2.0 ALTERNATIVES

2.1 Overview and Background Information

Definitions for all acronyms can be found in Chapter 10.0 of the DEIS

The identification of potential routes for a maglev project in the Pittsburgh metropolitan area began a number of years ago. In January 1987, Carnegie Mellon University (CMU) established a High-Speed Ground Transportation Center (HSGTC), funded by grants from the Commonwealth of Pennsylvania. In completing a database and exploring different technologies, the HSGTC recognized the potential of maglev as a commercial transportation system capable of carrying passengers and freight in regularly scheduled service. The following year, the HSGTC initiated a working group of various entities with regional interests to explore in more detail the concept of a high-speed ground transportation system. The working group included the following: AEG Westinghouse Transportation Systems, Inc.; Allegheny County; Michael Baker Corporation; CMU; Duquesne Light Company; Reed Smith Shaw and McClay; Transrapid International, Tri-State Conference on Steel; Union Switch and Signal, Inc.; United Steelworkers of America; Urban Redevelopment Authority of Pittsburgh; and the USX Corporation.

The following documents are incorporated into this DEIS by reference:

- *A Demonstration, Design, and Development Plan (May 1994).*
- *The Pennsylvania Project, Environmental Assessment (February 2000).*
- *Final Programmatic Environmental Impact Statement, Maglev Deployment Program (April 2001).*
- *Record of Decision, Maglev Deployment Program (July 2001).*
- *Initial Screening of Proposed Maglev Alternatives (May 2002).*
- *MAGport Station Alternatives Screening (May 2002).*
- *Project Technical Support Files (PTSF).*

One of the first efforts of the working group was the completion of a preliminary feasibility study to determine the project's probability of success. Following the feasibility study, the working group incorporated into a consortium, MAGLEV, Inc., to pursue a demonstration project for the Pittsburgh region. The Demonstration, Design & Development (DD&D) Plan was released in May 1994, and addressed manufacturing, building, operations, possible routes, and the conceptual engineering and environmental aspects of a maglev system demonstration project.

Through the mid-1990s, the development of the technology continued to evolve. Funding for a demonstration project was included in *TEA 21*. The elements of this maglev program are summarized in Figure 2.1-1. The Pennsylvania High-speed Maglev Project Team (which includes PAAC, PENNDOT, and MAGLEV, Inc.) was selected by FRA to compete with six other cities to pursue a maglev demonstration project.

In February 2000, an environmental assessment of the Pennsylvania maglev project was completed. Based on secondary source data, this environmental assessment identified preliminary alternatives for a maglev system and the potential environmental consequences that could result from the construction and use of such a system.

In April 2001, the FRA completed a PEIS for the Maglev Deployment Program. The technical basis for the PEIS was the information provided in the environmental assessment for the Pennsylvania

Program Purpose:

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 240 miles per hour.

Eligible Use of Funds:

The U.S. Secretary of Transportation is authorized to provide financial assistance to States (or authorities designated by one or more States) to fund preconstruction planning activities of one or more feasible high-speed maglev systems; and final design, engineering and construction activities for one high-speed maglev system to be selected by the Secretary.

Qualification Requirements:

To be eligible, projects must exhibit partnership potential; be able to be constructed with available Federal and non-Federal funding; result in an operating transportation system in revenue service; be undertaken through a public-private partnership; satisfy applicable statewide and metropolitan planning requirements; be approved by the Secretary based on a State application; be carried out as a technology transfer project; and, involve materials at least 70 percent of which are manufactured in the United States.

The Pennsylvania High-speed Maglev Project

Elements of the Maglev Deployment Program From the Transportation Efficiency Act for the 21st Century (TEA 21)

Figure 2.1-1

High-speed Maglev Project and studies completed by six other groups in other parts of the country pursuing their own maglev deployment projects. The purpose of the PEIS was to identify various alternative approaches for the broad federal actions that could meet overall program goals. The PEIS also identified the potential for environmental impacts associated with those alternatives. In July 2001, the FRA issued a ROD, which advanced the Pennsylvania High-speed Maglev Project and the Baltimore-Washington Maglev Project into the project-specific DEIS phase of the Deployment Program. Although similar in nature, the alternative alignments being studied in this DEIS are not identical to the conceptual routes identified in the DD&D Plan, the environmental assessment, or the PEIS. Rather, they evolved as a natural progression of those earlier studies.

The proposed alternative alignments for the Pennsylvania maglev project generally follow existing or proposed transportation corridors in the region (where feasible and able to meet engineering and safety criteria for the system). Each proposed alignment would connect the PIA in Allegheny County to the Greensburg area in Westmoreland County via_Downtown Pittsburgh (which includes the North Shore, the Central Business District [CBD] and the South Side) and the Monroeville/Penn Hills area. The route would traverse a transportation corridor of approximately 87 kilometers (54 miles). Passengers would access the maglev system at five locations. These passenger stations would be located at PIA (Landside air terminal area and Enlow Road area), Pittsburgh's CBD, the Monroeville/Penn Hills area, and near Greensburg in Westmoreland County. Other stations could also be added in the future.

Some of the proposed travel corridors between PIA and Downtown Pittsburgh were originally developed for the DD&D Plan by MAGLEV, Inc., in collaboration with various local transportation and planning agencies. Recognizing that a longer system could be more beneficial to the area, aid in solving regional transportation problems, and better meet the criteria of the Maglev Deployment Program, the Rail Systems Center at the Carnegie Mellon Research Institute proposed that the Downtown Pittsburgh to Monroeville and Monroeville to Greensburg corridors also be analyzed in the subsequent environmental assessment. The inclusion of potential alignments from Downtown Pittsburgh to the Greensburg area is expected to capitalize on what appears to be the most feasible and logical transportation corridors for the region. Both Monroeville and Greensburg are major regional traffic generators and/or destinations. Monroeville is the largest employment and commercial area in eastern Allegheny County and supports a large residential community as well. Greensburg is the county seat of Westmoreland County with several major commercial and residential developments nearby. If a maglev system were operating within these three corridors (PIA to Downtown Pittsburgh, Downtown Pittsburgh to Monroeville, and Monroeville to Greensburg), some of the region's most heavily traveled traffic corridors would have an alternative transportation system operating within them.

The alternative alignments were further refined for this DEIS. Guidance prepared by the Council on Environmental Quality (CEQ) defines reasonable alternatives as "those that are practical or feasible" from a technical and economical standpoint (CEQ, 1981). The preliminary range of alternatives included both a No-Build Alternative and a series of build alternatives for a maglev system. Each preliminary alternative was initially examined to determine whether or not it could meet the project's purpose and need. If an alternative was determined to be potentially capable of meeting the project's purpose and need, the alternative was assessed to determine how well the need could be met by that particular alternative. The process for determining an alternative's potential ability to meet the project need was based on both quantitative and qualitative criteria. Although the level of analytical effort increased as the environmental process advanced, and potential alternatives were either dismissed from further consideration or carried forward for more study, the same level of technical definition was applied to each alternative still under consideration at any particular stage of the evaluation.

The principal emphasis during the early stages of the evaluation process was to determine the practicality of the alternatives under investigation while identifying potential impacts to socioeconomic and environmental resources. To be effective as an intercity transportation mode, the proposed maglev system must attain high speeds while meeting other applicable technology specifications (related to horizontal and vertical curves, spirals, and tangents, and acceleration and deceleration rates. (See the PTSF for more detailed information on safety and engineering requirements.) Consequently, there has been a strong focus on initially developing each alternative to meet the operational speed criteria established by *TEA 21,* making engineering considerations and the constructability of potential alignments key factors in the analysis.

Detailed consideration was given to those alternatives that were determined to be able to meet the project's purpose and need. Several evaluation components were considered during the detailed studies, including further consideration of an alternative's ability to meet the project need; safety; engineering design; impacts to environmental features; socioeconomic impacts; and, comments received from public officials, the general public, and resource agencies.

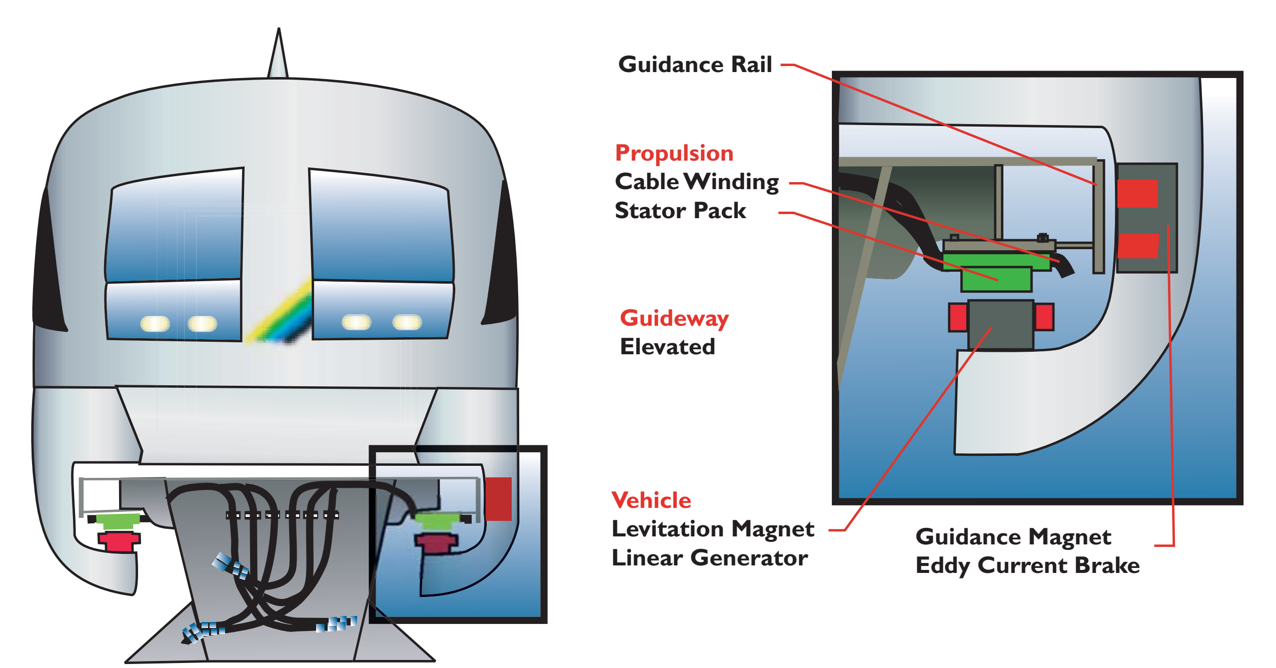
2.2 Description of Maglev Technology

Maglev technology utilizes non-contact, electromagnetic forces to levitate, guide, and propel vehicles along a fixed guideway. Despite the relatively "futuristic perception" of maglev, the concept of magnetic levitation has existed for over 100 years. It was not until the late 1960s, however, that the idea of using magnetic forces as a means of transportation propulsion gained impetus when two Americans, James Powell and Gordon Danby, received a patent for designing a maglev vehicle. Since then, a considerable amount of additional research, design, and production testing have occurred.

The Pennsylvania Project has selected to use the Transrapid International (TRI) maglev technology and system. The primary components of the TRI maglev technology and system are suspension and guidance, propulsion, guideway, vehicles, stations, and support facilities. Together, these components enable maglev transportation systems to operate safely at normal speeds in excess of 386 kph (240 mph).

2.2.1 Suspension and Guidance

Maglev vehicles would be securely wrapped around a fixed-guideway that provides support and guidance (Figure 2.2.1-1). The vehicle's levitation and lateral guidance are the princi-



The Pennsylvania High-speed Maglev Project

Maglev Suspension and Guidance
Figure 2.2.1-1

pal elements of the primary suspension. The levitation (vertical) and guidance (lateral) are controlled by varying the strength of the magnetic forces acting between the vehicle and the guideway to maintain the proper separation gap. Vehicle mounted electromagnets are powered by onboard batteries, generating attractive forces and pulling the magnets (thus, the vehicle) toward the guideway for both levitation and lateral guidance. The force generated by the electromagnets would create a vertical gap between the guideway and the vehicle of approximately 1 centimeter (0.39 inches) and a lateral gap of approximately 1.5 centimeters (0.625 inches).

2.2.2 Propulsion

The vehicles are propelled and stopped using a synchronous longstator linear motor. Ferromagnetic stator packs and three-phase stator windings are mounted on both sides along the underside of the guideway. The operation of this non-contact propulsion and brake system is analogous to a rotating electric motor whose stator is cut open and stretched along the underside of the guideway and whose motor function is assumed by the levitation magnets in the vehicle. In contrast to the rotating field in a conventional motor, the longstator linear motor produces an electromagnetic traveling field, which propels the vehicle along the guideway.

Converters in substations along the route regulate the acceleration and speed of the vehicle by changing the amplitude and frequency of the alternating current to allow the vehicle to accelerate smoothly from standstill to full speed. By slowing down the traveling field, the vehicle is slowed, without contact, to a smooth, controlled, and safe stop. In the event of public power or propulsion system failure, independent back-up braking in each vehicle section provides safe and accurate braking to the next available stopping area.

Substations receive power from the electrical supply system and convert it into the proper format to propel the vehicle. The propulsion control system controls and monitors the position of the vehicle at all times, comparing these real-time inputs to the set-points given by the operations control system, which result from the pre-programmed speed/time/location profiles developed for the route.

The number and location of the substations depends on several factors, which are applied both to the entire route and locally:

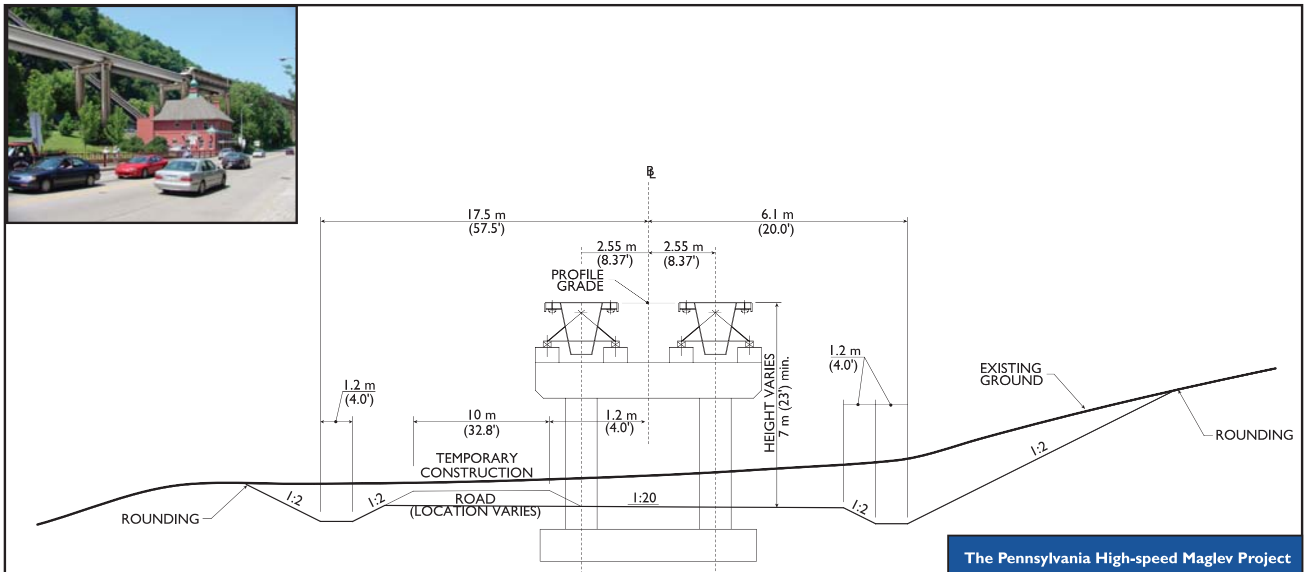
- Alignment length;
- Minimum vehicle headway requirements;
- Maximum load;
- Maximum speed;
- Maximum gradient; and
- Station locations and dwell times.

Through the spacing of the substations along the proposed alternative alignments, the route is divided into propulsion segments. Each propulsion segment is divided into smaller motor sections, usually between 0.5 kilometers (0.3 miles) and 2.0 kilometers (1.2 miles) in length. The longstator windings on the right and left sides of the guideway are fed independently from two power sources and physically offset with respect to each other. This provides a smooth transition between motor sections, and in the event that one side fails, the other has sufficient capability to propel the vehicle through the segment. Only one motor section is energized at any one time in each propulsion segment and only one vehicle can occupy a propulsion segment at one time. Wayside electrical switch stations switch the propulsion power from one section to the next as the vehicles proceed along the guideway. Propulsion segments could be fed redundantly from two substations, providing for additional system reliability.

Independent converters in the substation supply the propulsion power for the vehicles. If an individual converter fails, the vehicle can still continue to proceed at a slower speed. Even if an entire substation fails, the next substation can provide sufficient power in its place, thereby allowing the vehicle to reach its destination.

2.2.3 Guideway

The guideway will be an elevated structure, consisting of high precision welded steel guideway beams and reinforced concrete guideway piers. The guideway requires very tight manufacturing tolerances and specific stiffness requirements for its design. The typical elevated guideway beam is the Type I, with a maximum 62 meters (203 feet) in length. The project will also utilize Type II, maximum 25 meters (82 feet) in length, and Type III, 6 meters (20.3 feet) in length, as required. Other configurations are also possible up to the maximum of 62 meters (203 feet) in length. The guideway will be constructed at varying heights, enabling the elimination of all at-grade crossings and providing improved safety over other transportation modes. The minimum height planned for the guideway is 5 meters (16.5 feet). Guideway pier heights between 5 meters (16.5 feet) and 25 meters (82 feet) can be constructed without special civil structures (bridges). Secondary civil structures are planned for pier heights above 25 meters (82 feet) or span lengths greater than 37 meters (121 feet). Figure 2.2.3-1 shows a typical section of guideway.



The Pennsylvania High-speed Maglev Project

Typical Section of Guideway
Figure 2-2.3-1

NOT TO SCALE

2.2.4 Vehicles

Vehicles operating over the guideway are coupled together in groupings referred to as "consists" (Figure 2.2.4-1). The vehicles themselves are referred to as "sections" and to the casual observer would resemble train cars in use today on high-speed railway systems.

The Pennsylvania High-speed Maglev Project

Three-Section Maglev Consist
Figure 2.2.4-1

Consists would likely be comprised of three sections, but consists of up to ten sections are possible with no degradation of service. The length of consists on the proposed system, however, has been limited to five sections (two end sections and three middle sections) to accommodate a manageable overall platform length for passenger convenience. Consists would be configured to hold up to 108 seated and standing passengers in each end section and 128 seated and standing passengers in each middle section. Figure 2.2.4-2 illustrates a typical interior plan. The initial seating configuration could be changed for more spacious, first-class seating, or for higher-density, commuter-type seating. Separate consists could also be configured to carry freight during periods of off-peak ridership.

The Pennsylvania High-speed Maglev Project
Typical Interior of Vehicle Section
Figure 2.2.4-2

Each end section would be fitted with an attendant's compartment, onboard operation control systems, and passenger areas. The middle sections would be similar in appearance, but would not have an attendant's compartment nor onboard control equipment.

Each end section would be approximately 26 meters (85 feet) in length. Middle sections would be 25 meters (82 feet) in length. All sections would be approximately 3.7 meters (12 feet) wide and 4.2 meters (14 feet) high.

The look and feel of a maglev vehicle during operation will depend on the speed it is traveling. At lower speeds, the vehicle will be very similar to a traditional train. There will be some differences, though, at higher speeds, for people outside the vehicle. Based on field measurements and observation, high speed maglev pass-bys are characterized by high noise levels of brief duration. Observers would notice that the noise level rises fast then falls off more gradually, but in comparison to the noise from traditional trains, maglev is generally quieter at comparable speeds and also has a more uniform sound, thereby avoiding the high, shrill sound and the rolling, rumbling noise of conventional steel-wheeled trains. In effect, the sound from maglev could be perceived by some as being less piercing than noise from conventional rail traffic.

Outside observers would generally notice little vibration beyond 60 meters (200 feet), even while consists were traveling at 400 kph (250 mph). There would be no perceptible air movement under the elevated guideway.

For those inside a maglev vehicle, the high speeds would be achieved at a comfortable acceleration rate. Because there is no contact with the guideway, the hovering operation of maglev provides an extremely smooth ride. Acceleration and deceleration are achieved with passenger comfort and safety in mind, as evidenced by the fact that passengers do not need to be seated, nor wear seatbelts.

2.2.5 Stations

Passengers would board at loading locations referred to as MAGport stations, maglev passenger stations, or simply as passenger stations. The stations would allow for boarding and unloading of passengers and light freight, provide passenger amenities, including some opportunities for retail space. A conceptual drawing of a passenger station is shown on Figure 2.2.5-1. Directly related commercial development that would occur at the stations would be located within the "footprint" of the stations presented in this DEIS.

The Pennsylvania High-speed Maglev Project

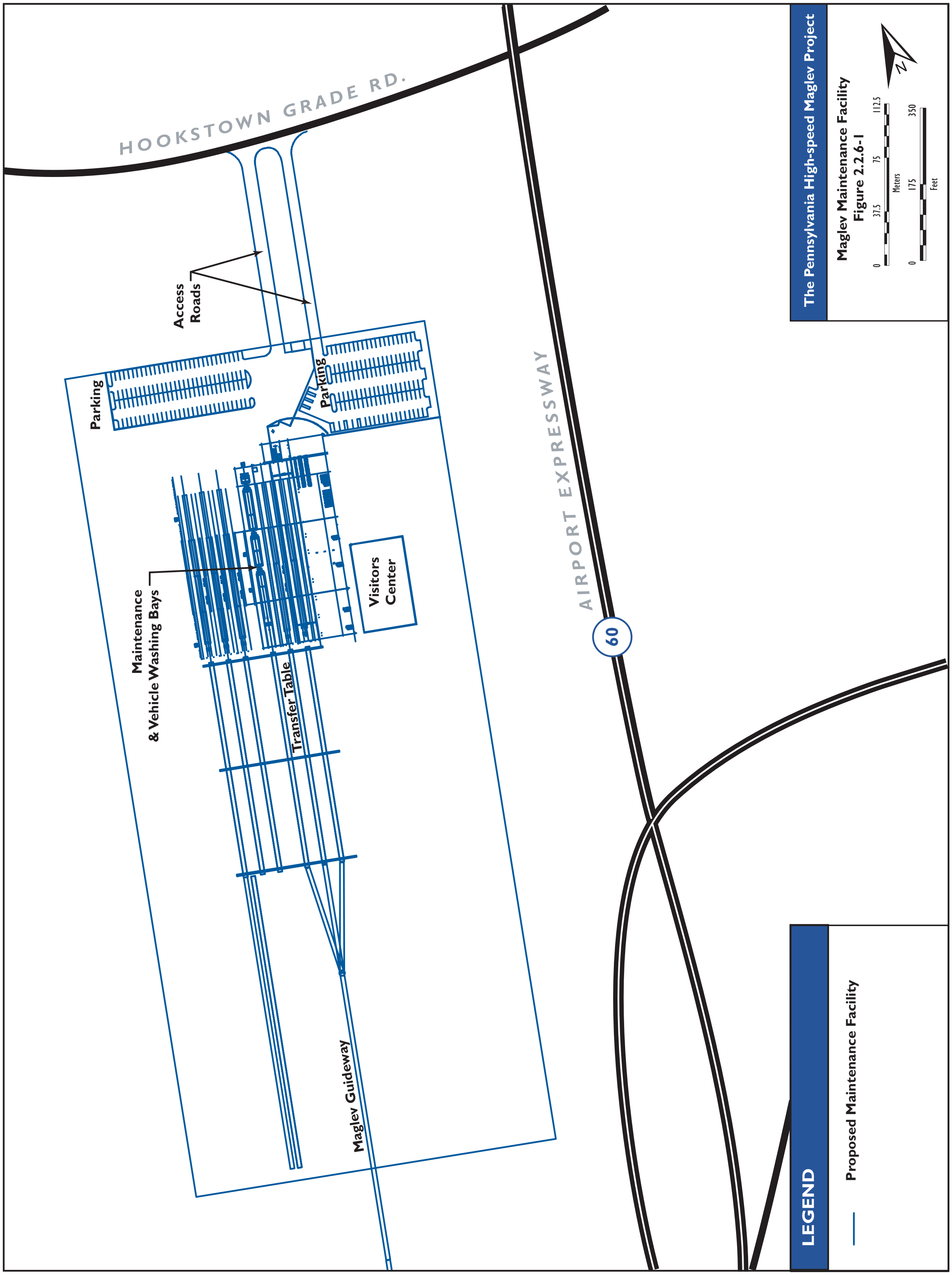
Conceptual Station
Figure 2.2.5-1

Stations would provide covered or surface parking lots for passengers driving cars to the stations. They also would serve as intermodal interfaces for travel by air, public transportation, bicycle, or on foot.

2.2.6 Support Facilities

Support facilities for the system would include a maintenance and operational control center, substations, cabling, various electrical controls, and communication equipment. All of these support facilities would be located within the system's right-of-way. A maintenance facility, as depicted on Figure 2.2.6-1, would be located at PIA in the North Field area. This site was selected through the project's preliminary station analysis process discussed in Section 2.9 and through coordination with PIA officials. The maintenance and operation control center is compatible with the *Land Use Plan for PIA* (June 2002), developed as part of the continuous master planning process for the airport.

The maintenance facility would occupy approximately 14.2 hectares (35 acres) and include a multi-story operation and maintenance center building, a visitor center, employee and visitor parking, maintenance vehicle parking and storage, open air vehicle storage, and the guideway, switches, and transfer table required to maintain the system and deploy the vehicles.


HOOKSTOWN GRADE RD.
Access Roads
Parking
Parking
Maintenance & Vehicle Washing Bays
Transfer Table
Visitors Center
Maglev Guideway
AIRPORT EXPRESSWAY
60
The Pennsylvania High-speed Maglev Project
Maglev Maintenance Facility
Figure 2.2.6-1
0 37.5 75 112.5
Meters
0 175 350
Feet
N
LEGEND
Proposed Maintenance Facility

The operations and maintenance facility would be one of the first structures to be constructed. It would be the key facility to initiate the certification of the entire initial line. Construction, outfitting, and operational verification of the facility would provide an evaluation platform for early assessment of the overall system performance for high-speed maglev technology in the United States.

Command and control of the maglev system would be based at the operations center. All activities related to the command and control of the system, including vehicle deployment, movement, switching, and monitoring, would originate from this location.

The visitors center would be a multi-level area where visitors would be provided a multimedia overview of magnetic levitation technology. Local maglev system visitors would also be able to observe vehicles and routine operational and maintenance activities at this location.

Daily and routine maintenance activities for the vehicles would be conducted at the maintenance center. Most of the facility would be devoted to areas specific to vehicle and system maintenance. The maintenance center would include up to five vehicle bays capable of all-weather coverage of a five-section consist approximately 128 meters (420 feet) in length. Some of the bays would be dedicated for maintenance activities (such as preventative maintenance and repairs) and storage and one would be an automated vehicle-washing bay. Waste water and chemicals used during vehicle maintenance operations would be stored and disposed of in accordance with procedures for local and state permitting. In addition to the bays, there would be areas for storage and various component/equipment repair and calibration.

The facility would also have the capability for outside storage areas and guideways for maintenance vehicles and equipment. The vehicle transfer table and switching operations would be located outside of the maintenance facility building.

2.3 Development of Preliminary Alternatives in the PEIS

The purpose of the FRA Maglev Deployment Program is to deploy/demonstrate maglev technology as a “next generation” high-speed ground transportation system that has “real-world” applications. FRA has been evaluating rail and maglev High-Speed Ground Transportation (HSGT) systems that could satisfy city-to-city transport for a number of years. These HSGT systems included: Accelerail; New High-Speed Rail (HSR) similar to the systems developed and in use in Japan, France, and Germany; and maglev. Top speeds for Accelerail would be in the range of 145 to 241 kph (90 to 150 mph). Although HSR systems in other countries have achieved record speeds of 515 kph (320 mph) under optimum testing conditions, research has shown that practical top speeds for HSR would not exceed 350 kph (217 mph). The maglev would reach 386 kph (240 mph).

Through the PEIS, the FRA determined that maglev systems would partially address several problems associated with regional transportation in the United States, and could serve as an alternative transportation system capable of reducing congestion at the nation’s airports and on its highways.

As part of the development of the PEIS, the FRA investigated alternative maglev technologies. Two maglev technologies, the Transrapid International System and the Maglev 2000 System, were proposed for the Maglev Deployment Program during the course of the PEIS. Although both technologies were considered feasible, the Pennsylvania High-speed Maglev Project chose to use the Transrapid International System. This system has been demonstrated and tested at a transportation-proving facility in Emsland, Germany, over the past 20 years. The manufacturers of the Transrapid International system consider it ready for commercial passenger service, as evidenced by the recent construction of a commercial system in China.

After evaluating the alternatives, the FRA decided to proceed with an Action Alternative, focusing on a maglev project in Pennsylvania or Maryland. The FRA determined that the potential high performance of maglev transportation could provide air-competitive trip times at longer trip distances between metropolitan areas than the other high-speed ground transportation alternatives. In issuing a ROD for the PEIS, which advanced the proposed Pennsylvania High-speed Maglev Project as part of the Preferred Alternative, the FRA identified a number of factors used to determine which type of high-speed ground transportation would satisfy the transportation needs of particular corridors, including the following:

- Shorter trip times;
- High reliability during peak demand;
- Convenience;
- Shared corridors;
- High capacity;
- Safety; and
- Independence from foreign sources of petroleum and other fuels.

The ROD concluded that, “the diversion of intercity trips from air, auto, and rail modes to Maglev could result in net reductions in energy usage, petroleum consumption, emissions of most airborne pollutants, and accidents. Higher speed, reliable travel would improve access between employment and population centers and help to accommodate the significant growth in population and travel demands projected for the future. Strategic economic goals of job creation, technological advancement, and international competitiveness would be enhanced by the development and building of maglev systems” (FRA, 2001). Because the current evaluation is a continuation of the work begun for the PEIS and documented in the ROD, only the Pennsylvania Build (Action) Alternative and the No-Build Alternative are considered in this site-specific EIS.

The remainder of this chapter describes the process used to advance potential alternatives from preliminary conceptualization to detailed study.

2.4 Planned Local Public Transportation as an Alternative

As a result of public comments received during the preparation of this DEIS, public transportation improvements programmed within the corridor were analyzed to determine their potential role in supporting the alternatives for this project. Both the PAAC and WCTA have annual capital improvement programs and ongoing operations activities in place that would result in better public transit services within the region.

Regionally, the *2025 Transportation and Development Plan for Southwestern Pennsylvania* (the region’s long-range transportation plan), prepared by the SPC, indicates that all available financial resources for adding new capacity to the area’s transit systems, including the PAAC and WCTA, are committed to other purposes through the year 2015. About half of the transit funding expected for western Pennsylvania during the long-range plan’s programming period is needed for actual transit operations, including payroll, components, supplies, and routine maintenance. Much of the remaining money will be needed for system preservation, modernization, and major capital maintenance of the existing systems.

Public transportation improvements within the corridor would enhance the local transportation network and increase intermodal connectivity. They would not, however, demonstrate the viability of maglev technology and, therefore, could not meet the overall project purpose and need. Consequently, they were not considered as part of the alternatives evaluation. Even though many past studies have shown that a strong public transportation system improves the quality of life within a local area, transit improvements would address a different set of potential project needs than the Maglev Deployment Program. Although there would be some overlap in these similar transportation projects, especially in meeting regional needs, the proposed transit improvements and the deployment of a regional maglev system would complement rather than compete against each other. Additionally, the construction of a maglev system would introduce a new mode of transportation into an area without any high-speed transportation service. Therefore, planned local mass public transportation alternatives were dismissed from further analysis in this DEIS.

2.5 Description of the Remaining Preliminary Alternatives for this DEIS

As a result of the findings documented in the PEIS and the subsequent ROD, and other factors relevant to the regional transportation development process, the remaining preliminary alternatives were refined for analysis during the preparation of this DEIS.

2.5.1 No-Build Alternative

The No-Build Alternative would consist of taking no action toward the construction of a maglev system in the Pittsburgh region. Present and future transportation deficiencies would need to be addressed by other transportation improvements aimed at increasing capacity on the region's highway network and within local transit systems and would continue to progress as separate projects. These capacity-adding projects and enhancements to the local public transit systems are included in the region's long-range transportation plan and its transportation improvement program.

Environmental impacts would occur as a result of these other projects, primarily as a direct impact of the projects themselves, but also because they may not completely address future regional transportation needs or not address problems in a timely manner.

The No-Build Alternative is always considered as an alternative for any project. It is carried into detailed study as a baseline for establishing the environmental consequences of the build alternatives. These impacts will be addressed in Chapter 4.0 of this DEIS.

2.5.2 Build Alternatives

The build alternatives consist of various alternative alignments for constructing a high-speed maglev system in southwestern Pennsylvania. The Pennsylvania High-speed Maglev Project would serve the area between PIA in western Allegheny County and the Greensburg area of Westmoreland County. It could also eventually be expanded beyond the region to provide more intercity service as demand increases.

The high-speed maglev system presented in this DEIS would include the fixed guideway alignments and five stations where passengers would access the system. The build alternatives include a maintenance facility and vehicle storage yard near the western terminus of the system, as well as the alignment leading to the facility from the PIA station, approximately 4.8 kilometers (3 miles) of additional guideway. Five unmanned, electrical substations to support the energy requirements of the system would also be part of any of the build alternatives.

Substations would normally be located within 3.2 kilometers (2.0 miles) of a passenger station. The first substation would be located adjacent to either the proposed maintenance facility near PIA or at the Enlow station. The second substation would be located in the vicinity of McKees Rocks, while the third substation would be located in the vicinity of the Downtown Pittsburgh station. The fourth substation would be located adjacent to the station serving the Monroeville/Penn Hills area. The fifth substation would be adjacent to the station serving the Greensburg/Hempfield Township area in Westmoreland County. Although other substations could be necessary, or the locations of the substations could be shifted to better meet the electrical power requirements of the system, all of the substations would be constructed within the right-of-way needed for the maglev guideway.

In order to complete the development of each alternative and facilitate future data gathering during the more detailed studies, the study area was divided into three planning analysis zones. The analysis zones are identified as Sections A, B, and C. Section A begins at PIA and connects to Section B in Downtown Pittsburgh. Section B begins in Pittsburgh's downtown and connects to Section C in the Monroeville/Penn Hills area. Section C begins in the Monroeville/Penn Hills area and ends at the proposed station near Greensburg. Alternative alignments were developed for each section, including possible locations of passenger stations.

The analysis zones correspond to locations associated with the proposed passenger stations and include the intervening geographic areas between those places. The use of separate planning analysis zones enabled the study team to conduct concurrent environmental investigations of the build alternatives that employed the same technical methodologies, collected similar data, and maintained identical research standards. Because logical termini were established in the PEIS at PIA and near Greensburg, the areas within the planning analysis zones were not considered different project segments, but simply a logical and efficient way to organize the environmental studies used to evaluate the build alternatives.

2.6 Preliminary Alternatives Analysis

Several screenings of alternative alignments have taken place throughout the project. For the first screening, preliminary alternatives for a maglev system in the Pittsburgh area were developed and evaluated in the environmental assessment (discussed in the opening section of this DEIS). Secondary source data (i.e., planning data from local and regional organizations or agencies) were utilized to measure the potential environmental consequences that could result from the construction of such a transportation system.

A second screening occurred during the engineering and environmental studies included as part of the development of the PEIS (also discussed in the opening section of this chapter). Although the environmental assessment formed the technical basis for those studies, an additional level of alternatives screening occurred when the proposed maglev alignments were presented to state and federal agencies and when public comments were submitted. The agency and citizen comments addressed in the PEIS helped refine the alternative alignments a second time.

For the environmental studies included as part of this DEIS, preliminary data were gathered for socioeconomic, cultural, and environmental features found within each section, and further engineering analysis of the potential alternative alignments was undertaken. (Information was collected on historic resources, potential hazardous waste sites, and community facilities. The individual community facilities included cemeteries, parks and other recreation areas, major employment centers, industrial parks, public facilities, churches, schools, major commercial areas, and major communities that are located along the potential alignments.) The analysis of other socioeconomic information, including demographics and environmental justice, was deferred until the range of alternatives was narrowed in the detailed studies that would be required later in the process that led to this DEIS.

Additional engineering information was collected during the preliminary analysis to assure that specific design criteria could be achieved and that the operational need would be met. Because the attainment of the speed criteria specified in *TEA 21* was legislatively mandated, the project design team attempted to meet it on each alignment. The design team, however, soon understood that the existing urban densities found within the neighborhoods of Section B made it unlikely any alignment within that planning area could reach speeds of 386 kph (240 mph) without significant environmental impacts. This placed a greater emphasis on achieving the required speed within the other two sections.

Each of the passenger stations, including the maintenance facility and visitors center, was also evaluated to identify the most feasible and compatible alignment for the deployment of a high-speed maglev system. Some alternative alignments could serve more than one possible station in a particular location, but other alignments would provide service to only one station. As part of the station analysis, roadway improvements needed to provide access to the stations were also identified and analyzed.

The following five general criteria were used to evaluate the potential maglev system proposed for the area:

- Safety and operational considerations;
- Length of the alternative alignment (in order to provide a preliminary estimate of possible capital and operating costs);
- Preliminary engineering design, including the attainment of a 386 kph (240 mph) operating speed within the overall alignment;
- Impact to environmental, cultural, and socioeconomic features; and
- Public and resource agency input.

Projected capital costs were not included as an initial screening criterion, but costs were considered on a relative scale based on the anticipated alignment length. The longest alignments would likely result in the highest capital costs. However, capital costs could also be affected by the inclusion of special structures, such as river crossings, tunnels, or extensive retaining walls. Special structures and the costs of required highway access improvements would increase the overall project cost. Capital cost estimates were subsequently revised, as noted in a later section of this chapter, to include those improvements, as required, based on the alternative alignment and station location.

The preliminary environmental analysis was applied to a 60-meter (200-feet) study buffer surrounding the proposed centerlines of each alternative alignment, in effect, 30 meters (100 feet) on each side of the centerline. Impacts to critical environmental features were tabulated for those located within this buffer zone. Sources of data included regional information obtained from the SPC geographic information system, historical aerial photography, recent aerial photography (April 2001 and June 2002), U.S. Geological Survey (USGS) quadrangle maps, statewide and national environmental data files, resource inventories from the Pennsylvania Historical and Museum Commission (PHMC), other project files, and field observations. All information was aggregated to allow comparison of alternative alignments within each section.

Technical information on the site-specific project was first presented to the public in a series of open house meetings held throughout the project area. The first round of public meetings was held between October 23, 2001 and November 1, 2001. This initial series of meetings introduced the project to the public, presented project needs, and identified potential areas of community concern. Nearly 300 people attended the meetings.

Similar information was provided to a special interagency task force comprised of representatives from environmental resource and transportation agencies with jurisdiction over, or having operating interests in, transportation projects in Pennsylvania. These agencies are shown in Figure 2.6-1.

Federal Agencies

Federal Aviation Administration
Federal Highway Administration
Federal Railroad Administration
Federal Transit Administration
U.S. Army Corps of Engineers
U.S. Coast Guard
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service

State Agencies

Pennsylvania Department of Agriculture
Pennsylvania Department of Community and Economic Development
Pennsylvania Department of Environmental Protection
Pennsylvania Department of Transportation
Pennsylvania Fish and Boat Commission
Pennsylvania Game Commission
Pennsylvania Historical and Museum Commission
Pennsylvania Turnpike Commission

Local Agencies

Port Authority of Allegheny County
Southwestern Pennsylvania Commission
Westmoreland County Transit Authority

The Pennsylvania High-speed Maglev Project

Environmental Resource and Transportation Agencies with Jurisdiction over Transportation Projects in Pennsylvania

Figure 2.6-1

2.7 Preliminary Alternatives Dismissed from Further Study

Although it would have been possible to compare potential alignments for the entire length of the project (from PIA to the Greensburg/Hempfield Township area), only alignments within each section were compared to one another because all three study sections exhibited different characteristics. Section A (PIA to Downtown Pittsburgh) is suburban in nature to the McKees Rocks area, where the corridor transitions to urban neighborhoods. Fast developing commercial hubs, new employment activity centers, and clustered residential neighborhoods are all found within Section A. Section B (Downtown Pittsburgh to the Monroeville/Penn Hills area), on the other hand, is almost completely urban in character (and mostly built-out), with dense residential neighborhoods, the region's foremost commercial and employment centers, and unique recreational activity areas and tourist attractions of regional importance. Section C (the Monroeville/Penn Hills area to the project's terminus in Westmoreland County) is both suburban and rural in nature, and includes parts of Westmoreland County's two fastest growing residential communities (Murrysville and Penn Township), as well as some active farmland.