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Testimony

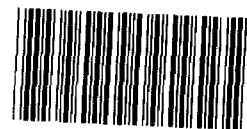
Before the Subcommittee on Surface Transportation,  
Committee on Commerce, Science, and Transportation,  
United States Senate

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HIGH SPEED GROUND  
TRANSPORTATION

Funds Need to be Focused  
Under Proposed Legislation

Statement for the Record of  
Kenneth M. Mead,  
Director, Transportation Issues,  
Resources, Community, and Economic  
Development Division



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Mr. Chairman and Members of the Subcommittee:

We appreciate the opportunity to testify on the issues surrounding the development of high-speed ground transportation (HSGT) in the United States. We have analyzed the available data on the progress of HSGT both in the United States and abroad, and to gain some first-hand experience, we have ridden on several HSGT systems, including the X2000 tilt train. We have also met with Amtrak managers, other railroad officials, HSGT project planners, transportation analysts, and members of the financial community. In the past two months, we have testified on HSGT issues before the House and Senate Appropriations Committees' Subcommittees on Transportation and before the House Energy and Commerce Committee, Subcommittee on Transportation and Hazardous Materials. Our testimony today focuses on the allocation of federal resources in a manner that best facilitates HSGT development.

By "high speed" we mean systems capable of sustained speeds of at least 125 mph.<sup>1</sup> As a result of upgrades to the right-of-way, Amtrak's Metroliner trains travel at 125 mph along some stretches of track between Washington, D.C., and New York City. Higher-speed rail systems, such as the French train à grande vitesse (TGV) and the Japanese Shinkansen, have carried millions of passengers over the years at speeds of between 150 and 185 mph. Magnetic levitation (maglev) technology being developed in Germany and Japan could carry passengers at speeds over 250 mph.

The Administration recently proposed legislation for developing high-speed rail corridors and advancing high-speed rail technology. Under the proposal, federal funds would be made available, subject to state and local government matching requirements, to increase speeds in certain rail corridors selected by the Secretary of Transportation. The Northeast Corridor Improvement Program would continue to be funded separately. The Administration has requested \$1.3 billion over 5 years to fund these and other HSGT initiatives.

Our basic points are as follows:

- The United States could pursue several technology options to make HSGT a reality here. The cost of these options increases with speed. The least costly alternative, making incremental improvements to existing rights-of-way, could permit speeds of up to 150 mph at a cost of between \$500 million and \$2.6 billion for a hypothetical 200-mile corridor. Higher-speed approaches, using technology similar to that of the French TGV, could permit speeds of up to 200 mph, but because these systems require new

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<sup>1</sup>In the United States, most Amtrak trains travel at speeds below 79 mph and often average only 50 to 60 mph.

rights-of-way, their cost increases to nearly \$4 billion for a 200-mile corridor. Maglev also requires straight and level rights-of-way, but because maglev requires costly guideways, such a system could cost up to \$12 billion for a 200-mile corridor.

- More than a dozen HSGT projects have been proposed around the nation, including incremental approaches, TGV-type systems, and maglev. Amtrak's Northeast Corridor Improvement Program is an example of an incremental approach to high speed that has been federally funded; it is the only project that has moved from planning to implementation. Plans to build TGV-type and maglev systems have attempted to secure private-sector financing. However, these plans have stalled because uncertainties about ridership and expected rates of return have discouraged private investment in HSGT. Investment bankers told us that without a substantial federal investment to reduce the perceived risks, few private dollars would flow towards HSGT systems.
  
- Until recently, federal funding for HSGT has largely been limited to the \$2.5 billion appropriated for Northeast Corridor improvements over a period of nearly 20 years. Recently, the Administration proposed the High-Speed Rail Development Act of 1993. The Secretary of Transportation proposes to spend \$140 million in fiscal year 1994 and a total of \$1.3 billion between 1994 and 1998 on HSGT. While modest in terms of the total cost of proposed HSGT systems, the proposal represents a significant increase over the federal commitment to HSGT of previous years. About \$1 billion of the proposed funding would be used for high-speed rail corridor development and the remainder would be used for technology development. The proposed legislation contains no schedule for bringing HSGT on line, nor does it limit the number of projects that can receive federal funds.
  
- Because HSGT systems are costly, a strategic approach is needed to focus federal funds on the projects of most merit. Such a focus would ensure that federal funds have the maximum impact. Developing HSGT in a single 200-mile corridor could cost between \$500 million and \$12 billion, depending on the technology chosen. Spreading the proposed \$1 billion over more than two or three incremental projects could substantially delay the day when 125-mph speeds become a reality in any particular corridor. More ambitious TGV-type or maglev projects, because of their high cost, may not benefit substantially if the funds were allocated over several projects.

- The proposed legislation contains much-needed criteria which would help provide a strategic focus of funding, based in large part on the social benefits that the HSGT systems are expected to provide. However, to make valid comparisons among projects, decisionmakers will require a thorough understanding of the underlying data and assumptions used in developing ridership forecasts. This is especially important, since expected ridership drives other criteria such as expected revenues, subsidy requirements, congestion relief, and air quality improvements.

Now we would like to discuss these points in more detail.

PERFORMANCE AND COSTS  
FOR DIFFERENT HSGT APPROACHES

The various approaches to HSGT have different performance characteristics and, not surprisingly, the systems that offer the highest speeds cost the most. The incremental approach--upgrading existing railroad rights-of-way--can permit speeds of up to 150 mph without significant purchases of new rights-of-way. The cost of this approach would be between \$2.7 million and \$13 million per mile. Table 1 shows the potential/probable upgrades and costs under the incremental approach to permit 125-mph speeds on a hypothetical 200-mile right-of-way.

Table 1: Infrastructure Upgrades Needed and Approximate Costs to Achieve 125-mph Speeds on a 200-Mile Corridor

Upgrades and other costs	Total Cost (in millions)
Bridge repair/modification	\$413.6
Electrification	400.0
Grade crossings	206.7
Added track	166.8
Signaling	89.1
Concrete ties	79.2
Stations	58.0
Continuous welded rail	30.6
Interlockings	13.7
Fencing	4.0
Planning costs and contingencies	584.7
New rolling stock	215.0
Grand total	\$2,261.3

Sources: Amtrak, and Transportation Research Board, Special Report 233: In Pursuit of Speed--New Options for Intercity Passenger Transport (Washington: National Research Council, 1991)

Actual costs would depend on the condition of the existing right-of-way in any given corridor. Some corridors, such as the Detroit to Chicago route, have already received considerable investment from a variety of sources. Achieving 125-mph speeds in such corridors would cost less than achieving such speeds in locations where rights-of-way have undergone fewer improvements.

More advanced rail systems like the French TGV can achieve speeds near 200 mph, but these systems require new rights-of-way, which increase the total cost to near \$20 million per mile. Maglev, which could achieve speeds of over 250 mph, may require new rights-of-way but will also require specialized guideways, which add further to the cost of these systems--up to \$60 million per mile. Table 2 provides a summary of the relative speed capabilities and costs of the technology options.

Table 2: Relative Top Speeds and Costs of High-Speed Ground Transportation

Types of technology	Speeds (mph)	Cost per mile (millions)
Maglev Japanese maglev German maglev	324 <sup>a</sup> 270 <sup>a</sup>	\$20 to \$60
TGV-type TGV (France) Shinkansen (Japan) Intercity Express--"ICE" (Germany)	186 163 156	\$17
Incremental Tilt trains (Sweden, et. al.) Metroliner (U.S.)	150 125	\$2.7 to \$13

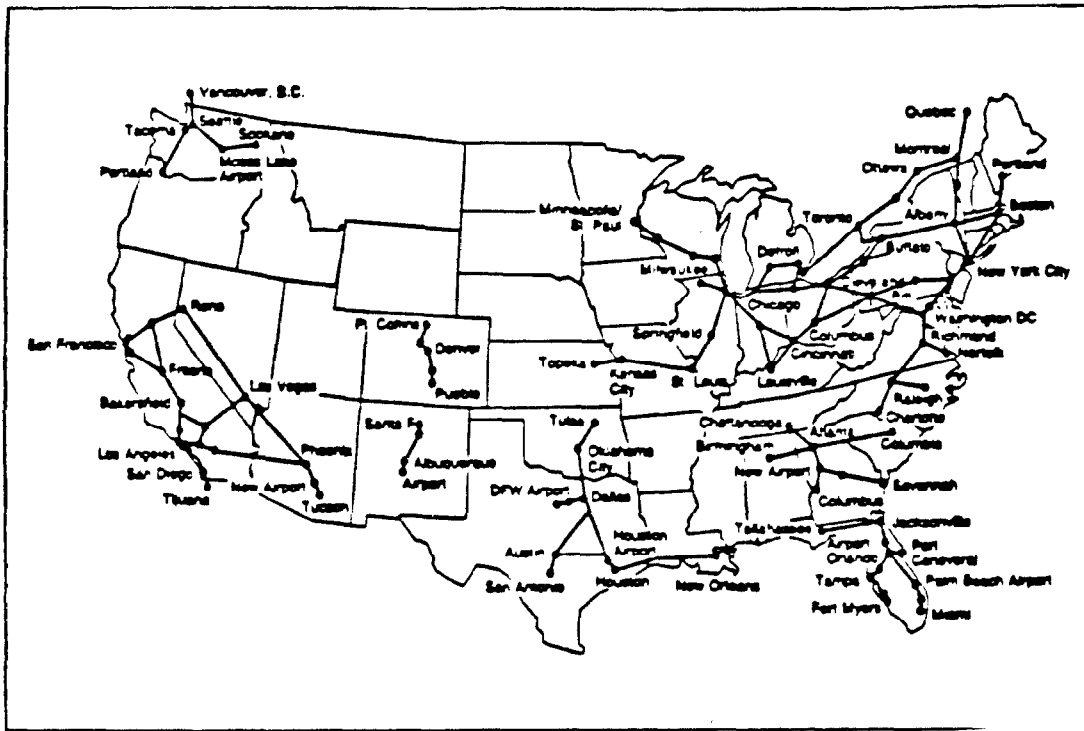
<sup>a</sup> Test speeds.

Because maglev is a developing technology and no high-speed maglev systems have entered revenue service anywhere in the world, cost estimates vary widely. Cost estimates vary for incremental approaches using tilt trains or Metroliner-type equipment because the cost of upgrades depends on the existing condition of the infrastructure, which varies among rail corridors. Cost estimates for TGV-type systems are more precise because the technology is in service and its infrastructure requirements are better defined than other technology options. A more detailed discussion of each technology option appears in appendix I.

NUMEROUS HSGT PROJECTS HAVE BEEN PROPOSED  
BUT NOT BUILT BECAUSE OF LACK OF FUNDING

Plans to introduce high-speed rail systems have been proposed in more than a dozen locations around the nation, as shown in figure 1.

Figure 1: High-Speed and Maglev Systems Under Study



Source: High-Speed Rail/Maglev Association

The federal government has funded Amtrak's Northeast Corridor Improvement Program and has provided the first \$5 million of a total of \$30 million for grade-crossing improvements, a component of incremental improvements along five rail corridors. A HSGT project in Texas proposes to link the cities of Houston, Dallas, and San Antonio, using TGV technology. Maglev proponents planned to build a system connecting Anaheim, California, with Las Vegas, Nevada. In Florida, a 13.5 mile maglev system is planned to connect the Orlando International Airport with International Drive, the location of numerous hotels serving the area's tourist attractions. However, these HSGT projects--all of which have sought funding from the private sector--have not attracted sufficient investment to move beyond the planning stages.

Members of the financial community told us that the private sector has been unwilling to commit financial resources to HSGT because of a number of perceived risks. Because of the lack of experience with HSGT in the United States, investors believe that ridership and revenue forecasts may be exaggerated. The financial community typically discounts traffic forecasts for demand-sensitive start-up projects like toll roads and, presumably, HSGT



projects. Furthermore, investors require that projects generate sufficient revenues to cover their debt service needs, including a substantial cushion to cover contingencies. For some projects, this cushion could be as high as 150 percent of the actual debt service costs. Unless the financial community believes that HSGT projects can generate enough revenues to both cover debt service and provide a return on investment commensurate with the risks, it is unlikely that private capital will be forthcoming. Investment bankers with whom we spoke said that in view of the perceived risks of HSGT, major private-sector investment is unlikely without a considerable increase in federal commitment.

PAST FUNDING HAS FOCUSED ON  
THE NORTHEAST CORRIDOR, BUT  
INCREASES ARE PLANNED

To date, federal HSGT assistance has been focused on the Northeast Corridor, where a \$2.5 billion federally funded incremental program has been in progress since 1976. Other federal assistance efforts include funding to study specific HSGT corridors and to develop HSGT safety regulations. In fiscal years 1991 and 1992, the Congress appropriated \$3 million for studies of specific HSGT corridors, contingent on matching funds being provided. The Federal Railroad Administration (FRA) has also used some of its research and development funds to draft safety regulations for HSGT systems. Recently, \$5 million out of a total of \$30 million authorized in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) was provided for eliminating grade-crossing hazards in five potential high-speed corridors.

For maglev, the federal government has sponsored the National Maglev Initiative (NMI), a 3-year study to assess the potential role of maglev in the United States. According to FRA officials, funding for NMI has totaled \$32 million.<sup>2</sup> The NMI report is due this spring. As part of ISTEA, the Congress authorized \$725 million for a National Maglev Prototype Development Program, but no funds were appropriated in fiscal years 1992 and 1993. The Bush Administration decided to allow the NMI to complete its work and issue its report before considering requesting these funds. ISTEA authorized up to \$1 billion in loan guarantees for HSGT projects, but no budget authority has been provided for this program.

During his campaign, President Clinton often offered HSGT as an example of the kind of infrastructure expenditure that the nation should be making. The new Administration has recently proposed the High-Speed Rail Development Act of 1993. The Secretary of Transportation proposes to spend \$140 million for

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<sup>2</sup>In previous testimonies we stated that the NMI funding totaled \$36 million according to figures provided by FRA officials. FRA has since revised the figure to \$32 million.

fiscal year 1994 and a total of \$1.3 billion during fiscal years 1994-98 to develop high-speed rail corridors and HSGT technology. Because HSGT is very costly and over a dozen projects have been proposed, deciding whether to focus these funds on two or three projects or to spread the funds across several projects will be a key determinant in the impact federal funds will have.

FEDERAL HSGT FUNDING  
SHOULD BE FOCUSED

The Administration's proposed \$1.3 billion for HSGT will provide maximum assistance to HSGT development in the short term only if the funds are strategically focused on a maximum of two or three projects. Of the \$1.3 billion, the Administration plans to provide about \$1 billion to develop high-speed rail corridors, while the remainder would be used to advance HSGT technology. Providing \$1 billion over 5 years averages \$200 million per year. If these funds are spread over as few as five projects, each would receive, on average, only \$40 million each year.

While there is no way of precisely determining how much federal funding constitutes a threshold for the success of a HSGT project, spreading funding over a number of projects would leave each with only a small fraction of the cost to bring HSGT on line. An incremental improvement program to achieve 125-mph speeds could cost over \$2 billion for a 200 mile corridor. Providing electrification alone could cost about \$400 million for a 200-mile corridor, and eliminating grade-crossing hazards could cost over \$200 million. While allocating small amounts of federal funding to several projects could facilitate limited incremental improvements leading to some increases in speed, attaining 125-mph speeds through this approach could be a very lengthy process. The current status of the Northeast Corridor, where Metroliner trains run at speeds of up to 125 mph, is the result of 17 years of congressional appropriations averaging about \$147 million per year for this one project. This figure is just slightly higher than the \$140 million in proposed funding for fiscal year 1994, which could be allocated to any number of corridors or technology development projects. Allocating \$50 million per year to the more ambitious projects, such as building a \$3.5 billion TGV-type system, may not provide the critical mass to move the project from planning to construction.

The proposed legislation provides no maximum or minimum for the number of projects that the Secretary of Transportation may designate for federal funding. Focusing funds on a limited number of projects will mean fewer funds for other projects. Section 1010 of ISTEA, which authorized \$30 million for eliminating grade crossings in rail corridors, provided for a maximum of five corridors.

CAREFUL DATA ANALYSIS IS REQUIRED TO

## CHOOSE PROJECTS FOR FEDERAL FUNDING

The decision on where the funds could be focused will be based on the benefit, cost, and other criteria outlined in the proposed bill. Although anticipated ridership is just one of the criteria, ridership is extremely important because it drives several others, such as anticipated revenues, subsidy requirements, congestion relief for other travel modes, and the impact on air quality. Because some data needed for accurate ridership forecasts are lacking, the accuracy of ridership forecasts could be compromised, in turn compromising the expectations of the system's performance under other criteria. Furthermore, the assumptions used in developing ridership forecasts must be well understood, since these assumptions can have a significant impact on the results of the forecasts.

The proposed legislation requires that states petition the Secretary of Transportation for eligibility for federal funding. In choosing projects, the Secretary will consider, among other things, anticipated congestion relief on other travel modes and anticipated air pollution reduction. We have testified that such social benefits should be considered in deciding where to invest federal funds. However, because these benefits depend upon how many people ride the system, inaccuracies in ridership forecasts will, in turn, affect estimates of social benefits.

Missing data on automobile travel could compromise the accuracy of ridership forecasts. Few data exist on the origin and destination of automobile trips. These data are essential to determine the numbers of automobile travelers that might switch to HSGT. Ridership forecasts have relied on less precise proxies such as toll ticket collection or extrapolations of national travel data that do not include city-pair data.

HSGT ridership forecasts are also based on a number of assumptions that must be assessed for reasonableness and their potential impact on the resulting predictions of ridership, revenues, and social benefits. For example, ridership forecasts typically assume that the fare on an HSGT system will be less than the competing airline fare. However, airlines would likely cut their fares if HSGT offered a serious challenge to their traffic bases. HSGT ridership forecasts also typically assume that a certain percentage of ridership will result from trips that would not have occurred in the absence of HSGT. Estimates of this ridership, called "induced demand," have ranged from 10 percent up to about 40 percent of total ridership in the forecasts. Some analysts believe that any assumption of induced demand over 10 percent of total demand may be too high.

## MODELING AND COST-BENEFIT ANALYSIS NEED IMPROVEMENT

While there is a need to understand ridership forecasting methodology, decisionmakers should also recognize that some pollution modeling techniques are outdated. Furthermore, converting a project's social benefits and costs to dollar terms to allow comparison with development costs is not an exact science. Finally, the opportunity costs of building a HSGT system need to be considered.

Outdated air-emissions models make measuring the effects of high-speed rail on air quality difficult. In April 1993, GAO testified that the art of predicting the impact of transportation projects on air quality is not well advanced.<sup>3</sup> In general, travel-demand models were originally developed 20 to 30 years ago to analyze the need for new or modified highway facilities. Because these models often do not incorporate or fully recognize such factors as vehicle speed or type, they are now ill-suited for analyzing the impact of transportation projects on air quality. Officials at a number of local planning organizations cited problems in evaluating this impact using existing information and models.

Comparing the potentially positive net public benefits of HSGT with its construction and operating costs is complicated because many of the social benefits of HSGT, such as reduced air pollution, are not readily translated into dollar amounts. In addition, there are social costs associated with HSGT. For example, while air traffic diversion could reduce airport noise, the HSGT system could result in a social cost by generating noise along the entire right-of-way.

In deciding whether a HSGT project should be built, alternative solutions should be assessed to determine whether HSGT is the most economic alternative. The National Research Council points out that predictions of economic development that would result from HSGT often do not take into account the opportunity cost of building a HSGT system instead of making airport or highway improvements.<sup>4</sup> Construction jobs could be created by widening interstate highways. Building new or expanded airports may provide a more flexible and lower-cost option. For example, the \$3.1 billion cost of the New Denver Airport, which will provide access to hundreds of cities around the nation and the world, was about half the estimated cost for a 200-mile maglev. Proposals to expand or construct highways and airports, however, could face serious opposition, limiting the practicality of this option in some cases.

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<sup>3</sup>Surface Transportation: Optimizing Returns on Investment Under Resource Constraints (GAO/T-RCED-93-29, Apr. 22, 1993)

<sup>4</sup>Transportation Research Board, Special Report 233: In Pursuit of Speed--New Options for Intercity Passenger Transport.

INCREASED FEDERAL PARTICIPATION  
COULD TAKE MANY FORMS

To date, the bulk of the federal government's assistance to HSGT has been in the form of appropriations specifically designated for the Northeast Corridor. The Administration's proposal is based on federal grants which the Secretary of Transportation would allocate to projects judged to be most appropriate on the basis of specified criteria. Because private investors have been reluctant to invest in the early stages of a project, federal funds could provide the needed equity to stimulate private investment. Other possible forms of federal assistance include guaranteed loans, revolving loan funds, or increased high-speed rail access to tax exempt debt.

- ISTEA's loan guarantee provisions. ISTEAs made HSGT eligible for \$1 billion in loan guarantees authorized by the Railroad Revitalization and Regulatory Reform Act of 1976. Loan guarantees would also reduce the perceived risk for private investors. Currently, there is no budget authority for this program.
- Direct loans through a revolving loan program. Some members of the financial community, as well as the Infrastructure Investment Commission, have suggested that the federal government establish its own revolving loan fund for infrastructure development or help fund state-level revolving loan funds for the same purpose. Such a fund could be established through federal investment (with the government acting as a shareholder), gasoline tax increases, or perhaps through appropriations, according to the commission's report.
- Tax-exempt debt for HSGT systems. HSGT proponents believe that removing the requirement that 25 percent of the value of HSGT development bonds be subjected to state volume caps is critical to HSGT system development. Tax-exempt bonds are an attractive mechanism for raising capital because bond issuers pay a lower interest rate than they would on taxable debt. Legislation has been introduced to remove the restriction on using tax-exempt bonds to finance HSGT development.

CONCLUSIONS

HSGT systems are expensive in any form, requiring a strategic selection of the most beneficial projects. As previously stated, the federal government has provided an average of \$147 million per year over 17 years for just one project--the Northeast Corridor. In contrast, the Administration's proposed \$140 million for fiscal year 1994 could be allocated to any number of projects outside the Northeast Corridor. Federal funding, if spread over many projects,

is not likely to provide the critical mass needed to move any of these projects to implementation in the near term. Therefore, we believe that if the Congress chooses to increase federal funding for HSGT, targeting funds to the most meritorious projects would be a critical success factor. The criteria in the Administration's proposed legislation could help provide this focus. However, the methodology and assumptions used in developing ridership forecasts need to be completely understood to determine the reliability of states' assertions regarding other criteria for selecting projects, such as anticipated revenues, subsidies, congestion relief, and air quality improvement.

APPROACHES TO HSGT

HSGT planners have three basic options. Incremental improvements can be made to existing railroad infrastructure, at a cost of between \$2.7 million and \$13 million per mile, which would permit speeds of up to 150 mph. Systems similar to the French TGV achieve speeds near 200 mph, but to ensure passenger comfort and safety, these systems require straight and level rights-of-way. TGV-type systems would cost close to \$20 million per mile to build. Maglev has the potential for speeds of over 250 mph, but requires, in addition to straight and level rights-of-way, specialized and expensive guideways that push the cost of these systems to between \$20 million and \$60 million per mile.

INCREMENTAL APPROACH BUILDS ON EXISTING INFRASTRUCTURE

Because the incremental approach requires little or no acquisition of new rights-of-way, it costs the least. According to the National Research Council (NRC), the cost to upgrade an existing rail line to allow speeds of about 110 mph would be about \$2.7 million per mile. The NRC estimates that to achieve speeds of 125 mph would cost \$10 million per mile, while speeds of 150 mph would cost \$13 million per mile.<sup>5</sup> These expenditures result from the need to electrify the rights-of-way, eliminate grade crossings, and otherwise upgrade the railroad infrastructure. In addition, high-speed operations under this approach would require the cooperation of the freight railroads that own most of the nation's track other than in the Northeast Corridor, which Amtrak owns. Amtrak is upgrading the Northeast Corridor, where 125-mph speeds are already achieved in some segments and 150-mph speeds are planned by the turn of the century. Amtrak is also pursuing development of a nonelectric locomotive capable of speeds of at least 125 mph that could provide high-speed service without the cost of electrifying routes outside the Northeast Corridor.

Electrifying Track and Eliminating Grade Crossings Are Costly

Electrifying rights-of-way and eliminating grade crossings are among the most expensive investments that must be made to upgrade existing rail services to high-speed levels. Electric locomotives are currently the only locomotives capable of traveling 125 mph or more. In Europe and Japan, electric locomotives are standard in high-speed passenger operations. Amtrak plans to electrify the

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<sup>5</sup>Transportation Research Board, Special Report 233: In Pursuit of Speed--New Options for Intercity Passenger Transport (Washington: National Research Council, 1991).

Northeast Corridor north of New Haven at a cost of about \$2 million per mile. Outside the Northeast Corridor, where most rights-of-way are not electrified, rail services are provided by diesel locomotives.

Because safety concerns limit train speeds through grade crossings, eliminating as many grade crossings as possible will be critical for HSGT. However, eliminating grade crossings by either raising or lowering the road is costly, ranging between \$5 million and \$20 million for each grade crossing project. Because grade crossings average about one per mile on routes where incremental improvements are planned, the total cost to eliminate all grade crossings would be prohibitive. A less expensive option is to close crossings, (i.e., create dead-end roads), but the resulting disruption to local traffic limits the applicability of this approach. Enhancing grade crossings with protective devices is another option, but passenger trains would still have to slow down at each remaining grade crossing. A combination of grade crossing treatments will likely be needed, depending on a project's budget.

Numerous Other Improvements Are Required to Upgrade Existing Rights-of-Way to Accommodate HSGT

Continuous-welded rail and concrete ties are required to help maintain the precise track alignment necessary for high-speed operations. High-speed switches are also needed. High-speed operations require cab signaling, that is, train control signals that are displayed in the locomotive cab. Furthermore, a system is needed that automatically slows or stops the train if the operator fails to respond properly to a signal.

Additional improvements may be needed, depending on the condition of existing rights-of-way. On routes with substantial freight traffic or conventional passenger service, additional track may be needed to allow high-speed passenger trains to pass the slower trains. Some bridges may need to be widened or require structural reinforcement to handle trains traveling 125 mph. Rights-of-way may need to be fenced to protect pedestrians and prevent vandalism.

Freight Railroad Cooperation Is Needed to Operate Trains Over Shared Rights-of-Way

Operating 125-mph passenger trains on the track currently used by slower-moving freight trains, conventional intercity passenger trains, and commuter trains raises logistics and safety issues. The Association of American Railroads (AAR), which represents the railroad industry, recently issued a policy statement stipulating that if high-speed passenger trains operate over rights-of-way owned by freight railroads, the passenger service should bear any



capital or maintenance costs required as a result of high-speed passenger operations. According to AAR and freight railroad officials, improvements to allow higher speeds are of little benefit to freight traffic, and the nation's freight railroads should therefore not be expected to share the costs. The freight railroads also want indemnity from potentially catastrophic liability from accidents in these rights-of-way. The 1987 collision of a Conrail freight train and an Amtrak passenger train in Chase, Maryland, heightened railroad industry concerns over liability for punitive damages. In the Chase accident, the Amtrak engineer and 15 passengers died and 174 passengers were injured; Conrail paid about \$130 million in out-of-court settlements. Because Amtrak cannot afford to indemnify freight railroads, it has requested that the Congress and the Administration examine how best to approach the liability indemnification issue.

#### Amtrak Continues to Improve High-Speed Service in the Northeast Corridor

Amtrak's Northeast Corridor Improvement Program is an example of the incremental approach to high-speed transportation. As a result of about \$2 billion worth of improvements since 1976, electrically powered Metroliner trains travel between Washington D.C. and New York City at speeds of up to 125 mph. Because the track north of New Haven is not electrified, trains traveling north must switch there to diesel locomotives, which are slower than electric locomotives. Travel between New Haven and Boston is further slowed by numerous curves along the route.

Amtrak plans to electrify the route between New Haven and Boston and is experimenting with new trains that can traverse curves at higher speeds than conventional equipment. For example, Amtrak is currently experimenting with the Swedish X2000 tilt train, which tilts into curves to provide passenger comfort while maintaining higher speeds. By using such modern train technologies, electrifying the route, continuing to eliminate grade crossings, improving signaling, and making other improvements, Amtrak hopes to offer 150-mph service in the Northeast Corridor by the end of the century.

#### Amtrak Is Examining Alternatives to Electrification

While only electric locomotives are currently capable of achieving 125-mph or higher speeds, Amtrak is pursuing development of a nonelectric locomotive that can achieve speeds of 125 mph. As noted earlier, outside the Northeast Corridor, most railroad rights-of-way are not electrified, precluding use of the faster electric locomotives. A nonelectric locomotive capable of speeds of 125 mph or more could permit high speeds without the expense of

electrifying the rights-of-way. Amtrak has been reviewing design proposals for such a locomotive, but thus far has found all the proposed locomotives to be too slow, too heavy, and/or too expensive.

Amtrak now plans to undertake an experiment that involves placing a new-generation turbine engine in an existing Amtrak turbine train in cooperation with the New York Department of Transportation. However, turbine trains have a history of high maintenance costs. Amtrak plans to place the experimental train in operation on the New York-Buffalo route to test performance and gather data on operating and maintenance costs.

#### TGV-TYPE AND MAGLEV SYSTEMS REQUIRE NEW RIGHTS-OF-WAY

For trains that operate over 150 mph, new track, new rights-of-way, or entirely new guideways will be required, adding considerably to costs. High-speed rail systems, such as the French TGV and the Japanese Shinkansen, generally operate on a dedicated right-of-way. Maglev systems require new rights-of-way and specialized guideways.

#### High-Speed Rail Systems Require Dedicated Rights-of-Way

Because of their higher speeds, TGV-type high-speed rail systems require relatively straight and level rights-of-way that are free from grade crossings and slower freight or conventional passenger rail traffic. As a result, a completely new right-of-way must usually be built. In central city areas, where acquiring new rights-of-way might be impractical, these systems could use existing rights-of-way, but would travel at lower speeds.

Significantly lower rail travel times can make rail travel competitive with air travel for many trips of less than 400 miles. Both the French and the Japanese recorded substantial traffic shifts from air to rail following the introduction of high-speed rail systems.<sup>6</sup> The NRC estimated that capital costs for a TGV-type

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<sup>6</sup>European nations and Japan have historically followed policies that favor rail over air and auto travel for intranational trips. Air fares are much higher in these countries, and investment in the highway systems came later than in the United States. Rail has therefore preserved a higher market share than it has in the United States even in markets not served by high-speed trains. Nevertheless, rail's market share increased significantly in French and Japanese markets after high-speed service was introduced.

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