Opportunity Cost of Inaction

High-Speed Rail and High Performance Passenger Rail in the United States

AMERICAN PUBLIC TRANSPORTATION ASSOCIATION

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Executive Summary

This paper addresses the initial investment and on-going cost of operation and maintenance of high-performance passenger rail (HPPR) in four of the Federal Railroad Administration (FRA) sanctioned HPPR regional networks – Northeast, Chicago Hub, California, and Northwest – over a 40 year period. The system can generate a net benefit of at least $660 million annually. If the nation should forgo this opportunity, it stands to sustain a cost of at least $26.4 billion in foregone economic benefits over the next four decades.

Studies by the Government Accountability Office (GAO), the European Union (EU), the International Union of Railroads (UIC), the American Association of State Highway and Transportation Officials (AASHTO) and others, suggest that the actual cost of building and/or improving rail lines is significantly less than the cost per mile of alternatives. In fact, in many corridors, passenger rail is the only feasible option for adding capacity, given the practical constraints facing aviation and highway expansion.

Passenger rail will benefit public transportation—regional HPPR networks will amplify the agglomeration economies associated with public transportation. Though not specifically enumerated in this paper, we anticipate these impacts will significantly increase net benefits.

The regional opportunity costs are also substantial. Not building HSR in California would cost the state $8.2 billion in foregone benefits over 40 years. The Midwest would forego $11.7 billion over 40 years. The Northeast Corridor would forego $5.5 billion over 40 years. The Pacific Northwest would forego $1.1 billion over 40 years.

This report provides clear evidence that maintaining the status quo will be an increasingly expensive proposition for American taxpayers.

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Introduction

The U.S. Census Bureau estimates that the population of our nation will grow by more than 100 million over the next 40 years. A sizeable portion of America's present population is searching for modal choice, and demographers predict that desire will only continue to grow in the face of rising fuel costs, environmental concerns, senior citizen mobility issues, and a steady growth in urban population centers brought on by Millennials and Empty Nesters.
("Transportation and the New Generation: Why Young People Are Driving Less and What It Means for Transportation Policy," Frontier Group/U.S. PIRG Education Fund, Benjamin Davis and Tony Dutzik, Frontier Group; Phineas Baxandall, U.S. PIRG Education Fund April 2012; "Aging in Place, Stuck without Options: Fixing the Mobility Crisis Threatening the Baby Boom Generation," Transportation for America, http://t4america.org/resources/seniorsmobilitycrisis2011)

All of these influences are putting pressure on America's transportation infrastructure, which by most credible measures is both hampered by deferred maintenance and inadequate capacity expansion. Since the early 1970s, transportation policy makers have recognized the need to maintain a competitive, multi-modal interurban transportation system. Unfortunately, our investment and policy development heretofore has led to a constrained system with limited consumer choice.

In the 1990s, beginning with the Clinton administration and continuing through the administration of George W. Bush, serious bi-partisan efforts were undertaken to address the needs of the nation's transportation infrastructure – including its intercity passenger rail corridors. But mid-point into the first decade of the 21st Century a public policy paralysis took hold that dissolved the bipartisan commitment to infrastructure. In the midst of this sea change, both an outgoing administration and an incoming administration attempted to breathe new life into the policy discussion on intercity passenger rail in America. In 2008, President Bush signed into law the Passenger Rail Investment and Improvement Act, which authorized an aggressive set of initiatives that had the potential to redress the growing mobility challenges facing the nation.

With the dark clouds of one of the world's most severe economic crises, the new administration of President Obama pushed through Congress in 2009 a massive economic stimulus package containing more than $7 billion in investments and the outlines for a nationwide strategy to give "80% of Americans access to high-speed rail within the next 25 years."

Over the next two years Congressionally approved funding for intercity passenger rail improvements grew to more than $13 billion with the promise for upwards of $50 billion more over the next four years. Overall, 39 States, the District of Columbia, and Amtrak submitted applications requesting more than $75 billion—well in excess of the available funding— for projects and corridors in every region of the country.

Ultimately, however, future investment was severely curtailed and by the spring of 2011 the Federal Railroad Administration (FRA) had dispersed a little more than $10 billion in grant funding to 32 states and Amtrak.

In light of this history and the prospects for the future, policy makers are faced with the question: What is the cost of not building an improved intercity passenger rail system?

To assess more realistic options in answering this question, this paper casts the issue as "high-performance passenger rail (HPPR)" – intercity passenger rail service that is highly integrated with other transportation services so that the travel time from door to door is competitive with other intercity transportation modes operating in particular corridors at distances of 100 to 600 miles.

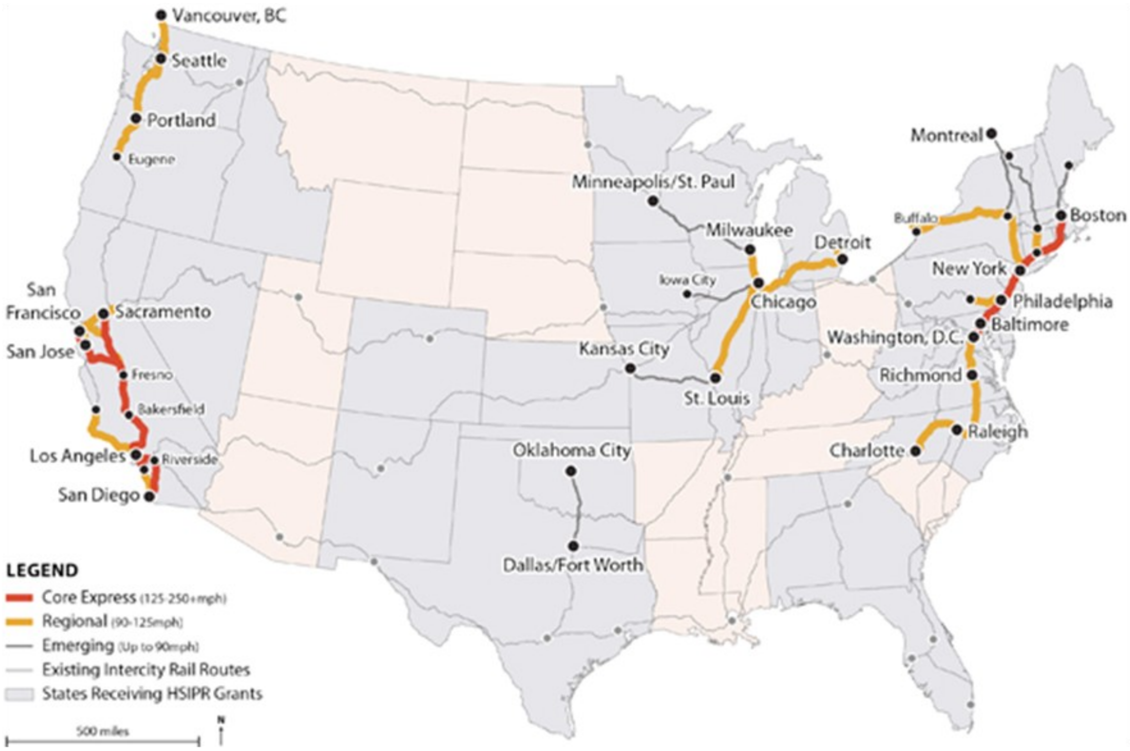
Beyond the paper's introduction, there are three chapters. The first addresses the cost to America's commercial aviation system if HPPR is not built. The second chapter addresses the cost to America's highway and roadway system if HPPR is not built. In each of these chapters the capital, maintenance, environmental and social costs associated with expanding capacity to meet demand without building HPPR will be identified. To fulfill this goal, the author draws heavily from one of the most, if not the only, comprehensive examinations of HPPR ever compiled. Titled "High-Speed Ground Transportation for America," the study was developed for and released by the U.S. Department of Transportation in September 1997. While exhaustive in its analysis, the study does contain several incorrect assumptions, for example, the expectation that fuel costs would not increase between 1997 and 2020. Though these assumptions may not have held up over time, they have not materially affected the veracity of the report's conclusions. If anything those assumptions have set a more conservative baseline for evaluation.

Because many decisions have been made since the 1997 DOT study that are now actually shaping the future character of America's intercity passenger rail system, this project will arrange its presentation around the four mega-corridors identified by the Federal Railroad Administration's "High-speed and Intercity Passenger Rail National Investment Overview" (see Figure 1) rather than the entirety of the 11 corridors discussed in the 1997 "High-Speed Ground Transportation for America."

The third chapter addresses the cost to the nation's transit systems, including urban, suburban and rural transit – if HPPR is not built – and sets forth the financial impact of the opportunity costs, the benefits forgone if HPPR is not built.

The conclusion offers perspectives that may lead to constructive policy discussions that ultimately put American HPPR on the right track.

Figure 1: High-speed and Intercity Passenger Rail National Investment Overview



(U.S. Department of Transportation, Federal Railroad Administration website, High-speed Intercity Rail Program)

Methodology

This paper relies on the assumptions that underlie the 1997 DOT analysis, "High-Speed Ground Transportation for America," U.S. Department of Transportation, September 1997 with the exception that all dollar values reflected in the 1997 DOT analysis have been updated to 2012 values. Thus, when comparing dollar values in the 1997 DOT analysis to the dollar values shown in this paper and referenced to the 1997 DOT analysis, the dollar values in this paper have been adjusted to reflect that a dollar in 2000 at 2012 present value is $1.34. Those assumptions are described in Appendix A at the end of this paper. This is supplemented with project data and projections of construction costs and congestion savings for highway and airport projects.

Further, this paper takes a different perspective on the issue of benefits by examining the cost of not enhancing the nation's passenger rail system, thereby continuing – as the United States has for the past half-century – to add and repair more lanes to highly congested roadways, and build more runways and add more flights to an already overcrowded and technologically outmoded aviation system.

Additionally, this paper takes a different perspective on the description and goals of the intercity passenger rail initiative previously characterized as "high-speed rail." As reflected in the administration's 2013 budget for the U.S. Department of Transportation, this initiative will be described as HPPR – High-Performance Passenger Rail, with its goal to provide 80 percent of Americans access to a multi-modal transportation system that offers faster travel times, better reliability, more frequent service, and seamless connections to destination and other modes of transportation.

This expanded and improved transportation network will help provide the additional capacity and travel options necessary to serve America's growing population.

> "[HPPR] represents a more accurate and better way of describing an innovative approach to addressing the complex 21st century transportation challenges facing the United States.
> "By 2050, the U.S. population will likely increase by more than 100 million people. Highway and airport congestion are increasing, with related economic and envi-ronmental impacts. To address these challenges and strengthen the country's competitive posi-tion in an increasingly global economy, the U.S. Department of Transportation has a comprehen-sive program to develop high -speed and intercity passenger rail."
> (U.S. Department of Transportation 2013 Budget, page 22, February 13, 2012)

In essence, this paper addresses the opportunity cost of not building HPPR.

Opportunity cost is defined by the Paris-based Organization for Economic Cooperation and Development (OECD) as "…[a measure of] opportunities foregone at the time an asset or resource is used, as distinct from the costs incurred at some time in the past to acquire the asset, or the payments which could be realized by an alternative use of a resource, e.g. the use of labor in a voluntary capacity being valued at the wages which could have been earned in a paid job."
(http://esa.un.org/unsd/sna1993/introduction.asp, OECD, September 25, 2001)

Included in this discussion are the capital, maintenance, environmental and social benefits that may not be realized, and an extrapolation of the costs the nation may incur if nothing, or very little, is done to enhance America's intercity passenger rail system, thereby not allowing HPPR to become a viable option for more travelers.

Conclusions presented in this paper suggest that much of the criticism of efforts to improve intercity passenger rail service and to eventually evolve high-speed passenger rail service in appropriate corridors – similar to the Japanese, European and Chinese systems – is hyperbolic and shortsighted.

Chapter 1: Aviation Cost Savings from HPPR

Capital and Maintenance Costs

America's commercial aviation system faces significant challenges.

The Airport/Airway Trust Fund that is supposed to support the development, maintenance and operation of the nation's aviation system is so strapped that it must rely on the U.S. Treasury for more than 35 percent of its revenue, and the system is facing an $80.1 billion (annualized at $16 billion) capital development backlog between now and 2015 according to Airports Council International – North America (ACI/NA).

> "The capital development projects discussed in the ACI/NA report included:
> Expanding an airport's capacity beyond its current design to meet growth in demand for aviation services; Bringing an airport up to FAA-mandated design standards to achieve full productivity of aircraft using the airport;
> Reconstructing aging airport infrastructure;
> Upgrading infrastructure to accommodate the introduction of different aircraft types; and,
> Addressing safety, security and environmental concerns."

Of this total backlog, according to ACI/NA, nearly 40 percent of all airside projects, 45 percent of all terminal projects, and 16 percent of landside projects cannot proceed due to inadequate funding. That represents approximately 30 percent of all projects at large hub airports, nearly 40 percent of all projects at medium hub airports, and about 25 percent of all projects at small hub airports.
("Airport Capital Development Costs 2011 – 2015," Airports Council International/North America, February 2011)

Specific examples of recent airport expansion projects include a new fifth 6,000 ft runway at Hartsfield Airport in Atlanta, Georgia that opened in 2006 at a cost of approximately $1.28 billion according to the *Atlanta Constitution*.
(*Atlanta Constitution*, May 24, 2006)

Washington's Dulles International Airport opened a new fourth runway in 2008 and is planning a fifth runway at a cost of $400 million according to the Metropolitan Washington Airports Authority's website.

And according to the Florida Department of Transportation the cost of constructing airport runways and complementary facilities can well beyond $2,200 per linear foot.

The Wisconsin Public Interest Research Group reported in the fall of 2010 that planned expansion and renovation of Chicago's O'Hare Airport was estimated at $6.6 billion while adding 16 new gates at the Minneapolis-St, Paul Airport was expected to cost approximately $400 million.
("How a Faster Passenger Rail Network Could Speed Travel and Boost the Economy," WISPIRG Foundation, Fall 2010)

And there are places where airport expansion is not logistically or politically possible. This friction is likely to only escalate with the anticipated population increases in these regions.

In addition to airport construction costs, the Federal Aviation Administration (FAA) is struggling to put in place a $40 billion navigation system upgrade that was originally targeted to come on line in 2016, but now appears unlikely to be operational until at least 2025, provided the funding can be found. This new system, known as NextGen, is intended to reduce costs and increase the capacity of the nation's airways. Unfortunately, it will only compound the airside congestion most of the major airport hubs and several of the regional airport hubs are experiencing.
("NextGen: Aligning Costs, Benefits and Political Leadership," ENO Transportation Foundation, April 2012)

Additionally, somewhere between 20 and 35 percent of all domestic airline flights are delayed by more than 15 minutes (the average is 59 minutes), according to the U.S. Department of Transportation's (DOT) Bureau of Transportation Statistics (BTS). As a result, the airlines suffered over 122 million hours of delays in 2010, amounting to a financial loss of more than $3.5 billion annually.

("Annual Report on Airline Performance," Bureau of Transportation Statistics, Research and Innovative Technology Administration, U.S. Department of Transportation, Washington, D.C., 2011)

In comparison, the authors of "Total Delay Impact Study: A Comprehensive Assessment of the Costs and Impacts of Flight Delay in the United States Final Report" estimate that,

> "the total cost of all US air transportation delays in 2007 was $32.9 billion including an $8.3 billion airline component consisting of increased expenses for crew, fuel, and maintenance; $16.7 billion for the time passengers lost due to schedule buffer, delayed flights, flight cancellations, and missed connections; $3.9 billion for the cost demand incurred because of passengers who avoid air travel as the result of delays; and, $4 billion for negative impact on the gross domestic product (GDP)."
> ("Total Delay Impact Study: A Comprehensive Assessment of the Costs and Impacts of Flight Delay in the United States Final Report," Michael Ball, Cynthia Barnhart, Martin Dresner, Mark Hansen, Kevin Neels, Amedeo Odoni, Everett Peterson, Lance Sherry, Antonio Trani, and Bo Zou, October, 2010)

Taken together these losses and unaddressed costs total somewhere between $137.5 billion ($27.5 billion annually) and $284.8 billion ($56.9 billion annually) over the next five years. Table 1 reflects the sum of annualized extraordinary costs facing America's commercial aviation industry.

Table 1: Annualized Extraordinary Costs Facing Commercial Aviation

Cost	Annualized Cost	Total Cost
Capital Development Backlog	$16 Billion	$80.1 Billion
Development and Implementation of NextGen	$8 Billion	$40.2 Billion
Delays Caused by Congestions and Other Factors	$3.5 to $32.9 Billion	—-
Total Annual Extraordinary Costs	$27.5 to $56.9 Billion	—-

("Airport Capital Development Costs 2011 – 2015," Airports Council International/North America, February 2011)("Annual Report on Airline Performance," Bureau of Transportation Statistics, Research and Innovative Technology Administration, U.S. Department of Transportation, Washington, D.C., 2011)
("NextGen: Aligning Costs, Benefits and Political Leadership," ENO Transportation Foundation, April 2012)
("Total Delay Impact Study: A Comprehensive Assessment of the Costs and Impacts of Flight Delay in the United States Final Report," Michael Ball, Cynthia Barnhart, Martin Dresner, Mark Hansen, Kevin Neels, Amedeo Odoni, Everett Peterson, Lance Sherry, Antonio Trani, and Bo Zou, October, 2010)

If the population continues to grow as the Census Bureau predicts, and without a viable alternative mode to help offset the anticipated growth in air travel as forecast by the FAA, the issues of congestion and cost will grow even more severe for the nation's airlines and airports. While not yet back to the record passenger levels of 2008, the number of passengers traveling by air grew to 712.6 million in the United States in 2010 and is expected to grow to as much a 1.2 billion by 2030, according to the FAA.

Add to that a projected near tripling of air cargo, from 36 million revenue ton miles in 2010 to nearly 90 million revenue ton miles in 2030, and it is quickly apparent that the nation's aviation network as well as the airside capacity of the nation's airports will be in need of the kind of mobility capacity HPPR could offer.

Throughout the nation are corridors that stretch between 100 and 600 miles in which airline travel is seriously congested, and for which HPPR could provide significant relief, being highly competitive from both time and pricing perspectives.

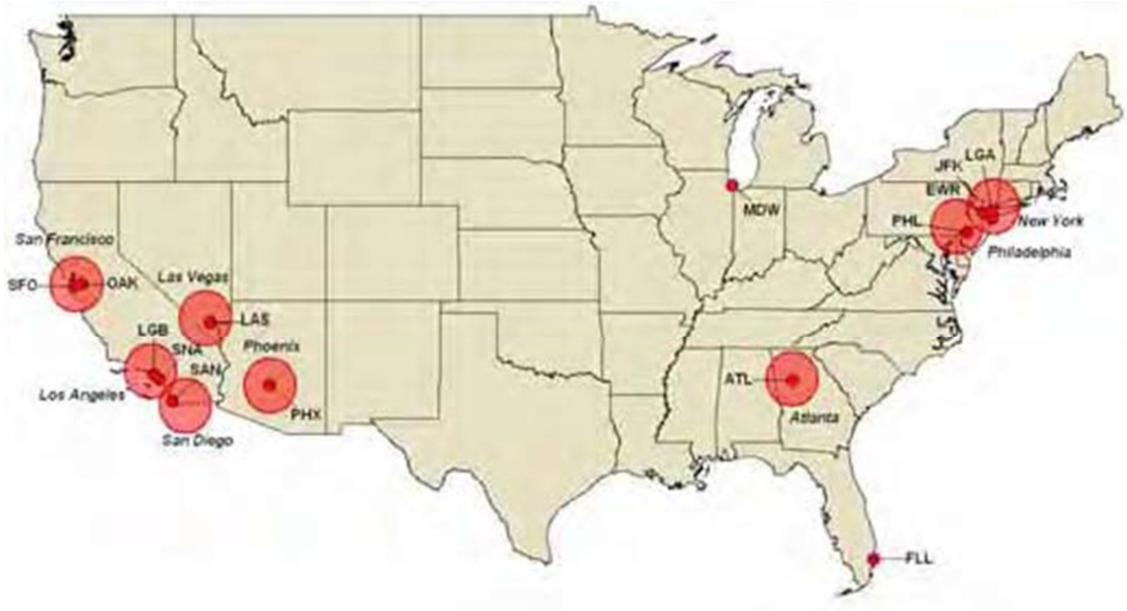
As reflected in Figure 2, "Congestion in the high-density east and west coast corridors will likely continue to increase. The following map shows 8 metropolitan areas and 14 airports that will require non-aviation support (i.e., increased and/or new passenger rail service) even after additional capacity is gained from planned aviation improvements expected through 2025."
("Vision for the future U.S. intercity passenger rail network through 2050", prepared by the Passenger Rail Working Group December 6, 2007)

Many of these airports lie in corridors where intercity passenger rail improvement projects are planned including:

- Atlanta, GA to Chattanooga, TN
- Anaheim, CA to Las Vegas, NV
- Victorville, CA to Las Vegas NV
- Los Angeles, CA to San Francisco, CA
- Los Angeles, CA to San Diego, CA
- Portland, OR, to Vancouver, BC, Canada
- New York, NY to Albany, NY to Buffalo, NY
- Boston, MA to New York, NY, to Washington, D.C., to Charlotte, NC
- New York, NY, to Scranton, PA
- Philadelphia, PA, to Harrisburg, PA
- Chicago, IL, to Detroit/Pontiac, MI
- Chicago, IL to St. Louis, MO
- Chicago, IL, to Minneapolis/St. Paul, MN
- Richmond, VA, to Hampton Roads, VA

(GAO, HIGH SPEED PASSENGER RAIL Future Development Will Depend on Addressing Financial and Other Challenges and Establishing a Clear Federal Role, March 2009, GAO-09-317)

Figure 2: Capacity Problems Still Unaddressed After Planned FAA Improvement Through 2025



(The MITRE Corporation, Center for Advanced Aviation System Development, "Capacity Needs in the National Airspace System (2007-2025), an Analysis of Airports and Metropolitan Area Demand and Operational Capacity in the Future," Washington, Federal Aviation Adminsitration. May 2007, pp. 16-17 and 22.)

Among these corridors are Washington to New York and New York to Boston where Amtrak already carries as many passengers daily as the scheduled airlines, as well as Washington to Richmond, Virginia; Los Angeles, California to San Diego, California; Portland, Oregon to Seattle, Washington; and Chicago, Illinois to Milwaukee, Wisconsin, to name a few, where with more frequent, reliable, and marginally faster service, intercity passenger rail could be an attractive alternative to the hassle, cost, and travel time of commercial aviation. Table 2 reflect Amtrak's share of selected corridors in 2007.

Table 2: Amtrak's Share of Air-Rail Travel Market In the Northeast Corridor and the West Coast

Rail Corridor	Amtrak Share of Air/Rail Market
Los Angeles/San Diego	95%
Washington/Philadelphia	94%
New York/Albany	93%
New York/Philadelphia	93%
New York/Providence	77%
Seattle/Portland	66%
New York Washington	55%
New York/Boston	36%
Boston/Philadelphia	7%
Washington/Boston	5%

(Machalaba, Daniel, *The Wall Street Journal*, "Crowds Heed Amtrak's 'All Aboard,' Improved Service, Air Woes Lure Travelers in Northeast; Long Hauls Still Suffer," August 23, 2007, page B1)

If the U.S. experience ends up to be anything like that of Europe or Japan, HPPR could bring about a significant mode-of-travel shift in certain corridors. In France, for example, air travel in the TGV Sub-Est corridor went from 31 percent of the market to just seven percent after the introduction of the TGV. Similarly, in the Madrid Seville corridor, air travel shifted from 40 percent of the travel market to 13 percent following the introduction of AVE.
("High Speed Rail Investment: an overview of the literature," Chris Nash, Institute for Transport Studies, University of Leeds, 1996)

And Paul Amos, Dick Bullock, and Jitendra Sondhi observed in their July 2010 World Bank report that in many of the shorter European and Japanese corridors, airline service has been suspended altogether, thus freeing up airlines to redeploy their fleets to longer more lucrative city-pairs while reducing congestion at other regional hubs.

In its 1997 analysis, "High-Speed Ground Transportation for America," the Department of Transportation projected that, depending on the corridor, the speed, and the travel time door-to-door, HPPR could divert between 16 percent and 30.9 percent of airline passengers, producing total airport congestion delay savings of approximately $19 billion annually in the four corridors examined. Those are savings that would be forgone without HPPR.
("High-Speed Ground Transportation for America," U.S. Department of Transportation, September 1997)

Focusing on the four selected corridors from the 1997 study, DOT made a sound case that HPPR can deliver significant mobility benefits for travelers wishing a transportation alternative to the airlines, and an overall transportation benefit that rewards both the airlines and the passengers who may continue using the airlines as their preferred mode of travel. These are benefits that would be foregone if HPPR is not built.

For example, in the California corridor from Los Angeles to San Francisco, DOT estimated that for new High-Speed Rail (defined as "advanced steel-wheel-on-rail passenger systems on almost completely new right-of-way…with maximum practical operating speeds on the order of 200 mph") the mode shift from air to HPPR would be approximately 27.6 percent, representing approximately 51 percent of the HPPR ridership. The total airport congestion delay savings for this level of service was estimated to be almost $6.614 billion ($8.9 billion in 2012 dollars) annually over the next ten years, thus producing a net reduction of air travel delay costs ranging from approximately one third to nearly four times airports' annual delay costs depending on which estimate of costs is used.

Table 3: Average Airline Mode shift to HPPR and Delay Savings for Remaining Airline Travel

Mega-Corridor	Percent of Mode Shift	Percent of HPPR Ridership	Airport Delay Savings (In Millions—2012)
California	24.4%	39.0%	$9,908
Chicago Hub	16.5%	30.6%	$2,385
Northeast Corridor	27.0%	22.0%	$3,815
Pacific Northwest	30.9%	27.0%	$161
Total 40-Year Average Airport Congestion Delay Savings:			$16,269

Table 3 reflects the average mode shift and total airport congestion delay savings in the four mega-corridors studied in this paper. Though Florida and Texas were included in the 1997 DOT analysis, as was Maglev technology, this paper does not include them. Also, in the 1997 DOT analysis California was presented in two parts, the Chicago Hub was presented in three parts, and the corridors stretching from Montreal, Buffalo and Boston to Charlotte, NC were presented in three parts. In this paper both sections of California are combined, as are all three portions of the Chicago Hub, and all three sections of the Northeast Corridor (see Figure 1).
("High-Speed Ground Transportation for America," U.S. Department of Transportation, September 1997)

Energy and Environmental Costs

In addition to the congestion cost savings HPPR can generate for commercial aviation, the estimated fuel savings on a per-passenger-mile basis for HPPR compared to flying are quite significant. According to American Association of State Highway and Transportation Officials (AASHTO) website, even today's train travel is 17 percent more fuel efficient than airlines on a per-passenger-mile basis. This figure is supported further by a 2009 paper presented to the 18th International Transport Research Symposium of the OECD that demonstrated that with a 70 percent load factor, energy consumption per seat kilometer for aircraft is 2.57 megajoules (MJ) per p/km (a megajoule is equivalent to one-third of a kilowatt hour of energy) compared to 0.5 MJ per p/km for conventional trains and 0.76 MJ per p/km for high-speed trains.
(Nash, C., "When to invest in high-speed rail links and networks," paper presented to the 18th International Transport Research Symposium, OECD/International Transport Forum, Madrid, November 2009)

If as much as 45 percent of a given corridor's air travel is diverted to HPPR, as is the current experience in the Paris/Madrid corridor, the energy savings can be rather large. Drawing on data in the DOT's "High-Speed

Ground Transportation for America," the emissions savings in the Northeast Corridor alone could be over $404 million a year.

Given the energy savings of HPPR compared to aviation, it follows that the environmental impact per passenger and passenger mile is almost as dramatic. Depending on the power source for HPPR, the European experience suggests that HPPR could produce as much as 6.5 times less particulate matter per passenger and 31.9 times less nitrogen oxides per passenger than aircraft over the same distance.
("Next Stop California: The Benefits of High-Speed Rail Around the World and What's in Store for California," CALPIRG Education Fund, June 2010)

In his 2009 paper, "Environmental Aspects of Inter-city Passenger Transport," Per Kageson estimated that even with the anticipated technological improvements that will come to the various transportation modes over the next ten to 15 years, the amount of emissions of greenhouse gases per seat kilometer will still advantage HPPR over aircraft with trains running at speeds up to 150 km/h emitting 9.5 grams of carbon dioxides per seat kilometer, trains running at speeds up to 280 km/h emitting 15.4 grams of carbon dioxides per seat kilometer compared to aircraft emitting 93.8 grams of carbon dioxides per seat kilometer. Assuming load factors of 80 percent for regional aircraft, 75 percent for high-speed trains, and 65 percent for conventional intercity trains, Kageson estimates the grams of carbon dioxide emissions per kilometer to be 14.6 for conventional trains, 20.6 for high-speed trains, and 117.2 for regional aircraft.
("Environmental Aspects of Inter-City Passenger Transport," Discussion Paper No. 2009-28, Joint Transport Research Centre, Per Kageson, December 2009)

Without HPPR, it is quite clear that the impact of aircraft emissions on the environment will continue to be quite significant despite fuel efficiency and emissions improvements airplane manufacturers will make over the next 10 to 15 years.
("High-Speed Rail and Sustainability," International Union of Railways, November 2011)

Social Costs

> "Today, Amtrak is the only intercity passenger railroad in the nation. It provides regular service to over 500 communities across the United States. Its long-distance trains provide a vital transportation service for those unable to fly or drive, and for many senior citizens (who account for 38 percent of adult passengers) and disabled persons. Forty-two percent of passengers with disabilities who traveled on Amtrak in fiscal year 2010 rode long-distance trains. They are often the only transportation mode still operating during severe winter weather conditions that ground planes and close highways. Long-distance trains also play an important role in emergency situations: they accommodated thousands of stranded airline passengers after the terrorist attacks of September 11, 2001."
> (Amtrak website)

Additionally, and as noted in a 2009 Government Accountability Office report,

> "Between 100 and 500 miles, high speed rail can often overcome air travel's speed advantage because of reductions in access and waiting times. Air travel requires time to get to the airport, which can often be located a significant distance from a city center, as well as time related to checking baggage, getting through security, waiting at the terminal, queuing for takeoff, and waiting for baggage upon arrival at a destination. By contrast, high-speed rail service is usually designed to go from city center to city center, which generally allows for reduced access times for

most travelers. Some travelers will have destinations starting points outside of city centers in closer proximity to airports, thus potentially minimizing or eliminating in some cases the access time advantage of high speed rail where high speed rail service does not connect to airports or other locations preferred by travelers. High speed rail also generally has less security and waiting time than airports."
(GAO, "High-Speed Passenger Rail: Future Development Will Depend on Addressing Financial and Other Challenges and Establishing a Clear Federal Role," March 2009, GAO-09-317)

As will be explored further in the next chapter HPPR has the potential to improve mobility and present travel options. This is particularly important at a time when the nation's airlines, faced with capacity constraints and rising fuel costs, are either reducing or eliminating air service to communities altogether. The top 50 airports in the nation now represent more than 80 percent of all airline departures. At the same time more than half of those airports had fewer flights in 2010 than they did in 2009.
("Air Service Cutbacks Hit Hardest Where Recession Did," New York Times, July 8, 2011)

Finally, if one accepts that the policy objective for federal funding of the aviation sector is to strengthen the Airports/Airway Trust Fund in order to reduce and/or eliminate its reliance on general fund revenue, thereby securing adequate reliable revenue to fully implement the NextGen navigation system and to reduce the airports/airways capital development backlog, then one should also accept that neither the commercial aviation sector nor the traveling public would be well served if HPPR is not constructed as part of a highly integrated national transportation system.

Chapter 2: Highways and Roadways

Capital and Maintenance Costs

Similar to the conditions facing the aviation sector of the nation's transportation system, the highway and roadway sector faces huge investment and congestion challenges that, despite their widely publicized impact on the productivity and competitiveness of the nation, have not yet been adequately addressed by policy makers.

This chapter offers an examination of the capital and maintenance, energy and environmental, and social costs associated with addressing these surface transportation issues if HPPR is not built as part of a highly integrated transportation system.

Because of the deteriorating condition of the nation's roadways and the growing demand for their use, the American Society of Civil Engineers (ASCE) annually releases a report card on the condition of the nation's transportation infrastructure. In recent years ASCE has given our nation's transportation infrastructure a "D," on par with developing nations in less fortunate areas of the world. The latest report projected that the condition of the nation's surface transportation system would "cost the economy more than 870,000 jobs and suppress the growth of the country's gross domestic product (GDP) by $3.1 trillion by 2020."
(ASCE press release, August 15, 2011)

In its 2008 on-line publication, "Public Roads," the Federal Highway Administration noted that, "Even as traffic on the Nation's highways has increased from 65 million cars and trucks in 1955 to almost 246 million today, the

condition of U.S. highways and bridges has deteriorated. According to estimates by the U.S. Department of Transportation, the current backlog of unfunded but needed repairs and improvements totals $495 billion."
("Public Roads," U.S. Department of Transportation, Federal Highway Administration, November/December 2008, Vol. 71, No. 6)

Because of the fiscal constraints of the Federal Highway Trust Fund and the difficulty faced by Congress and the Administration in passing the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) of 2005, the last multi-year surface transportation reauthorization act approved by Congress, two commissions were authorized to study the financing and structure of the federal government's surface transportation program. One of the authorized commissions, The National Surface Transportation Infrastructure Financing Commission, projected in its report, "Paying Our Way: A New Framework for Transportation," that absent a change in funding policy, an annual gap between the funding needs of our nation's highways and roads and the available revenue (including the federal motor fuels tax) would be in the range of $134 billion to $194 billion a year for the period of 2008 to 2035.

Investment levels included in the recently enacted Moving Ahead for Progress in the 21st Century (MAP-21) will not arrest the deferred maintenance and capacity needs.

Additional signs of the ominous condition of the nation's roadways are reflected in the annual "Urban Mobility Report" of the Texas Transportation Institute (TTI) at Texas A&M University that analyzes traffic congestion in urban areas across the United States and identifies both the time consumed and the volume of fuel burned in the course of the nation's daily commute.
The latest TTI report painted a bleak picture of seemingly endless "rush hours," massive congestion delays, lost worker productivity, and billions of gallons of wasted fuel as a result of drivers idling in gridlock. Highway and roadway congestion cost our nation more than $101 billion in wasted fuel and lost productivity in 2010. Intercity passenger travel by car was both a contributor to and a victim of this congestion.
("2011 Annual Urban Mobility Report," Texas Transportation Institute (TTI), Texas A&M University, 2011)

Looking forward through 2015, the 2011 TTI study predicts that commuters will experience an additional three hours of annual delay (up to 37 hours a year) with a total annual national cost in lost productivity of more than $133 billion – more than $900 per commuter, and worst of all, the annual loss of more than 2.5 billion gallons of fuel at a time of rising fuel prices and continued international tension. By April 2012 the average price for a gallon of gas approached $4, that is almost $10 billion in fuel charges that only add to concerns over national security, economic vitality, air quality and needless greenhouse emissions.

One strategy for addressing highway/roadway congestion might be to build more highways and roadways. Clearly some will need to be built and/or reconditioned, but according to the Michigan Department of Transportation website, a mile of "expressway" costs on average approximately $23.5 million. That compares quite favorably to the average cost per mile of building and/or renovating rail right of ways which, according to the Transportation Centre, costs an average $26 million per mile.
("Effects of High-Speed Rail Investment," Discussion Paper No. 2008-16, Joint Transportation Research Centre, August 2008)

Additionally, rail right-of-way consumes about one-third of the land roadways require, and because its focus is city center to city center, HPPR tends to support smart growth principles that encourage denser infill development and less sprawl.
("High-Speed Rail Investment Background Data," American Public Transportation Association, January 5, 2011)

Focusing on HPPR as a means of reducing congestion and easing the capacity crisis on the nation's highways, the U.S. Department of Transportation, in its 1997 report, "High-Speed Ground Transportation for America," estimated that in its first years of operation HPPR might divert as little as 1.1 percent to as much as 6.3 percent of intercity automobile travel in the four mega-corridors examined in this study.
("High-Speed Ground Transportation for America," U.S. Department of Transportation, September 1997)

One might presume that over time, as ridership in each of the HPPR corridors grows, the percent of intercity automobile traffic diverted to HPPR might also grow. Indeed, in Europe the mode shift from car and bus to HPPR affirms this expectation.

In his paper, "High Speed Rail Investment: an overview of the literature," Chris Nash of the Institute for Transportation Studies at the University of Leeds in England noted that car and bus travel in the TGV Sud-Est corridor shifted from 29 percent before the introduction of the TGV to 21 percent afterward. In the Madrid-Seville corridor the shift was from 44 percent before the introduction of the AVE to 36 percent afterward. Japan, Korea and Taiwan experienced even greater shifts suggesting that as much as 25 percent to 45 percent of intercity automobile travel could be diverted to HPPR.
("High Speed Rail Investment: an overview of the literature," Chris Nash, Institute for Transport Studies, University of Leeds, 1996)

Such a diversion of intercity automobile travel would have dramatic impact on the ability of states and localities to maintain their roadways, and would significantly alleviate roadway congestion. DOT's 1997 report suggests the savings just from reduced highway delays could be in the range of $489 million annually to $2.9 billion annually depending on the corridor. Those are savings that would be forgone without HPPR.
("High-Speed Ground Transportation for America," U.S. Department of Transportation, September 1997)

For example, in the Los Angeles to San Francisco portion of the California corridor, DOT estimated that 6.3 percent of drivers would shift to HPPR and in the San Diego to Los Angles portion of the corridor 1.1 percent of drivers would shift from autos to HPPR. In the four mega-corridors examined in from the 1997 study, the projected mode shift from auto to HPPR over all was on average about 3.1 percent, representing approximately 23 percent of the HPPR ridership. The total highway congestion delay savings from the four mega-corridors was projected to be $9.1 billion annually in 2012 present value dollars.

Table 4 reflects the mode shift and total highway congestion delay savings in each of the four mega-corridors studied for this project.

Table 4: Mode Shift From Highways to HPPR and Congestion Savings

Corridor	Percent of Mode Shift	Percent of HPPR Ridership	Highway Congestion Delay Savings (In Millions—2012)
California	3.7%	5.9%	$3,237
Chicago Hub	4.0%	39.0%	$927
Northeast Corridor	2.6%	11.0%	$3,857
Pacific Northwest	3.3%	47.0%	$655
Total 40-Year Highway Congestion Delay Savings:			$8,676

("High-Speed Ground Transportation for America," U.S. Department of Transportation, September 1997)

For comparison, the Passenger Rail Working Group in its 2007 report, "Vision for the future U.S. intercity passenger rail network through 2050," prepared for the National Surface Transportation Policy and Revenue Study Commission, projected 8.2 billion to 46.7 billion miles of annual vehicle travel savings could be saved with the development of HPPR, at a cost savings of $.7 billion to $6.6 billion annually (see Table 5).

Table 5: Projected Annual Vehicle Miles, Passenger Miles, and Time Savings from Development of HPPR

	2007—2015	2016—2030	2016—2030
Annual vehicle miles diverted	3.9 billion	13.0 billion	22.5 billion
Annual passenger miles diverted	8.2 billion	26.9 billion	46.7 billion
Annual value of time saved	$0.7 billion	$3.1 billion	$6.6 billion

Projections based on a 45 percent average load factor for filled passenger seats during operations and assumed that train passengers would be primarily diverted from highways. Travel-time-saved valued at $11.20 per hour, based on US DOT's Transit Economic Requirements Model (TERM).
("Vision for the future U.S. intercity passenger rail network through 2050," Prepared by the Passenger Rail Working Group of the National Surface Transportation Policy and Revenue Study Commission, December 6, 2007)

These two studies, commissioned ten years apart, clearly show that HPPR can deliver significant mobility benefits for travelers wishing a transportation alternative to driving, and overall transportation benefits that reward both the HPPR traveler and the passengers who may continue using the highway as their preferred mode of travel. These are benefits that would be foregone if HPPR is not built.

Environment and Energy Costs

The Passenger Rail Working Group, in its 2007 report, also estimated the fuel savings that would be derived by the modal shift from car to HPPR that it projected. Those fuel savings, reflected in the table below, ranged from $.04 billion annually to $2.2 billion annually (see Table 6).

Table 6: Annual Fuel Savings – Diversion of Travel from Highway Passenger Vehicle to HPPR

	2007—2015	2016—2030	2016—2030
Annual Value of Net Fuel Savings	$0.4 Billion	$1.3 Billion	$2.2 Billion

Projections based on a 45 percent average load factor for filled passenger seats during operations and assumed that train passengers would be primarily diverted from highways, based on US DOT's Transit Economic Requirements Model (TERM).
("Vision for the future U.S. intercity passenger rail network through 2050," Prepared by the Passenger Rail Working Group of the National Surface Transportation Policy and Revenue Study Commission," December 6, 2007)

In Europe's London to Paris corridor, it is estimated that passengers use one-third as much energy traveling by train as by car, and in the Madrid to Barcelona corridor, the fuel consumption is 28 percent of car travel. In Japan, train travel consumes, per passenger mile, one-sixth that of cars, and even more astounding is that the latest high-speed trains are 32 percent more energy efficient than the original high-speed trains while operating at speeds 43 miles per hour faster than the original Shinkansen trains.
("Next Stop California: The Benefits of High-Speed Rail Around the World and What's in Store for California," CALPIRG Education Fund, June 2010)

From an energy perspective, the cost of not building HPPR reflects the fact that there is no other viable transportation alternative that can reduce the demand for fossil fuel so dramatically. Depending on the power source for HPPR, i.e., electrification or internal combustion, the amount of fuel savings will vary, but just based on current comparisons of the nation's largely internal combustion powered intercity and commuter passenger rail system, it is already recognized that per passenger mile, train travel is 21 percent more fuel efficient than auto travel. As the amount of train travel powered by electricity increases, the level of fuel efficiency will continue to increase.

With transportation currently consuming about 60 percent of the nation's energy demand, as long as that demand stays at current or higher levels, our nation will continue to face unacceptably high levels of economic and security risk.

The 1997 DOT study, "High-Speed Ground Transportation for America," did not attempt to calculate fuel savings per se, but did attempt to calculate emissions savings from the diversion of auto travel to HPPR. Table 7 reflects the anticipated emissions savings based on the percent of highway traffic diversion projected in each corridor. For example, in the Northeast Corridor total emissions savings are estimated at $1.15 billion annually with approximately 2.6 percent of highway traffic diverting to HPPR.

Table 7: Approximate Highways Emissions Savings from HPPR

Corridor	Percent of Mode Shift to HPPR	Percent of HPPR	Highway Emissions Cost Savings (In Millions—2012)
California	3.7%	5.9%	$966
Chicago Hub	4.0%	39.0%	$154
Northeast Corridor	2.6%	11.0%	$667
Pacific Northwest	3.3%	47.0%	$63
Total 40-Year Highway Emissions Savings:			$1,850

("High-Speed Ground Transportation for America," U.S. Department of Transportation, September 1997)

In 1994, the Argonne National Laboratory published "Methods of Valuing Air Pollution and Estimated Monetary Values of Air Pollutants in Various U.S. Regions" (U.S. Department of Energy, 1994), in which a value of $26,400 per ton was assigned to nitrous oxide emissions in Los Angeles, $9,300 per ton was assigned to carbon monoxide, $18,900 per ton to reactive organic gases, and $4,700 per ton for particulate matter. Based on the experience of train service between Frankfurt and Basil, and Paris and Marseille, particulate matter per passenger was approximately 18.1 times less than automobiles, and nitrogen oxides were 46.2 times less per passenger.
("Next Stop California: The Benefits of High-Speed Rail Around the World and What's in Store for California," CALPIRG Education Fund, June 2010)

Thus, depending to the power source for HPPR, the environmental impact of market share shifting from auto to HPPR could be quite significant. If HPPR is not built, these are environmental savings foregone.

Social Costs

In the face of these considerations, the 2010 Census and the Federal Highway Administration's 2009 National Household Travel Survey point to changes in commuting and transportation habits among both the oldest and the youngest cohorts of the nation's population, particularly those in the 16 to 34 and the 50 and over age groups, that may provide a glimmer of hope for even more significant shifts from highway travel to HPPR. Both age groups are expressing strong desires for a more balanced transportation system with attractive options for on alternative transportation modes like mass transit, including HPPR, to meet their commuting and intercity traveling needs. Additionally, the 2009 National Household Travel Survey reported that, "between 2001 and 2009, the number and percent of households with no vehicle available grew by nearly one million households, from 8.1 percent of all households to 8.7 percent."
(2009 National Household Travel Survey, Federal Highway Administration, U.S. Department of Transportation)

The vehicle miles traveled per person peaked at around 10,000 in 2004, while total number of vehicles on the road has plateaued since 2006. Additionally, as a share of the population eligible to have driver's licenses, fewer young people are obtaining them. According to Transportation for America, Americans who do not drive increased by 1.1 million over the past 10 years with about 12 percent of adults older than 65 and nearly 30 percent of those over 75 no longer driving themselves. These are trends similar to travel choices being made in Europe, Japan and other countries that today operate a mix of public transportation options including HPPR.

(“Transportation and the New Generation: Why Young People Are Driving Less and What It Means for Transportation Policy,” Frontier Group/U.S. PIRG Education Fund, Education Fund April 2012)
(“Recent Changes in the Age Composition of Drivers in 15 Countries,” Michael Sivak, Brandon Schoet, University of Michigan Transportation Research Institute, UMTRI-2011-43 October 2011)

Table 8 summarizes the annual savings that would be forgone on the nation’s highway and roadway system if HPPR is not built.

Table 8: The 40-Year Cost Savings Forgone on the Nation’s Highways and Roadway System if HPPR is Not Built

Cost Savings Items (million of dollars – 2012 present value):	
Highway Congestion Delay Savings	$8,676
Annual Time Savings	$3,137
Average Annual Fuel Savings	$1,500
Annual Emissions Savings	$1,850
Total	$15,163

So while the mode shift from auto to HPPR may not seem significant as a percentage of either travelers shifting to HPPR or percentage of HPPR riders (see Table 4), the overall savings in terms of congestion, time, fuel and emissions are indeed quite significant. Thus it is clear that when these savings are combined with both the size of the maintenance and construction backlog and the current and future demographic changes, the cost of not building HPPR is quite large, especially with regard to the future mobility of our nation, its citizens, its commerce, and its security.

In the final chapter of this paper the foregone savings for transit and economic development if HPPR is not built is examined.

Chapter 3: Public Transportation and Economic Development Benefits from HPPR

Public transportation and HPPR are highly complementary, and if integrated can provide a seamless means to travel from an origin to a destination conveniently and economically. Together, HPPR and transit are a welcome combination that improves mobility, and enables the traveler to maximize the use of his/her time while having minimal impact on the environment and limiting the use of environmentally damaging fossil fuels.

As Paris, London and Tokyo, to name a few, have experienced, HPPR is simply the longer distance, higher speed extension of a transit system that may include community circulators, cross-town bus service, bus rapid transit, trolley, light rail and/or heavy rail service, and/or commuter rail service. The linkage of transit to HPPR, just as the linkage of transit to aviation and roadways, adds value to both modes, enhances the mobility of travelers, and offers the opportunity for greater economic development than any single mode by itself could generate. The cost of not building HPPR as part of a highly integrated transportation system is the loss of these benefits.
(“Next Stop California: The Benefits of High-Speed Rail Around the World and What’s in Store for California,” CALPIRG Education

Fund, June 2010)

A 2009 study, "Intermodal Surface Public Transport Hubs: Harnessing Synergy for Success in America's Urban and Intercity Travel," by Lyndon Henry and David L. Marsh observed that: "Promoting intermodal coordination among various public transport services has been a nominal goal of federal policy at least since the passage of the groundbreaking Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991.

Henry and Marsh noted that the National Commission on Intermodal Transportation (NCIT) – a body established under ISTEA – identified intermodal connectivity in public transport is a challenging but critical need:

> "In the passenger system, just as in the freight system, poor modal connectivity is a significant barrier to intermodalism. Too often, the bus station is 10 blocks from the commuter rail station, or the transit line stops at the airport, but too far away to walk to the terminals.
>
> "Among the benefits of effective intermodal coordination the NCIT identifies were:
>
> - Lowering transportation costs by allowing each mode to be used for the portion of the trip for which it is best suited;
> - Increasing economic productivity and efficiency, thereby enhancing the Nation's global competitiveness;
> - Reducing the burden on overstressed infrastructure components by shifting use to infrastructure with excess capacity;
> - Generating higher returns from public and private infrastructure investments;
> - Improving mobility for the elderly, disabled, isolated, and economically disadvantaged;
> - Reducing energy consumption and contributing to improved air quality and environmental conditions."

Henry and Marsh further noted that,

> "Passenger intermodalism has shown some signs of progress since passage of ISTEA.
>
> "Bus and rail transit systems more often coordinate schedules and farecards. Amtrak and intercity bus lines are recognizing the need to provide coordinated schedules and interline ticketing, and multimodal passenger stations are on the drawing boards around the country.
>
> "Intermodal surface public transport stations represent a rapidly evolving and developing concept, designed to provide a hub for interfacing and interconnecting a variety of intercity, regional, and local public transport systems, all within a single facility. These include:
>
> • Intercity motor coach (e.g., Greyhound, Amtrak Thruway)
> • Intercity passenger rail (Amtrak)
> • Regional bus and passenger rail
> • Local bus, rail transit, and other local-area modes
> • Access to shuttle vans and taxis (and often, park & ride facilities for personal motor vehicles)"

("Intermodal Surface Public Transport Hubs: Harnessing Synergy for Success in America's Urban and Intercity Travel," Lyndon Henry – Data Analyst, Capital Metropolitan Transportation Authority • Austin, Texas, David L. Marsh – General Manager, Capital Area Rural Transportation System • Austin, Texas, 2009)

Chief among Henry and Marsh's findings were that:

> "Public transportation providers can benefit from the efficiencies of shared costs and operational infrastructure, and public transportation services benefit from smoother intermodal interfaces and travel route connection opportunities that tend to promote higher ridership. Likewise, passengers benefit from improved systemwide connectivity and the greater convenience this affords in making connections among local, regional, or intercity travel.
>
> "Such ground-transport intermodal hubs have the particular advantage that they typically provide service into or at the edge of the core areas of central cities, and thus facilitate access via a multiplicity of local and regional transit route options.
>
> "In addition, intermodal public transport hubs tend to be strong attractors for transit-oriented development (TOD), often being transformed into destinations in their own right."
> ("Intermodal Surface Public Transport Hubs: Harnessing Synergy for Success in America's Urban and Intercity Travel," Lyndon Henry – Data Analyst Capital Metropolitan Transportation Authority • Austin, Texas, David L. Marsh – General Manager, Capital Area Rural Transportation System • Austin, Texas, 2009)

In its 2007 report to the National Surface Transportation Policy and Revenue Study Commission, the Passenger Rail Working Group noted that the anticipated demographic changes of the American population and the resurgence of urban centers suggest that public transportation and intercity passenger rail will play an important role for the growing segments of population who cannot or choose not to drive or fly.
("Vision for the future U.S. intercity passenger rail network through 2050," Passenger Rail Working Group of the National Surface Transportation Policy and Revenue Study Commission, December 6, 2007)

According to the American Public Transportation Association (APTA), "Americans took 10.4 billion trips on public transportation in 2011, the second highest annual ridership since 1957."
(American Public Transportation Association news release, March 12, 2012)

Interestingly, while virtually all areas of the nation witnessed this growth, many of the leading growth areas were also areas that are promoting improvements to their intercity passenger rail service as well. This is a clear indicator that the demographic trend is moving back toward more highly integrated public transportation.

At the same time, the age cohort younger than 35 is, according to the latest U.S. Census data, prefer a transportation system that provides good options and choices for their various trips. They are more inclined, where possible, to rely on public transportation, intercity passenger rail, and the airways to serve their transportation needs. ("National Household Travel Survey (NHTS)," U.S. Department of Transportation, Federal Highway Administration, 2009)

Indeed, the 2009 NHTS shows that since 2001 the share of trips in private vehicles has dropped while the share of trips on public transportation has grown for the age groups of 16 – 49 and 65+. For those who are not conveniently situated near public transportation, including intercity passenger rail, mobility has been significantly impaired. Still, according to Transportation for America, in 2009, seniors accounted for 9.6 percent of the more than 10.3 billion trips taken on public transportation in the United States. Over all, seniors made 328 million additional trips by transit in 2009 compared to 2001.
("Aging in Place, Stuck without Options: Fixing the Mobility Crisis Threatening the Baby Boom Generation," Transportation for

America, http://t4america.org/resources/seniorsmobilitycrisis2011)

Additionally, Amtrak continues to enjoy steady growth in ridership. The national passenger railroad carried more than 30 million passengers in 2011, setting another new record for eight of the past nine years.
("Amtrak on Pace to Set New Ridership Records," Amtrak press release, April 11, 2012)

To take full advantage of the integration of HPPR with public transportation, cities like London have pursued regeneration strategies that promote agglomeration – the creation of catchment regions that extend the reach of urban transit systems that link economic activities to labor markets.
("High-Speed Trains and the Development and Regeneration of Cities," Greengauge 21, June 2006) ("High-Speed Rail Development Programme 2008/9, Final Report for Workstream 2," Systra (2009)

Agglomerative strategies also produce environmental benefits. Even at existing levels of modal integration in 1997, the Federal Transit Administration (FTA) found that
levels of transit use annually avoid about 125 million pounds of hydrocarbons and over 150 million pounds of nitrous oxides that would otherwise be emitted by automobiles.
("High-Speed Ground Transportation for America," U.S. Department of Transportation, September 1997)

Transportation accounts for nearly one-third of U.S. carbon dioxide emissions. According to the American Public Transportation Association (APTA), public transportation in the United States saves 4.2 billion gallons of gasoline and about 37 million metric tons of carbon dioxide annually. Note that this is based on existing levels of transit use. There will be additional efficiencies as ridership trends continue.

Building HPPR that is highly integrated with other transportation modes, most especially public transit, offers the United States the opportunity to launch an economic revolution that can offset all the disadvantages and challenges that beset the nation due to crippling congestion on its highways, bewildering delays and even loss of air service at its airports, and the demographic dynamics of an aging and increasingly urban population.

The objective is not to put HPPR in competition with other modes of transportation, but to establish HPPR as a complementary mode, offering travelers another option for mobility.

As documented in other sections of this report, improvements in intercity passenger rail, in terms of speed, frequency and reliability, have had dramatic impact on mode choices and demand. Additionally, many countries with improved intercity passenger rail service have experienced growth in the numbers of induced travelers – people who may not have traveled before by any mode, but have found HPPR a welcome travel option.
("A profile of high-speed railways," Australian Government, Department of Infrastructure, Transport, Regional Development and Local Government, November 30, 2010)

Gin'es de Rus, on behalf of the Joint Transport Research Centre, in Discussion Paper 2008-16, "The Economic Effects of High-Speed Rail Investment," offers a "simple cost-benefit model for evaluation of high-speed rail." Conceivably, this same model could be used to evaluate HPPR, because ultimately the objective is to evolve ridership to a level that justifies high-speed rail investment.

De Rus suggests that:

> "The first step in the economic evaluation of this project is to identify how the investment, a `do something´ alternative, compares with the situation *without* the project. A rigorous economic appraisal would compare several relevant `do something´ alternatives with the base case. These alternatives include upgrading the conventional infrastructure, management measures, road and airport pricing or even the construction of new road and airport capacity.
>
> "The public investment in HSR infrastructure can be contemplated as a way of changing the generalized cost of rail travel in corridors where conventional rail, air transport and road are complements or substitutes. Instead of modeling the construction of HSR lines as a new transport mode we consider this specific investment as *an improvement* of one of the existing modes of transport, the railway. Therefore, it is possible to ignore total willingness to pay and concentrate on the incremental changes in surpluses or, alternatively, on the changes in resource costs and willingness to pay.
>
> "The annual social benefit of the project is the annual gross social benefit of introducing the high speed rail in the corridor subject to evaluation, where a `conventional transport mode´ operates. The main components of the annual social benefit are: time savings from deviated traffic, increase in quality, generated trips, the reduction of externalities and, in general, any relevant indirect effect in secondary markets including, particularly, the effects on other transport modes (the conventional transport mode). Other benefits related to the relocation of economic activity and regional inequalities are not included in the annual social benefit.
>
> "The economic rationale of spending public funds in HSR new lines depends more on its capacity to alleviate road and airport congestion, and to release capacity for conventional rail where saturation exists, than in the pure direct benefits of time savings and the net willingness to pay of generated traffic. Therefore, the justification of investment in HSR is highly dependent on local conditions concerning airport capacity, rail and road network situation, and existing volumes of demand. This is what one would expect anyway. The economic evaluation of a new technology has to compare these local conditions, reflected in the base case, with the `do something´ of introducing the new alternative of transport."
>
> (Joint Transport Research Centre, Discussion Paper No. 2008-16 revised, Prepared for the Round Table of 2-3 October 2008 on Airline Competition, Systems of Airports and Intermodal Connections, "The Economic Effects of High-Speed Rail Investment," Ginés de Rus, University of Las Palmas, Spain, October 2008)

Because there is little data available, it is difficult to identify with dependable specificity the actual economic benefit to the nation and to the various regions in which HPPR may be pursued. In the alternative, understanding what these benefits might be, and thus what the cost of not building HPPR might be, is to look at the potential impact of eliminating existing intercity passenger rail service.
("Vision for the future U.S. intercity passenger rail network through 2050," Passenger Rail Working Group of the National Surface Transportation Policy and Revenue Study Commission, December 6, 2007)

In their paper, "Economic Impacts of Intercity Passenger Rail Service: Evidence from Passenger Surveys," Benjamin R. Sperry and Curtis A. Morgan apply a direct measurement technique to both project future benefits if a particular corridor is enhanced by HPPR, as well as identify the impact if current service in the corridor was discontinued.

Writing in the _2011 Transportation Research Record_, Sperry and Morgan observe that based on passenger surveys administered to passengers on the Heartland Flyer – a 206-mile Amtrak passenger train that operates daily round trip service between Oklahoma City and Fort Worth – 70 percent of the riders would divert their trips to other modes of transportation while fully 30 percent of the ridership simply would not make the trip at all.

In addition to the likely 39,000 new annual auto trips that would be put on the roadways in this corridor, the economic impact of that loss of travel as measured by passenger spending and the sales tax revenue generated by that spending in each of the communities served by the Heartland Flyer is fully one-third of the total spending, and one-fourth of the sales tax revenue generated by the ridership of the Heartland Flyer. For the corridor and the communities within it that loss is an estimated $1 million in annual reduced passenger spending and nearly $381,000 in annual lost sales tax revenue. Project this impact across the four mega-corridors that are candidates for HPPR improvement, and the cost of potentially lost service as well as the future economic impact of not building HPPR is realized.
("Economic Impacts of Intercity Passenger Rail Service: Evidence from Passenger Surveys," Benjamin R. Sperry and Curtis A. Morgan, Transportation Research Record: Journal of the Transportation Research Board, No. 2261, Washington, D.C. 2011)

A similar study done for Amtrak of the economic impact of its Empire Builder service in Montana estimated nearly $14 million in annual economic benefits. These are benefits that would be forgone without intercity passenger rail service.
(Amtrak website, "Long Distance Train Facts)

Conclusion:

The 1997 DOT study provides the best overview of the potential net benefits that could flow from the construction and operation of HPPR in the United States. Tables 9 and 10 reflect the total benefits, minus the total average cost of building HPPR in the four mega-corridors studied in this project. The net benefit in each of the four corridors reflects the total projected 40-year cost of not building HPPR. This table, however, does not reflect many of the social and agglomerative costs discussed in this paper that would be incurred if HPPR is not built, primarily because there are no reliable statistics available at this time to measure these costs or benefits in relation to the construction, maintenance, and operation if HPPR in the United States or abroad.

Furthermore, for the following calculations, additional data was utilized for a minimum topline number for each corridor. Factors that cannot be sufficiently allocated to specific corridors are not included in the bottom line.

Table 9: The Benefits of Building HPPR (Millions of USD—2012 Present Value)

	Highway Delay Savings	Road Costs to Achieve Same Delay Savings	Emissions Savings	Airport Delay Savings	FAA Spending Savings	HSR User Benefit	Transportation Benefits
California	$3,237	$12,950	$966	$9,908	$4,652	$20,900	$52,613
Chicago Hub	$927	$3,709	$154	$2,385	$1,120	$5,620	$13,915
Northeast Corridor	$3,857	$15,426	$667	$3,815	$1,791	$55,949	$81,505
Pacific Northwest	$655	$2,621	$63	$161	$75	$3,039	$6,615

(“High-Speed Ground Transportation for America,” U.S. Department of Transportation, September 1997)
(The Effect of Government Highway Spending on Road Users' Congestion Costs, Clifford Winston and Ashley Langer, May 2006)
(The effect of FAA expenditures on air travel delays, Steven A Morrison and Clifford Winston, Journal of Urban Economics 63, 2008)

Table 10: The Cost of Not Building HPPR (Millions of USD—2012 Present Value)

	Transportation Benefits	Economic Output Generated	Tax Revenue Generated	Estimated Project Costs	Net Benefit of HPPR
California	$52,613	$205,200	$23,940	$68,400	$8,153
Chicago Hub	$13,915	$10,200	$1,190	$3,400	$11,705
Northeast Corridor	$81,505	$351,000	$40,950	$117,000	$5,455
Pacific Northwest	$6,615	$25,500	$2,975	$8,500	$1,090
Total 40-year cost of not building HPPR:					$26,403

(“High-Speed Ground Transportation for America,” U.S. Department of Transportation, September 1997)
Project cost estimates from:
(http://www.cahighspeedrail.ca.gov/assets/0/152/431/72e92f77-014b-45a0-ad04-6cfd6d79c778.pdf)
(http://www.progressiverailroading.com/high_speed_rail/article/Midwestern-states-hope-to-take-their-longplanned-highspeed-and-intercity-passenger-rail-network-to-the-next-level--20806)
(http://www.amtrak.com/servlet/ContentServer/Page/1248542787937/1237405732517)
(http://www.oregon.gov/ODOT/rail/docs/publications/2010_pcc_high_speed_rail_report_final.pdf)
(Economic Impact of Public Transportation Investment, Glen Weisbrod and Arlee Reno, October 2009)

This paper addresses HPPR – intercity passenger rail service that is highly integrated with other transportation services – as a vital element of the American transportation system. It attempts to address the question: What is the cost of not building an improved intercity passenger rail system as a complementary capacity to the nation’s overused, underfunded, and barely-maintained airways and roadways?

Recognizing the limitations of the dominant elements of today’s transportation system, and the potential benefits HPPR can provide, policy makers must not forgo the billions of dollars of annual economic, mobility, and energy/environmental benefits as the cost of not building HPPR.

Appendix A: Methodological Assumptions

Financial Assumptions:

In assessing the potential of high-speed ground transportation (HSGT), the study made a series of financial assumptions consistent with Federal practices. While internal financial thresholds may differ for each of the partners in any HSGT project, the following assumptions provide a consistent means of comparing the various cases, technologies, and illustrative corridors:

· **Planning period**—This is the period from the year 20001 to 2040 in which operations and continuing investments occur.

· **Monetary values**—Unless otherwise labeled, monetary values are 1993 constant dollars and are present values of the beginning of the assumed first year of operation in 2000.

· **Discount rate**—The study applied a ten percent discount rate (real) to the revenues, operating expenses, and continuing investments projected for the HSGT entity, which is presumed to be a private firm. Initial investments, assumed to pertain to the public sector, incorporate the Office of Management and Budget's discount rate of seven percent (real), as do the monetized values of all benefits except for those measured by system revenues.

· **Salvage value**—No salvage value (residual value of the investment at the end of 2040) was added to the cases' present value.

· **Construction period**—This period consists of the three years prior to 2000 (two years for vehicles). Initial construction activities were assumed to be evenly spread over the construction period, and the reported investments are the present values as of the year 2000 of the cost incurred in prior years (i.e. they are inflated at a rate of seven percent from the year of incurrence).

· **Cash basis**—The projections deal with cash inflows and outflows and treat plant and equipment replacements as continuing investments in the year incurred. This treatment recognizes phenomena of the type that would have been addressed in an annual allowance for depreciation had such an allowance been included in operating expenses.

· **Taxes**—The study assumed that the HSGT entity, as a member of a private/public partnership, would not be liable for property taxes on HSGT facilities and equipment, and would have no requirement for cash payment of income taxes related to its HSGT operations during the study period.

Fuel Availability and Price Assumptions:

Petroleum-based fuels were assumed to be in constant supply over the projection period: no repetition of the gasoline shortages of 1973 and 1979 was foreseen. Moreover, real fuel prices were assumed to remain constant through 2040, although the Department of Energy recently predicted increases in energy fuel prices5 due to shrinking resources, capital investments in more efficient technology, and more stringent environmental regulations. Any assumed increases in energy prices would have favorably affected the projections for HSGT, both by raising the fare levels of competing, energy-intensive modes and by giving most HSGT options a relative advantage in unit operating expenses for energy. Instead of showing improved HSGT results on the basis of a world commodity market that has been unpredictable in the past, this study found it more judicious to assume an unchanging energy environment.

Fares and Perceived Costs Assumptions:
Fares for all existing modes (perceived costs in the case of auto) were assumed to remain constant, in real terms, over the planning period. Thus, the projections in this report do not incorporate the effects of "fare wars"—characterized by marked fluctuations in tariffs and predatory pricing—that might occur among modes upon the introduction of HSGT service in a given corridor. Fares for public modes reflected a statistical analysis of actual 1993 traffic records, which yielded typical fares for business and non-business trip purposes. For auto, the study assigned a higher perceived cost to business travel ($0.16 per passenger-mile) than to non-business travel ($0.08 per passenger-mile). The former reflected the full cost of auto ownership (including depreciation and insurance), while the latter treated intercity travel as an incremental "out-of-pocket" expense and omitted ownership costs.
("High-Speed Ground Transportation for America," U.S. Department of Transportation, September 1997)

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Without the pioneering efforts of thousands of European and Asian planners, economists, construction laborers, railroad operations personnel and many others who saw the wisdom and had the courage to build and operate intercity passenger rail services throughout the world, much of the data and perspectives offered in this report would not be possible.

To the millions of intercity passenger rail travelers who availed themselves of the convenience and mobility offered by sophisticated intercity passenger rail service, thank you for demonstrating the veracity of the industry's visionaries.

To the dozens of scholars and researchers who have analyzed and chronicled the deliberation and performance of the world's intercity passenger rail service, thank you for providing the essential intellectual content upon which this report is based.

Through these combined efforts it is hoped that policy makers and infrastructure decision makers will come to realize that the cost of not building HPPR is greater than building it, and subsequently these policy and decision makers will take the necessary steps to make HPPR an integral part of America's transportation system in the 21st century.

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