starts, providing a benefit.

Recent analysis of the effects of Maglev implementation lead to new estimates of motor vehicle travel reductions of 196,153 km (121,884 mi) per day. This reduction implies a slight decrease in motor vehicle emissions compared to the original analysis, with net changes in emissions increasing for those criteria pollutants for which Maglev operation provides a benefit, and reducing for those pollutants for which Maglev operation leads to higher emissions when compared to the No-Action Alternative. Thus, the overall conclusions of beneficial effects for CO and VOC emissions, and insignificant increase in NOx, PM10, and SO_2 emissions, do not change with this new information.

4.8.4 Louisiana

Vehicle-miles traveled for the year 2020 are calculated to decrease by 225,205,000 as a result of the Louisiana Alternative. Another assumption, based on results from the regional TRANPLAN model, was that 9.5 percent of the traffic is now trucks. However, the reduced vehicle miles from passengers on the Maglev were assumed to be all in cars and as such, truck traffic was not reduced. This reduction in vehicle-miles traveled was used to calculate the emission benefits. Emission factors for the highway vehicles were derived using MOBILE5a and PART5. Input parameters used to run these computer models were consistent with the established inputs of the New Orleans Transportation Plan Year 2020. Using the vehicle-miles traveled and the emission factors, an emission inventory was then prepared for CO, NOx, VOC, PM10 for passenger vehicles.

The initial power consumption of the Maglev system was calculated to be 915,172,410 MJ (867.5 billion BTU) per year. This power generated was assumed to be 69 percent natural gas, 17 percent coal, and 14 percent nuclear.

The results of these analyses are presented in Table 4.8-4. Because power-plant emissions are not considered, substantial reductions in CO, NOx, VOC, and PM10 are shown. SO_2 was not considered for either source.

Upon further analysis of the Maglev system in the Energy section, it was determined that power consumption would be 1,021 billion BTU per year (refer to the Energy sections in Chapters 3 and 4 for details). This higher estimate of power consumption would lead to increased emissions from Maglev operation. However, the net effect of this increase will depend on the mix of energy sources used to provide the additional Maglev power requirements. Since the area is in compliance for all NAAQS, the attainment status should be reviewed for those criteria pollutants, if any, for which emissions increase with Maglev implementation. Depending on the energy sources used, the increased power supply emissions could be offset by the decrease in motor vehicle emissions associated with diverted travel. In that case, an overall benefit to air quality would be realized. Since the area is in attainment for all criteria pollutants, no changes to the attainment status are expected from Maglev operation.

Table 4.8-4 - Louisiana Change in Criteria Pollutant and Precursor Emissions in Year 2020

Vehicle Class	***Annual Regional VMT***		***Emission Factor (g/mile)***				***Annual Emissions (Tons)***								***Change in Emissions (Tons/Year)***			
							No-Action				***Maglev***				***Maglev Vs. No-Action***			
	No-Action	Maglev	CO	NO_x	VOC	PM10	CO	NO_x	VOC	PM10	CO	NO_x	VOC	PM10	CO	NO_x	VOC	PM10
Passenger Vehicles	9.883,129,108	9,657,609,843	18.59	1.68	1.55	0.06	202,468	18,280	16,875	654	197,848	17,863	16,490	639	-4,620	-417	-385	-15
Heavy-Duty Vehicles	1,037,455,542	1,037,455,542	8.43	5.38	1.51	0.37	9,642	6,149	1,728	421	9,642	6,149	1,728	421	0	0	0	0
Total	***10,920,584,650***	***10,695,065,385***					***212,110***	***24,429***	***18,603***	***1,075***	***207,490***	***24,012***	***18,218***	***1,060***	***-4,620***	***-417***	***-385***	***-15***

Source: (GNEOA, 2000)

4.8.5 Maryland

A reduction of 1,287,475 km (800,000 miles) of daily highway vehicle travel is predicted from implementation of the Maglev system. The pollution benefits, and emission factors used are presented in Table 4.8-5 for the year 2020 for VOC, CO, and NOx. Other pollutants were not considered.

From the Energy section, the power consumption of the Maglev system was calculated to be 235.2 billion BTU annually. This power will come primarily from fossil fuels (coal, oil, and natural gas). Based on projected reduction in daily 1,287,475.2 VKT (800,000 VMT), Maglev operation will result in net yearly energy savings of 1,536.6 billion BTU. Depending on the mix of energy sources used to meet the Maglev power requirements, this reduction in energy consumption could result in air quality benefits. Since the corridor area is in compliance for all NAAQS other than ozone, no change in the attainment status of these pollutants is expected from Maglev operation. The attainment status should be reviewed for those criteria pollutants, if any, for which emissions increase with Maglev implementation, with special attention to ozone, given its serious NAA status.

Table 4.8-5 - Maryland Summary of Estimated Annual Reductions in VOCs, CO and NO_x (2020)

	Daily VMT - Reduction From No-Action (light-duty vehicle miles)	**VOC Reduction from No-Action** (tons/year)	**CO Reduction from No-Action** (tons/year)	**NO_x No-Action** (tons/year)
No-Action	N/A	N/A	N/A	N/A
Maglev System	800,000	83.2	1003.1	242.9

Notes: Emission Factors from automobiles: HC=0.37 g/mile; CO=4.46 g/mile; NO_x=1.08 g/mile (FTA, MTA 1996); Running emissions only considered

Source: (MTA, 2000)

4.8.6 Nevada

The analysis was done for the years 2005, 2015 and 2020. No existing case was included for comparison.

The Maglev system is estimated to use 1,941.2 million MJ (1,840 billion BTU) per year. This value includes the effect of power plant efficiency, system efficiency, line loss, as well as use by stations and other Maglev facilities. Using information from the entire grid from the Nevada Power Company, a mix of 45.5 percent coal, 35.3 percent natural gas, and 19.2 percent hydropower was used.

Emission benefits for the reduced vehicle-miles traveled for on-road vehicles were also considered. The reductions from three different groups were highlighted: 1) buses with employees traveling from Las Vegas to Primm, 2) passenger vehicles with employees traveling from Las Vegas to Primm, and, 3) passenger vehicles with tourists traveling between Las Vegas and Primm. The participant estimated that Maglev operation would result in a reduction in motor vehicle travel of 417,719 km (259,559 mi) daily. In addition, there would be a reduction of 4,138 km (2,571 mi) of heavy-duty travel per day. Both congested 72.4 km/h (45 mph) and uncongested 104.6 km/h (65 mph) conditions were considered. Emission factors were derived from MOBILE5b, PART5, and MVE17g. Transportation control measures from the SIP were also used and included I/M, anti-tampering, stage II vapor recovery, oxygenated fuels, and low Reid Vapor Pressures. No separate listing of these emission benefits was provided.

The net change of the power plant-emissions and the vehicle-miles traveled benefits were calculated and decreases were found for CO, NO_x, VOC, PM10 and CO_2 in all years. Increases in the emissions for SO_2 were calculated for all years as well. The increases in SO_2 emissions are not expected to exceed the NAAQS. A summary of the changes in emissions is presented in Table 4.8-6.

Table 4.8-6 – Net Changes in Emissions Resulting from the Proposed Maglev Project

	2005 Emissions	2015 Emissions	2020 Emissions
Pollutant	**Tons/yr**	**Tons/yr**	**Tons/yr**
CO	-1,738	-1,515	-1,740
NOx	-351	-340	-437
TOC	-182	-171	-197
SO_2	209	207	204
PM10	-9.8	-9.7	-12.3

Mitigation measures can be suggested for fugitive dusts. These primarily focused on the construction phase and included wetting soil and other particles during hours of operation, treating soils or particles with substances that keep them together, making them heavier and less likely to become airborne, and encapsulating surfaces using wood, concrete or other materials so the soil and particles are not exposed to elements that could make them airborne. Also, proper operation procedures could be required of the contractor during construction and the drivers during system operation to avoid violating the 15-minute idling rule for diesel vehicles. Final station design would incorporate criteria to minimize delays in passenger loading and unloading.

4.8.7 Pennsylvania

The Environmental Assessment for the Pennsylvania Alternative states that the air quality analysis was performed assuming that there are no direct emissions from the Maglev system. Thus, the source of power and potential air emissions for the Maglev operations are not considered in the air quality analysis. For roadway traffic, the investment grade ridership analysis was used to estimate the annual reduction in vehicle miles traveled in the region in the year 2020. Table 4.8-7 shows this decrease and the resulting emissions benefits. The Maglev system is proposed as part of the Transportation Improvement Plan that is covered by the SIP; the project is believed to be in conformity.

Table 4.8-7 - Southwestern Pennsylvania Change in Relevant Regional Criteria Pollutant/Precursor Emissions

Predicted Annual 2020 Regional VMT Decrease	Change in Emissions Based on Regional Average Speed of 30.2 mph and Composite Vehicle Emission Factors (tons/year)		
		Ozone Precursors	
	CO	VOC	NO_X
979,820,000	-8776	-1180	-1461

4.8.8 No-Action Alternative

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be constructed. Therefore, there would be no impacts on air quality directly from a Maglev system. However, it is important to consider potential impacts from the No-Action Alternative that could arise from precluding the Maglev Deployment Program and the potential benefits of constructing a Maglev system.

It is anticipated that economic and population growth will continue around the country, resulting in increased intercity travel demand and ensuing congestion. Under the No-Action Alternative, motor vehicle and air travel demand is expected to be significantly higher than that under any of the Maglev Alternatives. The increase in motor vehicle, air, and light rail travel would result in a variety of transportation problems that may include, among others, increased congestion and transportation infrastructure expansion. The increase in air and motor vehicle intercity and long-distance travel would result in greater air-pollutant emissions with potentially significant impacts to air quality at the local, regional, and national levels. Increased operational congestion would also increase emission levels, with the potential to exacerbate air quality problems even further. Based on the stated concerns, it is expected that the No-Action Alternative could have an impact on air quality. The significance of the impacts need to be determined on an alternative specific basis, but are expected to range from moderate to significant.

4.9 SOLID WASTE

The waste from operating stations and administrative offices will be conventional waste such as paper, office supplies, consumer waste, food products, and food packaging. Wastes from track maintenance and maintenance facilities will include typical office wastes as well as industrial wastes, including materials containing petroleum products, solvents, batteries, scrap metals, and other used components. Although final locations of the stations and maintenance facilities have not been identified, solid waste management, including method of disposal and the identification of appropriate landfills, will likely be contracted out to local waste disposal contractors. The associated environmental impact will likely be to local municipal landfill and disposal facilities and their capacity to handle the increased load. It is anticipated that current local solid waste facilities will be able to handle the additional wastes generated as a result of Maglev operations. To the extent that the local landfill and/or disposal option is at capacity, contractors will go to the next available disposal location, thus minimizing potential impact to local disposal locations.

Maglev operation is not considered a significant producer of solid or hazardous waste and commercial contractors will dispose of conventional and hazardous solid waste at the nearest landfill or hazardous waste disposal facility. Therefore, no significant adverse direct nor indirect impacts to local solid waste capacity are anticipated. Because no significant adverse impact from solid waste is expected, mitigation is not planned.

4.9.1 No-Action Alternative

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be constructed. Therefore, there would be no impacts on solid waste directly from a Maglev system. However, it is important to consider potential impacts from the No-Action Alternative that could arise from precluding the Maglev Deployment Program and the potential benefits of constructing a Maglev system.

It is anticipated that economic and population growth will continue around the country, spurring increases in intercity travel demand. Under the No-Action Alternative the increase in motor vehicle, air, and light rail intercity travel would result in a variety of transportation problems that may include, among others, increased congestion and transportation infrastructure expansion. The construction of additional infrastructure for intercity and long-distance travel could have impacts to solid waste. The extent of solid waste impacts and the ability of existing facilities (e.g., landfills) to handle additional wastes generated as a result of development and expansion of highway, air or light rail transportation infrastructure would have to be examined at the local and regional levels.

4.10 SOCIOECONOMIC, ENVIRONMENTAL JUSTICE AND ELDERLY AND DISABLED

There are potential impacts to socioeconomic status identified for each of the alternatives. Potential positive impacts include secondary effects such as increased employment mobility, reduced traffic congestion, increased productivity from faster commuting, economic stimulation through increased employment opportunities, and other net gains. Conversely, some potential impacts may be significant in the relocation of home or business owners whose lands are needed for the Maglev construction. Other consequences are not desirable, but their over all impact is relatively slight, and through more specific design, can largely be mitigated. Many alternatives propose a corridor that would share existing mass-transportation infrastructures, such as rail lines, highways and airport facilities. In these cases, the marginal impact is quite negligible, even in the context of evaluating cumulative consequences.

The basis for the data analysis is 1990 census data that is extrapolated to reflect 1999 conditions. These same data were used to estimate the numbers and categories of populations under environmental justice (EJ) rules. Further analysis reveals the comparative populations as a percent of the affected population as well as presenting data reflecting the proportion of populations to the general populations in county or state data.

This is to evaluate the notion of disproportionate impact to populations. There are varying impacts to these covered populations as summarized below.

The information evaluating accessibility for the elderly and disabled focuses on infrastructure requirements, i.e., the accessibility of supporting facilities such as parking lots, terminals, and Maglev doors, seats, etc. Also addressed is existing infrastructure and the required improvements to permit accessibility for the elderly and disabled, such as transitions from sidewalk to terminal, ramps from parking lots, and appropriate platforms.

4.10.1 Socioeconomic

This section focuses on the impacts of potential property acquisitions by the project and resulting displacements that may occur. The 1990 Census data provide the statistical background for this issue. Census tract data were used to estimate the population within each 610 m (2,000 ft) wide proposed corridor.

There are varying positive and negative socioeconomic impacts to affected populations analyzed for each alternative:

- Displacement of residents.
- Displacement of businesses.
- Creation of demand for related commercial and office uses.
- Stressed locally-provided services.

Population, income, and racial-characteristics data from the 1990 U.S. Census were used to develop a population profile for the project study area.

The construction of the Maglev guideway will require approximately, a 15.24 m (50 ft) wide right-of-way for supports and possibly an access road, exclusive of cut fill which will likely be required in many areas. The remainder of the land within 1,219 m (4,000 ft) wide corridors should be unaffected so that many of the residences and businesses within the corridors should not have to be acquired.

Action Alternatives

Below is a summary of the socioeconomic impacts for all of the seven action alternatives. At this early stage of design, impacts have not yet been fully quantified. However, it is likely that the seven alternatives could experience similar impacts.

- Specific acquisitions cannot be identified in this stage of design; however, alignments are likely to be in existing rights-of-way with little additional acquisition anticipated. The actual number of property acquisitions is dependent on final-design requirements.
- A Maglev system may increase job accessibility for low-income populations that may stimulate local economies.
- Creation and support of new and existing jobs is anticipated.
- Project-increased development opportunities in areas that would enhance mobility in the alternative, creating a net benefit. There are a small number of acquisitions anticipated. Greatest land-use impact area is open space, which includes space without structures, cemeteries, barren, forested and agricultural lands.

There are acquisitions and displacements anticipated; however, these should be minimized by using existing utility and transportation corridors. Thus, a significant adverse impact is not anticipated.

Mitigation

Suggested strategies for minimizing the number of displaced residents, employees, and buildings include the following:

- Adjust alignment to minimize impacts.
- Take advantage of existing public or private rail/highway corridor rights-of-way in the alignment wherever feasible and practicable. Many of the alternatives propose the Maglev along existing transportation corridors. This strategy minimizes acquisition and use of real private property and buildings outside existing transportation holdings. The issue of affected environment becomes one of marginal impact, or the difference between existing disturbances and those changes resulting from the Maglev program.
- Use existing drainage, utility or transportation rights-of-way.
- Elevate Maglev and pass over directly impacted structures to eliminate total structure and property takings.
- Barriers or screening to block the visual and social impact.
- Tunneling to mitigate noise and vibration, visual, historic, archaeological and cultural, socioeconomic, and other impacts.
- Strategically locate Maglev structural elements to minimize the visual and social impact on the communities.
- The Uniform Relocation Assistance and Real Property Acquisition Act of 1970, as amended, (36 CFR Part 104 / 42 USC 4601) applies to all federal and federally assisted activities that involve real property acquisitions, usage, easements, displacements of persons or businesses, and relocations of persons or businesses. Local state laws, policies, plans and programs will determine the cost of real property acquisitions, the availability and cost of relocation sites, and planned remuneration. Additional or unusual circumstances that may arise may warrant other mitigation measures as determined on a case-by-case basis.
- The procedures and practices of the Uniform Relocation Assistance and Real Property Acquisition Policy Act (42 USC 4600) would govern where properties must be acquired.
- Address construction impacts on the communities.
- Define potential environmental justice considerations during site specific EIS process and implement significant community outreach programs to ensure the full involvement of the effected communities along the Maglev facility.
- Emphasize focused interactions with impacted minority and low-income groups, actively seeking participation of these communities.
- The proposed project could have a positive impact on some populations, especially those located near Maglev stations, by improving access and mobility between major commercial, residential, and transportation centers. Explore improved traffic flow to and from these areas to enhance investment opportunities and incentives for businesses and residents to locate to the area, thus enhancing occupational opportunities for low-income residents.

- As part of the site specific EIS process, the project team proponents could work closely with the local communities to make sure that the mitigation being planned is adequate and acceptable to the community.

4.10.2 Environmental Justice

There are various potential, negative environmental-justice impacts to populations. These include:

- Disproportionately-high location of facilities or rights-of-way within areas identified as low-income.
- Disproportionately-high location facilities or rights-of-way within areas identified as having a higher-than-average proportion of persons of any minority.
- Displacing minority or low income persons.

To evaluate disproportionate impact to minority and low-income populations, the populations covered under environmental justice rules were estimated using the 1990 census block data. As the Maglev Program progresses to final design, the population data will be utilized to determine impacts to minority and low-income people. Displacements and the location of facilities will be considered in the final impact analysis.

As an initial step, the impacts of potential property acquisitions and displacements that may occur for each of the Maglev Alternatives have been estimated. Although the system is planned to collocate in existing transportation rights-of-way, additional rights-of-way may be needed in some locations. Acquisitions and displacements could occur to accommodate the guideways, stations, electrical substations, central and decentralized maintenance centers, and other ancillary facilities along the route that are needed to provide power to the Maglev systems. At a later stage of project development, an iterative design and impact analysis process would identify the number of facilities and the land-area requirements for each of the Maglev Alternatives and thus where mitigation is needed for adverse impacts to persons or businesses affected by property acquisition.

The estimated number of structures taken, residential relocations and business displacements, and the racial composition for each alternative are shown in Table 4.10-1 below. For all alternatives the 1990-census-block data provide the statistical background for this issue. At this point in the design process, it is not possible to determine the exact number of relocations necessary for the alternatives. Specific analysis of relocation and other adverse effects must await the completion of more-detailed design, and would be reported in a project specific EIS.

Each alternative had census-block groups within the study area which met the EJ low-income/minority thresholds for further analysis, i.e., areas for which the minority and/or low-income populations constitute a large portion and for which impacts may be disproportionately borne by these populations.

The U.S. Census Bureau uses a set of money thresholds that vary by family size and composition to determine persons living in poverty in the U.S. Table 4.10-2 shows the 1990 Census data indications of households and poverty levels within each alternative.

Table 4.10-1 - Summary of Ranges of Potential Residence and Business Takings

	Estimated Number of Structures Taken		Estimated Number of Residents and Workers Displaced (with number/percent by racial composition)			
	Residence	**Business**	**Residents**		**Workers**	
California	**No specific information identified.**	**No specific information identified.**	8.2%-56.4% White 4.2%-36.7% African American 0.2%-0.7% Native American 3.6%-18.3% Asian / Pacific Islanders 27.5%-59.6% Hispanic American		**No specific information identified.**	
Florida (30.3m / 100 ft)	**0-39**	**0-5**			**0-150**	0-145 White 0-11 African American 0-12 Other
Georgia	**86**	**34**	**739**	46.51% White 50.20% African American 0.06% Native American 1.04% Asian / Pacific Islanders 2.18% Hispanic American	**942**	
Louisiana	**2-74**	**20-37**	**141-209**	83-125 White 18-115 African American 0-1 Native American 0-1 Asian / Pacific Islanders 3-4 Hispanic American	**65-1,062**	47-640 White 14-355 African American 1-15 Native American 0-5 Asian / Pacific Islanders 3-47 Hispanic American
Maryland	**No specific information identified.**	**No specific information identified.**	48.7%-70.6% White 21.9%-44.7% African American 3.1%-3.3% Native American 0.3% Asian / Pacific Islanders 2.2%-3.6% Hispanic American 0.8%-1.5% Other		**No specific information identified.**	
Nevada[2]	**135**	**0**	**245**[3]	214 White 31 Total minority	**3**	
Pennsylvania (183m/600ft)	**No specific information identified.**	**No specific information identified.**	74%-92% White 7%-23% African American 0.1%-0.3% Native American 0.4%-1.8% Asian / Pacific Islanders 0.4%-0.8% Hispanic American		33.3%-73.3% White 3.9-20.8% African American 0.08%-0.19% Native American 0.18%-1.61% Asian / Pacific Islanders 0.24%-0.81% Hispanic American 0.08%-1.16% other	

[1] Percentage By Route; [2] Low- and moderate-income and minority persons displaced [3] 16 (6.5%)Low Income; 19 (7.76%) Moderate Income; 31 (12.7%) Minority; Source: State EAs

Table 4.10-2 - Households Below Poverty Level

	Total Number Households	Number of Households Below Poverty Threshold	Percent Households Below Poverty Threshold
California[1]	52,408-133,277	7,408-22,310	14.14%-22.5%
Florida	2,539-34,673	63-236	2%-8%
Georgia	58,437	10,453	17.9%
Louisiana[1]	18,008-19,155	5,661-5712	29.6%-31.7%
Maryland	45,386-61,010	4,336-4,559	7.5%-9.7%
Nevada	39,722	962	2%
Pennsylvania	1,392-9,384 (residences)	202-2,184 (persons)	5.8%-13.6% (persons)

Range signifies alternative routes.
1 By Route
Source: (CM, 2000); (FDOT, 2000); (ARC, 2000); (GNOEC, 2000); (MTA, 2000); (CNSSTC, 2000); (PAAC, 2000)

To adequately consider minority and low-income populations in the alternatives, the impact findings for other potential impacts to the socioeconomic status will be compared once final route alternatives are selected with those areas of minority and low-income populations that meet the EJ thresholds for further analysis. Potential positive impacts include secondary affects such as increased employment mobility, improved living conditions for those whose properties are acquired, reduced traffic congestion, economic stimulation through increased employment opportunities, and other net gains. Assessments of non-proportional adverse impacts on minority and low-income populations will also be made. These include: public health and safety, noise and vibration, transportation and traffic, air quality, land use, visual resources.

Another area of potential impact for the elderly and disabled is emergency evacuation. Use of traditional methods such as inflatable chutes would be difficult for aged and disabled passengers, but not inconsistent with difficulty encountered in other transportation modes, including air, rail, and public transit. All Maglev vehicles, operating conditions, emergency procedures, and support and maintenance operations would meet all applicable FRA regulations. This would not be a significant impact.

The proposed alternatives are not anticipated to impose any additional barriers to the aged and disabled. In fact, improved access and mobility from the proposed Maglev implementation will provide a beneficial impact to these populations. Stations will have multi-modal connections to provide access to persons who do not drive, and will be disabled accessible.

Below is a summary of the environmental justice impacts for each of the alternatives at this stage of the planning process. More detailed and comprehensive analysis of likely environmental consequences to EJ populations will be conducted as alignments are selected and detailed designs proceed.

California

The study corridor and candidate route pass through areas with higher proportions of minority and low-income populations. However, these impacts are expected to be marginal since the majority of those sections with higher proportion of minority and low-income populations are currently disturbed by existing transportation corridors. The EJ impacts to population would appear to be minimal and do not at this stage suggest any significant adverse effects.

Florida

The population data do not indicate concentrations of minority and low-income populations along candidate routes. As a result, there will be no adverse EJ impacts to populations.

Georgia

Although there are some seemingly disproportionate impacts to minority and low-income populations along a specific segment, the 2000-foot wide study corridor lies within an existing transportation route. There is potential for significant environmental justice impacts to some population groups. With alignment adjustments within the corridor, the following site-specific alignment concerns should be considered during site-specific EIS:

- Alignment within the city of Atlanta should reconsider the displacement of African-American people.
- Reconsider the alignment along Northside Drive and the impact it causes to the neighborhood.
- Reconsider the impact to African-American churches and public housing projects if Maglev is constructed in the vicinity of Northside Drive.
- Reconsider underground alternatives to minimize visual impacts in the vicinity of Northside Drive.
- Reconsider the potential impacts to all churches, schools, hospitals, and other sensitve receptors.
- Reconsider the impact to minority communities in the city of Atlanta.
- Consider more public involvement with the minority community within the city of Atlanta and schedule meetings that do not conflict with other neighborhood activities.
- Reconsider alternative routing alignments for the Vine city community.
- Identify how many people could be displaced by each routing alternative.
- Consider involving the impacted communities in the planning process.
- Consider the problems facing Atlanta and the sacrificice of a few for the benefit of many.
- For work around the Atlanta University Center (AUC), consider that it may be considered 4(f) land and may be listed on the National Register.
- Consider a wider definition of “public involvement” to reflect both the length and diversity of the corridor. Specifically, add minority and community based organizations to the public involvement program.
- Select meeting locations that serve AUC and Vine city areas.
- Consider partnering with AUC.
- Consider different heights of the Maglev guideway to mitigate impacts to community adhesion and adverse health impacts.
- Reconsider alignment alternatives that minimize impact to village at Castleberry Hill and Herndon Homes.

- Consider representation of Fulton County, city of Atlanta, and directly impacted educational institutions on a study committee to address above concerns.
- Consider financial contributions from Cobb County.
- Consider relocating Maglev along I-75 and I-85.

Louisiana

The data do not project any disproportionately high and adverse effects on minority and low-income populations. There are no significant EJ impacts to any population.

Maryland

Data do not suggest any disproportionately high and adverse effects on minority and low-income populations. There are no significant EJ impacts to any population.

Nevada

The Hispanic population forms a greater proportion of the total corridor population than the Hispanic populations of the MSA as a whole, but still falls under the minimum requirements outlined in Environmental Justice rules. There are minimum EJ impacts to the population.

Pennsylvania

The data do not suggest any disproportionately high and adverse effect on minority and low-income populations. There are no significant EJ impacts to any populations.

Mitigation

Potential mitigation strategies are identical to the approaches for socioeconomic impacts discussed above, plus:

- Where adverse impacts to low-income or minority populations are anticipated, mitigation measures to be considered include avoidance, minimization, and compensation.
- The best mitigation is avoidance. The first way to mitigate impacts on minority and low-income populations is to be aware of their locations as the project is being defined and to try to avoid affecting them by siting project facilities to avoid impacts.
- To the extent that any alternative has an impact on minority and low-income populations, design alternatives will be considered to avoid undue adverse consequences.
- If impacts cannot be avoided, mitigation strategies developed for individual environmental issues, such as noise or traffic impacts, should be used to mitigate impacts to minority and low-income populations located in close proximity to the Maglev route.
- The placing of the elevated guideways over and through communities brings with it significant impacts: displacement, community cohesion, visual and EMF issues. Because some areas will experience multiple effects from the proposed Project, mitigations must be considered above and beyond those being considered for each individual resource impact. Additional mitigation measures may be necessary to adequately mitigate impacts in areas that are subject to

multiple significant impacts, and for areas where the impacts appear to disproportionately affect minority and low-income populations in these areas.

4.10.3 Elderly and Disabled

Action Alternatives

Potential impacts to the elderly and disabled are similar for each of the seven alternatives. These impacts can be summarized for those alternatives as follows: For the disabled and the elderly, the transitions encountered from the surrounding land-uses to the Maglev station, and within the station, would involve "way finding" through a barrier-free route from the surrounding access points to the train. This would include accessible horizontal- and vertical-transportation means as well as provisions on the "way finding" and emergency information alarm systems for the visual and hearing impaired. In addition, elderly and disabled passengers can experience difficulty using transportation facilities and following emergency-evacuation procedures.

Mitigation

All Maglev system elements will be designed, constructed, operated, and staffed to satisfy the Americans with Disabilities Act (ADA). Because design and management strategies should be in place, no specific mitigation strategies beyond already established requirements are anticipated. To address potential barriers, the Maglev Alternatives would include access in accordance with the ADA. With regard to hiring practices, there should be a conscientious hiring program to achieve the spirit of the ADA. All applicable ADA guidelines in force (Accessibility Guidelines for Buildings and Facilities, 36 CFR Part 1191) would be followed to ensure the project meets the goals of the ADA. While compliance with the above regulatory requirements ensures a maximum degree of mitigation legally, the spirit of accessibility may include additional means. This may include the design of a seamless and effortless pathway through all physical transitions encountered.

With a proactive design and personnel management strategies, all ADA requirements should be met. Thus, there should not be a significant adverse impact to the elderly and disabled from the construction and operation of any of the seven Maglev Alternatives.

4.10.4 No-Action Alternative

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be constructed. Therefore, there would be no impacts on socioeconomics, environmental justice, or the elderly or disabled directly from a Maglev system. However, it is important to consider potential impacts from the No-Action Alternative that could arise from precluding the Maglev Deployment Program and the potential benefits of constructing a Maglev system.

Under the No-Action Alternative, there will be no property acquisitions required, nor displacement of any population associated with Maglev infrastructure. However, it is anticipated that economic and population growth will continue around the country, promoting increases in intercity travel demand. Thus, under the No-Action Alternative it is expected that there will be greater need for air and road transportation infrastructure expansion. The construction of additional infrastructure for intercity and long-distance travel could have negative socioeconomic impacts such as property acquisitions and displacement of residential and business populations, and stresses on locally provided services. In addition, transportation infrastructure expansion could result in disproportionate adverse impacts to minority or low-income populations, as well as in effects to the elderly and disabled populations; impacts could include residential and business displacement, noise, traffic, community cohesion disturbance, and visual effects. The nature and extent of impacts will have to be determined on a local basis and would need to be compared to those incurred under the Maglev Alternatives.

4.11 LAND USE, FARMLAND AND 4(f) RESOURCES

Land use and development patterns result from a variety of factors including access, distance from goods and services, availability of transportation links, land ownership, location of population or workforce, and zoning controls, among many others. Land use patterns – the specific locations of various types of land uses – often follow historical use patterns, but are heavily influenced by planning initiatives and zoning ordinances in effect at the local, county (parish), or state levels. Current development in the areas surrounding the Maglev Alternatives largely reflects the twentieth-century proliferation of roadways and highways to serve and connect growing population centers, tempered by the specific types and densities of development allowed by zoning.

Implementation of the Maglev Deployment Program will involve the development of a major transportation system. There may be a number of effects on land use. The provision of new access to previously inaccessible undeveloped lands may stimulate development. Conversely, the transportation corridor may act as a barrier, disrupting neighborhood cohesion or inhibiting pedestrian or vehicular access to previously accessible destinations. The following sections discuss potential impacts on land use from the proposed Maglev Alternatives, based on preliminary project planning.

Specific land use effects are best evaluated on a case-by-case basis with field verification, once a preliminary design of the Maglev system is available. Direct impacts such as building displacements cannot be determined at this time, but it is expected that some residential and commercial relocations will be required. It is also likely that land use changes and/or rezoning may be required in areas where the Maglev system is incompatible with existing land use.

The purpose of the Farmland Protection Policy Act (FFPA) of 1984 is to minimize the extent to which federal programs convert farmland to non-agricultural uses (Pub.L. 97-98, Sec 1539-1549, 7 USC 4201, et seq). Soils classified by the United States Department of Agriculture, Natural Resource Conservation Service (NRCS) as prime or unique are collectively protected by this Act. In addition to this federal regulation, several states have enacted their own regulations to aid in the protection of farmland resources.

The FFPA requires a farmland impact evaluation for applicable federally funded projects. The Maglev Deployment Program must adhere to this requirement. Upon advancement of a Maglev Alternative, coordination with the NRCS is required through the completion of a Farmland Conversion Impact Rating Form (Form AD-1002) for each impacted county or parish. The form is used by the NRCS to evaluate the impact to designated prime, unique, statewide or locally important farmland soils.

A description of potential impacts to farmland resources associated with each of the proposed Maglev Alternatives is provided below. Impacts are based on preliminary planning and resource assessments at a general level of detail. A more refined assessment will be included in subsequent project environmental documentation.

Some forms of recreational opportunities and parklands are protected from impacts due to federal projects. Impacts to coastal, water-dependent recreation are considered under the Coastal Zone Management Act, whereby potential impacts may be reviewed and regulated by the administering state. Impacts to significant publicly owned parks and recreation areas, wildlife/waterfowl refuges, as well as certain historic sites, are regulated under Section 4(f) of the Department of Transportation Act (49 U.S.C. §303(c)). Under Section 4(f), the Secretary of Transportation shall approve a project that requires use of such areas only if (1) there is no prudent and feasible alternative to using the Section 4(f) land and (2) the project includes all possible planning to minimize harm to the resources being affected.

Indirect impacts from Maglev noise or visual intrusions could occur which might diminish the function and/or use and enjoyment of some recreational resources/opportunities. However, the appropriateness of Maglev near parks is likely to be seen differently by children than by adults. Children are likely to see the introduction of Maglev as an amenity; a feature that because of its visual entertainment value increases attractiveness or value of a park that is within view of a passing Maglev train. The novelty of the system, different from experiences to date, could be considered enjoyable, a pleasantness which delights the child's eye. Thus, Maglev may actually be a positive benefit to children when located near a park.

Although a detailed assessment of impacts to these resources are not possible at this conceptual level of planning and design, an assessment of potential impacts to recreational opportunities and parklands will aid the evaluation of Maglev Alternatives. A Section 4(f) evaluation will be included in any project specific environmental impact statement that involves a use of Section 4(f) protected resources.

The following information generally describes the potential for land use impacts as well as recreational and parkland impacts associated with each Maglev Alternative. Historic and archaeological impacts are discussed in Section 4.13 and are not covered here.

4.11.1 California

General land use impacts associated with the California Maglev Alternative would include increased pressures for development and/or redevelopment of areas surrounding proposed station locations and could lead to higher development densities. The types of land uses are not likely to change in those areas where transit facilities already exist. If a station is planned for a new area, land uses may change to commercial and service oriented developments that cater to commuters. A beneficial result could be an increase in infill developments. In addition, any planned redevelopments along the proposed Maglev corridor, particularly in the vicinity of the proposed stations, may likely see an accelerated schedule. The availability of high-speed Maglev service to a large metropolitan area is likely to increase the rate of residential development in outlying areas near proposed Maglev stations. Since the proposed Maglev corridor follows existing transportation corridors, potential impacts to surrounding land uses and to costs associated with property acquisition are expected to be insignificant.

Construction of the candidate Maglev Alternative is not likely to have direct impacts on farmlands since the system would be built predominantly within existing transportation rights-of-way, and because no farmlands have been identified adjacent to the Maglev Alternative right-of-way. However, secondary impacts on farmland from induced development are possible from this project. From a regional perspective, land in the eastern-most section of the corridor is less expensive than land in and around the Los Angeles Central Business District and, therefore, is more susceptible to development pressures. Farmlands in this eastern-most section of the corridor are presently being converted to residential and other land uses as a consequence of the regional demand for housing and other economic growth factors. Implementation of Maglev service in this area may accelerate the pace of planned farmland conversion, and may increase new demand for farmland conversion. It is expected that farmland conversion would be a moderate adverse impact to farmlands in the alternative.

The implementation of the California Maglev Alternative has the potential to pose minor negative impacts on land use and farmlands, and a potential for a moderate adverse impact to parklands. Hence, FRA has concluded that there is a potential for a moderate adverse impact to land use in the alternative.

4.11.2 Florida

Based on preliminary design, using land use projections from the Brevard County Comprehensive Plan, and assuming a 1.219 km (4,000 ft) study corridor, the participant estimated that project deployment has the potential to impact between 54.3 ha (134.2 ac) and 6,924.8 ha (17,111.4 ac) of residential use; between 23.6 ha (58.3 ac) and 61.3 ha (151.4 ac) of institutional land use; between 6.2 and 50.2 ha (15.3-124 ac) of commercial land use; up to 2.2 ha (5.4 ac) of office land use; up to 52.9 ha (130.7 ac) of light industrial land use; up to 31.4 ha (77.6 ac) of heavy industrial land use; and between 1,214 ha (3,000 ac and 1,761.2 ha (4,351.9 ac) of open space. Given the magnitude of the potentially impacted areas, FRA concludes that the project may significantly impact general land use in the alternative.

Construction and operation of the Maglev project could result in impacts to both prime and unique farmlands, depending on the final guideway selected. The total potentially impacted farmland area ranges between 8.5 ha (20.9 ac) and 34.6 ha (85.4 ac) of prime farmland impact, including significant areas of citrus groves (unique farmlands) and designated farmlands. Secondary impacts on farmland from induced development also are possible from this project, particularly near proposed passenger stations. Given the large areas and value of potentially impacted farmlands, it is expected that the project may have a significant adverse impact to the farmland resources of the alternative.

Construction of the candidate Maglev Alternative is not likely to have direct impacts on recreational opportunities in the region. However, in some cases, land may be acquired from passive recreational areas and open water. The Maglev system, if implemented, will likely increase access to and among some recreational venues in the region. The Florida project resides in the coastal zone, and would therefore undergo coastal zone consistency review, wherein potential impacts to coastal, water-dependent recreation would be considered. Further stages of project design will need to be tailored to avoid or minimize, to the extent possible, such impacts. The project will have a direct impact on Section 4(f) properties, requiring acquisition. Depending on final design and guideway selection, the project could result in between 39.0 ha (96.4 ac) and 65.0 ha (160.7 ac) of direct impact, primarily to the Scrub Jay Refugia Florida Conservation and Recreation Land (CARL) Project Area and the Merritt Island National Wildlife Refuge. In addition to direct impacts, the potential for indirect impacts to Section 4(f) resources also exists. Indirect impacts from increased noise levels or visual intrusions could occur that might diminish the function and/or use and enjoyment of some of these Section 4(f) resources. A detailed assessment, requiring a level of information that is not available at the conceptual planning level, is needed. Given the total areas and value of potentially affected parklands, FRA concludes that the project would have a significant adverse impact to parkland resources in the alternative.

The implementation of the Florida Maglev Alternative has the potential to pose significant negative impacts on general land use, farmlands, and parklands. And there is a potential for a significant adverse impact to land use in the alternative.

4.11.3 Georgia

The southern portion of the Georgia Alternative, from Hartsfield-Atlanta International Airport to Town Center in Cobb County, is dominated by existing rail and highway facilities that have attracted land use types requiring enhanced transportation systems. The Maglev facility may provide an improved level of transportation service that could enhance the attractiveness of this alignment and compliment the existing land use. The only location where the Maglev facility may not be consistent with existing land-use is where it intersects the Chattahoochee River National Recreation Area, in the southern portion of the alternative. Hence, implementation of the Georgia Maglev Alternative would have a beneficial impact on the existing land uses in the area.

Construction of the candidate Maglev Alternative is not likely to have direct impacts on recreation opportunities in the region. It will likely increase access to and among some recreational venues in the region. This alternative is not in the coastal zone, so it will not have potential impacts related to coastal, water-dependent recreation. With respect to parklands, the Maglev Alternative could result in direct impacts to athletic fields associated with a school utilized by the neighborhood community. Direct impacts to a 4.5 ha (11.0 ac) of park are also possible. This park may incur considerable impacts from the guideway, depending on the ultimate location of the tunnel opening. The exact impact to this park cannot be determined at this conceptual level of planning and design.

The Maglev Alternative passes directly through the Palisades Unit of the Chattahoochee National Recreation Area, a Section 4(f) resource. Despite directly crossing this area, the vast majority of this recreational area will be unaffected. The majority of the recreational activities associated with this recreational area occur up-river from the point where the Maglev Alternative would be located. Once constructed, the operational Maglev system should have minimal impact to the area as a natural and recreational resource. Other recreational resources that would be directly impacted by the proposed Maglev Alternative include one golf course, a cinema, and an indoor rock climbing facility. A detailed assessment, requiring a level of information that is not available at the conceptual planning level is needed in order to determine whether any of these impacts will be Section 4(f) impacts. Given the fact that the Maglev Alternative could impact several parklands, there is a potential for a moderate adverse impact to recreation areas in the alternative.

The implementation of the Georgia Maglev Alternative has the potential to provide some benefits to general land use in the alternative. However, it also has the potential to adversely impact farmlands and recreation areas. There is a potential for a moderate adverse impact to land use in the alternative.

4.11.4 Louisiana

The Louisiana Maglev Alternative could positively impact land use in the area by facilitating the movement of people following existing patterns of suburban residential development and population growth in the western and northwestern sections of the alternative. The northwestern area is a very fast growing area that is expected to see an increase in population density. The Maglev Alternative could serve as a focal point for population decentralization. In the south and southeastern sections, enhanced access to and from existing and planned facilities could be a beneficial impact of the project. Much of the proposed Maglev Alternative in the southeastern area will follow existing transportation alternative rights-of-way. This is considered beneficial since the Maglev Alternative will be compatible with existing land use. Based on this information, project implementation could have a moderate beneficial impact to land use patterns in the alternative.

There are no known agricultural protection areas or active farms in the vicinity of the proposed Maglev Alternative. In the northwestern section of the alternative, prime farmland soils are located south of Lake Pontchartrain and will be impacted by the proposed Maglev guideway and the planned passenger terminal. Approximately 58 ha (143 ac) of prime farmland soils will be impacted. This area is not actively farmed and there are no current plans to commence farming in this area. There are prime farmland soils mapped in the southern and southeastern region of the alternative, but these areas are completely urbanized and no longer suitable to be farmed. Secondary impacts on farmland from induced development also are possible from this project, particularly in the vicinity of proposed stations. Since the Maglev Alternative could have direct and secondary impacts on prime farmlands, the project would have a moderate negative impact on farmland resources.

Construction of the candidate Maglev Alternative is not likely to have direct impacts on recreation opportunities in the region. It would increase access to and among some recreational venues in the region. The alternative resides in the coastal zone, and would therefore undergo coastal zone consistency review, wherein potential impacts to coastal, water-dependent recreation would be considered. Further stages of project design will need to be tailored to avoid or minimize, to the extent possible, such impacts. No direct impacts to parklands are anticipated from construction and operation of the proposed Maglev Alternative. A designated bicycle route runs primarily perpendicular to the proposed Maglev Alternative. Impacts could be avoided with an elevated guideway and proper placement of guideway support structures. Based on preliminary design, impacts to recreation areas would be minor.

The implementation of the Louisiana Maglev Alternative has the potential to provide some benefits to general land use in the alternative. However, it also has the potential to pose moderate impacts on farmlands and recreation areas. Hence, it is concluded that there is a potential for a minor adverse impact to land use in the alternative.

4.11.5 Maryland

Residential and in some cases institutional land use categories are most likely to be sensitive to the introduction of a Maglev guideway and associated structures and operation. Industrial, commercial, and open space land uses may be more adaptable to a Maglev corridor passing directly through or adjacent to these areas. The specific engineering characteristics of the Maglev guideway design and construction methods will in large part determine the effects on land use. The guideway is expected to be elevated. Essentially, the Maglev guideway and associated passenger stations would be designed to have the potential to provide a positive influence on existing and future land use. Since the Maglev Alternative follows existing transportation corridors, potential negative impacts on general land use are expected to be insignificant.

Farmland that could be impacted by the proposed Maglev Alternative is associated with the BARC in Prince George's County just outside of the Capital Beltway. The actual impact acreage will be assessed as design progresses. Secondary impacts on farmland from induced development also are possible from this project, particularly in the vicinity of proposed passenger stations. Given the importance of the BARC, the project could pose significant adverse impacts to farmland resources.

Construction of the candidate Maglev Alternative is not likely to have direct impacts on recreation opportunities in the region. It will likely increase access to and among some recreational venues in the region. Portions of the project reside in the coastal zone, and would therefore undergo coastal zone consistency review, wherein potential impacts to coastal, water-dependent recreation would be considered. Further stages of project design would need to be tailored to avoid or minimize, to the extent possible, such impacts. Based on the conceptual level of planning and design, it does not appear that land from any public park would be needed for the construction of the candidate Maglev guideway. No direct parkland impacts are expected. Indirect impacts to nearby public parks, however, are likely to diminish the function and/or use and enjoyment of these recreational resources. A detailed assessment, requiring a level of information that is not available at the conceptual planning level, is needed. Recreational opportunities are numerous and diverse throughout the study region. Implementation of a Maglev transportation system connecting Baltimore with Washington, D.C., could enhance those opportunities, particularly in the center-city areas. Since only indirect impacts to some recreational areas are anticipated, and some positive effects could occur, the project would have an insignificant adverse impact to the recreation areas in the alternative.

The implementation of the proposed Maglev Alternative could have a minor adverse impact on general land use and recreational opportunities, and a significant adverse impact to farmlands. Thus, there is a potential for a moderate adverse impact to land use in the alternative.

4.11.6 Nevada

The majority of land affected by the project is open desert. Developed land affected by the Maglev Alternative is primarily associated with a mobile home park in Primm, in the southern area of the alternative. Other developed properties that are affected are warehouse and commercial areas south of Downtown Las Vegas, in the northern area of the alternative. Specific land use impacts include 1.64 ha (4.06 ac) of residential areas associated with the mobile home park in Primm; between 0.13 ha (0.31 ac) and 0.19 ha (0.48 ac) of industrial areas; between 0.39 ha (0.96 ac) and 0.49 ha (1.20 ac) of commercial areas; 0.01 ha (0.02 ac) of non-profit/community areas; and between 0.11 and 0.19 ha (0.27-0.48 ac) of transportation/communications/utilities areas.

The Nevada Maglev Alternative is mostly accommodated within existing highway rights-of-way. Most of the commercial development within the proposed Maglev Alternative is located in Las Vegas and is hotel/casino based. The intensity of this type of development along the urbanized area of the Maglev system is expected to increase as the redevelopment trend in Las Vegas continues. The Maglev Alternative could provide enhanced access/connectivity between these commercial developments. No conflicts with existing land use plans or plans of development have been identified at this stage. As part of a joint rail station, Maglev is planned to be one of several modes of transit serving downtown Las Vegas. Planned increases in residential and commercial densities could increase demand for Maglev, and Maglev could be expected to attract convenience commercial development in the vicinity of proposed station locations. Since there are no anticipated conflicts with existing and planned land uses, and the project could have beneficial impacts to existing transportation corridors, the project could have a minor positive impact to general land use in the alternative.

Since no farmlands were identified in the alternative, there will be no direct or secondary farmland impacts associated with the proposed Maglev system.

Construction of the Nevada Maglev Alternative is not likely to have direct impacts on recreation opportunities in the region, since the alternative will not traverse through recreational areas. It may increase access to and among some recreational venues in the region. This alternative is not in the coastal zone, so it will not have potential impacts related to coastal, water-dependent recreation. The proposed Maglev Alternative will not result in direct or indirect impacts to public parklands, since it would not encroach upon or be adjacent to any Section 4(f) lands. Detailed cultural resource studies and site investigations will be conducted as part of the site specific Environmental Impact Statement. Since the project does not cross-recreational areas or parklands, there would be an insignificant impact from project implementation.

The implementation of the Nevada Maglev Alternative has the potential to provide some benefits to general land use in the alternative. There are no farmlands in the alternative, and there would be insignificant adverse impacts to recreational areas. Hence, there is a potential for an insignificant adverse impact to land use in the alternative.

4.11.7 Pennsylvania

Open space and residential land uses would incur the greatest impact from the proposed Maglev Alternative, followed by commercial and heavy industrial. Specific land use impacts vary depending on the area of the alternative, and on the guideway selected. Some alternative regions pass through areas characterized by heavy industrial and light industrial land use and therefore have a substantially greater impact on these land uses than do other segments. The project could impact up to 6 ha (16 ac) of institutional land use. Increased pressures for development and/or redevelopment of areas surrounding proposed passenger station locations could lead to higher development densities. The types of land uses are not likely to change in those areas where transit facilities already exist. Where a station is planned for a new area, land uses may change to commercial and service oriented developments that cater to commuters. A beneficial result could be an increase in infill developments. No significant adverse impacts to general land use are expected, since the areas impacted are small, and the project has the potential to provide some benefits on future development.

The proposed guideway would result in impacts to both prime farmland soils and designated Agricultural Security Areas (areas consisting of 101 ha (250 ac) or more of farmland under the ownership of one or more people). The actual impact acreage will be assessed as design progresses. Secondary impacts on farmland from induced development also are possible from this project, particularly in the vicinity of proposed passenger stations. Given the large areas of potentially impacted farmlands, the project could have a significant adverse impact to farmland resources in the alternative.

Construction of the candidate Maglev Alternative is not likely to have direct impacts on recreation opportunities in the region, and may increase access to and among some recreational venues in the region. This alternative is not in the coastal zone, so it will not have potential impacts related to coastal, water-dependent recreation. To some extent, the majority of the alternative passes through or runs adjacent to existing parklands. Depending on the actual alternative region, direct impacts to parklands could range from 0.4 ha (1.0 acre) to 40 ha (100 ac). Indirect impacts to nearby public parks also could occur that might diminish the function and/or use and enjoyment of these recreational resources. Areas potentially impacted include neighborhood parks, amusement parks, theatres for the performing arts, and amphitheaters, among others. A detailed assessment, requiring a level of information that is not available at the conceptual planning level, is needed. Given the large areas of potentially indirectly impacted parklands, the project could have a moderate adverse impact to recreational areas in the alternative.

The implementation of the Pennsylvania Maglev Alternative would have an insignificant impact on general land use in the alternative. However, it has also been determined that there are large areas of farmlands and recreational areas that could be adversely impacted by the project. Hence, there is a potential for a significant adverse impact to land use in the alternative.

4.11.8 Mitigation

The implementation of a high-speed Maglev system with conveniently accessible passenger transfer stations could serve as the focus of transit-oriented development, if such a land-use strategy were desired and implemented by local planning and zoning officials. Transit-oriented development could focus on the creation of commercial activity centers with associated housing components and could negate potentially adverse land-use impacts. Essentially, it is the responsibility of the local planning and zoning authority to institute appropriate land-use regulations to guide the path of development into the future. To avoid potential conflicts with all land-use plans affecting Maglev alignments, project proponents will continue to coordinate with local governments and their planning and zoning departments to integrate the Maglev alignment and related activities into the land-use plans as they are amended.

The use of existing highway- and railroad-corridor rights-of-way, drainage easements, and utility-corridor rights-of-way would substantially reduce potential impacts to surrounding land uses. The construction of an elevated Maglev guideway in land-use-sensitive areas could also minimize impacts.

During design of the selected Maglev Alternative and preparation of contract plans, the United States Department of Agriculture, Natural Resource Conservation Service and the relevant State agricultural department, shall be contacted to discern strategies that may be appropriate to minimize impact to farmland resources. The elevation of the guideway in certain farmland-resource areas is one design approach that may be effective in reducing irreversible farmland impacts. Effective strategies to mitigate secondary impacts may entail coordination and planning efforts of local or county (parish) zoning agencies.

Direct impacts to recreational facilities and parks should be avoided to the extent possible. This may entail shifting the Maglev-guideway support structures. If necessary, relocation of directly impacted recreational facilities, such as playgrounds, public swimming pools, and athletic facilities may be possible if adjacent, accessible vacant land is available. As previously mentioned, significant recreational areas and public parks are considered Section 4(f) resources. Every effort should be made in the planning, development, and refinement of the selected Maglev-Alternative alignment to avoid these areas to the greatest extent practicable. If avoidance is not practicable and the resource is impacted, measures to minimize harm should be developed and implemented through direct consultation with the appropriate authority having jurisdiction over the impacted public-recreational resource.

4.11.9 No-Action Alternative

The No-Action Alternative would not advance the Maglev Deployment Program and the Maglev Alternatives. It is important to consider potential effects from the No-Action Alternative that could arise from precluding the provision of transportation and other related benefits from the Maglev Deployment Program. Under the No-Action Alternative, there would be no direct or secondary impacts to general land use, farmlands, and recreational areas and parklands in the Maglev Alternatives. Alterations to land use and zoning will continue across the nation, as usual, during the land development process. Also, conversion of farmland resources to non-agricultural uses, and of recreational areas will continue across the nation.

Under the No-Action Alternative, travel by motor vehicle is expected to be significantly higher than that under the Maglev deployment alternative. The increase in motor vehicle travel would result in a variety of transportation problems that may include, among others, increased congestion and road expansion. The construction of additional infrastructure for long-distance motor vehicle travel to address these problems could have considerable impacts to land use (general, farmlands, and recreation areas and parklands) from alteration and conversion. These impacts would need to be examined on a local and regional basis. These impacts could potentially be greater than those incurred under the construction alternative.

4.12 VISUAL AND AESTHETIC RESOURCES

Maglev Alternatives will traverse a wide variety of local visual settings, including: residential, commercial and industrial areas, areas that adjoin major thoroughfares and freeways and along railroad corridors, and central business districts. Alternatives may pass through open areas and near parks and historic properties. Many venues near the candidate corridors would be locations where the guideway can be seen, and which can be seen from persons in the Maglev vehicles, including private residences or public gathering places such as parks.

Maglev system elements have the potential for creating visual impacts from a variety of perspectives. From many locations the guideway will be seen against the backdrop of mountains and urban skylines that help define the visual image of some locations. From closer perspectives, the system will be seen as it crosses above thoroughfares that intersect the candidate route. Although the guideway would be a prominent visual feature, it may appear similar to extant structures (elevated sections of freeways and interchanges) and activities. From an aerial view, the elevated guideway would likely be perceived as similar to the ribbon-like lines of the railroads, freeway network and major thoroughfares. Where the Maglev guideway is co-located along highly developed transportation corridors, it may appear to merge with the existing visual environment.

In addition to visual changes associated with the guideway, the project has the potential to introduce visual impacts in station and maintenance facility areas. The Maglev system could change the visual siting of the alternative in those areas where they are different from the types of structures currently found in these areas. Parking at the stations may also introduce a change in visual character. Because Maglev facilities would be elevated, relatively massive, and cover large land areas when parking is included, they may appear oversized for their surroundings. This may be especially true where land uses are generally low scale in height and of moderate density. The Maglev facilities would be markedly different than their surroundings, which would present both opportunities and constraints for their ultimate design. Siting, relationship to adjoining uses, and compatibility in scale will be important factors in minimizing adverse impacts on their surroundings. Planning and design have not advanced to a degree to know the exact locations, nor the shape and size of Maglev facilities, so an impact assessment of these structures cannot yet be made.

Visual impacts may also arise at the locations of power substations if the guideway facilities are markedly different from current infrastructure. Because the substations must be placed at approximately equal spacings along the route, industrial land uses may not be available in the vicinity. In such circumstance, the substations could be incorporated in non-intrusive structures or facilities.

Because the candidate alternatives traverse such a great distance, there are thousands of viewsheds and individual views where the introduction of Maglev facilities could have a significant impact. Due to the length of the alternatives, their variations in composition and characteristics, and the limited amount of design development that has occurred, all potential visual impact consequences have not yet been defined. Although in many cases public comments have not been received that would enable a locally responsive consideration of the significance of visual impacts, the following general conclusions about impacts appear reasonable:

- Parks / Open Spaces / Public Properties - Visual impacts from parks, open spaces and schools along the route could be significant, depending on the proximity of the Maglev structures and the relationship to such sites. These views are likely to be considered as important community assets, however in some settings Maglev may have visual entertainment value.
- Residential Areas - The visual impacts of the elevated Maglev structure, which would generally be 9 m (30 ft) above grade, would probably be considered significant to residential areas that immediately adjoin the candidate alignment. An elevated guideway would introduce opportunities for seeing into private areas that were previously not generally visible to the public, such as backyards or through windows into residences. Residences previously visually shielded from highway traffic by noise walls could be exposed to the elevated guideway, reopening this issue in many residential areas along the candidate alternatives. The change in these views from proximate or more distant residential areas that are blocked by the aerial structure may be significant as well.
- Commercial/Industrial Areas - There could be visual impacts in the many commercial and industrial areas that adjoin the candidate alignment. Although there may be individually-sensitive views in these areas, to the extent that views may not be a contributing factor to the viability of commercial and industrial land uses, or that views may be of less concern to building occupants, visual impacts are likely to be less significant than for residential areas or park lands. Current views in commercial and industrial areas along the candidate route are influenced by existing aerial utility lines and aerial elements of transportation facilities, such that the introduction of an aerial Maglev structure may be consistent with the existing visual environment.
- Locations of Other Similar Use - The introduction of Maglev stations in areas that do not currently have similar types of facilities has a greater potential to create a significant impact. For example, the Maglev stations at airports or train stations would be constructed in areas that already have transportation terminals, so the addition of the Maglev components would be less likely to be significant (assuming that the maglev station designs are compatible with the urban design features or requirements of these areas).

Many of the design issues related to Maglev guideways, stations, and related facilities will be specifically addressed in later development and will advance to a degree to allow complete evaluations. The results of evaluations and accompanying consultation process will be reported in a project Environmental Impact Statement (EIS).

Below is a summary of the consequences of the impact of the Maglev system on the affected environment by alternative.

4.12.1 California

The California Maglev Alternative would share existing transportation infrastructure and be visible against the backdrop of downtown Los Angeles. Although the entire length of the corridor has not been evaluated and therefore overall visual impacts cannot be defined, it is clear that the route would transverse local visual settings, open areas, parks, and near some historic properties. Other than the parks, none of the areas traversed are designated as a sensitive visual resource (such as a scenic highway). There are locations along the route that will be marginally affected by the Maglev as a result of existing or planned transportation systems. At least one historic site, Union Station, could have a direct visual impact from Maglev construction.

Union Station is a Nation Register Historic Property. Development at this site will be controlled by the provisions of the Alameda District Plan, a master plan for commercial development at Union Station. It permits high-rise development on parcels surrounding Union Station, preserving the station itself and view corridors to it. It is in this context that the proposed Maglev stations will be sited and designed. Maintaining view corridors to the historic station and relating to the modern high-rises surrounding the station will be key to minimizing impacts. However, the Maglev system may not create a startling difference in function or scale from existing and proposed transportation facilities at Union Station.

At LAX and ONT, the modernistic elevated design of the guideway and stations would not be dissimilar to current and proposed airport architecture. Although master plans and designs are not yet finalized for the redevelopment of March Field, the same is likely to be true. The mass and scale of the Maglev system is very much in keeping with airport architecture for these three stations. This would be particularly true for the addition of parking lots or parking garages.

The quality of views from properties such as parks and schools may be of local concern. Individually sensitive views may exist in residential areas and to a lesser extent in commercial and industrial areas. These impacts could be considered a significant adverse impact.

4.12.2 Florida

Dramatic elevation differences between existing bridges and the new Maglev system may have significant visual impacts. Three crossings – Banana River, North Indian River, South Indian River Crossings were identified. A fourth, the SR3 Crossing at DR528 and Canaveral Barge Canal was anticipated to have a significant impact.

In addition the visual impact caused by the introduction of an elevated structure into relatively structure-free areas also exists. A significant change in the existing aesthetic character is anticipated for Courtenay and the Canaveral groves.

Maglev could significantly alter the aesthetic character of the Merritt Island Wildlife Refuge.

Where Maglev is built along existing transportation routes, visual impacts may be minimal. No scenic highway locations were identified. No locations were considered or designated important views. However, as noted above, where Maglev is located near residential, open space, wildlife refuges areas and river crossings, there is a potential for significant adverse impacts.

4.12.3 Georgia

The Georgia Alternative is comprised of commercial, service, and residential development with little vacant lands, other than parkland. For the most part, the Maglev may be a novelty and may not necessarily have an adverse visual effect on areas where it will co-locate on existing transportation infrastructure. There are significant adverse visual impacts anticipated in some of residential, public housing, parkland, and historic areas.

4.12.4 Louisiana

The historic viewshed of National Register of Historic Places (NRHP) listed, eligible, and potentially eligible buildings could be affected by the obvious intrusion of a modern transportation facility into the historic landscape. To the extent that the Maglev remains within existing transportation and utility infrastructure (railroad or power line corridors), no historic or architecturally significant building will be directly, physically impacted. An elevated Maglev train could have a significant adverse visual effect on the surrounding neighborhoods through which it passes, and is likely to be incompatible in size and design with the area's buildings.

4.12.5 Maryland

Though the guideway will be seen from many vantage points, screening from pine forest would be prevalent throughout much of the study area. The alternative is adjacent to the Baltimore-Washington Parkway, a National Park, and Maryland Historic Property and would serve historic Washington Union Station. Thus, Maglev implementation could have a significant adverse impact to visual resources in the alternative.

4.12.6 Nevada

The Las Vegas landscape is characterized by striking modern commercial buildings that are visually compatible with the proposed Maglev structures. Maglev may be highly valued in this setting. However, the large scale of the elevated guideways and the shadows they may cast will impact many existing facilities such as town-home clusters, an apartment complex, single-residence homes, and a mobile-home park. Guideways may block views of casinos and monument signs from highways and block views from hotel rooms. The guideway would, to varying degrees, cross horizon views of open desert and mountain ranges. No specific historic structures or districts within the visual impact zone have been identified. There is a potential for a significant adverse impact to visual resources in the alternative, especially in the desert areas south of Las Vegas.

4.12.7 Pennsylvania

The Pennsylvania Alternative will pass through various commercial and residential sites. Important vistas and scenic views that may be affected within this area and are accessible to the public include the views of the Ohio River and the Pittsburgh Central Business District, the West End Overlook, and sections of Mount Washington and Duquesne Heights. Vistas and views seen from the Hill District and Troy Hill will be affected. Views of a number of historic resources, including some NRHP listed sites, are likely to be altered. There is a potential for significant adverse impacts to visual resources in the alternative.

4.12.8 Mitigation

With each action alternative, a series of site-specific potential impacts, each with the caveat that more specific design features (for the corridor, the Maglev equipment, and supporting facilities) are required to determine consequences and therefore, mitigation.

Avoidance of significant impacts to important vistas, scenic views, and views of historic resources is preferred. If, however, these impacts cannot be avoided, appropriate mitigation measures will be recommended and implemented to reduce the negative impacts. Opportunities to mitigate visual impacts of the guideway would be somewhat limited due to the size and composition of structures required for the Maglev system. If particularly sensitive areas arise during the planning process, mitigation options may include:

- Alignment shifts to avoid impact.
- Vegetative screening, e.g., trees, hedgerows and other natural barriers.
- Landscaping features such as grass-covered earthworks, berms, etc.
- Decorative barriers such as fences and walls, and architectural enclosures.
- Consideration of the impact caused by mitigation remedies such as noise barriers, which in themselves agrevate visual impact. Use of natural or transparent/translucent sound wall materials may be one solution.
- Camouflaging or "obscuring" Maglev Alternatives through the use of earth berms.
- Burying of power lines.
- Careful design and placement of the guideway columns, attention to color and finish materials, as well as consideration of shadows and lighting.
- Consideration of site orientation, massing and scale.
- Computer-Aided Design (CAD) techniques used to superimpose the Maglev on photos of the existing viewscape to help quantify the extent of impacts.
- Restoring views by moving and/or reconstructing obstructed objects.
- Emphasizing high-end archtitectural design.
- Developing Maglev designs to take maximum advantage of the opportunity for developing siting and design criteria to maximize compatibility with other sites in the design stages.

Maglev designs will be developed to preserve architectural resources. For locations with special status such as parks or historic properties, adverse impacts will be avoided to the maximum extent possible to preclude conflict with protective regulations. Historic properties for which a change in the visual environment would diminish the character-defining features of the resource that made it eligible for NRHP listing, will be evaluated in accordance with established procedures. Section 4(f) protection for parks and historic properties will also require an evaluation to determine if the integrity of those resources will be compromised. Plans for mitigating the visual effects of the Maglev will be developed in consultation with Federal, State and local preservation agencies. Plan and design reviews will be conducted as required.

4.12.9 No-Action Alternative

The No-Action Alternative consists of the non-deployment of the Maglev project. Under the No-Action Alternative, there would be no visual and aesthetic impacts associated with the physical presence of the Maglev infrastructure. However, travel by motor vehicle and air is expected to be significantly higher under the No-Action Alternative than that under any of the Maglev Alternatives. This could lead to the construction of additional air and land transportation infrastructure to address, with the potential for impacts to visual and aesthetic resources. The added transportation infrastructure elements have the potential for creating visual impacts associated with structures such as airports, stations/terminals, parking, and maintenance facilities, support structures such as bridges, as well as from the ribbon-like lines of railroad and highway networks. These visual and aesthetic impacts would need to be examined on a local and regional basis, and could potentially be greater than those incurred under the Maglev Alternatives.

4.13 HISTORIC, ARCHAEOLOGICAL AND CULTURAL RESOURCES

Maglev design has not yet sufficiently advanced to assess where specific impacts could occur and to begin the formal consultation process about impacts to historical, architectural, archaeological and cultural resources. However, a general inventory of these resources was made for each alternative and a level of potential impact analyzed. A variety of prehistoric and historic sites or resources could potentially be impacted by every action alternative, though most potential for significant impacts will be associated with construction. Impacts during operational phases of the project are expected to be negligible given that most maintenance activities would probably occur within previously disturbed areas. Impacts to structures may also include those associated with noise mitigation such as insulation. If the decision to proceed with the Maglev Program is made, a site-specific inventory and impact analysis will be performed during the site-specific EIS process. At that time further consultation with each State Historic Preservation Officer (SHPO), the Advisory Council on Historic Preservation, and local historic societies will be accomplished for the identification of all appropriate historic properties, assessment of impacts, and development of mitigation measures. Below is a summary of the potential impacts for each alternative at the current level of planning.

4.13.1 California

There would be some direct impact to Union Station, a National-Register-listed property. The Burlington Northern Santa Fe (BNSF) railroad facilities at Redondo junction are likely to have a potential impact. The grounds of the Philips Mansion have the potential for impact depending on the final alignment. March Field Historic District and the Cantinela Adobe could also be potentially impacted. A few archaeological resources have been identified in the study area. There is the potential to disturb known sites as well as to impinge on currently unknown sites if ground-disturbing activities (excavation) occur in their vicinity. Several resources could be directly impacted, thus there is a potential for a significant adverse impact to historical, archaeological and cultural resources.

4.13.2 Florida

Potential for impact exists for two potentially NRHP-eligible and two non-NRHP-eligible archaeological resources. However, preliminary design precludes direct impact to these and other protected resources. Thus, there is a potential of an insignificant adverse impact to historical, archaeological and cultural resources.

4.13.3 Georgia

There are many historic districts, which the Maglev could pass through, and it is likely that the introduction of a modern magnetic-levitation rail could introduce elements that are visually out of character with the districts and would compromise the integrity of the districts' settings. Of these, two districts, the Atlanta University Center and Castleberry Hill are NRHP-listed. Twelve other individual NRHP-listed assets, as well as 22 potentially eligible pre-WWII neighborhoods, also exist in the study area. There are significant areas of impact anticipated. It is likely that ground-disturbing activities will, in some cases, result in the destruction of portions of an unknown number of archaeological sites, which may be eligible for the NRHP. Most of downtown Atlanta could be considered archaeologically sensitive, containing the remnants of structures and other features dating back to 1840. Based on the potential of a direct impact, there could be a significant adverse impact to historical, archaeological and cultural resources.

4.13.4 Louisiana

Though there are many historic structures along the route, many of them already have existing train tracks or other transportation infrastructure in close proximity. If the Maglev remains within previously disturbed railroad rights-of-way or power-line corridors, none of the historically significant buildings will be directly physically impacted. However, visual impacts to NRHP properties both fronting the corridor and at a distance must be considered during alternative route final design phase. There are no significant adverse impacts anticipated. There are numerous recorded archeological sites in the study area. Several locations have a potential of encountering archaeological resources at levels of subsurface disturbance likely during construction. However, no known locations are sites eligible for the NRHP. Based on these indirect impacts, there is a potential for a moderate adverse impact to historical, archaeological and historical resources.

4.13.5 Maryland

There are a number of historic resources that could be disturbed along the alternative, although the impacts are anticipated to be minor. This alternative would terminate at Washington Union Station, a National Register historic building, and may have other potential impacts in National Capital Planning Area. Impacts to specific resources will be detailed in the project specific EIS process. Further study, as outlined in Section 106 of the National Historic Preservation Act of 1966, is necessary. Several areas with potential archaeological resources have been identified. Based on these indirect impacts, there is a potential for a moderate adverse impact to historical, archaeological and cultural resources.

4.13.6 Nevada

None of the 19 historic and architectural resources identified are listed on the NRHP. However, potential impacts to other specific resources cannot be identified until a more-specific footprint of the alignment and supporting facilities is completed. A variety of prehistoric and historic sites or resources could potentially be impacted by the proposed project. Five NRHP listed buildings or groups of buildings are within 915 m (3,000 ft) of the project. Impacts of the project on cultural issues related to Native Americans will most likely be marginal since the guideway and associated facilities will be in existing rights-of-way or previously disturbed or -degraded sites. Continued work with the SHPO and affected Native American Tribes will ensure sensitivity. Although these resources may be present, it is unknown if they will be directly impacted. Thus, there is a potential for an insignificant adverse impact to historical, archaeological and cultural resources.

4.13.7 Pennsylvania

There are 21 historical resources that could experience a direct impact from Maglev development. For resources listed or determined to be eligible for NRHP, mitigation alternatives will be necessary to reduce negative impacts. There are 39 identified archaeological resources that could be impacted. Based on the potential of a direct impact, there could be a significant adverse impact to archaeological and historical resources.

4.13.8 Mitigation

The best form of mitigation for any impacts will be avoidance. Maglev alignments can be shifted to bypass affected resources. Where possible, guideway columns could be located about 31 m (102 ft) apart, giving designers an opportunity to avoid impacts on historic resources by relocating columns to move them away from or to span historic resources.

If adverse impacts cannot be avoided, other mitigation strategies could be undertaken, including:

- Historic Building Survey (HABS) or Historic American Engineering Record (HAER)-level recordation.
- Relocation of the historic property with appropriate covenants and conditions.

- Alteration in accordance with the Secretary of Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings or the Secretary of the Interior's Standard for Rehabilitation and Guidelines for Rehabilitating Historic Buildings.
- Vegetative screening (trees, hedgerows); grass-covered earthworks or other landscaping features.
- Introduction of artificial barriers such as fences, walls, noise barriers.
- Incorporation of historic-streetscape visual-impact-mitigation recommendations (stations and guideways, signage, lighting, etc.) of historic-preservation agencies consulted during planning.
- Evaluation of the engineering impacts of construction, including noise and vibrations, on historic properties.
- Evaluation of potential parking and traffic changes, including noise and vibrations, with relation to their effect on historic streetscapes and individual properties.

Archaeological sites, including cultural/Native American resources, would also be the subject of mitigation programs including:

- Development of a research design and limited testing of resource verification and valuation to enable Maglev-facility relocation to avoid resources.
- More-detailed testing to identify the specific resource identification and NRHP-eligibility determination, where it is not possible to avoid a location.
- Development of treatment plans for resources that could not be avoided, including provisions for excavation, curation and proper disposition of artifacts, including cultural/Native-American resources.
- Development of an accidental-discovery plan to address unanticipated finds during project construction.
- Data recovery excavations.
- Intensive archaeological surveillance (shovel/auger testing, backhoe excavations or marine survey) along the selected alternative and at station locations well in advance of construction to enable sufficient time for NRHP test excavations and/or archaeological-data recovery, as necessary.
- Archaeological construction monitoring to identify, collect, and catalogue potential important resources in areas where subsurface testing is impossible due to existing paving or other impediments.
- Archaeological remains unexpectedly encountered during construction should be left in place and evaluated by an archaeologist prior to proceeding.
- Provision for an archaeologist "on call" at all times by the contractor or construction company.
- Evaluation of any potential implication of and compliance to various Federal laws that mandate the protection of archaeological sites and cultural items and require agencies to include Native Americans and Federally recognized tribes in discussions and interactions on major Federal actions, including:
    - The Archaeological Resources Protection Act.
    - The National Historic Preservation Act.
    - The American Indian Religious Freedom Act.

- The Native American Graves Protection and Repatriation Act (this is of special concern in Nevada).
- Executive Order 123898 (Federal Actions to Address Environmental Justice in Minority and Low Income Populations).
- Executive Order 13084 (Consultation and Coordination with Tribal Governments).
- Executive Order 13007 (Access to Sacred Sites on Federal Lands may also have direction application).

4.13.9 No-Action Alternative

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be constructed. Therefore, there would be no impacts on historic, archaeological and cultural resources directly from a Maglev system. However, it is important to consider potential impacts from the No-Action Alternative that could arise from precluding the Maglev Deployment Program and the potential benefits of constructing a Maglev system.

It is anticipated that economic and population growth will continue around the country, promoting increases in intercity travel demand. Under the No-Action Alternative, travel by motor vehicle is expected to be significantly higher than that under any of the Maglev Alternatives. The increase in motor vehicle, air, and light rail intercity travel would result in a variety of transportation problems that may include, among others, increased congestion and transportation infrastructure expansion. The construction of additional infrastructure to address these problems could have considerable impacts on historic, archaeological and cultural resources. There is the potential to disturb known sites as well as intrude on currently unknown sites if ground-disturbing activities, such as excavation, occur in their vicinity. These impacts would need to be examined on a local basis, and could potentially be greater than those incurred under the Maglev Alternatives.

4.14 TRANSPORTATION

Maglev Deployment could have an impact on local or regional transportation. Local impacts could occur from the additional traffic to and from the Maglev stations, parking lots, and maintenance facilities. New local traffic patterns on existing streets would need to accommodate additional motor vehicles. Regional impacts could occur from the implementation of a faster and more reliable transportation mode between cities. The following environmental consequences section is divided into the local and regional transportation impacts.

Local Transportation

Maglev stations, parking lots, and maintenance facilities could have a potential impact on the local traffic and transportation. The placement of these facilities could increase the traffic within the specific location. In the vicinity of stations, Maglev may contribute to intersection congestion and vehicle delay because of the additional traffic proceeding to and from station parking and drop-off and pick-up areas. Local transportation could experience a significant adverse impact. At this time, the location and design of Maglev stations, parking lots, and maintenance facilities have not been finalized. Thus, the site specific and local traffic and transportation impacts cannot be fully identified and addressed at this planning stage.

Station, parking lot, and maintenance facility designs should include operational and geometric improvements that maintain, wherever reasonably possible, traffic conditions at acceptable levels of service. In general, mitigation would include the realignment of local traffic patterns and the creation of additional parking. Bus routes and other feeder systems could be rerouted to serve the Maglev stations in addition to normal routes. It is expected that the impact to other modes of transit would be insignificant. Measures would be established to encourage and promote access to Maglev stations by high occupancy vehicle modes as well as by pedestrian access and non-motorized vehicles. These measures could include bicycle facilities, convenient pedestrian access, pedestrian scale enhancements, cooperative agreements with public transit and private shuttle services. System design and layout would accommodate inter-modal transfers by providing means of direct access to other transit modes and by making inter-modal connections convenient and safe.

Physical improvements can be made to intersections and roadways. For existing intersections with traffic signals, additional turning lanes and through lanes could be added where rights-of-way are available. Elevated pedestrian walkways could be provided to eliminate the pedestrian traffic conflicting with the turning and crossing vehicles. This would provide additional green time to vehicular traffic.

Peak hour traffic impacts at stations can be lessened by instituting variable pricing of Maglev passenger fares to encourage riders to shift to “shoulder peak” hours or off-peak times of the day. In addition, this type of fare program would allow for a better optimization of the Maglev system and feeder services. Peak hour parking access demand at stations may warrant improvements of thoroughfares providing access to station parking as current excess street capacity is absorbed.

Additional methods to improve the capacity of analyzed intersections and arterials without physical improvements are possible. These methods are typically called Transportation Systems Management (TSM) improvements. Transportation system assessments typically find that the transportation system, while appearing to be saturated, is operating at less than peak efficiency. Minor investments can either preserve the system for future needs or enhance the operation to a more optimal level. This is desirable since these actions can assist day-to-day travel and forestall the time when major investments are more urgently required. Additionally, other strategic investments for specific new facilities or programs can be made that relieve existing problems. These types of actions can include provisions for such things as bike facilities or actions to reduce travel through incentives for transit and carpooling. Congestion management and incident management programs can also help reduce delay.

Regional Transportation

In general, implementation of the Maglev system would potentially benefit regional traffic and transportation by relieving congestion on roadways within an alternative. Congestion relief will improve a roadway’s level of service and safety. With the potential of positive impact to regional traffic and transportation, no mitigation is expected. Beneficial impacts are derived from ridership projections supplied, like all project specific data, by participating states. The following is an assessment of the impacts resulting from each of the seven action and No-Action Alternatives:

4.14.1 California

A preliminary range of patronage estimates has been developed to allow an initial assessment of transportation impacts. A range of boardings and related effects was derived from alternative market research and from available alternative trip tables.

High-speed service from LAX to March Field would provide travelers with a new travel choice that would save substantial travel time over automobile travel during congested peak travel periods of the day. Given that these trips are regional in nature, this would result in a regional reduction in vehicle-kilometers traveled (VKT)/vehicle-miles traveled (VMT) and a lessening of air pollution. Based on an analysis of alternative market research and travel markets, the reduction in daily VKT/VMT for autos would be approximately 3.3 million km (2.05 million mi) per day. On an annual basis the range in estimated VKT/VMT reduction for autos would be approximately 1.019 billion km (633.5 million mi). Additional reductions in VKT/VMT could occur from Maglev carrying commodities and lessening truck traffic. These reductions are estimated to be 16.1 to be approximately 33.796 million km (21 million mi) per year.

Given a substantial travel time advantage over competing modes of travel, a high-speed Maglev line running from LAX to March Field is expected to generate significant ridership by year 2020. The candidate alignment has been analyzed assuming eight passenger stations spaced an average 18.5 km (11.5 mi) apart. The precise locations of all stations are not known, so the information presented is somewhat general. Passenger boarding and alighting activity would occur at stations throughout the day, but will be most pronounced in the morning and evening commute periods (6–9 AM and 4–7 PM). Based on the overall reduction in VKT/VMT and the travel time reduction, the California Maglev Alternative could have a significant benefit to regional transportation.

Implementation of the Maglev Deployment Program could significantly benefit regional traffic and transportation by relieving congestion and reducing overall trip times. On a local level Maglev stations, parking lots, and maintenance facilities could have an insignificant negative impact to local traffic and transportation, requiring the adjustment of traffic patterns and the creation of parking. The overall benefit of congestion relief to the entire alternative significantly outweighs the local traffic impacts at potential station locations. Therefore, there could be an overall potential significant benefit to the traffic and transportation within the California Alternative.

4.14.2 Florida

The assumptions, with respect to the proposed M-2000 system's ridership, indicate that there would be approximately 4,000,000 annual person trips to NASA and 2,000,000 to the Port. The model attributes for estimating ridership were changed to reflect these values, and two new 2020 models were created to find traffic impacts based upon the difference in daily traffic volume from a Cost Feasible Highway Only Model and a Cost Feasible with Maglev model. The difference in the two models is that the aforementioned vehicle trips for NASA and the Port would load at their respective locations for the highway only model and for the Maglev model all of these trips would load at the current airport site, assuming that all of the vehicle trips destined to the Kennedy Space Center or to the Port would be directed to park at the Space Coast Regional Airport site and would prefer to take the Maglev to either destination.

A few important factors should be mentioned, however:

- There are no data on the number of airline passengers who would be using the newly improved airport facility and would be transferring directly to the Maglev System in lieu of arrival by automobile or bus. Obviously, as the percentage of airline passengers who do not access the highway system increases, the overall benefit to surrounding roadways would also increase.
- There are no data on the number of cruise line passengers who arrive at the Port by bus instead of by automobile. Many tourist packages use buses to transport passengers from several locations to a single destination. Based upon overall travel time "savings" it is doubtful whether or not these buses would stop to transfer everyone at the airport rather than continuing the short distance to the Port.
- No estimation was made to account for any other trip purpose. This means, for example, that no trips were included for employees that would "park at the airport and ride the Maglev to work" nor were any other trip purposes included for just riding the Maglev itself as a tourist attraction.

Currently, Brevard County does not have public transit bus service within the project study area. The KSC Visitor Center has bus service from the Visitor Center to the launch facilities. Ridership at the KSC Visitor Center is estimated at 4 million persons annually.

Implementation of the Maglev Deployment Program could have a moderate benefit to regional traffic and transportation from the minimal change in vehicle miles traveled, vehicle hours of travel and changes in volume. The participant estimated that Maglev implementation would result in motor vehicle travel reductions of approximately 178,074 km (110,650 mi) per year. On a local level, Maglev stations, parking lots, and maintenance facilities would have an insignificant negative impact on local traffic and transportation requiring the adjustment of traffic patterns and the creation of parking. The overall minimal benefit of congestion relief to the entire alternative and the insignificant adverse impact to local traffic congestion at potential station locations could result in an overall potential moderate benefit to the traffic and transportation within the Florida Alternative.

4.14.3 Georgia

If the Maglev system were implemented within the Georgia Alternative, the primary area for regional traffic impacts would be the I-75 facility and the area approximately 1.6 km (1 mi) on either side of this alignment. Since Maglev will be a completely grade separated facility paralleling I-75, it will not have a direct impact to the traffic flow, except perhaps during the construction phase when certain temporary lane restrictions are in place. However, the stations proposed for Maglev will have a direct impact on the roadways within the station areas.

Indirectly, the Maglev system is estimated to reduce the total daily VMT for the entire Atlanta region by as much as 196,153 km (121,884 mi) per day by the year 2025. This is not a significant percent change (approximately 0.08 percent), given the estimated VMT daily in 2025 of 257,369,000 km (159,921,700 mi); however, it does provide an alternative mode of transportation for I-75 route travelers.

The traffic impacts of providing a Maglev system along the I-75 corridor are expected to be positive in terms of decreasing congestion levels in this alternative. Maglev passengers can avoid heavy congestion on arterial streets and freeways, resulting in a slight reduction in the number of accidents and a reduction in fossil fuel consumption. This new mode of transportation would replace the automobile for some trip purposes. Finally, the waste in operating expenses for automobile travel due to long delays on the roadways could also be reduced.

The daily Maglev forecasted directional trips for this Program alignment configuration in 2025 is 19,984. The breakdown by purpose for total trips is as follows: work trips – 2,995; non-work trips – 1,034; and airport access trips – 8,888. The model used to yield these numbers is an industry-standard four-step modeling process based on ARC's calibrated model structure. These numbers indicate that Maglev can potentially alleviate the need for a significant number of parking spaces at Atlanta's Airport and can concurrently reduce the demand on the surface roadways leading to and from the Airport, including I-75.

The average annual daily traffic volume on I-75 within the alternative would be reduced by approximately two percent. One factor that is important in considering the beneficial qualities of Maglev is its potential reduction of accidents on I-75. Although detailed crash analysis was not conducted, research shows that approximately 50 fewer crashes may occur with Maglev per year. Based upon 1998 National Safety Council estimations of calculable costs (including the cost to society), assuming no fatalities, it is possible to translate these 50 beneficial fewer crashes into a total economic savings of approximately $2 million per year.

On a regional level, Maglev could result in a moderate daily savings in motor vehicle travel, decreased congestion, reduced delays, and economic savings from less collision. On a local level Maglev stations, parking lots, and maintenance facilities could have an insignificant negative impact to local traffic and transportation, requiring the adjustment of traffic patterns and the creation of parking. The overall impact of the Georgia Maglev Alternative from the modest benefit to regional transportation and the insignificant adverse impact to local traffic could be a moderate benefit to transportation.

4.14.4 Louisiana

If the Maglev system is implemented within the Louisiana Alternative, the motor vehicle travel in 2020 for the New Orleans area is projected to be approximately 47,157,000 km (29,302,000 mi) per day. This is approximately 992,965 km (618,000 mi) per day less than the No Action motor vehicle travel projections. The reduction in VMT in the region would result in noticeable improvements in the peak hour level of service for freeways and major arterials that parallel the Maglev Alternative. The Lake Pontchartrain Causeway is projected to carry 49,450 vehicles per day under the Action Alternatives, approximately 70 percent of the No-Action projected volumes. I-10 should also experience less congestion, however, projections are not available.

On a regional level, Maglev could cause noticeable improvements in peak hour traffic and reduced delays. On a local level, Maglev stations, parking lots, and maintenance facilities could have an insignificant negative impact on local traffic and transportation, requiring the adjustment of traffic patterns and the creation of parking. Thus, the overall impact to transportation from the Louisiana Alternative could be a potential significant benefit.

4.14.5 Maryland

The Maglev system will serve a variety of travel markets within the Maryland Alternative. These include commuters traveling regularly between the Baltimore and Washington areas, business travelers with activities in downtown Baltimore and Washington and the BWI Airport area, airline passengers traveling between BWI Airport and the adjacent cities, tourists and visitors to Baltimore and Washington making trips using Maglev to see attractions in each area. In addition, Maglev will be used for access to major sports venues. In Baltimore, these include PSI Net Stadium and Orioles Park at Camden Yards and in Washington include the new MCI Center.

People currently using the major north-south routes in the Baltimore-Washington corridor (U.S. 29, I-95, U.S.-1 and the Baltimore-Washington Parkway) may redirect their trips to the Maglev and reduce congestion on these roads. Diversion of growth in travel demand in the corridor to the Maglev system will mitigate the significant increase in congestion projected for the corridor. Congestion on major highways in the Baltimore-Washington corridor is projected to increase significantly over the next 20 years, generally averaging about a 33 percent increase on corridor highways.

For the travel markets and travelsheds served by Maglev, projected motor vehicle travel is 159.2 billion km (98.9 billion mi) annually for the No-Action Alternative in 2020. Based on preliminary estimates of Maglev ridership, the system would result in annual motor vehicle travel savings of 470 million km (292 million mi) (KCI, 2000).

Based on reduced congestion and the high annual VMT savings, the Maryland Alternative could have a significant benefit to the region’s transportation. On a local level Maglev stations, parking lots, and maintenance facilities could have an insignificant negative impact to local traffic and transportation, requiring the adjustment of traffic patterns and the creation of parking. Thus, the overall impact to transportation from the Maryland Alternative could be a potential significant benefit.

4.14.6 Nevada

Maglev service would (1) induce a shift in travel modes, primarily from low-occupancy motor vehicles to high capacity trains in the I-15 corridor, thereby reducing the level of congestion relative to the No-Action Alternative; (2) improve linkages among, and enhance the use of, existing and proposed transit modes in metropolitan Las Vegas; and (3) expand mobility options for individuals living and/or traveling within the Las Vegas-Primm corridor along I-15.

The diverted trips between Primm and Las Vegas are estimated from the commuter trips, assuming 4,000 current employees at Primm, of whom about 80 percent live in the Las Vegas area. Based on current surveys and employer tabulations, the current mode split is 82 percent automobile, 15 percent bus, and 3 percent other. The Maglev service is assumed to capture 90 percent of the bus share and 25 percent of the auto share. The investment grade ridership forecast projected 2005 visitor trips between Las Vegas and Primm to be about 24,000 one-way trips per day. The analysis predicted that Maglev would capture about 42 percent of these trips, currently made by automobile.

Assumed growth in employees and visitors accounts for increased trip diversion in future years. Maglev is projected to carry on the order of 40,000 passengers a day in 2020. On an annual basis this represents 14.6 million trips. About 44 percent of these trips would be diverted from other modes of travel. The other 56 percent of the projected Maglev ridership would be induced trips, new trips on Maglev by persons taking excursion rides they would not have taken without the availability of the Maglev. Such trips would include new trips to Primm and local trips on Maglev in Las Vegas, in the downtown to South Resort Corridor line segment.

Visitor and employee trips on Maglev would reduce annual vehicle miles of travel on I-15. By 2020, Maglev is projected to divert auto and bus trips from I-15 between Las Vegas and Primm, representing 417,719 VKT (259,559 VMT) per day as discussed in the Energy section of this document. These estimates assume a moderate growth forecast—2 percent annually—for the existing visitor growth, slight increases in employment at Primm between 1999 and 2002, and a modest beginning of an industrial park in the Ivanpah Valley by 2010.

Diversion of traffic to Maglev would reduce congestion, and consequently improve traffic operations, on I-15 relative to the No-Action Alternative. Maximum beneficial impact is expected to occur southbound approaching the California border at Primm. With proposed widening of I-15 south to Primm, a queue is expected to develop southbound where the road narrows from three to two lanes. Maglev is expected to reduce southbound Sunday PM I-15 traffic by approximately 5 percent, reducing traffic delay by a proportionate amount (2003).

As in Primm, most Maglev travel would occur during the hours of high visitor activity along the Las Vegas strip, which occur mainly outside of the traditional commute periods but would overlap some with the PM peak on certain days, e.g., Fridays. Like all hospitality workers, Primm workers are scheduled 24 hours a day, seven days a week, and therefore create only a diffuse travel peak. Further, due to the high level of projected excursion rides on Maglev, which both originate and terminate in Las Vegas, traffic to and from stations is expected to be less than travel to and from Primm. More travel would occur during less congested off-peak hours. Both of these factors would tend to reduce the level of traffic impacts attributable to Maglev in the vicinity of stations.

The implementation of Maglev service is expected to result in net benefits to other transit modes in the alternative. Employees now commute to Primm either by auto or on a chartered bus service subsidized by their employer. The chartered bus makes many stops in the urbanized area prior to making the trip to Primm, so employees without auto transportation spend many hours each week commuting. Introduction of the Maglev would make this chartered service far less attractive, so it is assumed that it would be discontinued. Similarly, commuters riding the Citizens Area Transit (CAT) service between downtown and the airport would find a great timesaving over the CAT service. Although Maglev would replace most, if not all, intercity bus service between Primm and Las Vegas and reduce bus ridership on CAT routes connecting downtown Las Vegas with McCarran International Airport, Maglev service would enhance inter-modal connections and generate an overall increase in area transit use.

Implementation of the Maglev Deployment Program could benefit regional traffic and transportation by relieving congestion and reducing overall trip times. On a local level, Maglev stations, parking lots and maintenance facilities could have an insignificant negative impact on local traffic and transportation, requiring the adjustment of traffic patterns and the creation of parking. It is expected that the overall benefit of congestion relief to the entire corridor would outweigh the local traffic impacts at potential station locations. Therefore, there could be an overall moderate benefit to the traffic and transportation within the Nevada Alternative.

4.14.7 Pennsylvania

An investment grade ridership forecast was prepared for opening day (2006) and design year (2026) conditions. The forecast used the existing urban travel mode maintained by the Southwestern Pennsylvania Commission (SPC), the regional MPO, as a basis for producing ridership forecasts. The modeling approach included the following features:

- Development of land use forecasts reflecting the impact of the Pennsylvania Project on a regional basis as well as local in the vicinity of Maglev stations.
- Independent review of land use forecasts and methodology.
- State preference surveys and analysis.
- Origin/destination survey in the alternative.
- Calculation of induced demand.

Segment fares \$2.50, \$5.00 and \$7.50 were modeled, at headways of 10 minutes, 20 minutes and 30 minutes. Using the \$5.00 segment fare at a 10-minute headway, the regional transportation model maintained by SPC and the Maglev model were used to project vehicle travel in the corridor for the year 2020 for the Maglev implementation alternative. Projections of motor vehicle travel for 2020 yield approximately 115,792,290 km (71,950,000 mi) per day, compared to 110,536,170 km (68,684,000 mi) with Maglev implementation, indicating a potential reduction of 5,256,120 km (3,266,000 mi) traveled per day from Maglev implementation. On a yearly basis, Maglev implementation would reduce motor vehicle travel by 1,576,836,000 km (979,800,000 mi).

The reduction in vehicle travel is approximately 4.5 percent, indicating a significant positive benefit on mobility within the corridor. Implementation of the Maglev deployment program could significantly benefit regional traffic and transportation by relieving congestion and reducing overall trip times. On a local level, Maglev stations and parking lots could have a significant impact to local traffic and transportation, requiring adjustment of traffic patterns and creation of parking. The overall benefit of congestion relief to the entire corridor significantly outweighs the local impacts at potential station locations. Therefore, there would be an overall potential significant benefit to traffic and transportation within the Pittsburgh area.

4.14.8 No-Action Alternative

Under the No-Action Alternative, the Maglev Deployment Program would not proceed. It is anticipated that economic and population growth will continue around the country. This expansion could result in increased intercity travel demand and ensuing congestion. The increased operational congestion could also lead to safety deficiencies of transportation systems. Roadways would continue to operate at a lower level of service with increased travel times and potentially unsafe conditions. Airports would continue to experience delays. Thus, the No-Action Alternative could have a significant adverse impact on transportation and traffic. Under the No-Action Alternative, it is expected that the demand for transportation infrastructure development actions, including airport, railway, and highway expansion projects, would be elevated to meet the increasing commuter travel demand. However, it is also uncertain what actions would be taken to address some of the main problems associated with inter- and intra-regional transportation in the United States.

4.15 ENERGY

Maglev trains are electromagnetically levitated and electrically propelled along a guideway. Electric energy is also used for auxiliary services. The energy supply for Maglev technology is normally drawn from the three-phase, public power grid (typically 110 kV).

The system power for the TRI Maglev trains is typically drawn through 30 MW substations and then stepped-down to 20 kV for internal energy supply and propulsion system use. The energy supply portion of the substation contains high and medium voltage switching equipment, internal power supply equipment, power supply equipment for the wayside components, safety shutdown systems, and control equipment.

The power supply and distribution system would provide power to the M2000 guideway, through high voltage conductors, substations, transformers, AC to DC converters and medium voltage conductors. The M2000 power distribution system can be described as follows: high voltage AC power from the utility company will be stepped down to a lower voltage and converted to DC voltage at substations spaced approximately 5 miles apart along the route of the M2000. The DC power from the substations will connect to 5kV DC distribution lines mounted on the guideway that, through electronic switches, feed blocks of Linear Synchronous Motors (LSM) positioned along the guideway. Substations would consist of two areas: the transmission area that would house power company's equipment, and the distribution area that would house the transformers and converters.

The low energy consumption of the Maglev system results from its lack of friction (non-contact technology), the high efficiency of its propulsion system, and the vehicle's low weight and low aerodynamic resistance (no fuel-storage, smooth exterior and underbody). For these reasons, when traveling at the same speed, Maglev consumes approximately 30 percent less energy than a modern high-speed train. Or formulated another way, for the same energy input, Maglev produces approximately 1/3 more output/performance. When compared with road and air travel, Maglev is even more energy efficient on a per passenger basis. For equal distances, the specific energy consumption of automobile travel is three times higher and for air travel, five times higher than that for the Maglev system.

Analysis of the potential energy impacts of the proposed alternative focuses on the potential impact to the electric power supply and distribution systems, identifying any electric capacity issues relevant for the support of the proposed project alternatives. The analysis also includes an assessment of the estimated net change in regional energy consumption in 2020, when comparing the Maglev Alternative with the No-Action Alternative. This comparison reflects the potential net impact on energy derived from changes in automobile and commercial travel in the region promoted by the implementation of the proposed alternative, and offset by energy requirements for operation of the Maglev system. Changes in travel are quantified in the form of changes in VMT induced by the Maglev Alternative, and are then converted to changes in energy use by applying average fuel efficiencies/energy consumption rates per unit of VMT for each of the affected modes. Potential sources of energy and any potential effects on existing or other future users of electricity are also discussed in this section.

The analysis of the potential impact in energy consumption concludes with the potential electrical energy to operate Maglev compared to the change in fossil fuel consumption from commuters no longer using automobiles. An additional consideration is that Maglev uses electric energy that could be generated from hydroelectric facilities, coal, petroleum, natural gas, wind, and other means of generation, while motor vehicle travel uses fossil fuels as its primary energy source.

4.15.1 California

When in full operation, the Maglev system would become one of the largest single electric energy users in the region. Under deregulation of the electric power industry in California, investor-owned utilities are becoming electrical transmission, distribution, and energy services companies. In addition, the operator of the Maglev system could purchase power from any of a number of power providers throughout the United States. As such, the potential effect of the project on local or regional power supply is difficult to determine. Given the now national supplier market, there should be greater opportunities for securing power in the long term. Similarly indeterminate under the new electric utility market are the potential indirect effects on the prices or availability of fuels or other resources used to generate electricity.

Several electrical substations and power distribution lines may need to be constructed as part of the system, to address the projected increase in electrical energy demand. The private and municipal electric utilities in the region have maintained aggressive programs of expanding their distribution systems to meet the needs of new users, so no constraints on distribution of power to the Maglev system or other users are anticipated. Thus, although the Maglev project would substantially increase electrical energy use in the region compared to the No-Action Alternative, this increase is not projected to have a significant effect on electric energy cost and availability to other users. No significant adverse impact to the electric power and distribution systems of the corridor is anticipated.

An average power consumption scenario was developed for the Maglev project, based upon direct energy (energy used to operate the vehicles) and excluding generation and transmission losses, to allow direct comparison with other transportation modes. Standard route energy use data for a 5-section train were derived from TRI's energy use data, including the acceleration, cruise, and deceleration modes. Assuming that Maglev consumes 16.7 kWh per km (26.9 kWh per mi) of travel (CM, 2000), and calculating total train miles traveled based on ridership, the participant estimated that the direct propulsion energy consumption for the Maglev train propulsion system would be 834.7 billion BTU per year. In addition to the energy used for train propulsion, the Maglev system would require the operation of several planned passenger stations along the corridor. Since the locations have not yet been designed, an assumed factor of 10 percent of train propulsion energy was used as representative of total station energy consumption. The estimated total energy consumption for the Maglev system would be 918.2 billion BTU per year.

It is anticipated that average weekday passenger boardings for the Maglev system in 2020 will range from 92,000 to 118,000 events (equivalent to 46,000 to 59,000 passengers per day). The passengers using the system would otherwise travel in private automobiles for the most part, with a small percentage using existing rail or bus transportation. For analytical purposes in projecting future energy use, it is assumed that all diverted trips would be from motor vehicles to the Maglev system. Implementation of the project would reduce daily automobile travel by approximately 3,300,000 VKT (2.050,000 VMT) in 2020. In addition, the proposed Maglev system will carry freight, with a corresponding reduction in daily truck travel ranging of 109,373 VKT (67,961 VMT). Data projections of average fuel efficiencies were used to estimate the potential gasoline use savings from Maglev implementation. Fuel efficiency for gasoline vehicles was assumed to be 11.03 km/L (22.55 mpg) for the low base case scenario and 9.66 km/L (19.75 mpg) for the high gasoline use case; for diesel vehicles, fuel efficiency was assumed to be 2.16 km/L (5.07 mpg) (CM, 2000). The calculated potential gasoline and diesel savings, in BTU equivalents, range from 4,223 to 4,741 billion BTU per year, assuming energy content values of 130,000 BTU and 138,000 per gallon of gasoline and diesel, respectively. The range accounts for the different scenarios of automobile travel and fuel efficiency for the year 2020 considered in the analysis.

The annual estimates of Maglev energy consumption (918.2 billion BTU) and fuel reduction from less motor vehicle travel (between 4,223 and 4,741 billion BTU) were used to calculate the potential net changes in energy consumption for the corridor. The participant estimated that the implementation and operation of the Maglev system in the corridor would result in a net reduction in regional energy consumption in the year 2020 ranging from 3,305 billion BTU to 3,823 billion BTU per year, which represents an overall decrease in energy consumption of at most 0.2 percent

Implementation of the proposed alternative would result in overall minor net energy savings for the region. Thus, a moderate beneficial impact to the energy system of the region is anticipated from the implementation of the proposed alternative. No mitigation for impacts on energy resources is required due to the absence of adverse impacts.

4.15.2 Florida

The power consumption of the M-2000 MOS is estimated to be 847,348.5 BTU per 29 km (18 mi) run. Maglev ridership was estimated to be 4 million passengers per year, based upon the travel mode choice assumptions stated in the Transportation section. In order to meet the estimated ridership the Maglev 2000 system would require 110 runs per day, which correspond to annual energy consumption of 34.03 billion BTU.

The implementation of the M-2000 system would reduce motor vehicle travel and slightly increase average travel speeds in the corridor. The participant estimated that the M-2000 would reduce VKT by 178,074 (VMT by 110,650) per year. Using the assumed 8 km/L (18 mpg) for fuel economy and a calculated energy content value of 53,226 BTU per liter (201,481 BTU per gallon) of gasoline (FDOT, 2000), M-2000 implementation would result in a reduction of 23,326 L (6,162 gal) of gasoline per year, which correspond to a reduction of 1.242 billion BTU per year.

The annual estimates of Maglev energy consumption (34.03 billion BTU) and fuel reduction from less motor vehicle travel (1.242 billion BTU) were used to calculate the potential net changes in energy consumption for the corridor. The participant estimated that the implementation and operation of the Maglev system in the corridor would result in a net increase in regional energy consumption in the year 2020 of 32.79 billion BTU, which corresponds to an increase of approximately 14.5 percent in transportation energy consumption. Thus, a moderate negative impact to the energy system of the region is anticipated from the implementation of the proposed alternative. No mitigation for impacts on energy resources is required due to the absence of significant adverse impacts.

4.15.3 Georgia

Georgia Power currently has a generation capacity of 126,468,120 MW h/yr (14,437 MW x 8760 hr/yr), which corresponds to approximately 4.31×10^{14} BTU/yr. In addition, Georgia Power is seeking to re-license three hydroelectric plants that will increase grid capacity. The passenger stations are proposed to be located in populated areas where the existing distribution infrastructure should be sufficient to handle the minimal increase in demand to accommodate Maglev.

The energy requirements for the Maglev system (train, passenger station, and central maintenance facility operations) were calculated based on TRI's train performance calculations, which account for speed, guideway alignment, number of stops, and number of cars/trains. Maglev energy consumption in 2025 was estimated to be 311.5 billion BTU, which accounts for approximately 0.07 percent of the current total generation capacity in the region, and would therefore represent an insignificant increase to total electrical generation. Given the current generation and distribution capacity in the corridor, it is expected that there will be adequate supply lines and distribution to handle the minimal energy consumption increase produced by the implementation of the proposed Maglev Alternative. Thus, no significant impact to the power and distribution systems of the corridor is anticipated.

The direct annual changes in energy consumption for the forecast years have been estimated for the area. It is assumed that the deployment of the Maglev system would not change airline operations or air travel demand between Atlanta and Chattanooga. The model used to predict energy usage was based on Trans Rapid International's train performance calculations. The model accounts for the speed profile, vertical and horizontal alignment of the Maglev guideway, and number of stops, and cars/train (three).

The changes relating to the action alternative are a very small portion of the total regional transportation operation. The participant estimated that there would be a decrease in vehicle travel of approximately 61,200,000 km (38,027,920 mi) per year by 2025. Using assumed values for fuel efficiency (26.9 mpg) and BTU content (125,000 BTU per gallon of gasoline), the reductions in motor vehicle travel result in energy savings of approximately 176.7 billion BTU for 2025.

The annual estimates of Maglev energy consumption (311.5 billion BTU) and fuel reduction from less motor vehicle travel (176.7 billion BTU) were used to calculate the potential net changes in energy consumption for the area. The participant estimated that the implementation and operation of the Maglev system in the area would result in a net minor increase in energy consumption for the chosen forecast year of approximately 134.8 billion BTU per year. Because of the small scope of the Maglev system in the regional context, and because the energy use of new fixed facilities for Maglev is counted, a slight increase in total regional energy requirements for transportation is forecast. The increase represents about 0.05 percent of the total regional transportation energy consumption in 2025, which will be on the order of 285 trillion BTU. The forecasted increase in energy consumption for the alternative is considered to be an insignificant adverse impact. Thus, no mitigation for impacts on energy resources is anticipated.

4.15.4 Louisiana

Net change in energy consumption for the Louisiana Alternative is evaluated by comparing the potential reduction in automobile travel in the region due to the implementation of the proposed alternative, with the additional electrical power requirements of the Maglev system operation. The Maglev system is estimated to consume approximately 820,000 kilowatt-hours on an average day, including Maglev operation, maintenance, and station requirements. This figure converts to approximately 2.8 billion BTU of power consumed by the Maglev system on a daily basis, which corresponds to approximately 1,021 billion BTU per year. As electrical substations would be located on both the North and South shores of Lake Pontchartrain, both Entergy and Cleco would be supplying electricity for Maglev operation. Through communications between Louisiana Maglev participants and the electric utility companies operating in the corridor, it has been determined that there would be sufficient generation capabilities to supply the projected energy consumption of the projected. Hence, it is concluded that the project will have an insignificant impact on the electric distribution and supply systems in the alternative.

The Louisiana Maglev Alternative could reduce peak period commuter traffic in the corridor. It could also promote the reduction of commuter congestion on or along the roadways serving the general area between the New Orleans International Airport and the downtown business district of the city of New Orleans. Benefits would be realized from increased vehicle mobility on the local highway system, which would result in less direct and indirect vehicle operational energy consumption. The participant estimated that the implementation of the Maglev system would reduce motor vehicle travel in the corridor to approximately 47,156,997 km (29,302,000 mi) per day. Thus, the difference in VMT between the No-Action and Action Alternatives is 992,965 km (617,000 mi) per day. This would result in approximately 140,060 L (37,000 gal) of fuel saved each day in the study area with the Maglev system, when using the same assumptions for vehicle mix, BTU content value (126,760 BTU/gallon), and average mileage ratings (7.09 km/L [16.68 mpg]) for 2020 as in chapter 3. This would convert to 4.7 billion BTU saved each day by implementing the Maglev system, which correspond to approximately 1,712 billion BTU per year.

The annual estimates of Maglev energy consumption (1,021 billion BTU) and fuel reduction from less motor vehicle travel (1,712 billion BTU) were used to calculate the potential net changes in energy consumption for the corridor. It is estimated that the implementation and operation of the Maglev Alternative in the area would result in net savings in energy consumption for the year 2020 of approximately 691 billion BTU per year, which represents a net reduction of less than 1 percent compared to the No-Action transportation energy consumption for the region.

The implementation of the proposed alternative would result in overall net energy savings for the region. Thus, a moderate positive impact to the energy system of the region is anticipated from the implementation of the proposed alternative. No mitigation for impacts on energy resources is required due to the absence of adverse impacts.

4.15.5 Maryland

The base-case operating plan for Maglev operating plan presumes the use of a 3-car train operating 320 round trips per week on a 64 km (40-mi) route. It was estimated that Maglev consumes 6,425,063 BTU per trip. The number of trips needed to meet projected ridership was estimated at 320 roundtrips per week. Adding a 10 percent factor for energy related to support operations, it was estimated that the Maglev system operation would consume 235.2 billion BTU per year (KCI, 2000).

The projected motor vehicle travel reduction resulting from travel on Maglev is 1,287,475 km (800,000 mi) daily in 2020, corresponding to 29,000 diverted daily motor vehicle trips. Consequently, the annual reduction in motor vehicle travel would be of 470 million VKT (292 million VMT). Assuming a fuel efficiency factor of 20.6 mpg and gasoline energy content of 125,000 BTU/gallon, the calculated reduction in motor vehicle travel is equivalent to a daily savings of 4.85 billion BTU, which corresponds to annual reductions in energy consumption of 1,771.8 billion BTU (KCI, 2000).

The annual estimates of Maglev energy consumption (235.2 billion BTU) and energy reduction from less fuel for motor vehicle travel (1,771.8 billion BTU) were used to calculate the potential net changes in energy consumption for the area. It is estimated that the implementation and operation of the Maglev Alternative in the corridor would result in net savings in energy consumption for the year 2020 of approximately 1,536.6 billion BTU per year, which represents a net reduction of about 1.85 percent compared to the No-Action Alternative transportation energy consumption for the region (KCI, 2000).

The implementation of the proposed alternative would result in overall net energy savings for the region. Thus, a moderate positive impact to the energy system of the region is anticipated from the implementation of the proposed alternative. No mitigation for impacts on energy resources is required due to the absence of adverse impacts.

4.15.6 Nevada

Under deregulation, the operator of the Maglev system could purchase power from any of a number of power providers throughout the United States. As such, the potential effect of the project on local or regional power supply is difficult to determine. Given the now national supplier market, there should be greater opportunities for securing power in the long term. Similarly indeterminate under the new electric utility market are the potential indirect effects on the prices or availability of fuels or other resources used to generate electricity. The Nevada Power Company (NPC) has maintained an aggressive program of expanding its distribution network in order to meet the power consumption requirements of new users. Representatives from the Nevada Maglev Alternative have discussed the Maglev power requirements with the NPC, and no constraints on power distribution to the system are anticipated. Implementation of the Maglev Alternative would substantially increase electrical energy use in the region compared to the No-Action Alternative. This increase is not projected to have a significant effect on electric energy cost and availability to other users. Thus, it is expected that there would be no significant adverse impacts to the electrical power and distribution systems of the area.

Direct Maglev energy was calculated as the energy used for propulsion, including auxiliaries, and is based upon energy and power studies from which energy consumption was estimated at 2,096 BTU per mile. Energy consumption for operations of the proposed Maglev system was estimated to be on the order of 5.041 billion BTU of electrical energy per day. On an annual basis, assuming operation on the same basic service plan throughout a 365-day year, Maglev would consume energy on the order of 1,840 billion BTU per year in 2020. Power requirements vary depending upon the number of trains in service, their total time in service, their operating speed, and a number of other factors.

Implementation of the proposed Maglev Alternative could induce a diversion of personal motor vehicle and bus trips to train travel, thereby potentially reducing traffic along the main roadways in the corridor. This potential reduction in motor vehicle travel demand could generate energy savings in the form of less gasoline and diesel fuel consumption as a result of the shortened or totally avoided trips. The estimate of diverted inter-city trips in the corridor is based upon the current level of trips of this type, which are assumed to grow at 3 percent a year to 2020. The expected reduction in motor vehicle travel would result in a decrease of 417,719 km (259,559 mi) daily with Maglev service operational in the corridor compared to the No-Action Alternative. In addition, there would be a reduction of 4,138 km (2,571 mi) of heavy-duty travel per day. Assuming fuel economy factors of 12.75 km/l (30 mpg) for gasoline and 1.7 km/l (4 mpg) for diesel vehicles (PTG, 2000c), respectively, and energy content values of 138,600 BTU/gallon-gasoline and 155,100 BTU/gallon-diesel, Maglev implementation results in annual savings of 453.1 billion BTU per year of primarily fossil fuel-based energy use (417.6 billion BTU from gasoline vehicle travel and 35.5 from diesel vehicle travel reductions).

The annual estimates of Maglev energy consumption (1,840 billion BTU) and fuel reduction from diverted motor vehicle travel (453.1 billion BTU) were used to calculate the potential net changes in energy consumption for the corridor. It is estimated that the implementation and operation of the Maglev system in the corridor would result in a net increase in regional energy consumption in the year 2020 of approximately 1,387 billion BTU per year. The energy savings from the reduction in motor vehicle trips in the corridor is more than offset by the increase in energy use by Maglev trains. It should be noted that a substantial portion of the increase in energy use results from a high level of Maglev service required to accommodate induced train travel. The increase in energy consumption represents about 1.5 percent of the total projected No-Action regional transportation energy demand in 2020. This forecasted minor increase in energy consumption for the corridor is considered to be an insignificant adverse impact to the energy supply and distribution systems of the area. Thus, no mitigation for impacts on energy resources is anticipated.

4.15.7 Pennsylvania

With the deregulation of the electric utility industry, the generation market has become more competitive. Service to the electrical substations that would be constructed to provide electricity for Maglev operation would be provided via the 138 kV transmission systems of Duquesne Light and Allegheny Power. The generating facilities within these two electric utilities are more than adequate to supply the projected total Maglev energy consumption of approximately 376 billion BTU per year for 2020. Increased energy consumption in the order of magnitude estimated for the Maglev system would not be a burden for the electric utility system, since current transmission and distribution systems should be adequate to reliably supply the needed energy for Maglev operation in the alternative.

Maglev would represent a little over one percent of total energy consumption in 2020. There already exist several industrial and commercial customers in the corridor whose energy consumption exceeds the Maglev projection. The potential impact of the Maglev project to the electric power supply and distribution system of the interconnected regional electrical network is minimal. Based on traditional assessment procedures, the electric transmission, distribution, and generation capacity resources planned and presently in service in the corridor region, it is concluded that they will satisfy the ECAR criterion for adequate reliability to serve currently projected demand and obligations. Thus, no significant adverse impacts to the electrical power generation and distribution systems of the corridor are anticipated.

Investment grade ridership estimates were produced and used to project vehicle travel in the corridor for the year 2020 for the Maglev implementation alternative. Projections of motor vehicle travel for 2020 yield approximately 115,792,290 km (71,950,000 mi) per day, compared to 110,536,170 km (68,684,000 mi) with Maglev implementation, indicating a potential reduction of 5,256,120 km (3,266,000 mi) traveled per day from Maglev implementation. The potential energy savings from reduced vehicle travel, in BTU equivalents, were calculated using the same assumptions of fuel efficiency and BTU content as in Chapter 3. The resulting reduction in energy consumption from reduced vehicle travel is approximately 6,381 billion BTU per year.

The annual estimates of BTU consumption (376 billion BTU) and fuel reduction (6,861 billion BTU)) were used to calculate the potential net changes in energy consumption for the corridor. It is estimated that the implementation and operation of the Maglev system in the corridor would result in a net decrease of 6,485 billion BTU for the year 2020. This decrease represents about 5 percent of the total regional transportation energy consumption in 2020, indicating a significant positive impact.

4.15.8 No-Action Alternative

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be constructed. Therefore, there would be no impacts on transportation directly from a Maglev system. However, it is important to consider potential impacts from the No-Action Alternative that could arise from precluding the Maglev Deployment Program and the potential benefits of constructing a Maglev system.

It is anticipated that economic and population growth will continue around the country, spurring increased intercity travel demand and ensuing congestion. The increased operational congestion could also lead to safety deficiencies of transportation systems. Roadways would continue to operate at a lower level of service with increased travel times and potentially unsafe conditions. Airports would continue to experience delays. Thus, the No-Action Alternative could have a significant adverse impact on transportation and traffic. Under the No-Action Alternative, it is expected that the demand for transportation infrastructure development actions, including airport, railway, and highway expansion projects, would be elevated to meet the increasing commuter travel demand. However, it is also uncertain what actions would be taken to address some of the main problems associated with inter- and intra-regional transportation in the United States. It will be necessary to examine the impacts on a local, regional and national basis.

4.16 PUBLIC SAFETY AND HEALTH

By law, the FRA has responsibility for ensuring railroad safety throughout the Nation. To monitor railroad compliance with federally mandated safety standards, FRA employs 400 inspectors operating out of 47 offices throughout the country. FRA's traditional site-specific safety inspection program has produced substantial gains in railroad safety with real benefits for the American people. Public safety, health and environmental factors are some of the most important considerations with regard to the implementation of the Maglev Deployment Program. Public safety and health issues will be considered for both potential Maglev technologies in the following analysis. Before any of the alternatives are implemented, the FRA will analyze at the time of final design the safety and health performance of the proposed action during the site-specific EIS process.

Electromagnetic fields and radiation emissions from the Maglev technologies could pose a potential public safety and health risk. EMF/EMR safety standards and guidelines have been established to protect the public. As long as these standards are met, Maglev operation should be safe, and accepted by the public. This section analyzes the potential for EM emissions from Maglev and considers them with regard to established EMF/EMR safety guidelines and standards.

4.16.1 Systems Safety Features

TR08 Maglev

All proposed alternatives, except Florida, would use the Transrapid Maglev system. Although the most current Transrapid Maglev System would be deployed, information is only available from an earlier version, the TR07. The latest version, the TR08, is reported by TRI to be designed to at least achieve and possibly exceed the performance of the TR07. If the TRI technology is chosen for the Maglev Deployment Program, detailed technical information will be developed on the current state of TRI Maglev System performance and safety features. These features would be fully assessed in a site-specific EIS. The following preliminary information is based on data obtained a decade ago on the TR07.

Passenger-carrying vehicles of the TRI type have been tested since 1976, and field data are available from the TRI's 31.5 km (19.6 mi) test track in Emsland, Germany. That test facility has been in operation since 1987 and currently operates up to eight rides per day, 6 days per week. Since construction, the facility achieved a total of 650,000 km (403,891 mi) and has carried approximately 200,000 passengers. According to TRI, there have been no major mishaps during construction or operation.

The safety concepts of the TRI's Maglev includes:

- Automatic train control and system protection without the need for operator intervention for safety-critical functions.
- Automatic monitoring and reporting of all system equipment, functions, and status including automatic dimensional inspection of the guideway.
- Protection of passengers during ingress and egress of trains in stations by a platform gate system (if desired by operator).
- Passive protective measures (barriers, etc.) against the intrusion of obstacles into the vehicle's path.
- Fire protection measures and rescue strategy.
- Designed-in crashworthiness to minimize hazards associated with collision with unexpected obstacles.
- At crossing points where TRI alignments intersect with road and rail links, TRI's Maglev will be grade separated to ensure there is no opportunity for physical contact between other transportation facilities.

Guideway Safety Considerations. Safety is a principal feature of TRI design. Safety starts with the basic wrap-around-the-guideway design of the physical vehicle and extends through to the fully automatic operation-control system.

Unlike conventional railways, there are no plans for exposed high-voltage components such as overhead supply cables. All electrical components are fully insulated and/or enclosed or buried to prevent unauthorized contact. System safety is also enhanced since only relatively short sections of the guideway (motor sections) are powered at any one time (as the train physically passes). Other sections are inherently safe with no power applied.

As a mitigation measure, a U-shaped protective shield that would go under and to the sides of the guideway and lower part of the Maglev vehicle could be used. This shield could lower the sound levels to below and to the side of the guideway, and keep dust and debris from being swept directly off the side of the guideway. The shield could also protect the under-running parts of the Maglev vehicle and the public from these under-running parts. In addition, in cold climate areas, heating elements could be installed on the shield and on the guideway to prevent ice buildup during snow storms.

Collisions between trains on the same guideway are unlikely due to the nature of the propulsion system in the guideway. The motor would force each of the trains located within the same propulsion segment to travel at the same speed and direction. Collisions with other transportation systems are excluded by avoiding the use of at-grade intersections and the wrap-around construction of the train to the guideway makes derailment unlikely.

In comparison to other transportation systems, the loads experienced by the trains and guideway in the Maglev system are extremely low, thereby reducing the overall operating risk. This is accomplished by continuous transfer of the vehicle loads along the entire length of both sides of the train via levitation and guidance magnets. As in all transportation modes, accidents can happen. There is the remote chance that trucks, buses, and cars could accidentally hit a guideway support column. Using the latest technology, any changes in the guideway can be accurately identified and located by automatic monitoring of the geometry of the guideway.

As a mitigation measure, a U-shaped protective shield that would go under and to the sides of the guideway and lower part of the Maglev vehicle could be used. This shield could lower the sound levels below and to the side of the guideway, and keep dust and debris from being swept directly off the side of the guideway. The shield could also protect the under-running parts of the Maglev vehicle and the public from these under-running parts. In addition, in cold climate areas, heating elements could be installed on the shield and on the guideway to prevent ice buildup during snow storms.

Communication and Control. The design of the longstator propulsion system and the operation control system technically prevents two trains from being in the same motor section at the same time. Even if this did theoretically occur, since the motor is in the guideway, it would force both trains to travel at the same speed in the same direction, thereby again preventing a collision.

The safety features of the automatic train control and system protection systems are designed to minimize human error from causing an event, which could lead to a safety-relevant situation. The operation-control system, which does have this responsibility, is designed and built with full technical and operational redundancy with automatic shutdown routines to prevent any situation escalating to a level where human safety could be at risk.

The primary communication between the vehicle and the operation-control center is via the radio-transmitted operation-control system. The same will be true for the stations. To augment this, normal mobile telephones may be used (public networks) both during the trip time and in case of emergency.

Vehicle Component Safety. If the facility loses power during operation, the vehicle relies on its on-board batteries to maintain levitation until the vehicle is brought to a stop using the back-up (eddy current) brakes. Power interruptions have been simulated numerous times over the years without serious safety implications. The newest TRI vehicle, the TR08, has a design speed of 550 km/h (342 mph). The maximum operating speed of the proposed alternative is approximately 500 km/h (310 mph).

The Maglev feature for emergency and rescue operation provides a redundant electrical-power system (batteries) within the vehicle to provide enough power to levitate the vehicles in a "hover" mode for reduced operating conditions. This feature would allow the Maglev to reach the next stopping area for safe egress. In cases where emergency evacuation is necessary, this would be accomplished by means of evacuation tubes, located at each door, in areas with firm, level ground. Walkways with stairs are provided along the guideway at auxiliary stopping areas where adverse ground conditions such as water or swamps occur. Specific details addressing the evacuation of elderly or disabled passengers will be addressed during final site design.

The nose area of the train is reinforced, shaped to deflect most guideway obstructions, and has a crush zone to absorb larger collisions. These design considerations minimize the effect to passengers.

During operation at the TRI Test Facility in Northwest Germany, vehicles have traveled in gusty weather with wind speeds up to 60 m/s (197 ft/sec) without any contact between the magnetic levitation components and the guideway. Even if contact should occur (regardless of the reason), there are no safety issues involved.

The Maglev vehicles also incorporate state-of-the art protection from direct and indirect lightning strikes. The vehicle is designed to allow a predefined crossover of the lightning-current between guidance magnets in the vehicle and the guidance rails on the guideway beams. The beams are grounded to the guideway substructures, which are in turn grounded to the soil. The vehicle body is designed and qualified as a Faraday Cage. All vital vehicle functions are qualified for EMF-compatibility due to lightning.

Fire Safety. Maglev vehicles expose the public to similar fire hazards as conventional electric propulsion rail cars. Recently finalized Federal rules for rail passenger equipment cover a wide range of hazards and specify acceptable materials for interior compartments. All of these specifications and standards are intended to reduce the likelihood of a fire and to reduce the severity of a fire mainly by reducing the smoke quantity and toxicity and heat content of any fire that should occur. The TRI design will be required to satisfy the requirements pertaining to fire safety in the Federal passenger equipment rule.

Emergency Preparedness and Evacuation. In most circumstances Maglev vehicles will operate as intended, and passengers will board and disembark through the normal doors at stations. The extensive use of elevated Guideway makes evacuation procedures a special concern. The TRI design depends on evacuation tubes at each door to provide emergency egress. In locations where the tubes are not practical (i.e., over water, swamp, steep rugged terrain), special structures and stairways are provided leading to safe areas. Onboard operating personnel would be responsible for assisting elderly or disabled passengers. Applicable passenger equipment standards require rail systems to complete an emergency plan and specify number of emergency exits with special lighting and signage. During the site-specific design stage, local fire fighter and rescue workers could be consulted to prepare emergency plans.

All Maglev passenger stations and support and maintenance areas will be serviced by State and local police, and local ambulance, fire, and hospital emergency services. Existing emergency procedures and routes associated with currently operating transportation, transit, and commuter facilities (buses, trains, and airplanes) are applicable to support the Maglev operation. The medical equipment to be carried on the Maglev vehicles will be specified through the route operator and U.S. regulations. Related emergency plans, specialized evacuation procedures, and emergency preparedness training should be addressed during final site design.

MAGLEV 2000

The Florida Alternative proposes to use the M-2000 technology. Although the M-2000 has not been constructed or tested, it is designed and engineered to maximize safety and reliability through the use of design approaches that minimize risk, multiple-redundant components that eliminate the chances of single point and common mode failures, back-up systems, and continuous, real-time monitoring of the operating health of the M-2000 guideway and vehicles.

The safety concepts of Maglev 2000:

- Real-time, continuous monitoring of all guideway section.
- Video, sensors and laser to detect hazardous objects.
- On-board sensors to monitor the proper functioning of guideway loops.
- Speed and position of all vehicles on the guideway are continuously monitored and controlled by a central facility.
- Crashworthiness design to deflect impacting objects either airborne objects or on the guideway.
- Continuous two-way voice communications between the vehicle operators and the central facility.
- Levitation and guidance system designed to withstand extremely strong external forces, such as, very strong crosswind gusts.

Guideway Safety Considerations. The M-2000 guideways, both narrow-beam and planar, are elevated well above grade so that access to the guideway is restricted. In addition, there is a large physical clearance (i.e., 15 cm (6 in)) between the levitated vehicle and the guideway. These characteristics minimize the possibility of deliberate or accidental damage to the guideway, and the emplacement of hazardous objects.

All portions of the guideway are continuously monitored in real-time by the central traffic-control facility, using both zoom video cameras mounted on poles and sensors to detect when hazardous objects are present. The vehicle can also determine whether the guideway beam position and orientation is correct, or whether it has shifted, and to what degree.

In addition, each time a vehicle travels the entire length of the guideway, its sensors will detect whether the local guideway loops are functioning correctly or not. That is, the vehicle can detect whether the levitation and guidance loops are open circuited or short circuited (completely or partially), whether they have moved from their proper position, and whether the AC in the LSM winding has the proper time-dependent shape and magnitude.

Communication and Control. All of the diagnostic and locational information will be transmitted in real time to the central traffic-control facility, which can then specify what corrective-maintenance actions should be carried out to ensure continuous safe operation.

The vehicle will continuously monitor the operating health of all of the vehicle subsystems, and the information will be transmitted in real-time to the central traffic-control facility. If off-normal conditions were to develop in the superconducting magnets (i.e., temperature, helium flow rate, etc.) cryostats, or cryocoolers, the vehicle could be diverted to the nearest station for corrective maintenance. Similarly, if there were any problems with computer, communication, and control systems on-board the vehicle, this information would be transmitted in real time to the central facility, which would then divert the vehicle for corrective maintenance.

The speed and position of all vehicles on the guideway will be continuously monitored and controlled by the central facility, to ensure that safe separation distances (i.e., headways between vehicles) are always maintained. Because the speed of a vehicle is controlled by the frequency of the AC fed to the guideway and is independent of external forces on the vehicle, it is simple for the control facility to maintain safe headways at all times.

In the M-2000 LSM propulsion system, the whole guideway is not continuously energized, but only "blocks" where M-2000 is present are powered-up. Movement of the M-2000 vehicles on the Maglev system would be controlled by a central traffic facility, and not by operators on the individual vehicles. The central facility will have a real-time display of the speed, location, and operational conditions of all vehicles traveling on the system, together with real-time monitoring of the operating conditions at all points on the guideway.

Sensors on the guideway – e.g., magnetic, electronic, ultrasonic, and/or laser – will determine the instantaneous location and speed of all vehicles, and transmit the data back to the central facility. Zoom video cameras mounted on poles will continuously relay images of all portions of the guideway to the central control facility, so that hazardous objects on the guideway can be detected and a possible accident averted. In addition, laser beam detectors would be used to determine if large objects, e.g., a tree branch, had fallen on the guideway.

Continuous two-way voice communication capability between the vehicle operators and the central traffic facility would be maintained to ensure that any relevant information was rapidly interchanged. In the event of a sudden failure of two or more magnets, for example, the vehicle operator might initiate an emergency braking procedure, and notify the central facility accordingly.

Vehicle Component Safety. The superconducting magnets on the M-2000 vehicles are extremely safe and reliable. The superconductor windings are very cryo-stable, with large amounts of high-purity aluminum stabilizer, so that local flux jumps and conductor movement cannot cause the magnets to quench. Superconductor magnets built to these principles for a wide range of applications have demonstrated the ability to operate for years without quenching or failing.

Moreover, the 16-quadrapole magnets (8 pairs of positive and negative polarity) are individually energized and cooled. Failure of an individual magnet will not cause adjacent magnets to fail. The M-2000 vehicle will remain safely levitated, even if 4 adjacent independent magnets were to simultaneously fail, an essentially zero-probability event – much smaller than the probability of simultaneous engine failure on a jet airliner.

Even if levitation were to fail due to an event such as the collision of the vehicle with an external object on the guideway, the M-2000 system is designed so that the vehicle would come down safely on the guideway and slide to a controlled, non-injurious stop.

The M-2000 vehicle body has been designed with high-strength composite materials to minimize the possibility of, and damage due to, the potential collision of the vehicle with external objects, both those on the guideway and airborne objects (e.g., tree branches in a high-wind situation). The ends and sides of the vehicle are very strong and the vehicle shape is contoured to maximize the probability of deflecting impacting objects, with minimum damage to the vehicle.

The M-2000 levitation and guidance system is designed to withstand extremely strong external forces that act on the vehicle without causing it to contact the guideway. For example, very strong crosswind gusts acting on a 483 km/h (300 mph) vehicle could produce a lateral (sideways) force approaching 1 g. For Maglev systems with moderate guidance stability, such a wind gust could make the vehicle contact the guideway. In contrast, in the M-2000 Maglev System, the guidance stability is so strong that it would take an external force of well over 2 g to make the vehicle contact the guideway – a much larger force than ever could occur in actual operation.

Fire Safety. Maglev vehicles expose the public to similar fire hazards as conventional electric propulsion rail cars. Recently finalized Federal rules for rail passenger equipment cover a wide range of hazards and specify acceptable materials for interior compartments. All of these specifications and standards are intended to reduce the likelihood of a fire and to reduce the severity of a fire mainly by reducing the smoke quantity and toxicity and heat content of any fire that should occur. The Maglev 2000 design will be required to satisfy the requirements pertaining to fire safety in the Federal passenger equipment rule.

Emergency Preparedness and Evacuation. In most circumstances Maglev vehicles will operate as intended and passengers will board and disembark through the normal doors at stations. The extensive use of elevated Guideway makes evacuation procedures a special concern. The Maglev 2000 design depends on evacuation tubes at each door to provide emergency egress. In locations where the tubes are not practical (i.e., over water, swamp, steep rugged terrain) special structures and stairways are provided leading to safe areas. Onboard operating personnel would be responsible for assisting elderly or disabled passengers. Applicable passenger equipment standards require rail systems to complete an emergency plan and specify number of emergency exits with special lighting and signage. During the site-specific design stage, local fire fighter and rescue workers could be consulted to prepare emergency plans.

All Maglev passenger stations and support and maintenance areas will be serviced by State and local police, and local ambulance, fire, and hospital emergency services. Existing emergency procedures and routes associated with currently operating transportation, transit, and commuter facilities (buses, trains, and airplanes) are applicable to support the Maglev operation. The medical equipment to be carried on the Maglev vehicles will be specified through the route operator and U.S. regulations. Related emergency plans, specialized evacuation procedures, and emergency preparedness training should be addressed during final site design.

Summary

TRI Maglev TR08 and the M-2000 vehicles, guideways, facilities, and operation should be designed to achieve or exceed all safety standards. Station safety is important to consider. Safety within each station, including the concern of performing a controlled vehicle stop, should be addressed during final site design. In particular, at-grade crossings with other conventional transportation modes are almost completely eliminated, resulting in a significantly reduced safety concern. Based on the safety record of other Maglev deployments, the Maglev deployment alternatives should not have a significant adverse impact to safety.

4.16.2 EMF/EMR Consequences and Mitigation: Maglev EMF Safety Compliance

Expected System Impacts. There are three categories of safety, health and environmental (SHE) hazards of electromagnetic fields and radiation to be considered for Maglev system and operations:

1. Electromagnetic fields (EMF) and electromagnetic radiation (EMR) levels for human exposures, linked (albeit inconclusively) to environmental or potentially adverse health effects. Research is continuing to resolve uncertainties in health end effects and exposure (dose metrics).
2. Electromagnetic interference (EMI) due to induced, radiated or conducted emissions from/to rail systems and equipment. This is considered in Section 4.18.
3. Electromagnetic compatibility referring to EMI "cross-talk" between different components and subsystems.

To review electromagnetic field issues, FRA evaluated baseline system design, proposed siting, and technical data from operational or test performance of the Maglev Alternative. This comprehensive review addressed environmental levels of EMF and EMR, as well as safety hazards related EMI testing in subsystem integration. Testing procedures and standards for prevention and mitigation of radiative, conductive or inductive EMI compatibility assurance are well established and are considered. Human exposure safety was addressed by recommending compliance with the best (most protective) applicable safety standards listed in the Tables in Section 3.16.2.

In addition, the FRA examined the relative levels of EMF/EMR for Maglev Alternatives and their comparability to existing electric transportation systems, whose operation and EMF/EMR environmental levels are well accepted by the public.

Presently, the lack of specific EMF, static fields and EMR information for proposed Maglev systems (TR08 and M-2000) allows for only approximate EMF comparability assessments. Extensive EMF information was obtained by FRA/Volpe Center for TR07 and found to be well below existing standards and guidelines. Figures 4.16-1 through 4.16-3, and Tables 4.16-1 and 4.16-2 below provide a comparison of average magnetic field levels for surveyed transportation systems and for common home or office sources. Average time-varying extremely low frequency (ELF) (0-3,000 Hz) magnetic fields in the TR07 were comparable to average fields measured in other transportation systems, as shown in these figures and tables. Although the EMF characteristics of power lines and of home and office appliances are very different from Maglev, these magnetic field levels are also shown for comparison in Table 4.16-1. It can be seen that average values of magnetic field levels for TR07 are comparable to other electric transit and rail systems and below applicable safety limits.

For six of the alternatives proposing to adopt and adapt the German Transrapid (TR08) Maglev system, the technical EMF and EMR data and details of design and testing performance are currently lacking. They are assumed to be comparable to the TR07 version, which was thoroughly evaluated by the FRA and Volpe Center Maglev safety team under the National Maglev Initiative in 1990-95 (see Section 3.16). TR07 data, to the extent they are applicable, indicate that there are no major EMF or EMR issues that cannot be cost-effectively mitigated in the planning, siting and design stages. If necessary, a mixture of EMF and EMR mitigation strategies described below can be considered to control any potential safety or environmental impacts of concern.

Because no EMF/EMR data is available for the superconducting M-2000 Florida Alternative, the Japanese MLU and MLX Maglev system characteristics and mitigation strategies for passengers, workers and wayside exposures to static magnetic fields are used for estimation and comparison with applicable standards. For instance, in-vehicle floor shielding and redesign to move passenger seating as far away as possible from the superconducting magnets under the floor, have reduced the static fields from the initial 200 gauss, to below 20 gauss measured at floor level (Ikehata, 1999). Environmental magnetic fields for the MLX-002 were found to be below 2 gauss under the guideway and rapidly diminish as distance increases from the guideway along the ROW (Sasakawa, 1998). The large power conditioning station at Yamanashi has perimeter fencing and controlled access to manage exposures. Maintenance to the vehicle superconducting magnets is done after quenching, in null fields. Similar exposure management and mitigation strategies could be adopted for the M-2000, with special attention to vulnerable wearers of medical electronic devices susceptible to EMI from static fields above 1 gauss. The FRA may also require posted warnings as needed to protect aging workers and passengers who are likely to use medical implants.

The combined impact of Maglev EMF and EMR and of other present sources were considered, as a required human exposure safety standard for EMR (ACGIH, 1999 and IEEE, 1999a). Broadband radio frequency radiation exposures are considered by comparing and adding the ratios relative to the respective limits for several frequency ranges. Therefore, Maglev Alternatives with preexisting EMF and EMR emission sources must inventory all sources located in/near their alternative corridors, and conduct a broadband survey of current levels of exposure. Only then can the potential for impact be assessed from static fields, ELF/EMF, and EMR from proposed Maglev facilities and operations. During the final design, the design and operation of the Maglev systems will be assessed for compliance with all applicable EMF/EMR health guidelines and standards listed in Tables 3.16-1 through 3.16-4.

Compliance with Applicable Safety Standards

Federal agencies are adopting and adapting standards and guidelines issued by professional or consensus standards organizations as required by PL 104-113, the National Technology Transfer Act of 1996. The FRA is committed to ensuring compliance of rail developers and operators with the most current and protective safety, health and environmental guidelines.

Existing U.S. and international human exposure safety standards and guidelines for exposures to static magnetic fields, EMF at power frequency and harmonics, and higher frequency (through microwave) EMR are voluntary (see Section 3.16). Their primary goal is protection from short-term acute effects, e.g., limiting whole body or localized heating, prevention of induced neurostimulation, visible effects (magnetophosphenes), limit currents through the heart and limbs, prevention of electric shock, and RF burns.

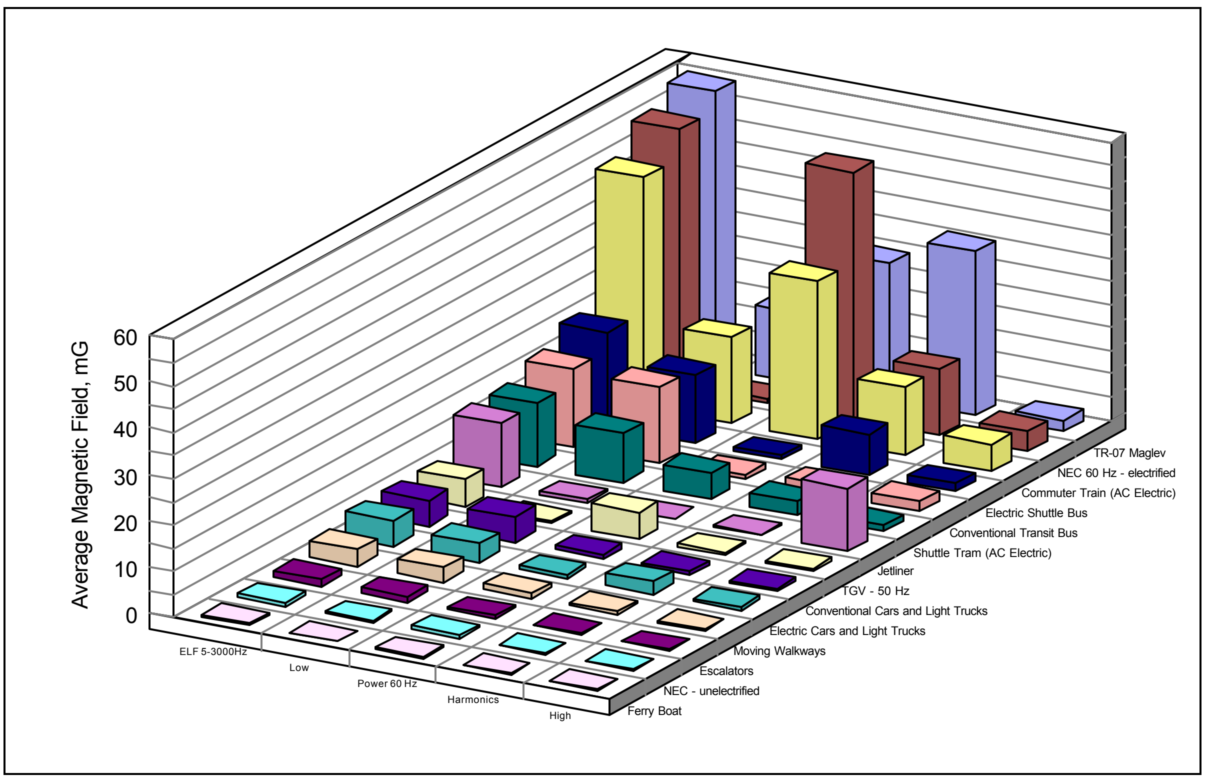
These standards have considered, but are not aimed at prevention of long-term, low level chronic exposures linked with potentially adverse health effects. Existing EMI/EMC standards (see Table 3.18-2) and guidelines will prevent and limit EMI impacts from stray currents and voltages and ensure the safe operability and compatibility of subsystems in the vehicle and along the wayside.

The FRA preferred approach is to recommend adoption of the most protective exposure safety standards for both workers and the public, in order to allay high public anxiety with regard to new technologies and EMF/EMR, and to facilitate the adoption of new magnetic levitation technologies. In the interim, the FRA endorses a "prudent avoidance" policy regarding EMF, as advocated by WHO (WHO, 2000). The FRA recommends voluntary industry and Maglev developer/operator compliance with existing international and national EMF and RF exposure safety standards and guidelines. FRA's proactive approach to monitoring state-of-science on EMF health effects was evident in the EMF technical studies included in the Final Environmental Impact Statement (FEIS) and the FRA's Record of Decision (ROD) for the Northeast Corridor Electrification Project, which are directly applicable to the selected alternative for Maglev system development (DOT, 1994 and DOT, 1995). FRA recognized that public concern about EMF/EMR, safety, health and environmental impacts by requiring baseline surveys <u>before</u> starting system construction and periodic monitoring and <u>after</u> commencing test operations, to ensure compliance with the most protective applicable safety standards. In addition, a long-term EMF monitoring program along the NEC and near power substations was established to assure that excessive environmental and occupational EMF exposures are reduced as needed, ensuring the resolution of uncertainties in potential adverse health impacts. A similar approach would be applicable to a Maglev Deployment Project.

Results of EMF for the TRI TR07 vehicle show it complies with German, international, and U.S. standards. Thus, the potential of the proposed Maglev TR08 Deployment project to have any significant adverse safety impact is low. Health or environmental impacts from EMF/EMR are unlikely, if TR08 is similar to TR07 in design and performance.

A team of experts will visit the test track in Germany to carry out measurements of EMF and EMR levels for the TR08, in order to collect data for the actual Maglev system that would be implemented. Further analysis would be carried out to verify compliance with U.S., German, and other international applicable standards.

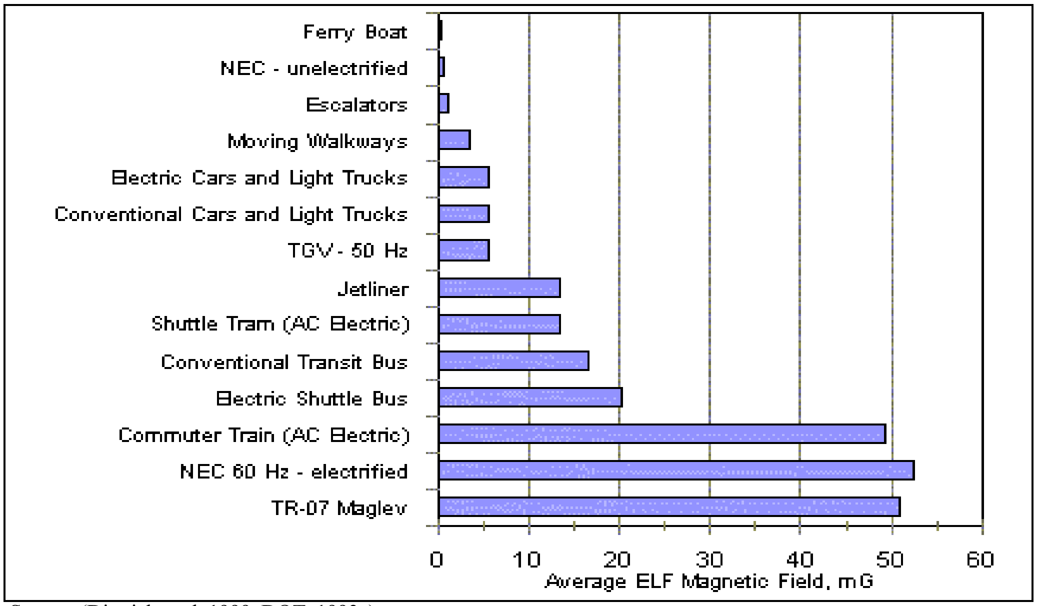
The bar chart in Figure 4.16-1 gives the MFL values, averaged over time and spatially, inside different types of transportation vehicles. The bars show the average values of MFL in milliGauss (1 mG = 1 microTesla) for 4 frequency sub-bands within the ELF range of 5-3000 Hz: sub-power frequency, 60 Hz power frequency, harmonics to 300 Hz and higher to 3 KHz. Each electrotechnology has its characteristic "spectral signature" and sometimes complex and highly variable in time, space and frequency MFL. Data plotted are averages of many samples taken at different locations and across time, e.g., with sensors recording at passenger's ankle, waist and head heights in several vehicles. Complete transportation systems surveys were performed by Electric Research and Management, Inc. for the Volpe Center, sponsored by FRA and DOE (DOT, 1993a; Dietrich et al, 1999) of which is summarized in this section. The original reports contain extensive figures and statistical tables, with detailed information on EMF at different locations for each transportation system surveyed, including the TR07 Maglev.



Source: (Dietrich et al, 1999; DOT, 1992)

Figure 4.16-1 - Average Magnetic Field Levels (MFLs) in 13 Transportation Systems

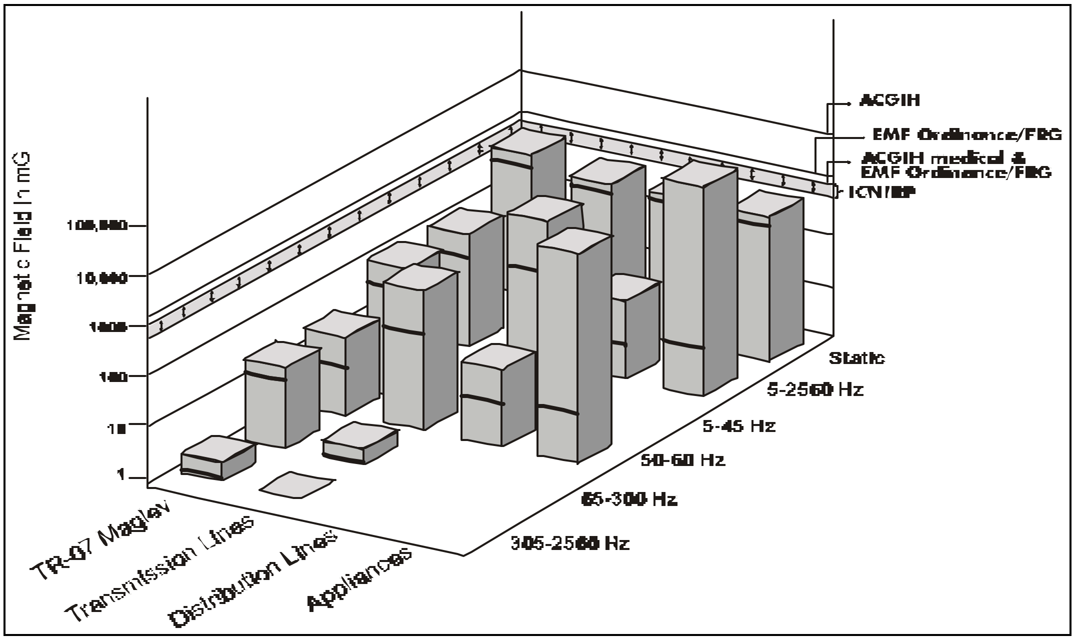
Figure 4.16-2 presents the relative magnetic field levels (1 milliGauss= 0.1 microTesla) averaged over time, ELF frequency band and locations, inside TR07 Maglev and other transportation vehicles and facilities (airports). The EMF environment for each electrotechnology varies with frequency, speed or power loading, and location over time, unlike the stable and predictable EMF for power lines.



Source: (Dietrich et al, 1999, DOT, 1993a)

Figure 4.16-2 - Extremely Low Frequency (ELF) Magnetic Fields (EMF)

Figure 4.16-3 compares the available human EMF (60 Hz) exposure safety standards tabulated in Section 3.16 to average ELF/EMF levels for the TR-07 Maglev, relative to typical transmission and distribution power lines and common home appliances. The bar heights are averages of maximum levels, and the line on each bar corresponds to mean levels. Bars are shown for each spectral band in the ELF/EMF range (to 3 KHz: sub-power frequency (3-45 Hz), power frequency (50-60 Hz), power harmonics (65-300 Hz) and higher frequency harmonics.



Source: (DOT, 1992; and Table in Section 3.16.2)

Figure 4.16-3 - Maglev EMF Levels Relative to Common EMF Sources and Applicable Safety Standards and Guidelines

Table 4.16-1 - Comparison of EMF in TR07 Time-Varying Fields and Other Appliances

Source/Location	Distance (m)	Magnetic Field (mG)
TR07 Passenger Compartment (< 47.5 Hz)	Floor level – Head level	100 20
TR07 Guideway (< 47.5 Hz)	3	65-95
	10	20
TR07 Power Equipment	5	20
TR07 Feeder Cables	< 1	2
Microwave Oven (60 Hz.)	0.3	40-80
Electric Range (60 Hz.)	0.03	60-2,000
Hair Dryer (60 Hz.)	0.03	60-20,000
Television (60 Hz.)	1	0.1-2

Source: (ARC, 2000; DOT, 1992)

Table 4.16-2 - Comparison of Average ELF/EMF Fields for Various Transportation Systems

Transportation System	RMS Field (mG)
TR07	50.6
NEC-60 Hz	52.5
NEC-25 Hz	133.8
Ferry Boat	<1
Escalators	2
Moving Walkways	4
Electric Cars and Light Trucks	6
Conventional Cars and Light Trucks	6
Jetliner	14
Electric Shuttle Tram	14
Conventional Transit Bus	17
Electric Shuttle Bus	20
Electric Commuter Train	50

Source: (DOT, 1992, Dietrich et al, 1999)

4.16.3 Mitigation

Siting. Electric power distribution and conditioning facilities can be selected to minimize EMF impacts to exposed people at low- or no-cost, while maintaining efficiency and safe operability. The most cost-effective EMF control approach is prevention through siting and design of power generation and delivery systems, and the selection of signaling and data communication frequencies so as to avoid inadvertent interference with sensitive wayside facilities. Where facility siting or guideway power lines and inverters, switching and power substations are severely constrained, other EMF mitigation options below can be considered and implemented as necessary.

Comparability of EMF with other Electrified Rail Systems. A useful model for Maglev system alternative selection is the Northeast Corridor Improvement Project strategy of cost-effective EMF prevention in planning and design stages: overhead catenary system, and Power Transfer Facilities Design were selected (2x 25kV catenary with auto-transformers) so as to minimize environmental EMF along the ROW and to provide partial magnetic field cancellation (except for passengers who sit inside the current loop). Away from the track, the EMF was expected to be half that produced by each overhead wire current for conventional rail transit due to this design.

In addition to EMF field reduction, the TGV analog design offered EMI minimization at the source, by balancing the load with respect to ground through the use of a return feeder wire for the catenary current, and by minimizing the dynamically induced EMF in parallel conductors (gas and water pipelines, bridge railings) and in power lines, or telephone wires in the near- field. Similar strategies of EMF avoidance through design of the TR08 power and propulsion for the electromagnet levitation and guidance and third rail power conditioning and supply systems are desirable.

Prudent Avoidance. In response to public concern, there are cost-effective EMF “prudent avoidance” and prevention and reduction strategies – explicitly advocated by the WHO and by NIEHS. Also, workers' exposures to EMF can be minimized through training, as well as work rules, assignments and scheduling. Public EMF exposures can be also avoided through: buffer zones available using zoning restrictions along the ROW and vicinity; posted warning for pacemaker wearers of any unsafe EMF levels; and fencing around electrical facilities and other EMF sources to restrict public access. Finally, if at any time it is determined that unsafe EMF conditions exist, there are retrofit mitigation options, such as shielding or installation of dummy wires to counter unbalanced transmission and distribution line loads. Similarly, Occupational Safety and Health Administration (OSHA) and NIOSH require hazard communication (hazcom) and hazard awareness training programs for highly exposed workers.

Passive or Active Magnetic Shielding. A number of cost-effective "industry best practices" are available to rail designers, builders and operators to prevent, minimize, manage or mitigate unreasonable EMF exposures to workers and the public, or any potentially adverse EMF/EMR safety impacts from undesirable EMC or EMI effects. EMI mitigation options might include: redesign of distribution lines for partial shielding (bi-filar windings, co-axial cables in metal shields), providing dummy return wires for unbalanced currents or other form of active feedback currents for shielding; magnetic or simply metallic sheet enclosures as shielding of transformers.

4.16.4 No-Action Alternative

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be constructed. Therefore, there would be no impacts on public safety and health directly from a Maglev system. However, it is important to consider potential impacts from the No-Action Alternative that could arise from precluding the Maglev Deployment Program and the potential benefits of constructing a Maglev system.

It is anticipated that economic and population growth will continue around the country, promoting increased travel demand. Under the No-Action Alternative, there would be an increase in intercity travel demand, which may result in motor vehicle, air, and light rail transportation infrastructure expansion. The transportation environment has existing EMF/EMR producers and more are added each day. The use in transportation of two-way communications, cellular telephones, global positioning systems and other emitters is growing daily, adding to the radio frequency environment. Thus, the impacts associated with new transportation infrastructure and operating systems need to be evaluated. However, there have been no clear epidemiological studies that confirm potential impact from these and other transportation EMF sources, and research is continuing.

4.17 NOISE & VIBRATION

This section provides a brief overview of Maglev noise and vibration characteristics and impact analysis. More detailed discussion may be found in FRA's guidance manuals entitled *High-Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA, 1998) and *Noise from High Speed Maglev Systems* (FRA, 1993), as well as in FTA's guidance manual entitled Transit Noise and Vibration Impact Assessment (FTA, 1995). Although this section focuses entirely on Federal impact criteria, state and local criteria, where applicable, must also be considered. Appendix F provides definitions for noise and vibration impact analysis terminology, including definitions of commonly used noise descriptors.

In evaluating potential Maglev noise and vibration impacts, two components must be examined. In increasing order of importance, these include noise and vibration produced by: (1) maintenance and operational facilities; and (2) operations. These topics are addressed separately in each of the following sections.

Facility Noise and Vibration. The assessment of potential facility noise and vibration include the effects of increased roadway traffic in and out of supporting facilities (e.g., parking lots, parking garages, passenger stations), as well as noise and vibration from equipment including generators, transformers, etc. Typically, these specific issues are addressed when more detailed project design data are available.

Operational Noise. Operational noise is the primary area of interest with respect to potential project impact. These impacts may span an entire corridor for the duration of operational activities. Specific components of Maglev operational noise include engine noise, for vehicle propulsion, mechanical and vehicle/guideway interaction noise, and aerodynamic noise. Table 4.17-1 identifies the approximate ranges of speeds for each of the dominant noise sources.

Table 4.17-1 - Maglev Dominant Noise Sources

Category	Speed Range km/h (mph)	Dominant Noise Sources
I	0 - 31 (0 – 50)	Engine Propulsion Noise
II	31-99 (50 – 160)	Mechanical/Guideway
III	99-186 (160 – 300)	Aerodynamic

Source: (FRA, 1998)

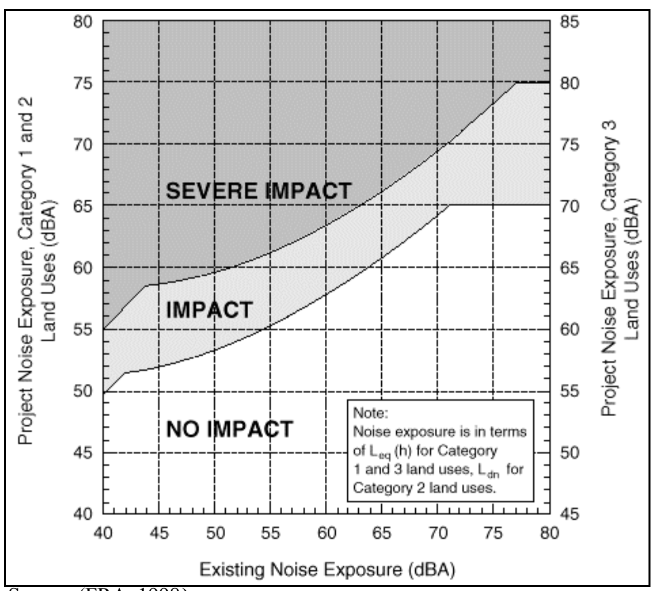
FRA impact criteria (FRA, 1998) gauge potential impacts by: (1) analyzing absolute project sound levels; and (2) comparing outdoor sound levels before and during operations. Conditions, defined for 3 land use categories, are designated as *No Impact*, *Impact*, or *Severe Impact*. Table 4.17-2 summarizes the three land-use categories.

Table 4.17-2 - FRA Land Use Categories

Land-Use Category	Noise Descriptor	Land-Use Category Description
1	$L_{eq}(h)$	Land primarily intended for serenity and quiet, including National Historic Landmarks, outdoor amphitheaters, etc.
2	L_{dn}	Land containing residences and other buildings typically used for sleep where there is a particular sensitivity to noise at night, including homes, hospitals, hotels, etc.
3	$L_{eq}(h)$	Land containing institutional buildings used primarily during the daytime and evening, including schools, libraries, churches, and other buildings with interior spaces requiring quiet (i.e., medical offices, conference rooms, recording studios and concert halls). This category also includes some historical sites, parks and recreational facilities.

Source: (FRA, 1998)

Figure 4.17-1 summarizes FRA's impact criteria. Originally based on human annoyance studies, the impact criteria define regions of "no impact," "impact," and "severe impact," based on a combination of existing noise exposures and predicted project noise exposures. "Impact" is defined for combinations of existing and project sound levels believed to be noticeable to most people, but not of sufficient level to cause strong, adverse reactions from the community. "Severe Impact" is defined for existing/project sound levels believed to highly annoy a significant percentage of people.

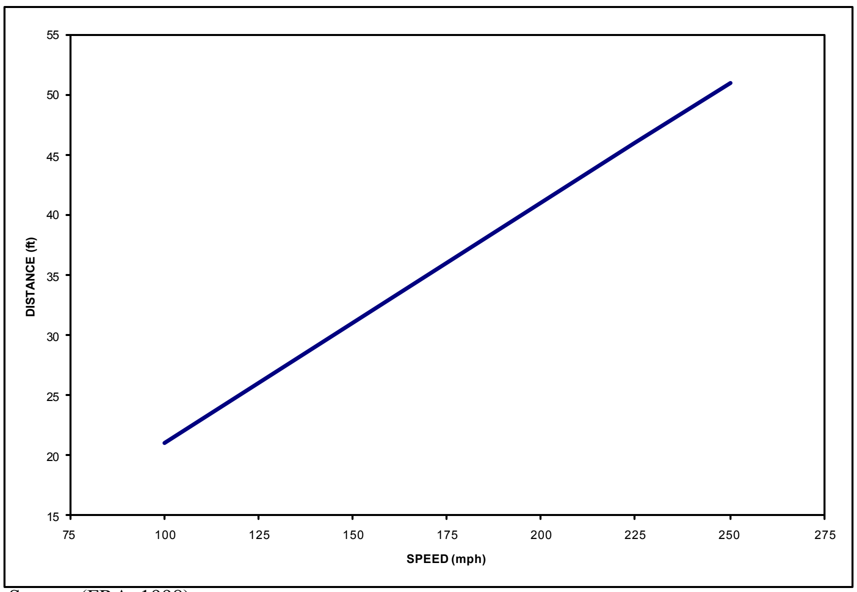


Source: (FRA, 1998)

Figure 4.17-1 - FRA Impact Criteria for High-Speed Rail Projects

Startle Effect From High-Speed Transit. A phenomenon commonly referred to as *startle effect* must also be examined when evaluating potential noise impacts for Maglev operations. Startle effect is human annoyance due to the high onset rate of a Maglev train's sound signature. Onset rate is the average rate of change of increasing sound-pressure level, in decibels per second (dB/sec), associated with the rapid approach of a high-speed train. Sounds with fast onset rates tend to be more annoying than sounds with less rapid variation or steady noise with the same maximum noise level. Research, primarily investigating the effect of high onset rates by low-flying military aircraft, indicates that people are increasingly annoyed by sudden sounds with onset rates greater than about 15 dB per second (dB/sec). For example, onset rates of greater than 15 dB/sec occur for receivers within 18 m (60 ft) of a 241 km/h (150 mph) train, and occur at greater distances for trains at higher speeds. When onset rates exceed about 30 dB/sec, people tend to be startled, or surprised by the sudden onset of the sound. This is known as the *startle effect*.

Figure 4.17-2 below presents the relationship between distance from the guideway and the speed of a Maglev train for startle annoyance. The curve represents the distance within which startle effects can occur.



Source: (FRA, 1998)

Figure 4.17-2 - Speed/Distance Startle Effect Relationship

It should be noted that since acoustic data for low-level military aircraft overflights were used in the derivation of this relationship, its direct applicability to Maglev operations, which are somewhat more predictable in nature than aircraft overflights, may be questioned.

In addition to actual Maglev operational noise, increased roadway noise at and near supporting passenger stations may result in impacts. As a result, Federal Highway Administration (FHWA) regulations (23 CFR Part 772) are utilized to augment FRA guidance in the assessment of potential noise impacts. Specifically, the FHWA peak-hour L_{eq} Noise Abatement Criteria (NAC) is used for determining peak-hour impacts for candidate projects. Peak-hour data are considered to be conservative, given that all other hours of the day will likely have less noise exposure and therefore less impact, if any. Table 4.17-3 below summarizes the FHWA NAC.

Table 4.17-3 - FHWA Noise Abatement Criteria

Activity Category	Noise Abatement Criteria L_{eq} (dBA)	Description
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary Significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: (FRA, 1995)

The NAC indicate an impact when a new project results in: (1) a substantial (12 dBA or greater) increase in peak-hour L_{eq}; and/or (2) project noise levels exceed or come within 1 dBA of the levels highlighted in Table 4.17-3 above.

Operational Vibration. Potential groundborne vibration impact must be analyzed with respect to both "human annoyance" and "building damage." (FRA, 1998) This analysis is conducted according to land-use category. FRA requires that human annoyance be assessed in accordance with the categories and vibration limits presented in Table 4.17-4.

Table 4.17-4 - Groundborne Vibration Impact Criteria

Land Use Category	Groundborne Vibration Impact Levels (dB, re 1 µ in/sec)		Land Use Category Description
	Frequent Events (>70 per day)	**Infrequent Events** (<70 per day)	
1	65 dB	65 dB	Buildings where low ambient vibration is essential for interior operations.
2	72 dB	80 dB	Residences and buildings where people normally sleep.
3	75 dB	83 dB	Institutional land uses with primary daytime use.

Source: (FRA, 1995)

Some buildings, with uses particularly sensitive to vibration, have unique FRA groundborne vibration impact criteria. Table 4.17-5 below summarizes the vibration criteria for Special Buildings.

Table 4.17-5 - Summary of Vibration Criteria for Special Buildings

Type of Building or Room	Groundborne Vibration Impact Levels (dB, re 1 µin/sec)	
	Frequent Events (>70 per day)	**Infrequent Events** (<70 per day)
Concert halls	65 dB	65 dB
TV studios	65 dB	65 dB
Recording studios	65 dB	65 dB
Auditoriums	72 dB	80 dB
Theaters	72 dB	80 dB

Source: (FRA, 1995)

Finally, for particularly sensitive structures, such as fragile and fragile historic buildings, FRA building-damage criteria are 102 dB and 90 dB, respectively. For example, based on data provided by the Maglev manufacturer, such structures within approximately 9 m (30 ft) of the guideway would be susceptible to damage, and should be considered as potentially impacted.

General Assumptions

Typically, worst-case scenarios were used in performing analyses. For example, operational modeling scenarios typically do not take into account terrain or building-structure shielding, which may result in lower project sound levels at noise receptors. Also, where several corridor options are possible for a particular project, related computations are based on worst-case assumptions.

In addition, many variables are still undefined at this stage of the process. Consequently, in the case of existing sound levels, conservatively low values are used for evaluating potential impacts. Similarly, in the case of train lengths, the longest trains available from the manufacturer are typically used in the evaluation. A team of experts will visit the test track in Germany to carry out measurements of noise and vibration levels for the TR08 system, in order to collect data for the actual Maglev system that would be implemented.

Another very important assumption has to do with the specific model of the Maglev vehicle. The potential noise and vibration impacts for all the Maglev Alternatives have been estimated based on TR07 data provided by the manufacturer. The newer model TR08 train, which the manufacturer claims is quieter, is proposed for use in each of the corridors, with the exception of Florida, where a different technology is proposed. As such, all potential noise impacts estimated using the TR07 data should be conservative from a noise and vibration impact standpoint.

With regard to operational noise mitigation from noise barriers, unless otherwise noted, eight decibels of reduction is assumed.

4.17.1 California

Centralized and decentralized maintenance facilities, central operational facilities, or switch boxes are located away from potential noise-sensitive receptors. Based on their planned location away from receptors, there should be an insignificant negative impact from noise. However, further planning and analysis must be performed to determine potential noise impacts due to passenger stations, guideway maintenance facilities and electrical substations.

In order to evaluate potential project-noise impacts, baseline conditions must be determined. FRA's methodology for estimating noise exposure for general assessment (FRA, 1998) was used to determine existing noise exposures. As a component of this analysis, areas located across existing highways from candidate routes were excluded because: (1) the large distance separating potential noise receptors and the Maglev operations; and (2) the potential for highway noise to "mask" Maglev noise.

Table 4.17-6 summarizes the anticipated operational-noise impacts of the candidate corridor, both with and without mitigation. Impacted and severely impacted sites include primarily single-family, multifamily and mobile homes, as well as schools, hotels, churches and recreation and community centers. This table shows that there is a potential of a significant adverse noise impact with the Maglev operation.

Table 4.17-6 - Summary of Potentially Impacted Sites - California

	Number of Sites	
	Without Mitigation	**With Mitigation**
Impact	2,903	1,986
Severe Impact	1,976	1,006

Source: (CM, 2000)

Further planning and analysis must be performed to determine if there will be any startle effects as a result of the alternative.

No buildings are within minimum distances defined by FRA's most-stringent vibration impact criteria. Thus, no significant adverse building-damage vibration impacts are anticipated as a result of the alternative. Human-annoyance impacts are not specifically evaluated at this early stage of planning, but should be considered during final design stage.

4.17.2 Florida

Further planning and analysis must be performed to determine what, if any, will be the impacts due to passenger stations, electrical substations, guideway and fixed maintenance facilities, as well as construction of the guideway.

In order to evaluate potential project-noise impacts, baseline conditions must be determined. FRA's methodology for estimating noise exposure for general assessment (FRA, 1998) was used to determine existing-noise exposures. This analysis assumes the M-2000 vehicle has similar noise emissions as the TRO7. Given these estimated existing-sound exposures, Table 4.17-7 below summarizes anticipated operational-noise impacts. This table shows that there is a potential of a significant adverse noise impact with the Maglev operation.

Further planning and analysis must be performed to determine if there will be any startle effects as a result of the alternative.

Based on FRA impact criteria, no building-damage or human-annoyance impacts are anticipated as a result of the alternative. Thus, the potential of a significant adverse vibration impact is not anticipated from Maglev operation.

Table 4.17-7 - Summary of Potentially Impacted Sites - Florida

	Number of Sites	
	Without Mitigation	**With Mitigation**
Impact	11	(N/A*)
Severe Impact	5	

*Detailed information is not currently available at this planning level to analyze the number of impacted sites with mitigation. Source: (FDOT, 2000)

4.17.3 Georgia

Further planning and analysis must be performed to determine what, if any, will be the impacts due to passenger stations, electrical substations and guideway maintenance facilities. There are no expected impacts due to maintenance facilities given FRA's land-use criteria and their proximity to commercial lands.

In order to evaluate potential project-noise impacts, baseline conditions must be determined. FRA's methodology for estimating noise exposure for general assessment (FRA, 1998) was used to determine existing-noise exposures. Additionally, ambient sound-level measurements were undertaken at 20 of the sites originally identified as potentially impacted.

Table 4.17-8 summarizes the anticipated operational noise impacts of the alternative, both with and without mitigation. Impacted and severely impacted sites include primarily single-family and multifamily homes, as well as mobile homes, hotels, schools and churches. The eighteen impacted sites (without mitigation) include 369 receptors. Areas located across existing highways from candidate routes were typically not impacted because of the large distance separating potential noise receptors and the Maglev operations. This table shows that there is a potential of a significant adverse noise impact with the Maglev operation to 369 receptors within the 18 sites.

Table 4.17-8 - Summary of Potentially Impacted Sites - Georgia

	Number of Sites	
	Without Mitigation	**With Mitigation**
Impact	115	N/A*
Severe Impact	42	

*More information is needed to determine the level of impact for two sites with mitigation.
Source: (ARC, 2000)

Based on FRA impact criteria, startle effects may potentially occur for two sites, including 86 single-family residences and one apartment building.

Based on FRA criteria, no human-annoyance vibration impacts are expected for the candidate corridor. Thus, the potential of a significant adverse vibration impact is not anticipated from Maglev operation. There are an undefined number of buildings that may potentially be damaged near fly-over portions of the guideway (i.e., within 9 m (30 ft) of the guideway), however more-detailed source data are required from the TRI Maglev manufacturer to conduct a complete analysis during the final design stage.

4.17.4 Louisiana

Based on FRA impact criteria, there are no expected noise impacts from maintenance facilities, substations, and potential passenger stations. However, it is premature to accurately analyze this impact until the final design stage.

In order to evaluate potential project noise impacts, baseline conditions must be determined. A combination of comprehensive ambient sound-level measurements and FRA's methodology for estimating noise exposure for general assessment (FRA, 1998) was used to determine existing noise exposures.

Table 4.17-9 below presents a summary of impacted sites. Data are not available to determine the number of impacted sites with implementation of noise mitigation; however, potential noise-mitigation measures include barriers and placement of the guideway. This table shows that there is a potential of a significant adverse noise impact with the Maglev operation.

Table 4.17-9 - Summary of Potentially Impacted Sites - Louisiana

	Number of Sites	
	Without Mitigation	**With Mitigation**
Impact	401	129
Severe Impact	271	12)

*Detailed information is not currently available at this planning level to analyze the number of impacted sites with mitigation.
Source: (GNOEC, 2000)

No startle impacts are expected as a result of the alternative. However, it is premature to accurately analyze this impact until the final design stage.

After completion of anticipated land acquisition for the Maglev system, no human annoyance vibration impacts are expected. However, it is premature to accurately analyze this site-specific impact until the final design stage.

4.17.5 Maryland

Further planning and analysis must be performed to determine potential noise impacts due to maintenance facilities, operational facilities, switches, passenger stations, electrical substations, and construction of the alternative. However, it is premature to accurately analyze this impact until the final design stage.

FRA's methodology for estimating noise exposure for general assessment (FRA, 1998) was used to determine existing-noise exposures at these sites. Table 4.17-10 summarizes the anticipated operational-noise impacts of the corridor, both with and without mitigation, in the form of noise barriers. Impacted and severely impacted units include primarily single-family and multifamily homes, as well as some schools and motels. This table shows that there is a potential of a significant adverse noise impact with the Maglev operation.

Table 4.17-10 - Summary of Potentially Impacted Sites - Maryland

	Number of Impacted Sites	
	Without Mitigation	**With Mitigation**
Impact	115-446	45-547*
Severe Impact	52-316	

* More information is needed to determine the level of impact for sites with mitigation.
Source: (MTA, 2000)

No investigation of startle effects has been documented. However, it is premature to accurately analyze this impact until the final design stage.

Vibration impacts should be considered for potential impacts. However, it is premature to accurately analyze this site-specific impact until the final design stage.

4.17.6 Nevada

It is expected that the final locations of passenger stations, electrical substations and maintenance areas will be determined during the final design phase so as to minimize or eliminate potential noise impacts.

FRA's methodology for estimating noise exposure for general assessment (FRA, 1998) was used to determine existing noise exposures. Table 4.17-11 below summarizes the anticipated operational-noise impacts of the candidate corridor, both with and without mitigation. Impacted and severely impacted sites include primarily single- and multifamily homes and hotels, as well as mobile-home parks and conference facilities. Guideway placement and/or the construction of noise barriers is suggested as a means of minimizing these impacts. Based on the level of impact identified in Table 4.17-11 a moderate adverse noise impact is anticipated from Maglev operation.

Table 4.17-11 - Summary of Potentially Impacted Sites - Nevada

	Number of Impacted Sites	
	Without Mitigation	**With Mitigation***
Impact	1	1
Severe Impact	3	0

Analysis was not performed detailing which sites would be impacted, or to what degree, after implementation of noise mitigation measures. This summary was derived using a *conservatively assumed 6 dBA of noise reduction due to the construction of barriers.*
Source: (CNSSTC, 2000)

Potential startle effects have been identified for one hotel site, as well as motorists on I-15. However, it is premature to accurately analyze this impact until the final design stage.

Based on preliminary speed profiles for the alternative, there may be vibration-annoyance impacts at three residential sites, two motel sites and one RV park site. Potential building-damage impacts are not addressed in the EA. However, it is premature to accurately analyze this site-specific impact until the final design stage.

4.17.7 Pennsylvania

Further planning and analysis must be performed to determine potential noise impacts due to maintenance facilities, operational facilities, switches, passenger stations, electrical substations, and construction of the corridor. However, it is premature to accurately analyze this impact until the final design stage.

A preliminary analysis was done to quantify receptor impacts based on typical operating parameters predicted for this alternative. Based on this information, a worst case impact zone was developed. The results are included in Table 4.17-12

Table 4.17-12 - Summary of Potentially Impacted Sites – Pennsylvania

	Number of Impacted Sites	
	Without Mitigation	**With Mitigation***
Impact	225-937	N/A
Severe Impact	0	N/A

Analysis was not performed detailing which sites would be impacted, or to what degree, after implementation of noise mitigation measures. This summary was derived using a *conservatively assumed 6dBA of noise reduction due to the construction of barriers.*
Source: (CNSSTC, 2000)

No investigation of startle effects has been documented. However, it is premature to accurately analyze this impact until the final design stage.

No vibration impacts are anticipated based on FRA noise and vibration documentation on Maglev operations (FRA, 1998) relative to more traditional high-speed rail. However, it is premature to accurately analyze this site-specific impact until the final design stage.

4.17.8 Mitigation

Table 4.17-13 below summarizes typical mitigation measures for minimizing Maglev noise impact during the construction phase, the operational phase, and with regard to support facilities. Although several of the mitigation measures have been identified in the various EAs, noise barriers generally have been identified as the most effective measure for mitigating operational noise. As specified in FRA 1998, depending on source-to-receptor geometry, between six and ten decibels of reduction can be expected as a result of the construction of noise barriers.

Table 4.17-13 - Summary of Noise Mitigation Measures

Construction	Operation	Facilities
Timing of work	Route selection	Site selection
Muffling of diesel engines	Speed adjustments	Noise barriers
Use of newest equipment	Noise barriers	Careful selection of public address systems
Minimal use of impact pile driving	Sound insulation of buildings	
Temporary noise barriers		
Effective community public relations		
Initiate noise monitoring program		

Source: (MTA, 2000; FDOT, 2000; GNOEC, 2000; ARC, 2000; CNSSTC, 2000; CM, 2000; PAAC, 2000)

Potential vibration mitigation techniques, some of which are presented in the various EAs, include:

- Upgrading guideway support columns.
- Increasing elevation of guideway.
- Increasing mass of guideway supports.
- Increasing mass of guideway foundation.

In general, detailed mitigation discussions are not identified at this early planning stage, but will have to be prepared for any project(s) that proceeds to the site-specific EIS phase. Including a discussion of detailed mitigation measures in this PEIS is somewhat premature since detailed alternative information is not yet available.

4.17.9 No-Action Alternative

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be constructed. Therefore, there would be no noise and vibration impacts directly from a Maglev system. However, it is important to consider potential impacts from the No-Action Alternative that could arise from precluding the Maglev Deployment Program and the potential benefits of constructing a Maglev system.

It is anticipated that economic and population growth will continue around the country, promoting increased intercity travel demand and ensuing congestion. Under the No-Action Alternative there would be an increase in intercity travel demand, which may result in motor vehicle, air, and light rail transportation infrastructure expansion. Consequently, as traffic volume increases and transportation infrastructure is developed and expanded, the associated, potentially adverse noise and vibration effects will also continue to escalate. Typically, states (and/or regions) have short- and long-term multi-model transportation plans in place. The No-Action Alternative assumes current short- and long-term development plans will be implemented in the absence of the construction of a Maglev corridor. Thus, it is expected that the No-Action Alternative could result in more significant noise and vibration impacts than those associated with the Maglev Alternatives.

4.18 ELECTROMAGNETIC RADIO FREQUENCY RADIATION

The potential for adverse electromagnetic interference (EMI) safety hazards also must be considered. Railroad and transit owners and operators usually study EMI during planning and design, as well as address any problems during acceptance testing of new locomotives or signal and control systems. Traction power systems, as well as motive power equipment, typically introduce non-sinusoidal currents and higher harmonics (ripple) into the electrified railway system. These produce varying levels of electrical noise. Similarly, electronic switching using fast thyristors (GTOs, IGBT) and Variable Voltage Variable Frequency (VVVF) power and speed controllers, as well as the TR07 pulse-inverter also may introduce a rich spectrum of EMI effects, whether due to radiated, induced, or conducted interference. This broadband noise might adversely affect the operation of safety-critical signal, control and communication systems, such as use of the Global Positioning System (GPS) differential augmentation receivers for positive train control (PTC) applications.

EMI from harmonics distortion or rectification “ripple” from switching and power conditioning equipment may also block or distort the signals that control transit or rail movement authority, gates, interlockings, and switches, thus causing accidents. EMI-related stray currents corrosion of abutting metal structures is an important issue, especially for shared right-of-way and DC-powered transit. Induced fields and stray currents- if not managed- could lead to sparking, short-outs, breakdown in communications, explosion of abutting corroded gas pipelines, and water main or sewer line bursts. If not properly grounded at frequent intervals, induced currents or voltage might also cause shock to people maintaining and inadvertently touching improperly grounded accessible gas or water mains, or to persons touching nearly ungrounded fences or bridge guardrails in the vicinity of the guideway.

Radio frequency interference to and from wayside facilities and operations from electrified train systems have been studied in considerable detail, particularly in the Japanese and European electrified railway system. The key source of rail and transit EMI, namely arcing due to the collapse and reestablishment of the electrical connection between the pantograph and overhead catenary lines in traditional electrified trains, is <u>not</u> expected to be present in the Maglev system. However, the TR08 has 3rd rail segments near stations for levitation power at low speeds, and there are RF microwave antennas and transceivers along the ROW (at about 40 GHz, but specific frequency is not known) to detect vehicle location and speed and to transmit diagnostics and vital status data to the central control station.

The potential safety impacts of the Maglev system alternatives to and from passengers’ electronic devices on-board, and unrelated facilities and systems along the ROW considered, are expected to be minimal or manageable, particularly given the rapid decay of the magnetic field and radiation with distance from the Maglev vehicle and guideway. The types of electrical circuit systems to be evaluated for potential noise interference to on-board vital safety and Maglev propulsion or levitation systems, regenerative braking, signaling and controls, or communications and external location and data transmission systems are:

- Trackside systems: power equipment, communication equipment, and signaling and control equipment.
- Station systems: power equipment, communication equipment, escalator/ elevator, heating, ventilation, and air conditioning (HVAC) system.
- Depot systems: power equipment, communication equipment, signaling and control equipment, and machine tools.
- Systems adjacent to the right-of-way: power equipment, communication equipment, navigation equipment, and control equipment.

Proper grounding and shielding, or other EMI prevention and control options shall be evaluated and emplaced along the Maglev route selected to ensure safe Maglev operability. Testing will ensure compliance with EMI standards (see Table 3.18-2).

Electromagnetic interference can affect operating systems and facilities along the ROW via electrical noise in a variety of ways, depending on use of AC or DC propulsion power, on-board and wayside propulsion power, and signalling frequencies:

- Communication through telephone lines may be affected by increased noise disturbances due to the field harmonics from the operation of the Maglev. Generally, noise interference is directly related to several factors including: distance from the ROW, earth resistivity, and current loading for normal or abnormal operating conditions. The magnitude of potential interference in communications circuits would depend on circuit screening factors and on powered-rail-to-earth resistance values.
- Telephone metallic wires are normally electrically shielded, twisted pair wires in which the shielding is grounded at regular intervals. The induced voltage due to an electrified rail or Maglev during normal or abnormal conditions may require additional grounding. Fiberoptics are immune to EMI.
- Cable television should not be affected by Maglev noise interference because of its distinct frequency, but site-specific information is still desirable to assess the need for filtering.
- Computer networks of nearby businesses also may be subjected to interference due to Maglev, although it is not expected to significantly affect network operation.
- Electronic navigational systems (radars, GPS ground stations and repeaters) are not expected to be affected by Maglev noise interference because of well separated frequency domain, but site-specific information is still desirable.
- Electric transmission power lines and circuits are not expected to be affected by stray Maglev induced voltages because of their relatively higher voltage. The power transmission and distribution lines nearby, however, could induce stray voltage and leakage currents in conductors could affect the Maglev performance.
- Voltages can be induced on metallic fences and guardrails situated along the ROW. Therefore, site-specific information, like length and fence height, should be assessed to specify proper grounding intervals. Stray currents and eddy currents must also be prevented to control shortouts.

EMI Human Health and Safety Impacts. There are some potential acute EMI human health or safety hazards to be considered. These are due to static magnetic fields, or to

AC electric and magnetic fields, or RF radiation interfering with the normal operation of medical electronic devices, such as: implanted electronic pacemakers and defibrillators, insulin pumps, pain controllers and electric wheel-chairs. Also there are magnetic torque effects from static magnetic fields typical of Maglev on metallic medical prostheses and implants, such as: braces, hip implants, sutures, and aneurism clips. The FDA Center for Devices and Radiologic Health (CDRH) regulates medical devices and requires testing (e.g., EMI from cell phones) to prevent their malfunction, but older implants are susceptible to EMI in RF and microwave fields, as are metallic implants or devices for the disabled to static and AC magnetic fields. Referenced standards (see Section 3.16) protect susceptible individuals by setting 5 Gauss static magnetic field limits and 1 Gauss (or 0.1 milliTesla) magnetic and 1 KV/m electric fields at 60 Hz AC. These exposure safety limits apply to both public and occupational environments. For EMF within the ELF range of 25-800 Hz, ICNIRP has published frequency dependent limits for workers and the general public. For RF radiation, there are also frequency dependent public and occupational exposure safety limits on electric and/or magnetic fields and on corresponding radiated power density (see FCC, ACGIH, ICNIRP, and IEEE referenced standards in Section 3.16).

The potential for EMI is more of a concern for Maglev's safe operation than the impact from Maglev on nearby airports and military and civilian operations. The potential for a significant adverse impact to Electromagnetic spectrum from Maglev Deployment can be prevented and minimized. At the current early planning level of Maglev design, the inventory of potential electronic emitters and receivers that Maglev could interfere with has not been completed for any of the alternatives. The potential EMI impacts are a system safety concern that will be thoroughly evaluated during the site-specific environmental review if the Maglev Deployment Program proceeds with one or more alternatives.

4.18.1 Mitigation

"Best Practice" for EMI Control. The FRA's approach to assessing, and minimizing, the potential for excessive EMF or EMI exposures due to electrification and high-speed rail operation along the North East Corridor (NEC) would be followed for the Maglev Deployment Program, since they explicitly and proactively considered environmental and potential health effects of EMF to passengers, workers, and to people living and working along the corridor. The FRA also required Amtrak (the developer and operator) to adopt best industry practices in preventing and minimizing EMF/EMR exposures and EMI/EMC problems. FRA required Amtrak to survey EMF levels before and after system development and operation, and to establish an EMF monitoring program to ensure compliance with applicable safety standards as well as to determine the need for any future EMF or EMI mitigation and control program to reduce public exposures or safety impacts.

An adequate EMI control program can be based on industry best practices and operating experience, including electrified commuter rail, public transit authorities with DC 3rd rail and/or AC catenary systems, and Amtrak in the NEC – all of which have encountered and successfully managed similar issues. AC filtering and cathodic protection for bridges and steel pipes or structural beams, circuit interrupts, and grounding along pipelines are commonly used. Other simple methods are fencing the perimeter and posting warnings or advisories to restrict public access, limiting work crew exposure times.

As long experience with electrified direct and AC transit and rail systems has shown, potential EMI problems from Maglev system operation close to sensitive communication and control facilities (e.g., airports, traffic control centers, military installations, ports, banks, cell phone and emergency dispatch) can be effectively addressed through several "best practice" strategies. Different mitigation options exist along the ROW for the exposed public, such as: posted warnings or fences to restrict public access, buffer zones or as wide a ROW as possible, restricted zoning and building permits to avoid undue residential development in the proximity of tracks and along the catenary or power lines, and enabling workers to manage and monitor their workplace EMF exposures through a prudent avoidance policy.

Measured or predicted broadband electromagnetic noise (unintended EM radiation) and the potential for EMI will have to be assessed by reference to relevant standards (see Table 3.18-2). To minimize unintended Maglev system impacts to nearby facilities (e.g., transit systems, military and airport radar and communications, telephone or emergency communications centers, hospitals, bank ATMs), or if relevant standards are exceeded, proper prevention and mitigation options will be implemented, consistent with system design and site specific conditions.

4.18.2 No-Action Alternative

Under the No-Action Alternative, the Maglev Deployment Program would not proceed and a Maglev system would not be constructed. Therefore, there would be no electromagnetic radio frequency radiation impacts directly from a Maglev system. However, it is important to consider potential impacts from the No-Action Alternative that could arise from precluding the Maglev Deployment Program and the potential benefits of constructing a Maglev system.

The environment has existing EMI producers and more are added each day. Two way and point-to-point communications, cellular telephones, global positioning systems, and other emitters are added daily to the radio frequency spectrum. In addition, as new transportation infrastructure and operating systems are implemented to meet the increasing travel demand, new sources of EMI would be added to those currently present. Thus, the electromagnetic environment will continue to be used more intensively and frequently, increasing the potential of interference from and to transportation systems.

4.19 CONSTRUCTION IMPACTS

Construction of any of the seven proposed Maglev Alternatives may result in localized short-term air, noise, vibration, water quality, traffic, visual, vegetation, utility and public safety impacts. With proper planning and sequencing, construction related impacts to sensitive natural resources such as wetlands, floodplains, and critical habitats, and to cultural resources should be essentially avoided.

Air Quality. Air quality impacts from construction activities will be temporary and are primarily associated with the operation of diesel-powered equipment and the generation of fugitive dust from excavation and earth moving activities. Air emissions from construction equipment can be minimized by properly maintaining engines. Fugitive dust is also generated as trucks travel to and from the construction site along temporary haul roads, and from the handling of cement, aggregate and other materials. The effect of fugitive dust would vary depending on local weather conditions during periods of extensive earth moving activities. Requiring the contractor to implement dust control measures can substantially minimize fugitive dust impacts, including:

- Application of water and/or calcium chloride to haul roads.
- Using haul trucks equipped with dust covers.
- Minimization of exposed, erosion prone areas to the greatest extent practicable.
- Stabilization of exposed earth with grass, mulch, pavement, or geotextile matting as early as possible.
- Covering or shielding stockpiled materials from the wind.

Noise. Noise impacts from construction activities are a function of the noise generated by construction equipment, the location of construction, the sensitivity of adjacent land uses, and the timing and duration of the noise generating activity. Typically, a construction project is carried out in stages, each of which generates a certain level of noise based on the mix of equipment in use at that time. The dominant source of noise from most construction equipment is the diesel engine. Impact pile driving, pavement breaking, and blasting are the primary exceptions to this generalization.

It is anticipated that the major noise producing activity associated with Maglev system construction will be associated with the construction of the guideway support columns, since they may require the use of an impact pile driver. The installation of the guideway itself is not anticipated to generate substantial noise. This is because the guideway will be prefabricated at factories and shipped to the construction site for assembly.

Measures that can be employed to minimize construction noise fall into two general categories: 1) design considerations; and 2) construction staging and/or sequencing of operations. Design considerations would include: erection of temporary walls, stockpiles, or earth berms between the noise source and potential sensitive receptors; the identification of preferred haul/truck routes that avoid sensitive receptors to the greatest extent practicable; and locating stationary noise generating equipment at a distance from noise sensitive receptors. Construction staging should be planned to avoid prolonged noise generating activities and to minimize nighttime construction activities. Lastly, the installation of proper mufflers on all diesel power equipment would further reduce noise impacts from construction activities.

Vibration. Construction activity can result in varying degrees of ground vibration, depending on the equipment and methods employed. Operation of construction equipment causes vibrations that spread through the ground and diminish in strength with distance. Buildings in the immediate vicinity of the construction site respond to these vibrations with varying results ranging from no perceptible effects at the lowest levels, low rumbling sounds and perceptible vibrations at moderate levels, and slight damage to foundations at the highest levels. The construction activities that typically generate the most severe vibrations are impact pile driving and blasting.

Construction of any of the proposed Maglev Alternative alignments will require extensive pile driving, particularly associated with construction of the guideway support columns. This activity may produce vibration levels that could potentially result in slight damage to the foundations of buildings near the construction site.

Blasting may be required for some areas along each of the Maglev Alternative corridors where large areas of bedrock need to be removed. For example, the Georgia Alternative proposes that a tunnel be constructed at a location along the route, which would require blasting. Like impact pile driving, blasting can create surface vibrations that can potentially damage buildings immediately adjacent to the construction site. The exact magnitude of the vibrations generated from blasting activities and impact pile driving depends upon the structure of the underlying geologic matrix. In order to predict and minimize impacts, a detailed characterization of the geologic conditions of the selected Maglev Alternative would be conducted as design advances.

It is possible that some types of heavy vehicles and excavation activities can generate sufficient ground-borne vibration levels to be perceptible in some buildings located adjacent to construction site. The vibration levels created by the normal movement of construction vehicles such as graders, loaders, dozers, scrapers, and dump trucks, are generally the same order of magnitude as the ground-borne vibration created by heavy vehicles traveling along nearby streets.

Water Quality. Earthwork, including clearing and grubbing, excavating, grading, embankment formation, and stockpiling, will be required during the construction of any of the proposed Maglev Alternative corridors. Exposed soils may result in the potential for increased site erosion and sedimentation impacts to nearby water resources. Additionally, the construction of some of the guideway support structures and other system elements may require dewatering of excavation sites. The dewatered water may contain suspended sediments and other contaminants that could potentially affect receiving waters.

Given the high potential for water quality impacts associated with Maglev corridor construction activities, a General Construction Stormwater Permit, a National Pollution Discharge Elimination System Permit (NPDES), a Section 404 Water Quality Certification, and other discharge and water resource permits will likely be required for any of the alternatives. A Nationwide Permit or Individual Section 404 Permit from the U.S. Army Corps of Engineers may also be required, depending upon the extent of wetland impacts associated with project construction. Additionally, a Storm Water Pollution Prevention Plan (SWPPP) will need to be prepared and implemented at the selected site, regardless of its location. The SWPPP will, at a minimum, identify appropriate Best Management Practices (BMPs) and include a detailed monitoring program. Notice of the availability of the SWPPP will be conspicuously posted at the construction site.

Some of the BMPs that may potentially be included in the SWPPP and implemented at the construction site include, but are not limited to:

- Conducting earthwork activities during a known dry season.
- Diverting stormwater that originates off-site away from the construction site.

- Minimizing the extent and duration of exposed soils by using temporary or permanent seeding, mulching, or geotextile matting.
- Proper use of haybales and silt fencing.
- Constructing appropriately sized temporary sedimentation basins.
- Establishing a bermed construction equipment storage and refueling area.
- Establishing a designated equipment cleaning/washing area that is bermed and includes some measures for the treatment of runoff prior to discharge.
- Conducting in-stream construction activities during periods of low flow.
- Using cofferdams for work in the water.
- Establishing an emergency response spill contingency plan.

Traffic. Construction of any of the Maglev Alternatives could potentially result in temporary interruptions to local traffic patterns. Maintenance of traffic and construction staging could be planned and scheduled to minimize traffic delays to the greatest extent practicable. Appropriate signing could be used to notify motorists of road closures and detours. Access to local residences and businesses in the vicinity of the construction site could be maintained to the greatest extent practicable. Temporary disruptions in access will be directly coordinated with residents and business owners. Residents located along designated truck haul routes may have to contend with the day-to-day hauling activities associated with the construction site. However, as construction advances to a new section of the corridor, haul routes may change and the impact at the former section may no longer exist. In addition, where available, other modes of transportation like barges and rail could be used to haul construction related materials and equipment. With the implementation of a Traffic Maintenance and Protection Plan, the overall construction impact on traffic and transportation is considered to be minimal for all proposed Maglev locations. Traffic sequencing is often used to allow safe passing between oncoming traffic during construction and may be a mitigation alternative.

Visual Aesthetics. Temporary visual impacts attributed to construction activities will be greatest for those residents immediately adjacent to the construction site. Views of heavy equipment and material stockpiles will be commonplace for the duration of the construction activities. Fugitive dust may also impede visual quality during limited periods.

Vegetation. Construction disturbances and re-vegetation have the potential to introduce and/or spread noxious and invasive weed species. This has become an issue of major biological significance nationwide. When alternatives are selected to continue, a site specific EIS will address this issue in detail.

Utilities. Construction of any of the proposed Maglev Alternative alignments will likely require utility relocations. Temporary service disruptions may be experienced during the relocation process. Construction activities will be planned and scheduled to minimize utility service disruptions to the greatest extent practicable.

Public Safety. Particular attention should be given to the maintenance of public safety during the duration of construction, given the normal hazards associated with construction. Public access to construction sites should be limited to the greatest extent possible. This can be accomplished with temporary fencing, warning signs, or other safety precautions.

4.20 IRREVERSIBLE OR IRRETRIEVABLE USE OF RESOURCES

Implementation of the Maglev Deployment Program involves a commitment of a range of natural, physical, human, and fiscal resources. The use of land for construction of the ultimate Maglev facility is considered an irreversible commitment during the time period that the land is dedicated to the transportation system. However, if a greater need arises for use of the land, or the Maglev facility is no longer needed, the land can be converted to its original or another use, similar to the conversion of defunct rail corridors to recreational and other alternative uses.

Considerable amounts of fossil fuel and construction materials, such as cement, steel, aluminum, copper wire, wood and others, will be expended, similar to what would be required for alternative transportation improvements or facilities oriented to provide for travel demand in any region of the country. These construction materials are generally irretrievable. However, they are not in short supply, and their use will not have an adverse effect upon their continued availability. Once constructed, operation of the Maglev system is not dependent solely on fossil fuels but on electricity, which can be generated by means that do not involve the consumption of non-renewable resources.

Construction of the ultimate Maglev system will require a substantial one-time expenditure of funds, which are not retrievable. Construction will also require substantial amounts of labor, which, although irreversible, will likely result in short-term stimulation of the local and regional economy of the selected corridor.

Commitments of resources may involve use of areas that are wetlands, floodplains, sources of minerals, historic sites, and other natural and cultural resources. While these commitments may be irretrievable, they are not unusual in the development of a large transportation project that benefits a large public. The losses incurred will be minimized or compensated through a variety of measures, including avoidance by design, alignment shifts, construction techniques, compensatory flood storage, wetland creation or enhancement, historic documentation, and other suitable and appropriate means.

The acceptability of making a commitment of the aforementioned resources hinges on the concept that the Maglev system represents a safe, rapid, energy efficient, environmentally sound, and convenient transportation technology. The benefits of the system are anticipated to justify and outweigh the commitment of the resources used for its construction and operation.

4.21 LOCAL SHORT-TERM USE OF THE ENVIRONMENT AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The environmental impacts associated with the Maglev Deployment Program will result in both short and long-term impacts as described in this PEIS. Short-term construction effects could potentially include localized noise, air and water pollution, and congestion. However, based on standard environmental specifications and BMPs included as part of construction contracts, these short-term effects would not have a lasting impact on the environment. In addition, short-term gains to local economies would occur during construction due to the additional jobs and purchase of services and supplies.

Long-term alterations to the human and natural environment will occur with the deployment of an operating Maglev transportation system. However, the Maglev system would serve as a viable alternative to alleviate the congestion presently encountered along existing airway and automotive corridors that will worsen with the increasing demand for commuter travel. Associated socioeconomic and environmental benefits of the Maglev system could include regional economic development, support to comprehensive land-use planning emphasizing transit-oriented developments, reduced air emissions, and comparatively reduced consumption of non-renewable resources such as fossil fuels. Additionally, the system will offer long-term structural reliability, improved travel safety and convenience, and energy savings.

Transportation plays a significant role in all aspects of American life. The Maglev Deployment Program is an advanced transportation technology that, despite the short-term uses of the environment it requires, will contribute considerably to the maintenance and enhancement of long-term productivity nationwide.

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APPENDICES

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APPENDIX B – TEA-21

United States Code
Title 23 - Highways
Chapter 3 - General Provisions
§ 322. Magnetic levitation transportation technology deployment program.

Sec. 322. Magnetic levitation transportation technology deployment program

(a) Definitions. - In this section, the following definitions apply:

(1) Eligible project costs. - The term "eligible project costs" -

(A) means the capital cost of the fixed guideway infrastructure of a MAGLEV project, including land, piers, guideways, propulsion equipment and other components attached to guideways, power distribution facilities (including substations), control and communications facilities, access roads, and storage, repair, and maintenance facilities, but not including costs incurred for a new station; and

(B) includes the costs of preconstruction planning activities.

(2) Full project costs. - The term "full project costs" means the total capital costs of a MAGLEV project, including eligible project costs and the costs of stations, vehicles, and equipment.

(3) MAGLEV. - The term "MAGLEV" means transportation systems employing magnetic levitation that would be capable of safe use by the public at a speed in excess of 240 miles per hour.

(4) Partnership potential. - The term "partnership potential" has the meaning given the term in the commercial feasibility study of high-speed ground transportation conducted under section 1036 of the Intermodal Surface Transportation Efficiency Act of 1991 (105 Stat. 1978).

(b) Financial Assistance. -

(1) In general. - The Secretary shall make available financial assistance to pay the Federal share of full project costs of eligible projects selected under this section. Financial assistance made available under this section and projects assisted with the assistance shall be subject to section 5333(a) of title 49, United States Code.

(2) Federal share. - The Federal share of full project costs under paragraph (1) shall be not more than 2/3.

(3) Use of assistance. - Financial assistance provided under paragraph (1) shall be used only to pay eligible project costs of projects selected under this section.

(c) Solicitation of Applications for Assistance. - Not later than 180 days after the date of enactment of this subsection, the Secretary shall solicit applications from States, or authorities designated by 1 or more States, for financial assistance authorized by subsection (b) for planning, design, and construction of eligible MAGLEV projects.

(d) Project Eligibility. - To be eligible to receive financial assistance under subsection (b), a project shall -

(1) involve a segment or segments of a high-speed ground transportation corridor that exhibit partnership potential;

(2) require an amount of Federal funds for project financing that will not exceed the sum of -

(A) the amounts made available under subsection (h)(1); and
(B) the amounts made available by States under subsection (h)(3);

(3) result in an operating transportation facility that provides a revenue producing service;

(4) be undertaken through a public and private partnership, with at least 1/3 of full project costs paid using non-Federal funds;

(5) satisfy applicable statewide and metropolitan planning requirements;

(6) be approved by the Secretary based on an application submitted to the Secretary by a State or authority designated by 1 or more States;

(7) to the extent that non-United States MAGLEV technology is used within the United States, be carried out as a technology transfer project; and

(8) be carried out using materials at least 70 percent of which are manufactured in the United States.

(e) Project Selection Criteria. - Prior to soliciting applications, the Secretary shall establish criteria for selecting which eligible projects under subsection (d) will receive financial assistance under subsection (b). The criteria shall include the extent to which -

(1) a project is nationally significant, including the extent to which the project will demonstrate the feasibility of deployment of MAGLEV technology throughout the United States;

(2) timely implementation of the project will reduce congestion in other modes of transportation and reduce the need for additional highway or airport construction;

(3) States, regions, and localities financially contribute to the project;

(4) implementation of the project will create new jobs in traditional and emerging industries;

(5) the project will augment MAGLEV networks identified as having partnership potential;

(6) financial assistance would foster public and private partnerships for infrastructure development and attract private debt or equity investment;

(7) financial assistance would foster the timely implementation of a project; and

(8) life-cycle costs in design and engineering are considered and enhanced.

(f) Project Selection. -

(1) Preconstruction planning activities. - Not later than 90 days after a deadline established by the Secretary for the receipt of applications, the Secretary shall evaluate the eligible projects in accordance with the selection criteria and select 1 or more eligible projects to receive financial assistance for preconstruction planning activities, including -

(A) preparation of such feasibility studies, major investment studies, and environmental impact statements and assessments as are required under State law;

(B) pricing of the final design, engineering, and construction activities proposed to be assisted under paragraph (2); and (C) such other activities as are necessary to provide the Secretary with sufficient information to evaluate whether a project should receive financial assistance for final design, engineering, and construction activities under paragraph (2).

(2) Final design, engineering, and construction activities. - After completion of preconstruction planning activities for all projects assisted under paragraph (1), the Secretary shall select 1 of the projects to receive financial assistance for final design, engineering, and construction activities.

(g) Joint Ventures. - A project undertaken by a joint venture of United States and non-United States persons (including a project involving the deployment of non-United States MAGLEV technology in the United States) shall be eligible for financial assistance under this section if the project is eligible under subsection (d) and selected under subsection (f).

(h) Funding. -

(1) In general. -

(A) Contract authority; authorization of appropriations. -

(i) In general. - There is authorized to be appropriated from the Highway Trust Fund (other than the Mass Transit Account) to carry out this section $15,000,000 for fiscal year 1999, $20,000,000 for fiscal year 2000, and $25,000,000 for fiscal year 2001.

(ii) Contract authority. - Funds authorized by this subparagraph shall be available for obligation in the same manner as if the funds were apportioned under chapter 1, except that -

(I) the Federal share of the cost of a project carried out under this section shall be determined in accordance with subsection (b); and

(II) the availability of the funds shall be determined in accordance with paragraph (2).

(B) Noncontract authority authorization of appropriations. -

(i) In general. - There are authorized to be appropriated from the Highway Trust Fund (other than the Mass Transit Account) to carry out this section (other than subsection (i)) $200,000,000 for each of fiscal years 2000 and 2001, $250,000,000 for fiscal year 2002, and $300,000,000 for fiscal year 2003.

(ii) Availability. - Notwithstanding section 118(a), funds made available under clause (i) shall not be available in advance of an annual appropriation.

(2) Availability of funds. - Funds made available under paragraph (1) shall remain available until expended.

(3) Other federal funds. - Notwithstanding any other provision of law, funds made available to a State to carry out the surface transportation program under section 133 and the congestion mitigation and air quality improvement program under section 149 may be used by the State to pay a portion of the full project costs of an eligible project selected under this section, without requirement for non-Federal funds.

(4) Other assistance. - Notwithstanding any other provision of law, an eligible project selected under this section shall be eligible for other forms of financial assistance provided under this

title and the Transportation Equity Act for the 21st Century, including loans, loan guarantees, and lines of credit.

(i) Low-Speed Project. -

(1) In general. - Notwithstanding any other provision of this section, of the funds made available by subsection (h)(1)(A) to carry out this section, $5,000,000 shall be made available to the Secretary to make grants for the research and development of low-speed superconductivity magnetic levitation technology for public transportation purposes in urban areas to demonstrate energy efficiency, congestion mitigation, and safety benefits.

(2) Noncontract authority authorization of appropriations. -

(A) In general. - There are authorized to be appropriated from the Highway Trust Fund (other than the Mass Transit Account) to carry out this subsection such sums as are necessary for each of fiscal years 2000 through 2003.

(B) Availability. - Notwithstanding section 118(a), funds made available under subparagraph (A) -

(i) shall not be available in advance of an annual appropriation; and

(ii) shall remain available until expended.

APPENDIX C

THE IMPACTS OF THE TRANSRAPID MAGNETIC LEVITATION TRAIN ON HUMAN HEALTH AND THE ENVIRONMENT

By Kilpatrick Stockton LLP

For Transrapid International-USA

May 2000

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THE IMPACTS OF THE TRANSRAPID MAGNETIC LEVITATION TRAIN ON HUMAN HEALTH AND THE ENVIRONMENT

EXECUTIVE SUMMARY

A. Introduction

Maglev (for "magnetic levitation") represents a dramatic innovation in surface transportation. Instead of riding on wheels, maglev trains float down guideways on magnets. The train's levitating force is created by an attractive pull between conventional electromagnets on the train and an iron rail located in the guideway on which the train travels. Electromagnets also provide the train's lateral guidance, propulsion and braking forces.

In 1990, the federal government launched the National Maglev Initiative (NMI) to assess the potential for maglev trains to service this country's intercity transportation needs. This initiative, a joint project of the Federal Railroad Administration (FRA), the U.S. Army's Corps of Engineers and the Department of Energy, included evaluations of the engineering, environmental, safety and economic aspects of existing and proposed maglev systems. The final report on this initiative (NMI Report) was a ringing endorsement of the maglev concept.

A German consortium known as Transrapid International (TRI) has developed a fully-operational maglev train after 30 years of research and development and 15 years of full-scale testing at a test track in Emsland, Germany. TRI's U.S. subsidiary, Transrapid International–USA (TRI-USA), is promoting the development of maglev transportation systems in this country utilizing the maglev technology developed by TRI.

As with any new type of technology, the introduction of maglev trains in the U.S. has raised questions about the system's potential effects on the environment. TRI-USA asked Kilpatrick Stockton LLP to conduct a comprehensive survey of research to date on the environmental and safety aspects of the Transrapid maglev technology. This paper presents the results of that survey.

B. Electromagnetic Fields

Proposals to introduce maglev trains into the U.S. transportation system come at a time when there is considerable debate over the possible health risks associated with electromagnetic fields (EMF). Because maglev train systems are known to generate a low intensity, but highly complex EMF, a considerable amount of research has focused on whether these fields pose potential risks to human health. Many of these studies have been funded by the FRA.

One such study was a comprehensive review of prior EMF research. It concluded that the intensity of EMF associated with Transrapid was no higher, either on a peak field or average field basis, than those of other rail technologies. The study's authors concluded that maglev technology, although a unique exposure environment, does not present any unusual EMF exposures to passengers or crew.

The FRA also funded a research team to travel to Germany to measure, characterize, and analyze EMF emissions from the Transrapid system. The resulting report describes the magnetic field measurements conducted on board and in the vicinity of the train, the guideway, the passenger station, control center, and the power supply facilities at TRI's test facility in Emsland, Germany. The study concluded that the magnetic fields associated with Transrapid, while unique among fields measured elsewhere in the environment, have not been shown to produce adverse biological effects in living organisms.

Another study commissioned by the FRA addressed the potential effects of those EMF characteristics that appear unique to maglev systems: variability of intensity and frequency over time. This study investigated the biological effects in human cells and rats from exposures to an EMF environment similar to that associated with Transrapid. Based on the cell research, the study concluded that maglev EMF exposure at up to seven times the intensity produced by Transrapid has no deleterious effect on the growth or differentiation of the human cells studied.

The rat experiments looked at the effect of Transrapid-type EMF on changes in pineal melatonin levels—thought to be an important indicator of potentially carcinogenic changes in higher animals. The study concluded that EMF similar to that produced by Transrapid had no statistically significant influence on melatonin levels.

In sum, although the low-energy magnetic fields associated with Transrapid are highly complex and are unlike magnetic fields generated by other man-made devices, there is no evidence that such fields produce adverse biological effects.

C. Noise

The noise measurements of the Transrapid were compared to those generated by other types of trains. These comparisons showed that at all operational speeds, Transrapid was quieter than every type of rail train tested, including a normal freight train, a regional express train, an intercity train, and the high-speed German ICE and the French TGV trains.

In 1998, the FRA issued guidelines for use in predicting noise levels from Transrapid trains. Only at the highest anticipated speeds (250-300 mph) and at relatively close distances to the most noise-sensitive areas (residential housing, schools, hotels, churches and parks) would maglev noises be in the "severe impact" category. By employing a combination of physical sound barriers, modification of speed profiles, and locating guideways away from such areas, planners of Transrapid systems should be able to readily accommodate even the most noise-sensitive communities.

D. Vibrations

The effect of vibrations from passing Transrapid trains has also been extensively evaluated. Even though a Transrapid train does not literally touch the guideway, the dynamic loads of the train on the guideway cause perceptible ground-borne vibrations. Vibrations from normal Transrapid operation, however, are not expected to be significant. TRI estimates that vibrations would not be noticeable, even at 250 mph, beyond 200 feet from the guideway. At 155 mph, this "no-perception" distance drops to 115 feet. It is expected that in most areas, the guideway can be aligned to assure that the train avoids passing within the "perception" distance of vibration-sensitive buildings or equipment.

E. Air Quality

Air emissions associated with Transrapid include the following:

• Direct air emissions from the *construction* of Transrapid: These emissions, consisting primarily of short-term emissions of particulates and nitrogen oxides, should be insignificant compared to the other air emissions discussed in this paper.

• Direct air emissions from the operation of Transrapid: There will be no such emissions from the train itself and relatively minimal emissions from the operation of the stations.

• Indirect air emissions *reductions* from highway vehicles and aircraft that may be displaced by the maglev system: The most significant of these include volatile organic compounds, nitrogen oxides, sulfur dioxide, particulates, carbon monoxide, and carbon dioxide.

• Indirect air emission *increases* depending upon the sources of electricity selected to power the Transrapid system: The nature and amount of such emissions will vary depending on the power-producing source(s) utilized, but may include volatile organic compounds, nitrogen oxides, sulfur dioxide, particulates, carbon monoxide, and carbon dioxide.

The most significant effects on air quality from the introduction of Transrapid systems in the United States can be estimated by comparing the anticipated emission reductions from maglev's displacement of air and highway travel with the anticipated emissions increases from the generation of electricity needed to power the maglev trains.

The NMI Report looked at 16 transportation corridors in the United States where maglev systems appear to be feasible. The report found that the displacement of air travel in the distance range of 100-600 miles promises to result in significant decreases in fuel consumption. According to the NMI Report, maglev can offer trip times within this distance range that are competitive with air travel for a small fraction of the energy consumed by an aircraft (as measure in terms of energy consumed for passenger mile traveled).

The operation of a new Transrapid system will require the generation of electricity, primarily for the operation of the train itself, but also, to a lesser extent, for the operation of the associated stations and other equipment. The NMI Report concluded that by substituting maglev vehicles for aircraft (and to a lesser degree, for highway vehicles and diesel powered trains) emissions from many mobile sources would be replaced by emissions from electrical power plants. The authors concluded that, except for sulfur dioxide emissions, there would be sizable reductions in all categories of air pollutants from the introduction of maglev.

The increase in sulfur dioxide emissions projected in the NMI Report was based on an assumption that much of the electricity for the new maglev trains would come from the burning of fossil fuels, particularly coal. However, this may no longer be a valid assumption in light of the rapid deregulation of the power-generating industry in the United States.

F. Safety

Transrapid's safety features have been extensively tested at full-scale at TRI's test track in Emsland, Germany, demonstrating that with respect to accidental injuries and fatalities, Transrapid is likely to be the safest form of mechanized transportation in history.

An essential component of Transrapid's safety-related design is the "safe hover" requirement that a train must be able, under any circumstance, to come to a stop at a location on the guideway where passengers can be safely evacuated. The Transrapid has built-in design characteristics to assure that such safe-stopping zones are always accessible to passengers.

Transrapids design is able to meet a new "safe hover" safety standard by assuring there will be no unexpected loss of either the levitation or guidance system. Each magnet on Transrapid has an individual control system with redundant gap sensors to assure that the required distance between the train and the guideway is maintained at all times.

Even if the external source of electricity fails while the train is in operation, on-board batteries will supply emergency power to maintain the levitation and guidance systems. In such an emergency, braking will also be carried out by the on-board batteries, which will slow the train down and allow it to delevitate, lower onto mechanical skids, and glide to a stop.

Unlike railway systems, it is virtually impossible for a Transrapid train to "derail" (i.e. to separate from an intact guideway) because the bottom of the train wraps around the guideway. Also unlike most other railway systems, the guideway of the Transrapid will be fully grade-separated and will have no intersections with highways or railroads. The system will typically be built using elevated guideways to allow other traffic routes, such as highways and railroad tracks, to pass under the guideway. As a result, collisions with other types of vehicles will not occur.

G. Indirect Health and Safety Impacts

To the extent Transrapid systems divert passengers from highway travel, the probability that passengers will suffer accidental death or injury during their travels will be greatly reduced.

As noted above, the likelihood of Transrapid's actually causing a highway or railway accident is virtually non-existent because the system will be elevated as necessary to avoid all road and railroad track intersections.

Transrapid systems should result in improvements in air and highway system performance by diverting passengers from automobiles and aircraft. With the introduction of high-speed systems like Transrapid in a number of the country's mid-distance intercity corridors, highway and airport congestion can be significantly reduced. The reduction in societal stress from the decrease in traffic congestion and travel delays would be an important benefit of Transrapid.

H. The Convenience and Comfort of Transrapid

The operation of Transrapid trains will be optimized during turns and grade-climbing to avoid any inconvenience to passengers, such that Transrapid passengers will not be required to wear seatbelts and may walk around in the passenger compartment of the train at any time.

Transrapid trains have also been designed to assure that passengers are not startled or made uncomfortable by rapid pressure changes when two trains pass one another or when a train enters a tunnel. Passenger compartments of Transrapid trains employ state-of-the-art technology to assure pressure-tightness of vehicle bodies.

Transrapid passengers will be able to travel in complete safety regardless of the weather. Because of its contactless technology, Transrapid will remain safe and operational in poor weather and at high and low temperatures. Consequently, Transrapid systems should be more resistant to weather delays that frequently plague airways, highways, and some forms of conventional railway systems.

I. Land Use Impacts

The potential effects on land use of a new Transrapid system must be assessed in the context of federal, state and local laws designed to protect land uses that are valued by the public. If such values are threatened with irreversible harm, these laws will require modification or relocation of the proposed Transrapid system to avoid or minimize such impacts. Transrapid offers more flexibility than other surface transportation systems to accommodate valued land uses.

Land area needs of Transrapid systems are relatively modest because the vehicles are quite narrow. Moreover, Transrapid guideways can either be elevated or constructed at grade, giving designers the flexibility to avoid interference with existing land use patterns by constructing the guideways above the existing terrain. Areas under the guideways can continue to support agriculture, flood plain drainage, wetlands and wildlife habitats.

Maglev systems consume less land than any other form of motorized transport. The elevated double-track guideway of Transrapid spans about 90 feet between supports. The area required for each support is about 900 square feet, resulting in an effective land consumption for an elevated Transrapid system that is much less than the land use requirements for either a new highway or a conventional railroad system. Even Transrapid guideways constructed at grade occupy less land than other transport modes.

Another important advantage of Transrapid, whether or not the guideway is elevated, is the minimal impact of the train on local hydrology. The natural flow of surface water need not be diverted or interrupted by either construction or operation of Transrapid--in contrast to roads and conventional railroad tracks.

Like conventional railway stations, Transrapid stations can serve as hubs for new urban development. To optimize the rapid travel times and benefits of Transrapid, stations located along a typical travel corridor will be relatively few and far between. Consequently, unlike highways that often promote sprawl development along the entire length of a new highway system (and especially at major intersections), Transrapid stations can be effectively utilized by urban planners to attract concentrated residential and commercial development around stations that are relatively distant from one another. In short, a Transrapid system can be expected to promote concentrated development at relatively few points of access, particularly in the hands of far-sighted community planners.

J. Impacts on Wildlife and Plants

Much of the above discussion of the direct and indirect land use impacts of Transrapid systems applies as well to the effects of this new technology on plants and wildlife. Corridors traversed by Transrapid likely will include a variety of wildlife habitants including grassland, woodlands, lakes and ponds, rivers and streams and agricultural lands. In most cases, the effects of a new Transrapid system on these habitats, and the wildlife that occupy them, will be minor and temporary.

Natural drainage patterns need not be interrupted by Transrapid guideways, even for at-grade systems. Where necessary, Transrapid guideways can be elevated to further minimize the impact on sensitive habitat. Disruptions during construction across grasslands, wetlands, and agricultural lands will be temporary, with habitat returning to a normal vegetative state, even within corridors and under guideways, after construction is completed. With elevated maglev systems, wildlife can pass from one side of the guideway to the other relatively undisturbed, highlighting a major advantage of maglev over most highways and conventional railroads.

K. Energy Consumption

Transportation accounts for at least two-thirds of the oil consumed in the U.S. The country's appetite for oil is primarily due to the fact that when Americans travel they prefer, or are compelled, to travel in automobiles. Nearly 70% of the projected increase in petroleum consumption in this country by the year 2015 will be related to transportation, and the lion's share of that increase will be due to increased automobile use.

As a matter of sound public policy, any new transportation system that reduces our dependence on petroleum, and on fossil fuels in general, should be encouraged. Transrapid is by no means a complete solution to our over-dependence on fossil-fuel-based travel, but it is certainly a step in the right direction.

Transrapid systems will be virtually independent of petroleum-based fuels, so that maglev networks will help lessen U.S. dependence on foreign oil. As noted previously, Transrapid can offer trip times far shorter than highway travel, and competitive with middle-distance air travel, for a small fraction of the energy consumed by automobiles and aircraft.

L. Conclusion

Transrapid maglev trains promise to be the "green" transportation systems of the future. Indeed, this innovative technology should be safer, more convenient, less polluting, less disruptive of existing land uses, and "friendlier" to the natural environment than any other system of mechanized transport yet developed.

I. BACKGROUND

In 1991, a committee of 19 experts assembled by the National Research Council issued a special report on the potential for high-speed ground transportation (HSGT) technologies to meet the demand for transportation service in high-density travel corridors in the U.S. (hereinafter "NRC Report").[1] The NRC Report made the following observation:

> Intercity travel in the United States continues to grow, but the transportation infrastructure to support this growth is becoming more difficult to provide. Increasing highway capacity and building new airports can cause pollution and environmental disruption, create noise, and encourage greater use of valuable energy resources. Moreover, funding improvements to this infrastructure systems, which require public subsidies, strain already stretched budgets.

In response to the dramatic increase in highway and airport congestion over the past decade many public officials have pushed to expand or build new airports and highways in crowded intercity travel corridors. However, not only are such construction projects becoming increasingly costly, they are not always the solution to the congestion problem. In fact, such projects often make congestion worse.

A recent study by the Surface Transportation Policy Project (STPP), for example, confirmed what many suspected: more often than not, building new highways often substantially increases the number of vehicles on those highways. The STPP found that every 10 percent increase in the size of a highway network results in a 5.3 percent increase in the amount of driving-over and above any increase from population growth or other factors.[2] In a press release accompanying this report, STPP Executive Director Roy Kienitz stated that "the most common response to congestion, road building, is just making things worse . . . we don't need more of the same: we need new solutions that give people a way to avoid traffic jams."[3]

The same phenomenon has been observed with respect to airports. As they have been expanded to a handle more traffic, many airports have become even more congested. In 1987, 21 major airports experienced substantial flight delays. Although billions of dollars have been spent since then on airport expansion, this year up to 40 major airports are expected to experience substantial delays.[4]

It is clear that if something is to be done about the increasing congestion and delay associated with air and highway travel, the U.S. must look to other forms of transportation. High-speed trains, and especially magnetically levitated (maglev) trains, are once again being explored as a partial solution to our crowded highways and airports.

Historically, the U.S. government's interest in high-speed ground transportation has waxed and waned. The government's earliest involvement with high-speed (over 125 mph) rail was authorized by the High-Speed Ground Transportation Act of 1965. That law authorized the Federal Railroad Administration (FRA) to begin a research and demonstration program in high speed rail travel involving the Metroliner and Turbo Train. This program demonstrated that high-speed trains between Boston and Washington would attract passengers in significant numbers. In the 1970s, the FRA's research program funded studies of early maglev trains, with the goal of selecting the most promising one for a demonstration project. By 1974, this research resulted in a prototype research vehicle powered by a linear induction motor that set a speed record of 255 mph. However, in 1976 funding for the FRA research program was canceled before a full-scale demonstration model could be developed.

In 1990, after a decade in which there was little interest in maglev trains in this country, the federal government announced a National Maglev Initiative (NMI) to assess the potential for maglev transportation to service intercity transportation needs. This initiative, a joint project of the FRA, the U.S. Army Corps of Engineers and the Department of Energy, had the lofty goal of promoting the improvement in intercity travel in the 21st century by the development and implementation of commercially viable maglev trains. The project included evaluations of the engineering, environmental, safety and economic aspects of maglev systems. The final report on the NMI (NMI Report)[5] was a ringing endorsement of the maglev concept. The study's authors recommended a federally-supported effort to promote the development of an American version of this promising new technology.

At about the same time that the NMI rekindled interest in maglev, Congress passed the Intermodal Surface Transportation Efficiency Act[6] authorizing $725 million to demonstrate high-speed maglev systems. However, none of the maglev research money was appropriated by Congress and interest in maglev in this country again flagged in the mid-1990s.

Meanwhile, research on maglev technology continued in Japan and Germany, with both countries setting up demonstration projects and spending billions of dollars on maglev research. A German consortium known as Transrapid International (TRI) has now developed a fully-operation maglev train after 30 years of research and development. TRI's U.S. subsidiary, Transrapid International-USA (TRI-USA), is promoting the development of maglev transportation systems in the United States utilizing the maglev technology developed by TRI. TRI's maglev train has gone through several iterations, with the most recent version, the TR08, now ready for commercial production. A similar earlier version, the TR07, has been extensively tested in Germany and is the subject of much of the scientific research cited in this paper. The TR07 and TR08 versions of the maglev train are collectively referred to below as "Transrapid."

Transrapid is one of two basic types of maglev trains. The levitating force for Transrapid is created by attraction between conventional electromagnets on the train and in an iron rail located in the guideway on which the train travels. The alternative approach, based on an electrodynamic "repulsive" system, is still under development in Japan. In both systems, the vehicle's electromagnets react with the guideway to lift the maglev train and propel it down the guideway.

The contactless technology of the maglev train is revolutionary in that it represents the first high-speed ground transportation system that does not operate on wheels-the mechanism relied on by the human race as a means of transport for thousands of years.

In June 1998 Congress passed the Transportation Equity Act for the 21st Century (TEA-21), one of the major components of which is a maglev technology deployment program.[7] TEA-21 authorized $1.01 billion for the program, which is intended to result in the first segment of a maglev-serviced transportation corridor in the United States. In May 1999, as part of the maglev deployment program, the FRA named seven U.S. transportation corridors as finalists for future maglev development.

As with any new technology, the introduction of maglev trains in the U.S. has raised questions about the system's potential environmental impacts. TRI-USA asked Kilpatrick Stockton LLP to survey the research conducted to date on the environmental and safety aspects of this new technology. Much of this research was sponsored by the U.S. government, the German government (in the process of certifying Transrapid as safe for commercial application in Germany), and by TRI itself, based on its years of studying the operation of the system at its full-scale test track in Emsland, Germany. This paper presents the results of our review of these studies.

II. POTENTIAL EFFECTS ON HUMAN HEALTH FROM EXPOSURE TO TRANSRAPID'S ELECTROMAGNETIC FIELDS

A. Introduction

Proposals to introduce maglev trains like Transrapid into the U.S. transportation system come at a time when there is considerable debate over the possible heath risks posed by electromagnetic fields (EMFs). Because Transrapid is known to generate a low intensity but highly complicated EMF, a considerable amount of research has focused on the potential risk of these fields to human health.

Apprehension over the health effects associated with EMFs in the United States began in the early 1970s as the result of the increasing use of extra high voltage transmission lines. This concern grew after the publication of a study in 1979 purporting to link the proximity of homes to electrical transmission and distribution lines with an increased incidence of childhood leukemia.[8]

Since then there have been numerous other studies of the potential health effects of human exposures to various sources of EMF. To date, the results of this research are inconclusive. Some studies have associated EMF with human health risks. Others have found associations with biological effects, though not harmful ones, and others have found no association with biological effects, harmful or otherwise.

EMF-generating electrically powered trains have been commonplace in this country for nearly a century. Although the *strength* of the electrical and magnetic fields generated by the Transrapid is no greater than that associated with electrified rail systems, the *variability and complexity* of the Transrapid's EMF are uncommon (as discussed below). Accordingly, the potential health risk presented by the magnetic fields associated with Transrapid systems is a legitimate area of inquiry.

What criticism there has been to date regarding the potential environmental and safety aspects of Transrapid has emphasized the potentially harmful effects of the EMF generated by maglev systems. The Green Party in Germany, for example, has emphasized uncertainties regarding those biological effects as one of that the Party's primary objections to the commercial deployment of Transrapid in that country.[9]

EMF generated by Transrapid is by far the most comprehensively studied environmental effect of this new technology. Because of the substantial public interest in this topic–and given its complexity–we devote a considerable portion of this paper to a discussion of what is known about potential biological effects of Transrapid-generated EMF.

B. What is EMF?

Beginning in the seventeenth century, scientists began to theorize that magnetism, and a more recently investigated phenomenon known as electricity, were components of the same fundamental force of nature. At first it was noted that iron could be magnetized by putting it near a wire carrying electricity. It was then shown that the converse was true: a moving magnet could generate an electric current through a nearby wire. It is now known that every magnetic force is associated with a corresponding electrical force and vice versa. This is known as the electromagnetic force, and the three-dimensional space over which this force acts is known as the electromagnetic field, or EMF. Stated another way, every EMF has both magnetic field and electrical field components.

The *electrical* field components of the type of low energy EMF associated with Transrapid is easily shielded and has not been associated with adverse biological effects. In contrast, the *magnetic* field component of low energy EMF has been associated with biological effects and is not as easily shielded. Consequently, it is the magnetic field component of low energy EMF that has been of greatest interest to researchers.

The quantity commonly used to characterize the strength of magnetic fields in studies of low energy EMF on human health is the *intensity* of the magnetic field. It is often measured in milligauss (mG) units.

Because the intensity of a given magnetic field can vary over time, this raises the question of how best to measure the EMF of a complex system like Transrapid. For example, one can measure the intensity of EMF at any given point in time, known as the "spot intensity," or one can calculate the *average* intensity over a fixed period of time, known as the "time weighted average" (TWA) intensity. Another characteristic of a magnetic field that may be of interest is the *maximum* intensity that occurs over a given period of time; this is known as the "peak intensity." Given these different ways of measuring magnetic field intensities, it is important when comparing the "strengths" or "intensities" of different magnetic fields to clarify which of these characteristics are being compared.

In addition to *intensity*, another important characteristic of a magnetic field is its *frequency*. Low energy electromagnetic forces can be viewed as energy traveling in waves. The *frequency* of electromagnetic waves is the measure of how fast a single wave moves past a point in space in one second. Its unit of measurement is the hertz (Hz). Stated as an equation, 1 Hz = 1 cycle/second.

Energy associated with electromagnetic fields is proportional to the frequency of the electromagnetic waves: the higher the frequency, the greater the energy. EMFs of the type generated by a maglev train (or any other type of electric-powered machine) have very low frequencies and therefore are associated with very low energy levels. EMF with frequencies in the range of zero to 3000 Hz are commonly referred to as extremely low frequency EMF or "ELF-EMF." The EMFs from Transrapid and other man-made devices fall mainly within this ELF range, as does the natural magnetic force of the earth.

Another important characteristic of some EMFs is known as *intermittency*. This is a way to describe the *variability in the frequency* of the EMF. For example, because the frequency of a magnetic field from a U.S. household appliance remains fairly constant (at 60 Hz), it is said to have low intermittency. Intermittency is of interest in this paper because the EMF of the Transrapid, unlike most forms of electrical rail transport, is known to have a high degree of intermittency.

Some type of EMFs are also characterized as having "*transients*." Transients can occur when an EMF source suddenly switches from one state to another, such as occurs when an electrical appliance is turned on and off. Transients can be visualized as very short-lived, high frequency (from 10,000 Hz to several million Hz) electromagnetic wave "spikes." Transients are also one of the characteristics associated with the EMF of Transrapid.

Because the forces of EMF act in three dimensions and also vary over time, it is it is all but impossible to characterize completely the EMF environment over a large spatial area or over a significant timeframe. This complexity also makes it difficult to describe the EMF of a given system without resorting to three-dimensional schematics and mathematical models–particularly the complicated EMF associated with Transrapid.

Notwithstanding these complications, this paper addresses Transrapid-related EMF in simple terms, without resorting to mathematical equations or vector diagrams. The reader should understand, however, that this approach somewhat oversimplifies the true nature of these fields.

C. The Human Health Effects of Extremely Low Frequency EMF

Electromagnetic fields with much higher frequencies than ELF-EMF have drawn most of the attention of researchers over the past several decades because of the readily observable threats they pose to biological systems. EMF characterized by very high frequencies is generally referred to as electromagnetic *radiation* and can best be visualized as particles of energy ("photons" or "quanta") moving through space. Very high frequency electromagnetic radiation–with frequencies exceeding 10^{16} Hz–is known as "ionizing" radiation. This type of high energy radiation, examples of which include x-rays and gamma rays, easily break chemical bonds in living organisms and can cause direct damage to genetic materials in cells.

In contrast, the energy levels of ELF-EMF, such as those generated by Transrapid, are far too weak to directly break chemical bonds or cause direct genetic damage. Consequently, until recently it was generally assumed that ELF-EMF does not have a significant effect on living organisms. It has only been in the past 20 years or so that the more subtle, but potentially significant, effects of ELF-EMF on biological systems have drawn the attention of the scientific community and the public.

People in the United States are routinely exposed to ELF-EMF with a frequency of 60 Hz. This is because 60 Hz is the agreed-upon "power frequency" used for electricity in this country. In Europe, the "power frequency" is 50 Hz. Not surprisingly then, 50-60 Hz has been by far the most extensively studied frequency range of EMF in the United States and Europe.

It should be noted that many epidemiological studies have found no detrimental associations between EMF and human health. However, an increasing number of such studies report a statistically significant association between EMF exposure (or EMF exposure "surrogates," as discussed below) and biological effects, such as an increased risk of certain cancers.[10] Although many scientists maintain that a cause and effect linkage between EMF exposure and cancer has yet to be conclusively demonstrated, in 1998 a majority of scientists in a working group assembled to review all EMF epidemological studies to date concluded that there was enough evidence to classify EMF as a possible human carcinage [11]

In reviewing the studies of human exposures to EMF, it must be kept in mind that there has been no general agreement in the scientific community on which characteristic or combination of characteristics of EMF (such as spot intensity, time-weighted-average intensity, peak intensity, frequency, intermittency, transients, etc.) is the best one to measure when investigating the potential effect of ELF EMF on biological systems.

One of the measurements most frequently used in EMF studies has been the time-weighted average (TWA) intensity. TWA is the average of a series of intensity measurements taken over a fixed period of time. TWA intensity is the EMF characteristic usually measured in studies of EMF exposures of electrical workers. Until recently, it was assumed that TWA was the EMF characteristic that most closely relates to the dose (i.e., impact–producing level) of EMF that an individual receives. However, some researchers now argue that this assumption is not correct for certain kinds of EMF. Stated another way, the observation that there may *not* be a correlation between TWA intensity and observable bioeffects in a given experiment might demonstrate that the EMF is safe-but it could also mean that the "wrong" characteristic of the EMF was measured in that experiment.

This complication in the study of EMF exposures is illustrated by the following observation. It is known that some cancers, such as childhood leukemia, show a stronger association with EMF *surrogates* (such as how close an individual lives to high-voltage electrical transmission lines) than they do with measurements of actual EMF intensities in the homes of the study population. For example, researchers found a statistically significant relationship between childhood leukemia and the proximity of the children's homes to electrical transmission lines. *However, no correlation could be found between these same health effects and the actual measurements of the EMF intensities in children's homes* (the spot intensity and TWA intensity were the two characteristics measured).

By far the most comprehensive of these residential studies was a project in Sweden that involved over 500,000 individuals. This study found that the measurement of the distance of a residence from electrical transmission and primary distribution lines, combined with historic load data for those lines, was a much better predictor of risk for childhood leukemia than actual spot measurements of EMF.[12] As one study notes, "it is reasonable to hypothesize that an as yet undiscovered factor associated with proximity to power lines is a causative agent in childhood leukemia."[13]

These "surrogate" studies raise a difficult question that pervades the study of EMF: If something about the EMF associated with power lines is resulting in increased cancer risk, and that characteristic cannot be accurately described by measurements of EMF *intensity*, what exactly is it about power lines that causes the observed effects and how can it be measured?

We emphasize the above complications in studies of low-energy EMF sources to make an important point: It is often difficult to compare different studies of the effect of EMF on biological organisms because to do so would be to compare "apples and oranges." Accordingly, one must take care to specify the characteristic(s) of the EMF that are measured in a given study, rather than simply state that the EMF measured in that study was "stronger" or "weaker" than that measured in other studies.

Further complicating matters, the study of the potential effect of EMF on humans must also take into consideration the *natural* EMF environment. The earth has its own magnetic field, which is referred to as "geomagnetism." This magnetic field is characterized as "static" because its frequency is zero. That is, the earth's magnetic field has a constant intensity that does not change over time when measured at a given point on the earth's surface. Such a static EMF is also referred to as a "DC" EMF.

All living things have been exposed to the earth's "natural" magnetic field since life began. It has only been in recent times that our magnetic field environment has been dramatically altered by the widespread use of electrically powered machines, which generate fields of different intensity and frequency than "natural" geomagnetism. The EMF of Transrapid is complicated by the fact that it generates both static and variable magnetic fields.

As noted above, certain epidemiological studies have associated EMF exposure with increased cancer risk. Recent human and animal studies have focused on the biological mechanisms (on whole animals, animal organs, and animal cells) associated with this increased risk. One study commissioned by the FRA (referred to in this paper as the "Broadband Study") surveyed past and ongoing research on the effects of EMF on biological systems. The authors note at the outset the "lack of consensus in the scientific community as to the extent, or existence, of possible adverse health effects from, or physiological response to, EMF exposure."[14] They also stress the importance of distinguishing between biological effects of EMF exposures (many of which have been observed), and *adverse* biological effects of such exposures (far fewer of which have been observed).

The Broadband Study takes issue with the relatively small number of scientists who claim that there cannot be adverse impacts from ELF-EMF on the bodies of higher animals because the energy levels associated with ELF-EMF are well below the thermal energy levels that naturally exist in those animals. The authors point out that numerous studies have demonstrated that animals have measurable reactions to low-energy EMF, and they conclude that given sufficient intensity, "there is no question that low-energy magnetic fields can have biological effects."[15]

In other words, the question is not whether there are EMF effects in animals, but whether those effects are harmful. If a potentially harmful effect is observed, the obstacle then facing researchers is to determine whether that effect is associated with intensity, frequency, intermittency, or some other characteristic or combination of characteristics of the magnetic field under study.[16]

Recent human and animal studies have focused on the biological changes that might be causing the increased risk of cancer associated with exposures to certain types of EMF. Several researchers have observed that melatonin, a hormone produced by the pineal gland in humans and other animals, appears to protect against the same kinds of cancers that have been associated with EMF exposures in epidemiological studies.[17] This has lead some scientists to ask whether an important biological mechanism associated with the increase in such cancers might be the inhibition of melatonin synthesis by the pineal gland.[18] Recent experiments on the effect of EMF exposures on human cells suggest this might well be the case. Some of those cellular experiments have shown that EMF exposures can indeed inhibit the cell's production of melatonin.

The effect on melatonin production is only one of a number of bioeffects noted from EMF exposures in recent cellular and animal experiments, which have generally reinforced observations from epidemiological studies. As noted in the Broadband Study: "Conclusions regarding the possibility that EMF exposure may affect cancer risk in humans are remarkably consistent among reviewers from the fields of cancer epidemiology and cellular carcinogenesis."[19]

While more studies of the effects of low-energy EMF are needed, studies to date have resulted in a general consensus among researchers that ***it is unlikely that there is a single attribute of magnetic fields that determines a response in all biological systems.*** Rather, there is evidence that various biological systems respond to different EMF characteristics in different ways. Studies have now linked the *frequency* of EMF, the *intensity* of EMF and the *intermittency* of EMF to different biological responses in humans.

To summarize, animal and cell studies to date have demonstrated that it is important to consider a variety of EMF characteristics in determining what constitutes "dose" (i.e., exposures that cause biological effects) in EMF experiments. Frequency, intermittency, intensity, time rate-of-change and other EMF characteristics have been associated with different effects in various biological systems.[20] Whether the observed effects are actually *harmful* to the biological systems in question, however, has not been resolved by these studies.

D. EMF from the TR07

As illustrated in **Figure 1**, the magnetic fields generated by the Transrapid originate from many different sources on the maglev train and in the guideway. Transrapid produces a complex EMF, considerably more complicated than that generated by electric power lines and most other sources of man-made magnetic forces. This complexity is due to the continuous adjustments of the system's electro-magnetic components to maintain speed, levitation, propulsion and guidance. These sources generate different kinds of fields that continuously interact with one another and change as the train moves down the guideway.

Maglev magnetic fields are not substantially different from rail systems in terms of *intensity.* Transrapid EMF intensity is within the range of rail technologies in terms of both peak intensity and time weighted average intensity, as shown in **Figure 2**. What *does* distinguish the Transrapid from other rail technologies is its unique combination of DC fields (originating primarily from the guideway), the *range of frequencies* encountered, and the highly variable changes in the intensity levels measured over time (intermittency).[21]

In an effort to determine the potential effects of EMF generated by maglev trains, the FRA funded several studies in the early 1990s, including the Broadband Study referred to above. Another FRA-sponsored study (hereinafter "Summary Report") identified and evaluated the results of studies of Americans exposed to EMFs in the ELF range (i.e., 0 to 3000 Hz) to determine how the EMF exposure environment of the typical American has been characterized to date. The FRA felt that this understanding would "provide a context for evaluating the exposures associated with new technologies such as magnetically levitated vehicles (maglev)."[22]

The Summary Report reviewed three major categories of previous EMF studies: residential exposures, occupational exposures and transportation exposures. The study noted that at the time of the survey (1990-91) very little research had been done on transportation-related exposures. Rather, most of the earlier studies investigated the effects of exposure to the "power frequency" of EMF (50 to 60 Hz); that is, the EMF associated with conventional uses of electrical power.

Most of the power frequency studies also assumed that the appropriate characteristic to measure was the time-weighted average (TWA) intensity. As we have seen, however, and as the Summary Report acknowledges, both laboratory and epidemiological studies suggest that the TWA intensity of EMF may not be the "main parameter of interest" in studying the bioeffects of EMF.[23] The Summary Report also reviewed laboratory studies of EMF and concluded that "no single mechanism can account for the various biological effects that are now being reported with some consistency from laboratory studies."[24]

Despite the uncertainties noted in the Summary Report, the authors reached important conclusions about maglev systems. They found, for example, that comparing available information on EMF associated with different types of electric rail transport technologies shows that in terms of intensity, the maglev fields were no higher, either on a peak field or average field basis, than those of other rail technologies considered in the study.[25] The Summary Report concludes that based on available data ***"maglev technology, as evidenced in the German TR-07 system, although a unique exposure environment, does not present any unusual ELF-EMF exposures to passengers or crew***."[26]

This is consistent with the following conclusion of the Broadband Study: ***"[T]here is no evidence that the TR-07 maglev vehicle is likely to represent any risk from magnetic field exposure that is greater than that associated with one or more of the presently operating electrically powered rail systems."*** [27]

To allow a more direct comparison of EMF from maglev systems with other EMF sources, the FRA contracted with Electric Research and Management, Inc. (ERM) to measure, characterize, and analyze EMF emissions from the Transrapid TR07 ("ERM Study").[28] ERM evaluated the intensity, spatial, and frequency characteristics of both static (DC) and alternating (AC) magnetic fields associated with the TR07. The resulting report describes the magnetic field measurements conducted in August 1990 onboard the TR07 and in the vicinity of the train, guideway, passenger station, control center and power supply facilities at the Transrapid Test Facility in Emsland, Germany.

ERM recognized that the relatively simple devices used to measure EMF from high-power transmission lines—the source of fairly stable EMFs of 60 Hz frequencies—would not be appropriate for the TR07. To capture the complicated EMF characteristics of the Transrapid, the researchers used a new monitoring system known as MultiWave.

The primary conclusions of the ERM Study were as follows:

- In the passenger compartment of a TR07 vehicle moving down the guideway a wide range of frequencies (2.5 to 2,000 Hz) was recorded which varied greatly over time.

- Elevated magnetic field levels only exist near the guideway for the brief periods of time when the train passes by. Like the fields onboard, the magnetic fields along the guideway show a multitude of frequencies varying over time.

- Magnetic fields at the passenger station were similar to those along the guideway.

As the ERM Study notes: "The frequency characteristic of the time-varying magnetic fields onboard the TR07 vehicle, at the station, near the guideway, or near the power supply equipment are unique from those that have been measured to date anywhere else in the environment."[29] The study also notes, however, that this frequency characteristic has not been shown to produce significant adverse biological effects in living organisms.

With respect to the *intensity* of the TR07 magnetic fields, both in terms of time weighted average and peak intensities, the levels in the train compartments, along the guideway and at the station when the train passes by, fall well within those of magnetic fields associated with household appliances. [30] The ERM Study notes that because there is so little known about what aspects of low frequency magnetic fields, if any, are biologically significant, public acceptance of magnetic field exposures is based more on "equity and comparability" than to other sources of EMF than to quantifiable characteristics of the field itself. In this light, the study compares the intensity of the magnetic fields generated by other common sources of EMF, reaching the following conclusions:

- Static fields encountered on board the TR07 are generally within the range of the earth's naturally occurring magnetic field.

- The peak intensities of the static fields encountered on board the TR07 are comparable to those near a refrigerator which is equipped with a magnetic door seal.

- The average intensities of the magnetic fields found in the passenger compartment of the TR07 fall well within the intensity levels that characterize magnetic fields found near household appliances and at the outer edge of transmission line rights-of-way. The magnetic field intensities found near the guideways when a train passes by are typical of those found at the edge of transmission line rights-of-way and near household appliances.[31]

- **Figure 3** compares the EMF intensitites associated with Transrapid to the intensities associated with other types of electrical equipment in common use.

The ERM Study also compares the intensities of the magnetic fields generated by TR07 with established safety standards, with the following results:

- TR07 magnetic fields onboard the vehicle are at least two orders of magnitude (or 100 times) below the level set as the maximum for continuous exposure by the World Health Organization.

- The maximum magnetic field intensities found on the TR07 are one order of magnitude (or 10 times) below the continuous public exposure criterion (1 Gauss) set by the International Radiation Protection Agency.

- TR07 magnetic fields onboard the vehicle are three orders of magnitude (or 1,000 times) below the standard set by the American Conference of Governmental Industrial Hygienists.[32]

In sum, ERM's comparison of the TR07 EMF with those generated by other EMF sources concludes that the average intensity and peak intensity of the TR07 field is comparable to that encountered in the environment from other common sources. However, the frequency range over which these intensities are encountered, and the variability of changes in intensity over time, make the maglev EMF unique compared to other commonly encountered sources.

Another study commissioned by the FRA addresses some of the uncertainties noted in the above studies, and particularly the potential EMF effects of those characteristics that appear unique to maglev systems: variability of intensity and frequency over time. The study, conducted by Kenneth R. Groh at the Argonne National Laboratory ("Groh Study"),[33] investigated the biological effects in human cells and rats from exposures to an EMF environment similar to that associated with Transrapid. Magnetic fields and their individual AC and DC components were tested at the range of intensities measured by ERM in the passenger compartment of the TR07.

Higher intensity fields, up to seven times the average intensity measured in the TR07 (referred to as "7X TR07), were also studied. The 7X TR07 was thought to simulate the maximum magnetic field strength likely to be generated in the passenger compartment of superconducting maglev trains like the one now being tested in Japan.

The cells used in the Groh Study were transformed human cancer cell lines. These cell lines were selected because the literature reported associations between changes in such cells and exposure to ELF-EMF. The cells were exposed to the TR07-simulated magnetic fields and then examined for cell growth changes and alteration of chemically stimulated cell differentiation.

A total of 22 magnetic field exposure experiments were run on the test cells, varying magnetic field exposure by intensity, frequency, field orientation, and duration. For one type of cells (melanoma cells) the changes in growth rates and in melatonin production levels were measured. ***It was found that there was no change in growth or melatonin production due to TR07-type magnetic field exposures.*** For another type of cell (CEM T-lymphoblastoid cells) intermittent and continuous exposure to 1X and 7X TR07 magnetic fields produced no variation in cell growth or differentiation. The Groh Study concludes that ***"maglev EMF exposure at up to seven times the intensity produced by the TR-07 vehicle . . . has no deleterious effect on the growth or differentiation of CEM T-lymphoblastoid cells."***[34]

The Groh Study subjected approximately 1,000 rats to experiments during which the animals were exposed to TR07-simulated magnetic forces daily, for seven days in each of three experiments during different times of the day. (Because melatonin levels in rats—as in humans—are known to vary between hours of light and hours of darkness, the differences between effects of daytime and nighttime exposures were also explored.)

In the rat experiments, the daily rhythm of pineal gland melatonin and its regulatory enzyme (NAT) was determined several times during the course of the magnetic field exposure. ***No significant changes in pineal melatonin levels occurred as a result of simulated TR07 magnetic field exposure under a number of exposure scenarios.***[35] The only statistically significant pineal gland response to maglev-type magnetic fields occurred when animals were exposed to intermittent DC magnetic fields at *7X TR07* intensities and frequencies-that is, the type of EMF associated with the Japanese maglev but not with Transrapid. The study concludes that ***"MF fields simulating those that are produced by the TransRapid TR-07 vehicle had no statistically significant influence on pineal indoleamine rhythms."***[36]

E. Summary of Studies Relating TR07 EMF Exposures to Human Health Effects

Based on the EMF studies summarized above, it is reasonable to conclude that although the extremely low frequency magnetic fields associated with Transrapid are highly complicated and quite uncommon, there is no evidence that those fields are associated with adverse biological effects in humans or animals.

III. NOISE

A. Introduction

The noise levels generated by maglev trains have also been cited by the German Green Party and others as one of the potentially negative environmental impacts of this new technology. As with EMF impacts, a discussion of the levels and effects of noise generated by Transrapid requires a rudimentary understanding of the characteristics of sound, and of that category of sound commonly referred to as "noise."

Vibrations of air molecules that reach the inner ear produce the sense of sound. Any sound, such as a note from a musical instrument, can be defined in three ways: pitch, loudness (or intensity) and quality (or timbre). These three ways of perceiving sound correspond exactly to three physical characteristics of sound waves: frequency, amplitude and harmonic constitution (or waveform), respectively.

The frequency of sound waves is the time it takes one complete wave to move past a point in space in one second, as measured in cycles per second, or Hertz (Hz). In human beings, hearing occurs when sound waves with frequencies between 15 and 20,000 Hertz (Hz) reach the inner ear.

Where frequencies are multiples of one another (e.g., 220 Hz, 440Hz, 660 Hz), they are said to be harmonically related. Most people perceive harmonically related sounds as pleasant.

The amplitude (or intensity) of a sound wave is the measure of the degree of motion of air molecules within the wave. The greater the amplitude, the harder a wave strikes the eardrum and the louder the sound is perceived. Hence, "amplitude," "intensity" and "loudness" all refer to the same characteristic of sound. The amplitude of a sound (loudness) is usually described by comparing it to a standard sound measured in decibels (dB).

A sound of zero dB is defined as the sound wave that has an amplitude just below that of human perception. As we increase the decibels of a sound it is perceived to be louder. For example, the amplitude of whispering is about 10 dB. The amplitude of rustling leaves is about 20 dB. Decibels are arranged in logarithmic scale, meaning a sound of 20 dB has 10 times the intensity of a sound of 10 dB. Therefore, we perceive rustling leaves as being 10 times louder than a whisper.

When describing the effect of sound on the human ear, scientists frequently use a variation of the decibel concept known as the A-weighted sound pressure level, measured as the A-weighted decibel (dBA). The term "A-weighted" represents a filtering of sound thought to mimic the way sound waves are filtered by the human ear before the vibrations actually interact with bones of the inner ear. Amplitudes of some every day sounds are as follows:

- 10 dBA: sound of a whisper
- 20 dBA: sound of rustling leaves
- 20-30 dBA: background noise of distant urban conditions

- 40-60 dBA: human conversation under normal conditions
- 70-90 dBA: urban background traffic noise
- 100 dBA: pneumatic drill
- 130 dBA: jet engine at 100 yards

Any sound of an intensity above 120A dB (some say 130 dBA) is considered above the pain threshold in humans.

We can define “noise” as sounds of mixed frequencies that are not harmonically related. Noise can be unpleasant to the listener because of this lack of harmonics. Of course, even harmonic sounds can be unpleasant, and even painful, if they are loud enough. Whether a sound is considered pleasant or unpleasant “noise” at decibels below the pain threshold depends on the listener and cannot be measured objectively. This subjective variable, then, complicates the assessment of whether the noise from a new transportation system will be considered acceptable or unacceptable to a given community.

Although the extent to which noise is either pleasant or unpleasant to most people is a function of both the amplitude (loudness) and timbre (harmonics), most studies of the public acceptability of noise sources have focused on loudness, as expressed in terms of A-weighted sound pressure levels (measured in dBA). As noted below, this is the measure used by the FRA in determining acceptable noise levels from new railway systems. Although we use only dBA (loudness) in this paper in evaluating the noise from Transrapid, it should also be noted that the frequency spectrum associated with noise from Transrapid exhibits no conspicuous peaks in level and has a uniform nature-thereby avoiding the high, shrill sound and the rolling, rumbling noise of many conventional steel-wheel trains. In other words, the sound from Transrapid may be perceived by many as more pleasant than noise of the same intensity from conventional rail traffic.

Noises in a given community come from a variety of sources and usually change continuously over the course of a day. A concept known as the equivalent A-weighted sound pressure level (Leq) is often used to describe the noise level of a community. This concept might be thought of as a way to “average” the loudness of various noises in a community over a given period of time (usually a 24-hour period).

Another measure of community noise levels is the “day-night average sound pressure” (Ldn). This is the 24-hour average sound pressure, with the sound pressure experienced at night weighted slightly to account for a community’s increased sensitivity to nighttime noises.

Because the FRA uses Ldn and Leq to evaluate the noise impact of conventional trains, we use these concepts as well in this paper.

Another important noise characteristic, and one that may be of greatest concern with respect to maglev trains, is the time history characteristic (or “onset rate”) of the noise, which is sometimes called the “startle effect.” Brief loud noises, especially ones that come up quickly and are not expected by the listener, can have a high startle effect. People usually find such noises more annoying than noises of equal intensity that continue over a longer period of time or that build up more gradually so as to give the listener warning of the approach. One way to dampen the startle effect is to allow the listener to anticipate a loud noise by using a quieter and/or more harmonic sound to signal that the louder noise is about to occur.

B. Noise and Transrapid

As illustrated in **Figure 4**, noise from Transrapid comes from a variety of sources, with different sources predominating at different speeds. At speeds from zero to 60 mph, noise from the train's propulsion or auxiliary equipment predominates, the main source of this noise being the vibration of magnets in the propulsion system. Because this noise level is relatively low and is generally not considered annoying, it is not addressed further in this paper.

At 60 to 120 mph, mechanical noise from guideway vibrations predominates. Despite the lack of physical contact between moving Transrapid trains and the guideway, the trains are not free from mechanical/structural noise. In this speed range the major noise sources are from the vibration of magnets in the propulsion system and vibrations of the guideway and train body. Because a steel guideway vibrates more than a concrete one, a steel structure produces more noise as the train glides over it at these speeds.

At speeds above 120 mph, aerodynamic noise resulting from the rush of air over the surface of the train predominates. This noise, which increases significantly as the train accelerates from 120 to 300 mph, is created by sound waves generated from the surface of the train pushing through the surrounding air. The most significant acoustical noise is created by the flow of air around the front of the train and through the gap between the bottom of the vehicle and the top of the guideway.

As noted previously, noise has been identified as a potential source of concern associated with maglev trains. The first operational maglev trains generated high acoustical noise, with levels over 100 dBA at normal cruising speeds measured at 25 yards away. TRI extensively redesigned the front end of the TR06 version of the train to address these noise problems. After that redesign, noise tests conducted in mid-1995 by IABG (an independent testing group in Germany) demonstrated that the TR07 was considerably quieter than the TR06.[37] Further front-end redesign in development of the TR08, TRI's revenue-service version of maglev, has made the train quieter still.

The noise measurements of the TR07 by IABG were compared to the noise levels generated by other types of trains. These comparisons showed that at speeds of under 180 mph, the TR07 was quieter than every type of rail train tested, including a normal freight train, a regional express train, an inter-city train, and the high speed German ICE and the French TGV trains. (See **Figure 5**). At low speeds, Transrapid avoids the major noise sources of highspeed rail: wheel-rail contact and pantograph-catenary (overhead power systems) contact. Because those noise sources predominate at low speeds, their absence in Transrapid provides a significant performance advantage in urban areas. For example, Transrapid can travel 25% faster than existing high-speed rail trains before reaching typical peak noise restrictions of 80 to 90 dBa.[38]

An investigation of the noise generated by the TR07 Transrapid was conducted under contract to the U.S. Department of Transportation (DOT Study).[39] The purposes of the study were to determine maglev's noise sources, develop noise criteria for high speed maglev systems, prepare design guidelines for noise control and recommend an acoustic test facility for maglev research.

As the DOT Study points out, one must do the following to determine how the FRA noise criteria apply to the Transrapid: (1) identify any noise sensitive areas that might be impacted by the train; (2) determine the cumulative impact of the train on those areas by measuring the increased noise level expected in each area; and (3) based on standards developed by the FRA, determine if the noise increase will have “no impact,” an “impact,” or a “severe impact” on each sensitive area.

How the FRA noise criteria will apply to Transrapid depends on the particular alignment one has in mind. Only after the alignment is determined can the noise-sensitive areas along that alignment, if any, be identified and the existing ambient noise levels in those areas measured. Because any noise generated by a Transrapid train depends on its speed, one would also have to develop a corresponding speed profile for the selected alignment to determine the resulting increased noise levels in the areas through which the train travels.

In 1998 the FRA issued guidelines that can be used to predict noise from a Transrapid at different distances from the guideway.[40] Only at the highest anticipated speeds (i.e., over 225 mph) and at relatively close distances to the most noise-sensitive areas (residential housing, schools, hotels, churches and parks) would maglev noises be in the “severe impact” category. By a combination of sound barriers, modification of speed profiles, and distancing the guideway from noise-sensitive areas, route planners of Transrapid systems should have the flexibility to accommodate even the most sensitive communities.

One advantage of a new transportation system like Transrapid is that it can be located so as to avoid unacceptable impacts. The guideway can be moved far enough away from noise-sensitive areas to avoid severe impacts or it can be located in an area that already has high noise levels that would effectively mask the increase caused by Transrapid. For example, if a Transrapid guideway is located in a highway right-of-way such that the highway is between the guideway and a noise sensitive area, the maglev is not expected to have an adverse effect on the noise-sensitive area regardless of its speed because the noise characteristics of major highways are generally of such intensity and quality that they mask the noise generated by Transrapid, even at speeds of 250 mph or greater.

Instead of, or in addition to, an alignment change to avoid noise-sensitive areas, the speed profile of the Transrapid can be modified to slow the train down in such areas to lower the noise intensity to acceptable levels.

Another alternative is the construction of noise barriers, as is often done on highway systems, to muffle the sound of passing trains. Where the Transrapid guideway is elevated, the barriers would be mounted on the sides of the guideway to be effective. If the guideway is at ground level, barriers could be constructed along the rights-of-way as is done with highways. Studies have shown that properly built noise barriers can decrease the noise intensity of a passing Transrapid train by up to 8 dBA.[41] That is, such barriers can make passing maglev trains seem eight times quieter.

The “startle effect” of a new train can be inferred from recent research by the U.S. Air Force on the noise impacts of low-flying aircraft. The Air Force found that startle effect depended on the rate that a noise goes from zero to its maximum intensity from the perspective of the listener. This “onset rate” is a function of the speed of the noise source and the distance of the source from the listener. Utilizing these observations, a DOT study found that for trains, the potential for startle is confined to an area quite close to the tracks. For the Transrapid, for example, when the train is traveling at 100 mph, startle can occur to a listener within 21 feet of the guideway; at 250 mph, it can occur to a listener within 52 feet from the guideway, assuming no warning is given of the approach of the train and no noise barriers are constructed to dampen the startle effect.[42] **Figure**

6 shows how startle effect varies based on the speed of the maglev train and its distance from the listener.

As with noise impacts, it is generally agreed that changes in alignment and/or use of noise barriers can readily reduce the startle effect of the Transrapid to acceptable levels. Alternatively, the sounding of an acoustic warning device might precede the passing of the train, thereby reducing this effect.

In sum, at realistic operating speeds, the noise from Transrapid will be quieter than any other train now in service. Transrapid can travel at least 50 percent faster than conventional trains before reaching noise levels of 80-90 dBA, the levels considered to be restrictive for highly noise-sensitive areas. At speeds approaching 225 mph, aerodynamic noise from the Transrapid can exceed the FRA's "severe impact" criteria for certain noise-sensitive areas. However, maglev system planners should be able to reduce these noise impacts to acceptable levels by employing a combination of alignment relocation, speed profile variation, and the placement of sound-absorbing barriers.

IV. VIBRATIONS

The effect of vibrations from passing Transrapid trains has also been extensively evaluated. This effect is related to the noise effects because vibrations of various materials are often accompanied by noises. Ground-borne vibrations of the type caused by the Transrapid are usually measured in terms of velocity decibels (VdB).

The vibrations from a passing vehicle can have a negative effect on people, buildings and equipment. To evaluate the potential for damage to a building, the *peak velocity* of a vibration, referred to as peak particle velocity (PPV), is of greatest interest. In comparison, the root mean square (RMS) velocity is usually of greatest interest in assessing the effect of a vibration on people, because this is one way to look at the *average* intensity of a vibration. RMS velocity is considered a better measure of the effect of vibrations on people than peak velocity because the human body tends to take some time to react to vibrations. Vibrations with RMS of less than 70 VdB are usually not considered significant for human beings.

Even though a Transrapid vehicle does not literally touch the guideway, the sudden on and off load of the vehicle's weight on the guideway causes various kinds of vibrations. These vibrations pass through the guideway foundations into the ground and are known as ground-borne vibrations. The extent to which these vibrations move through the ground to impact people and structures along the travel corridor depends on the guideway foundation construction, the characteristics of the soil, and the distance from the guideway to the receptor. Soil conditions are known to have a strong influence on the levels of ground-borne vibrations.

As shown in **Figure 7**, the FRA has established ground-borne vibration impact criteria for various kinds of building uses.[43] The one criterion potentially applicable to Transrapid is what FRA calls the "human annoyance" standard. The FRA also has a building damage standard, but this is not expected to be applicable to the relatively low level ground vibrations expected from the Transrapid at other than very short distances from the guideway.

The FRA has assigned different human annoyance standards to each of three categories of land use, with the lowest (VdB) level assigned to buildings where vibration would interfere with sensitive equipment. A higher VdB is allowed for residences where people sleep, and a higher VdB still is allowed for institutional land uses with primarily daytime exposures.

Vibration impacts from normal Transrapid operations are not expected to be significant. Estimates by TRI of those impacts show that vibrations would not be noticeable, even at 250 mph, beyond 200 feet from the guideway. At 155 mph, this "no-perception" distance drops to 115 feet.[44] It is expected that in most areas, the guideway can be aligned so as to assure that the train does not pass within these distances of vibration-sensitive buildings or equipment.

V. AIR POLLUTION

A. Introduction

A comprehensive evaluation of the effect of Transrapid on air quality must include an evaluation of three categories of emissions sources: direct air emissions from the construction of the maglev system, direct air emissions from the operation of the system, and *indirect* air emissions from the off-site production of electricity needed to run the system. Further, measurement would be needed to identify the net *indirect* air emissions from Transrapid to evaluate how any increase in pollutants from the electricity generation to power a Transrapid system would be offset by decreases in pollutants from the displacement of other kinds of polluting vehicles, primarily highway vehicles and aircraft.

B. Pollutants of Interest

Air pollution can be defined as any emission of a substance into the atmosphere in amounts considered harmful to human health or the environment. The air pollutants of greatest concern in this country, and consequently the ones we emphasize in this paper, are those regulated under the federal Clean Air Act (CAA). The one exception is the emission of carbon dioxide and other "greenhouse gases," which are of concern because of their potential impact on global warming. These gases have not yet been regulated under the CAA, although they may well be in the future in response to international pressures to address the global warming phenomenon. Accordingly, this paper also address Transrapid's effect on greenhouse gas emissions.

Specifically, this paper addresses Transrapid's potential impact on the following air emissions:

- Direct air emissions from the *construction* of Transrapid. These emissions, consisting primarily of short-term emissions of particulates and nitrogen oxides, should be insignificant compared to the other air emissions discussed in this paper.

- Direct air emissions from the operation of Transrapid. There will be no such emissions from the train itself and only minimal emissions from the operation of the stations.

- Indirect air emission *increases* due to the production of the electricity needed to power the Transrapid system. The nature and amount of such emissions will vary depending on the power-producing source(s) utilized, but may include volatile organic compounds, nitrogen oxides, sulfur dioxide, particulates, carbon monoxide, and carbon dioxide.

- Indirect air emission *reductions* from highway vehicles that may be displaced by maglev trains. The most significant of these include volatile organic compounds, nitrogen oxides, sulfur dioxide, particulates, carbon monoxide, and carbon dioxide.

C. The Regulatory Framework

Because the emission of air pollutants is highly regulated in this country, any assessment of the air quality effects of Transrapid must take this regulatory framework into account. The regulation of air pollution is governed by the CAA and state laws implementing that Act. The CAA amendments of 1990 made numerous changes in the law intended to accelerate the pace at which the nation's air quality is improved. Titles 1 and 2 of the 1990 amendments relate directly to the air pollution impacts of transportation systems.

Title 1 addresses the attainment and maintenance of national ambient air quality standards (NAAQS). Attaining and maintaining NAAQS are central objectives of the CAA. These standards address the emission of "criteria pollutants " and "ozone precursors" (i.e., chemicals that react with light and atmospheric gases to form ozone). We refer to these emissions collectively in this paper as "criteria pollutants." Criteria pollutants include the following:

- Nitrogen Oxides (NOx). These compounds are considered ozone precursors because they combine with light and other chemicals in the atmosphere to create ozone (0_3). Many major metropolitan areas have not yet met the NAAQS for ozone. Most of these communities have failed to do so because of NOx emissions from automobiles.

- Sulfur Dioxide (SO_2). This is a major source of acid rain, which can form thousands of miles away from the SO_2 source. Major sources of SO_2 include gasoline combustion by vehicles and the burning of high-sulfur coal by power plants.

- Particulate Matter (PM). These are microscopic particles generated by a variety of sources, including, among others, fugitive dust emissions from construction projects and soot from the burning of fossil fuels.

- Carbon Monoxide (CO). This is considered a "local" air pollution problem because, unlike the other criteria pollutants listed above, its most harmful effects are usually felt in the general vicinity of the emission source.

- Volatile Organic Compounds (VOCs). This category of gases includes many different kinds of organic compounds that readily evaporate upon contact with the atmosphere. VOCs are also ozone precursors.

As required by the CAA, areas around the country have been classified as attainment or non-attainment for ozone, carbon monoxide, and particulate matter, depending on whether or not the air in a particular area meets the NAAQS for that pollutant. Depending on the degree to which an area exceeds the NAAQS for a given criteria pollutant, the area is required to implement control programs to achieve the standard within a specified period. Such programs are to be incorporated into state implementation plans (SIPs) enforceable by the states and by the U.S. Environmental Protection Agency (USEPA). The air pollution impacts of any new transportation system such as Transrapid must be evaluated in the context of the SIPs developed by the state or states in which the system will operate.

In addition, the "conformity" provisions in the 1990 CAA amendments strengthen the requirement in the Act that federally approved or financially assisted projects conform to state implementation plans. Conformity provisions recognize that transportation-related air quality issues must be analyzed on a system-wide basis and be controlled through regional strategies.

Under this approach, the air pollution effects of federally supported projects must now be analyzed in the aggregate rather than on a project-by-project basis, as was done previously. The impact of a Transrapid system on a region's overall air emissions would be part of any conformity analysis under the CAA, because it is assumed that the system would be supported, least at initially, with federal funds.

Title 2 of the 1990 CAA Amendments relate to mobile sources of air pollution. Among other things, Title 2 sets more stringent emission standards, or requires the USEPA to do so, for automobiles, trucks and buses. Any assessment of the air pollution effect of substituting Transrapid for highway vehicle transportation should take into consideration the anticipated strengthening of the mobile source emission standards contemplated under Title 2.

To implement the 1990 CAA amendments, the USEPA established stringent new NAAQS for particulate matter and ozone. Although implementation of these NAAQS has been delayed by court action, these standards (or some variation of them) are likely to take effect eventually. Consequently, the air pollution effects of any new transportation system should also be evaluated in the context of these new particulate and ozone standards.

Combustion engines and power plants are two important sources of the particulate matter and ozone regulated by the USEPA. Accordingly, these pollutants should be addressed in an assessment of Transrapid's air pollution impacts for two reasons: (1) the operation of Transrapid is expected to *reduce* emissions of particulates and ozone precursors due to the displacement of fossil-fuel burning engines currently in use; and (2) Transrapid has the potential to *increase* the level of such emissions from the new electricity production needed to power a maglev system.

D. Greenhouse Gasses

The "greenhouse effect" is a natural process by which some of the sun's heat (infrared radiation) is trapped in the earth's atmosphere in much the same was as heat is trapped inside a greenhouse by glass. Many gases in the atmosphere can trap heat (infrared radiation) by deflecting it back to the earth after it is reflected off of the earth's surface. These "greenhouse gases" include naturally-occurring substances such as carbon dioxide, methane and nitrous oxide, as well as man-made gases such as the chlorofluorocarbons used in refrigeration equipment.

There is much uncertainty in predictions of the effects of increases in the levels of greenhouse gases on global warming. However, it is now recognized by most observers, based on complex climate and statistical models and instrumental data, that there is a real global warming trend. This is the finding of the Intergovernmental Panel on Climate Change (IPCC), an international body of thousands of scientists from over 100 nations who evaluate peer-reviewed literature and advise governments on climate change issues.[45] The IPCC predicts a number of adverse consequences if this global warming trend continues through the 21st century, including severe droughts and floods in many of the world's populated areas. Continued global warming could also have negative impacts on the world's ecological equilibrium.

A general consensus exists in the scientific community that the emission of greenhouse gases from man-made sources is a leading cause of global warming. In December 1997, representatives from 160 countries meeting in Kyoto, Japan established emission targets for the participating parties. The resulting "Kyoto Protocol" aims to limit emissions of six greenhouse gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorcarbons and sulfur hexafluoride.

By far, the greatest source of these gases in the United States is carbon dioxide released into the atmosphere from the burning of fossil fuels (coal, petroleum products, and natural gas), with the largest single contributor being the combustion of petroleum-based fuels by the transportation sector. Transportation in this country now accounts for 447 million metric tons of carbon emissions each year, or 32% of all such emissions in the United States.

A critical objective in the effort to combat global warming and to control the emissions of criteria pollutants in the U.S. is to substantially reduce this country's dependence on fossil fuels, particularly coal and petroleum, as its primary sources of energy. As discussed below, an important benefit of Transrapid is its potential to help the United States achieve this goal.

E. Air Emissions from Construction of a Transrapid System

Air emissions from the construction of a Transrapid system, including the guideway and the stations along the guideway, should not be any more significant than the emissions associated with other "linear" construction projects, such as highways and railroads. Increased emissions of two criteria pollutants during construction of Transrapid are of potential concern: particulates from fugitive dust and fuel combustion, and nitrogen oxides from fuel combustion. Precise estimates of how Transrapid construction activities will increase these emissions can only be made after the size of parking lots, stations, maintenance yards and other infrastructure associated with the system have been determined for the location in question.

Fugitive dust from construction operations is regulated in most states. Those regulations generally require construction project managers to take all reasonable steps to prevent fugitive dust during construction, such as the use of water during soil-disturbing operations, the covering of open-bodied trucks and the grading of roads. Such measures during the construction of the Transrapid guideway and stations should keep fugitive emissions to an acceptable minimum.

Nitrogen oxide emissions from diesel-burning vehicles during construction is not expected to add significantly to the total NOx emissions from other sources in the area.

F. Direct Air Emissions from Transrapid

The lack of any direct emissions of air pollutants from the operation of maglev trains makes Transrapid one of the most environmentally-friendly transportation systems ever devised. There may be a slight increase in certain direct air emissions from *stations* along the Transrapid guideways due to the use of fuel burning equipment (heaters and boilers) and emergency generators. However, there would be at most only minimal levels of emissions from such sources, and they are not expected to be of environmental concern.

G. Indirect Air Emissions from Transrapid

As noted previously, the most significant impacts on air quality from the introduction of Transrapid systems in this country would be the changes in pollutant emissions from the *decrease* in reliance on air and road travel and the *increase* in the generation of energy needed to power the Transrapid systems.

1. Decrease in Motor Vehicle Travel

Transrapid can be expected to divert automobile drivers and passengers away from near-total reliance on the automobile. To the extent it is successful in doing so, the environment will benefit from decreased emissions from the combustion of petroleum products.

The extent of this benefit will depend on the number of vehicle passengers diverted to Transrapid. The resulting decrease in the number of vehicles on the road is commonly measured in terms of the reduction in vehicle miles traveled (VMT). A number of methods are used by transportation planners to estimate the extent to which a new transportation project will reduce the VMT in existing transportation systems. Travel modeling was pioneered in the United States in support of the federal government's efforts to establish a uniform method of prioritizing federally-funded highway projects. The government devised a standardized process for analyzing transport demand, known as the Urban Transportation Modeling System (UTMS), to determine the amount, type and location of travel in a designated study area.[46] Once this demand is estimated, the effects of Transrapid on vehicle use in the study area, based on assumptions regarding rider preferences and needs, can be estimated. Using this estimate as an input, the decrease in highway VMT due to a new Transrapid system can be calculated.

Standard models also exist for estimating how the reduction in VMT in a given study area will result in a decrease in VOC, CO, CO_2, NOx, SO_2 and PM emissions. For example, EPA has developed models known as MOBILE 5b (for VOC, CO and NOX emissions) and PART 5 (for SO_2 and PM emissions) that are now being widely used by transportation planners. The emission reductions estimated from these models can, in turn, be incorporated into pollution dispersion models to predict the impact on air quality.

In short, using sophisticated computer models, estimating the vehicle emission reductions that may result from the introduction of a Transrapid system in a given area is a more precise science now than ever before–provided that reliable estimates of the numbers and kinds of highway vehicles displaced by a new Transrapid system can be made. Determining the actual vehicle displacements from Transrapid is a much less exact science, although many believe that reasonable estimates of such displacements are possible.

The National Maglev Initiative (NMI) explored the complexities of estimating the extent to which both automobile and airplane passengers would be diverted to Transrapid if the system were available to them. The resulting NMI Report found that this question was very much dependent on where the train is located. In general, the study assumed maglev trains would be built in areas where they would compete directly with short-distance (100-600 mile) air travel and only secondarily with highway travel. Accordingly, the NMI Report focused on decreases in air passenger miles resulting from Transrapid and assumed the diversion of automobile passengers to Transrapid would be relatively insignificant.

The NMI Report's assumption that a maglev train would not significantly reduce highway traffic is highly debatable. Others have assumed that a maglev system in the proper geographical location *would* divert many automobile passengers to the high-speed train, given that maglev will make travel faster, safer, and, in many cases, much more convenient. For example, studies by TRI found that a Transrapid system operating between Hamburg and Berlin, Germany's two largest cities, would divert 1.5 million passengers per year from aircraft, and even more—1.65 million passengers per year—from automobiles.

2. The NMI Report's Conclusion on the Decrease in Air Travel vs. the Increase in Power Needs

The NMI Report looked at 16 transportation corridors in the United States where maglev systems appeared to be feasible. An important criterion in the selection of these corridors was that there had to be a significant volume of air travel of under 600 miles distance. When total trip time by maglev and by aircraft were compared for each corridor, maglev trip times were shorter in 10 of the 16 corridors, leading the authors to conclude that many travelers in those corridors would readily switch from air travel to maglev if given the opportunity. The maximum trip distance in these 10 corridors was 300 miles. However, even up to distances of 600 miles, maglev's trip time was not appreciably greater than the trip time by air, suggesting that many passengers would prefer to travel by maglev even at those longer distances, especially if the maglev fare was comparable and maglev services more reliable and less weather-dependent.[47]

The displacement of air travel in the 100-600 mile travel distance range promises to result in significant decreases in fuel consumption. According to the report, maglev can offer trip times competitive with air travel for a small fraction of the energy consumed by an aircraft.

The report evaluated the energy savings that could be realized by maglev's displacement of air travel by simulating the operation of maglev in 11 of the 16 corridors studied. Energy savings tended to be the greatest where most of the ridership was diverted from aircraft, rather than from automobiles.

Based on energy consumed at the system connection (that is, airport or electrical supply), maglev's energy consumption could be compared to that of the fuel-efficient Boeing 737-300 for a 124- to 620-mile trip, as measured in terms of energy per passenger mile traveled. Even without assuming the use of newer, more efficient power plants, maglev would consume only one-quarter to one-half of the energy consumed by a 737-300 carrying the same number of passengers the same distance.

The operation of a new Transrapid system will require the generation of electricity, primarily for the operation of the train itself, but also, to a lesser extent, for the operation of the associated stations and other equipment. How much energy will be needed to operate a given Transrapid system depends on the number of trains in the system, the number and length of trips, the number of vehicles in each consist (train), and other factors specific to that system.

The NMI Report concluded that by substituting maglev vehicles for aircraft (and to a lesser extent, for highway vehicles and diesel powered trains), emissions from many mobile sources would be replaced by emissions from electrical power plants. The study compared the simulated reductions in air pollution from these displaced mobile sources to estimated increases in air pollution from the generation of electricity needed to power maglev systems.

The NMI Report assumed that maglev's electricity requirement would be provided from all of the nation's primary energy sources as projected for the year 2020. The study adopted the Department of Energy's projection that by 2020, the U.S. would derive its power as follows: 49.4 percent from coal, 17.9 percent from natural gas, 15.5 percent from nuclear, 4.2 percent from oil, and 13 percent from renewable resources such as hydropower, wind, and solar. For want of better data, the NMI Report simply assumed that each of the 11 maglev systems evaluated would utilize the same percentages of the country's power sources as are used nationwide in 2020. Based on this assumption, the authors concluded that, except for SO_2 emissions, which would increase by 21%, there would be sizable reductions in all categories of criteria pollutants from the introduction of maglev. The average percent change for the specific emissions in the corridors studied is shown in **Figure 8**.

The 21% projected increase in SO_2 emissions is based on the assumption that much of the electricity for the new maglev trains would come from the burning of fossil fuels, particularly coal. However, this may no longer be a valid assumption in light of the rapid deregulation of the power-generating industry in the U.S.

One impact of the deregulation of the electrical utility industry is that consumers of electricity, including the operators of Transrapid systems, will have the option of drawing power from non-fossil fuel burning sources that do not produce high levels of SO_2. Power industry deregulation is now in effect or under serious consideration in almost every state. This trend has already resulted in the widespread restructuring of the power-generating industry. One result of this restructuring will be to give consumers much more freedom of choice in selecting their source(s) of electrical power. California and many other states already give many consumers this option.

Accordingly, it is reasonable to assume that by the time Transrapid systems are built in the United States, operators of those systems will have the option of choosing "green power" to run their systems. Some green power sources, such as geothermal, wind, and solar power, produce virtually no air pollution. Others, like state-of-the-art natural gas, biomass and hydro-electric, can have very low emission levels. Because these clean energy sources generate little or no SO_2, the assumption in the NMI Report that this pollutant will necessarily increase from the introduction of maglev trains need not be the case.

Green power is expected to cost slightly more than traditional power from coal, petroleum, and nuclear power plants, at least at first. However, it is reasonable to assume that, at the very least, the operators of a new Transrapid system will be able to choose a mix of affordable sources of energy such that there will be no net increase in emissions of SO_2, and there will be correspondingly significant net decreases in emissions of other criteria pollutants from the introduction of maglev trains.

VI. SAFETY

A. Introduction

The designers of Transrapid were well aware of the risks of conventional means of transportation. They took advantage of the fact that maglev is a new, radically different transportation system to optimize safety features in the design stage of the train. These safety features have now been extensively tested at TRI's test track in Emsland, Germany. Those studies demonstrate that, measured in terms of accidental injuries and fatalities, Transrapid will be the safest form of mechanized transportation in history.

In Germany, each transportation system must be examined, licensed, and certified to operate by an independent safety certification group.[48] TUV Rheinland is the independent organization that certified the safety of the Transrapid TR07. In doing so, TUV exhaustively examined the TR07 vehicle, guideway, switches and control systems and concluded that Transrapid met rigid safety standards developed specifically for maglev systems.[49] These standards (hereinafter "German Safety Standards"), were developed by a working group headed by the German Federal Railways, the Testing and Planning Company for Maglev systems, the Institute for Railway Technology, and safety experts from the railroad industry and TUV.

In 1992, the Volpe National Transportation Systems Center conducted a study of these German Safety Standards "to determine the suitability of German safety requirements for application to magnetic levitation (maglev) systems as proposed for U.S. passenger operations" (hereinafter "Volpe Study").[50] The Volpe Study concluded that "[w]hat is being undertaken in Germany appears to ensure an equivalent level of safety to what is expected in the United States for similar ground transportation."[51] The study also notes that the FRA's safety regulations will have to be extensively updated to address maglev systems in this country, and recommends that the German Safety Standards be an important point of reference in that effort.[52]

In 1990, the FRA published a report on the results of a preliminary safety review of the Transrapid TR07 by the FRA's Office of Research and Development ("FRA Safety Report").[53] The following discussion of the Transrapid's safety features is based largely on the Volpe Study, the FRA Safety Report, and technical publications of TRI. These references make a compelling case for the argument that Transrapid is the world's safest motorized system of transportation.

B. Safe Hovering

Uncontrolled contact between the Transrapid train and the guideway on which it travels would create an unacceptable safety risk, even at relatively low speeds. To prevent this from happening, the German Safety Standards establish a "safe hover" concept that requires that trains remain levitated, other than at designated stop locations, under all conceivable failures and emergency conditions. Transrapid is designed to meet this standard by assuring there will be no unexpected loss of either the levitation or guidance system. A high degree of redundancy has been built into both systems. Each magnet has an individual control system with redundant gap sensors to assure that the required distance between the train and the guideway is maintained at all times.

For these redundant systems to operate properly, adequate electricity must be supplied to the magnets, even if the external source of electricity fails while the train is in operation. If such a failure should occur, on-board batteries will supply emergency power to maintain the levitation and guidance systems. These batteries are charged during the journey to assure that the train will continue to levitate until it reaches the next terminal. In such an emergency, braking will also be carried out by on-board batteries which will slow the train down to about seven mph, after which the train will lower onto skids and glide to a stop. The skids are especially constructed to avoid heat buildup from friction during this braking operation.

C. Safe Evacuation

An essential component of Transrapid's safety-related design is the requirement that a train must be able, under any circumstance, to come to a stop at a location on the guideway where passengers can be safely evacuated. The following design characteristics have been built into Transrapid to assure that such safe-stopping zones are always accessible to passengers:

- The on-board battery systems are designed to assure that the train can reach the closest evacuation zone in the event of an emergency or unexpected loss of external power. This is assured by having four battery systems on each vehicle, any two of which can carry a vehicle to the closest safe-stopping zone. These batteries are electrically isolated from one another and are recharged from power transmitted from the guideway through linear generators as the vehicle moves down the guideway.
- The train must be capable of bringing itself to a stop at a safe stopping location without any input or guidance from the central control system.
- The train must be capable of assuring safe operations independent of the central control system. This requirement has been met by building redundancy, or independent operation, into the Transrapid system. Two redundant computer systems are used for vehicle control. Each system contains three channels that are continuously monitored. Loss of one channel in either system is tolerated, but a second channel failure in any one system results in an "automatic" stop at the next station on the guideway until the situation is corrected.

D. Safe Speed Control

The speed of Transrapid must be carefully maintained to avoid passenger discomfort on turns and grades, to prevent sudden accelerations and decelerations that could be potentially dangerous to occupants, and to assure that proper, pre-selected speed profiles are maintained. The driver of the Transrapid train does not actively control the speed of the train or any other aspects of the train's out-of-station operation except during emergencies or other abnormal operating conditions. Train speed, braking, and other operations are controlled remotely by a central controller.

Once the central controller chooses a speed profile for a given route, that information is transferred to the decentralized (wayside) portion of the system, which consists of a series of control units along the guideway. These wayside units communicate to the central controller all route characteristics necessary to implement the operational plan. When all of the route characteristics are cleared by central control for operation, the safe speed enforcement portion of the control system monitors vehicle speed to assure it remains within the specified profile.

E. Near Impossibility of "Derailment"

Unlike railway systems, it is virtually impossible for a Transrapid train to leave an intact guideway because the bottom of each vehicle wraps around the guideway. A purely theoretical scenario exists under which a train could leave the guideway: encountering an open switch. However, as noted below, the train is programmed such that it cannot approach any switch that is not in a safe, closed position, as registered by three independent sensors.

F. Collision Avoidance

Unlike conventional railway systems, the guideway of the Transrapid will have no at-grade intersections. The system will be built to allow other traffic routes, such as highways and railroad tracks, to pass under the guideway (or in some cases, over the guideway). Accordingly, collisions with other types of transport vehicles will not be possible. This feature gives Transrapid a significant safety advantage over conventional rail in that it will eliminate additional gradecrossing accidents that currently account for about half of the fatalities involving U.S. intercity passenger rail travel.

A collision between two maglev trains is technically impossible because the design of the long stator propulsion system (and the operation control system) prevent two trains from being in the same motorized section of the guideway at the same time. The principle of Transrapid's longstator linear synchronous motor excludes the possibility of a collision between two maglev vehicles traveling at different speeds in the same direction or traveling in opposite directions on the same guideway.

The route selection and verification process (imbedded in the operation control system) that assures safe train speeds will assure that appropriate distances are maintained between trains. This same route integrity system assures that all guideway switches along the route are properly locked into place well before a train passes. Before this is done, three separate sensors on both ends of the guideway section that make up a switch must register the correct position and verify that the switch is properly locked in place. If all three sensors do not register their correct positions, the route integrity portion of the control system will not authorize the train to move along the designated route.

The guideway will be regularly inspected to assure it is free from any large objects that might obstruct the path of a train. Rights-of-way will be maintained free of trees and other objects that may result in limbs or other obstructions falling onto the guideway. In the very unlikely event that a train encounters a heavy object on the guideway at high speeds, the shape of the nose of the train is designed to deflect the object to one side. The front of the train has a designed-in crush zone to absorb collisions with heavier objects without endangering passengers.

The guideway support structures will be designed and constructed in compliance will all seismic protection requirements to assure the guideway remains earthquake proof.

G. Emergency Braking

Transrapid's emergency braking system is designed to assure a controlled deceleration of a train in the event of an emergency. Transrapid has both primary and back-up braking systems. The back-up system only operates if the primary system fails.

The primary braking system is operated by the central control system. It functions by reversing vehicle thrust generated by the propulsion system mounted in the guideway. Each car has two independently operating backup brakes, known as eddy current brakes, that induce eddy currents in the guideway's motor windings to slow the trains down to less than 10 mph. At that speed, the levitation magnets are de-energized and the train settles onto landing skids, quickly coming to a stop due to the friction between the skids and the guideway. The skids are coated with a special high-friction material to assure rapid deceleration. The heat generated by the train skidding along the guideway will be high enough to melt ice that may have formed on the guideway assuring sufficient friction to bring the train to a stop. At no time, however, will the frictional heat be high enough to create a risk of fire.

H. Fire Safety

Transrapid vehicles set new standards for railway vehicles in terms of fire safety. Materials used to construct the vehicles are non-combustible, poor transmitters of heat, temperature-resistant and able to withstand fire penetration. The vehicles will not carry fuel or any type of pressurized systems on-board. To comply with passive fire protection standards, the interior furnishing in Transrapid meets the 1988 Air Transport Standards (five-minute fire at 1100°C without the emission of harmful fumes). Transrapid trains easily attain the German Safety Standards requirement that all materials inside the train meet the highest safety level and that fire walls between vehicle sections have a 30-minute resistance. These standards also require that in the event of a fire, passengers must be able to readily evacuate from the burning section to an adjacent section.

Fire extinguishing equipment will be available at safe-stopping zones along the guideway. In the highly unlikely event that a Transrapid train experiences a fire and a loss of power simultaneously, the vehicle will be automatically braked by the eddy current brakes (as noted above) allowing it to glide to a smooth stop at the nearest evacuation point.

I. Indirect Health and Safety Impacts

1. Reduction in Highway and Airline Accidents

To the extent Transrapid systems divert passengers from highway and airline travel, the probability of those passengers suffering death or injury during their trips will be greatly reduced. The NMI Report estimates that operation of maglev trains in the 16 U.S. corridors studied would ultimately prevent 25 air fatalities, 26 highway fatalities, and 37 rail fatalities per year. As noted above, however, the NMI Report also assumed that the great majority of diverted passengers would be from air travel, with a relatively small number from highway travel. To the extent Transrapid diverts larger percentages of highway travelers—as would likely be the case in certain travel corridors—the prevention of injuries and fatalities would increase substantially, given that highway travel causes far more life-threatening accidents per passenger mile traveled than does air or conventional railroad travel.

As noted above, the likelihood of Transrapid actually causing a highway or railway accident is virtually non-existent because the system will be elevated as necessary to avoid all road and railroad track intersections. Some have questioned whether highway drivers in rights-of-way shared with Transrapid might be startled, particularly at night, by the sudden on-rush of an approaching maglev train. There is little danger of this happening because the typical separation distance between the maglev guideway and the roadway is 120 feet. This separation also applies to the headlights of the maglev train. In situations where closer guideway/roadway groupings are required, light barriers may be employed to prevent visual distractions.

2. Reduction in Highway and Airport Stress

In promoting the development of high speed ground transport (HSGT) systems in this country, the NRC Report noted that the primary objective of these systems would be to expand capacity in those corridors that are experiencing, or will soon experience, significant travel delays. The report observes that decades of high economic growth and low oil prices have dramatically increased travel. In the nine years since that report was written, both air and highway travel use in this country have greatly exceeded expectations. Meanwhile, highway expansions and airport construction have not been able to keep up with the rapidly increasing demand.

The NRC Report states that one of the primary benefits of HSGT systems would be the resulting improvements in air and highway system performance, assuming significant numbers of air and highway travelers are diverted to HSGT systems. The report notes that the "gains to the airport and highway systems and their users would vary greatly from one HSGT project to another, but they could be large."[54] Because air traffic delays are believed to increase exponentially as flight operations approach capacity, and given that many airports are now operating at or near capacity, the authors of the NRC Report conclude that even relatively small percentage reductions in airline passengers diverted to HSGT travel could reduce delays and congestion significantly.[55] In short, with the introduction of HSGT systems like Transrapid in a number of the country's mid-distance (100- to 600-mile) intercity corridors, highway and airport congestion and delays can be significantly reduced.

VII. CONVENIENCE AND COMFORT

A. Passenger Comfort

The operation of Transrapid trains will be optimized during turns and grade-climbing to avoid any inconvenience to passengers, such that Transrapid passengers will not be required to wear seatbelts and may move around in the passenger compartment of the train at any time.

Transrapid trains have been designed to assure that passengers are not startled or made uncomfortable by rapid pressure changes when two trains pass one another or when a train enters a tunnel. Passenger compartments of Transrapid trains employ state-of-the-art technology to assure pressure-tightness of vehicle bodies. Further, minimal wind gusts between passing vehicles were carefully predicted when Transrapid developed standards for tunnel size and distances between parallel guideways.

Transrapid's contactless technology assures smooth running with minimal rolling and engine noise inside the vehicle. A primary factor influencing the comfort of conventional rail passengers is the jolting and jerking that occurs when trains traverse rougher sections of track. These rough spots will be virtually non-existent in maglev trains.

B. Weather Independence

Because of its contactless technology, Transrapid can remain fully safe and operational in poor weather and at high and low temperatures. Unlike conventional electricity-driven rail systems, passengers need not be concerned with ice build-up on overhead electrical lines. The drive components for Transrapid are installed on the underside of the guideway where they are protected against snow and ice build-up.

The air gap of approximately six inches between the top of the guideway and the underside of the Transrapid vehicle allows the train to remain in operation even if a layer of snow of this thickness should accumulate on the guideway. Moreover, such accumulation is unlikely as snow should be continuously blown off the guideway by the wind or from passing trains.

In short, Transrapid systems should be more resistant to weather delays that frequently plague airlines, highways, and some forms of railway transport.

C. Decreased Travel Time

According to the NMI Report, the linehaul trip time (actual travel time, *excluding* time to access stations or airports) for maglev trains would be less than the trip time for airline flights of under 200 miles. When the authors of the report considered *total* trip time (i.e. including access time) maglev had an advantage over air travel in 10 of the 16 study corridors up to trip distances of 300 miles. Even at 600-mile distances, Maglev's total trip time disadvantage would be relatively small compared to air travel.

VIII. LAND USE IMPACTS

A. The Regulatory Framework for Evaluating and Mitigating Adverse Land Use Impacts

Pursuant to the National Environmental Policy Act (NEPA)[56] the FRA must conduct an environmental assessment of any new transportation project that may have a significant impact on human health and the environment. The FRA has issued revised regulations, effective May 26, 1999, that provide guidance on how these environmental assessments should be conducted. These guidelines emphasize the need for full disclosure of the various land use impacts from new projects, and how those impacts can be mitigated. The FRA guidance, referred to as the "Updated Environmental Assessment Procedures" will require that any new federally supported transportation system, such as Transrapid, be evaluated for its potential to impact ecological systems, wetland areas, endangered species habitat, flood plains, woodlands, open space, existing and planned land use, parklands, and locations of historic, archeological or cultural significance.[57]

In addition to NEPA's requirement that all of these potential impacts be fully evaluated and disclosed, other state and federal laws require that many adverse land use impacts be avoided altogether—or at least mitigated to the maximum extent practicable. For example, a proposed Transrapid system will be required to comply with the following federal environmental laws intended to preserve and protect wildlife and land use values:

- Under the Endangered Species Act, if the proposed Transrapid system may impact the habitat of a threatened or endangered species such that it might jeopardize the continued existence of that species, the proposed system must be modified to avoid that impact.[58]

- Under Section 4(f) of the Department of Transportation Act, if a Transrapid project requires the use of any significant public park, recreation area, wildlife or waterfowl refuge, or historic site, that project may only proceed upon a showing that there is no prudent and feasible alternative to the use of that land and a demonstration that all possible planning has been undertaken to minimize the resulting harm.[59]
- Under Section 106 of the Historic Preservation Act, if the Transrapid project may adversely impact a site of historical, archeological, architectural, or cultural significance, the project sponsors must consult with the State Historic Preservation Officer and the Advisory Council on Historic Preservation to determine how best to avoid such impacts.[60]
- Under Section 404 of the Clean Water Act, [61] any significant impact of Transrapid on wetlands would require a federal permit from the U.S. Army Corps of Engineers. This permit would require the planners of the Transrapid system to select the approach that minimizes adverse impacts on wetlands. Best Management Practices would be required during construction of the guideway and stations to assure that impacts to wetland and streams are avoided or minimized to the maximum extent practical.
- Under the Fish and Wildlife Coordination Act, if the Transrapid project will potentially impact natural ecological systems or will modify streams or other bodies of water in some way, the project may only proceed after the project sponsors consult with the U.S. Fish and Wildlife Service and state wildlife agencies to determine how to best mitigate those impacts.[62]

Any assessment of the land use impacts of a new Transrapid system must be addressed in the context of these and other federal and state laws designed to protect land uses that are valued by the public. If such values are threatened with irreversible harm, these laws will require that the proposed maglev system be modified or relocated to avoid or minimize such impacts. As will now be seen, Transrapid has far more flexibility than other surface transportation systems to meet these land-use related requirements.

B. The Direct Land Use Impacts of Transrapid

Land requirements for Transrapid systems will be relatively modest because the vehicles are quite narrow.[63] Maglev's elevated dual guideways have small footprints and can be located along existing rail and highway rights-of-way, bringing maglev vehicles directly into downtown terminals with relatively little disruption of existing land use patterns.

Transrapid guideways can either be elevated or constructed at grade. In areas where land use concerns are important, this feature gives the planners of the system the flexibility to avoid interference with existing land use patterns by constructing the guideways up and over the existing terrain. Areas under the guideways can continue to be used for agriculture, flood plain drainage, wetlands and wildlife habitat.

Maglev systems consume less land than any other form of transport. The elevated double-track guideway of Transrapid spans about 90 feet between supports.

The area required for each support is 900 square feet, more or less, depending on the load capacity of the ground, leading to an effective land consumption for the elevated Transrapid of about 1.5m^2/m. Land consumption for the at-grade Transrapid is about 12 m^2/m, comparing favorably to land requirements of 13.7m^2/m for a conventional railway system and 37.5 m^2/m for an interstate highway.

There may be no need for a surface road running alongside the Transrapid after the guideway is constructed. Access roads should not be necessary for safety reasons, with the exception of those needed to assure emergency vehicle access to designated safe stopping zones along the guideway. Nor is a roadway needed for maintenance of the Transrapid system, since all maintenance can be undertaken from the guideway itself.

Another important advantage of Transrapid, whether or not the guideway is elevated, is that the system will not affect the local hydrology. The groundworks necessary for installing the column foundations are minimal when compared to those required for roads or railways. For example, in many cases "raft" foundations can be used which are no deeper than the basement of an average house. Piled foundations will probably be necessary only in rare situations.

The natural flow of surface water need not be diverted or interrupted by the guideway, as is the case with roads and railroad tracks. Nor will Transrapid guideways require the construction of drainage ditches alongside, as do many roads and railways. Environmentalists have long complained that highway ditches--and the propensity of landowners to use those ditches for wetlands drainage--are a significant adverse consequence of new highway projects. Because with Transrapid there is no need for ditches, there will be no such adverse environmental impacts.

Impacts of Transrapid systems on floodplains can be all but eliminated by raising the guideway above the 100-year flood elevation. The ease with which flood plain impacts of maglev systems can be avoided starkly contrasts with conventional railroads, where track embankments can radically divert the flow of floodwaters.

The Maglev Technical Advisory Committee concluded in 1989 that it is technically and economically feasible to build maglev systems along existing Interstate highways.[64] Accordingly, it has been shown that much of the Transrapid alignment in a given transportation corridor can be co-located with existing railway or roadway corridors because of the maglev train's superior turning and grade-climbing abilities. Transrapid can also be located along electrical transmission line corridors. Such routing flexibility with existing highway, rail and utility rights-of-way will help avoid new land use disruptions.

Compared to other high-speed ground transportation systems, Transrapid is also quite flexible in the way it can be made compatible with the existing environment. Because of the superior grade-climbing ability of maglev trains, it is relatively easy to blend a Transrapid guideway into an existing landscape. Thus, Transrapid should require far fewer tunnels along a given transportation corridor than would be the case with a conventional railway system.

C. Indirect Impacts

Although transportation systems and land use are inextricably linked, historically there has been little recognition of the importance of transportation planning in shaping land development patterns.

In 1991, Cambridge Systematics, Inc. surveyed the land use forecasting procedures utilized in this country's major metropolitan areas. The study's authors concluded that those procedures had changed little over the previous 20 years.[65] They found that only two of the cities studied used available models for forecasting the effects of transportation systems on urban development, and the two cities that did so failed to use the models correctly.

This shortsightedness in transportation planning appears to be changing. As the FRA's Office of Policy has noted, "the role of transportation in shaping development patterns, has begun to focus attention on the need to integrate transportation and land use planning."[66] The Intermodal Surface Transportation Efficiency Act of 1991 for the first time requires that transportation planning be integrated with the urban planning process and consider the land use impacts of any new transportation project.

As noted above, Transrapid may well be unique among modern transportation systems in its ability to accommodate existing land use patterns. But what about the potential for Transrapid to actually *shape* those patterns? Because of the importance of such *indirect* land use impacts of transportation projects, no assessment of the environmental effects of Transrapid or any other transportation system would be complete without some discussion of those impacts.

1. Urban Sprawl

The promotion of urban sprawl is an indirect land use impact of new transportation systems that has attracted considerable attention over the past decade. The potential for unplanned sprawl development to compromise valued land uses, such a wildlife habitat, open space, forested areas, parks, agricultural lands and wetlands is well known. Urban sprawl also tends to increase dependency on automobile travel with all of its attendant problems of traffic congestion, increased reliance on foreign oil, more highway accidents and deteriorating air quality.

Accordingly, determining how high-speed maglev trains will affect urban sprawl is an important issue. Some observers have suggested that once high-speed trains begin to proliferate, they will spawn sprawling mega-cities. For example, Cesare Marchetti, a scientist at Vienna's International Institute for Applied Systems Analysis, has predicted that maglev technology will increase the size of our larger cities by five to six times over the next century.[67] Marchetti argues that historically human settlements have grown exponentially in relation to the distance an individual can travel in one hour. Hence, Berlin was three miles across in 1800, based on the speed with which people walked. By 1997, Berlin had grown to be 25 miles across, largely because of the introduction of automobiles. With the introduction of high-speed maglev trains, Marchetti envisions a Berlin that is 125 miles across with a population of over 100 million.

Whether maglev trains will spawn such mega-cities is highly debatable. For one thing, trains like Transrapid are designed to link cities together, not to provide for mass transport within a single city. The sprawling city of the future envisioned by Marchetti suggests there would be numerous station stops within one metropolitan area served by high-speed maglev trains. However, such frequent stops would defeat the primary purpose of such trains-to move people rapidly *between* cities that are hundreds of miles apart. Indeed, studies have shown that the time advantage of maglev trains over high speed railroad trains begins to disappear as stops along the way become too frequent and close together, thereby decreasing maglev's speed advantage to the point where it may no longer make economic sense when compared to conventional passenger trains or other mass transits systems.

As was the case with conventional railway stations in the past, Transrapid stations should serve as hubs for new urban development. To maximize the travel time benefits of Transrapid, stations along a guideway should be relatively few and far between. Consequently, unlike the way highways can promote sprawl development all along the entire length of a new corridor (and especially at major intersections), Transrapid stations can be utilized by urban planners to create concentrated areas of residential and commercial development around stations that are relatively distant from one another. In short, rather than promoting sprawl development, a Transrapid system can be designed to promote *concentrated* development, particularly in the hands of creative community planners.

2. Less Airport and Highway Construction

Air passenger capacities projected for the 21st century are too extensive for even improved airports to accommodate. The expansion of many air terminals to serve this projected air traffic will require the development of extensive tracts of premium real estate. Although generally considered less land-intensive than linear modes of transportation, airports require major commitments of land. For example, according to the NMI Report, Los Angeles International Airport occupies a land area comparable to that required for a maglev corridor from Los Angeles to San Francisco, and JFK International occupies an area comparable to that required for a maglev corridor from Boston to Washington, D.C.

The NMI Report concludes that maglev offers an economically comparable option, in terms of land development needs, to airport expansion.

IX. IMPACTS ON FLORA AND FAUNA

Much of the above discussion of the direct and indirect land use impacts of Transrapid systems is relevant to an assessment of the effects of these new trains on plants and wildlife. The types of wildlife habitats that will be traversed by Transrapid systems depend, of course, on the transportation corridor selected. In most cases, the effects of a new Transrapid system on these habitats, and the wildlife that utilize them, should be minor and temporary.

As we have seen, natural drainage patterns need not be disrupted by Transrapid guideways, even for at-grade systems. Where necessary, Transrapid guideways can be elevated to further minimize the impact on sensitive habitat. Grasslands, wetlands, and agricultural lands, after being temporarily disrupted by the construction of the guideways, will be allowed to return to their normal vegetative states, even within corridors and under guideways. With elevated maglev systems, wildlife can pass from one side of the guideway to the other relatively freely -- a major advantage over most highways and conventional railroads. The NRC Report notes that an important advantage of elevated high speed trains is that they would not fragment local habitats.[68] Such fragmenting disturbs the environment of both plants and animals and can have adverse consequences for the health and survival of indigenous species.[69]

Although noise criteria for high-speed train effects on wildlife have not been established, the FRA procedures use an interim criterion based on the single event noise descriptor (SEL). The interim criterion indicates a potential impact when the SEL is 100 dBA or higher–a noise intensity Transrapid would rarely generate.

A permanent impact of a Transrapid system would be the removal of trees from the guideway right-of-way. Trees that might interfere with the train operation would not be allowed to grow under or near the guideway. However, if forested habitat is considered of high ecological value, efforts can be made to route guideways around such environmentally sensitive areas.

X. ENERGY CONSUMPTION

Transportation accounts for at least two-thirds of the oil consumed in this country.[70] Transportation alone consumes more petroleum than the U.S. produces and more than the U.S. imports each year.[71] According to the Congressional Office of Technology Assessment (OTA), the average American citizen uses five times as much energy for transportation as the average Japanese citizen and nearly three times as much as the average citizen of Western Europe.[72]

Americans consume more than one-third of the entire world's transportation energy, even though they account for only 4.7 percent of the world's population.[73] Moreover, transportation-related energy consumption in this country is growing rapidly. One of the most conservative forecasts, by the Department of Energy's (DOE's) Information Administration, projects that transportation-related energy consumption will grow 30 percent by the year 2015.[74] This prediction assumes that fuel efficiency of motor vehicles will continue to improve, but that these improvements will be overwhelmed by increases in both the number of vehicle trips taken and the average trip length. OTA believes these Energy Department predictions may actually prove to be too low. According to OTA, without substantial policy intervention, future rates of travel are quite likely to be higher and efficiency lower than DOE projects, with a resulting greater increase in transportation energy use than the projected levels.[75]

As petroleum consumption in the U.S. grows, primarily due to the growth in petroleum-based transportation systems, this country will become even more dependent on foreign oil producers, many of whom do not share our political or economic interests. The amount of oil imported by the United States is now approaching 50% of our total consumption—a greater percentage than Americans were consuming at the time of the energy crisis of the mid-1970s.

Moreover, as noted above, there is now convincing evidence that growing rates of atmospheric carbon emissions, a major source of which is gasoline combustion, are producing a global climate change that could jeopardize human health and global ecosystems. The ability of the United States to take a lead role in reducing worldwide emissions of greenhouse gases will no doubt be compromised if this country is unwilling--or unable--to stem the rapid increase in motor vehicle use projected over the next two decades.

Our country's appetite for oil is primarily due to its appetite for travel and the fact that when Americans do travel they prefer, or are compelled, to travel in automobiles. Nearly 70% of the projected increase in petroleum consumption in this country by the year 2015 will be related to transportation, and the lion's share of that increase will be due to automobile transportation.[76]

As a matter of sound public policy, any new transportation system that reduces our dependence on petroleum, and on fossil fuels in general, should be encouraged. Maglev is by no means a complete solution to our over-dependence on fossil-fuel-based travel, but it is certainly a step in the right direction. Perhaps most importantly, the promotion of maglev travel in this country will send an important message to the rest of the world that the United States intends to assume a leadership role in promoting less petroleum consumption and greater use of "green power."

Maglev will be virtually independent of petroleum-based fuels, so that maglev networks will help lessen U.S. dependence on foreign oil for its travel needs. Based on simulations of maglev operations in 11 of 16 corridors studied, the NMI Report concluded that average maglev energy consumption will be about one-half of that of air travel for a 600-mile trip of comparable air time. For shorter distances, maglev's energy and time advantages increase dramatically. For a 125-mile trip, maglev will consume about one quarter of the energy needed for shorthaul air travel, while completing the trip in 15 percent less time.[77] In corridors where most of the ridership will be diverted from aircraft, potential energy and petroleum savings tend to be the greatest.

In sum, Transrapid can offer trip times that are far shorter than highway travel, and competitive with air travel, for a small fraction of the energy consumed by automobiles and aircraft.

XI. CONCLUSIONS

After decades of study and applied engineering coupled with full-scale testing, Transrapid maglev trains offer potential benefits to human health, safety, convenience and comfort. Moreover, Transrapid promises to be one of the most environmentally-friendly systems of transport ever devised in terms of air quality, compatibility with existing land uses, energy efficiency, and noise acceptability.

The apparent lack of adverse human health and environmental impacts from Transrapid maglev trains, especially when compared to other transportation modes, should be an important factor in any decision to build or expand passenger transportation systems, particularly in corridors that are now served by short-range (100- to 600-mile) airways and inter-city highways.

Footnotes

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[30] *Id*. p. 1-5 to 1-7.

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[32] *Id. p.* 1-8.

[33] Groh, *The Biological Effects of Maglev Magnetic Field Exposures,* Final Report, Aug. 1993 ("Groh Study").

[34] *Id*.

[35] *Id*. p. 4-4.

[36] *Id*. p. 5-4.

[37] United States Department of Transportation, *Noise from High Speed Maglev Systems, January 1993.*

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[39] United States Department of Transportation, Federal Railroad Administration, *High Speed Ground Transportation Noise and Vibration Impact Assessment,* Dec. 1998. ("1998 DOT Study").

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[42] *Id.*

[43] *Id.*

[44] *Id.*

[45] IPCC, *Summary for Policymakers of the Contribution of Working Group I to the IPCC Second Assessment Report,* 1995.

[46] Zegras and Guruswamy, *Transport Modeling for Energy & Environment: United States Experience and Relevance to the Developing World,* April 1995.

[47] NMI Report p. 3-3.

[48] United States Department of Transportation*, Safety of High Speed Magnetic Levitation Systems, German High-Speed Maglev Train Safety Requirements--Potential for Application in the United States*, Interim Report, Feb. 1992 ("Volpe Study"), p. 2-5.

[49] *Id.* p. 1-4.

[50] *Id*. p. 1-1.

[51] *Id.* p. 10-1

[52] *Id*.

[53] U.S. Department of Transportation, *Preliminary Safety Review of the Transrapid Maglev System,* Nov. 1990.

[54] NRC Study p. 122.

[55] *Id*. p. 123.

[56] National Environmental Policy Act of 1970 ("NEPA"), 42 U.S.C. § 4371 *et. seq*.

[57] Department of Transportation, Federal Railroad Administration, *Procedures for Considering Environmental Impacts*, FRA Docket No. EP-1, Notice 5, effective May 26, 1999, Sec. 14(n)(15)).

[58] 16 U.S.C. § 1536.

[59] 49 U.S.C. § 303 (c).

[60] 16 U.S.C. § 470.

[61] 33 U.S.C. § 1344.

[62] 16 U.S.C. § 662(a).

[63] NMI Report p. 13/29.

[64] The Maglev Technical Advisory Committee, *Benefits of Magnetically Levitated High-Speed Transportation for the United States.* Vol. 1--Executive Report, Reporting to the United States Senate, Committee on Environment and Public Works, June 1989.

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[70] Department of Energy/Energy Information Administration, *Annual Energy Outlook 1996* (DOE/EIA - 0383 (96) 48, January 1996 ("DOE Outlook").

[71] *Id*. p. 70.

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[73] *Id.*

[74] *Id*.

[75] *Id*.

[76] DOE Energy Outlook, p. 118-19.

[77] NMI Report p. 8/8.

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APPENDIX D – GLOSSARY OF TERMS

Action Alternative - An alternative which proposes some management action, as contrasted to the No-Action Alternative.

Actual Use - The amount of use that actually occurred.

Affected Environment – The physical, biological, social and economic environment within which human activity is proposed.

Americans with Disabilities Act (ADA) - The ADA sets legal requirements for accessibility.

Authorized Use - Activities and amount of use approved by the authorized officer. Approval can be granted by issuance of a permit or approval of an annual itinerary, operating plan including amendments thereof associated with a permit.

Carrying Capacity - The number of recreationists that can be accommodated in a specific area based on ecological, physical, facility, and/or social factors.

Commercial Use or Activity - Any use or activity on National Forest System lands where (a) an entry or participation fee is charged, or (b) the primary purpose is the sale of good or service, and in either case, regardless of whether the use or activity is intended to produce a profit.

Construction - Any activity that directly alters the environment, excluding surveying or mapping.

Cumulative Effects - Effects resulting from a project and other past, present and reasonably foreseeable future projects.

Disturbance - A discrete event, either natural or human induced, that causes a change in the condition of an ecological system.

Ecosystem - A system formed by the interaction of living organisms, including people, with their environment. Spatially, ecosystems are described for areas in which ft is meaningful to talk about these relationships.

Endangered Species - Any species listed under the Endangered Species Act which is in danger of or threatened with extinction throughout all or most of its range.

Environmental Impact Statement (EIS) - An environmental analysis, as required by the National Environmental Policy Act (NEPA), for proposed federal actions that may have a significant effect on the quality of the human environment (40 CFR 1502.3).

Ethnographic - The anthropological study of societies that are still in existence. Generally, the observation and organized description of current human behavior or behavior that is remembered by living people.

Expansion - A facility's capability to produce or operate beyond its existing capacity, excluding repairs or renovations that do not increase capacity.

Habitat - The natural environment of a plant or animal.

Heritage Resources - Formally known as cultural resources. These resources are the tangible and intangible aspects of cultural systems, living and dead, that are valued by a given culture or contain information about the culture. Heritage resources include, but are not limited to sites, structures, buildings, district, and objects associated with or representative of people, cultures, and human activities and events.

Historic Site - Site or activity area associated with non-indigenous peoples.

Indicator - A specific measurement used to gage a resource or social condition.

Indigenous Species - Any species of flora or fauna that naturally occurs in a wilderness areas and that was not introduced by humans.

Indirect Effects - Those effects occurring at a later time or at some distance from the triggering action.

Memorandum of Understanding - A memorandum of understanding developed between tow or more agencies to document areas of agreement on topics of mutual concern.

Mitigate - Actions to avoid, minimize, reduce, eliminate, or rectify the adverse impact of a management practice.

Monitoring - The collection of information to determine the effects of resource management and to identify changing resource conditions or needs.

National Environmental Policy Act (NEPA) - Legislation declaring the productive harmony with nature, and protection of the environment, to be national policy. NEPA provides for analyzing the environmental consequences of proposed management actions on all National Forest System lands, including management actions taken in wilderness.

National Register of Historic Places - A listing maintained by the USDI, National Park Service of areas which have been designated as historically significant. The Register includes places of local and State significance, as well as those of value to the nation in general.

National Wetland Inventory (NWI) – Wetland area was calculated using existing NWI maps. The wetland assessment of the corridor included an evaluation of wetland types, area, and funcitons and values of the wetland systems.

National Wild and Scenic River System - Rivers with outstanding remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values designated by Congress under the Wild and Scenic Rivers Act for preservation of their free-flowing condition.

National Wilderness Preservation System (NWPS) - All lands covered by the Wilderness Act and all subsequent designations, irrespective of the department or agency having jurisdiction.

Native Species - Any species of flora or fauna that naturally occurs in the United States and that was not introduced by humans.

Nonconforming Uses - Uses that do not conform to wilderness, as defined by the Wilderness Act, but which are allowed to occur by law as special provisions. Examples are livestock grazing, mining, and the use of motorized equipment for trail maintenance.

Nonpoint Source Pollution - Water pollution that cannot be traced to a single source, such as a factory, but collects from a wide area. Examples would include pesticide or fertilizer that ends up in rivers or lakes, or percolates through the soil into groundwater.

Notice of Intent - A notice published in the Federal Register to announce the description and nature of a proposed action, estimated date for filing a draft or final EIS, and the reviewers obligation to comment. NOIs are legally required for an EIS (40 CFR 1508.22).

Preferred Alternative - The alternative identified as being preferred by the agency.

Prehistoric Site - Site or activity area associated with indigenous peoples.

Record of Decision (ROD) - The portion of a Final Environmental Impact Statement that identifies the proposed action, signed by the appropriate deciding officer.

Riparian - The land and vegetation immediately adjacent to a body of water, such as a stream, lake, or river; such vegetation depends upon a perpetual source of water.

Scoping - Determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action (40 CFR 1501.7) Process to identify what potential environmental impacts, alternatives and other issues will be addressed in the EIS.

Sensitive Species - Those species on an official state list or recognized by the

Regional Forester, needing special management to prevent them from becoming endangered or threatened.

Standards - Quantitative ideals for social and physical conditions that describe acceptable and appropriate conditions for indicators.

Visual Quality - Scenic attributes of landscapes that elicit psychological and physiological benefits to humans.

Watershed - The entire area that contributes water to a drainage system or stream. Portion of the forest in which all surface waters drain to a common point.

Wetland - Areas that are inundated by surface or ground water with a frequency sufficient to support a prevalence of vegetative or aquatic life dependent upon the water for growth and reproduction.

Wind Energy Conversion System - A collection of tall windmills placed in an area that has suitable winds of consistent speeds, such as a prairie or ridge. As the wind turns the blades, the motion drives a generator that creates electricity.

APPENDIX E – ACRONYMS, SYMBOLS & ABBREVIATIONS

A	Ampere
ac	Acre
AC	Alternating Current
ACGIH	American Conference of Governmental Industrial Hygienists
ACHP	Advisory Council on Historic Preservation
ADA	Americans with Disabilities Act
ADEA	Age Discrimination in Employment Act
ADF	Automatic Direction Finder
APCD	Air Pollution Control Division
ARC	Atlantic Regional Commission
ASA	Architecturally-Sensitive Area
ATM	Automatic Teller Machine
ATSF	Atchison, Topeka and Santa Fe
BARC	Beltsville Agricultural Research Center
BGE	Baltimore Gas and Electric
BLM	Bureau of Land Management
BMP	Best Management Practices
BTU	British Thermal Unit
BW	Baltimore-Washington
BWI	Baltimore-Washington International Airport
C	Centigrade
CARB	California Air Resources Board
CARL	Florida Conservation and Recreation Land
CARTA	Chattanooga Area Regional Transportation Authority
CAT	Citizen’s Area Transit
CBD	Central Business District
CBTC	Communications-Based Train Control
CCT	Cobb Community Transit
CDRH	Center for Devices and Radiologic Health
CEC	California Energy Commission
CEQ	Counsel on Environmental Quality
CFR	Code of Federal Regulations
CM	Centimeter
CMAQ	Congestion Mitigation and Air Quality
CMP	Coastal Zone Management Plan
CMS	Congestion-Management System
CO	Carbon Monoxide
COE	U.S. Army Corps of Engineers
COMAR	Code of Maryland Regulations
CWA	Clean Water Act
CZM	Coastal Zone Management
DC	Direct Current
DCA	Ronald Reagan International Airport
DNR	Department of Natural Resources

DNR	Department of Natural Resources
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
EA	Environment Assessment
E1EM	Estuarine Sub-Tidal Emergent
E2EM	Estuarine Inter-Tidal Emergent
ECAR	East Central Area Coordination Region
EDF	Environmental Defense Fund
EEOC	Equal Employment Opportunity Commission
EIS	Environmental Impact Statement
EJ	Environmental Justice
ELF	Extremely Low Frequency
EM	Electromagnetic
EMC	Electromagnetic Compatibility
EMF	Electromagnetic Fields
EMI	Electromagnetic Interference
EMR	Electromagnetic Radiation
EPA	Environmental Protection Agency
EPD	Environmental Protection Division
ESD	Electrodynamically Suspended
ESD	Electrostatic Discharge
ESH	Environment, Safety and Health
F	Fahrenheit
f	Frequency
FAA	Federal Aviation Administration
FDOT	Florida Department of Transportation
FEC	Florida East Coast
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FHBM	Flood Hazard Boundary Maps
FHWA	Federal Highway Administration
FIDS	Forest-Interior-Dwelling-Species
FIRM	Flood Insurance Rate Map
FP&L	Florida Power and Light Company
FPPA	Farmland Protection Policy Act
FRA	Federal Railroad Administration
ft	Foot
FTA	Federal Transit Administration
G	Gauss
Gal	Gallon
GEMS	Gulf Coast Ecologist Management Sites
GPS	Global Positioning System
GRTA	Georgia Regional Transportation Authority
ha	Hectare
HABS	Historic Building Survey

HAER	Historic American Engineering Record
HAIA	Hartsfield Atlanta International Airport
HF	High Frequency
HSGT	High-Speed Ground Transportation
HSR	High-Speed Rail
HU	Habitat Unit
HVAC	Heating, Ventilation and Air Conditioning
Hz	Hertz
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEC	International Electrotechnical Commission
I/M	Inspection and Maintenance
IAD	Dulles International Airport
ICE	Intercity Express
IN	Inch
IRL	Indian River Lagoon
JeT	Jefferson Transit-East Bank
KCS	Kansas City Southern
Kg	Kilograms
Km	Kilometers
Km/h	Kilometers per Hour
Km/l	Kilometers per Liter
KSC	Kennedy Space Center
kV	Kilovolt
kW/h	Kilowatt Hours
L	Liters
Lb	Pound
LAX	Los Angeles International Airport
LOS	Level-of-service
LPG	Liquid Petroleum Gas
LSM	Linear Synchronous Motor
M	Meter
Maglev	Magnetic Levitation
MAP	Millions-of-air-passengers
MARC	Maryland Rail Commuter
MARTA	Metropolitan Atlanta Rapid Transit Authority
MD DNR	Maryland Department of Natural Resources
MG	Milli-Gauss
Mg/m^3	Micrograms per Cubic Meter
Mi	Miles
MINWR	Merritt Island National Wildlife Refuge
MJ	Megajoules
MPG	Miles per Gallon
MPH	Miles per Hour
MPO	Metropolitan Planning Organization
MTA	Maryland Mass Transit Administration
MTA	Metropolitan Transportation Authority

MW	MegaQatt
NAA	Non-Attainment Areas
NAAQS	National Ambient Air Quality Standards
NAC	Noise Abatement Criteria
NASA	National Aeronautics and Space Administration
NCPC	National Capital Planning Commission
NDDB	Natural Diversity Database
NDOT	Nevada Department of Transportation
NEC	Northeast Corridor
NECIP	Northeast Corridor Improvement Project
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Council
NFIP	National Flood Insurance Program
NOAB	New Orleans Aviation Board
NOIA	New Orleans International Airport
NOx	Nitrogen Oxide
NPC	Nevada Power Company
NPDES	National Pollution Discharge Elimination System
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NWI	National Wildlife Inventory
NWI	National Wildlife Inventory
NWI	National Wetlands Inventory
O&M	Operation and Maintenance
OAQPS	Office of Air Quality Planning and Standards
OCS	Overhead Catenary System
OFW	Outstanding Florida Waters
ONT	Ontario International Airport
OSHA	Occupational Safety and Health Administration
PAAC	Port Authority of Allegheny County
PEIS	Programmatic Environmental Impact Statement
PEPCO	Potomac Electric Power Company
PFA	Priority Funding Area
PFO	Palustrine Forested
PIT	Pittsburgh International Airport
PJM	Pennsylvania, New Jersey, Maryland
PM	Particulate Micrometers
PPM	Parts Per Million
PTC	Positive Train Control
PTG	Parsons Transportation Group
PWRC	Patuxent Wildlife Research Center
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
ROD	Record of Decision
ROW	Right-of-Way
RPS	Regional Planning Commission

RSPA	Research and Special Programs Administration
RTA	Regional Transportation Authority
RTP	Regional Transportation Plan
RV	Recreational Vehicle
SACP	Safety Assurance and Compliance Program
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCR	Silicon Controlled Rectifier
SCRA	Space Coast Regional Airport
SDWA	Safe Drinking Water Act
SHE	Safety, Health and Environment
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SPC	Southwestern Pennsylvania Commission
SOV	Single-Occupancy Vehicle
SR	State Route
STP	Surface Transportation Program
SWPPP	Storm Water Pollution Prevention Plan
T	Tesla
T&D	Transportation and Distribution
TEA	Transportation Equity Act
TGV	Train a Grande Vitesse
TRB	Transportation Research Board
TRI	Transrapid International
TSM	Transportation System Management
~g/m^3	Micrograms per Cubic Meter
UHF	Ultra High Frequency
UP	Union Pacific
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
V	Volt
VHF	Very High Frequency
VKT	Vehicle-Kilometers Traveled
VMT	Vehicle-Miles Traveled
VOC	Volatile Organic Compound
Volpe Center	John A. Volpe National Transportation Systems Center
VOR	Very High Frequency Omni-Range
VSR	Visually Sensitive Receptor
VVVR	Variable Voltage Vehicle Frequency
WHO	World Health Organization
WMA	Wildlife Management Areas
WMATA	Washington Metropolitan Area Transit Authority
WSSC	Wetlands of Special State Concern
WSSC	Wetlands of Special State Concern

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APPENDIX F – NOTICE OF INTENT

[Federal Register: December 29, 1999 (Volume 64, Number 249)]
[Notices]
[Page 73117-73118]
From the Federal Register Online via GPO Access [wais.access.gpo.gov]
[DOCID:fr29de99-162]

DEPARTMENT OF TRANSPORTATION

Federal Railroad Administration

Programmatic Environmental Impact Statement for the Maglev Deployment Program

AGENCY: Federal Railroad Administration (FRA), U.S. Department of Transportation (DOT).

ACTION: Notice of intent to prepare an Environmental Impact Statement.

SUMMARY: FRA is issuing this notice to advise the public that FRA will prepare a programmatic environmental impact statement (PEIS) for the Maglev Deployment Program, to solicit public and agency input into the development of the scope of that PEIS, and to advise the public that outreach activities conducted by the program participants will be considered in the preparation of the PEIS.

FOR FURTHER INFORMATION CONTACT: For further information regarding the programmatic environmental review, please contact: David Valenstein, Environmental Program Manager, Office of Passenger Programs, Federal Railroad Administration (RDV 10), 400 Seventh Street, SW (Mail Stop 20), Washington, D.C. 20590, (telephone 202 493-6368). For information regarding the Maglev Deployment Program, please contact: Arnold Kupferman, Maglev Program Manager, Office of Railroad Development, Federal Railroad Administration (RDV-2), 400 Seventh Street, SW (Mail Stop 20), Washington, D.C. 20590, (telephone 202 493-6370). For further information regarding any of the individual projects, please contact the applicant representatives identified below under the Alternative Sites heading.

SUPPLEMENTARY INFORMATION:

Background

Section 1218 of the Transportation Equity Act for the 21st Century (TEA 21) added section 322 to title 23 of the United States Code. Section 322 provides a total of $55 million for Fiscal Years 1999 through 2001 for transportation systems employing magnetic levitation (``Maglev'') and an authorization of appropriations for an additional $950 million over Fiscal Years 2000 through 2003. Responsibility for implementing the program has been delegated by the Secretary of Transportation to the Federal Railroad Administrator. Section 322 requires FRA to establish project selection criteria, to solicit applications for funding, to select one or more projects to receive financial assistance for preconstruction planning activities, and, after completion of such activities, to provide financial assistance for final design, engineering, and construction activities leading to the implementation of a maglev deployment project.

FRA has determined that implementing the maglev deployment program is a major Federal action with the potential to significantly impact the human environment. As a consequence, FRA is initiating the preparation of an EIS as required under the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 et seq.) and the regulations of the President's Council on Environmental Quality implementing NEPA (40 CFR 1500 et seq.). FRA intends to prepare a programmatic EIS (PEIS) to address the selection process and the potential for significant environmental impact from the maglev deployment program. The agency will prepare additional site specific environmental reviews, as appropriate, as the program progresses.

The Environmental Review Process

As provided for in 23 U.S.C. 322, FRA has initiated a competition to select a project for the purpose of demonstrating the use of maglev technology to the American public. Using criteria specified in section 322, FRA has selected seven projects, sponsored by States or their designated agencies, to receive preconstruction planning grants. As a part of the preconstruction planning effort, FRA has required the seven applicants to prepare environmental assessments and conduct public involvement and scoping activities for their respective project proposals. FRA will use these individual project environmental assessments and records of agency and public comment and participation in preparing the PEIS, which will be made available to the public for comment. FRA anticipates issuing a draft EIS in the summer of 2000. After reviewing comments on the draft PEIS, FRA will prepare a final PEIS that addresses these comments and incorporates any additional analyses and material deemed necessary. The final PEIS will be made available for public review for not less than 30 days before FRA takes any final action on the program.

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Alternatives Sites

The following applicants and projects (with identified applicant representatives) were selected by the Secretary to receive preconstruction planning assistance and represent the range of potential program alternatives:

- Port Authority of Allegheny County: A 45-mile project linking Pittsburgh Airport to Pittsburgh and its eastern suburbs (Mr. Bruce W. Ahern, Port Authority of Allegheny County, 2235 Beaver Avenue, Pittsburgh, PA 15233-1080, telephone 412-237-6121).

- Maryland Department of Transportation: A 40-mile project linking Camden Yard in Baltimore and Baltimore-Washington International Airport to Union Station in Washington, D.C. (Mr. Suhair Alkhatib, Maryland Mass Transit Administration, William Donald Schafer Tower, 6 St. Paul Street, Baltimore, MD 21202-1614, telephone 410-767-3751).
- California-Nevada Super Speed Train Commission: A 42-mile project linking Las Vegas to Primm, Nevada (Ms. Richann Johnson, Executive Assistant, California-Nevada Super Speed Train Commission, 400 Las Vegas Blvd. South, Las Vegas, NV 89101, telephone 702-229-6551).
- Florida Department of Transportation: A 20-mile project linking Port Canaveral to the Space Center and the Titusville Regional Airport (Mr. Nazih K. Haddad, Manager, Intercity Passenger Rail, Florida Department of Transportation, 605 Suwannee Street, Mail Station 57, Tallahassee, FL 32399-0450, telephone 850-414-4534).
- Greater New Orleans Expressway Commission: A 40-mile project linking New Orleans Union Passenger Terminal to the airport and across Lake Ponchartrain to the northern suburbs (Mr. Bryan Clement, Greater New Orleans Expressway Commission, 3943 N. Causeway Blvd., Metairie, LA 70002, telephone 504-835-3116).
- Georgia/Atlanta Regional Commission: First 40 miles of 110-mile project from Atlanta to Chattanooga, TN. (Mr. Robert McCord, Maglev Project Manager, The Atlanta Regional Commission, 40 Courtland Street, NE, Atlanta, GA 30303, telephone 404-463-3253).
- State of California: A 70-to 75-mile system connecting Los Angeles International Airport to Union Station in downtown Los Angeles to Ontario Airport and further east into Riverside County (Mr. Albert Perdon, Maglev Project Director, Albert Perdon & Associates, 12748 Castleford Lane, Cerritos, CA 90703, telephone 310-871-1113).

Scoping and Comments

FRA encourages broad participation in the EIS process during scoping and review of the resulting environmental documents. Comments and suggestions are invited from all interested agencies and the public at large to insure the full range of issues related to the proposed action and all reasonable alternatives are addressed and all significant issues are identified. In particular, FRA is interested in determining whether there are areas of national environmental concern where there might be the potential for significant impacts, either adverse or favorable, as a result of advancing the maglev deployment program. Because the applicants are required to conduct public outreach as part of their preparation of environmental assessments, FRA does not plan to hold public scoping meetings. The applicants are responsible for contacting appropriate Federal, State, and local agencies, private organizations and citizens to solicit input regarding their respective program alternatives. Persons interested in providing comments on the scope of the programmatic environmental document should do so by February 18, 2000. Comments can be sent in writing to Mr. David Valenstein at the address identified above. Persons interested in providing comments on issues of environmental concern with respect to any of the individual projects should contact the applicant representatives identified above. FRA has in place a Maglev Deployment Program page (http://www.fra.dot.gov/o/hsgt/maglev.htm) on the agency's Internet site where the public can obtain additional information related to the Maglev Deployment Program. FRA also intends to establish a separate page on the agency's site specifically addressing the environmental impact statement process for the Maglev Deployment Program.

Issued in Washington, D.C. on: December 20, 1999.
Arrigo P. Mongini, Acting Associate Administrator for Railroad Development.
[FR Doc. 99-33788 Filed 12-28-99; 8:45 am]
BILLING CODE 4910-06-P

APPENDIX G – LIST OF RECIPIENTS OF THE PEIS

Washington Agencies

Mr. Joseph Montgomery
Director, NEPA Compliance Division
U.S. Environmental Protection Agency
Ariel Ross Building
Room 7241
1200 Pennsylvania Avenue
Washington, DC 20004

Mr. Ken Mittelholtz
Office of Federal Activities
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Ms. Cynthia J. Burbank
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National Association of Counties
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Mr. Thomas R. Warne
President
American Association of State Highway and Transportation Officials
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Washington, DC 20001

Mr. Edward R. Hamberger
President and Chief Executive Officer
Association of American Railroads
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Mr. Frank K. Turner
President
American Short Line Railroad Association
1120 G Street, NW, Suite 520
Washington, DC 20005

Mr. Robert Matthews
President
Railway Progress Institute
700 North Fairfax Street
Suite 601
Alexandria, VA 22314-2098

Mr. Donald J. Borut
Executive Director
National League of Cities
1301 Pennsylvania Avenue, NW
Washington, DC 20004

Mr. J. Thomas Cochran
Executive Director
The U.S. Conference of Mayors
1620 Eye Street, NW
Washington, DC 20006

Mr. William R. Dodge
Executive Director
National Association of Regional Councils
1700 K Street, NW, Suite 1300
Washington, DC 20006

M. John Berry
U.S. Department of the Interior
1849 C. Street, NW
Washington, DC 20240

California

Federal Agencies

U.S. Army Corps of Engineers
Los Angeles District
P.O. Box 53271
Los Angeles, CA 90053

U.S. Environmental Protection Agency, Region IX
75 Hawthorne Street
San Francisco, CA 94104

U. S. Department of the Interior
600 Harrison Street, Suite 515
San Francisco, CA 94104

National Park Service
Pacific West Region
600 Harrison Street, Suite 600
San Francisco, CA 94107

U.S. Fish and Wildlife Service
Carlsbad Field Office
2730 Locker Avenue, West
Carlsbad, CA 92008

U.S. Department of Transportation
Federal Aviation Administration
Western Pacific Region H.Q.
Quality and Environment
World Way Postal Center
Box 92007
Los Angeles, CA 90009

Federal Highway Administration
Western Resource Center
201 Mission Street, Suite 2100
San Francisco, CA 94105

Federal Railroad Administration
Riverside Field Office
1770 Iowa Avenue, Suite 230
Riverside, CA 92507

Federal Transit Administration
Regional Office
21 Main Street, Suite 2210
San Francisco, CA 94105

Advisory Council on Historic Preservation
Denver Office
12136 W. Bajaud Avenue
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Senators and Representatives

The Honorable Barbara Boxer
United States Senate
312 N. Spring Street, Suite 1748
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The Honorable Dianne Feinstein
United States Senate
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The Honorable Maxine Waters
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The Honorable Gary G. Miller
U.S. House of Representatives
22632 Golden Springs Drive
Diamond Bar, CA 91765

The Honorable Ken Calvert
U.S. House of Representatives
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Riverside, CA 92506

Governor

The Honorable Gray Davis
State Capitol Building
Sacramento, CA 95814

State Agencies

California Department of Water Resources, Southern District
770 Fairmont Avenue, Suite 102
Glendale, CA 91203-1035

South Coast Air Quality Management District
21865 E. Copley Drive
Diamond Bar, CA 91765

Regional Water Quality Control Board
320 W. 4th Street, Suite 400
Los Angeles, CA 90013

California Business, Transportation and Housing Agency
980 Ninth Street, Suite 2450
Sacramento, CA 95814

Caltrans, District 7
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Los Angeles, CA 90012

Caltrans, District 8
464 West Fourth Street, 6^{th} Floor
San Bernardino, CA 92401-1400

California Environmental Protection Agency
555 Capitol Mall, Suite 235
Sacramento, CA 95814

California Air Resources Board
Box 2815
Sacramento, CA 95812

State Water Resources Control Board
901 P Street
Sacramento, CA 95814

Los Angeles Regional Water Control Board
101 Centre Plaza Drive
Monterey Park, CA 91754-2156

California Health and Human Services Agency
Statewide Health Planning and Development
1600 Ninth Street, Room 433
Sacramento, CA 95814

Department of Health Services
714/744 P Street
Sacramento, CA 95814

California High Speed Rail Authority
925 L Street, Suite 1425
Sacramento, CA 95814

California Native American Heritage Commission
915 Capitol Mall, Room 364
Sacramento, CA 95814

California Resources Agency
1416 Ninth Street, Room 1131
Sacramento, CA 95814

California Coastal Commission
South Coast Area Office
200 Oceangate, 10th Floor
Long Beach, CA 90802

California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

California Department of Fish and Game
4949 Viewridge Avenue
San Diego, CA 92123

California Department of Parks and Recreation
1416 Ninth Street
Sacramento, CA 95814

Environmental Design, Planning, Acquisition, and Local Services
1416 Ninth Street
Sacramento, CA 95814

California State Historic Preservation Officer
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Sacramento, CA 95814

California Department of Water Resources
P.O. Box 942836, Room 1115-1
Sacramento, CA 94236-0001

State Lands Commission
100 Howe Avenue
Suite 100 South
Sacramento, CA 95285

Environmental Planning and Management
100 Howe Avenue
Suite 100 South
Sacramento, CA 95285

California Trade and Commerce Agency
801 K Street, Suite 1700
Sacramento, CA 95814

Regional Agencies

Southern California Association of Governments
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Gateway Cities Council of Governments
7300 Alondra Boulevard
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San Bernardino Associated Governments
472 N. Arrowhead Avenue
San Bernardino, CA 92401

San Gabriel Valley Council of Governments
3871 E. Colorado Boulevard #101
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One Civic Plaza
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Environmental and Hazardous Materials Management
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Foothill Transit Authority
100 N. Barrabca Avenue
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West Covina, CA 91791-1600

Los Angeles to Pasadena Blue Line Construction Authority
625 S. Fair Oaks Avenue
South Pasadena, CA 91030

Los Angeles World Airports
Authority
One World Way
Los Angeles, CA 90045

March Joint Powers Authority
P.O. Box 7480
Moreno Valley, CA 92552

Los Angeles County Metropolitan
Transportation Authority
One Gateway Plaza
Los Angeles, CA 90012-2952

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1700 W. Fifth Street
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P.O. Box 1090
Riverside, CA 92502

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1825 Third Street
Riverside, CA 92507

Southern California Air Quality
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Diamond Bar, CA 91765

Union Pacific Railroad
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Los Angeles County
Environmental Planning &
Evaluation
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Monterey Park, CA 91754

Riverside County
County Administrative Center
Transportation / Land
Management
4080 Lemon Street
Riverside, CA 92501

San Bernardino County
Planning Department
385 North Arrowhead, 3rd Floor
San Bernardino, CA 92415-0182

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City of Alhambra
111 South First Street
Alhambra, CA 91801

City of Arcadia
240 West Huntington Drive
Arcadia, CA 91007

City of Azusa
213 East Foothill Boulevard
Azusa, CA 91702

City of Baldwin Park
14403 East Pacific Avenue
Baldwin Park, CA 91706

City of Bell
6330 Pine Avenue
Bell, CA 90201-1290

City of Chino
13220 Central Avenue
Box 667
Chino, CA 91708-0667

City of Chino Hills
2001 Grand Avenue
Chino Hills, CA 91709

City of Commerce
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City of Industry
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City of Claremont
P.O. Box 880
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City of Colton
650 North La Cadena Drive
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City of Compton
205 South Willowbrook Avenue
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City of Corona
815 West 6th Street
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City of El Monte
11333 Valley Boulevard
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City of El Segundo
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City of Fontana
8353 Sierra Avenue
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City of Gardena
1700 West 162nd Street
Gardena, CA 90247

City of Glendale
613 East Broadway
Glendale, CA 91206

City of Glendora
Glendora City Hall
116 East Foothill Boulevard
Glendora, CA 91741

City of Grand Terrace
22795 Barton Road
Grand Terrace, CA 92324

City of Hawthorne
445 West 126th Street
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City of Huntington Park
6550 Miles Avenue
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City of Inglewood
One Manchester Boulevard
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City of Irwindale
5050 North Irwindale Avenue
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City of La Puente
15900 East Main Street
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City of La Verne
3660 D Street
La Verne, CA 9170-3599

City of Los Angeles
City Hall
200 North Spring Street
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City of Lynwood
11330 Bullis Road
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City of Maywood
4319 East Slauson Avenue
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City of Monrovia
415 South Ivy Avenue
Monrovia, CA 91016
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City of Montclair
5111 Benito Street
Montclair, CA 91763

City of Montebello
1600 Beverly Boulevard
Montebello, CA 90640

City of Monterey Park
Municipal Services Center
320 West Newmark Avenue
Monterey Park, CA 91754

City of Moreno Valley
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City of Ontario
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City of South El Monte
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City of West Covina
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West Covina, CA 91793

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500 West Broadway
Anaheim, CA 92805

Arcadia Public Library
20 West Durate Road
Arcadia, CA 92805-3699

Bruggemeyer Memorial Library
318 South Ramona Avenue
Monterey Park, CA 91754

University Library
Document Section
California State University
Fullerton
P.O. Box 4150
Fullerton, CA 92834

Pearson Library
California Lutheran University
60 West Olsen Road
Thousand Oaks, CA 91360

Delmar T. Oviatt Library
California State University
Northridge
1811 Nordhoff Street
Northridge, CA 91330

Kennedy Memorial Library
California State University
Los Angeles
5151 State University Drive
Los Angeles, CA 90032-8300

Honnold Mudd Library
Government Publications Dept
Claremont Colleges
800 Dartmouth Street
Claremont, CA 91711-3907

West Covina Public Library
1601 West Covina Parkway
West Covina, CA 91790-2785

Carson Regional Library
Government Publications Unit
151 East Carson Street
Carson, CA 90745

Montebello Regional Library
1550 West Beverly Boulevard
Montebello, CA 90640

Norwalk Regional Library
12350 Imperial Highway
Norwalk, CA 90650-3199

Valencia Library
23743 West Valencia Boulevard
Valencia, CA 91355

Angelo M. Iscoboni Library
4990 Clark Avenue
Lakewood, CA 90712-2676

Culver City Library
Government Documents
4975 Overland Avenue
Culver City, CA 90230

Doheny Memorial Library
USC
Government Documents
MC-0182
University Park
Los Angeles, CA 90089-0182

Garden Grove Regional Library
11200 Stanford Avenue
Garden Grove, CA 92640-5318

Inglewood Public Library
101 W. Manchester Boulevard
Inglewood, CA 90301-1771

Lancaster Public Library
601 W. Lancaster Boulevard
Lancaster, CA 93534

Long Beach Public Library
101 Pacific Avenue
Long Beach, CA 90822-1097

Los Angeles Central Library
Serials Division
630 W. 5th Street
Los Angeles, CA 90071-2002

Mary Norton Clapp Library
Documents Division
Occidental College
1600 Campus Road
Los Angeles, CA 90041-3392

Ontario City Library
215 East C Street
Ontario, CA 91764

Palm Springs Public Library
Technical Services Section
300 S. Sunrise Way
Palm Springs, CA 92262

Pasadena Public Library
285 East Walnut Street
Pasadena, CA 91101-1598

Payson Library
Pepperdine University
24255 Pacific Coast Highway
Malibu, CA 91263-1771

Riverside City/County Library
3581 Seventh Street
Riverside, CA 92501

San Bernardino County Library
104 W. Fourth Street
San Bernardino, CA 92415-0035

Santa Ana Public Library
Documents Section
26 Civic Center Drive
Santa Ana, CA 92701

School of Law Library
Southwestern University
675 S. Westmoreland Avenue
Los Angeles, CA 90005-3992

Torrance Public Library
3301 Torrance Boulevard
Torrance, CA 90503-5013

University Research Library
UCLA
Maps & Government Information
405 Hilgard Avenue
Los Angeles, CA 90095-1575

Government Information
Department
University of California Irvine
Campus Drive, Building 102
Irvine, CA 92623

College of Law Library
University of La Verne
1950 Third Street
La Verne, CA 91709-0000

Armacost Library
University of Redlands
1249 East Colton Avenue
Redlands, CA 92374

Rivera Library
University of California Riverside
P.O. Box 5900
Riverside, CA 92517

E.P. Foster County Library
651 E. Main
Ventura, CA 93002

Wardman Library Government
Documents
Whittier College
13406 East Philadelphia Street
Whittier, CA 90680

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Federal Agencies

Federal Aviation Administration
5950 Hazeltine National Drive
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Orlando, FL 32822

Federal Emergency Management Agency
3003 Chamblee Tucker Road
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Kennedy Space Center, FL 32899

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John F. Kenneddy Space Center
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Patrick AFB, FL 32925-3341

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400 West Bay Street
Jacksonville, FL 32232-0019

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909 SE 1st Avenue
Miami, FL 33131

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1315 East-West Highway
Silver Springs, MD 20910

U. S. Department of Interior
Buerau of Land Management
411 Bliarwood Drive, Suite 404
Jackson, MS 39206

U. S. Department of Interior
National Parks Service
100 Alabama Street, Bldg. 1924
Atlanta, GA 30303

U. S. Environmental Protection Agency
61 Forsyth Street, SW
Atlanta, GA 30303

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U.S. Army Corps of Engineers
Regulatory Division
Atlantic Permits Branch
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Jacksonville, FL 32202

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United States Coast Guard
Seventh Coast Guard District
Brickell Plaza Federal Building,
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Miami, FL 33131

Alfred F. Ames
U.S. Department of Commerce
Economic Development Administration
304 North 8th Street, Room 841
Boise, ID 83702

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United States Senate
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The Honorable Connie Mack
United States Senate
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The Honorable Dave Weldon
U.S. House of Representatives
2725 Judge Fran Jamieson Way
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Governor

The Honorable Jeb Bush
The Capitol
Tallahassee, FL 32399

State Agencies

Florida Department of Community Affairs
2555 Shumard Oak Boulevard
Tallahassee, FL 32399-2100

Virginia Wetherell, Secretary
Florida Department of Environmental Protection
Land Use & Biological Services
3900 Commonwealth Boulevard
MS 130
Tallahassee, FL 32399

Florida Department of State
PL-02, The Capitol
Tallahassee, FL 32399

Florida Department of
Transportation-Central Office
605 Suwannee Street
Mail Station 59
Tallahassee, FL 32399

Florida Department of
Transportation-District 5
(Orlando Office)
719 S. Woodland Boulevard
Deland, FL 32720-6834

Florida Department of
Transportation
Orlando Urban Office
5151 Adanson Street
Orlando, FL 32804

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Florida Game & Fresh Water Fish
Commission
620 South Meridian Street
Tallahassee, FL 32399

Robert Bradley, Secretary
Florida Land & Water
Adjudicatory Commission
Office of the Governor
The Capitol
Tallahassee, FL 32399

Florida Transportation
Commission
605 Swuannee Street, M.S.9
Tallahassee, FL 32399-0450

Mr. James Wood
Florida Department of
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Office of Siting Coordination
3900 Commonwealth Boulevard
Tallahassee, FL 32399

Mr. Bradley J. Hartman
Florida Fish and Wildlife
Conservation Commission
Office of Environmental Services
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Winter Park, FL 32789

Regional Agencies

East Central Florida Regional
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Economic Development
Commission
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57-Y Harvey Court
Rockledge, FL 32955

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District
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Orlando, FL 32809

Southwest Florida Water
Management District
2379 Broad Street
Brooksville, FL 34609

Space Coast Area Transit
401 South Varr
Cocoa, FL 32922

Space Coast Development
Commission
2000 South Washington Avenue
Titusville, FL 32780-4739

Space Coast Regional Airport
355 Golden Knights Boulevard
Titusville, FL 32780

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Orlando International Airport
One Airport Boulevard
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Counties

Brevard County Board of County
Commissioners
2725 Judge Fran Jamieson Way
or Building C
Viera, FL 32940

Brevard County Metropolitan
Planning Organization
2715 Judge Fran Jamieson Way
or Building A
Viera, FL 32940

Mr. Bob Kamm
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2715 Judge Fran Jamieson Way
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Cities

City of Cape Canaveral
105 Polk Avenue
P.O. Box 326
Cape Canaveral, FL 32920

City of Cocoa
603 Brevard Avenue
Cocoa, FL 32922

City of Cocoa Beach
2 South Orlando Avenue
Cocoa Beach, FL 32931

City of Melbourne
900 East Strawbridge Avenue
Melbourne, FL 32901

City of Palm Bay
120 Malabar Road, SE
Palm Bay, FL 32901

City of Rockledge
916 Brunswick Lane
Rockledge, FL 32955

City of Titusville
P.O. Box 2806
Titusville, FL 32781-2806

Libraries

Cape Canaveral Public Library
201 Polk Avenue
Cape Canaveral, FL 32920

Central Brevard Library and Reference Center
308 Forrest Avenue
Cocoa, FL 32922

Cocoa Beach Public Library
550 North Brevard Avenue
Cocoa Beach, FL 32931

Melbourne Public Library
540 East Fee Avenue
Melbourne, FL 32901

Merritt Island Public Library
1195 North Courtenay Parkway
Merritt Island, FL 32953

South Orange Library
11346 South Orange Blossom Trail
Orlando, FL 32837

Others

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Archie Carr National Wildlife Refuge
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Canaveral Port Authority
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Cape Canaveral, FL 32920

Cocoa Beach Area Chamber of Commerce
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Cocoa Beach, FL 32931

Melbourne Airport Authority
One Air Terminal Parkway
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Merritt Island Homeowners Association
1085 Pine Island Road
Merritt Island, FL 32953

Merritt Island National Wildlife Refuge
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1331 Palmetto Avenue
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Defenders of Wildlife
8175 Imber Street
Orlando, FL 32828

Florida Defenders of the Environment
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Gainesville, FL 32609

Florida Wildlife Federation
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Tallahassee, FL 32314-6870

National Wildlife Federation
2590 Golden Gate Parkway
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Sierra Club-Florida Chapter
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Georgia Department of Natural Resources
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Georgia Department of Transportation
No. 2 Capital Square
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Comm. Wayne Shackleford
Georgia Department of Transportation
State Capitol
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William M. Tomlinson, Director
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270 Washington Street, SW
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Georgia Department of Transportation
Office of Environment and Location
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Hal Wilson
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Tennessee Department of Transportation
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200 City Hall Annex
100 E 11th Street
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Upper Chattahoochee Riverkeeper
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Nick Ogden, Chief
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Cobb County Community Development Department
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Mr. Dan Dobry
Cobb County Department of Transportation
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Mr. Nayef Haddad, Director
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Ms. Nancy Leathers, Director
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Maryland City at Russett Branch
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Laurel, MD 20724

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Odenton Branch
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Odenton, MD 21113

Provinces Branch
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Severn Square Shopping Center
Severn, MD 21144

Laurel Branch
507 7th Street
Laurel, MD 20707

Beltsville Branch
4319 Sellman Road
Beltsville, MD 20705

Hyattsville Branch
6532 Adelphi Road
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Greenbelt Branch
11 Crescent Road
Greenbelt, MD 20770

New Carrollton Branch
7414 Riverdale Road
New Carrollton, MD 20784

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4820 Annapolis Road
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Mount Rainier Branch
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Light Street Branch
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Woodridge Regional Library
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APPENDIX H – ACOUSTIC TERMINOLOGY

This section presents pertinent terminology used throughout the noise and vibration sections of this document. Terminology is generally consistent with ANSI standards S1.1-1994, S12.8-1998, S12.18-1994 and S1.4-1983 (R1997), as well as Johnson, et al. (Johnson, 1991.)

A-Weighting: The weighting network used to account for changes in level sensitivity as a function of frequency. The A-weighting network de-emphasizes the high (6.3 kHz and above) and low (below 1 kHz) frequencies, and emphasizes the frequencies between 1 kHz and 6.3 kHz, in an effort to simulate the relative response of the human ear. See also frequency weighting.

Acoustic Energy: Commonly referred to as the mean-square sound-pressure ratio, sound energy, or just plain energy, acoustic energy is the square of the ratio of the mean-square sound pressure (often frequency weighted), and the reference mean-square sound pressure of 20 μPa, the threshold of human hearing. It is arithmetically equivalent to $10^{(SPL/10)}$, where SPL is the sound pressure level, expressed in decibels.

Ambient Noise: All-encompassing sound that is associated with a given environment, usually a composite of sounds from many sources near and far.

Background Noise: All-encompassing sound of a given environment without the sound source of interest.

Day-Night Average Sound Level (DNL, denoted by the symbol, L_{dn}): A 24-hour time-averaged L_{AE}, adjusted for average-day sound source operations. The adjustment includes a 10-dB penalty for operation, denoted by the symbol N, occurring between 2200 and 0700 hours, local time. L_{dn} is computed as follows:

$$L_{dn} = L_{AE} + 10*\log_{10}(N_{day} + 10*N_{night}) - 49.4(\text{dB})$$

where:

L_{AE}	=	Sound exposure level in dB;
N_{day}	=	Number of vehicle pass-bys between 0700 and 1900 hours, local time;
N_{night}	=	Number of vehicle pass-bys between 1900 and 0700 hours, local time; and
49.4	=	A normalization constant which spreads the acoustic energy associated with highway vehicle pass-bys over a 24-hour period, i.e., $10*\log_{10}$(86,400 seconds per day) = 49.4 dB.

Decibel (dB): A unit of measure of sound level. The number of decibels is calculated as ten times the base-10 logarithm of the square of the ratio of the mean-square sound pressure (often frequency weighted), and the reference mean-square sound pressure of 20 μPa, the threshold of human hearing. The following figure presents a comparison of typical A-weighted decibel sound levels.

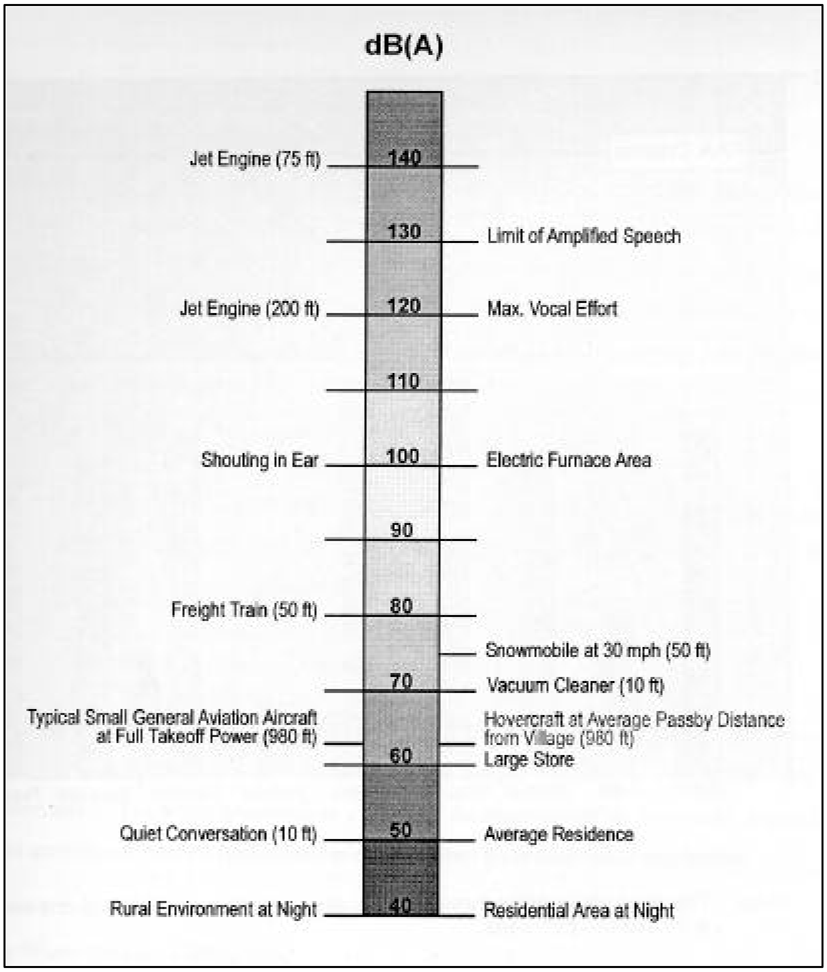

Figure H-1 - A-Weighted Sound Levels

Energy: See Acoustic energy.

Equivalent Sound Level (TEQ, denoted by the symbol, L_{AeqT}): Ten times the base-10 logarithm of the square of the ratio of time-mean-square, instantaneous A-weighted sound pressure, during a stated time interval, T (where $T=t_2-t_1$), divided by the squared reference sound pressure of 20 µPa, the threshold of human hearing; e.g., 1HEQ, denoted by the symbol, L_{Aeq1H}, represents the hourly equivalent sound level. L_{AeqT} is related to L_{AE} by the following equation:

$\mathbf{L_{AeqT}} = L_{AE} - 10*\log_{10}(t_2-t_1)$ (dB)

where L_{AE} = Sound exposure level in dB.

L_{AE}: See Sound exposure level.

L_{AeqT}: See Equivalent sound level.

L_{dn}: See Day-night average sound level.

Maximum Sound Level (MXFA or MXSA, denoted by the symbol, L_{AFmx} or L_{ASmx}): The maximum, A-weighted sound level associated with a given. Fast-scale response (L_{AFmx}) and slow-scale response (L_{ASmx}) characteristics effectively damp a signal as if it were to pass through a low-pass filter with a time constant of 125 and 1000 milliseconds, respectively. Note: Fast response is typically used for measuring individual highway vehicle pass-bys. Slow response is recommended for the measurement of long-term impact due to highway traffic noise, where impulsive noises are not dominant, and is also used for measurements of sound source levels, which vary slowly as a function of time, such as aircraft.

Noise: Any unwanted sound. “Noise” and “sound” are used interchangeably in this document.

Noise Barrier: The structure, or structure together with other material, that potentially alters the noise at a site from a BEFORE condition to an AFTER condition.

Sound Exposure Level (SEL, denoted by the symbol, L_{AE}): Over a stated time interval, T (where $T=t_2-t_1$), ten times the base-10 logarithm of the ratio of a given time integral of squared instantaneous A-weighted sound pressure, and the product of the reference sound pressure of 20 µPa, the threshold of human hearing, and the reference duration of 1 sec. The time interval, T, must be long enough to include a majority of the sound source’s acoustic energy. As a minimum, this interval should encompass the 10 dB down points.

In addition, L_{AE} is related to L_{AeqT} by the following equation:

$L_{AE} = L_{AeqT} + 10*\log_{10}(t_2-t_1)$ (dB)

where L_{AeqT} = Equivalent sound level in dB (see definition above).

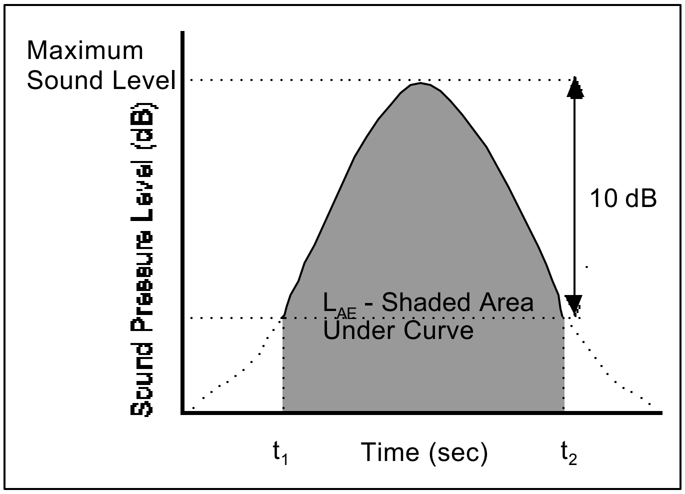

Figure H-2 - Graphical Representation of L_{AE}

APPENDIX I – FLORA AND FAUNA

Table I-1 - Maglev Alternatives Flora and Fauna Species (common names)

	Flora		Fauna		
California	Black walnut Fremont cottonwood Hoover's woolystar Live oak Marsh sandwort	Reed grass Santa Ana sucker Spine flower Willow (several species)	Arroyo chub Santa Ana sucker		
Florida	Blodgett's ironweed Blue butterwort Blunt-leaved peperomia Brown-haired snoutbean Cabbage palm Cinnamon fern Curtiss' milkweed Giant leatherfern Hand fern Lakala's mint Large-flowered rosemary Many-flowered grass pink Nodding pinewood	Queen's delight Rain lily Red maple Royal fern Sand pine Sand-dune spurge Satinleaf Sea grass Shell mound prickly pear cactus Small-leaved melanthera Snowy orchid Tampa vervain Terrestrial peperomia Tiny polygala Wax myrtle Wild coco Wild pine	Florida mouse West Indian manatee American oystercatcher Arctic peregrine falcon Black skimmer Brown pelican Florida burrowing owl Florida scrub-jay Least tern Limpkin Little blue heron Piping plover Red-cockaded woodpecker	Reddish egret Roseate tern Snowy egret Southeastern American kestrel Southern bald eagle Tricolored heron White ibis Wood stork Atlantic sturgeon Common snook American alligator Atlantic green turtle	Atlantic logger-head turtle Atlantic salt marsh snake Blue-tailed mole skink Eastern indigo snake Florida pine snake Gopher frog Gopher tortoise Roseate spoonbill Sand skink Short-tailed snake Florida grasshopper Sparrow
Georgia	Black willow Blackberry Broomsedge Chestnut oak Chinese privet Dandelions Dog fennel Eastern red cedar Ebony spleenwort Fescue Flowering dogwood Goldenrod Japanese honeysuckle	Juncus Oak Pignut hickory Pine Ragweed Red maple Sheep sorrel Smartweed Southern cattail Sweetgum White oak Yellow poplar	Bat Beaver Fox Mouse Muskrat Rabbit Skunk Squirrel Vole Water shrew White-tailed deer Woodchuck American robin Barred owl	Blue jay Bluebird Bobwhite quail Brown thrasher Common snipe Cooper's hawk Eastern meadowlark European starling Great blue heron Mallard Mockingbird Mourning dove Red-shouldered hawk	Red-tailed hawk Screech owl Warbler Wild turkey Wood duck Woodpecker Black racer snake Bull snake Bullfrog Green frog Painted turtle Rat snake Salamander Snapping turtle
Louisiana	Alligator weed Bald cypress Black rush Bulltongue Bulrush Buttonbush Cattail Duckweed Groundseltree Marsh-hay cordgrass Pennywort River seedbox	Saltgrass Sedge Smartweed Smooth beggarstick Smooth cordgrass Soft rush Spike-rush Switchgrass Water hyacinth Water tupelo Wax myrtle	Catfish Crappy Largemouth bass Sunfish	Black drum Blue crab Gulf Menhaden Southern flounder Other marine and estuarine species	
Maryland			Groundhog Raccoon White-tailed deer Canada geese		

Nevada	Creosotebush Hopsage Indigo bush Mormon tea Shadscale White burrobush Wolfberry	Bighorn sheep Coyote Elk Ground squirrel Jackrabbit Kangaroo rat	Kit fox Mule deer Pocket mouse Desert tortoise Side-blotched lizard Whiptail	
Pennsylvania	Aster Black cherry Dogwood Eastern hemlock Goldenrod Grass Grennbrier Hawthorn Hickory Multiflora rose Northern red oak Raspberry Red maple Sugar maple Sumac Viburnum White oak Yellow poplar	Beaver Cottontail rabbit Eastern chipmunk Gray squirrel Meadow vole Mink Mole Mouse Muskrat Raccoon Red fox Red squirrel Smoky shrew Southern bog lemming Star-nosed mole Striped skunk Virginia opossum Vole White-tailed deer Woodchuck	American kestrel Barred owl Belted kingfisher Black-billed cuckoo Brown-headed cowbird Common grackle Coopers hawk Eastern bluebird Eastern wild turkey Flycatcher Great horned owl Indigo bunting Killdeer Long-eared owl Northern cardinal Red-shouldered hawk Red-tailed hawk Red-winged blackbird Ruffed grouse Rufus-sided Towhee Sharpshinned hawk Sparrow	Swallow Swamp sparrow Thrush Timice Vireo Warbler Woodpecker Wren Black rat snake Eastern box turtle Eastern garter snake Eastern milk snake Five-lined skink Frog Mountain chorus frog Northern black racer snake Northern ring neck snake Painted turtle Salamander Snapping turtle Toad Water snake Woodland salamander

Source: (CM, 2000); (FDOT, 2000); (ARC, 2000); (GNOEA, 2000); (MTA, 2000); (CNSSTC, 2000); (PAAC, 2000)

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APPENDIX K - SCOPING LETTERS

RECEIVED 2/16/00

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U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION
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February 14, 2000
2 pages

David Valenstein
Environmental Program Mgr, Office of Passenger Programs
Federal Railroad Administration (RDV 10)
400 Seventh Street, SW (Mail Stop 20)
Washington, D.C. 20590

Dear Mr. Valenstein:

This letter is sent to you in response to the FRA notice in the December 29, 1999 Federal Register soliciting public input into the development of the scope of the programmatic environmental impact statement (PEIS) for the Maglev Development Program.

In this letter, I will not be discussing specifically safety issues, as my understanding is that such safety issues will be addressed in later Federal Register notices. Here I will address issues that affect the environmental evaluation, including quality of life issues of those near the maglev guideway.

In general, a maglev should be subject to the same analysis of environmental tradeoffs that any fixed guideway system would. This is especially true since most of the proposals are in urban or suburban areas with relatively high population densities, and so the presence of the maglev system will affect a large number of people.

The need for environmental input into decisions about whether to place individual line segments of a transportation facility on elevated structures, at ground level, or below ground, also applies to Maglev. Usually below ground will have the least effect on the environment, but it is also usually the most expensive.

An evaluation of the strength requirements for the vehicles is needed to determine the optimum environmental vs. safety trade-off. Different levels of vehicle strength can be achieved, but this will affect the vehicles' energy efficiency. There are many ways a maglev train could become involved in life-threatening situations for the occupants. These include maglev wrecks due to guideway damage (for example, a truck collision with a support post), an intrusion of objects into the clearance diagram of the maglev vehicle (including its under-running parts), a misaligned turnout, an operation control system malfunction, maintenance work, or vandalism. In these instances the vehicle strength will become an important consideration for passenger and crew survival, but various vehicle strengths need to be environmentally balanced against the economies of operation.

Based on my experience at the Maglev test facility near Emsland, Germany, both as a rider and from inspection of the infrastructure there from ground level, this test facility is in a flat, rural farming and forest area that has plenty of rainfall each year. This maglev, therefore, has not operated in an urban or suburban environment, nor in a dry, dusty climate. Noise, echoing off buildings rather than being absorbed by fields and forests, is a consideration. The visual intrusion of the guideway needs to be evaluated through computer drawings from many angles using actual construction dimensions, not only from photos where camera angles minimize the visual impact of supports. This is additionally true where guideway turnouts (to allow maglev vehicles to switch from one track to another) are placed, as these structures, with machinery to move the guideway, are massive. These turnouts may also create noise at some level.

The environmental affects of any specific design need to be evaluated. The guideway used on the Transrapid test track at Emsland has a wide, flat top, on which dirt and soot could collect if they were in an urban environment. The passing of the maglev at the 240mph speeds required could sweep much of this off and down from the guideway and create dusty, swirling wind not only above the guideway, but to the side and below it, because parts of the vehicle under-run the guideway surface. The affect of these possibly dusty and high speed wind swirls on the quality of life of those near the guideway need to be taken into account. Winter storms will leave snow and ice to be swirled from the guideway. While in a rural area with almost no pedestrians the negative affect might be negligible, this would not be true in an urban environment. If the Maglev operates in a dry area, these effects will made worse by abrasive dust and small sand particles, which also could cause wear to the maglev parts as the dust and sand move in the small air gap between the guideway and the vehicle.

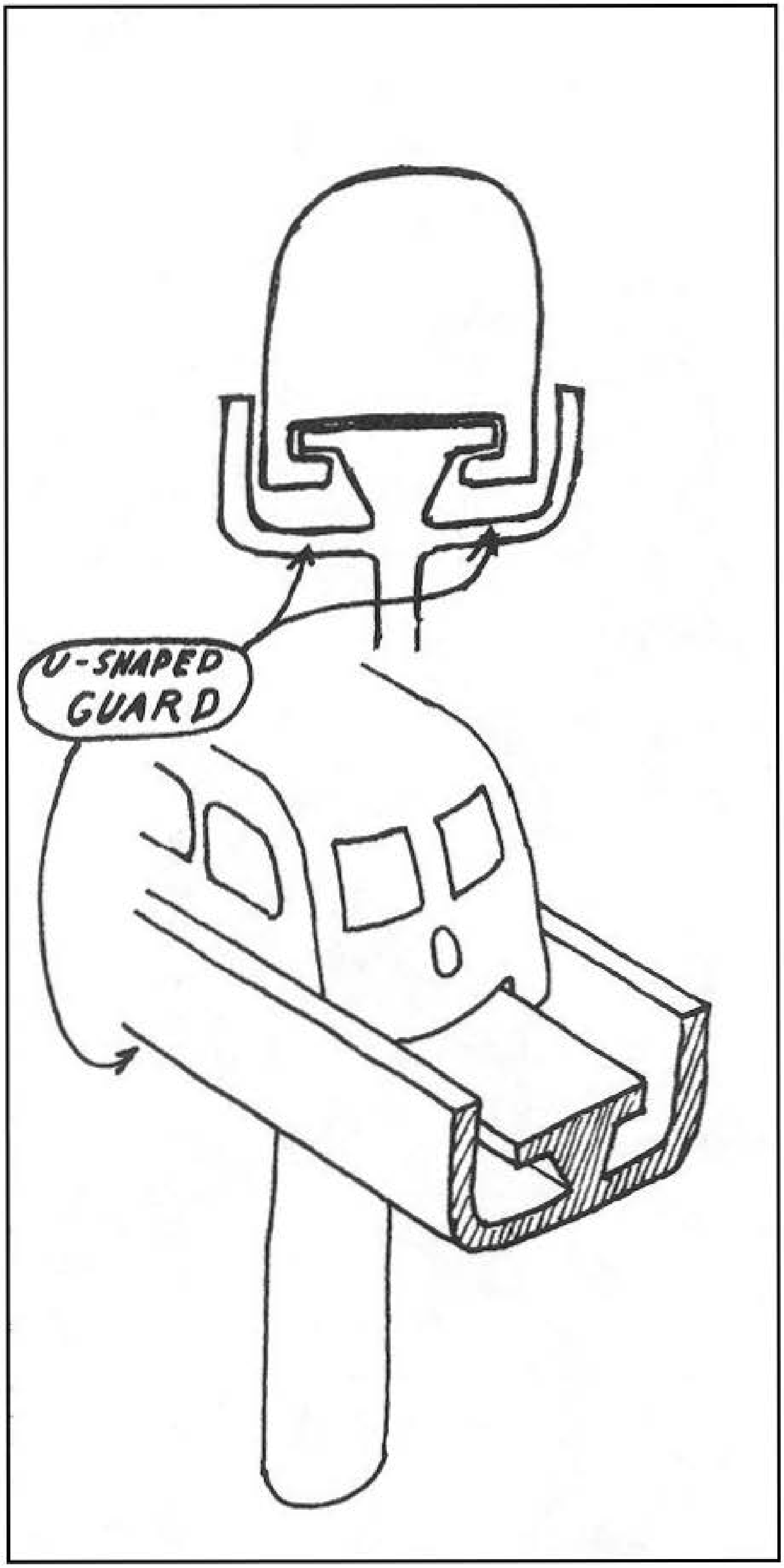
Some of these effects could be mitigated by having a continuous U-shaped protective shield that would go under and to the sides of the guideway and lower part of the maglev vehicle. This would lower the sound levels below and to the side of the guideway, and keep dust and debris from being swept directly off the side of the guideway. Such a shield under the guideway and vehicle would also have many safety benefits by protecting the under-running parts of the maglev vehicle, and protecting the public from these under-running parts. An evaluation of the environmental value of requiring such a shield should be part of any environmental review.

Your consideration of these environmental factors in the scope of the PEIS would be appreciated.

Sincerely,

Louis T. Cerny

Louis T. Cerny


U-SHAPED
GUARD

Commonwealth of Pennsylvania
Pennsylvania Historical and Museum Commission
Bureau for Historic Preservation
Post Office Box 1026
Harrisburg, Pennsylvania 17108-1026

Feb. 14, 2000

Bruce Ahern
Port Authority of Allegheny County
2235 Beaver Avenue
Pittsburgh, PA 15233

TO EXPEDITE REVIEW USE
BHP REFERENCE NUMBER

Re: ER 89-1675-003-X & Y & Z
FRA: Maglev Environmental Assessment
Allegheny and Westmoreland Counties

Dear Mr. Ahern:

The Bureau for Historic Preservation (the State Historic Preservation Office) has reviewed the above listed project in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended in 1980 and 1992, and the regulations (36 CFR Part 800) of the Advisory Council on Historic Preservation as revised in 1999. These requirements include consideration of the project's potential effect on both historic and archaeological resources.

We are in receipt of the Environmental Assessment for the Pennsylvania High Speed Maglev Project Draft Report of Probably Impacts. For the purposes of Section 106 consultation this report is missing several key components. The new regulations of the Advisory Council on Historic Preservation outline the need for public and interested parties participation in the identification and evaluation of historic resources and the assessment of project affects on historic resources. This report did not outline how these requirements will be met. In addition since this is a Probable Impact report and therefore a planning study it should have identified the Area of Potential Effect for the project and the methodology for the identification and evaluation of historic and archaeological resources in the APE beyond the known resources. At least the section on Historic, Archaeological and Architectural Resources should outline the steps to be taken for this project to meet its Section 106 consultation requirements. The report did not include the appropriate legislation under which this project is being reviewed. It is too early in the process to discuss mitigation strategies, though we would support avoidance of all resources if at all possible.
We do not agree that this report has identified all the historic resources which may be affected by this project and it is, in our opinion, premature to discuss the selection of alternatives.

Page 2
B. Ahern
Feb. 14, 2000

If you need further information in this matter please consult Susan Zacher at (717) 783-9920.

Sincerely,

Kurt W. Carr, Chief
Division of Archaeology
and Protection

cc: FRA
Tracey Cullen, Michael Baker, Jr. Inc.
KWC/smz

NCPC
NATIONAL CAPITAL PLANNING COMMISSION

801 Pennsylvania Avenue, NW
Suite 301
Washington, DC 20576
tel 202 482-7200
fax 202 482-7272
www.ncpc.gov

IN REPLY REFER TO:
NCPC File No. MP96

MAR 3 - 2000

Mr. David Valenstein
Environmental Program Manager
Federal Railroad Administration (RDV-10)
400 Seventh Street, SW (Mail Stop 20)
Washington, DC 20590

Dear Mr. Valensein:

Thank you for the opportunity to comment on the scoping for the proposed Programmatic Environmental Impact Statement on the Magnetic Levitation (Maglev) Deployment Program. A portion of that planned program involves a Maglev demonstration project in the Washington National Capital Region. We hope our comments will assist you in refining your agency's course of action concerning this important project to the National Capital Region. These scoping comments are limited to the Commission's role as the central planning agency for the federal government in the National Capital Region and express our general views on planning and environmental issues.

As noted in advanced program description information provided in the Federal Register, and in information discussed by the Maryland Department of Transportation, the objective of this environmental document is to address various issues of the program including documenting how the Baltimore-Washington corridor, within the northeast and southeast national travel corridors, meets Federal Railroad Administration (FRA) requirements and qualifies for selection by FRA for funding final design, engineering and construction of a Maglev line. The program documentation will also identify benefits to Maryland and the District of Columbia if any.

In the development of the programmatic EIS, routes will be evaluated for a Maglev system extending the 40 $\pm$ miles between Baltimore and Washington, D.C. with the potential for expansion along the northeast corridor to Boston and along the southeast corridor to North Carolina. The document will address providing direct mainline access to BWI Airport and the possibility of locating portions of the Maglev guideway along segments of I-95, the Baltimore-Washington Parkway, and the Amtrak and CSX Railroad rights-of-way.

Mr. David Valenstein
Page 2

Station sites will be evaluated in downtown Baltimore, at BWI Airport, near the Capital Beltway and at Washington Union Station.

Three major areas will be addressed in the report, as identified by available project information:

- The environmental characteristics of the selected technology, focusing on electromagnetic fields, air, energy and noise considerations

- An environmental screening of the corridors based primarily on existing data for all applicable sponsor prepared EA categories, and

- A descriptive and quantitative estimate of the environmental consequences of each of the preferred routes.

The Commission staff proposes that two additional programmatic issues be addressed. These issues are important to evaluate for the context of not only the National Capital Region but also the national program as a whole.

First, we strongly encourage the Federal Railroad Administration to assess impacts to historic properties and districts that might be generated by this program. We believe that this NEPA document should incorporate the requirements of the National Historic Preservation Act, Section 106 Review process, as specified in Section 800.8 of the regulations. Undertaking such coordination will require specific additional notice requirements by the FRA to the Advisory Council. However, the streamlining of the programmatic EIS with this process should result in greater benefits to this programmatic review.

The second issue the Commission believes necessary to evaluate at this stage is a visual and aesthetic analysis of both the primary and secondary infrastructure needed to support the Maglev guideway. In addition to the guideway itself, this should include maintenance right-of-way facilities, emergency access route requirements, and ancillary power structures.

Mr. David Valenstein
Page 3

We appreciate your consideration of our comments at this stage of the project planning. The Commission anticipates your successful completion of the Environmental Impact Statement and looks forward to review of the draft EIS and to the future submission of this project for Commission review should the Baltimore-Washington corridor be subsequently selected for full demonstration construction. If you have technical questions concerning the information related in this letter, you may contact Mr. Eugene Keller, in the Office of Plans Review, at (202) 482-7251.

Sincerely,

William R. Lawson, FAIA
Acting Executive Director

State of Louisiana

James H. Jenkins, Jr.
Secretary

Department of Wildlife & Fisheries
Post Office Box 98000
Baton Rouge, LA 70898-9000
(225) 765-2800

M.J. "Mike" Foster, Jr.
Governor

March 20, 2000

Mr. Jeff Roesel
CTE Engineering, Inc.
650 Poydras Street, Suite 1900
New Orleans, La. 70130

Re: Gulf Coast MagLev Deployment Project Environmental Assessment, February 29, 2000

Dear Roesel:

Personnel of our technical staff have reviewed the above referenced document and do not concur with the findings. There are significant environmentally sensitive issues that are not addressed within this document, such as but not limited to, protected species of birds. The proposed routes on both the north and south shore of Lake Pontchartrain will adversely impact nesting sites of the bald eagle. The north shore area also contains nesting sites of the osprey.

Significant adverse impacts to wetlands located on both the north and south shores of Lake Ponchartrain is very likely. We strongly disagree with the findings of this document concerning impacts to wetlands. The method of construction will greatly determine the amount of direct and indirect impacts to these sensitive wetlands.

Mr. Fred Dunham of my staff has been assigned to this matter. He can be reached at the above address or at 225.765.2367 or dunham_fo@wlf.state.la.us.

Sincerely,

James H. Jenkins, Jr.

fod
c: FRA

An Equal Opportunity Employer

Georgia Department of Natural Resources

Lonice C. Barrett, Commissioner

Historic Preservation Division

W. Ray Luce, Division Director and Deputy State Historic Preservation Officer
500 The Healey Building, 57 Forsyth Street, N. W., Atlanta, Georgia 30303
Telephone (404) 656-2840 Fax (404) 657-1040 http://www.gashpo.org

April 12, 2000

Robert E. McCord
Atlanta Regional Commission
40 Courtland Street, N.E.
Atlanta, Georgia 30303

re: Railroad: Atlanta-Chattanooga Maglev Deployment Project
Fulton et. al. counties, Georgia
HP991012-001

Dear Mr. McCord:

The Historic Preservation Division (HPD) has received a copy of the report entitled "Programmatic Environmental Assessment FRA-98-4545, February 2000," prepared by the Atlanta Regional Commission for the U. S. Department of Transportation Federal Railroad Administration, with regard to the proposed Atlanta-Chattanooga Maglev project. Our comments, as requested, are offered to assist the Federal Railroad Administration and the U. S. Department of Transportation in complying with Section 106 of the National Historic Preservation Act.

We appreciate the efforts being made to identify historic resources within the project corridor and take them into account in the early stages of project planning. We generally concur with the report's initial findings regarding the presence of historic resources in the project corridor. At this time, we have one specific comment regarding the characterization of the Friendship Church in the Atlanta University National Register Historic District. The report describes the church as having been "reconstructed" and therefore is "no longer considered historic" (page 5-111). The National Register nomination form for this historic district notes that the church, built in 1871, was damaged by fire in 1943, the interior was rebuilt following the fire, but the exterior remains largely intact, although stuccoed after the fire and again more recently; the church is classified as a "contributing" historic building in the district.

We also concur with the report's recommendations calling for intensive field surveys of historic resources (including buildings, structures, districts, and historic and archaeological sites) to identify all National Register-eligible as well as listed historic properties within the project's area of potential effects, should the project be selected for funding, in compliance with procedures set forth in the Advisory Council on Historic Preservation's regulations 36 CFR 800 implementing Section 106 of the National Historic Preservation Act.

Letter to Robert E. McCord
April 12, 2000
Page 2

We look forward to working with the Atlanta Regional Commission and the Federal Railroad Administration to insure that historic properties are considered in this undertaking. If we may be of further assistance, please contact Serena G. Bellew, Environmental Review Associate Planner, at 404-651-6624. Please refer to our project number HP991012-001 in any future communications regarding this project.

Sincerely,

Richard Cloues

Richard Cloues
Deputy State Historic Preservation Officer

cc: Jolene M. Molitoris, Federal Railroad Administration
Wayne Shackelford, Georgia Department of Transportation
Dan H. Latham, Coosa Valley RDC
Kevin McAuliff, North Georgia RDC

OFFICE OF PLANNING AND BUDGET

ROY E. BARNES
GOVERNOR

WILLIAM M. TOMLINSON
DIRECTOR

GEORGIA STATE CLEARINGHOUSE MEMORANDUM
EXECUTIVE ORDER 12372 REVIEW PROCESS

TO: Beverly Rhea
Atlanta Regional Commission
40 Courtland Street, N.E.
Atlanta, GA 30303-

FROM: Georgia State Clearinghouse

DATE: 4/13/00

SUBJECT: Executive Order 12372 Review

PROJECT: EA: Atl.-Chattanooga MAGLEV Deploy. Proj.

STATE ID: GA000413003

CFDA#:

The State level review of the above referenced document has been completed. As a result of the environmental review process, the activity this document was prepared for has been found to be consistent with state social, economic, physical goals, policies, plans, and programs with which the State is concerned.

Additional Comments:

No enclosures.

ZC/aw

Form SC-4-EIS-4
January 1995

OFFICE: (404) 656-3854 AN EQUAL OPPORTUNITY EMPLOYER FAX: (404) 656-7916
270 WASHINGTON ST., S.W. • ATLANTA, GEORGIA 30334-8500

PARSONS

PARSONS TRANSPORTATION GROUP INC.
Barton-Aschman • De Leuw, Cather • Steinman
Two Landmark Center • 225 East Robinson Street, Suite 410 • Orlando, Florida 32801 • (407) 316-8400 • Fax: (407) 316-8877

April 17, 2000

Mr. Fred Dunham
State of Louisiana
Department of Wildlife & Fisheries
Post Office Box 98000
Baton Rouge, LA 70898-9000

Reference: Environmental Issues
Gulf Coast MagLev Demonstration Project

Dear Mr. Dunham:

Your letter dated March 20, 2000 presenting the review comments of your technical staff concerning the Gulf Coast MagLev Deployment Project Environmental Assessment, dated February 29, 2000 has been forwarded to my attention. This letter documents our understanding of the telephone conversation between Mr. William Barbé at CTE and yourself, on March 28, 2000 regarding the environmental issue areas and comments, either expressed or inferred, in your letter.

The environmental assessment was prepared to provide general baseline data that will be used by the Federal Railroad Administration (FRA) in the preparation of a Programmatic Environmental Impact Statement (PEIS) which will compare and analyze the environmental issues. The EA was prepared as a screening tool for general alignments to allow for the selection of a preferred alternative course of action for deployment. The EA was not intended to contain detailed site-specific environmental studies or definitive findings of significance and effect. It was kept focused on the issues of the action and areas of potential or likely concern to present a reasonable consideration and disclosure of the environmental issue areas. The EA as prepared will serve as a base document on which to build a more comprehensive statement of disclosure and prepare a detailed site specific Environmental Impact Statement.

The EA did acknowledge the general geographical local nesting areas of the bald eagle without specifically pinpointing the actual nest locations. Identifying actual locations would have been unwise and irresponsible for the bald eagle or other protected and sensitive species nesting like the osprey. We concur that other likely sensitive issues were not identified in the broad generalized approach used. Such aspects as vegetation succession, various edge conditions and fragmentation of cover types and indigenous habitat issues will be accomplished with detailed biological surveys and analyses of an actual physically defined and preferred alignment.

Page 2
Mr. Fred Dunham
April 17, 2000

Wetland types and involvement issues were only generally described. The wetland specifics of their water regimes, supported biological communities and hydrophytic vegetation will also be accomplished with detailed biological surveys and analyses of an actual physically defined and preferred alignment. The consequences of wetland impact only went as far as providing the likelihood of the amount of wetland that would be permanently lost, disrupted or manipulated and the general functional value issues that may be of concern. We concur that some of the most important wetland issue areas will deal with method and length of construction. Not only are the direct construction effects on wetlands important but also the secondary and cumulative influences that may result over extended periods of time from construction activity. Here again the charge was more general magnitude and broadly defined importance to provide a reasonable consideration of the major environmental issue areas and concern involved that will be further scrutinized and disclosed in an EIS.

Please contact Mr. Howard Newman if we can be of any assistance to you, or your staff specialists, in clarifying aspects of this project as proposed, or promulgating additional concerns and issues to the FRA that you feel need either disclosure or disposition in their forthcoming EIS. Mr. Newman can be reached at (407) 316-8400 (ext. 9007) or howard.newman@parsons.com.

Very truly yours,

PARSONS TRANSPORTATION GROUP

Eric C. H. MacDonald
Project Manager

c: David Valenstein, Federal Railroad Administration
John C. Martin, Parson Transportation Group
James D. Morinec, Consoer Townsend Envirodyne Engineers, Inc.

U. S. DEPARTMENT
OF TRANSPORTATION

Federal Highway
Administration

Pennsylvania Division

228 Walnut Street, Room 536
Harrisburg, PA 17101-1720

MAY 0 1 2000

In reply refer to:
HOP-PA.11

Mr. Bruce Ahern
Port Authority of Allegheny County
2235 Beaver Avenue
Pittsburgh, PA 15230

Dear Mr. Ahern:

On March 8, 2000 we received a copy of the Final Environmental Assessment for the Pennsylvania Maglev Project. We understand the document has been submitted to the Federal Railroad Administration (FRA) and the process is underway to select a city to proceed with a site specific Environmental Impact Statement (EIS). Based on our review of the document, we find that the corridor impacts could be significant and substantial coordination with the FHWA, Pennsylvania Turnpike Commission, PennDOT, as well as the resource agencies will be absolutely critical to the success of this project. At this time, we only have one specific comment which relates to the air quality benefits of the proposed system. We believe the air quality benefits should be strongly emphasized especially since Pittsburgh is classified as a non-attainment Transportation Management Area (TMA).

In the event Pittsburgh is selected, we highly suggest a multi agency "kick-off" meeting be held to develop a strategy for implementation. The FHWA contact person will be Mr. Tony Mento, P.E. @ (717) 221-3412. Thank you for the opportunity to review and comment on the well prepared document.

Sincerely yours,

David W Cugh

for James A. Cheatham
Division Administrator

CC: ARNOLD KUPFERMAN, FRA

NCPC
NATIONAL CAPITAL PLANNING COMMISSION

801 Pennsylvania Avenue, NW
Suite 301
Washington, DC 20576
tel 202 482-7200
fax 202 482-7272
www.ncpc.gov

IN REPLY REFER TO:
NCPC File No. MP96

MAY 18 2000

Mr. Suhair Alkhatib
Project Manager
Mass Transit Administration
Maryland Department of Transportation
William Donald Schaefer Tower
6 Saint Paul Street
Baltimore, Maryland 21202-1614

Dear Mr. Alkhatib:

Thank you for the opportunity to have my staff review the detailed information and public forum discussion on the Maryland Mass Transit Administration's Magnetic Levitation (Maglev) Demonstration project at your meeting of April 26, 2000, in the District of Columbia. As described in that meeting, a portion of that project involves a Maglev guideway in the Washington National Capital Region with its southern terminus at Union Station.

In the presentation at the meeting, your agency noted that the Maglev system would extend 40± miles between Baltimore and Washington, D.C. with the potential for expansion along the northeast corridor to Boston and southeast corridor to North Carolina. It was also identified that locating portions of the Maglev guideway along segments of I-95, the Baltimore-Washington Parkway, and the Amtrak and CSX Railroad rights-of-way is being considered.

I want to take this opportunity to express the severe reservations the Commission staff has concerning the Baltimore-Washington Parkway alignment corridor. I also want to express my deep concern that the Commission comment letter provided to you on the Environmental Assessment was not included in that document or considered in its final development. At the April 26 meeting, the National Park Service again voiced their significant concerns about the Maglev project locating in the vicinity of the Baltimore-Washington Parkway and clearly indicated it will oppose location of the project in that area. This historic resource and important cultural landscape would be adversely affected by the proposal.

Mr. Suhair Alkhatib
Page Two

I want to emphasize the Commission staff belief that the federal parkway lands currently being considered as a possible alignment should not be viewed as a transportation corridor. Additionally, we believe that the Patuxtent Wildlife Research Center is a highly valuable federal wildlife reserve that demonstrates characteristics which this Commission would view as incompatible with the intent of a transportation corridor alignment unless closely coordinated with the U.S. Fish and Wildlife Service and the U.S. Geological Survey Service. All lands associated with Patuxent Research Refuge are managed with coordination between the refuge and research staffs so that the priority remains on research activities.

In response to information presented at your meeting and in the information appearing in the Environmental Assessment, I want to note the following additional concerns.

The Environmental Assessment, does not present an adequate evaluation of electrical energy usage in the National Capital Region and Maryland involving the sources of electrical generation or the total cumulative impacts of the energy required for the Maglev operations. We recognize this is a deficiency that can be addressed in future environmental analysis, but the Commission wishes assurance that this impact attribute will be fully addressed.

The Commission requests a more detailed evaluation of all Electro-magnetic frequency (EMF) impacts associated with this project. The Environmental Assessment essentially concludes there is no standard for hazardous effect of exposure and consequently restates existing background information. The Commission staff finds this approach unacceptable in the preparation of potential NEPA document information. The Environmental Assessment failed to expand on the important conclusion expressed in the one short paragraph cited in the Environmental Assessment recounting the EMF RAPID Program study of 1998, sponsored by National Institute of Environmental Health Sciences, National Institutes of Health. In that study, minimizing exposure was an objective repeatedly stressed. The effort to <u>minimize EMF exposure</u> must be explored in the MTA's further evaluation of this technology. Nowhere in the current environmental evaluation is that direction expressed or committed to. Moreover, the Commission staff finds that several of the references to EMF exposure levels in the Environmental Assessment are outdated or understated in the presented tables.

Mr. Suhair Alkhatib
Page Three

Finally, the Commission staff is concerned about the estimated low ridership projections for this undertaking. As discussed at the meeting, only 33,000 daily trips are projected when the transport system becomes operational. And although the staff recognizes the importance of this effort as a technology demonstration project, it is a concern that significant cultural and environmental resource areas in the National Capital Region would be impacted with a facility that has limited anticipated service to the public. Again this potential characteristic sharpens the focus that an appropriate alignment must be determined.

With the objective in mind to fully inform the Commission of the continued planning of the Maglev Project, I would like to request that an information presentation be scheduled with the Commission staff about this transportation effort in the Washington/Baltimore area. Please contact Mr. William Dowd, Director of the Office of Plans Review at (202)-482-7240 to identify a date for this informational meeting.

We appreciate your consideration of our further comments at this stage of the project planning. If you have technical questions concerning the information related in this letter, you may contact Mr. Eugene Keller, in the Office of Plans Review, at (202) 482-7251.

Sincerely,

for William R. Lawson, FAIA
Acting Executive Director

cc: Mr. David Valenstein
Environmental Program Manager
Federal Railroad Administration (RDV-10)
400 Seventh Street, SW (Mail Stop 20)
Washington, D.C. 20590

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APPENDIX L - METRIC/ENGLISH CONVERSION FACTORS

	English to Metric (approximate)	Metric to English (approximate)
Area	1 Acre (ac) = 0.40469 Hectares (ha) 1 Square Mile (sq mi) = 2.58999 Square Kilometers (sq km)	1 Hectares (ha) = 2.47105 Acre (ac) 1 Square Kilometer (sq km) = 0.38610 Square Mile (sq mi)
Distance	1 Miles (mi) = 1.609344Kilometers (km) 1 Foot (ft) = 0.3048 Meters (m) 1 Inch (in) –2.54 Centimeters (cm)	1 Kilometers (km) – 0.62137 Miles (mi) 1 Meters (m) = 3.28084 Foot (ft) 1 Centimeters (cm) = 0.39370 Inch (in)
Weight	1 Pound (lb) = 0.45359 Kilograms (kg) 1 Pound (lb) = 0.00045 Metric Tonnes 1 Short Ton (0.8929 Long Ton) = 0.90718 Metric Tonnes 1 Long Ton (1.1200 Short Ton)= 1.0160 Metric Tonnes	1 Kilograms (kg) = 2.20662 Pound (lb) 1 Metric Tonnes = 2,204.62 Pound (lb) 1 Metric Tonnes = 0.98421 Long Ton 1 Metric Tonnes = 0.90718 Short Ton
Speed	1 Miles per Hour (mph) = 2.609344 Kilometers per Hour (km/h)	1 Kilometers per Hour (km/h = 0.62137 Miles per Hour (mph)
Volume	1 Gallon (gal) = 3.78541 Liters (L)	1 Liters (l) = 0.26417 Gallon (gal)
Temperature	1° Fahrenheit (F) = -17.22°Celsius (C) [(x-32)(5/9)] ˜F = y˜ C	1° Celsius (C) = 33.8° Fahrenheit (F) [(9/5) y + 32] ˜C = x˜ F
Power	1 Megawatt = 1000 Kilowatts (kW)	
Energy	1 Joule = 0.000947 BTU (IT) 1 Joule = 0.00094845BTU (th) 1 Joule = .00094709 BTU (mean) 1 Megajoule = 0 1,000,000 Joules (j)	1 BTU (IT) = 1,055.056 Joules (j) 1 BTU (th) = 1,054.35 Joules (j) 1 BTU (mean) = 1,055.87 Joules (j)
EMF	1 Tesla (T) = 800,000,000 Amperes per Meter (A/m) 1 Gauss (G) = 80,000 /A/m 1 T = 10,000 G 1 Milli-tesla (mT) = 10 G 1 mT = 10,000 mG 0.10 uT = 0 1 mG 1 uT = 10 mG 100 uT = 1 G 1 nT = .010 mG 100 nT = 1 mG	

Multiplication Factor	Prefix	Symbol
1,000,000,000 = 10^9	giga	g
1,000,000 = 10^6	mega	m
1,000 = 10^3	kilo	k
100 = 10^2	hecto	h
1=1		
0.01 = 10^{-2}	centi	c
0.001 = 10^{-3}	milli	m
0.000001 =10^{-6}	micro	˜
0.00000001 = 10^{-9}	nano	n
0.0000000000 = 10^{-12}	pico	p

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APPENDIX M – U.S. SECRETARY OF TRANSPORTATION SLATER SELECTS TWO HIGH SPEED MAGLEV PROJECTS [http://www.dot.gov/affairs/fra201.htm]

U.S. Department of Transportation
Office of Public Affairs
Washington, D.C.
www.dot.gov/briefing.htm

News

FOR IMMEDIATE RELEASE
Wednesday, January 18, 2001
Contact: Yvette Lester
Telephone: 202-493-6024
FRA 02-01

U.S. Secretary of Transportation Slater Selects Two High Speed Maglev Projects

U.S. Secretary of Transportation Rodney E. Slater today announced the selection of two projects in Maryland and Pennsylvania to be advanced into the next phase of the competition to build and demonstrate the first magnetically levitated (maglev) high-speed train system in revenue service in the United States.

"It has been extremely difficult to select from all of the meritorious projects, but we must now focus the remaining effort and funding on the Maryland and Pennsylvania projects, the ones best positioned for early demonstration of Maglev's promise," said Secretary Slater.

Citing the Clinton-Gore administration's commitment to making high-speed rail a reality across the nation, Secretary Slater also noted that today's announcement follows on his October 18 announcement that the Federal Railroad Administration (FRA) had approved high-speed service for Amtrak's Acela Express on the Northeast Corridor (NEC), and an October 11 announcement designating two new high-speed rail corridors in northern New England and the South Central states.

A competition was initiated in May 1999, with the selection of seven projects to receive planning funds and participate in a competition. After intensive planning and design efforts by the sponsors of the seven participating projects, and evaluation of each project by multi-disciplined DOT staff, the Secretary selected the two projects. In the next phase, each project team will refine its estimates of ridership revenue and cost and its financial plan, strengthen the financial commitments of its sponsors, and begin work on a site specific environmental assessment. $14 million will be available for these purposes. On the basis of the new information resulting from these efforts, the Department of Transportation would then be in a position to select a single project which would be eligible for a grant of $950 million in federal funding authorized for construction under Section 1218 of the Transportation Equity Act for the 21st Century (TEA-21), and subject to appropriation by the Congress. The selected projects are:

> **Baltimore, Maryland to Washington DC:** A 40-mile project linking Camden Yard in Baltimore (a sports complex and center for recreation and tourism) and Baltimore-Washington International (BWI) Airport to Union Station in Washington, D.C. This project has been under study since 1994. The project sponsors also see this as providing rapid transportation between sports venues for winning a bid for the 2012 Olympics.

Pittsburgh, Pennsylvania: A 47-mile project linking Pittsburgh Airport to Pittsburgh and its eastern suburbs. The project has been under study since 1990 and is backed by a coalition of state and local agencies, labor unions, and members of the Pittsburgh community. Maglev Inc., the organization that would develop the project sees it as not only a transportation system for commuters and air travelers, but also as a platform for bringing precision steel fabrication technology used in construction of the guideway to the Pittsburgh region.

The Secretary strongly encouraged the remainder of the projects, those in California, Florida, Georgia, Louisiana, and Nevada to continue to develop their plans and seek alternative sources of financing. To assist them, each of these projects is slated to receive almost $1 million in federal funds, as specified by Congress in the FY 2001 appropriation.

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Briefing Room
[http://www.dot.gov/affairs/briefing.htm]

Maglev Background Sheet
[http://www.dot.gov/affairs/maglevbg.htm]