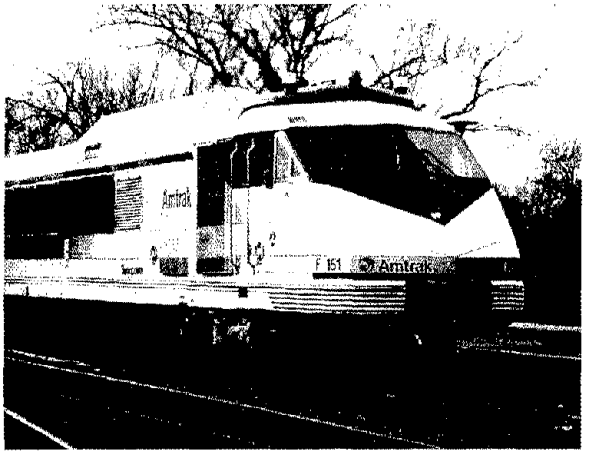
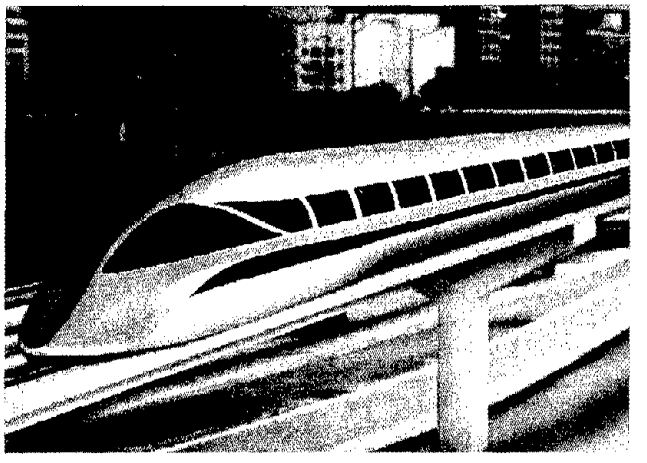
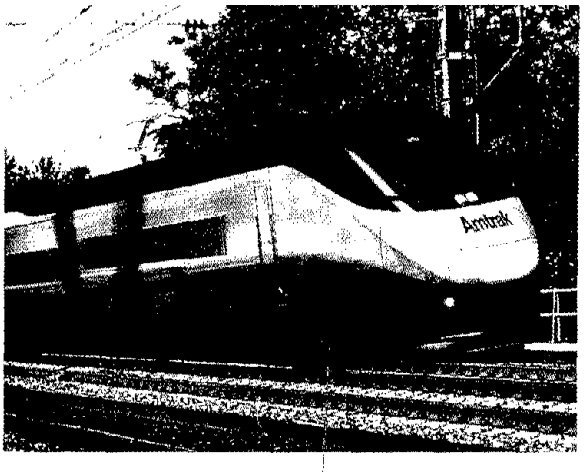
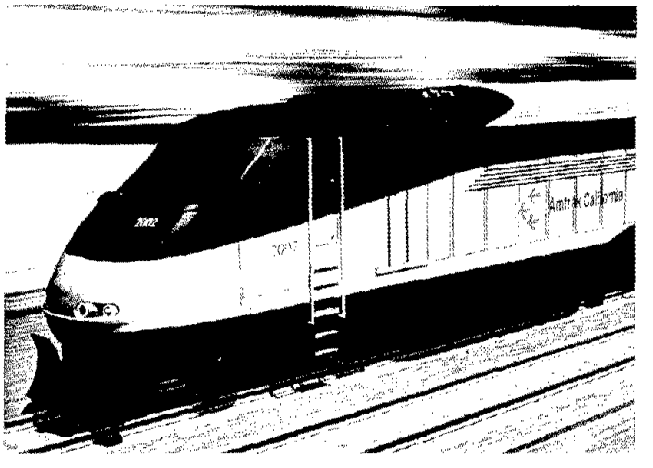
High-Speed Ground Transportation for America

PB97-192041









August 1996

U.S. Department
of Transportation
**Federal Railroad
Administration**

THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

August 21, 1996

The Honorable Al Gore
President of the Senate
Washington, DC 20510

Dear Mr. President:

I am pleased to transmit the Overview to the Report of the Commercial Feasibility of High-Speed Ground Transportation requested under Section 1036 of the Intermodal Surface Transportation Efficiency Act. The main body of this comprehensive report will be transmitted in the near future.

The Report examines the potential for operating various high-speed ground transportation technologies in populous regions of the United States.

I look forward to working with the Congress as we continue to examine the potential of these and other surface transportation options to enhance the Nation's mobility for the future.

Sincerely,

Federico Peña

Enclosure

THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

August 21, 1996

The Honorable Newt Gingrich
Speaker of the House of Representatives
Washington, DC 20515

Dear Mr. Speaker:

I am pleased to transmit the Overview to the Report of the Commercial Feasibility of High-Speed Ground Transportation requested under Section 1036 of the Intermodal Surface Transportation Efficiency Act. The main body of this comprehensive report will be transmitted in the near future.

The Report examines the potential for operating various high-speed ground transportation technologies in populous regions of the United States.

I look forward to working with the Congress as we continue to examine the potential of these and other surface transportation options to enhance the Nation's mobility for the future.

Sincerely,

Federico Peña

Enclosure

Overview Report

High-Speed Ground Transportation for America

Federal Railroad Administration

U. S. Department of Transportation

August 1996

INTRODUCTION

High-speed ground transportation (HSGT)—a family of technologies ranging from upgraded existing railroads to magnetically levitated vehicles—is a passenger transportation option that can best link metropolitan areas lying about 100 to 500 miles apart. Common in Europe and Japan, HSGT in the United States already exists in the Northeast Corridor between New York and Washington, and will soon serve travelers between New York and Boston.

To provide an objective basis for transport policy formulation and planning at the State and Federal levels, this report examines the economics of bringing HSGT to well-populated groups of cities throughout the United States. The intention is to draw nationwide—not corridor-specific—conclusions from projections of the likely investment needs, operating performance, and benefits of HSGT in a set of illustrative corridors in several regions. Although useful collectively, these case studies cannot substitute for the more detailed, State- and privately-sponsored analyses of specific corridors that would be prerequisite to HSGT implementation.

Mandate

As evidenced by Executive Branch support of the 1993 High-Speed Rail Development Act, the Swift Rail Development Act of 1994, and the Next-Generation High-Speed Rail Program, the Department of Transportation has begun to emphasize the value of considering HSGT along with other available transportation options. Moreover, Section 1036 of the Intermodal Surface Transportation Act of 1991 requires the Secretary of Transportation to perform a study of HSGT's commercial feasibility. Meanwhile, several States have expressed a strong interest, and some have taken concrete steps, in developing HSGT as part of a balanced intercity transport system.

What Is HSGT?

HSGT is self-guided intercity passenger ground transportation that is time-competitive with air and/or auto on a door-to-door basis for trips in the approximate range of 100 to 500 miles. This is a market-based, not a speed-based, definition: it recognizes that the opportunities and requirements for HSGT differ markedly among different pairs of cities.

A **corridor** is a natural grouping of metropolitan areas and markets that, by their proximity and configuration, lend themselves to efficient service by ground transport.

Why Consider HSGT?

HSGT activity in the United States will only occur because of pressing transportation needs. As population and income growth spurs additional travel demand, intercity transportation by air and auto increasingly suffers from congestion and delay. This is particularly true within metropolitan areas, at surrounding airports, and during weekend,

holiday, and bad-weather periods. This declining quality of service adversely affects intercity travelers, other transport system users, carriers, and the general public.

To counteract these trends requires additional capacity. Increasingly, expansion of airports and highways poses environmental and dollar costs and typically elicits public hesitation in the affected communities. HSGT, however, comprises a family of transportation options that can, in some instances, offer social, economic, and environmental benefits, maximize the use of existing facilities, and come about through a strictly limited, one-time public investment. In short, HSGT options—while not necessarily the optimal mobility enhancement in every region—can expand the range of potential responses to transport needs in heavily populated corridors.

HSGT Technologies

The HSGT options fall into three groups: accelerated rail service ("Accelerail"), new high-speed rail systems ("New HSR"), and magnetic levitation ("Maglev"),[2] in order of increasing performance capabilities and initial cost.

The Accelerail Options[1]

Speed (mph)	Non-electrified[3]	Electrified[4]
90	"Accelerail 90"	[not addressed]
110	"Accelerail 110"	[not addressed]
125	"Accelerail 125F"	"Accelerail 125E"
150	"Accelerail 150F"	"Accelerail 150E"

Accelerail constitutes upgraded intercity rail passenger service on existing railroad rights-of-way, most of which belong to the freight railroads. The Accelerail options considered in this report have top speeds ranging from 90 to 150 mph. At the lower speed levels, only non-electrified systems[3] undergo scrutiny; the higher speed regimes include both electrified[4] and non-electrified motive power.

Typical Accelerail-type systems include tilt trains such as the X-2000 in Sweden, Talgo in Spain, and Pendolino in Italy; the InterCity 225 service in the United Kingdom; and today's Metroliners between New York and Washington.

In most corridors, Accelerail would rely on the cooperation of the freight railroads. The ongoing participation of the Burlington Northern Santa Fe in the Pacific Northwest corridor

[1] The analysis did not address every Accelerail option in every corridor. In particular, review of existing railroad alignments suggested that Accelerail 150 would be impracticable in California South, the Pacific Northwest, Florida, and the Southeast Corridor.

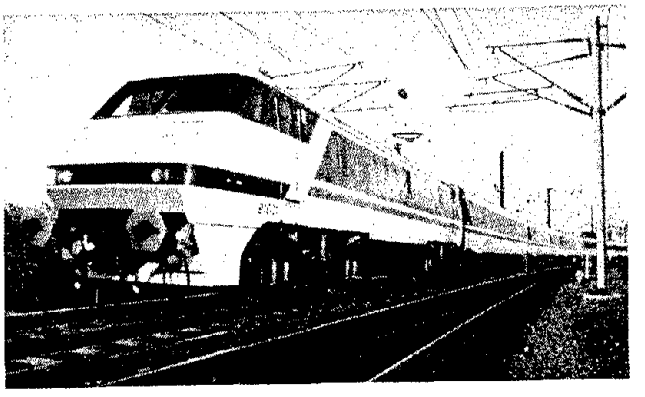
[2] The equipment and services cited and/or depicted herein are only examples. They are not exhaustive, nor do they represent endorsement by the U.S. Department of Transportation of any particular design, product, or manufacturer.

[3] That is, powered by on-train Diesel or turbine heat engines that rely on fossil fuels (hence the distinguishing letter "F" in "Accelerail 125F" and "Accelerail 150F").

[4] Relying on remote power plants with electrical power distributed to trains via a system of overhead wires.

exemplifies the kind of partnerships that will be prerequisite to HSGT development on existing rights-of-way.

Accelerail Example: Swedish X-2000



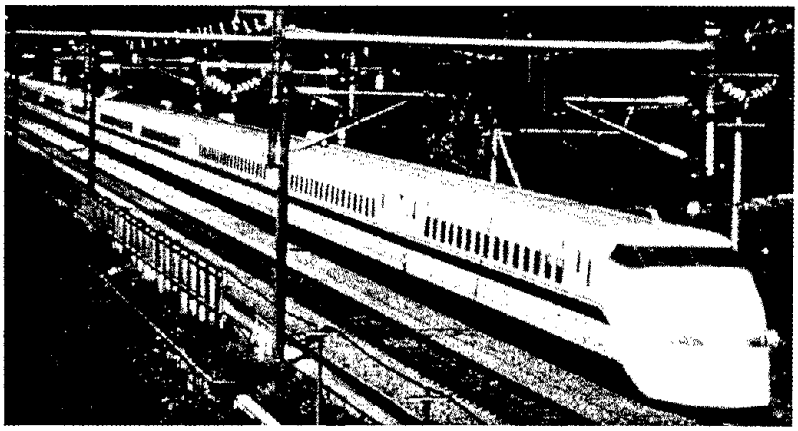
Accelerail Example: British InterCity 225

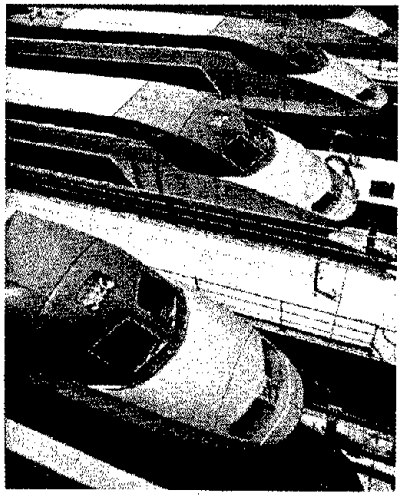
Accelerail Example: Amtrak's Metroliner

New HSR represents advanced steel-wheel-on-rail passenger systems on almost completely new rights-of-way. Through a combination of electrification and other advanced components, expeditious alignments, and state-of-the-art rolling stock, New HSR can attain maximum practical operating speeds on the order of 200 mph.[5] On the other hand, because the trains are able to operate on existing track, New HSR can combine new lines with existing approaches to urban terminals. The ability to operate over existing rights-of-way at their prevailing speeds, as well as on new routes, means that New HSR service can be extended beyond the New HSR line to other cities. Prominent examples of New HSR include the French TGV, the Japanese Shinkansen, and the German Intercity Express (ICE).

[5] The French National Railways (SNCF) has successfully tested steel-wheel-on-rail systems at speeds well in excess of 200 mph.

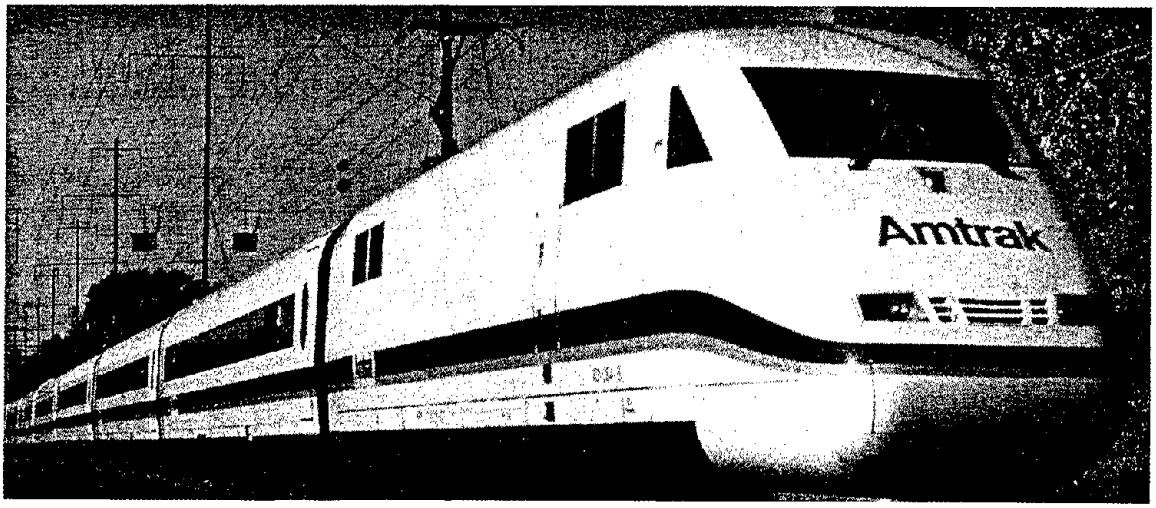
Example of New HSR: Japanese Nozomi Shinkansen





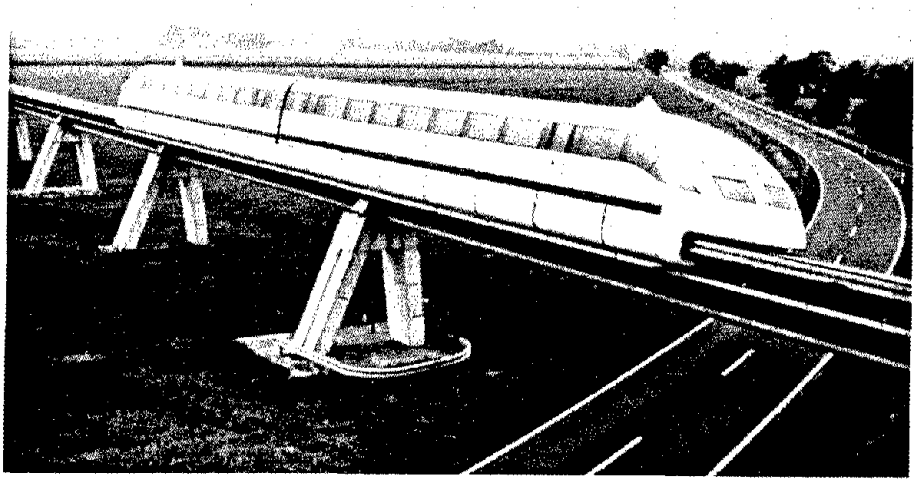
Example of New HSR: French TGV

Example of New HSR: German InterCity Express (ICE)



Maglev is an advanced transport 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 the need for wheels and many other mechanical parts, thereby minimizing resistance and permitting excellent acceleration, with cruising speeds on the order of 300 mph or more. This high performance would enable Maglev to provide air-competitive trip times at longer trip distances than other HSGT options. Germany has a Maglev technology ready for commercial use; Japan has a competing and technologically different system under test. There are no Maglev systems currently operating in commercial service.

Maglev Example: German Transrapid



COMMERCIAL FEASIBILITY AND PARTNERSHIP POTENTIAL

Conceptual Framework

In requesting this report, the Congress asked for an analysis of the "commercial feasibility" of HSGT.[6] The private-sector concept of "commercial feasibility" invokes a basic criterion: "Will the project pay for itself?" Traditionally, that question means: "Will the future net revenues provide an acceptable return on the initial capital investment?" Freight railroads, as largely self-contained enterprises owning, maintaining, operating, and marketing their fixed facilities, vehicles, and transport services, properly apply the traditional criterion of commercial feasibility to every project that they consider, be it a track capacity expansion, a line extension, or a new line of business. Other types of firms, such as manufacturing, similarly scrutinize proposals for their effects on the business as a whole.

Under this study's assumptions, procedures, and resultant projections, the HSGT options analyzed in this report do not meet the traditional private-sector criterion for "commercial feasibility." That criterion, however, may provide too narrow a perspective on the benefits and costs of HSGT, because intercity passenger transportation in the United States is a joint product of public and private investments. Each travel mode—air, highway, and rail—shows distinctly split responsibilities for such essential functions as the provision, maintenance, and operation of rights-of-way, terminals, and vehicles. Thus, every means of intercity passenger transport in this country represents an implicit or explicit **private/public partnership** that—while incorporating user financing in large measure—also demonstrates governmental support and involvement.

[6] Public Law 102-240, section 1036(d).

Partnership Potential Defined

Recognizing the current structure of the intercity passenger transport industry and the encouragement historically afforded by governmental entities to technological initiatives, this report assesses HSGT cases for their **partnership potential**—their apparent capacity to draw the private and public sectors together in planning, negotiations, and, conceivably, project implementation. **Broadly gauging the attractiveness of an HSGT project, partnership potential does not address the project's advisability, equity, or worth from the public policy perspective, nor its practicability from the financial viewpoint.** Only detailed studies at the State level can fully treat the latter topics.

To exhibit partnership potential as defined in this report, the projections for an HSGT technology in a particular corridor must satisfy at least the following two conditions:

First, private enterprise must be able to run the corridor—once built and paid for—as a completely self-sustaining entity. Thus, over the planning period, the HSGT operator's total revenues would need to cover not only the corridor's operating and maintenance expenses but also its continuing investment needs, such as for new vehicles to replace and expand the fleet. This condition would assist in attracting a private operator and would provide reasonable assurance to the public that its initial investment in HSGT is, indeed, a one-time contribution, not a prelude to continuing operating or capital subsidies. By positing a system free of operating subsidies, this report clearly differentiates between future HSGT corridor development and existing intercity passenger rail transportation.

Second, the total benefits of an HSGT corridor must equal or exceed its total costs. [7,8] This approach encompasses the full range of benefits and costs, including environmental and other nonmarket benefits and costs, irrespective of the parties on whom they fall—for example, HSGT system users, the general public, and the HSGT operator. (As described further below, other approaches to measuring benefits and costs may be of equal or greater interest to policy makers as they consider specific HSGT projects.)

Total benefits, as measured in this report, comprise the following components:

- **Benefits to HSGT users** consist of—
  - — **System revenues,** which measure the benefits for which HSGT users are projected to pay; and
  - — The **users' consumer surplus,** which represents the difference between the full value of HSGT transportation to passengers and the

[7] Total benefits and total costs are expressed as net present values, as of the year 2000, over the planning period (2000—2040).

[8] In the Main Report, Chapter 5 describes in detail the methodology for developing demand, revenue, and cost projections, while Chapter 6 does the same for the projections of users' consumer surpluses and benefits to the public at large.

fares they would pay. The surplus arises because fare levels are set to maximize net revenues rather than to exact payment from each traveler for the full worth of the transportation provided.[9]

- **Benefits to the public at large** redound to the general public and to users of modes other than HSGT. These benefits recognize the effects of diverting significant passenger volumes from existing modes to HSGT, and consist of savings from alleviated congestion and reduced emissions in air and highway travel.

Total costs consist of operating and maintenance expenses, continuing investments necessary (after initial system construction) to assure capacity for future traffic growth, and the initial investment in HSGT infrastructure and vehicles. Viewed from the perspective of incidence, total costs fall into two fundamental categories:

- **Costs borne by users** (this equates to system revenues); and
- **Publicly-borne costs** (total costs less system revenues).

This report uses "partnership potential" as an indicator of the aggregate financial and economic impacts of HSGT alternatives in a set of illustrative corridors. Detailed State studies of individual corridors would benefit from additional evaluation measures as well as site-specific investigations and data. Thus, while "partnership potential" may offer useful insights in assessing the likelihood of HSGT development by State and local governments and their private partners, it does not constitute an express or implied criterion for Federal approval or funding.

Owing to locally perceived transportation conditions and business opportunities, States and private entities may still see partnership potential in options that lack it according to this report. Clearly, as long as States can develop the requisite financing, they can choose their own measurement techniques and thresholds to reflect local and regional public priorities.

Additional Measures Bearing on Partnership Potential

State studies will inevitably use additional measures to assess whether early indications of partnership potential[10] can withstand further, necessary scrutiny. Examples of these additional measures include, but are not limited to, the following.

---

[9] The models used to project revenues in studies of this type do not incorporate the oft-changing fares—keyed to such factors as the precise date and time of travel, overnight stay requirements, amount of advance booking time, and competing carriers' prices—that characterize yield management in modern passenger transport companies. To the extent that an actual HSGT operator exceeds this report's projections by implementing sophisticated yield management techniques that maximize net system revenues while forcing each rider to pay a fare that approaches the full value of the transportation to him or her, then "users' consumer surplus" will be converted to "system revenues."

[10] Such as the findings of this report and of other preliminary investigations at the State level.

Financial Measures

It is highly desirable that the private sector should be able to make a substantial contribution, based on operating surpluses, toward the initial capital investment. Indeed, the potential for private/public partnerships becomes larger the higher the percentage of initial investment that can be covered by operating surpluses.

Furthermore, the absolute size of the initial investment requirement will strongly influence partnership potential, since different States and private consortia will have different capacities for assembling the financing required for a proposed HSGT project.

Benefit/Cost Measures

In performing definitive feasibility studies of HSGT systems, policy makers and the public may deem it essential to compare not just total benefits with total costs, but also the benefits and costs accruing to users and the public at large respectively. Comparisons of benefits to the public at large with publicly-borne costs, for instance, would allow policy makers to determine the degree to which the public at large would obtain a return on its investment in HSGT.

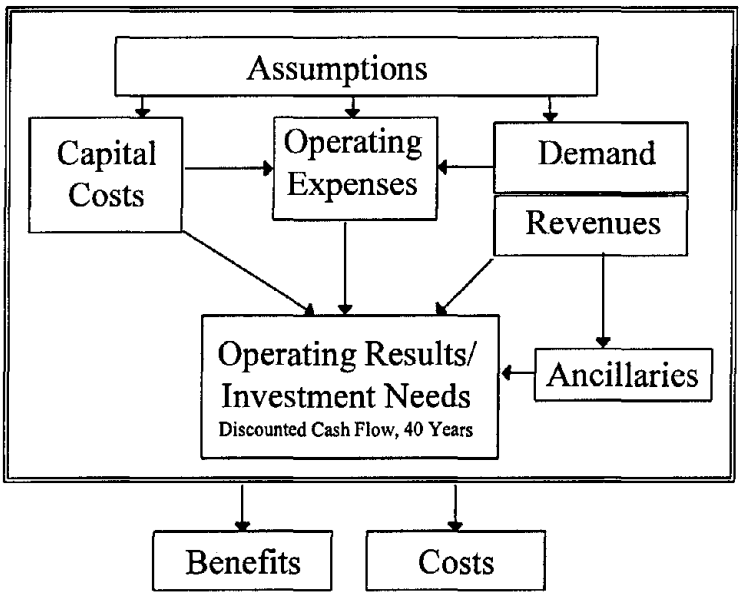
Analytical Components

In assessing the private/public partnership potential of HSGT in the United States, this report consistently applies a set of analytical components to a series of "cases"—specific technological options in illustrative corridors. The figure below summarizes the relationships among these components.

For consistency, the analysis uses Year 1993 constant dollars throughout and assumes that construction and vehicle acquisition is complete by the Year 2000, which is the first year of operations. The planning period, for which projections are prepared, extends through Year 2040. Present values are stated as of the Year 2000, cover the period through 2040, and incorporate two real[11] discount rates: ten percent for system revenues, expenses, and continuing investments (all assumed to pertain to the HSGT operator); and the OMB-mandated seven percent for benefits to the public at large, user benefits, and public investments. The HSGT system is assumed to acquire (and is charged for) its own right-of-way in New HSR and Maglev options, but is a tenant on existing freight railroads in most Accelerail options.

[11] In keeping with the use of constant dollars, real discount rates include no allowance for inflation. Nominal discount rates, which include inflation, would be three or four percent higher currently.

Simplified Flow of Analytical Components



Capital Costs

Cost estimates reflect the specific needs of each technology, appropriate Federal Railroad Administration safety guidelines and regulations (for example, regarding highway/railroad grade crossings), the characteristics of each corridor, and prevailing unit costs.

The initial investment includes upgraded or new track[12]; structures; communications and train control systems; electrification (where applicable to the technology); highway/railroad grade crossing safety enhancements; fencing and environmental mitigation measures; right-of-way acquisitions and realignments; stations, yards, and shops; locomotives, cars, and other vehicles; and an allowance for contingencies, engineering, and program management.[13] For the Accelerail options, the entire cost of the fixed plant improvements is assumed to rest with the HSGT system, even though the freight railroad operation may also stand to gain from some project elements. Any tangible benefits of Accelerail to the freight railroad would enter into the latter's partnership negotiations and financial arrangements with the public HSGT sponsors and the HSGT operator.

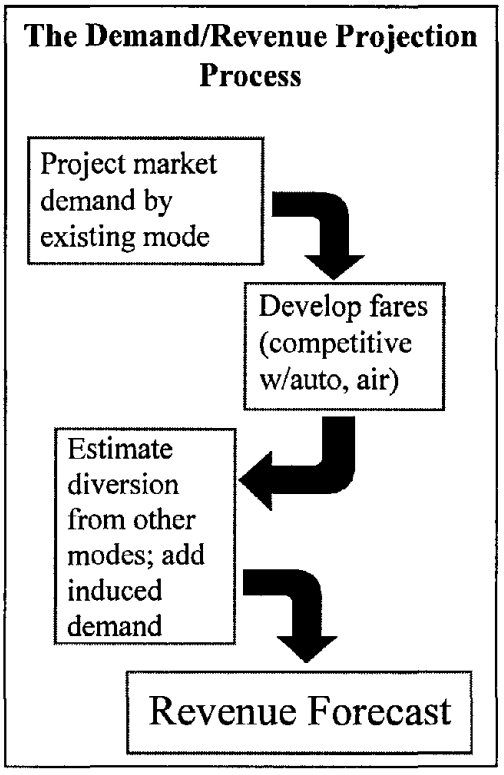
In addition to the initial investment, assumed to be borne by the public, this study addresses continuing investments by the HSGT operator—for instance, expansions and replacements of the vehicle fleet during the 40-year planning period.

[12] "Guideway" in the case of Maglev

[13] Ranging from approximately 30% of base costs for Accelerail to 41% for New HSR and Maglev.

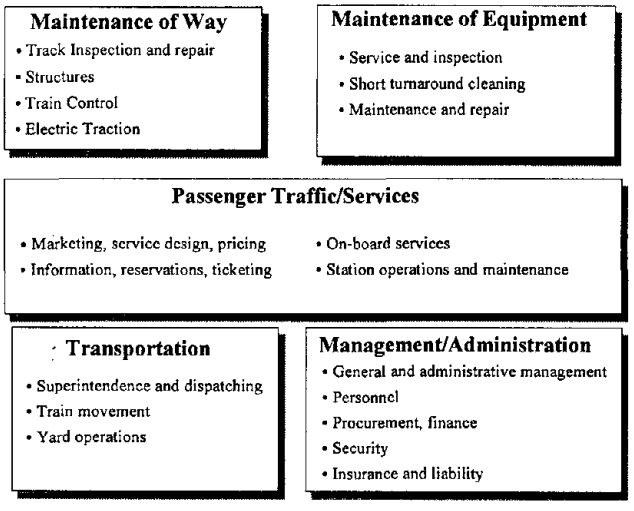
Demand and Revenue Forecasts

For each case, the analysis first projects ridership demand by mode **in the absence of HSGT**. Fares for HSGT are then set to maximize net revenue given HSGT's competitive stance versus other modes in city-to-city markets. (The capital investments and consequent total travel times powerfully influence that competitive stance.) A series of **diversion models** projects the ridership that the new HSGT service would attract from air, auto, existing intercity rail, and bus. Depending upon the market, up to 10 percent of diverted traffic is added to reflect "induced demand," trips that would not take place at all by any mode without the introduction of HSGT. Passenger transportation revenues of the HSGT system are the product of the ridership and fares in the constituent city-to-city markets.



Operating and Maintenance Expenses

The projections for each case include a build-up of operating and maintenance (O&M) expenses in the functional areas of maintenance of way; maintenance of equipment; transportation; passenger traffic and services; and general and administrative. In each functional area, the O&M model identifies all the required activities and calculates the resources—personnel, materials, energy, and purchased services—needed to perform those activities at the projected level of ridership demand and operations.



Ancillary Activities

In addition to intercity passenger service, the HSGT operator could conduct ancillary activities that conform with or support its main line of business. This

analysis estimates, on an activity-by-activity basis, the net revenues from mail and priority express service, parking, station concessions, and certain on-board service amenities (e.g., telephones). Varying in importance from case to case, these net ancillary revenues cumulatively amount to between three and ten percent of system revenues.

Operating Surpluses

The HSGT operator's annual operating surplus is the difference between system revenues (i.e., passenger transportation revenue plus net revenue from ancillary activities) and O&M expenses. The "surplus after continuing investments" is the present value of the future operating surpluses, less the present value of continuing investments projected to be made by the HSGT operator in future years.

Benefits

As described above, total benefits include, in addition to system revenues:

- **Users' consumer surplus**—gains to HSGT users over and above the fares that they pay; and
- **Benefits to the public at large**—congestion relief in the air and highway modes and reductions in emissions.[14]

Both of these categories can be quantified in dollar terms; since they involve neither double counting of benefits nor transfers from one region or type of project to another, they can be included in total HSGT corridor benefits.[15]

On the other hand, total benefits do not include certain items that—although quantifiable—either duplicate the included benefits or represent "transfer effects" that might just as well accrue in other locations due to other major investments. Examples include economic impacts from HSGT operations and construction; capital savings on airports and highways; and energy savings. From the nationwide viewpoint of this report, such duplicative or transfer impacts—while of interest to potential partners in the development of specific corridors—could not appropriately enter into the projected total benefits of each HSGT corridor.

In addition, some impacts did not readily lend themselves to systematic quantification (for example: benefits to the American HSGT equipment industry; impacts on the automobile or aircraft industries) or required site-specific data exceeding the scope of this national study (for instance, such environmental impacts as noise and water pollution). Such items may merit scrutiny in studies of specific corridor proposals at the State level.

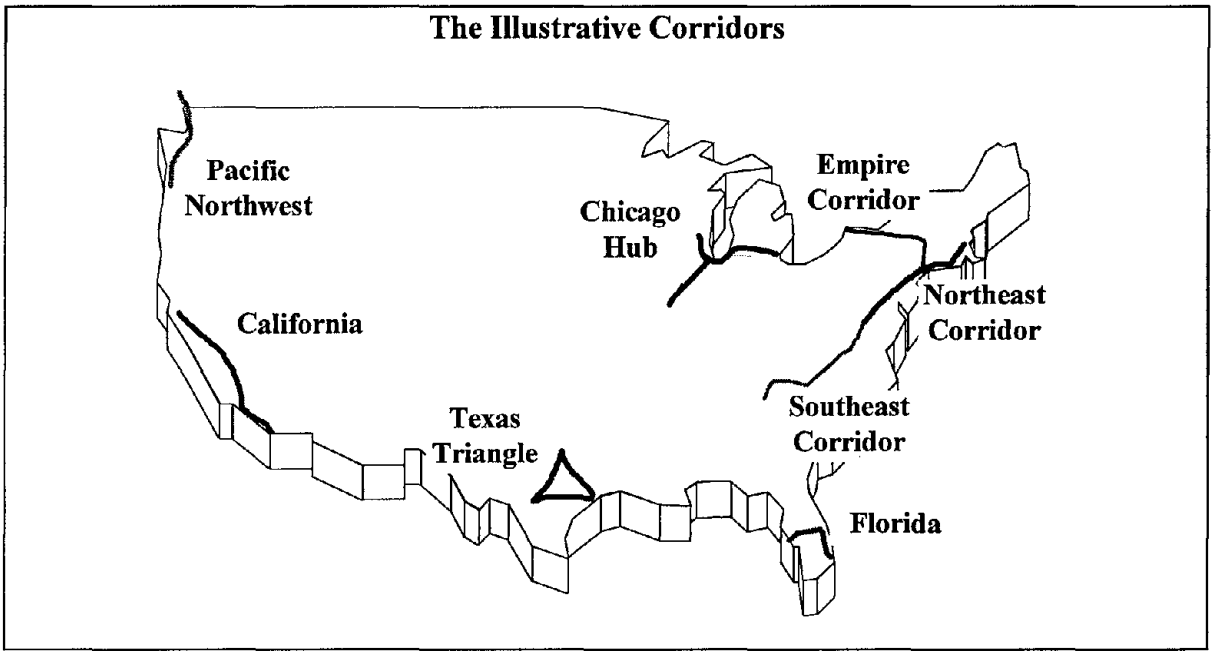
---

[14] Integration of intercity HSGT—regardless of technology—with existing metropolitan area transit systems would help to maximize the public benefits from congestion reduction and clean air.

[15] See Chapter 6 in the Main Report for the criteria for inclusion in total benefits.

The Illustrative Corridors

The analytical components were consistently applied to a set of illustrative corridors depicted in the following map. Providing a broad spectrum of lengths and travel densities, these corridors represent:



- Existing corridors in which passenger trains regularly operate at speeds of 110 mph and above:
  - — Northeast Corridor (Boston—New York—Washington)
  - — Empire Corridor (New York—Albany—Buffalo)
- All corridors designated by the Secretary of Transportation under Section 1010 of the Intermodal Surface Transportation Act of 1991, as eligible for special funds dedicated to grade crossing safety on potential HSGT routes:
  - — Pacific Northwest (Eugene, Oregon—Portland—Seattle—Vancouver, B.C.)
  - — California ("North/South": Bay Area—Los Angeles—San Diego; and "South": Los Angeles—San Diego alone);
  - — Chicago Hub (Chicago to Detroit, Milwaukee, and St. Louis as a network; and Chicago—Detroit and Chicago—St. Louis by themselves);
  - — Florida Corridor (Miami—Orlando—Tampa);
  - — Southeast Corridor (Washington—Richmond—Charlotte, N.C.); and
- The Texas Triangle, which presents a unique spatial configuration of heavily populated metropolitan areas.

Summary of Projections

The following observations synthesize the projections as contained in the corridor profiles that follow in this Overview Report.[16]

Total Benefits and Total Costs

On a basis incorporating total benefits and total costs, every illustrative corridor has at least one technology, and every technology has at least one corridor, that meets the threshold conditions for partnership potential. Corridors with the highest base traffic densities generate positive ratios for a broad range of technologies, including those with the highest speed capabilities; conversely, corridors with the lowest base traffic densities develop positive ratios only for the lower-speed options.

The projections suggest that—subject to the assumptions and scope of this study—the less expensive technologies, relying on upgraded existing rail lines and freight railroad cooperation, could typically provide higher ratios of benefits to costs than the very high-speed options, which may offer higher benefits but would ordinarily cost much more.

However, cases where public benefits do not exceed public costs need not be ruled out for consideration by States or private concerns. In these cases, unmeasurable transfer effects or mobility concerns may justify further consideration.

User Benefits and Costs; Public Benefits and Costs

When both benefits and costs are disaggregated according to their incidence, it becomes clear that users invariably obtain benefits in excess of what they pay for HSGT services. In fact, benefits to the public at large exceed the publicly-borne costs in only about one-quarter of the illustrative HSGT cases. Such effects on users versus the public at large merit further attention in State analyses of HSGT and in reaching decisions on public funding of high-speed rail and Maglev.

When benefit-cost analysis of HSGT is approached in this way, lower-cost HSGT options appear to generate higher ratios of benefits to costs. Along with this finding, public benefit-cost analysis may yield valuable information necessary for fully apprising the value of HSGT options.

Importance of State Studies

In contrast with a nationwide study such as this one, individual State studies can more closely examine specific corridors, with greater sensitivity to the State's underlying reasons for considering HSGT. Such detailed examination may favor a non-HSGT solution, Accelerail, New HSR, or Maglev. A State, for example, may wish to provide a high-reliability, high-

[16] These observations pertain to all illustrative corridors except those treated as incremental extensions of the Northeast Corridor.

frequency HSGT option and may believe that only New HSR or Maglev can offer a sufficient quality of service. Likewise, a State may place an extraordinarily high value on environmental benefits, and would seek the HSGT option that maximizes those benefits. A State may regard the cooperation of its freight railroads as impossible to achieve, thereby precluding Accelerail; or a State may perceive Accelerail as the ideal compromise between its fiscal constraints and its desire for improved intercity transport. Financing issues, moreover, would call for detailed scrutiny, since the absolute size of the required initial investment (in conjunction with the available resources of the private and public participants) will heavily influence the feasibility of HSGT proposals. Finally, the States and localities, through their intermodal planning processes, are uniquely qualified to judge the synergy between HSGT corridor development and the enhancement of regional public transit services, highways, and airports. Taken together, these examples underscore the importance of site-specific, State-sponsored studies to the definitive characterization of HSGT and other intercity transport options.

Selected Sensitivity Analyses

In addition to analyzing 66 combinations of corridors and technology options,—a scope that reveals the effects of a host of variables on HSGT system performance,—this study analyzed the sensitivity of representative cases to selected changes in key assumptions.

Effects of Lower Air Fares

This study assessed the potential effects of expanded low-cost, low-fare air service on the operating results of HSGT.

Low-fare air service was already widespread in 1993[17] and influenced this study, particularly in California, the Chicago Hub corridors, and Texas. The other illustrative corridors may be less hospitable to low-fare aviation, owing to heavy existing airport congestion or short stage lengths, both of which raise unit operating costs.

Nevertheless, an expansion of "low-fare" air carriers into specific HSGT markets could adversely affect the projected HSGT revenue base. In two sample markets, a simple simulation of air fare reductions of 30 percent (with no other changes in the size of the base air market or in HSGT fares) showed reductions in diversions from air to HSGT of about 30 percent, and overall HSGT ridership losses ranging from 10 to 25 percent.

In specific city-pairs that appear susceptible to pronounced air fare competition, prospective HSGT partners would reduce their uncertainties by simulating, in detail, the long-term implications of direct air/HSGT fare rivalry.

[17] 1993 was the base year for establishing air fares, trip times, frequencies, and travel volumes for the demand projections.

Effects of Higher Operating Expenses

If HSGT operating and maintenance expenses prove to be 25 percent higher than those developed for this report, the following cases would no longer meet the requirement of a surplus after continuing investments—i.e., they would no longer be projected to be self-sustaining once built:

— Accelerail 90 in California North/South, Chicago Hub Network, and Chicago—St. Louis; and

— In Chicago—Detroit: Accelerail 110, 125E, and 150E.

No material changes would occur in the ratios of total benefits to total costs, thus confirming the relatively small part that O&M expenses play in this ratio.

Therefore, a 25 percent hike in expenses would eliminate the indication of partnership potential for six cases at most, all of which are in either the Accelerail 90 category or the Chicago Hub region.

In two typical cases, a 75 percent increase in liability expenses would produce an eight- to ten-percent increase in total O&M expenses. Such an increase would have no perceptible effect on the benefit/cost ratios.

Effects of Lower Discount Rate

Application of a uniform seven percent discount rate to the present value analyses would enhance the apparent partnership potential of the HSGT cases by raising the present value of the operating surpluses.

Effects of Mixing and Matching Technologies

Normatively, the study developed each case by matching one corridor with one technology. However, a more detailed approach—segmenting each corridor and applying different, yet compatible, technology levels to each segment based on market conditions—could materially improve the projection results. Indeed, in one illustrative corridor, the simultaneous application of two technologies yielded benefit-to-cost ratios that were higher than for any single technology of comparable performance.

CORRIDOR-BY-CORRIDOR PROJECTIONS

The following sections summarize the projections for each of the illustrative corridors.[18,19] **While each corridor summary discusses the partnership potential of the**

[18] By their very nature, projections depend on the reasonableness of their underlying assumptions (described in Chapter 4 of the Main Report) and are subject to divergences between the assumptions and actual conditions. For

various options, it is up to the States and their public and private partners to determine, through detailed studies, what to build—if anything.

California North/South

Since the 1980's the State of California has supported and expanded Amtrak rail service. The California High-Speed Rail Commission, created in 1993, is conducting a series of studies to determine the feasibility of implementing an HSGT system between Los Angeles and the San Francisco Bay Area with future extensions to San Diego and Sacramento. The State's studies are scheduled for completion by December 1996.

As delineated for this report, the California North/South corridor covers the entire distance between the Bay Area, Los Angeles, and San Diego.[20] The projections suggest that this corridor could generate up to 6 billion annual passenger-miles by the year 2020. Offering Los Angeles—San Francisco line-haul travel times of three and two hours respectively, a New HSR or Maglev system in California is projected to produce an annual operating surplus. The initial investment in such a California North/South corridor could reach the $20-$25 billion range for the higher-speed options due to the challenging terrain and extensive route-mileage involved.

The State of California could also adopt a more gradual approach to HSGT, for which the State's diverse geography provides many potential avenues. This report examined a small sample of the possibilities. Accelerail 90 and 110 via the Coast Line, for instance, could cost between one and three billion dollars and generate ridership equal to that of today's Northeast Corridor. Accelerail 125 and 150 through the Central Valley would serve a somewhat larger population base but would necessitate (for expeditious service) significant civil works across the Tehachapi Mountains.

[The profile for California North/South follows.]

---

these and other reasons, the results of the systems described in this report may vary materially from the projections. This further underscores the need for detailed studies prior to initiation of corridor development.

[19] Additional data appears in the Main Report.

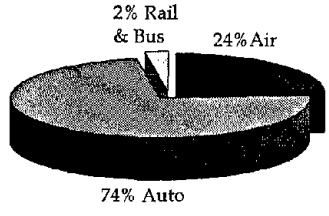
[20] This study does not address the Sacramento market.

California North-South

Corridor length (miles):	
Accelerail 90, 110	595
Other Accelerail, New HSR	546
Maglev	527
Metropolitan area population (mil.):	
Bay Area (San Francisco/Oakland)	6.3
Los Angeles	14.5
San Diego	2.5
Intermediate points (via coast, via valley)	0.7, 2.5
Total (via coast, via valley)	24.0, 25.8
1990 population higher than 1970 by:	
Via coast, via valley	44.6%, 46.5%

Current Scenario:

Existing Market Share by Mode
(All city-pair markets on a passenger-mile basis)



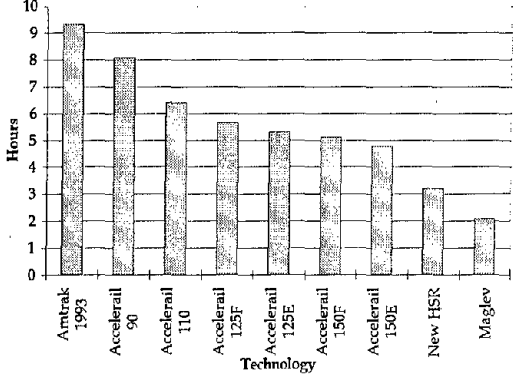
Total intercity passenger-miles: **19,533 million**

Intercity travel density (Passenger-miles per route-mile): **32.8 million**

HSGT in 2020: (Refers to entire corridor except as noted)

Line-Haul Travel Times

(San Francisco-Los Angeles as an example)



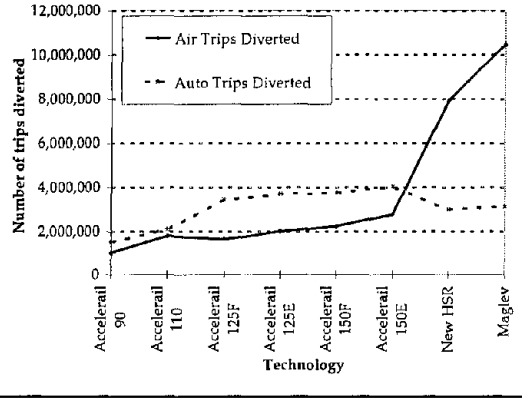
Frequencies & Fares

(San Francisco-Los Angeles as an example for frequency)

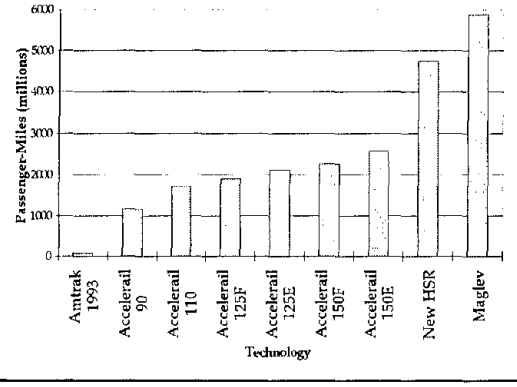
Technology	Frequency (Daily round trips)	Fares (Cents/mile)
Amtrak 1993*	5	14.0
Accelerail 90	29	16.6
Accelerail 110	31	15.7
Accelerail 125F	39	16.9
Accelerail 125E	44	16.6
Accelerail 150F	44	16.4
Accelerail 150E	53	16.1
New HSR	92	16.2
Maglev	91	19.4

*Amtrak 1993 fares are estimated yields. Amtrak service consisted of four rail/bus frequencies via the valley and of one thru-train via the coast.

Diverted Air and Auto Trips



Passenger-Miles



California North/South

Projection Results (Dollar Amounts are Present Values in Millions for the Period 2000—2040)

	Accelerail							
	90	110	125F	125E	150F	150E	New HSR	Maglev
Surplus After Continuing Investments[21]	**$276**	**$714**	**$870**	**$864**	**$1,151**	**$1,232**	**$2,489**	**$5,584**
Total Benefits:	**$5,848**	**$8,657**	**$9,781**	**$11,176**	**$11,307**	**$13,288**	**$23,181**	**$30,429**
Benefits to HSGT Users:								
System Revenues	$1,582	$2,210	$2,627	$2,902	$3,051	$3,429	$6,208	$9,162
Users' Consumer Surplus	$2,153	$3,055	$3,374	$3,745	$3,913	$4,396	$7,688	$10,324
Total Benefits to HSGT Users	$3,735	$5,265	$6,001	$6,647	$6,964	$7,824	$13,896	$19,486
Benefits to the Public at Large	$2,113	$3,392	$3,780	$4,530	$4,343	$5,464	$9,285	$10,943
Total Costs:	**$2,619**	**$4,410**	**$9,688**	**$10,985**	**$9,925**	**$11,400**	**$19,511**	**$27,007**
Components of Total Costs:								
Initial Investment	$1,314	$2,914	$7,931	$8,948	$8,024	$9,203	$15,792	$23,430
O&M Expense	$1,222	$1,365	$1,611	$1,854	$1,724	$2,034	$3,318	$3,348
Continuing Investments	$84	$132	$146	$184	$176	$162	$401	$230
Incidence of Total Costs:								
Costs Borne by Users	$1,582	$2,210	$2,627	$2,902	$3,051	$3,429	$6,208	$9,162
Publicly-Borne Costs	$1,038	$2,200	$7,060	$8,084	$6,873	$7,971	$13,303	$17,846
Total Benefits Less Total Costs	**$3,228**	**$4,247**	**$93**	**$191**	**$1,383**	**$1,889**	**$3,670**	**$3,422**
Benefits to HSGT Users Less Costs Borne by Users	$2,153	$3,055	$3,374	$3,745	$3,913	$4,396	$7,688	$10,324
Benefits to the Public at Large Less Publicly-Borne Costs	$1,075	$1,192	($3,280)	($3,554)	($2,530)	($2,507)	($4,018)	($6,902)
Ratio of Total Benefits to Total Costs	**2.2**	**2.0**	**1.0**	**1.0**	**1.1**	**1.2**	**1.2**	**1.1**
Ratio of Benefits to HSGT Users, to Costs Borne by Users	2.4	2.4	2.3	2.3	2.3	2.3	2.2	2.1
Ratio of Benefits to the Public at Large, to Publicly-Borne Costs	2.0	1.5	0.5	0.6	0.6	0.7	0.7	0.6

Partnership Potential, by Option

[Options with **black background** are projected to satisfy this report's two preliminary screening conditions for partnership potential: (1) a surplus after continuing investments and (2) a ratio of total benefits to total costs of 1.0 or more. **In conducting detailed studies, States may wish to consider additional financial measures, as well as the ratio of "benefits to the public at large" to "publicly-borne costs." "Partnership potential" does not constitute an express or implied criterion for Federal approval or funding.**]

Accelerail 90	Accelerail 110	Accelerail 125F	Accelerail 125E	Accelerail 150F	Accelerail 150E	New HSR	Maglev

[21] Equals: System Revenues less (O&M Expense plus Continuing Investments).

California South

A heavily traveled Amtrak route, the San Diego-Los Angeles corridor serves a population of approximately 12 million, or nearly 40 percent of the total population of the State of California. This is a mixed-use commuter and intercity corridor, already publicly owned over most of its length, in which the State has already made improvements.

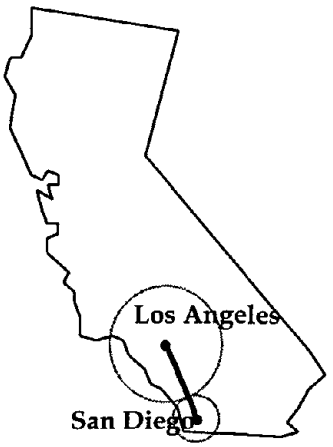
HSGT would reduce Amtrak's scheduled trip time of nearly three hours to two hours or less for Accelerail, one and one-third hours for New HSR, and 45 minutes for Maglev. These line-haul time savings are projected to result in higher traffic levels. Should the State elect to consider further Accelerail-type improvements, the potential effects on both commuter and intercity service would need to be taken into account.

The initial investment for California South would range from about $500 million for Accelerail 90 to $5 billion for Maglev.

[The profile for California South follows.]

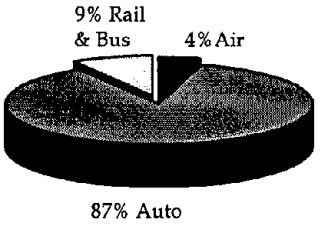
California South

Corridor length (miles):	
Accelerail options	128
New HSR	142
Maglev	123
Metropolitan area population (mil.):	
San Diego	2.5
Los Angeles	14.5
Total	17.0
1990 population higher than 1970 by:	50.2%



Current Scenario:

Existing Market Share by Mode
(All city-pair markets on a passenger-mile basis)

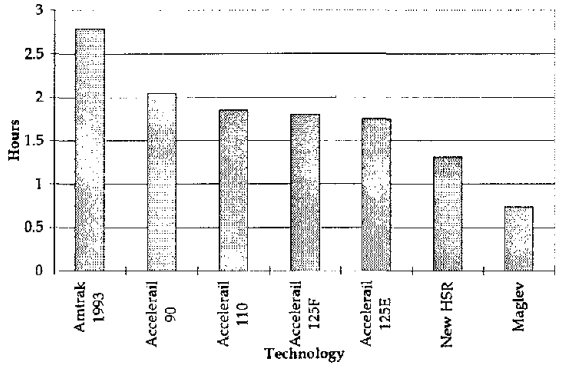


Total intercity passenger-miles: **1,968 million**

Intercity travel density (Passenger-miles per route-mile): **15.3 million**

HSGT in 2020:

Line-Haul Travel Times

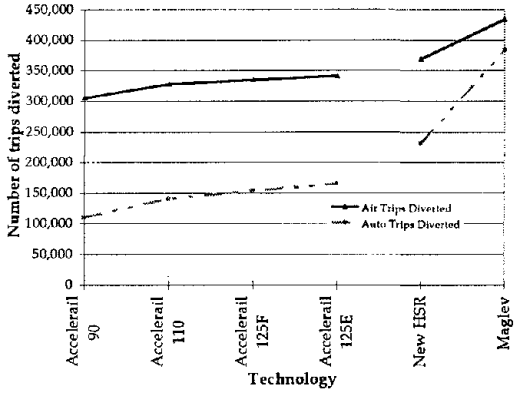


Frequencies & Fares

Technology	Frequency (Daily round trips)	Fares (Cents/mile)
Amtrak 1993*	9	15.0
Accelerail 90	25	27.6
Accelerail 110	26	28.5
Accelerail 125F	26	28.5
Accelerail 125E	27	28.5
New HSR	26	24.4
Maglev	55	31.2

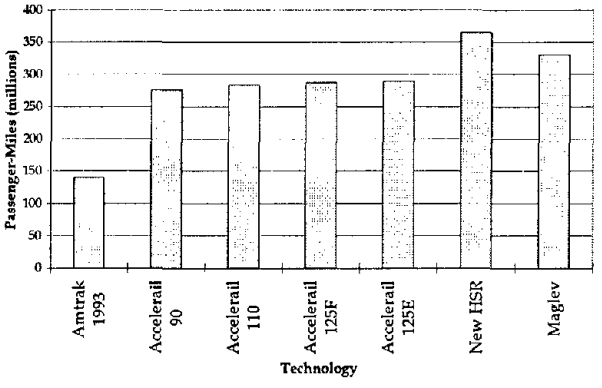
*Amtrak 1993 fares are estimated yields.

Diverted Air and Auto Trips



Passenger-Miles

(see note 2)



Note 1: Accelerail 150F and 150E not analyzed.
Note 2: The New HSR peak in passenger-miles reflects a longer route rather than a higher ridership.

California South

Projection Results (Dollar Amounts are Present Values in Millions for the Period 2000—2040)

	Accelerail					
	90	110	125F	125E	New HSR	Maglev
Surplus After Continuing Investments	**$206**	**$241**	**$252**	**$214**	**$176**	**$284**
Total Benefits:	**$2,197**	**$2,438**	**$2,487**	**$2,607**	**$2,946**	**$3,742**
Benefits to HSGT Users:						
System Revenues	$614	$652	$662	$668	$725	$848
Users' Consumer Surplus	$752	$807	$827	$843	$976	$1,249
Total Benefits to HSGT Users	$1,366	$1,459	$1,488	$1,511	$1,701	$2,096
Benefits to the Public at Large	$831	$979	$999	$1,096	$1,246	$1,646
Total Costs:	**$867**	**$1,068**	**$1,104**	**$1,423**	**$4,661**	**$5,569**
Components of Total Costs:						
Initial Investment	$459	$657	$694	$969	$4,112	$5,006
O&M Expense	$380	$387	$386	$430	$498	$531
Continuing Investments	$28	$24	$24	$24	$51	$32
Incidence of Total Costs:						
Costs Borne by Users	$614	$652	$662	$668	$725	$848
Publicly-Borne Costs	$253	$416	$442	$755	$3,936	$4,722
Total Benefits Less Total Costs	**$1,329**	**$1,370**	**$1,384**	**$1,184**	**($1,715)**	**($1,827)**
Benefits to HSGT Users Less Costs Borne by Users	$752	$807	$827	$843	$976	$1,249
Benefits to the Public at Large Less Publicly-Borne Costs	$578	$563	$557	$341	($2,691)	($3,076)
Ratio of Total Benefits to Total Costs	**2.5**	**2.3**	**2.3**	**1.8**	**0.6**	**0.7**
Ratio of Benefits to HSGT Users, to Costs Borne by Users	2.2	2.2	2.2	2.3	2.3	2.5
Ratio of Benefits to the Public at Large, to Publicly-Borne Costs	3.3	2.4	2.3	1.5	0.3	0.3

Partnership Potential, by Option

[Options with **black background** are projected to satisfy this report's two preliminary screening conditions for partnership potential: (1) a surplus after continuing investments and (2) a ratio of total benefits to total costs of 1.0 or more. **In conducting detailed studies, States may wish to consider additional financial measures, as well as the ratio of "benefits to the public at large" to "publicly-borne costs." "Partnership potential" does not constitute an express or implied criterion for Federal approval or funding.**]

Accelerail 90	Accelerail 110	Accelerail 125F	Accelerail 125E	New HSR	Maglev

Chicago Hub Network

As portrayed in this study, the Chicago Hub Network consists of the routes from Chicago to Detroit, Milwaukee, and St. Louis. The states along these routes are pursuing implementation of HSGT. For example, in 1994 Illinois completed a study of 125 mph service for the Chicago-St. Louis line, and is now examining financing options. Michigan and Amtrak are working to develop a high-speed plan between Chicago and Detroit, and are testing a state-of-the-art train control system on the Amtrak-owned segment of that line.

This analysis treats the three Chicago Hub routes as an integrated network that employs a common operator, fleet, and fixed facilities; realizes operating cost efficiencies; and benefits from traffic which crosses Chicago when traveling between cities on two legs of the system.

According to the projections, the current Amtrak ridership of 1.2 million annual trips on the Chicago Hub routes increases five to six times in the Accelerail cases, rises to 8.1 million with New HSR, and reaches 9.3 million with Maglev. All options are projected to generate operating surpluses that cover their continuing investment costs. Total initial investments range from $1.1 billion for Accelerail 90 to $18 billion for Maglev.

When the Hub Network results are compared to the sum of the individual results of the constituent routes, the effects of networking become very clear: depending upon the technology case, passenger miles are 37 to 49 percent higher, annual revenues 35 to 48 percent greater, annual operating surpluses 53 to 178 percent higher, and O&M expenses per passenger-mile from 14 to 27 percent lower.

[The profile for the Chicago Hub Network follows.]

Chicago Hub Network

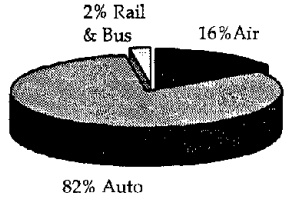
Corridor length (miles):	
Accelerail options	662
New HSR	648
Maglev	646
Metropolitan area population (mil.):	
Chicago	8.1
Detroit	4.7
Milwaukee	1.6
St. Louis	2.4
Intermediate points	1.2
Total	18.0
1990 population higher than 1970 by:	1.6%

New HSR, Maglev alignment:
(Not all cities shown)

Accelerail alignment shown below:

Current Scenario:

Existing Market Share by Mode
(All city-pair markets on a passenger-mile basis)



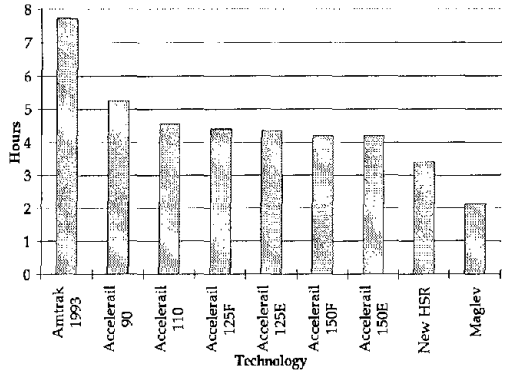
Total intercity passenger-miles:
10,451 million

Intercity travel density
(Passenger-miles per route-mile):
16.2 million

HSGT in 2020: (Refers to entire corridor except as noted)

Line-Haul Travel Times

(Detroit-Milwaukee as an example)



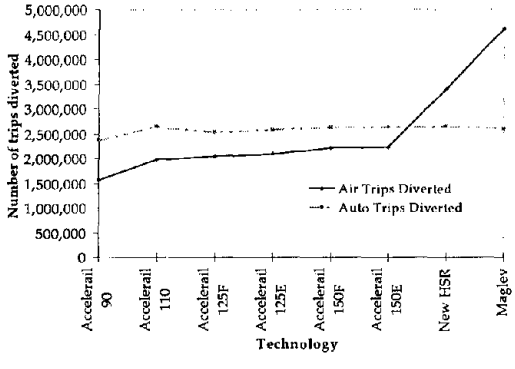
Frequencies & Fares

(Detroit-Milwaukee as an example for frequency)

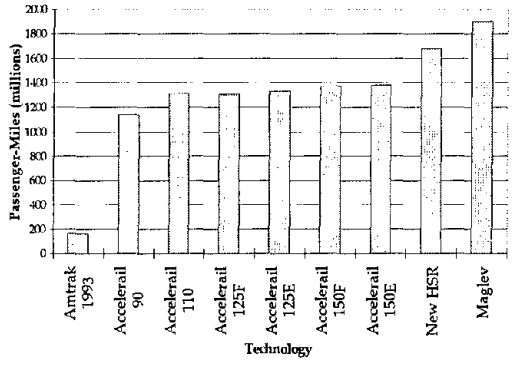
Technology	Frequency (Daily round trips)	Fares (Cents/mile)
Amtrak 1993*	2	11.0
Accelerail 90	12	14.5
Accelerail 110	13	16.6
Accelerail 125F	13	18.1
Accelerail 125E	14	18.1
Accelerail 150F	14	18.8
Accelerail 150E	14	18.8
New HSR	13	23.0
Maglev	46	30.9

*Amtrak 1993 fares are estimated yields. Detroit-Milwaukee service is via connection at Chicago.

Diverted Air and Auto Trips



Passenger-Miles



Chicago Hub Network

Projection Results (Dollar Amounts are Present Values in Millions for the Period 2000—2040)

	Accelerail							
	90	110	125F	125E	150F	150E	New HSR	Maglev
Surplus After Continuing Investments	**$257**	**$560**	**$708**	**$584**	**$835**	**$690**	**$1,371**	**$2,974**
Total Benefits:	**$5,395**	**$6,781**	**$6,986**	**$7,176**	**$7,505**	**$7,619**	**$10,146**	**$13,824**
Benefits to HSGT Users:								
System Revenues	$1,396	$1,831	$1,977	$2,013	$2,167	$2,175	$3,217	$4,962
Users' Consumer Surplus	$1,888	$2,363	$2,392	$2,454	$2,594	$2,606	$3,478	$4,491
Total Benefits to HSGT Users	$3,283	$4,194	$4,368	$4,468	$4,761	$4,781	$6,694	$9,453
Benefits to the Public at Large	$2,111	$2,587	$2,618	$2,709	$2,745	$2,838	$3,452	$4,371
Total Costs:	**$2,201**	**$2,758**	**$3,706**	**$5,058**	**$5,039**	**$6,622**	**$14,130**	**$19,775**
Components of Total Costs:								
Initial Investment	$1,062	$1,487	$2,438	$3,628	$3,708	$5,137	$12,285	$17,787
O&M Expense	$1,041	$1,167	$1,179	$1,333	$1,237	$1,394	$1,663	$1,904
Continuing Investments	$98	$104	$90	$97	$95	$91	$182	$85
Incidence of Total Costs:								
Costs Borne by Users	$1,396	$1,831	$1,977	$2,013	$2,167	$2,175	$3,217	$4,962
Publicly-Borne Costs	$805	$927	$1,730	$3,045	$2,872	$4,448	$10,913	$14,813
Total Benefits Less Total Costs	**$3,194**	**$4,023**	**$3,280**	**$2,118**	**$2,466**	**$997**	**($3,984)**	**($5,951)**
Benefits to HSGT Users Less Costs Borne by Users	$1,888	$2,363	$2,392	$2,454	$2,594	$2,606	$3,478	$4,491
Benefits to the Public at Large Less Publicly-Borne Costs	$1,306	$1,660	$888	($336)	($128)	($1,609)	($7,461)	($10,442)
Ratio of Total Benefits to Total Costs	**2.5**	**2.5**	**1.9**	**1.4**	**1.5**	**1.2**	**0.7**	**0.7**
Ratio of Benefits to HSGT Users, to Costs Borne by Users	2.4	2.3	2.2	2.2	2.2	2.2	2.1	1.9
Ratio of Benefits to the Public at Large, to Publicly-Borne Costs	2.6	2.8	1.5	0.9	1.0	0.6	0.3	0.3

Partnership Potential, by Option

[Options with **black background** are projected to satisfy this report's two preliminary screening conditions for partnership potential: (1) a surplus after continuing investments and (2) a ratio of total benefits to total costs of 1.0 or more. **In conducting detailed studies, States may wish to consider additional financial measures, as well as the ratio of "benefits to the public at large" to "publicly-borne costs." "Partnership potential" does not constitute an express or implied criterion for Federal approval or funding.**]

Accelerail 90	Accelerail 110	Accelerail 125F	Accelerail 125E	Accelerail 150F	Accelerail 150E	New HSR	Maglev

The **Chicago—Detroit** and **Chicago—St. Louis** corridors represent subsets of the Chicago Hub Network, chosen to exemplify the performance of routes in the 200—300 mile range.

Chicago-Detroit

The Chicago-Detroit route is 279 miles long with a population of about 14 million. The Chicago and Detroit areas account for over 94 percent of the population, with 8.1 million and 4.7 million residents respectively. Amtrak currently offers three round trips taking about five and one-half hours each way between Detroit and Chicago. Running time would drop to three hours and forty minutes with Accelerail 125F, under two and a half hours with New HSR, and about an hour and a half with Maglev. Frequencies would start at 15 with Accelerail and rise to 44 with Maglev.

In this corridor, HSGT traffic would show increases from Amtrak's level of 390,000 passengers in 1993. Operating surpluses in all options but Accelerail 90 are projected to cover continuing investments. The total initial investment ranges from about $500 million for the lower speed Accelerails to $7 billion for Maglev.

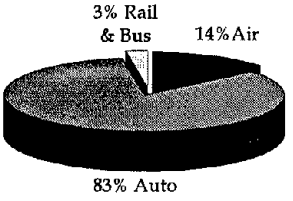
[The profile for Chicago—Detroit follows.]

Chicago-Detroit

Corridor length (miles):	279
Metropolitan area population (mil.):	
Chicago	8.1
Detroit	4.7
Intermediate points	0.8
Total	13.5
1990 population higher than 1970 by:	1.4%

Current Scenario:

Existing Market Share by Mode
(All city-pair markets on a passenger-mile basis)

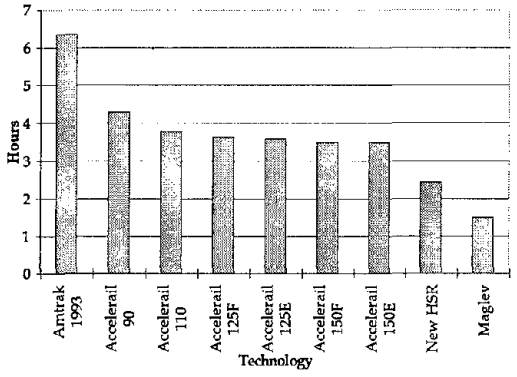


Total intercity passenger-miles:
4,217 million

Intercity travel density
(Passenger-miles per route-mile):
15.1 million

HSGT in 2020:

Line-Haul Travel Times

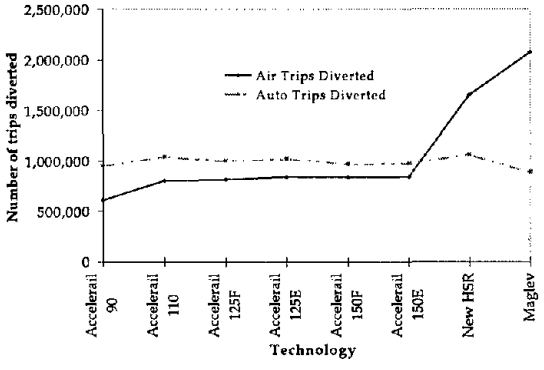


Frequencies & Fares

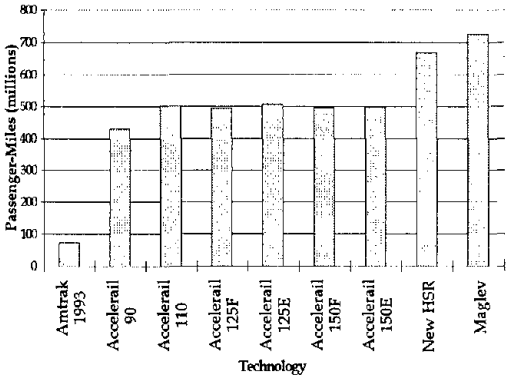
Technology	Frequency (Daily round trips)	Fares (Cents/mile)
Amtrak 1993*	3	10.0
Accelerail 90	15	13.4
Accelerail 110	17	15.6
Accelerail 125F	17	17.0
Accelerail 125E	17	17.0
Accelerail 150F	17	18.2
Accelerail 150E	17	18.2
New HSR	22	24.0
Maglev	44	32.9

*Amtrak 1993 fares are estimated yields.

Diverted Air and Auto Trips



Passenger-Miles



Chicago—Detroit

Projection Results (Dollar Amounts are Present Values in Millions for the Period 2000—2040)

	Accelerail							
	90	110	125F	125E	150F	150E	New HSR	Maglev
Surplus After Continuing Investments	**($16)**	**$114**	**$189**	**$82**	**$184**	**$115**	**$457**	**$1,160**
Total Benefits:	**$1,958**	**$2,524**	**$2,559**	**$2,658**	**$2,625**	**$2,672**	**$4,349**	**$5,783**
Benefits to HSGT Users:								
System Revenues	$479	$652	$696	$715	$745	$749	$1,327	$1,996
Users' Consumer Surplus	$635	$811	$804	$837	$813	$820	$1,380	$1,721
Total Benefits to HSGT Users	$1,113	$1,463	$1,500	$1,552	$1,558	$1,570	$2,707	$3,717
Benefits to the Public at Large	$844	$1,061	$1,060	$1,106	$1,067	$1,102	$1,642	$2,066
Total Costs:	**$979**	**$1,225**	**$1,657**	**$2,381**	**$1,890**	**$2,580**	**$6,154**	**$7,881**
Components of Total Costs:								
Initial Investment	$484	$688	$1,151	$1,748	$1,329	$1,945	$5,284	$7,044
O&M Expense	$449	$503	$472	$598	$531	$604	$798	$801
Continuing Investments	$45	$34	$34	$35	$30	$30	$72	$35
Incidence of Total Costs:								
Costs Borne by Users	$479	$652	$696	$715	$745	$749	$1,327	$1,996
Publicly-Borne Costs	$500	$573	$961	$1,666	$1,146	$1,831	$4,826	$5,885
Total Benefits Less Total Costs	**$979**	**$1,300**	**$902**	**$277**	**$735**	**$92**	**($1,805)**	**($2,098)**
Benefits to HSGT Users Less Costs Borne by Users	$635	$811	$804	$837	$813	$820	$1,380	$1,721
Benefits to the Public at Large Less Publicly-Borne Costs	$344	$488	$98	($560)	($79)	($729)	($3,184)	($3,819)
Ratio of Total Benefits to Total Costs	**2.0**	**2.1**	**1.5**	**1.1**	**1.4**	**1.0**	**0.7**	**0.7**
Ratio of Benefits to HSGT Users, to Costs Borne by Users	2.3	2.2	2.2	2.2	2.1	2.1	2.0	1.9
Ratio of Benefits to the Public at Large, to Publicly-Borne Costs	1.7	1.9	1.1	0.7	0.9	0.6	0.3	0.4

Partnership Potential, by Option

[Options with **black background** are projected to satisfy this report's two preliminary screening conditions for partnership potential: (1) a surplus after continuing investments and (2) a ratio of total benefits to total costs of 1.0 or more. **In conducting detailed studies, States may wish to consider additional financial measures, as well as the ratio of "benefits to the public at large" to "publicly-borne costs." "Partnership potential" does not constitute an express or implied criterion for Federal approval or funding.**]

Accelerail 90	Accelerail 110	Accelerail 125F	Accelerail 125E	Accelerail 150F	Accelerail 150E	New HSR	Maglev

Chicago—St. Louis

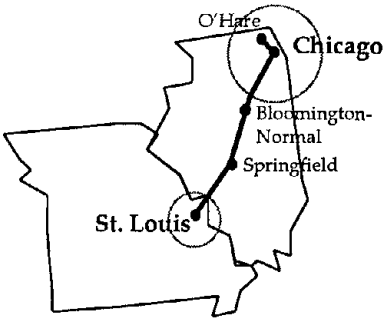
The 282-mile Chicago-St. Louis corridor has 10.8 million residents, of whom 300,000 live outside the two endpoint metropolitan areas. From Amtrak's current Chicago-St. Louis trip time of five and one-half hours, HSGT would reduce travel time to as low as three hours with Accelerail, two hours with New HSR, and one and one-half hours with Maglev. Frequencies would start at ten daily round trips for Accelerail, and increase to 32 for Maglev.

With HSGT, traffic is projected to grow beyond Amtrak's current level of 300,000 annual passengers. Initial investments would range from $500 million for Accelerail 90 to over $9 billion for Maglev.

[The profile for the Chicago—St. Louis corridor follows.]

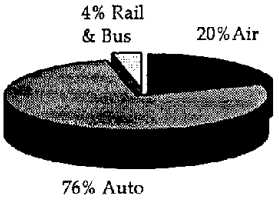
Chicago-St. Louis

Corridor length (miles):	282
Metropolitan area population (mil.):	
Chicago	8.1
St. Louis	2.4
Intermediate points	0.3
Total	10.8
1990 population higher than 1970 by:	3.3%



Current Scenario:

Existing Market Share by Mode
(All city-pair markets on a passenger-mile basis)

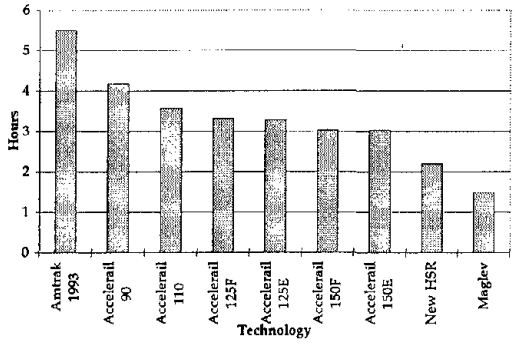


Total intercity passenger-miles:
2,234 million

Intercity travel density
(Passenger-miles per route-mile):
7.9 million

HSGT in 2020:

Line-Haul Travel Times

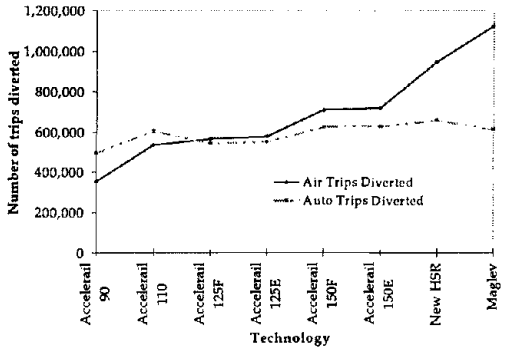


Frequencies & Fares

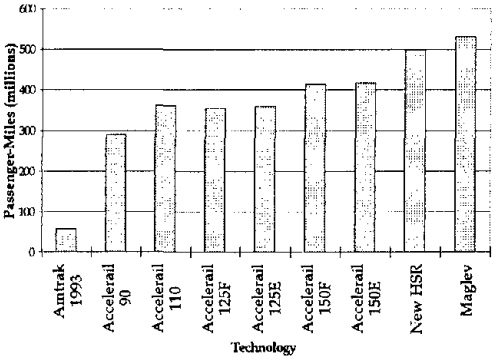
Technology	Frequency (Daily round trips)	Fares (Cents/mile)
Amtrak 1993*	3	10.0
Accelerail 90	10	14.7
Accelerail 110	13	16.7
Accelerail 125F	12	18.8
Accelerail 125E	12	18.8
Accelerail 150F	14	18.7
Accelerail 150E	14	18.7
New HSR	16	21.8
Maglev	32	29.0

*Amtrak 1993 fares are estimated yields.

Diverted Air and Auto Trips



Passenger-Miles



Chicago—St. Louis

Projection Results (Dollar Amounts are Present Values in Millions for the Period 2000—2040)

	Accelerail							
	90	110	125F	125E	150F	150E	New HSR	Maglev
Surplus After Continuing Investments	**$33**	**$111**	**$169**	**$131**	**$215**	**$154**	**$218**	**$618**
Total Benefits:	**$1,162**	**$1,672**	**$1,740**	**$1,785**	**$2,088**	**$2,128**	**$2,765**	**$3,474**
Benefits to HSGT Users:								
System Revenues	$344	$494	$541	$550	$636	$640	$893	$1,286
Users' Consumer Surplus	$459	$642	$649	$662	$799	$805	$1,027	$1,225
Total Benefits to HSGT Users	$803	$1,136	$1,190	$1,211	$1,434	$1,445	$1,920	$2,511
Benefits to the Public at Large	$359	$536	$551	$573	$654	$683	$845	$963
Total Costs:	**$811**	**$1,040**	**$1,446**	**$1,935**	**$2,412**	**$3,102**	**$6,575**	**$9,959**
Components of Total Costs:								
Initial Investment	$500	$657	$1,074	$1,516	$1,991	$2,617	$5,900	$9,291
O&M Expense	$291	$349	$346	$393	$388	$453	$616	$621
Continuing Investments	$20	$34	$26	$26	$32	$32	$59	$46
Incidence of Total Costs:								
Costs Borne by Users	$344	$494	$541	$550	$636	$640	$893	$1,286
Publicly-Borne Costs	$468	$545	$905	$1,385	$1,776	$2,463	$5,682	$8,673
Total Benefits Less Total Costs	**$350**	**$632**	**$294**	**($151)**	**($324)**	**($974)**	**($3,810)**	**($6,485)**
Benefits to HSGT Users Less Costs Borne by Users	$459	$642	$649	$662	$799	$805	$1,027	$1,225
Benefits to the Public at Large Less Publicly-Borne Costs	($109)	($10)	($354)	($812)	($1,123)	($1,779)	($4,837)	($7,710)
Ratio of Total Benefits to Total Costs	**1.4**	**1.6**	**1.2**	**0.9**	**0.9**	**0.7**	**0.4**	**0.3**
Ratio of Benefits to HSGT Users, to Costs Borne by Users	2.3	2.3	2.2	2.2	2.3	2.3	2.2	2.0
Ratio of Benefits to the Public at Large, to Publicly-Borne Costs	0.8	1.0	0.6	0.4	0.4	0.3	0.1	0.1

Partnership Potential, by Option

[Options with **black background** are projected to satisfy this report's two preliminary screening conditions for partnership potential: (1) a surplus after continuing investments and (2) a ratio of total benefits to total costs of 1.0 or more. **In conducting detailed studies, States may wish to consider additional financial measures, as well as the ratio of "benefits to the public at large" to "publicly-borne costs." "Partnership potential" does not constitute an express or implied criterion for Federal approval or funding.**]

Accelerail 90	Accelerail 110	Accelerail 125F	Accelerail 125E	Accelerail 150F	Accelerail 150E	New HSR	Maglev

Florida

The Florida Department of Transportation has actively pursued HSGT implementation during the last decade. In 1995 it requested proposals to build, operate and maintain an HSGT system along a Tampa-Orlando-Miami route, to which the State has committed to provide $70 million annually. Five prospective operators submitted franchise applications; in February 1996 the State Department of Transportation selected the Florida Overland Express (FOX) consortium to develop New HSR, subject to satisfactory completion of a financing agreement with the State. At this writing, such an agreement is still under negotiation.

A Tampa-Orlando-Miami HSGT corridor would serve over half of Florida's population, as well as many visitors to this southeastern state. As projected for this report, HSGT is expected to reduce travel time for Miami—Tampa from the current Amtrak/bus combination of 5 hours 14 minutes to as low as two and three-quarters hours with the Accelerail options, two and one-half hours with New HSR, and less than two hours with Maglev.[22] Frequencies would range from eight to nine daily trips for Accelerail to 30 for New HSR and 59 for Maglev. This is primarily an auto-oriented, fairly short-distance corridor, with an average trip length of 130—140 miles, less than half the total route length. Initial investment requirements are projected to range from about $1 billion to $7 billion, depending on the selected technology.

The State of Florida and its HSGT franchise applicants have conducted their own detailed studies of a range of HSGT options in the Miami—Orlando—Tampa corridor. Those studies yielded less favorable results for Accelerail-type systems in Florida than those reported on an illustrative basis in this nationwide study.

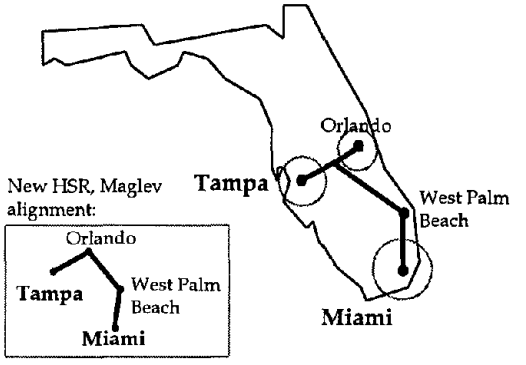
[The profile for the Florida corridor follows.]

[22] The circuity imposed by the assumed shape of this corridor (see the profile for Florida) limits the time savings in the higher-speed options, a problem that would require more detailed route studies to resolve.

Florida

Corridor length (miles):	
Accelerail options	306
New HSR, Maglev	317
Metropolitan area population (mil.):	
Tampa	2.1
Miami	3.2
Intermediate points	2.6
Total	7.9
1990 population higher than 1970 by:	91%

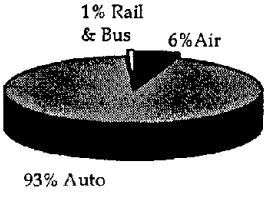
Accelerail alignment shown below:



New HSR, Maglev alignment:

Current Scenario:

Existing Market Share by Mode
(All city-pair markets on a passenger-mile basis)

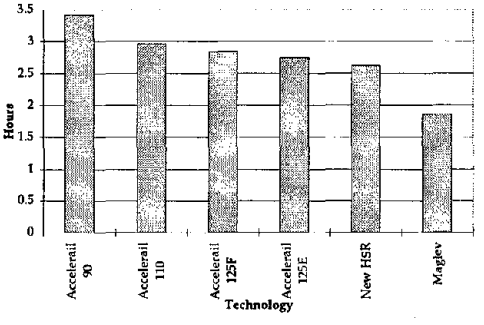


Total intercity passenger-miles: **7,774 million**

Intercity travel density (Passenger-miles per route-mile): **25.4 million**

HSGT in 2020:

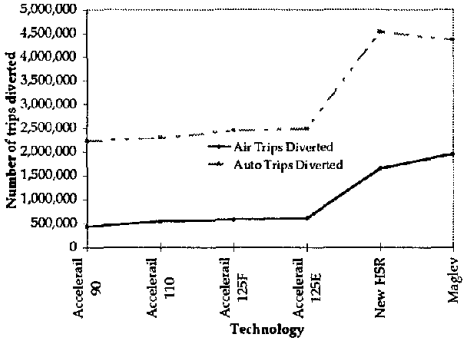
Line-Haul Travel Times



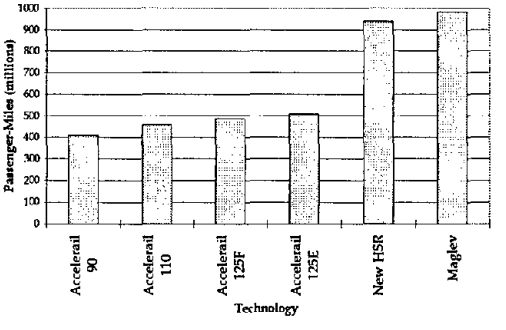
Frequencies & Fares

Technology	Frequency (Daily round trips)	Fares (Cents/mile)
Accelerail 90	8	21.3
Accelerail 110	9	22.6
Accelerail 125F	9	22.4
Accelerail 125E	9	22.3
New HSR	30	27.4
Maglev	59	33.7

Diverted Air and Auto Trips



Passenger-Miles



Note: With the exception of 2 daily bus/rail offerings requiring 6 hours of travel, Amtrak currently has no comparable passenger rail service in operation; Accelerail 150F and 150E not analyzed.

Florida

Projection Results (Dollar Amounts are Present Values in Millions for the Period 2000—2040)

	Accelerail					
	90	110	125F	125E	New HSR	Maglev
Surplus After Continuing Investments	**$152**	**$244**	**$270**	**$239**	**$915**	**$1,552**
Total Benefits:	**$1,941**	**$2,252**	**$2,392**	**$2,495**	**$5,671**	**$6,818**
Benefits to HSGT Users:						
System Revenues	$663	$790	$834	$865	$2,060	$2,718
Users' Consumer Surplus	$681	$787	$847	$886	$2,435	$2,781
Total Benefits to HSGT Users	$1,344	$1,577	$1,680	$1,752	$4,494	$5,499
Benefits to the Public at Large	$597	$675	$712	$743	$1,176	$1,319
Total Costs:	**$1,746**	**$1,850**	**$2,057**	**$2,668**	**$5,461**	**$8,220**
Components of Total Costs:						
Initial Investment	$1,235	$1,305	$1,494	$2,041	$4,316	$7,054
O&M Expense	$462	$482	$499	$562	$1,028	$1,091
Continuing Investments	$49	$64	$64	$65	$116	$75
Incidence of Total Costs:						
Costs Borne by Users	$663	$790	$834	$865	$2,060	$2,718
Publicly-Borne Costs	$1,082	$1,061	$1,224	$1,802	$3,401	$5,502
Total Benefits Less Total Costs	**$195**	**$402**	**$335**	**($173)**	**$210**	**($1,402)**
Benefits to HSGT Users Less Costs Borne by Users	$681	$787	$847	$886	$2,435	$2,781
Benefits to the Public at Large Less Publicly-Borne Costs	($486)	($385)	($512)	($1,059)	($2,225)	($4,183)
Ratio of Total Benefits to Total Costs	**1.1**	**1.2**	**1.2**	**0.9**	**1.0**	**0.8**
Ratio of Benefits to HSGT Users, to Costs Borne by Users	2.0	2.0	2.0	2.0	2.2	2.0
Ratio of Benefits to the Public at Large, to Publicly-Borne Costs	0.6	0.6	0.6	0.4	0.3	0.2

Partnership Potential, by Option

[Options with **black background** are projected to satisfy this report's two preliminary screening conditions for partnership potential: (1) a surplus after continuing investments and (2) a ratio of total benefits to total costs of 1.0 or more. **In conducting detailed studies, States may wish to consider additional financial measures, as well as the ratio of "benefits to the public at large" to "publicly-borne costs." "Partnership potential" does not constitute an express or implied criterion for Federal approval or funding.**]

Accelerail 90	Accelerail 110	Accelerail 125F	Accelerail 125E	New HSR	Maglev

Northeast Corridor

Through an exemplary—and relatively inexpensive—private/public partnership among freight railroads, suppliers, the Department, States, and localities,[23] the New York-Washington segment of the Northeast Corridor in 1969 offered the first modern HSGT in North America with the introduction of the Metroliners. Upgraded as a result of the Northeast Corridor Improvement Project, Amtrak's Metroliner service now reliably links its endpoint cities with timings under three hours. Amtrak is completing the upgrading of the New York-Boston segment of the route, which will include electrification between New Haven and Boston. Planned work will raise speeds to 150 mph over parts of the Washington-Boston line by the end of the decade, reducing New York-Washington running times to two and a half hours, and New York-Boston to three hours.

Since Accelerail 150E is already planned for implementation by the year 2000, this study fully addressed only the two highest-speed options, New HSR and Maglev. Between New York and Washington, trip times would shrink to two hours with New HSR and one and one-third hours with Maglev. New York-Boston trip times would be even shorter: one and two-thirds hours with New HSR and just over one hour with Maglev. Train frequencies would be extremely high—about 100 round trips daily between New York and Washington, and 80 to 90 round trips daily between New York and Boston.

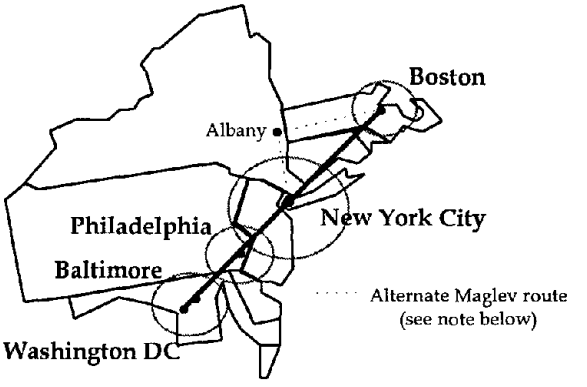
Passenger-miles on the corridor are projected to expand significantly over the comparable 1993 level of 1.3 billion. The quality of the service offered would allow fare yields to be moved forward aggressively, and revenues are projected to cover all expenses, continuing investments, initial vehicle investments, and over half of the initial infrastructure investment. The total initial investment would be in the $20 billion bracket due to the need to build through the most heavily developed area in the country, and the need for extensive tunneling and bridgework.

[The profile for the Northeast Corridor follows.]

[23] See Walter Shapiro, "The Seven Secrets of the Metroliner's Success," *Washington Monthly,* March 1973, p. 7.

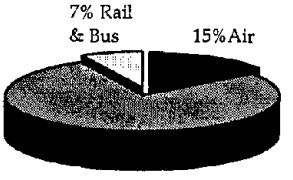
Northeast Corridor

Corridor length (miles):	441
Metropolitan area population (mil.):	
Boston	4.2
New York City	18.1
Philadelphia	5.9
Baltimore	2.4
Washington D.C.	3.9
Intermediate points	1.3
Total	35.8
1990 population higher than 1970 by:	4.4%



Current Scenario:

Existing Market Share by Mode
(All city-pair markets on a passenger-mile basis)

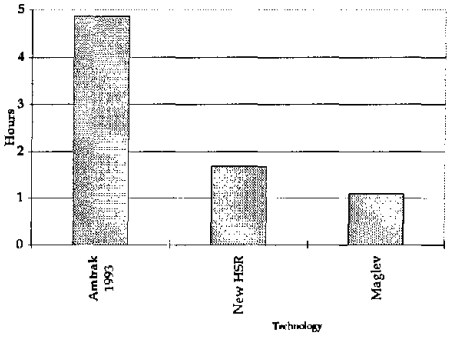


Total intercity passenger-miles: **20,879 million**

Intercity travel density (Passenger-miles per route-mile): **47.3 million**

HSGT in 2020: (Refers to entire corridor except as noted)

Line-Haul Travel Times
(Boston-New York City as an example)

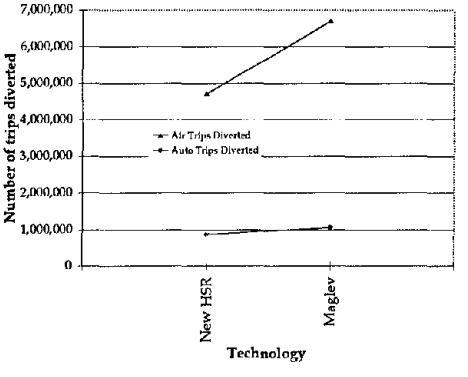


Frequencies & Fares
(Boston-New York City as an example for frequency)

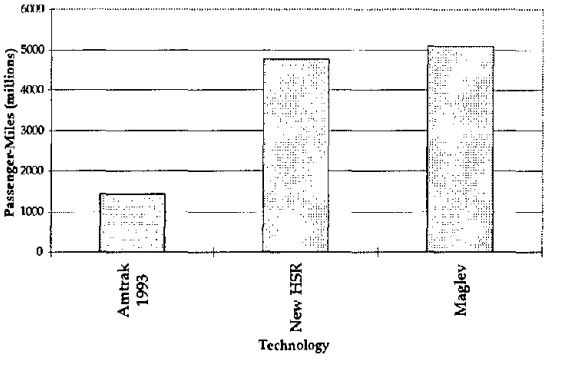
Technology	Frequency (Daily round trips)	Fares (Cents/mile)
Amtrak 1993*	13	24.0
New HSR	84	33.2
Maglev	85	37.9

*Amtrak 1993 fares are estimated yields.

Diverted Air and Auto Trips



Passenger-Miles



Notes: Amtrak 1993 figures which refer to the entire corridor included Metroliner service (i.e., express service from Washington DC to New York City).
The alternative Maglev route has undergone state scrutiny but in not analyzed herein.

Northeast Corridor

Projection Results (Dollar Amounts are Present Values in Millions for the Period 2000—2040)

	New HSR	Maglev
Surplus After Continuing Investments	**$8,277**	**$11,607**
Total Benefits:	**$24,941**	**$28,943**
Benefits to HSGT Users:		
System Revenues	$13,442	$16,285
Users' Consumer Surplus	$7,861	$8,538
Total Benefits to HSGT Users	$21,303	$24,823
Benefits to the Public at Large	$3,638	$4,121
Total Costs:	**$24,293**	**$26,815**
Components of Total Costs:		
Initial Investment	$19,127	$22,137
O&M Expense	$4,687	$4,328
Continuing Investments	$478	$349
Incidence of Total Costs:		
Costs Borne by Users	$13,442	$16,285
Publicly-Borne Costs	$10,851	$10,530
Total Benefits Less Total Costs	**$648**	**$2,128**
Benefits to HSGT Users Less Costs Borne by Users	$7,861	$8,538
Benefits to the Public at Large Less Publicly-Borne Costs	($7,213)	($6,410)
Ratio of Total Benefits to Total Costs	**1.0**	**1.1**
Ratio of Benefits to HSGT Users, to Costs Borne by Users	1.6	1.5
Ratio of Benefits to the Public at Large, to Publicly-Borne Costs	0.3	0.4

Partnership Potential, by Option

[Options with **black background** are projected to satisfy this report's two preliminary screening conditions for partnership potential: (1) a surplus after continuing investments and (2) a ratio of total benefits to total costs of 1.0 or more. **In conducting detailed studies, States may wish to consider additional financial measures, as well as the ratio of "benefits to the public at large" to "publicly-borne costs." "Partnership potential" does not constitute an express or implied criterion for Federal approval or funding.**]

Pacific Northwest

The Pacific Northwest corridor in the States of Oregon and Washington and the Province of British Columbia exemplifies the private/public partnerships on which future HSGT would need to build. The States and the Burlington Northern Santa Fe Railway (BNSF) have committed funds and planning expertise to Accelerail-type improvements in this corridor.[24] These partnerships have led to recent service improvements, including demonstrations of recent European trainsets and Amtrak's return to the Seattle—Vancouver, B.C. market.

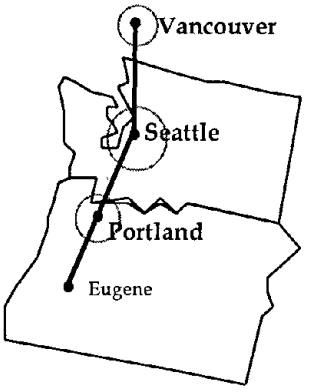
The projections for this study characterize the Pacific Northwest as a potential locale for further Accelerail-type development. This result accords with the corridor's length and traffic patterns—at 469 miles, it exceeds the Northeast Corridor's route mileage, yet has shorter average trip lengths and less travel density. The initial investment for HSGT in this corridor is projected to range from about $600 million for the lowest-cost Accelerail upgrade, to $14 billion for Maglev.

[The profile for the Pacific Northwest corridor follows.]

[24] Also in the Pacific Northwest region, the Union Pacific Railroad has joined the BNSF in a project to provide positive train separation using improved train control technology.

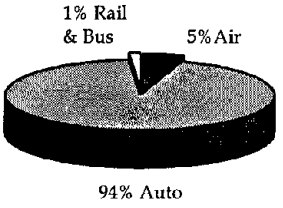
Pacific Northwest

Corridor length (miles):	454
Metropolitan area population (mil.):	
Vancouver	1.6
Seattle	2.6
Portland	1.5
Eugene	0.3
Intermediate points	0.6
Total	6.5
1990 population higher than 1970 by:	42.6%



Current Scenario:

Existing Market Share by Mode
(All city-pair markets on a passenger-mile basis)

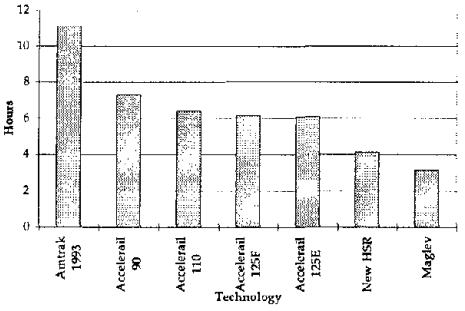


Total intercity passenger-miles: **4,170 million**

Intercity travel density (Passenger-miles per route-mile): **9.2 million**

HSGT in 2020: (Refers to entire corridor except as noted)

Line-Haul Travel Times
(Eugene-Vancouver as an example)

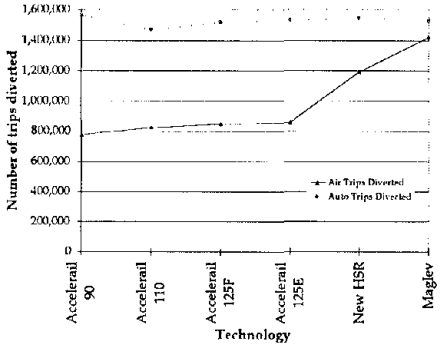


Frequencies & Fares
(Eugene-Vancouver as an example for frequency)

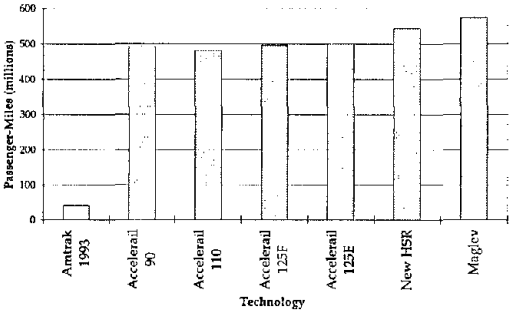
Technology	Frequency (Daily round trips)	Fares (Cents/mile)
Amtrak 1993*	3	9.0
Accelerail 90	15	20.3
Accelerail 110	15	24.8
Accelerail 125F	15	24.8
Accelerail 125E	15	24.7
New HSR	17	33.9
Maglev	35	41.3

*Amtrak 1993 fares are estimated yields.

Diverted Air and Auto Trips



Passenger-Miles



Pacific Northwest

Projection Results (Dollar Amounts are Present Values in Millions for the Period 2000—2040)

	Accelerail					
	90	110	125F	125E	New HSR	Maglev
Surplus After Continuing Investments	**$181**	**$333**	**$359**	**$324**	**$521**	**$859**
Total Benefits:	**$2,675**	**$2,925**	**$3,038**	**$3,090**	**$4,168**	**$5,028**
Benefits to HSGT Users:						
System Revenues	$810	$964	$996	$1,004	$1,492	$1,935
Users' Consumer Surplus	$1,216	$1,304	$1,363	$1,379	$1,899	$2,310
Total Benefits to HSGT Users	$2,027	$2,268	$2,359	$2,384	$3,391	$4,245
Benefits to the Public at Large	$648	$657	$679	$706	$777	$783
Total Costs:	**$1,227**	**$1,490**	**$1,869**	**$2,757**	**$8,790**	**$15,057**
Components of Total Costs:						
Initial Investment	$598	$859	$1,233	$2,076	$7,819	$13,980
O&M Expense	$590	$589	$595	$620	$893	$985
Continuing Investments	$40	$42	$42	$61	$78	$92
Incidence of Total Costs:						
Costs Borne by Users	$810	$964	$996	$1,004	$1,492	$1,935
Publicly-Borne Costs	$417	$526	$873	$1,752	$7,298	$13,121
Total Benefits Less Total Costs	**$1,447**	**$1,434**	**$1,168**	**$333**	**($4,622)**	**($10,028)**
Benefits to HSGT Users Less Costs Borne by Users	$1,216	$1,304	$1,363	$1,379	$1,899	$2,310
Benefits to the Public at Large Less Publicly-Borne Costs	$231	$130	($194)	($1,046)	($6,521)	($12,338)
Ratio of Total Benefits to Total Costs	**2.2**	**2.0**	**1.6**	**1.1**	**0.5**	**0.3**
Ratio of Benefits to HSGT Users, to Costs Borne by Users	2.5	2.4	2.4	2.4	2.3	2.2
Ratio of Benefits to the Public at Large, to Publicly-Borne Costs	1.6	1.2	0.8	0.4	0.1	0.1

Partnership Potential, by Option

[Options with **black background** are projected to satisfy this report's two preliminary screening conditions for partnership potential: (1) a surplus after continuing investments and (2) a ratio of total benefits to total costs of 1.0 or more. **In conducting detailed studies, States may wish to consider additional financial measures, as well as the ratio of "benefits to the public at large" to "publicly-borne costs." "Partnership potential" does not constitute an express or implied criterion for Federal approval or funding.**]

Accelerail 90	Accelerail 110	Accelerail 125F	Accelerail 125E	New HSR	Maglev

Texas Triangle

The State of Texas has a population of approximately 18 million, of whom 54 percent live in the metropolitan areas of the Texas Triangle corridor. Efforts to bring HSGT to the Texas Triangle resulted in the 1991 franchise award to the Texas TGV consortium to build and operate a New HSR system. However, Texas TGV was unable to obtain the necessary funding. A potential HSGT operator has expressed interest in Accelerail for the Houston-Dallas route; this type of service is under scrutiny locally.

To serve the growing population living along the Triangle, the present study considered two HSGT routes: a 790-mile triangular configuration for Accelerail and a 436-mile wishbone configuration for New HSR and Maglev. Using the Dallas-San Antonio market as an example, HSGT could achieve travel times of as low as three hours with Accelerail, two and one-half hours with New HSR, and one and two-thirds hours with Maglev. Frequencies would start at ten daily trips for Accelerail and increase to 22 for New HSR and to 47 for Maglev.

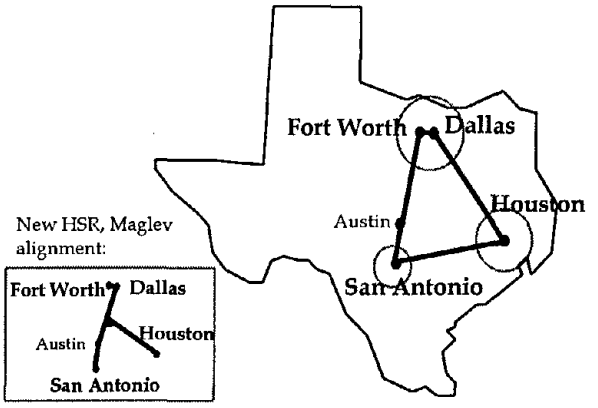
Owing to the abundance of short-haul flights in the Texas Triangle, the projections show travelers to be highly time-sensitive; accordingly, traffic is projected to rise with travel time improvements. Operating surpluses are expected to be sufficient to cover continuing investments across all technologies. The initial capital costs would range from about $900 million for Accelerail 90 to $5 billion for New HSR and $10 billion for Maglev. New HSR in this analysis actually costs the public less than Accelerail 150E because the former's shorter, wishbone route requires lower initial infrastructure costs, which are further offset by higher revenues from a larger contingent of riders.

[The profile for the Texas Triangle follows.]

Texas Triangle

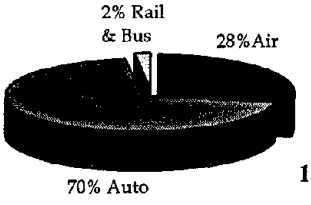
Corridor length (miles):	
Accelerail options	783
New HSR, Maglev	436
Metropolitan area population (mil.):	
Dallas-Ft. Worth	3.9
Houston	3.7
San Antonio	1.3
Intermediate points	1.3
Total	10.2
1990 population higher than 1970 by:	67%

Accelerail alignment shown below:



Current Scenario:

Existing Market Share by Mode
(All city-pair markets on a passenger-mile basis)

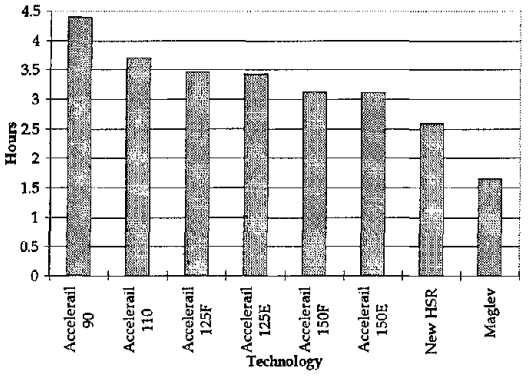


Total intercity passenger-miles: **7,300 million**

Intercity travel density: (Passenger-miles per route-mile): **16.7 million** (based on New HSR/Maglev distance)

HSGT in 2020: (Refers to entire corridor except as noted)

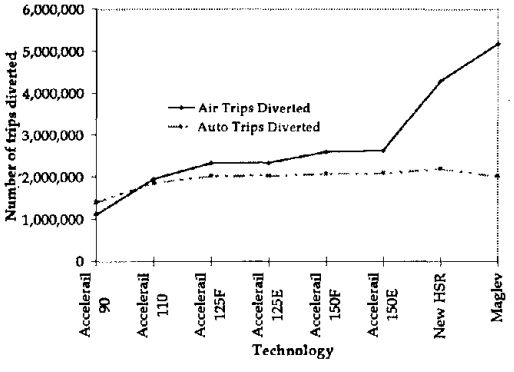
Line-Haul Travel Times
(Dallas-San Antonio as an example)



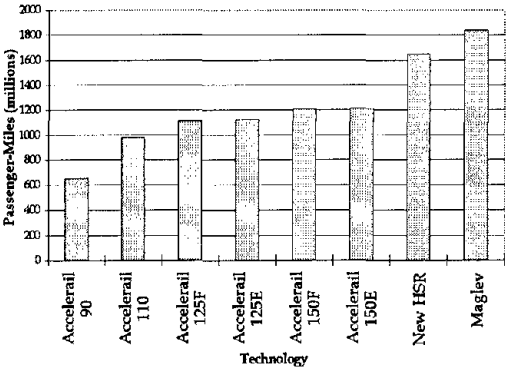
Frequencies & Fares
(Dallas-San Antonio as an example for frequency)

Technology	Frequency (Daily round trips)	Fares (Cents/mile)
Accelerail 90	10	17.7
Accelerail 110	15	17.8
Accelerail 125F	16	17.7
Accelerail 125E	17	17.7
Accelerail 150F	18	18.8
Accelerail 150E	18	18.8
New HSR	22	21.7
Maglev	47	28.4

Diverted Air and Auto Trips



Passenger-Miles



Note: Amtrak had no comparable passenger rail service in operation.

Texas Triangle

Projection Results (Dollar Amounts are Present Values in Millions for the Period 2000—2040)

	Accelerail							
	90	110	125F	125E	150F	150E	New HSR	Maglev
Surplus After Continuing Investments	**$195**	**$456**	**$586**	**$486**	**$797**	**$646**	**$1,168**	**$2,453**
Total Benefits:	**$2,311**	**$3,779**	**$4,326**	**$4,414**	**$4,868**	**$4,966**	**$7,382**	**$9,682**
Benefits to HSGT Users:								
System Revenues	$894	$1,399	$1,586	$1,604	$1,837	$1,847	$2,909	$4,311
Users' Consumer Surplus	$1,050	$1,814	$2,116	$2,146	$2,395	$2,412	$3,654	$4,543
Total Benefits to HSGT Users	$1,944	$3,213	$3,702	$3,750	$4,232	$4,259	$6,563	$8,853
Benefits to the Public at Large	$367	$566	$624	$664	$636	$707	$819	$829
Total Costs:	**$1,562**	**$2,657**	**$4,768**	**$5,732**	**$5,389**	**$6,981**	**$6,812**	**$11,984**
Components of Total Costs:								
Initial Investment	$863	$1,714	$3,767	$4,613	$4,349	$5,780	$5,071	$10,127
O&M Expense	$646	$871	$918	$1,046	$971	$1,134	$1,510	$1,735
Continuing Investments	$53	$72	$83	$73	$69	$67	$232	$122
Incidence of Total Costs:								
Costs Borne by Users	$894	$1,399	$1,586	$1,604	$1,837	$1,847	$2,909	$4,311
Publicly-Borne Costs	$668	$1,258	$3,182	$4,128	$3,552	$5,134	$3,903	$7,674
Total Benefits Less Total Costs	**$749**	**$1,122**	**($441)**	**($1,318)**	**($520)**	**($2,015)**	**$570**	**($2,302)**
Benefits to HSGT Users Less Costs Borne by Users	$1,050	$1,814	$2,116	$2,146	$2,395	$2,412	$3,654	$4,543
Benefits to the Public at Large Less Publicly-Borne Costs	($301)	($692)	($2,557)	($3,464)	($2,916)	($4,427)	($3,084)	($6,845)
Ratio of Total Benefits to Total Costs	**1.5**	**1.4**	**0.9**	**0.8**	**0.9**	**0.7**	**1.1**	**0.8**
Ratio of Benefits to HSGT Users, to Costs Borne by Users	2.2	2.3	2.3	2.3	2.3	2.3	2.3	2.1
Ratio of Benefits to the Public at Large, to Publicly-Borne Costs	0.6	0.4	0.2	0.2	0.2	0.1	0.2	0.1

Partnership Potential, by Option

[Options with **black background** are projected to satisfy this report's two preliminary screening conditions for partnership potential: (1) a surplus after continuing investments and (2) a ratio of total benefits to total costs of 1.0 or more. **In conducting detailed studies, States may wish to consider additional financial measures, as well as the ratio of "benefits to the public at large" to "publicly-borne costs." "Partnership potential" does not constitute an express or implied criterion for Federal approval or funding.**]

Accelerail 90	Accelerail 110	Accelerail 125F	Accelerail 125E	Accelerail 150F	Accelerail 150E	New HSR	Maglev

Incrementally Treated Corridors

The Empire and Southeast Corridors received special treatment because they would serve as natural extensions of the Northeast Corridor—an existing HSGT operation that is undergoing improvement. A single entity (Amtrak) currently operates intercity rail passenger service in the Northeast, Empire, and Southeast Corridors; this study therefore assumed that the Northeast Corridor entity would take responsibility for future HSGT in the extensions as well. These factors allowed for an incremental approach which modeled the performance of (a) the Northeast Corridor alone and (b) the combination of the Northeast Corridor with either[25] its Empire or Southeast Corridor extension, and derived the incremental projection by simply subtracting (a) from (b).

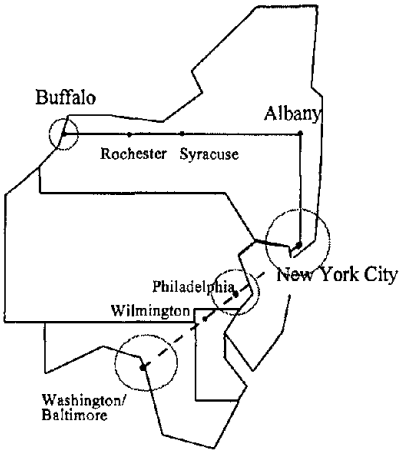
The projection results for the incrementally treated corridors are preliminary in nature because of the multiplicity of available options for analysis[26] and the sheer size and complexity of combining the Nation's most densely trafficked corridor with very long extensions (leading to route lengths in the 800-900 mile range—tantamount to the distance from New York to Chicago). Since a complete study of each of these incremental corridors exceeded the scope of this analysis, their presentation is restricted to general indications for sample options.[27]

Empire Corridor

Linking New York City with most major cities of Upper New York State (Albany, Utica, Syracuse, Rochester, Buffalo, and intermediate points), the Empire Corridor traditionally represents one of the Nation's richest intercity rail passenger markets. Further strengthening that market, the completion of Amtrak's direct access between the

Empire Corridor as Extension of Northeast Corridor

Corridor length (miles New York-Buffalo):	431
Metropolitan area population (mil.):	
New York City	18.1
Buffalo	1.2
Intermediate points	3.1
Total	22.4
1990 population higher than 1970 by:	-0.6%



Map Legend

Empire Corridor
Northeast Corridor (NEC)
(through or connecting service)

[25] A combination of HSGT in all three corridors—Northeast, Empire, and Southeast—was not modeled, nor were other potential Northeast Corridor HSGT extensions (e.g., Hartford/Springfield and Harrisburg).

[26] For instance, each of the Accelerail options in the extensions can theoretically be matched with either Accelerail 150E or New HSR in the Northeast Corridor. Thus, instead of the eight technologies modeled elsewhere in this report, the Empire and Southeast Corridors can each have at least 14.

[27] This study matched Accelerail options in the extensions with New HSR in the NEC. Future detailed studies would do well to couple Accelerail options in the Southeast and Empire Corridors with electrified Accelerail service in the Northeast Corridor.

Empire and Northeast Corridors has created the potential for through Accelerail service between Upper New York State and New Jersey points, Philadelphia, Baltimore, and Washington. Such connectivity would, of course, be fundamental to the design of any New HSR or Maglev systems.

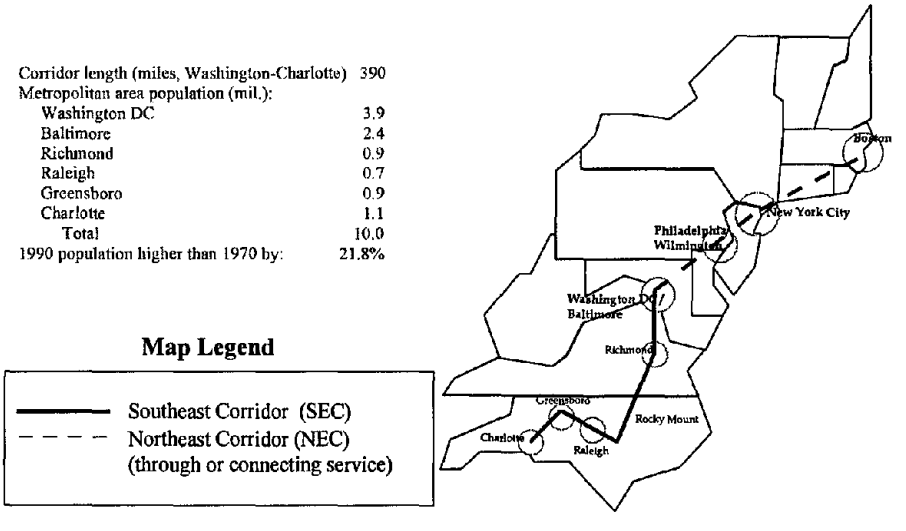
On an incremental basis, preliminary projections for the Empire Corridor suggest that both Accelerail 125F and Maglev could have partnership potential. Because of the Northeast Corridor connection, average trip lengths and average per-passenger revenue for Empire Corridor trips would exceed those for most other illustrative corridors.[28] The substantial traffic volumes and revenues foreseen for the Empire Corridor, coupled with the constancy of New York State's interest in HSGT over this established intercity rail passenger route, suggest that it might serve as a useful object of further incremental study along the lines described above.

Southeast Corridor

The Southeast Corridor, linking Washington, D.C. with Richmond, Greensboro, Charlotte, and other important Virginia and North Carolina points, also represents a natural extension of the Northeast Corridor. In fact, the potential for traffic and revenue synergy is even greater in the Southeast than in the Empire Corridor: while the Empire Corridor directly serves New York City, every Southeast Corridor traveler bound for New York must traverse some 200 Northeast Corridor route-miles as well, with potentially lucrative revenue consequences for the HSGT operator.

Southeast Corridor as Extension of Northeast Corridor[29]

Corridor length (miles, Washington-Charlotte)	390
Metropolitan area population (mil.):	
Washington DC	3.9
Baltimore	2.4
Richmond	0.9
Raleigh	0.7
Greensboro	0.9
Charlotte	1.1
Total	10.0
1990 population higher than 1970 by:	21.8%



The projections reflect the synergies inherent in the Northeast Corridor/Southeast Corridor combination: the average trip on the Southeast Corridor would be longer and generate more revenue than on any other illustrative route, including California North/South.

[28] The exceptions are New HSR and Maglev in California North/South; and the Southeast Corridor.

[29] The Secretary of Transportation recently added to the designated Southeast Corridor, an extension from Richmond to the Hampton Roads region of Virginia. This analysis does not address that extension.

Because of these ridership and revenue prospects, this study applied to the Southeast Corridor the same analytical approach and assumptions that characterized the Empire Corridor. Viewed incrementally, the preliminary Southeast Corridor projections suggest that all three sample options (Accelerail 90, New HSR, and Maglev) could have partnership potential. In light of these preliminary results, the Southeast Corridor states and Amtrak might consider jointly exploring the incremental economics of a wide range of Southeast Corridor scenarios (including various routing and segmentation alternatives) as extensions of prospective Northeast Corridor services.

CONCLUSIONS

Taken together, the following conclusions suggest that States should consider HSGT along with other options for improving intercity passenger transportation.

Investment Needs

- HSGT can cost from less than $2 million to $50 million per route-mile to build. The less expensive options—upgraded existing railroads with 90-150 mph maximum speeds—can, in some corridors, represent affordable travel improvements that would expand the range of transportation choices. With top speeds up to 200-300 mph, the costlier options can provide very fast, reliable, and comfortable transportation service, as in a Maglev timing of just over an hour between midtown Manhattan and downtown Boston.
- In the design and application of all HSGT technologies, the Department regards safety as paramount. Evolving safety research and regulation could thus influence the capital cost structure for Accelerail, New HSR, and Maglev. Similarly, research and development in other facets of railroad and Maglev system design could reduce the investment levels for HSGT technologies. As the effects of these regulatory advances and technology development efforts become known, they will enter at the State level into the conceptual and detailed design of specific HSGT infrastructure and equipment investments.

Demand Levels

- HSGT is projected to develop appreciable ridership. For example, by the year 2020 in the most heavily trafficked corridors (California North/South and the Northeast Corridor), New HSR and Maglev could exceed by as much as a factor of four Amtrak's current Northeast Corridor travel volumes. Likewise, Accelerail in California, Texas, and the Chicago Hub Network could approach or exceed existing Northeast Corridor patronage levels by 2020.

Operating Results

- In most of the illustrative cases, HSGT is projected to function on a self-sustaining basis—independent of public subsidies—once the initial investment is in place.

- Beyond covering future operating and maintenance expenses and continuing investment needs, revenues in most of the illustrative cases could cover a portion of the initial investment.
- In specific instances, the operating results of HSGT may be strengthened when individual corridors are linked in a network, or when existing corridors are extended, because demand and revenues increase while unit costs may decrease. Further detailed studies would be necessary to confirm this potential in specific locations.

Benefit/Cost Analysis

- HSGT's total benefits exceed total costs in most of the illustrative cases.
- Each HSGT technology would have one or more corridors that provide a favorable ratio of total benefits to total costs: New HSR, for example, is projected to have partnership potential[30] in four of nine applicable illustrative corridors,[31] and Maglev in two of nine.
- In a given corridor, the less expensive Accelerail technologies, relying on upgraded existing rail lines and freight railroad cooperation, could typically provide higher ratios of benefits to costs than New HSR and Maglev.
- On the basis of total costs and benefits, each illustrative corridor would have one or more HSGT technologies that would meet the threshold conditions for partnership potential. The more heavily traveled corridors would generally show partnership potential over a broader spectrum of technologies.
- **When benefits and costs are analyzed and compared insofar as they affect HSGT users and the public at large, respectively:**
  - **— Users invariably enjoy an excess of benefits over costs.**
  - **— The public at large has a favorable ratio of benefits to costs in only a subset of corridor cases (approximately one-fourth of those analyzed), all of which are Accelerail options.**

---

[30] As defined in this report, "partnership potential" is the apparent capacity of an HSGT corridor to draw the private and public sectors together in planning, negotiations, and, conceivably, project implementation. To exhibit partnership potential, the projections for an HSGT technology in a particular corridor must satisfy at least the following two conditions: First, private enterprise must be able to run the corridor—once built and paid for—as a completely self-sustaining entity. Second, the total benefits of an HSGT corridor must equal or exceed its total costs. This report uses "partnership potential" as an indicator of the aggregate financial and economic impacts of HSGT alternatives in a set of illustrative corridors. Detailed State studies of individual corridors would benefit from additional evaluation measures as well as site-specific investigations and data. Thus, while "partnership potential" may offer useful insights in assessing the likelihood of HSGT development by State and local governments and their private partners, it does not constitute an express or implied criterion for Federal approval or funding. For further particulars on "partnership potential," the reader is referred to earlier sections of this Overview Report.

[31] That is, corridors other than the incremental extensions to the Northeast Corridor.

- Accelerail's potential for HSGT at a modest initial investment cost validates the Department's Next-Generation High-Speed Rail technology development program—which supports use of existing railroads—and confirms several States' decisions to implement Accelerail options.

Importance of Partnerships

- Successful private/public partnerships are essential to the construction and implementation of all HSGT systems. While necessarily varying among corridors and technologies, the potential for such partnerships will be strongest where self-sustaining operations can attract a private HSGT entity, where the benefits provide the State with a convincing rationale for the public investment, and where a State regards HSGT as a preferred approach to enhancing intercity travel mobility in an intermodal setting.

State Planning Needs

- The States have specialized knowledge of local conditions and priorities, and the very nature of corridor planning also calls for detailed consideration of various complex staging, routing, and mixed technology options from a State and local perspective. Where public policy considerations dictate, States may also wish to pursue an examination of the incidence of benefits and costs in conjunction with their detailed corridor studies.

Further details on the scope, procedures, assumptions, and results of the study appear in the Main Report.

Photo Credits

[All photos are used by permission. Photo use does not represent endorsement by the U.S. Department of Transportation of any particular design, product, or manufacturer.]

Cover (clockwise from top left)

- RTL-2 Turboliner photo courtesy of the New York State Department of Transportation.
- Maglev illustration courtesy of Florida Maglev Consortium, Inc.
- California Department of Transportation locomotive photo courtesy of Electro-Motive Division, General Motors.
- American Flyer illustration courtesy of Bombardier/GEC Alsthom Consortium, Inc.

Section on "HSGT Technologies"

- Metroliner photo courtesy of Amtrak, Washington, DC.
- British Intercity 225 photo courtesy of Intercity East Coast Ltd., York, England.
- X-2000 tilt train photo courtesy of ABB Traction Inc., Elmira, NY.
- TGV photo courtesy of Societe Nationale des Chemins de Fer Francais, Paris, France.
- Nozomi Shinkansen photo courtesy of Japan Railways Group, New York, NY.
- Intercity Express photo courtesy of Clay Moritz, Silver Spring, MD.
- Maglev photo courtesy of Thyssen Henschel.

Reproduced by NTIS

National Technical Information Service
Springfield, VA 22161

This report was printed specifically for your order from nearly 3 million titles available in our collection.

For economy and efficiency, NTIS does not maintain stock of its vast collection of technical reports. Rather, most documents are printed for each order. Documents that are not in electronic format are reproduced from master archival copies and are the best possible reproductions available. If you have any questions concerning this document or any order you have placed with NTIS, please call our Customer Service Department at (703) 487-4660.

About NTIS

NTIS collects scientific, technical, engineering, and business related information — then organizes, maintains, and disseminates that information in a variety of formats — from microfiche to online services. The NTIS collection of nearly 3 million titles includes reports describing research conducted or sponsored by federal agencies and their contractors; statistical and business information; U.S. military publications; audiovisual products; computer software and electronic databases developed by federal agencies; training tools; and technical reports prepared by research organizations worldwide. Approximately 100,000 *new* titles are added and indexed into the NTIS collection annually.

For more information about NTIS products and services, call NTIS at (703) 487-4650 and request the free *NTIS Catalog of Products and Services*, PR-827LPG, or visit the NTIS Web site **http://www.ntis.gov**.

NTIS
Your indispensable resource for government-sponsored information—U.S. and worldwide

U.S. DEPARTMENT OF COMMERCE
Technology Administration
National Technical Information Service
Springfield, VA 22161 (703) 487-4650