Chapter 2
HSGT IN ITS INTERMODAL CONTEXT

This chapter defines HSGT and explains why it merits consideration as a viable passenger transport option in congested intercity corridors.

DEFINITION OF HSGT

HSGT is self-guided intercity passenger ground transportation—by steel-wheel railroad or magnetic levitation (Maglev)—that is time-competitive with air and/or auto for travel markets in the approximate range of 100 to 500 miles.[1] A **market** is a city-pair—two metropolitan areas, such as New York City and Washington, D.C.; a **corridor** is a natural grouping of metropolitan areas and markets that, by their proximity and configuration, lend themselves to efficient service by ground transportation.

This is a market-driven, performance-based definition of HSGT. It recognizes that total trip time (including access to and from stations), rather than speed *per se*, influences passengers' choices among transport options in a given market; and that travelers evaluate each mode not in isolation, but in relation to the performance of the other available choices.[2] A specific technological option may constitute HSGT in a corridor 185 miles in length, yet may fall far short of HSGT status in a 400-mile corridor. Conversely, another option might suit a longer corridor admirably but represent an ineffective expenditure of public funds in a much shorter corridor. Moreover, raising top speeds in a corridor may provide only one of many ways to reduce trip times but may not be the most cost-effective way.[3]

IMPETUS FOR HSGT

HSGT activity in the United States will only occur because of pressing transportation needs. As travel demand grows, intercity transportation by air and auto increasingly suffers from congestion and delay, particularly within metropolitan areas; at and surrounding airports; and during weekend, holiday, and bad-weather periods. This

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[1] A few examples of HSGT service around the world include the Shinkansen in Japan; the TGV in France; the ICE and planned Berlin—Hamburg Maglev in Germany; and in the United States, Amtrak's Metroliners between New York and Washington. Important HSGT services exist in other countries as well.

[2] Trip time represents but one of the many criteria used by travelers in choosing among modes, as described in National Analysts, Inc. for FRA, *The Needs and Desires of Travelers in the Northeast Corridor: A Survey of the Dynamics of Mode Choice Decisions*, NTIS publication PB 191 027, February 1970. Other criteria defining the transportation product include fares (perceived costs for auto), frequency, and service quality. See the discussion of demand and diversions in Chapter 5.

[3] Cf. Transportation Research Board, *In Pursuit of Speed,* pp. 89, 90, and 97.

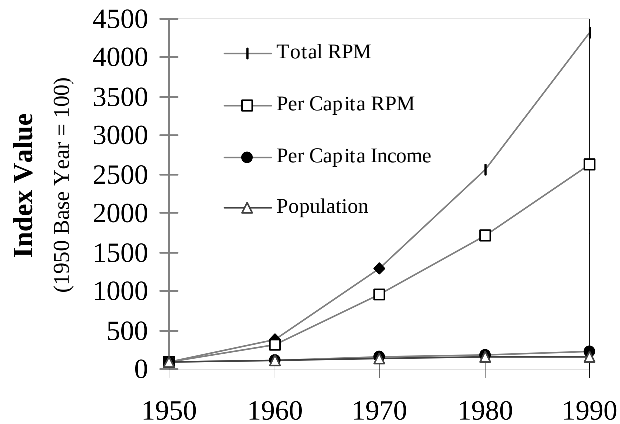
declining quality of service adversely affects intercity travelers, other transport system users, carriers, and the general public, and provides the impetus for careful evaluation of HSGT options.

The following sections explicate those needs by examining nationwide trends in the air and highway modes.

Air Transportation

Domestic intercity air travel has grown much faster than population and income since 1950, as demonstrated in Figure 2-1. The relatively high growth in air travel from 1950 to 1970 reflects in part the substitution of air travel for the formerly ubiquitous intercity rail travel. In recent decades, the discrepancies among air passenger, population, and income growth rates have diminished (see Figure 2-2). This trend stems from the maturation of the air travel industry, the acclimation of entire generations to flight as an everyday occurrence, and the decline in the price of air travel in real terms from the 1970s to today.[5] The Federal Aviation Administration (FAA) has projected domestic air carrier revenue passenger miles (RPM) and passenger enplanements to increase at an average annual rate of 3.7 and 3.5 percent, respectively, between 1993 and 2005.[6] These increases assume higher load factors, greater seating capacity in aircraft, and longer passenger trip lengths. Over the same period, RPM and passenger enplanements for international air carriers are forecast to increase at an average annual rate of 6.3 and 6.5

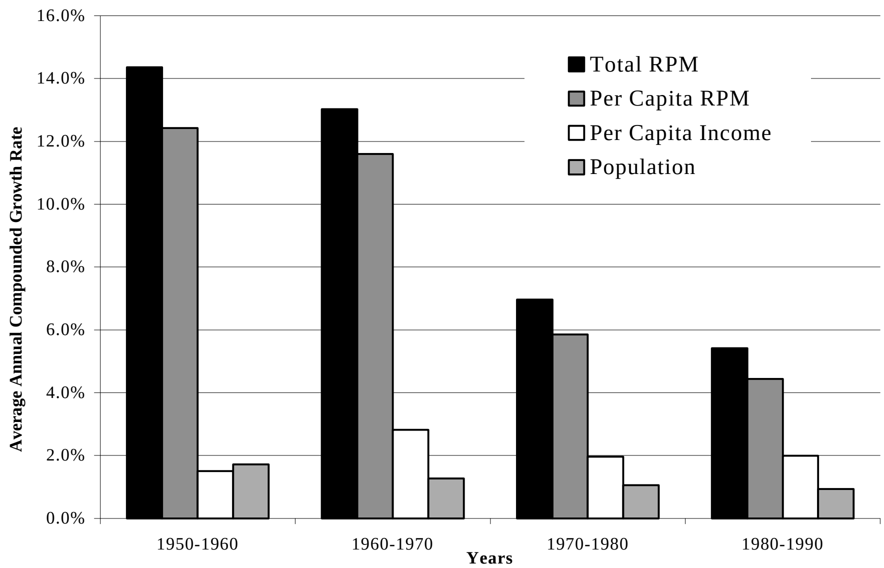
Figure 2-1
Domestic Air Travel: Long-Term Trends in Revenue Passenger-Miles (RPM), Population, and Income[4]



[4] U.S. Bureau of the Census, *Statistical Abstract of the United States: 1994*, 114th ed., pp. 8, 451.
[5] The revenue per passenger mile in constant 1993 dollars declined from an average of 21 cents in the years 1968 to 1971 to an average yield of 13 cents per mile in 1993. Contributing to this trend has been the emergence of such low-cost regional carriers as Southwest Airlines. Federal Aviation Administration, *FAA Aviation Forecasts Fiscal Years 1994-2005*, FAA-APO-94-1 (March 1994), p. III-25.
[6] Ibid., pp. I-7.

percent respectively. For regional/commuter airlines, RPM are expected to grow at 8.5 and 6.9 percent annually on average.[7]

Figure 2-2
Air Travel Comparisons —
Average Annual Compounded Growth Rates by Decade[8]



Beyond 2005, increases in population and income are expected to result in long-term growth for air travel. Generally, however, air travel is forecast to increase faster over the next ten years than in the longer term because the growth rates of population and income are declining and are expected to continue to do so. For the period 2005 to 2020, the FAA published a forecast that is more limited in scope than its short-term forecast and that omits any prediction for domestic RPM. It does, however, predict that domestic air carrier enplanements will increase at an annual average rate of 2.5 percent from 2005 to 2020,[9] lower than the 3.5 percent growth forecast for 1993 to 2005 (but still substantial in view of existing capacity constraints). That assumption agrees with an assumed drop in the growth rate for national income.[10]

Over the past decades, the expansion of air traffic has far outpaced the growth in airport capacity. As demonstrated in Figure 2-3, existing airport congestion has created perceptible delays; the FAA now regards 23 airports, each exceeding a threshold of 20,000 airline flight delay-hours per year, as “delay problem” locations, and projects that 32

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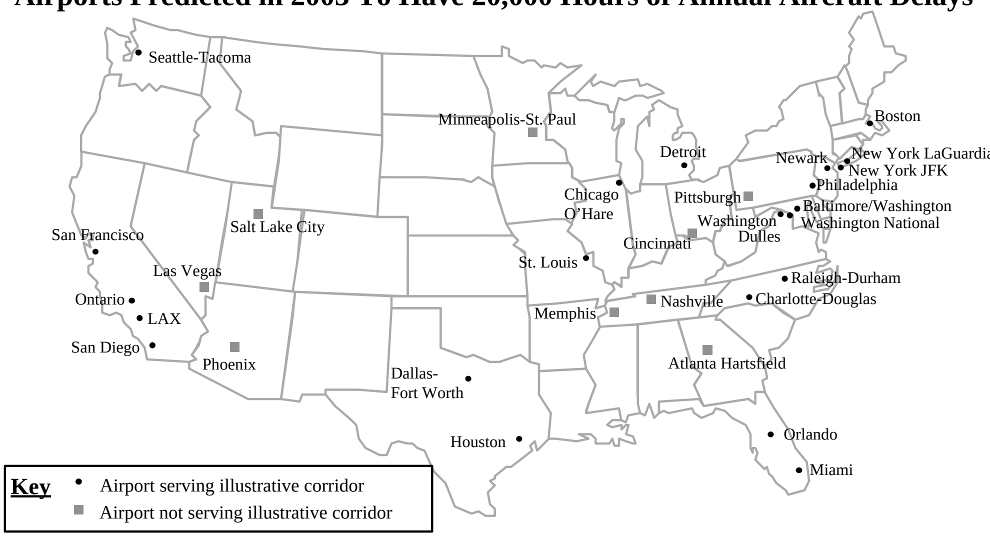
[7] Ibid., p. I-8, 9.
[8] U.S. Bureau of the Census, *loc. cit.*
[9] Federal Aviation Administration, *FAA Long-Range Aviation Forecasts: Fiscal Years 2005-2020*, FAA-APO-94-7, July 1994, p. 2.
[10] Chapter 4 compares and contrasts the FAA forecasts with those for this report.

airports will exceed the threshold by the year 2003 unless capacity is increased.[11] However, the FAA is investing significantly to improve airport capacity.

Figure 2-3
Airports Predicted in 2003 To Have 20,000 Hours of Annual Aircraft Delays[12]



Aircraft delay creates significant cost penalties. The FAA has calculated the average aircraft operating cost to be $1,587 per hour based on a range of $42 per hour for small single-engine planes to $4,575 per hour for large aircraft. With this information the FAA determined that an airport incurring 20,000 hours of annual delay will cause delay costs of at least $32 million.[13] Other costs include the environmental effects (e.g., noise and emissions) of aircraft delays and the effects on passengers who suffer the consequences of missing work, meetings, connections, and business opportunities. These costs—affecting air carriers and passengers alike—significantly influence the benefit/cost analysis (Chapter 6).

In the face of increasing air traffic, delays and costs, many states and localities must decide whether and how much to invest in airport expansion to reverse—or at least alleviate—deterioration in the quality of air service. The FAA has identified and recommended actions to prevent the projected growth in delays. The recommended improvements include new technology to optimize existing airport capacity, terminal air space procedures, and en route airspace capacity. The FAA considers that the largest

[11]Federal Aviation Administration, *1994 Aviation Capacity Enhancement Plan*, Report No. DOT/FAA/ASC-94-1, October 1994, p. 1-1.
[12] Ibid., p. 1-17.
[13] Ibid., p. 1-1.

capacity gains come from building new airports and new or extended runways at existing airports. To increase capacity, 15 of the 23 delay-problem airports identified in 1993 are planning or constructing new or extended runways; 24 of the 32 delay-problem airports foreseen for 2003 have similar expansion programs as well. In total, at the Nation's top 100 airports, the anticipated cost of adding planned and proposed runway capacity exceeds $9.0 billion.[14]

The FAA's National Plan of Integrated Airport Systems predicts that—if the recommended improvements are effected—capacity at most of the 29 "large hub" commercial service airports in the United States would adequately meet the forecast in demand.

Weather conditions consistently account for over 50 percent of aircraft delays of 15 minutes or more (72 percent in 1993). The FAA therefore proposes technology improvements for new electronic guidance and control equipment to allow for two or three flight arrival streams instead of one or two during periods of poor visibility.[15]

At some problem airports, primarily the large metropolitan area airports on the East and West Coasts, the FAA has determined that recommended improvements alone would not adequately meet the projected growth in demand. The FAA does, however, point out other potential solutions to the aviation system capacity problem. Characterized as "marketplace solutions" because they rely on competitive free-market influences, these solutions also depend on the interest and participation of aviation and transportation industry groups and various governmental organizations. These marketplace solutions could include[16]:

- expansion of smaller regional/commuter carriers;
- emergence of tiltrotor aircraft technology[17];
- development of a next generation of aircraft with seating capacity of 500 to 800;
- enhancement of reliever and general aviation airport systems;
- advances in telecommunications;
- intermodalism; and
- development of HSGT.

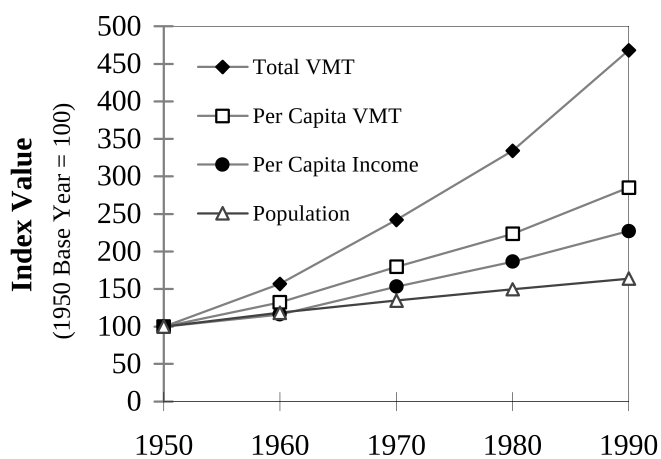
[14] Ibid., p. 2-11.
[15] Ibid., p. 1-13 and chapter 5.
[16] Ibid., chapter 6.
[17] Tiltrotor is the subject of a recent study: Civil Tiltrotor Development Advisory Committee, *Report to Congress in Accordance with PL 102-581*, December 1995.

The FAA considers HSGT to be a potential means of relieving the pressure on short-haul air traffic by diverting air trips of 500 miles or less.[18] In addition, the FAA points out that intercity HSGT systems can be designed for immediate access to airports, with rail stations inside air passenger terminals, and that HSGT could provide connections between multiple airports in large metropolitan areas. These intermodal concepts have influenced the design and evaluation of the HSGT systems assumed for this study.[19] For example, Figure 2-3 demonstrates that the illustrative corridors in the study (identified in Chapter 3) serve most of the metropolitan areas experiencing severe air traffic delays. Moreover, the HSGT corridors include station sites at airports wherever practicable.

Highway Transportation

The growth in per capita vehicle-miles traveled (VMT), like that of RPM for air travel, showed particular strength in the 1950's and 60's. These decades saw the decline of U.S. rail passenger service as well as marked growth in automobile ownership, per capita income, and general living standards (See Figure 2-4 and Figure 2-5). More recently, for the eight-year period from 1983 to 1991, total highway travel increased at an annual rate of 3.5 percent,[21] while population grew at approximately only 1 percent.[22]

Figure 2-4
Automobile Travel: Long-Term Trends in Vehicle-Miles Traveled (VMT), Population, and Income[20]



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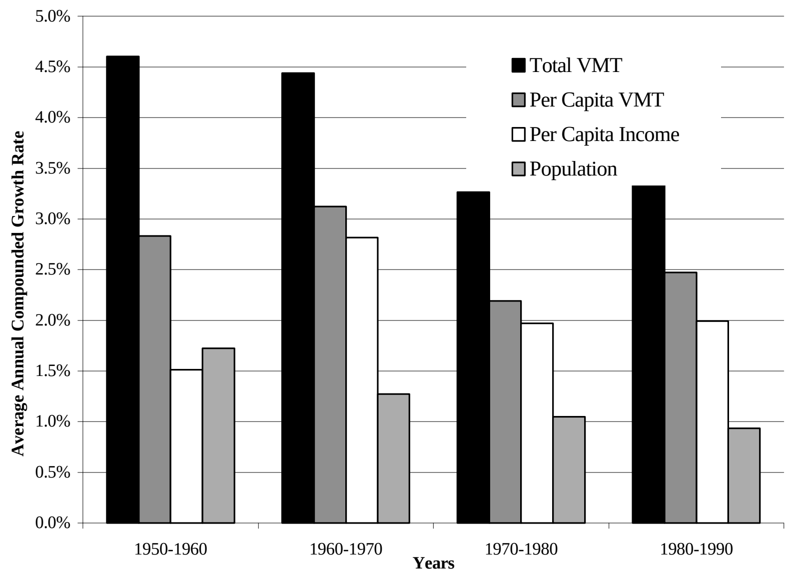
[18] Federal Aviation Administration, *1994 Aviation Capacity Enhancement Plan*, p. 6-18
[19] See Chapter 4 for particulars.
[20] U.S. Bureau of the Census, *Statistical Abstract of the United States: 1994*, pp. 8, 451; Federal Highway Administration, *Highway Statistics: Summary to 1985*, p. 225; U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics: Historical Compendium, 1960-1992*, September 1993, p. 20.
[21] Report of the Secretary of Transportation to the U.S. Congress, *The Status of the Nation's Highways, Bridges, and Transit Conditions and Performance*, 1993, p 19.
[22] U.S. Bureau of the Census, *op. cit.*, p. 8.

Growth in urban travel outpaced rural travel at 3.9 percent per year versus 2.9 percent.[23] Overall vehicle travel increased by 32 percent between 1983 and 1991 measured by the change in rural and urban VMT.[24] This growth reflects increases in vehicle trip length, population, and person-trips per capita, a reduction in vehicle occupancy, and mode shifts to single occupant vehicles.

Figure 2-5
Automobile Travel Comparisons –
Average Annual Compounded Growth Rates by Decade[25]



The Federal Highway Administration (FHWA) forecasts that the average annual rate of growth in overall highway travel will decline from historical levels. Traditionally, highway travel growth has exceeded 3.0 percent annually since 1945. In a departure from past trends, FHWA forecasts that for the 20-year period from 1992-2011, overall highway travel will only grow at an average rate of 2.5 percent per year, for a total increase of about 65 percent.[26] This forecast is based on FHWA assumptions that mass transit usage will increase at an aggressive rate in substitution for highways.[27]

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[23] Report of the Secretary of Transportation, *loc. cit.*
[24] Ibid., pp. 37-38.
[25] U.S. Bureau of the Census, *op. cit.,* pp. 8, 451; Federal Highway Administration, *Highway Statistics: Summary to 1985*, p. 225; U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics: Historical Compendium, 1960-1992*, September 1993, p. 20.
[26] Report of the Secretary of Transportation., p. 149.
[27] Ibid., p. 155.

The FHWA's analyses suggest that highway system performance will deteriorate through 2011 in the Nation's 33 urbanized areas with population greater than one million, as well as in some smaller urbanized areas. This reflects a comparison of current and expected highway expenditures with amounts needed to fund the maintenance and improvements required to accommodate projected demand.[28] Actual congestion statistics, particularly for urban areas, illuminate the trend of deteriorating performance. For example, on urban highways on the Interstate System, the percentage of peak-hour travel that occurred under congested conditions exceeded 70 percent in 1991, compared to 55 percent in 1983. On other urban freeways and expressways, the percentage of congested peak-hour travel rose from 49 percent in 1989 to over 61 percent in 1991. Of total urban peak-hour congestion, 65 percent occurred in the 33 urban areas with populations of over one million.[29] Peak hour congestion more than doubled from 1983 to 1991 on rural interstates, which are comparatively less prone to bottlenecks. Therefore, current and anticipated demand will tax the highway system's ability to maintain existing levels of mobility.

The costs of highway congestion include delay, increased travel time, increased fuel consumption, increased vehicle emissions and reduced air quality, increased cost of goods transported resulting in increased costs to the consumer, and increased aggravation to the driver. A report by the Texas Transportation Institute states that in 1991, the total cost of congestion for 50 urban areas studied was approximately $42.3 billion, with delay accounting for approximately 89 percent of this amount, and excess fuel consumption for the remainder.[30]

Some potential approaches to alleviating the rate of growth in highway congestion include:

- construction of additional lane-miles and new highways;
- application of congestion pricing to highway use, perhaps through electronic toll collection;
- implementation of intelligent vehicle-highway systems—also known as intelligent transportation systems—now under development by the FHWA; and
- provision of intracity and intercity alternatives to the automobile that promise to attract significant traffic.

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[28] Ibid., pp. 171 and 174.
[29] Ibid., p. 85.
[30] Texas Transportation Institute, *Trends in Urban Roadway Congestion—1982 to 1991*, Vol. 1: Annual Report, Research Report 1131-6, Austin: September 1994, p. 32.

Summary: The Intermodal Context

America’s air and highway transportation systems are experiencing increasing congestion. Preservation of service quality for those modes will entail significant investment. Meanwhile, HSGT represents a family of transportation options that may be found to offer social, economic, and environmental benefits in specific applications, although the required public and private investment would be substantial. Thus, the question before the States and localities ultimately reduces to this: **Given the need to preserve and improve travel mobility, and given the available options, what <u>combination</u> of approaches would be most suitable, and how might each mode bring its inherent advantages to bear in such a combination?**

With respect to HSGT, this report will assist States, localities, and the general public in answering that question.