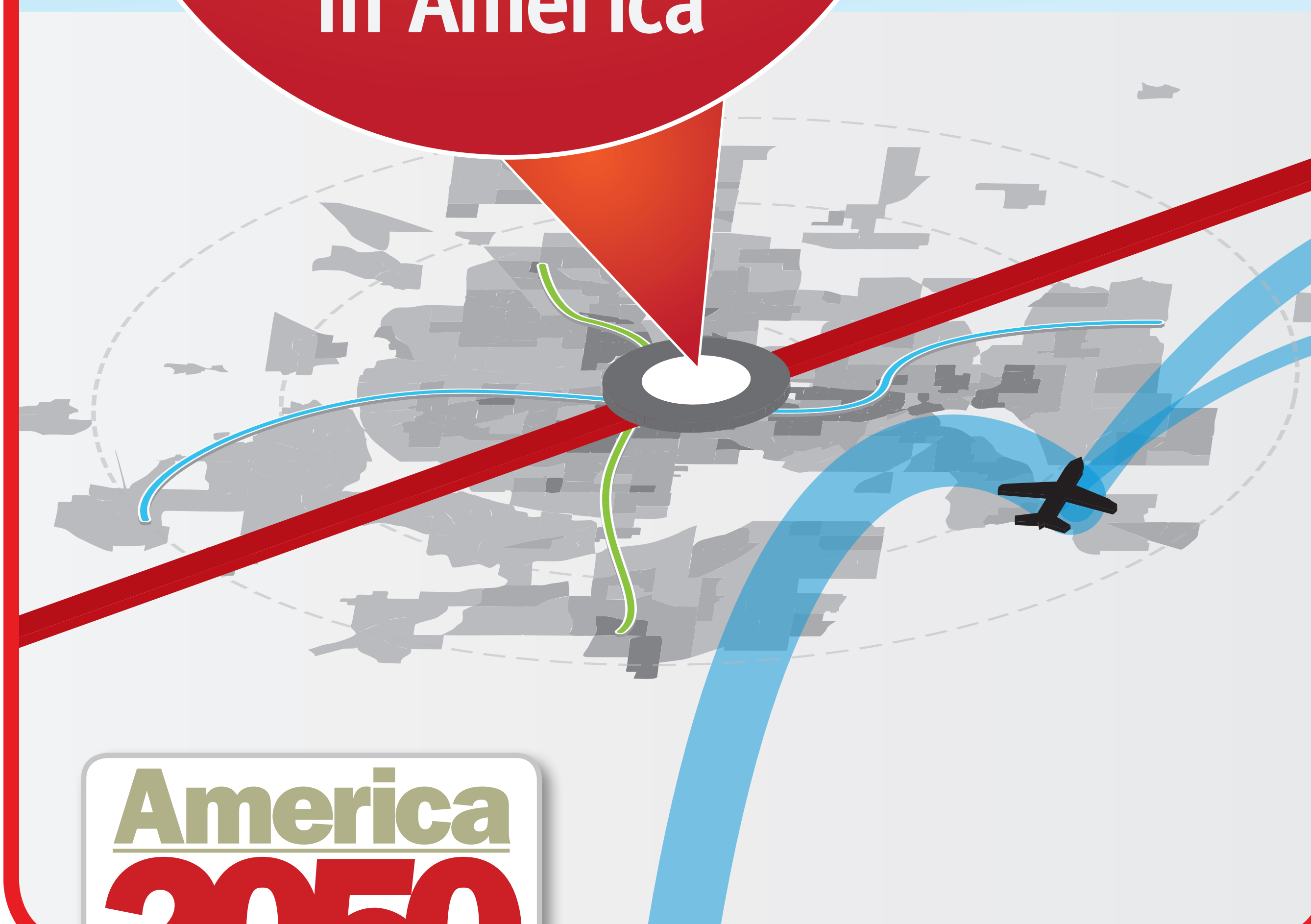
HIGH SPEED RAIL in America



America 2050

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Contents

Executive Summary

The United States has embarked on a program of building high-speed rail corridors in the nation's most urbanized corridors and regions. This is a bold step toward meeting the infrastructure needs of the coming century, including providing capacity for economic growth in regions where air and road congestion threaten economic competitiveness and quality of life.

However, given the newness of the program, there is a steep learning curve for states and regions in developing high-speed and even "classic" intercity passenger corridors. This report aims to educate the public and decision makers about the elements of success for high-speed rail as measured by factors that contribute to ridership demand for these services, particularly as they apply to the unique spatial attributes and travel patterns of America.

This report provides the first and only comparative study of close to 8,000 existing and proposed rail rights of way (of fewer than 600 miles in length) and their relative ability to attract passengers. In doing, the analysis reveals which regional corridors are best suited for high-speed rail in the United States, based on factors that have contributed to rail ridership in other systems around the world. Our approach evaluates and scores each corridor based on parameters related to regional population, employment concentrations, transit accessibility, air travel markets, and composition of employment sectors, among others. Those corridors receiving the highest scores in our analysis are most suited to attract ridership and should be the focal point of federal investments.

The federal government has defined three categories of high-speed rail in the United States: Core Express Corridors, Regional Corridors, and Emerging/ Feeder Routes, to reflect the great variety of regional characteristics and suitability for passenger rail nationwide. This is not a "one size fits all" program. While not every corridor in the country may be able to generate sufficient demand to justify Core Express Corridors at this time, incremental investments in corridors suited for Regional and Emerging/ Feeder service can meet important transportation needs while building markets for passenger rail that may someday justify investments in Core Express Corridors.[1]

Research Findings

- High-speed rail works in very specific conditions, primarily in corridors of approximately 100–600 miles in length where it can connect major employment centers and population hubs with other large and moderate-sized employment centers and population hubs. Such corridors exist primarily in the nation's 11 megaregions, where over 70 percent of the nation's population and productivity (as measured by regional GDP) is concentrated.
- Some of the most promising rail corridors for attracting ridership in the United States are in corridors of less than 150 miles. These shorter corridors, such as New York-Philadelphia, Los Angeles-San Diego, and Chicago-Milwaukee, can anchor investments in longer, multi-city corridors and be priced to attract both high-speed commuting and intercity trips.
- Very large cities are potentially powerful generators of rail ridership. The presence of a very large city on a corridor with medium-size and smaller cities has greater impact than connecting medium cities of the same size for generating ridership.
- Composition of the workforce within a metro region may have significant implications on regional intercity travel. People who work in knowledge industries, such as those in the financial sector, tend to be more mobile and travel more for business than those in industrial sectors.

Recommendations

- The federal government should adopt a quantitative approach to evaluating rail investments across the country in line with clear objectives for the national rail program. This paper presents one such approach that can be used to evaluate corridors against a set of factors based on national data, such as population, employment, and travel data.
- The federal government should prioritize capital investments in corridors with the greatest opportunity to attract ridership and thus offset operating costs.

1 The Federal Railroad Administration define Core Express corridors as those with dedicated tracks reaching speeds of 125-150 miles per hour serving major population centers. A table of FRA definitions is on p. 7.

- The United States lacks recent data on long distance automobile travel, the most common mode for trips of up to 1,000 miles. The last study of this kind, the 1995 American Travel Survey is outdated and of limited use. A new American Travel Survey should be initiated, making use of mobile and GPS technologies, while protecting privacy data. Updated, national, long distance, travel data is necessary to improve forecasts for high-speed rail ridership, which today are often based on outdated data and assumptions.

Study Design

This study evaluated 7,870 rail corridors of less than 600 miles against data for variables that contribute to passenger rail ridership. These variables include: population, employment, transit ridership, population and employment within areas served by transit, air ridership along the corridor, and highway congestion.

The data was collected spatially, using geographic information systems (GIS) analysis, by establishing 2-mile, 10-mile, and 25-mile service areas for the intercity rail station in each metropolitan area along the rail corridor, or in the absence of a train station, the center of the central business district of the metropolitan area. Data was collected for every metropolitan area along the route for a dozen variables, shown below.

A score was then computed for each rail corridor on a per-mile basis, based on the sum of a weighted average of these dozen criteria. Scores range from 0 – 20.15.

TABLE 1

Criteria Used to Develop Corridor Score

Primary Factors: Weighted 3X	
Regional Population (25 Mile)	(RP)
Employment CBD (2 Mile)	(ECBD)
Secondary Factors: Weighted 2X	
Transit Connectivity Employment	(TCE)
Transit Connectivity Population	(TCP)
City Population (10 Mile)	(CP)
City Employment (10 Mile)	(CE)
Regional Population Growth Factor	(RPGF)
Regional Air Market	(RAM)
Tertiary Factors: Weighted 1X	
Commuter Rail Connectivity Population	(CRP)
Corridor Traffic Congestion	(CTC)
Share of Financial Workers	(SF)
Share of Workers in Tourism Industry	(ST)

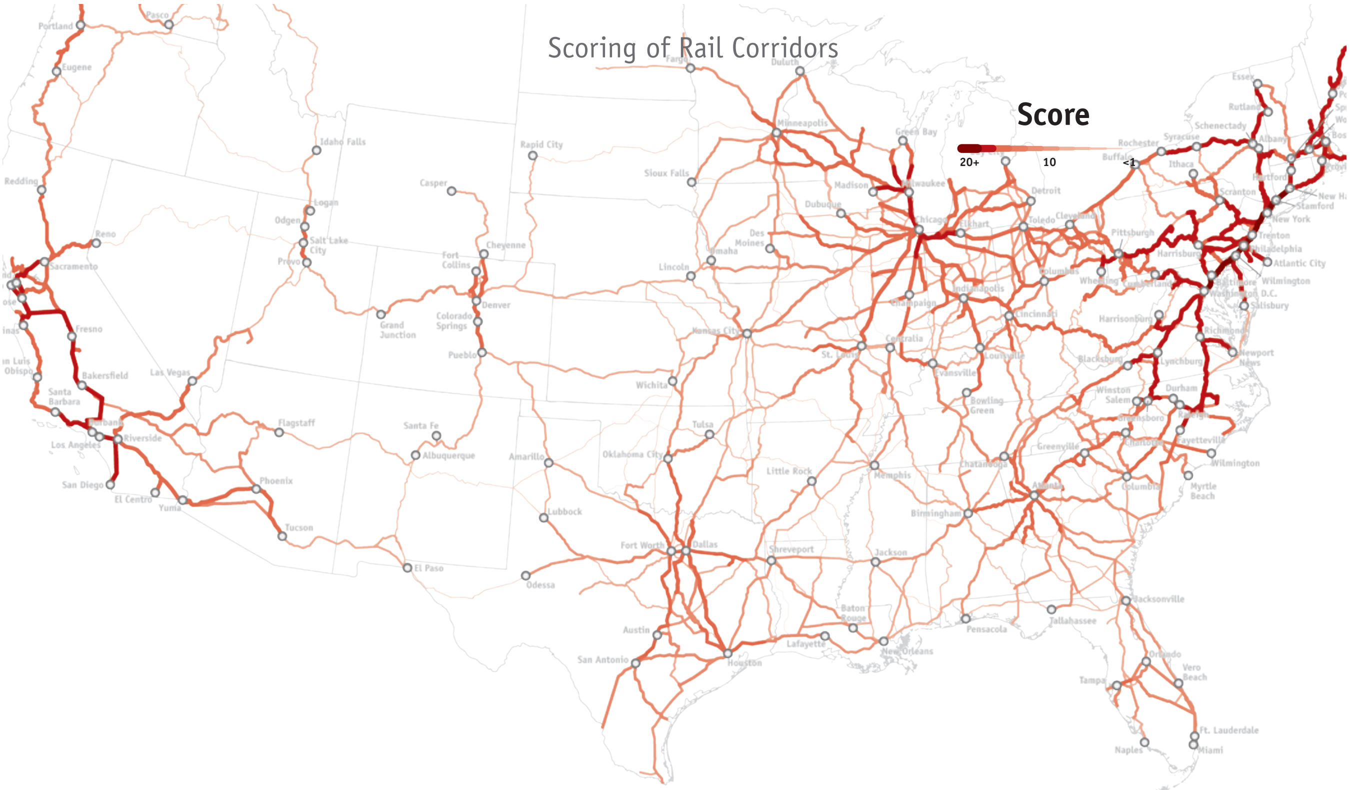
Regional Profiles of Rail Corridors

1. The **Northeast Megaregion**, encompassing the major cities along the northeastern seaboard, leads the nation in virtually every parameter evaluated in this study, from population, density, employment, share of knowledge workers, to transit connectivity. The highest ranking corridor in this study is Washington to New York with a score of 20.15 – also the most heavily traveled rail corridor in the nation. Boston to New York follows close behind with a score of 19.87. Off the mainline Northeast Corridor, the highest scoring corridors in the Northeast Megaregion are: Albany-New York (19.29), Washington-Richmond (18.31), and Philadelphia-Harrisburg (18.07).

2. The **Great Lakes Megaregion** includes a "hub and spoke" network of rail corridors emanating from the Chicago hub. Behind only New York, Chicago has the second densest business district in the nation with more than half a million jobs within two miles of Union Station and a robust regional rail system serving 70 million passengers a year. The population growth rates of regions in the Great Lakes are slower than the nation as a whole. The Great Lakes has a strong regional air market (defined as flights shorter than 600 miles) with seven markets of more than 500,000 passengers a year connecting to Chicago. The top ranking corridors in the Great Lakes are: Chicago-Milwaukee (19.38); Chicago-Indianapolis (17.38); Chicago-Detroit (16.80); Chicago-Cincinnati (16.40); and Chicago-St. Louis (16.19).

3. **California and the Southwest**, including the Arizona Sun Corridor, includes some of the largest and fastest growing regions in the nation. Planning for a new, dedicated high-speed rail system is underway to connect Northern and Southern California – two populous regions that also share the largest regional air market in the country and heavy highway congestion on the highway corridor connecting them. Six of eight large metros in California and Arizona have rail transit systems, while San Francisco and Los Angeles also have commuter rail. The major cities of Arizona – Phoenix and Tucson – are smaller, less densely populated, and lacking in extensive transit service, resulting in lower rankings than their California counterparts. The highest ranking corridors in California and the Southwest tend to be short corridors connecting to Los Angeles, including Los Angeles-San Diego (19.62); Los Angeles-Riverside (19.43); Los Angeles-Santa Barbara (18.96); San Francisco-Sacramento (18.21); Los Angeles-San Francisco (17.98); Los Angeles-Las Vegas, NV (16.94); and Phoenix, AZ – Tucson, AZ (16.37).

4. **Florida**: Aside from California, Florida is the only region in the nation currently pursuing a new, dedicated high-speed rail system. While Florida's population, employment, and transit characteristics are not near the top of national statistics, other exogenous factors positioned the state at the front of the line for federal high-speed rail dollars: project readiness and public ownership of the right-of-way between Tampa and Orlando. The state's largest regions are smaller and more decentralized, but their projected population growth rates are notable. Florida's four largest cities, Miami, Orlando, Tampa, and Jacksonville, are all expected to grow at a rate of at least 30 percent over the next 30 years, with Orlando projected to grow at 60 percent. The lower scores for Florida corridors reflect the lack of a single dominant city, such as Los Angeles, Chicago, or New York, to act as a magnet for intercity trips. However, tourist destinations such as Disney World and the Orlando Convention Center, connected by high-speed rail, could act as significant generators of rail ridership not accounted



Source: America 2050

for by our methodology. The top corridors in Florida are: Tampa-Miami (13.93) along the proposed HSR Route; Tampa-Orlando (13.63); Sebastian/Vero Beach-Miami (12.96).

5. **Texas and the Gulf Coast**: The largest Texas cities are highly decentralized, stretching over large areas, with low density in their cores. Texas population growth rates are high (the four largest cities are each expected to grow by more than 50 percent), and their populations have very low transit accessibility. Texas has invested heavily in road infrastructure in the last decade, adding over 1,000 lane miles of highways while traffic congestion has worsened in that same time period. Texas has a relatively large short haul air market, with 4.4 million passengers in 2008 moving between Dallas and other points in the Texas Triangle and Gulf Coast. The highest scoring Texas corridors in our study are: Dallas-Houston (16.12); Dallas-Austin (14.86); San Antonio-Dallas (14.75); Oklahoma City-Dallas (14.32).

6. **Piedmont Atlantic Megaregion**: Population centers in the Piedmont Atlantic Megaregion tend to be relatively low density and fast growing. Atlanta, Georgia has the largest rail transit system in the megaregion, with 13.2 percent of its population and 34 percent of its jobs located within the transit accessible zone. Charlotte, North Carolina has a new light rail system that only serves a small portion of the metropolitan region. While Atlanta Hartsfield is the nation's largest airport, most of its flights have destinations outside the megaregion. The top scoring corridors in this region are: Birmingham-Atlanta (15.93); Atlanta-Charlotte (15.68); Washington, DC-Charlotte (15.16); and Charlotte-Raleigh (14.84).

7. **Cascadia**: The Cascadia megaregion's primary corridor connects Eugene, Oregon to Vancouver, British Columbia across the Canadian border. Seattle and Portland, the megaregion's two major U.S. cities, are medium size in population, but relatively compact with transit systems that serve 31 percent and 58 percent of the jobs in Seattle and Portland, respectively. Ridership on Amtrak Cascades service has quadrupled from 1994 to today. Washington State has been active in planning a long-term vision for regional rail service in the Cascades corridor and was awarded more than $600 million by the federal government in 2010 to begin incremental improvements to the rail corridor. Portland-Seattle was the highest scoring stretch of this corridor with a score of 17.68, not including Vancouver because of the lack of equivalent Canadian data. It was followed by the Portland-Eugene segment of the same corridor, which scored 15.42.

8. **Front Range – Intermountain West**: With the exception of medium-sized Denver, the cities of the Front Range are relatively small. Their size, combined with the far distance and mountain terrain between them, makes high-speed rail a difficult financial proposition for the small number of passengers it would likely serve. On the other hand, the regions are growing rapidly, and Denver and Salt Lake City are notable because they have recently invested in expanding and improving their regional rail and transit systems. In the Salt Lake City region, the linear, 100-mile rail corridor between Ogden and Provo provides some intercity service, though it is designed as a regional commuter system, reflecting that region's needs. The top scoring corridor in the region is Denver-Pueblo (17.13), followed by Denver-Cheyenne (15.51); and Provo-Ogden (14.90).

CHAPTER 1

Ridership: The Key to Success

Introduction

This report aims to build understanding among decision makers and the public about the factors contributing to high-speed rail ridership, to better inform federal, state, and local investments. Especially as we emerge from a recession, investing in projects that can realize their promised benefits and gain a measure of financial self-sufficiency is paramount. While the potential to gain ridership is certainly not the only factor in a project's success (the ability to secure funding, maintain local support, and overcome design and engineering challenges is equally critical), ridership demand is important enough to be used as a preliminary screen of a proposed project's utility.

Projected ridership is one way to measure whether rail services can realize their potential benefits, including gains in energy efficiency, economic productivity, reducing greenhouse gas emissions, and others. If newly built high-speed rail services do not attract projected ridership over time, they will not only fail to deliver their promised benefits but they may waste energy, resources, and require excessive operating subsidies. The long term success of the new federal High Speed Intercity Passenger Rail program is dependent on investing in corridors with the potential to attract ridership and realize rail's benefits, establishing a positive track record for the program as a sound investment in our national economy.

This report builds on America 2050's previous study "Where High-Speed Rail Works Best," which evaluated connections among 27,000 city pairs in the United States to recommend where the federal government should first invest its limited stimulus dollars for high-speed rail.[2] That report recommended that given limited funds, federal investments should go first to corridors with the greatest demand for ridership in order to demonstrate early success and build support for a long-term, national program. This report continues in that vein, providing a more detailed analysis of actual and proposed multicity passenger rail corridors, evaluating them against factors contributing to ridership demand, accounting for their actual station locations, the network benefits of multiple stations along a corridor, and the physical rail alignments within a regional context.

2 Yoav Hagler and Petra Todorovich, "Where High-Speed Rail Works Best." New York: America 2050. http://www.america2050.org/pdf/2050_Report_Where_HSR_Works_Best.pdf

Chapter 1 discusses the factors contributing to rail ridership and how an approach that evaluates rail corridors on the basis of standardized, nationally-available data could improve the transparency of the federal program and promote sound investment decisions. Chapter 2 presents the results of our analysis of close to 8,000 existing and proposed rail corridors around the country, grouped by megaregion,[3] to highlight the challenges and opportunities in each region and discuss the most promising corridors. Our study offers one approach to making decisions about rail investments, which we hope will be considered by the federal government. Additionally, by building understanding about the factors that contribute to rail ridership, we aim to help shape a more successful national passenger rail program and promote sound investment and planning decisions in passenger rail.

The Federal Context for Rail Investment

High-Speed Rail (HSR) is defined differently around the world. Outside the United States, HSR generally refers to trains that travel above 150 miles per hour (250 kilometers per hour). The European Union defines HSR as newly built lines equipped for speeds of greater than 155 miles per hour (250 km per hour) or upgraded lines equipped for speeds of greater than 124 miles per hour (200 km per hour).[4] In its 2010 guidelines, the Federal Railroad Administration (FRA) defines three distinct classes of HSR service in addition to conventional passenger rail (Table 2).[5]

The three categories of high-speed rail service provided by the FRA illustrate a federal approach that recognizes the vast range of rail service levels and regional characteristics across the country. Rather than pushing HSR that is "one size fits all," the FRA proposes to make investments appropriate to the unique characteristics of individual corridors. A potential danger of this approach is that regions anticipating "Core Express" may

3 Megaregions are large networks of metropolitan areas connected by commuting and travel patterns, business relationships, and large infrastructure and natural systems.

4 European Union. 1996. "Council Directive 96/48/EC of 23 July 1996 on the interoperability of the trans-European high-speed rail system."

5 U.S. Department of Transportation Federal Railroad Administration 2010. "National Rail Plan: Moving Forward: A Progress Report." p. 10 and U.S. Department of Transportation Federal Railroad Administration. 2009. "Vision for High-Speed Rail in America." p. 2.

TABLE 2

FRA Definitions of High-Speed Rail and Intercity Passenger Rail

	Corridor Length (miles)	Top Speeds (mph)	Dedicated tracks	Population Served	Level of Service
Core Express Corridors	Up to 500	125-250	Yes, except in terminal areas	Major population centers	Frequent express, electrified
Regional Corridors	100–500	90–125	Dedicated and shared tracks	Mid-sized urban areas and smaller communities	Frequent
Emerging/ Feeder Routes	100–500	Up to 90	Shared tracks	Moderate population centers, with smaller, more distant areas	Less frequent*

*Assumed, FRA does not specify.

be disappointed with incremental improvements that bring their existing services up to "Regional" or "Emerging/Feeder" service, which shares tracks with freight or commuter trains, restricting top speeds and optimal trip times.

However investments in upgraded, conventional passenger rail service ("classic" passenger rail, if you will) in corridors lacking the market to justify Core Express are still important. They provide residents in these regions greater mobility options and begin to build a larger market for passenger rail in those corridors, which may someday justify upgrades to Regional or Express service. These classic passenger rail lines may also act as feeder lines to Core Express services, much in the same way the Vermonter, Empire, and Keystone branch lines in the Northeast connect to the mainline Northeast Corridor, strengthening the entire network.

How and where to invest federal dollars in Core Express versus Regional and Emerging/ Feeder is a key question for national rail policy. One way to approach this is to reserve Core Express systems for the regions with the largest markets, since these are the most expensive systems to build and operate. This would explain the federal investment in Core Express in California, but not in Florida, which has a smaller potential market, due to smaller regional populations and other factors. In Florida, it seems the availability of a publicly-owned right of way and project readiness facilitated state and federal support of a dedicated Core Express system. Once built, this system will provide an important demonstration of whether high quality, frequent service can overcome other challenges to attracting rail ridership, such as decentralized land development. The analysis that follows in this report discusses how markets in California and Florida differ, based on factors such as population, density, employment characteristics, and transit accessibility.

In other regions with medium-sized markets, understanding potential ridership demand will help all levels of government make sound decisions in rail improvements. Generally, we recommend focusing federal money on capital investments in corridors that have the greatest opportunity for supporting their operating costs, as determined by ridership projections. States and local governments may decide to subsidize rail operations until services attract enough ridership to achieve self sufficient operations and maintenance, or as a policy decision to promote rail ridership.[6] (This is, in effect what federal and state governments did with the Interstate Highway System in the 1960s and 70s, before suburban development generated significant use of the national system.)

Other factors too may determine how and where the federal government chooses to invest, such as local funding and financing, engineering and design considerations, the capacity of state and regional agencies to carry out projects, and local political support. Federal investments may also be motivated by the desire to promote economic development in underperforming regions, such as former manufacturing economies. No matter its goals, national rail policy and decision making should be informed by a clear and objective understanding of projected ridership demand in the different corridors, drawing on nationally available data, such as we provide in this report, and new, improved data on long distance travel in America.

An additional important consideration for passenger rail investment is the impact of expanding passenger rail services on America's privately-owned and environmentally friendly freight rail network. This is less of a concern in corridors that are pursuing Core Express (Florida and California), which consist of dedicated, grade separated, rights of way that do not share tracks with commuter trains and freight trains except in station and terminal areas. However, those regions pursuing Regional or Emerging/ Feeder services are generally proposing to upgrade existing tracks owned by freight railroads to improve the frequency, trip times, and reliability of passenger service in those shared corridors. In these cases, the level of traffic on the freight railroad (is it part of the railroad's "core" network?) will certainly impact the feasibility and the cost of improving passenger service on the corridor, and should be weighed along with other project feasibility considerations.

Finally, the federal government and states should begin to actively plan and acquire rights of way together for future high-speed rail development, particularly in the most promising corridors. Right of way acquisition, especially in densely populated regions, is one of the most challenging aspects of building high-speed rail systems. Even regions pursuing only classic rail service today could save hundreds of millions of dollars in the future by acquiring pieces of rights of way as opportunities arise. Florida's farsighted construction of the Interstate-4 corridor with room down the median for high-speed trains in the 1990s was a key ingredient in its success in wining billions of federal dollars for high-speed rail in 2010.

The Need for Better Intercity Travel Data and Forecasting Models

While virtually every state pursuing passenger rail improvements performs some type of ridership demand forecast, these forecast vary widely in their inputs and assumptions from project to project and consultant to consultant, and thus are limited in their ability to support nationwide comparisons.

6 While ticket revenues may cover operating costs on corridors with high levels of ridership, even in the most successful systems, rail capital costs are almost always borne by the public sector.

Ridership demand forecasts typically rely on regional travel demand models in which information is gathered on a study area's present and projected population, employment, household attributes, and transportation systems.[7] The basic forecasting model is a four-step method that uses trip generation, trip distribution, mode choice, and route assignment as determinants of travel.[8]

Unfortunately, given limited available data about U.S. long distance travel, it is difficult to forecast potential ridership for high-speed rail. While national aviation data is available, it does not include the point of origin or final destination of the passenger – only airport to airport flows. There is also no up-to-date national data source for long distance automobile trips – the mode by which the majority of intercity trips take place. The most recent national study of intercity travel, the American Travel Survey, was completed in 1995 and therefore is of limited use. Thus, as a first step towards better high-speed rail planning, we strongly encourage the federal government to collect improved intercity travel data, particularly for highways. Ideally, a new survey would bring the intercity travel information in the American Travel Survey up to date. Using privacy-protected data sources from mobile and GPS technologies could help reduce the cost and improve the accuracy of this survey well beyond the 1995 American Travel Survey.

In the absence of more comprehensive, national, intercity travel data that would allow precise ridership forecasts for proposed corridors, this study presents a comparative model of ridership demand by corridor, drawing on existing data sources that are standardized for every metropolitan region. Such a comparative model of ridership demand could also help guide federal policy makers on where to make smart rail investments, and provide accountability for high-speed rail investments already being made. Instead of evaluating and comparing precise ridership estimates from the states (e.g. X riders in California versus Y riders in Texas) based on inadequate data and varying assumptions, we propose an alternative assessment framework that considers the various factors or parameters that influence ridership without attempting to pinpoint ridership explicitly.

The following section discusses parameters that could form the basis of an approach to federal investment decision making, and which we used to evaluate the corridors discussed in the following chapter.

How we Evaluated Rail Corridors in this Study

There are many different factors inherent in cities and regions that contribute to rail ridership. These include the size of central business districts, total regional population, transit accessibility, population growth, air travel demand, and variations in regional employment mix, among others. Twelve of these parameters were used to score corridors across the country in order to evaluate their relative suitability for passenger rail investments. Table 3 shows these twelve parameters and their relative weighting in the analysis.[9] We used our best understanding of factors that drive ridership based on available research of domestic and international rail corridors to choose the parameters and their relative weights in the table below.

Naturally, choosing to weight the parameters differently would result in prioritization of different corridors. For example, giving greater weight to population growth than current population would skew the results away from the larger, slower growing cities in the Northeast and Midwest and toward the faster growing cities in the South and West. As discussed above, whatever the system used to judge the relative merit of a corridor investment, it should be based on empirical evidence and the weighting should be consistent with the policy goals that underlie these investments.

TABLE 3

Criteria Used to Develop Corridor Score

Primary Factors: Weighted 3X	
Regional Population (25Miles)	(RP)
Employment CBD (2Mile)	(ECBD)
Secondary Factors: Weighted 2X	
Transit Connectivity Employment	(TCE)
Transit Connectivity Population	(TCP)
City Population (10 Mile)	(CP)
City Employment (10 Mile)	(CE)
Regional Population Growth Factor	(RPGF)
Regional Air Market	(RAM)
Tertiary Factors: Weighted 1X	
Commuter Rail Connectivity Population	(CRP)
Corridor Traffic Congestion	(CTC)
Share of Financial Workers	(SF)
Share of Workers in Tourism Industry	(ST)

Preparing Data for Equation

First, each criterion was divided by the total length (in miles) of the corridor. This step results in the data being on a per mile basis, which allows for comparison between corridors of varying lengths. Without this step, longer corridors with more data points would have had an advantage over shorter corridors.

$$\text{Value}_n / \text{Length of Corridor}_n$$

For each criterion, the corridor was given a rank from zero to 7,870, based on their relative value.

$$\text{Rank } (\text{Value}_n/\text{Length}_n)$$

These ranks were then converted to a value between 0 and 1 by dividing the rank by the maximum rank in each category and subtracting that result from 1. This yielded a number between 0 and 1 for each entry with the highest value 1 and lowest 0.

$$1 - (\text{Rank}_n / \text{Maximum Rank})$$

The final equation was then applied to these adjusted corridor ranks.

$$\text{Corridor Score} = 3*(RP+ECBD) + 2*(TCE+TCP+CP+CE+RPGF+RAM) + (CRP+CTC+SF+ST)$$

7 Walters, Jerry. 2003. "Direct Ridership Forecasting: Out of the Black Box." http://www.smartgrowthplanning.org/PDFs/0805DirectRidershipForecastingWeb.pdf 2003.

8 United States Government Accountability Office. 2009. "High-speed Passenger Rail Future Development Will Depend on Addressing Financial and Other Challenges and Establishing a Clear Federal Role." Report to Congressional Requesters.

9 For a complete explanation of the methodology for creating the corridor scores see the Appendix.

Using the equation presented above, we calculated a score for every existing or proposed corridor of less than 600 miles in length in the country. Scores range from 0 – 20.15. This score represents a weighted per-mile average of data along the length of a corridor between any two end points. The top scoring corridor was New York-Washington, DC with a score of 20.15. This total score represents data obtained not only from New York and Washington, DC but also the metropolitan regions of Philadelphia and Baltimore that lie in between. This corridor analysis is better suited for estimating rail demand than a simple city pair analysis, as it accounts for the "network effects" of major intermediate stations. The ability of trains to gain passengers at intermediate stations is an efficiency advantage over aviation; trains can pick up additional passengers while avoiding the inconvenience and fuel expenditure of an airplane making intermediate stops. The normalization of the corridors on a per-mile basis ensures that longer corridors would not automatically score higher than shorter corridors. However, longer corridors with intermediate stations in cities of medium or large size do score higher than long corridors with few stations in between the end points, unless the end points are large generators of ridership (like in California).

How to Interpret the Scores in the Study

There is no single number above which a corridor is suitable for high-speed rail and below which it is not. Rather, these scores represent a relative ranking across twelve criteria that contribute to intercity rail ridership. While it would be tempting to designate ranges of score that indicate suitability for Core Express versus Regional and Emerging/ Feeder, the relative nature of our ranking system prevents this. Instead, we can suggest that given the significant capital requirements of Core Express, these types of investments should be reserved for the highest ranking corridors. For example, a score of 19 means that for most of the criteria used, the corridor was in the top one percent of all corridors analyzed. All corridors with scores in this range include metropolitan regions with large central business districts, large regional populations, and transit connections. These are the corridors in the country most suited for Core Express service.

Corridors with scores of above 17 were in the top 10 percent of most of the criteria analyzed. Many of these corridors may also be suitable for Core Express, or will be as they experience continued population and economic growth in the coming decades. These corridors generally include at least one major metropolitan center with a large central business district, large regional populations and transit connectivity, or compact corridors with multiple, medium sized metropolitan regions.

Corridors with scores of 10 and below were in the bottom 50 percent of most of the criteria analyzed. These corridors consisted mostly of relatively small or medium sized cities spaced at distances at the outer range of rail travel with only sparsely populated land in between. These corridors would not justify priority federal funding for Core Express, given their relative low ranking.

Of course, investment decisions about the level of service and design of the system must weigh multiple considerations, in addition to projected ridership demand. A corridor's relative strength in ridership demand should be weighed with other investment criteria, such as engineering constraints, right-of-way conditions, and potential conflicts with freight traffic.

Table 4 displays a sample of corridors and the scores they received in this study. To compare like corridors across regions, this table is separated into three sections: short corridors of less than 150 miles; mid-length corridors of 150 to 300 miles; and long corridors greater than 300 miles. More detail will be provided on the corridors in the following chapter.

TABLE 4

Scoring of a Sample of Short, Medium, and Long Corridors

Short Corridors - 150 Miles or Less

Origin	Destination	Length	Score
New York NY	Philadelphia PA	91	19.86
Los Angeles CA	San Diego CA	150	19.62
Chicago IL	Milwaukee WI	86	19.38
Washington DC	Richmond VA	110	18.31
Sacramento CA	San Francisco CA	139	18.21
Tampa FL	Orlando FL	84	13.63

Mid-Length Corridors - 150 - 300 Miles

Origin	Destination	Length	Score
Washington DC	New York NY	224	20.15
Boston MA	New York NY	231	19.87
Portland OR	Seattle WA	185	17.68
Chicago IL	Saint Louis MO	282	16.19
Birmingham AL	Atlanta GA	164	15.93
Atlanta GA	Charlotte NC	257	15.68
Dallas TX	Houston TX	243	16.12
San Antonio TX	Houston TX	211	13.92

Long Corridors - Greater than 300 Miles

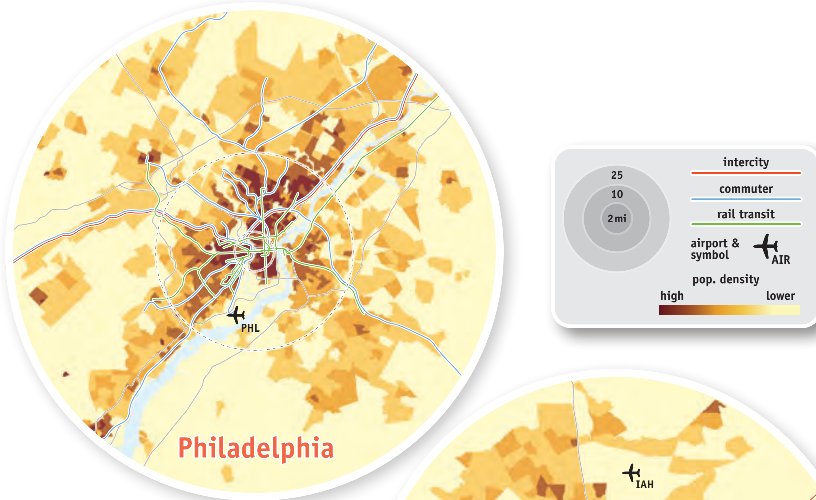
Origin	Dest	Length	Score
Washington DC	Boston MA	455	19.81
Los Angeles CA	San Francisco CA	453	17.98
Los Angeles CA	Las Vegas NV	338	16.94
Chicago IL	Minneapolis MN	423	16.66
Washington DC	Charlotte NC	376	15.16
San Antonio TX	Dallas TX	312	14.75
Tampa FL	Miami FL	319	13.93
Charlotte NC	Richmond VA	369	11.88
New Orleans LA	Houston TX	362	11.27
Denver CO	Albuquerque NM	476	9.91

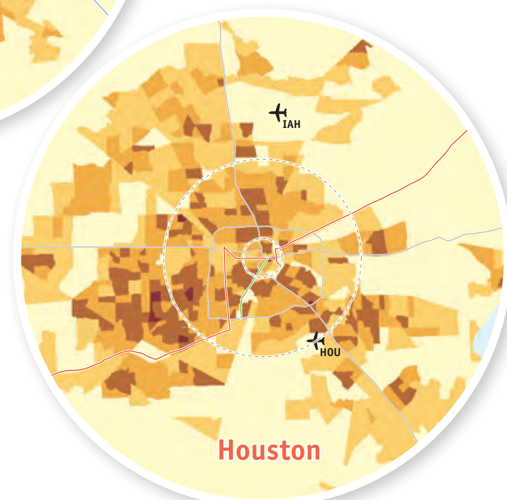
Geographic Zones

Throughout the study, to analyze population and employment density around train stations, we created geographic zones of 2-mile, 10-mile, and 25-mile radii around the existing or proposed train station, or lacking a train station, the center of the city's central business district. Creating standard zones allows equal comparison of different cities for which political boundaries of municipalities and regions may vary widely.

These geographic zones also allow for a better examination of variation in population density across regions. This is well demonstrated in the case of Philadelphia and Houston – two metropolitan statistical areas of approximately 6 million people, but drastically different spatial development characteristics.

Within the 2-mile radius of Philadelphia's 30th Street Station, there are approximately 220,000 inhabitants. This contrasts sharply with Houston's population of 72,000 people living within 2 miles of center of Houston's central business district (the center point of Houston's CBD was used, as it lacked a downtown train station.) At the 10-mile ring, Philadelphia has 2.1 million people compared to 1.5 million people in the same area of Houston. At the 25-mile ring, the regions balance out – 4.6 million in Philadelphia compared to 4.5 million people in Houston. The population density in Philadelphia's 2-mile and 10-mile radii around its intercity rail station suggest that there would be many more potential riders and destinations within walking distance of Philadelphia's train station, which is also served by a robust local and regional rail system. In Houston, most potential rail riders would need to access the train station by automobile, requiring extensive parking, and possibly precluding some of the transit oriented development opportunities and energy efficiencies of high-speed rail.





Understanding the Factors Contributing to Passenger Rail Ridership

This section describes the rationale for selecting the different factors contributing to rail ridership analyzed in this study, and factors not analyzed that also may have an impact. In general, the study adopts a regional planning perspective on factors that drive ridership demand, focusing on the interplay between land use and transportation and how it impacts transportation behavior.

Corridor Geography and Characteristics

Despite the excitement that high-speed rail has generated in the national dialogue, it would be foolish to promote high-speed rail in every community. Successful high-speed rail systems around the world generally operate in very specific conditions, primarily in corridors of approximately 100–600 miles in length where HSR can connect major employment centers and population hubs with other large and moderate-sized employment centers and population hubs. Such corridors exist primarily in the nation's 11 megaregions, where over 70 percent of the nation's population and productivity (as measured by regional GDP) is concentrated.[10]

Within the megaregions, high-speed rail competes with different modes depending on the distance of the trip. For trip distances of up to 200 miles, rail competes primarily with private automobile travel. Local transit connectivity, residential and employment density, and regional congestion on the road network will positively impact rail ridership at this distance. Under 200 miles, reliable rail service can attract would-be drivers by offering door to door trip times competitive with auto travel, even without obtaining world class speeds.[11]

Over longer distances (200–600 miles), rail competes with automobiles and air travel. In competition with air, there are two separate but equally important markets: origin-destination travelers and interlined or connecting passengers.

Since the end point for origin-destination air travelers is a place within the metro region and not the rail station or airport, the potential to capture these air passengers will tend to respond directly to variations in trip time and frequency. To compete with air travel at these distances, very high speeds must be maintained, and high capacity Core Express systems are appropriate. The relative accessibility of major attractions within the region to the high-speed rail station, on foot or by connecting transportation options, will also help determine the competitiveness of high-speed rail for these types of trips.

10 America 2050. 2008. "America 2050: An Infrastructure Vision for 21st Century America." p. 11. Regional Plan Association, New York, New York.

11 Steer Davies Gleave. 2004. "High Speed Rail: International Comparisons" Prepared for Commission for Integrated Transport.

"Interlined" passengers are those passengers travelling to an airport with the intent of connecting to another flight. These air passengers differ from origin-destination passengers in that their destination is the airport, not another point within the metro region. It is therefore more difficult to attract these passengers to rail, even with competitive trip times and frequent service. The diversion to rail of interlined passengers depends on additional interventions beyond high speeds and frequencies on rail, including: 1) physical integration of tracks and terminals, 2) fare and pricing integration and 3) logistical integration of baggage, check-in, and security. To get higher rates of interlined passengers to divert to rail all three types of integration must occur. Places where airports and rail stations are seamlessly integrated in all three areas, such as Germany and Switzerland, have been more successful in attracting interlined passengers to rail than with physical connections alone.[12]

Regional Parameters

Regional parameters here refer to spatial, demographic, employment and growth rate characteristics of metropolitan regions that respond gradually to policy and planning interventions.

Population

Total **population** of the service area is the most basic driver of intercity rail ridership, aside from the quality of service provided.[13] Larger cities and regions generate more trips, because of a larger potential customer base and greater numbers of destinations for visitors and business trips.

Population density is an important determinant of rail ridership; different levels of density account for the variation in ridership between regions of the same population size, but different land development patterns. High residential densities around a train station provide access to greater numbers of potential passengers. Higher densities along transit corridors connecting to a train station also increases the number of people who can access the train station easily. Also, as residential densities increase, car ownership declines; families that own fewer or no cars are more likely to take transit and intercity rail.[14]

By its nodal nature, rail has the tendency to serve and reinforce concentrations of population, employment and commerce, while highways and road networks have the opposite, decentralizing effect. And unlike intercity air travel, rail brings people directly into city center, reinforcing those centers as the primary location for services and activities. The more population, employment, and institutions are located in centers, the greater potential intercity travel market can be served by rail.

Projected population growth is also critical to assessing the potential of a high-speed rail corridor. In regions that are growing quickly, high-speed rail and related regional development strategies have the potential to shape urban growth patterns over the next half century. Many of the Sunbelt cities that grew rapidly around the interstate highway system in the second half of the 20th century are projected to continue to grow at high rates in the coming decades and have the opportunity to redirect future growth to urban cores around rail stations.

Employment and Labor Market

Employment and **employment density** are major generators of ridership for intercity rail systems. The market for high-speed rail, especially for Core Express service in which ticket prices tend to be high, depends heavily on business travel.[15] Rail's competitive advantage over other modes is its ability to link city centers and cover significant distances in a relatively short amount of time. Large central business districts are critical in focusing intercity business travel into areas that are easily accessed by rail. For this reason, while total regional population might have more predictive capacity than total regional employment, the existence of large clusters of centralized employment in central business districts is relatively more important to predicting intercity rail ridership than population density.

The **composition of the labor market** also impacts the potential ridership of new high-speed rail systems. Since knowledge industries require bringing people together for face-to-face communication and knowledge exchange, cities and regions with high levels of knowledge sector employment will benefit the most from introduction of high-speed rail systems.[16] A study of the German rail network and its ridership demonstrated that there is more demand for intercity rail travel in knowledge based economies than in manufacturing economies.[17]

> If a region is already well-served by transit, it will also be better suited for intercity rail travel.

Transit Connections

The presence of local and regional transit systems is critical to intercity ridership for two reasons. First, as mentioned above, transit increases the catchment area of intercity rail, connecting departing passengers to the station and arriving passengers to their destinations around the region, all without the need to park or rent a car. Second, a successful transit network is dependent on the major destinations of a region (employment, government, services, institutions, homes) being concentrated in central business districts (CBDs) accessible by that system.[18] This characteristic will also contribute to the success in attracting intercity rail riders originating and arriving in that region. Thus, if a region is already well-served by transit, it will also be better suited for intercity rail travel.

12 Phone interview with Anthony Perl, Director of Urban Studies Program, Simon Fraser University. 16 March 2010.

13 Harman, Reg. 2006. "High Speed Trains and the Development and Regeneration of Cities." Greengauge 21.

14 Holtzclaw, John W. 2000. "Smart Growth -- As Seen From the Air Convenient Neighborhood, Skip the Car." Paper Presented at the Air & Waste Management Association's 93rd Annual Meeting & Exhibition, Salt Lake City, Utah.

15 Harman, Reg. 2006 "High Speed Trains and the Development and Regeneration of Cities." Greengauge 21.

16 Chen, ChiaLin and Peter Hall. 2009. "The Impacts of High Speed Trains on the British Economic Geography: A Study of the UK's IC125/225 and its Effects" University College London.

17 America 2050 Report. Forthcoming. "The German Experience: Rail Ridership, Population Density, and Labor Markets in Germany." New York: Regional Plan Association.

18 Pushkarev, Boris S., Jeffrey M. Zupan, and Robert S. Cumella, 1982. Urban Rail in America: An Exploration of Criteria for Fixed-Guideway Transit. Bloomington: Indiana University Press.

The importance of regional transit connectivity is evident on the Japanese high-speed rail system, where the Tokaido line of the Shinkansen high-speed railway, connecting Tokyo, Osaka, and Kyoto, carries 150 million passengers a year.[19] In contrast, the volume on the twelve classic passenger rail lines connecting to the Tokaido line was more than double the HSR volumes in the same year, carrying nearly 400 million passengers. Thus by connecting to these feeder networks, the Shinkansen serves as many people as it does, not because 150 million people a year can walk or drive to the train station, but because classic intercity and commuter trains bring those people to the major nodes on the Tokaido line within a couple of minutes of departure for convenient cross platform transfers. This example also serves to illustrate how high-speed rail should be considered the pinnacle of the rail transit network, serving the less-frequent, high value, intercity business and discretionary trips. Annual ridership figures of local transit and commuter rail service are generally several orders of magnitude greater than intercity rail ridership because they occur on a daily basis.

Existing Intercity Travel Markets

Whether there is existing demand for travel between major cities is a good indication of whether there will be demand for high-speed rail service connecting those cities. Given the paucity of national long distance travel data, in this study we studied air travel volumes and highway congestion on intercity routes as proxies to indicate potential demand for intercity services. As will be discussed in Chapter 2, major short-haul air markets in California, the Northeast, Texas, and the Midwest, indicate likely demand for rail in those same corridors.

Existing rail ridership is also a good indication of demand for upgraded services on that corridor. This measure is also limited, however, due to the dearth of existing reliable intercity rail services outside a few select corridors in the Northeast, California, and the Midwest. However, those rail corridors today that show strong and/or growing ridership would likely grow even further with investments to improve reliability, trip times, and frequencies.

Level of Service and Competition

Outside of the Northeast Corridor, the low level of rail ridership in the United States can primarily be attributed to poor levels of service. Few trips per day, lengthy trip times, and frequent delays attract a riding public that is composed mostly of train enthusiasts and people with few other options.

Train service must meet a minimum standard of frequency, trip time, and reliability in the first place to attract any riders at all. Above that standard, attracting riders from other modes, such as air and automobiles is relative to the quality of the competing options in that corridor. Even for longer trips (300–600 miles), private automobiles still capture more travelers than rail[20] because they get drivers to their destination faster and more conveniently. In the Pacific Northwest Rail Corridor, for example, drivers may be tempted to take the train traveling this 187-mile route from Portland to Seattle, but at a trip time of 3 hours and 30 minutes and with only 4 trains per day and delays, the trip does not offer a significant time savings compared to driving and is less reliable. Despite this, ridership on this corridor has more than tripled since the mid-1990s, due to steady, incremental improvements to service led by the state of Washington. Given the infrequency of service, it is not surprising that the vast majority of passengers on this corridor are leisure travelers; [21] business travelers generally require greater scheduling flexibility.

Providing a minimum of 1–2 trains per hour with trip times competitive with auto travel is necessary to capture a significant share of the intercity travel market, as takes place in the successful Northeast Corridor. Above that threshold, factors such as on-time performance, connecting transportation options, comfort, ticket price, booking convenience and flexibility, and amenities, such as wireless internet service, all make a difference in attracting riders.

Recently, curbside buses have proliferated in the Northeast Corridor ,where competitors such as MegaBus and BoltBus have succeeded in attracting riders new to public transit because of selling points like low fares, free wireless internet, and frequent service (up to every half hour) between major Northeastern cities. What the buses do not offer is speed or reliability, as they primarily travel the highly congested Interstate-95. The success of the buses in the Northeast demonstrates that the potential market for intercity transit services is much greater than those who currently ride the rails, particularly if the price and amenities are right.

Other factors that influence how many people chose rail are the relative appeal and cost of other options. Factors such as high gas prices, highway tolls, highway congestion, airport security, airport delays, and lower rates of auto ownership could all push people to passenger rail. In regions with low levels of highway congestion, on-time air travel, and low gas prices, rail may not be particularly attractive, particularly for trips under 200 miles.

Summary

These regional parameters form the basis of our detailed analysis of corridors by megaregion described in the following chapter. It bears noting that given the diversity of spatial development patterns in the United States, any national model will prejudice certain types of regions over others. Research of existing high-speed rail systems around the world suggests that densely developed cities and regions with transit networks and intercity travel markets generate the greatest ridership demand. However, a counterpoint is that high-speed rail that connects to airports and park-and-ride facilities is just as effective in attracting riders in auto-oriented regions. While we have not seen evidence of this in European case studies, such a model has not yet been attempted in the United States. Regardless of what parameters are weighted most heavily in the model in use, the advantage of the approach presented in this paper is that the weighting and choice of inputs is completely transparent, allowing critical evaluation of whether the investment choices match the intent of public policies.

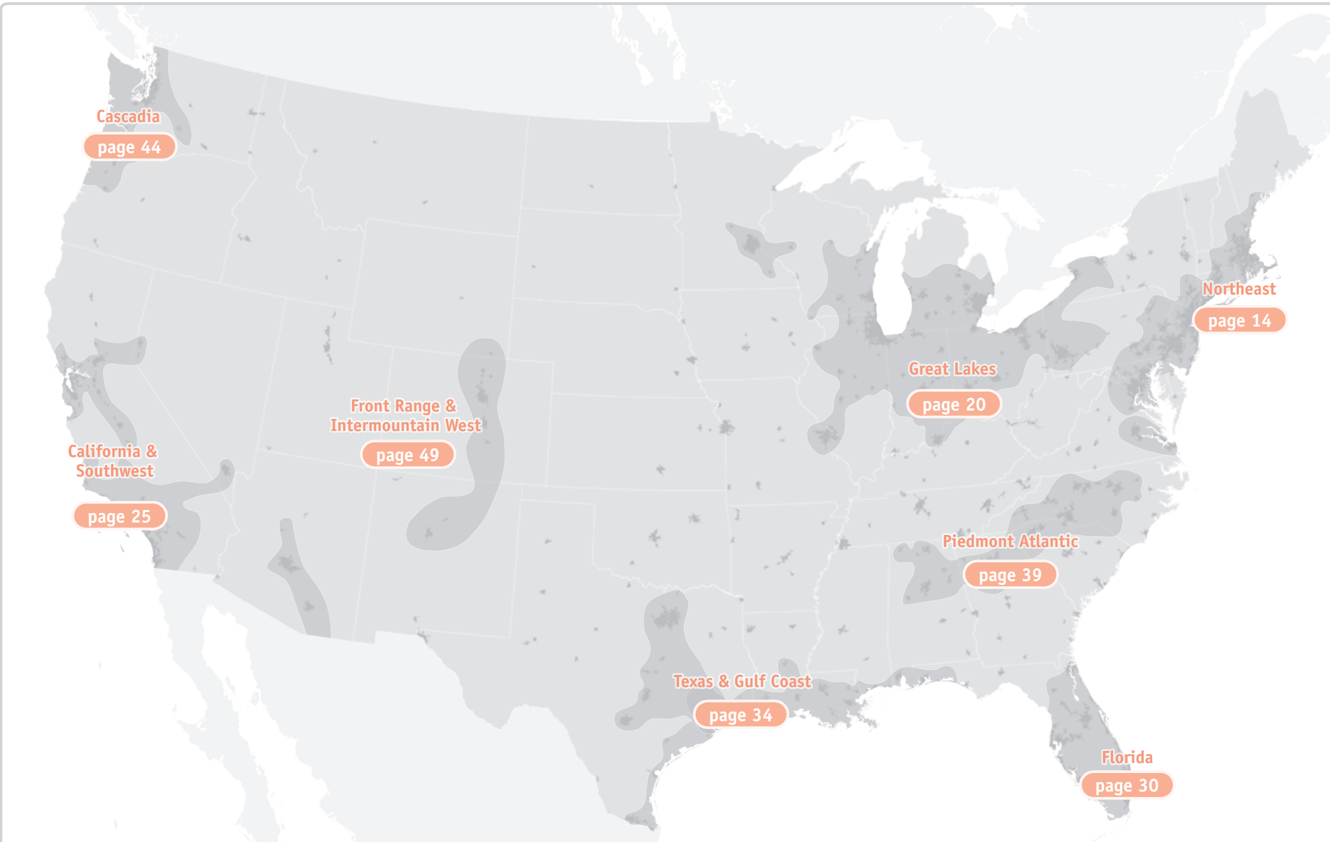
19 Central Japan Railway Company. 2008. Annual Report.

20 According to the American Travel Survey, private automobiles accounted for 91 percent of trips 300 – 499 miles and 76 percent of trips 500 – 999 miles. U.S. Department of Transportation Bureau of Transportation Statistics. "1995 American Travel Survey." p. 3.

21 Washington State Department of Transportation. 2006. "Amtrak Cascades Ridership and Revenue Forecasts Technical Report." Vol. 5 P. 4–1.

CHAPTER 2

Regional Profiles of Rail Corridors



Introduction

In this section we measure existing and proposed rail corridors across the country against the parameters described in the previous section. The chapter groups the rail corridors by megaregion, with the assumption that in each U.S. megaregion there is at least one promising rail corridor worthy of improvement, if not several.

Megaregions are large networks of proximate metropolitan regions linked by business travel, commuting patterns, infrastructure, and large natural systems. Encompassing networks or chains of cities and regions of 100 to 600 miles in length, megaregions match the scale of high-speed rail investments around the world.[22] Many of the current planning efforts and funded high-speed rail programs in California, the Midwest, Florida, Texas, and the Northeast match the megaregion scale and the commuting patterns and business travel that take place there.

While Amtrak's existing long distance rail corridors will continue to play an important role in connecting the nation, our research focuses on the most promising rail corridors for attracting ridership, which are generally less than 600 miles in length and confined to the nation's megaregions, where 70 percent of the nation's population resides.

22 For a full explanation of megaregions refer to Hagler, Yoav. 2009. "Defining U.S. Megaregions." New York: America 2050/ Regional Plan Association..

The Northeast

The megaregion receiving the highest scores in this study for ridership demand is also the region with largest volumes of intercity passenger rail ridership in the nation on Amtrak's Northeast Corridor, connecting Boston, New York, and Washington, DC. Rail service has thrived in the Northeast Corridor not just because of the list of regional characteristics described below, such as population density and transit connections, but because the Northeast Corridor is entirely publicly owned, allowing prioritization of passenger service and minimization of freight transportation on this heavily traveled passenger corridor.

Public ownership is not without its drawbacks however, and since the majority of Northeast Corridor was transferred in 1971 to the newly created Amtrak by the federal government, Amtrak has struggled to obtain sufficient funds to maintain the corridor in a state of good repair, let alone make capital investments to improve trip times and reliability. Perhaps inspired by more ambitious rail planning efforts elsewhere in the country like California, two recent proposals for HSR Core Express service in the Northeast Corridor by a University of Pennsylvania team and Amtrak, respectively, propose connecting New York to Washington in 90 minutes and New York to Boston in 105 minutes at the cost of $5-7 billion a year for 20 years.[23] If any region in the country has the ridership demand to justify such an investment, it is the Northeast.

Population and Employment

The Northeast Megaregion is characterized by a series of dense urban centers stretching from Boston to Washington, DC. At the geographic center of the megaregion, New York City is also the megaregion's population and economic hub. New York leads the nation in both population and employment at all three geographic scales considered in this study (2-mile, 10-mile and 25-mile zones around the major intercity train station, in this case Penn Station). Density near center city train stations is particularly high in the Northeast relative to other regions in the country. Seven northeastern cities are among the top ten nationwide for population in the two-mile zone.

TABLE 5

Population Profile for Major Cities in Northeast Megaregion

	2 mi.		10 mi.		25 mi.		Projected 2040 Growth
	Pop.	Rank	Pop.	Rank	Pop.	Rank	
New York	520,000	1	7,300,000	1	14,000,000	1	13%
Philadelphia	220,000	3	2,100,000	4	4,600,000	4	13%
Washington	140,000	8	1,900,000	5	4,500,000	6	29%
Boston	170,000	5	1,700,000	6	3,400,000	12	13%
Baltimore	170,000	4	1,300,000	15	2,500,000	20	35%
Hartford	120,000	10	700,000	38	1,700,000	37	17%
Providence	100,000	16	600,000	48	1,700,000	36	14%

Source: America 2050 analysis of 2000 U.S. Census and 2010 Woods and Poole Economics

TABLE 6

Employment Profile for Major Cities in Northeast Megaregion

	2 mi.		10 mi.		25 mi.		Projected 2040 Growth
	Empl.	Rank	Empl.	Rank	Empl.	Rank	
New York	1,670,000	1	3,700,000	1	6,300,000	1	23%
Philadelphia	230,000	9	1,000,000	9	3,100,000	3	36%
Washington	300,000	6	,200,000	5	3,000,000	5	47%
Boston	450,000	4	100,000	7	2,400,000	10	26%
Baltimore	150,000	13	600,000	21	1,600,000	20	42%
Hartford	80,000	31	300,000	52	900,000	51	32%
Providence	120,000	18	500,000	24	1,300,000	25	33%

Source: America 2050 analysis of 2007 Bureau of Economic Analysis and 2010 Woods and Poole Economics

TABLE 7

Population and Employment for Toronto and Montreal

	Population		Employment	
	10 Mile Equivalent	25 Mile Equivalent	10 Mile Equivalent	25 Mile Equivalent
Toronto	2,500,000	5,100,000	1,300,000	2,600,000
Montréal	2,000,000	3,600,000	1,200,000	1,800,000

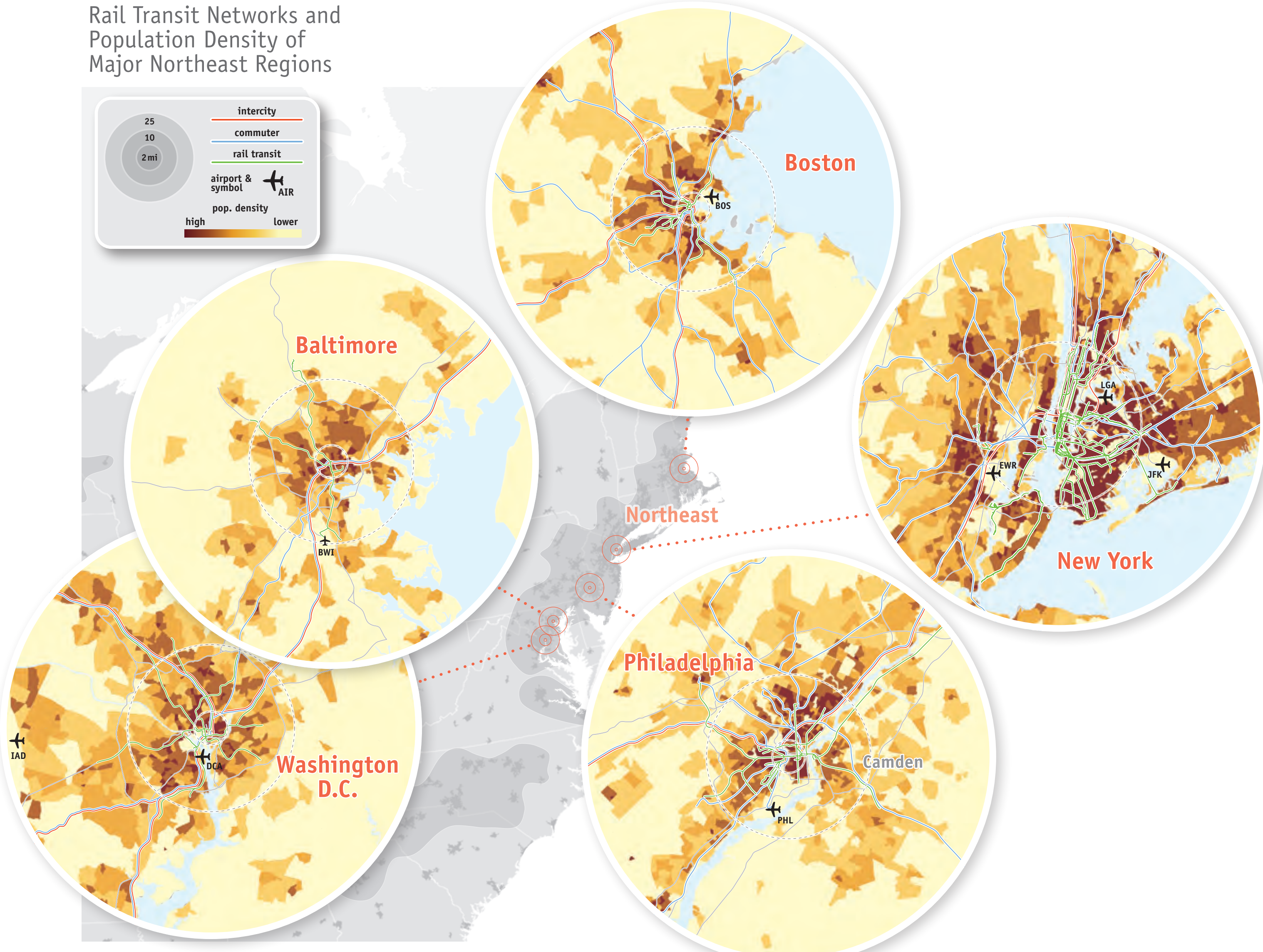
Source: Statistics Canada

The Northeast also has dense central business districts that are made possible by regional and local transit services. Employment near central train stations, as well as at the city (10-mile zone) and metro (25-mile zone) is high compared to other regions in the nation. The major northeastern cities also have high levels of knowledge workers,[24] specifically in the three major metropolitan areas of New York, Boston, and Washington, DC that help drive demand for business travel. The four major metro regions in the Northeast – Boston, New York, Philadelphia, and Washington, DC – all rank in the top ten in total number of knowledge workers, and Boston and Washington, DC also rank in the top ten in percentage of workforce in knowledge industries, with 34 percent

23 See: University of Pennsylvania School of Design, 2010, "Making High-Speed Rail Work in the Northeast Megaregion," Studio Final Report, and Amtrak, 2010, "A Vision for High-Speed Rail in the Northeast Corridor."

24 Knowledge Worker or Creative Class, used here interchangeably, are defined by the USDA here: http://www.ers.usda.gov/Data/CreativeClassCodes/methods.htm

Rail Transit Networks and Population Density of Major Northeast Regions



and 38 percent respectively. The average share of metropolitan workforce in knowledge industries is 26 percent. Six of the seven cities listed in TAble 6 have higher than average shares of knowledge workers in their metropolitan areas.

Despite this generally favorable profile for intercity rail, the cities and metro regions in the Northeast, with the exception of greater Washington, DC, tend to have slower projected growth rates as compared to metro regions in the South and West, providing fewer opportunities for rail investments to shape future growth patterns in these already densely developed regions. Nonetheless, the Northeast Megaregion is projected to add 18 million additional people by 2050, creating the opportunity to attract a large number of new jobs and residents to places served by expanded high-speed rail and connecting regional rail services.

The two largest Canadian cities of Toronto and Montreal, although not included in the analysis, are relevant as we think about developing high-speed rail corridors in the Northeast and the northern Midwest. The 10-mile and 25-mile populations for these two cities are estimated using coarser geographic boundaries than are available in the United States, however provide rough estimates of population and employ-

TABLE 8

Transit Accessibility and Ridership by Region

	within Transit Accessible Zone				Avg. Weekday Ridership (Q4 2009)
	Population	%	Jobs	%	
New York	7,300,000	52	3,390,000	54	8,418,333
Philadelphia	1,280,000	28	680,000	22	532,133
Washington	1,140,000	26	1,060,000	35	935,200
Boston	950,000	28	640,000	27	846,800
Baltimore	370,000	15	250,000	15	116,867

Source: America 2050 analysis and APTA 2009 Fact Book

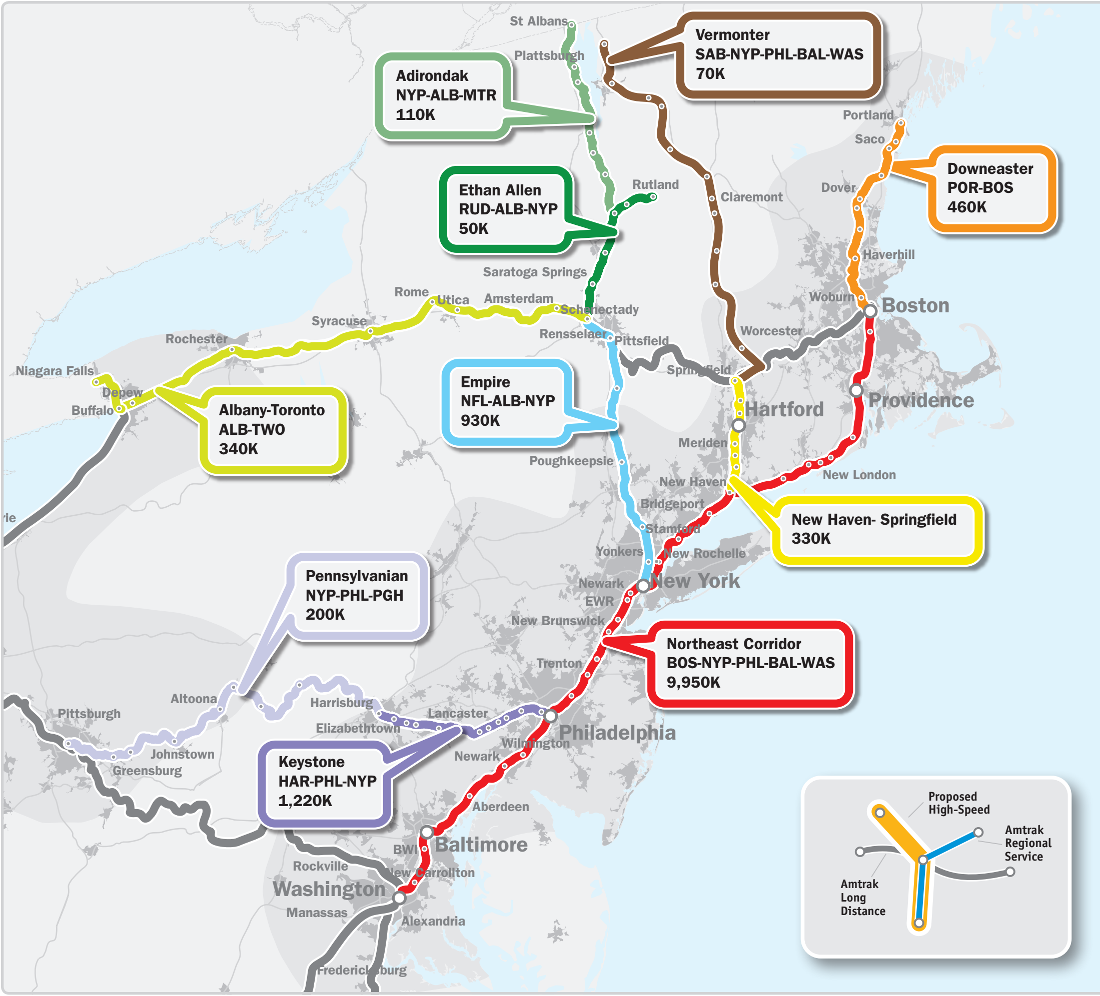
TABLE 9

Reach of Commuter Rail Network

	Within 2 Miles of Commuter Rail Station	
	Population	Jobs
New York	13,980,000	5,460,000
Philadelphia	3,750,000	1,370,000
Boston	3,610,000	1,370,000
Washington	2,330,000	1,310,000
Baltimore	700,000	440,000
Providence	460,000	330,000

Source: America 2050 analysis

Passenger Rail Service in the Northeast Megaregion



Source: Amtrak ridership data FY 2009

ment in these zones.[25] Toronto, if included, would be the second largest city in the Northeast behind New York City, while Montreal is similar in size to Philadelphia and Washington, DC.

The Northeast leads the nation in transit connectivity. The five largest cities in the Northeast megaregion account for 80 percent of the total rail transit ridership (subway and light rail) in the nation. These metro regions also top the list in people living near transit. In the 25-mile region around New York City, more than 7 million people live and more than 3 million people work within a ½ –1 mile radius of a rail transit station. Philadelphia, Boston, and Washington, DC have between 25 to 30 percent of their population and 20 to 35 percent of their employment near local transit systems.

These cities also have among the highest commuter rail ridership in the country and the most population and jobs located within 2 miles of commuter rail stations. All of the major cities on the corridor have regular commuter rail service. These systems combine to carry more than 300 million passengers in 2009 or 75 percent of the nation's total commuter rail volume.

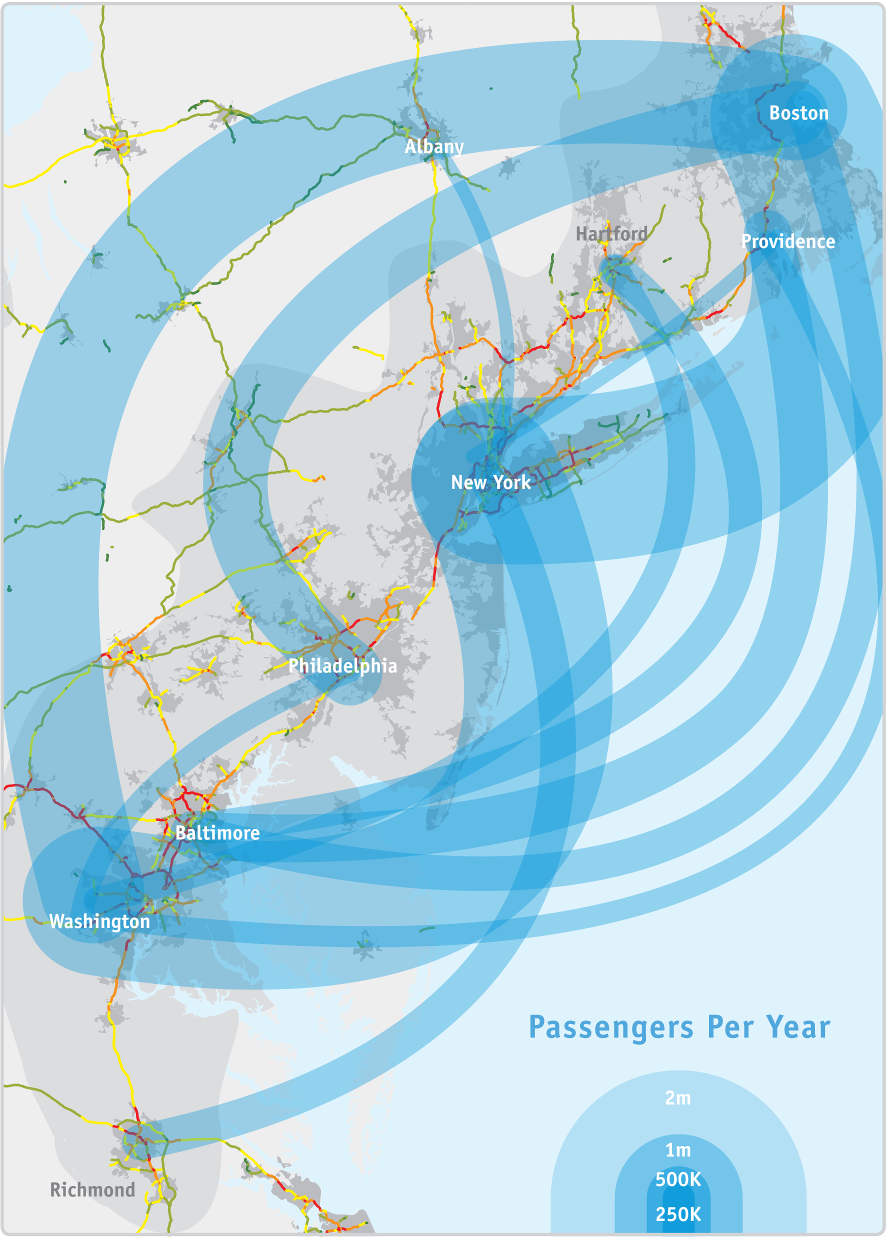
Rail Service

The current intercity rail service in the Northeast is the most developed and extensive in the nation. Ridership on the mainline Northeast Corridor was 9.9 million in 2009, accounting for more than one-third of Amtrak's total national ridership. The Keystone, Empire, and New England branch lines carried 3 million additional annual riders , while connecting western Pennsylvania, upstate New York, and communities in New England to the mainline corridor.

Unlike most of the national network on which Amtrak operates, the entire Northeast Corridor is under public ownership, the majority of which is owned by Amtrak itself. The major challenges facing the Northeast Corridor are capacity constraints and the need to bring the existing infrastructure

25 The 10-mile population is estimated using Census Sub Divisions (CSDs). For Montreal the following CSDs were used: Montréal, Laval, Longueui; for Toronto only the Toronto CSD was used. The 25-mile estimate is the Census Metropolitan Area for both Toronto and Montreal. All data taken from Statistics Canada. http://www.statcan.gc.ca.

Regional Air Market and Road Congestion in the Northeast



Source: Federal Aviation Administration 2009

TABLE 10

Annual Passengers Originating in and Destined to Airports within the Northeast

New York	2,900,000
Boston	2,800,000
Washington	2,500,000
Philadelphia	1,300,000
Baltimore	1,200,000
Providence	1,000,000
Hartford	700,000

Source: America 2050 analysis of FAA 2009

TABLE 11

Regional Air Markets in the Northeast

	Annual Passengers
New York to Boston	1,303,451
New York to Washington	1,160,211
Washington to Boston	809,528
Baltimore to Providence	373,330
Richmond to New York	278,650
Baltimore to Boston	270,672
Hartford to Baltimore	260,116
Hartford to Washington	214,899
Washington to Philadelphia	176,203
Providence to Washington	165,209
New York to Providence	112,433
Albany to New York	102,626

Source: America 2050 analysis of FAA 2009

TABLE 12

Average Delay Major Northeast Airports in 2007 (in Minutes)

Airport	Minutes	National Rank
New York Kennedy	23.5	1
Newark	23.0	2
New York LaGuardia	20.3	3
Philadelphia	16.8	4
Boston	12.2	7
Washington Dulles	10.7	9
Baltimore-Washington	9.0	19
Washington National	7.7	29

Source: America 2050 analysis of FAA 2009

to a state of good repair at a cost of $8.8 billion.[26] Although ambitious trip time goals were set decades ago, inconsistent and inadequate funding has meant that the Metroliner and later Acela programs have never lived up to expectations. Today, Amtrak service on the corridor represents the only example of high-speed rail in the United States, achieving a top speed of 150 miles per hour. However, the average speeds, and thus trip times, between the major cities on the corridor fall well short of European and Asian counterparts.

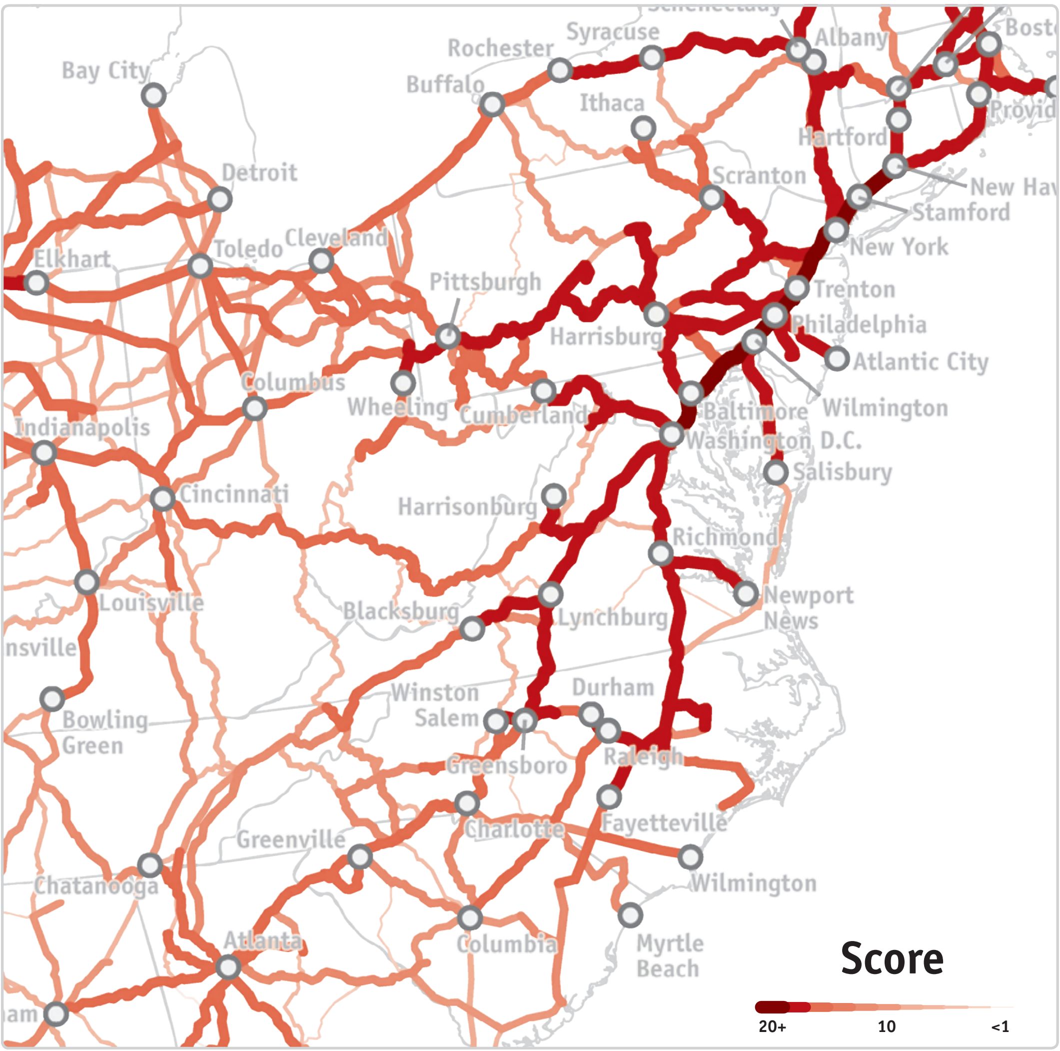
Congestion and Travel Market

Although Amtrak currently captures nearly two-thirds of the rail/air market starting and ending in New York and Washington, DC, airlines still carry more than 1 million annual passengers on this route, which includes interlined travelers connecting to their final destinations. New York is also the top domestic destination for flights of less than 600 miles from Toronto and Montréal, with 700,000 and 300,000 annual passengers respectively.

Many of the nation's most congested airports are located in the Northeast Megaregion. The three major airports in the New York metropolitan area have an average on time arrival performance of 68 percent, the worst of any major metropolitan area. Other airports in the Northeast are also among the nation's worst performers, such as Philadelphia with 74 percent and Boston with 76 percent of air trips arriving on time.

26 The Northeast Corridor Infrastructure Master Plan. 2010. Prepared by the NEC Master Plan Working Group. P. 9.

Scoring of Corridors in the Northeast Megaregion



Source: America 2050

TABLE 13

Scoring of Corridors in the Northeast Megaregion

Origin	Destinations	Length	Score	Total Employment Within 2 Miles of Major Nodes	Total Population within 25 Miles of Major Nodes	Cumulative Air Market*	Total Transit Accessible Population in Major Nodes
Washington DC	New York NY	224	20.15	2,400,000	26,200,000	2,060,000	10,100,000
Boston MA	New York NY	231	19.87	2,400,000	21,800,000	1,430,000	8,200,000
New York NY	Philadelphia PA	91	19.86	1,900,000	19,700,000	190,000	8,600,000
Washington DC	Boston MA	455	19.81	3,100,000	34,000,000	5,790,000	11,100,000
Albany NY	New York NY	145	19.29	1,700,000	15,400,000	100,000	7,300,000
Baltimore MD	Philadelphia PA	95	19.04	400,000	7,200,000	120,000	1,600,000
New York NY	Springfield MA	137	19.00	2,000,000	18,100,000	80,000	7,300,000
Washington DC	Richmond VA	110	18.31	300,000	5,400,000	50,000	1,100,000
Harrisburg PA	Philadelphia PA	103	18.07	400,000	6,200,000	60,000	1,300,000
New York NY	Cleveland OH	572	17.70	2,300,000	25,400,000	1,670,000	9,000,000
Buffalo NY	New York NY	439	17.56	1,900,000	18,200,000	1,270,000	7,400,000
Portland ME	Boston MA	119	16.14	500,000	3,800,000	-	900,000
Boston MA	Albany NY	202	15.65	600,000	6,400,000	10,000	900,000
Pittsburgh PA	Philadelphia PA	347	14.84	500,000	8,500,000	430,000	1,400,000
Washington DC	Pittsburgh PA	299	14.74	500,000	6,800,000	170,000	1,300,000
New Haven CT	Springfield MA	62	12.07	300,000	3,200,000	-	-
New Haven CT	Essex Junction VT	290	7.47	300,000	3,500,000	-	-

*America 2050; Includes annual flights among all airports located along the corridor.

The Northeast Megaregion's roads are also choked with congestion. Interstate-95, the primary intercity route that parallels the Northeast Corridor, is one of the most consistently congested interstates in the nation. Fifty-seven percent of the highway between New York and Washington, DC operates at over 75 percent of the design capacity during the peak hour, causing major delays, especially in the major urban areas. This congestion is even higher on the northern half of the corridor with 69 percent of the highways operating at over 75 percent of the design capacity.[27]

Scoring of Corridors

The Northeast Megaregion has many of the rail corridors with the highest scores in our ranking system in the country. The multiple dense urban centers present an ideal landscape for high-speed rail implementation. There is great variation on the quality of the corridors within the megaregion. The mainline Northeast Corridor, between Boston and Washington, DC (and sub-corridors along this route) scores the highest. The New York-Washington, DC corridor is the only corridor in the nation that received a score of above 20.

The highest performing corridor in the Northeast off of the mainline is the Empire Corridor between New York City and Albany. With a score of above 19, it scores above most other corridors around the country in our rankings and provides key linkages between New York City and its state capital. Currently, these two cities represent the 5th highest ridership for any city pair in the Amtrak system, and the highest off the Northeast Corridor. The corridor scores dips when the entire Empire corridor is considered from New York City to Buffalo. This reflects the fact that with the additional 300 miles, no additional major metro area is added to the corridor. However, the addition of several mid-sized metros – Utica, Syracuse, Rochester – keeps the score above 17, not in the top tier of corridors, but still competitive with many nationwide.

Several other corridors in the Northeast rank high, including the extension of the Northeast Corridor south to Richmond and Philadelphia to Harrisburg. The farther extension across the state of Pennsylvania to Pittsburgh does not perform as well due to the relatively long distance and lack of any major population centers across the state.

Two corridors running north from New Haven, Connecticut performed poorly in this analysis. The first, a short corridor running from New Haven to Springfield, Massachusetts suffered from the lack of a major metropolitan center like New York, and in isolation would not be a preferred HSR corridor. However, when considered as a piece of the potential inland route between New York and Boston, this piece could add to the ridership between these two major metropolitan areas with three mid-sized cities (the New York-Springfield corridor scored 19). The extension of this corridor north from Springfield though Vermont does not pass through any population centers and is likely not to attract the ridership necessary to sustain frequent high-speed service.

27 Highway volume data were obtained from the Federal Highway Administration and was prepared as part of their Freight Analysis Framework. Road capacity was estimated by FHWA using highway capacity manual 2000 methodology.

The Great Lakes Megaregion

Population and Employment

Unlike the Northeast, where all the major urban centers lie on a single corridor, the cities of the Great Lakes Megaregion are more dispersed in a "hub and spoke" network. At the geographic and economic center of this network is Chicago. Behind only New York, Chicago has the second densest business district in the nation with more than a half million jobs within two miles of Union Station. The Great Lakes Megaregion has four of the top 25 cities in population (10-mile ring), including Chicago, Detroit, Minneapolis, and Milwaukee.

Beyond the major cities, the Great Lakes Megaregion has dozens of population centers within 400 miles of Chicago. This geography is well suited to making connections between the classic passenger rail network and strategic investments in Core Express service. However, unlike fast growing regions in the South and West, most of the cities in this region are projecting stagnant or slow growth. To the extent the Great Lakes regions are growing, most of the growth is taking place beyond the 10-mile city center. Rail investments in the Midwest should be designed to help redirect regional growth to the city centers to the extent possible. A notable exception is Minneapolis, which is projecting 15 percent population growth in its ten-mile zone and 33 percent in its 25-mile zone over the next 30 years.

Transit Connectivity

With the exception of Chicago, which has a robust local and regional transit system, Midwestern cities tend to have lower transit connectivity than either the major urban centers in the Northeast with heavy rail systems or southern and western cities that are building and expanding new light rail networks. Of the ten Great Lakes cities listed in Tables 13 and 14, only five have rail transit systems. Chicago, with by far the most extensive system, has 30 percent of its population and nearly 40 percent of it jobs in its 25-mile zone within transit accessibility. In Minneapolis, only 4 percent of the population and 12 percent of the employment are transit accessible. Three other cities in the megaregion, St. Louis, Pittsburgh, and Cleveland, have small light rail systems that add some limited connectivity value to an intercity passenger rail network.

A half million jobs lie within two miles of Chicago's Union Station.

TABLE 14

Population Profile for Major Cities in Great Lakes Megaregion

	2 mi.		10 mi.		25 mi.		Projected 2040 Growth
	Pop.	Rank	Pop.	Rank	Pop.	Rank	
Chicago	140,000	7	2,680,000	3	5,800,000	3	9%
Detroit	70,000	42	1,340,000	13	3,600,000	10	1%
Minneapolis	110,000	13	1,200,000	16	2,700,000	16	33%
Saint Louis	50,000	115	820,000	30	2,200,000	24	10%
Cleveland	20,000	255	860,000	28	1,900,000	28	-3%
Pittsburgh	70,000	32	900,000	27	1,800,000	32	4%
Cincinnati	60,000	64	820,000	31	1,800,000	33	20%
Kansas City	40,000	152	760,000	32	1,700,000	35	39%
Milwaukee	100,000	18	920,000	24	1,600,000	40	14%
Indianapolis	50,000	107	760,000	33	1,500,000	41	37%

Source: America 2050 analysis of 2000 U.S. Census and 2010 Woods and Poole Economics

TABLE 15

Employment Profile for Major Cities in Great Lakes Megaregion

	2 mi.		10 mi.		25 mi.		Projected 2040 Growth
	Empl.	Rank	Empl.	Rank	Empl.	Rank	
Chicago	550,000	3	1,220,000	6	3,000,000	4	24%
Milwaukee	240,000	8	840,000	13	1,300,000	27	22%
Minneapolis	190,000	11	1,000,000	10	1,700,000	19	34%
Pittsburgh	150,000	12	570,000	23	1,000,000	40	31%
Saint Louis	110,000	19	450,000	32	1,100,000	35	29%
Kansas City	100,000	21	430,000	39	1,000,000	42	44%
Cleveland	90,000	25	500,000	28	1,300,000	24	24%
Indianapolis	90,000	26	440,000	37	900,000	47	43%
Cincinnati	70,000	37	440,000	35	900,000	46	33%
Detroit	50,000	61	440,000	38	2,100,000	11	20%

Source: America 2050 analysis of 2007 Bureau of Economic Analysis and 2010 Woods and Poole Economics

Chicago has the only commuter rail network in the Great Lakes Megaregion. It carries 70 million passengers annually, second only to New York. Within 25 miles from downtown Chicago there are 7 million inhabitants and nearly 3 million jobs located within 2 miles of a commuter rail station.

Rail Transit Networks and Population Density of Major Great Lakes Regions

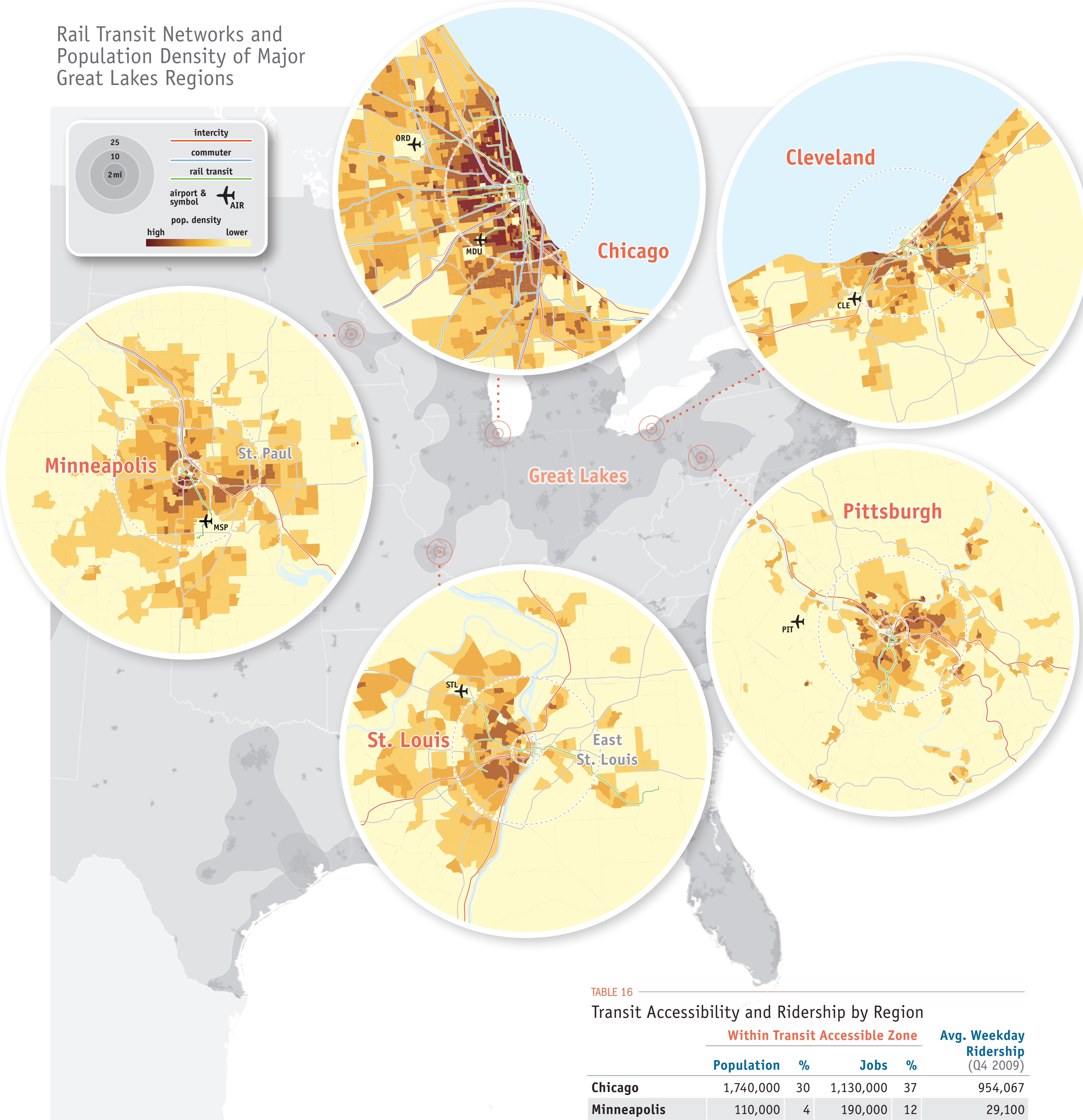


TABLE 16

Transit Accessibility and Ridership by Region

	Within Transit Accessible Zone				Avg. Weekday Ridership (Q4 2009)
	Population	%	Jobs	%	
Chicago	1,740,000	30	1,130,000	37	954,067
Minneapolis	110,000	4	190,000	12	29,100
Saint Louis	280,000	13	310,000	27	60,100
Cleveland	240,000	13	120,000	9	N/A
Pittsburgh	170,000	9	50,000	5	27,100

Source: America 2050 analysis and APTA 2009 Fact Book

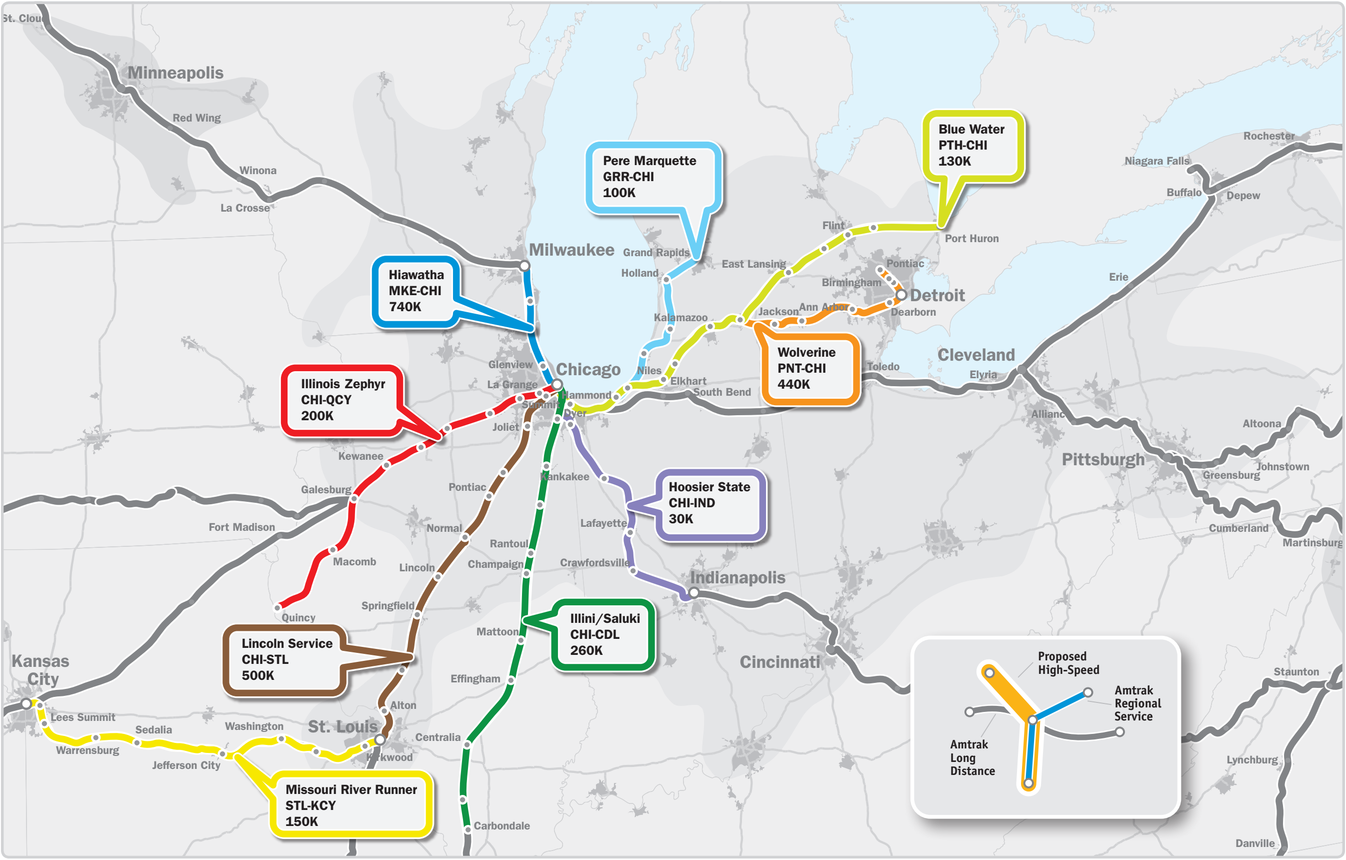
TABLE 17

Reach of Commuter Rail Network in Midwest

	Within 2 Miles of Commuter Rail Station	
	Population	Jobs
Chicago	7,300,000	2,700,000

Source: America 2050 analysis

Current Passenger Rail Service in the Great Lakes Megaregion



Source: Amtrak ridership data FY 2009

Rail Service

The Chicago to Milwaukee corridor is the largest intercity rail market in the Midwest, serving approximately 740,000 riders in 2009. After that relatively large market, the Lincoln service, connecting Chicago to St. Louis carried 500,000 people in 2009, followed by the Wolverine service connecting Chicago to Detroit with an annual ridership of 440,000.

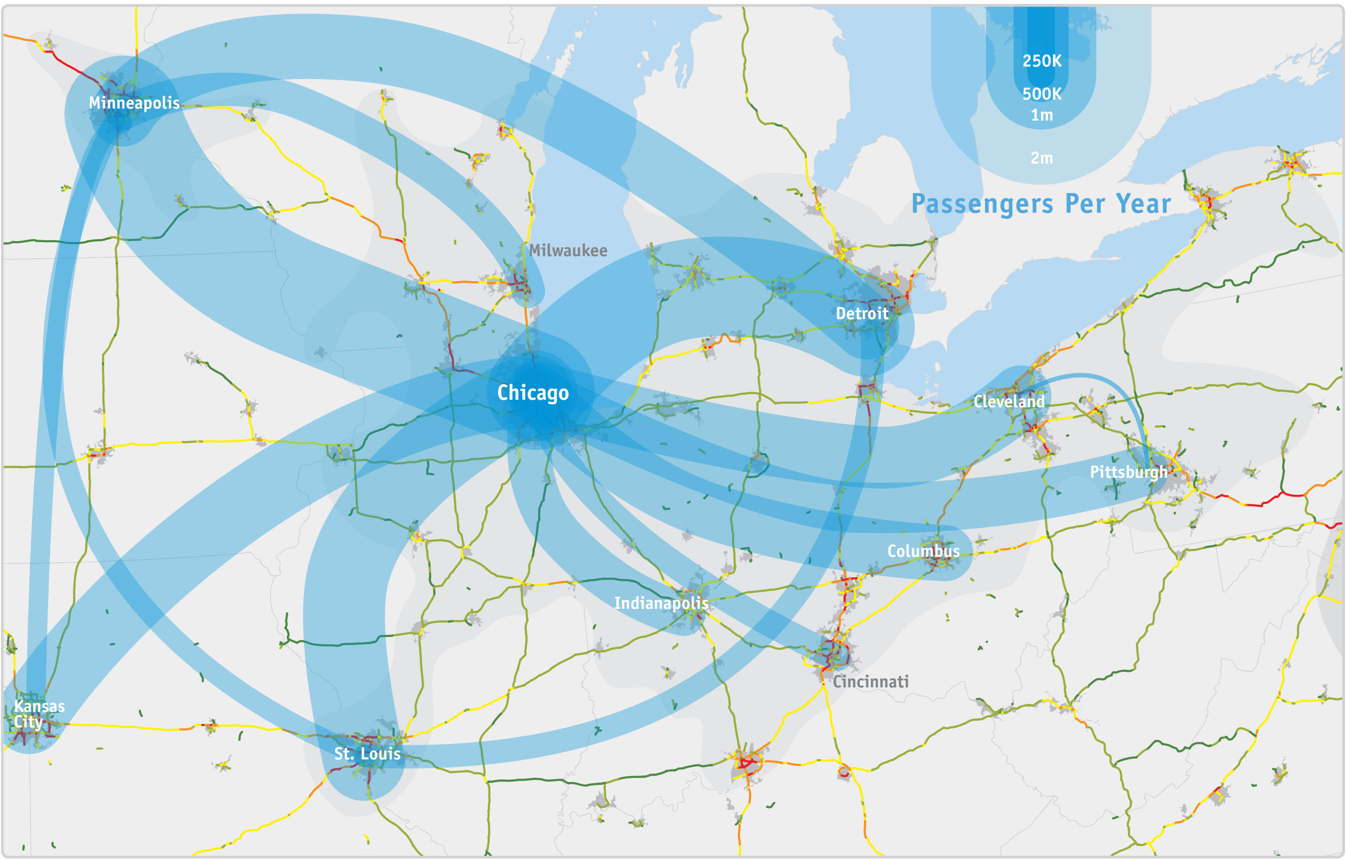
Plans to upgrade passenger rail system in the Midwest have recently gained momentum after making modest improvements over the last decade. The Midwest Interstate Passenger Rail Commission is an official collaboration between state transportation officials pursuing incremental improvements to the passenger rail network in the megaregion. In January 2010, the FRA awarded $2.6 billion to states in the Midwest to begin incremental improvements to current rail service, including major work on two primary corridors, Chicago-St. Louis and Chicago-Minneapolis.

The regional air market between Chicago and the secondary cities in the Great Lakes megaregion is fairly robust, with more than seven markets serving more than 500,000 passengers a year. The largest single air market among these ten cities is Chicago-Minneapolis, with more than one million annual trips (Table 19). Two other regional air markets, Chicago-Detroit and Chicago-St. Louis are among the top 25 air markets less than 600 miles.

While auto congestion plagues many Midwestern metropolitan regions, the relatively long distances between the cities in this megaregion means that the share of congested roadway between the cities is lower than in other megaregions across the country. There is highway congestion on some of the shorter intercity corridors, such as Chicago-Milwaukee, however, with only 32 percent of the highway between these two cities operating at over 75 percent of design capacity during the peak hour, congestion is less significant than in other regions, such as California and the Northeast.

Plans to upgrade passenger rail system in the Midwest have recently gained momentum after making modest improvements over the last decade.

Regional Air Market and Road Congestion in Great Lakes Megaregion



Source: Federal Aviation Administration 2009

TABLE 18

Annual Passengers Originating in and Destined to Airports within the Midwest

Chicago	5,200,000
Minneapolis	2,700,000
Detroit	2,600,000
St. Louis	1,600,000
Kansas City	1,300,000
Cleveland	1,100,000
Indianapolis	1,000,000
Milwaukee	1,000,000
Cincinnati	900,000
Pittsburgh	800,000

Source: America 2050 analysis of FAA 2009

TABLE 19

Regional Air Markets in the Midwest

	Annual Passengers
Chicago to Minneapolis	1,058,393
Chicago to Detroit	901,196
Chicago to Saint Louis	743,985
Kansas City to Chicago	649,003
Detroit to Minneapolis	592,821
Chicago to Cleveland	560,275
Chicago to Columbus	508,940
Chicago to Pittsburgh	457,209
Indianapolis to Chicago	401,594
Milwaukee to Minneapolis	302,970
Cincinnati to Chicago	239,984
Detroit to Saint Louis	212,122
Saint Louis to Minneapolis	186,313
Kansas City to Minneapolis	177,838
Pittsburgh to Cleveland	40,992

Source: America 2050 analysis of FAA 2009

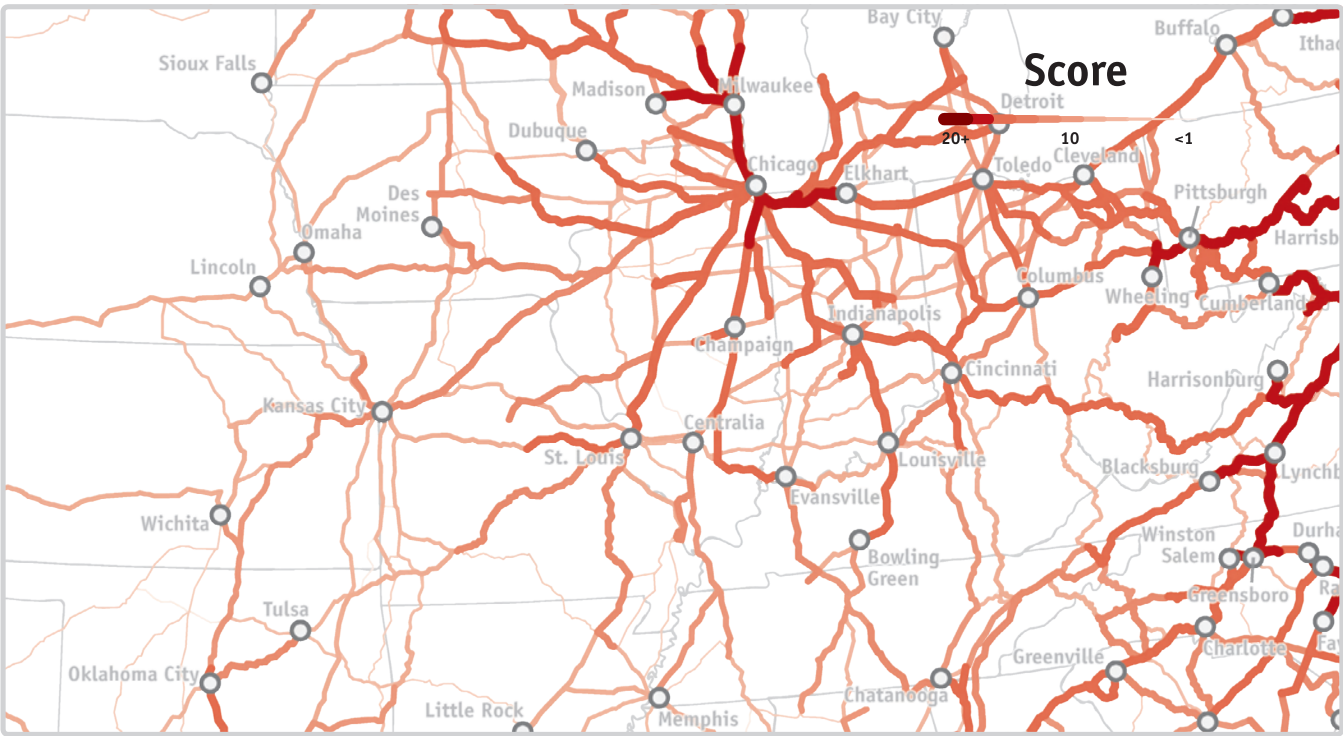
TABLE 20

Average Delay Major Midwestern Airports in 2007 (in Minutes)

Airport	Minutes	National Rank
Chicago O'Hare	13.9	6
Chicago Midway	10.5	10
Minneapolis	10.4	11
Detroit	9.5	16
Pittsburgh	8.7	22
Cleveland	8.3	24
Cincinnati	7.9	26
St. Louis	7.1	31

Source: FAA 2009

Scoring of Corridors in the Great Lakes Megaregion



Source: America 2050

TABLE 21

Scoring of Corridors in the Great Lakes Megaregion

Origin	Destinations	Length	Score	Total Employment Within 2 Miles of Major Nodes	Total Population within 25 Miles of Major Nodes	Cumulative Air Market*	Total Transit Accessible Population in Major Nodes
Chicago IL	Milwaukee WI	86	19.38	810,000	7,900,000	150,000	1,740,000
Chicago IL	Indianapolis IN	197	17.38	660,000	7,600,000	400,000	1,740,000
Chicago IL	Detroit MI	281	16.80	690,000	11,800,000	1,030,000	1,740,000
Chicago IL	Cincinnati OH	320	16.40	730,000	9,400,000	710,000	1,740,000
Chicago IL	Saint Louis MO	282	16.19	700,000	8,400,000	860,000	2,020,000
Chicago IL	Minneapolis MN	423	16.66	1,010,000	10,800,000	1,620,000	1,840,000
Chicago IL	Pittsburgh PA	472	13.97	830,000	9,300,000	580,000	1,900,000
Cleveland OH	Pittsburgh PA	138	13.27	240,000	3,600,000	40,000	410,000
Madison WI	Milwaukee WI	82	13.11	280,000	2,100,000	40,000	-
Chicago IL	Omaha NE	499	11.19	590,000	6,600,000	430,000	1,740,000
Cleveland OH	Cincinnati OH	256	11.21	250,000	4,800,000	130,000	240,000
Chicago IL	Memphis TN	531	10.79	620,000	7,400,000	250,000	1,740,000
Kansas City MO	Saint Louis MO	278	9.62	210,000	4,000,000	120,000	280,000

*Includes annual flights among all airports located along the corridor.

Top Corridors

All the major corridors in the Great Lakes Megaregion have Chicago as a major end point. As more of these corridors develop and improve service, Chicago will transform from a terminal to a hub, adding value to the entire network. Our study ranks the Chicago-Milwaukee corridor as the top corridor in the megaregion. Currently the top performing city pair in the Amtrak network outside of the Northeast, this corridor ranks among the top nationwide, with a score above 19.

Four other corridors emanating from Chicago, all with scores between 16.5 an 17.5 are in the second tier nationwide and are strong candidates for HSR Regional, including Detroit, Cincinnati (via Indianapolis), St. Louis, and Minneapolis. Although all four corridors score in the same range, the Chicago-Minneapolis corridor may have the edge, because of the larger air market and the strength of ridership on the Milwaukee-Chicago section of the corridor.

Corridors in the Midwest that do not include Chicago do not obtain scores that suggest viability of HSR Core Express, such as the St. Louis-Kansas City corridor, Cleveland-Pittsburgh corridor and the “3C’s” corridor in Ohio connecting Cleveland, Columbus, and Cincinnati, though they are certainly suitable for improved passenger rail service.

California and the Southwest

Population and Employment

California and the Southwest, including the Arizona Sun Corridor, have some of the largest and fastest growing regions in the nation. These regions account for eight of the top thirty populations within the 25-mile zone (Table 22) and six of the ten metropolitan regions listed in Table 22 have projected growth rates of over 45 percent, some of the highest growth rates in the nation over the next thirty years. On the whole, the metro regions of California and the Southwest are large, with above average growth rates and moderate to high population density.

However, these regions vary greatly in their density, total population, and employment. Nearly every city typology can be found in California and the Southwest. Los Angeles, the nation's second largest city at both the 10- and 25-mile zone, has less population density at its core than the cities in the Northeast and a smaller central business district than cities like Chicago or San Francisco. San Francisco, the state's second largest region, is a compact city with the nation's fourth largest central business district and second largest downtown population. Phoenix is the eighth largest region in the nation at the 25-mile zone, but has relatively little population or employment in its urban core, indicative of the auto-oriented development that has characterized its rapid growth over the last few decades.

Many of California's secondary cities, such as San Jose, Sacramento, and San Diego, are still relatively large by national standards. This geography, with three large population centers in each of the Northern California, Southern California, and Arizona Sun Corridor megaregions – separated by 300 to 400 miles – creates an ideal geography for HSR Core Express. Within the larger regions are shorter corridors that potentially add great value to the larger system, such as San Diego-Los Angeles, San Francisco-Sacramento and San Jose, and Phoenix-Tucson.

The high growth rates in the region also offer the potential to shape growth patterns around new rail infrastructure, specifically in the Arizona Sun Corridor and the Inland Empire in California, in which a blend of high-speed commuter and intercity service can be used to cater to the particular demands of the population. For example, Riverside has a low job to population ratio, indicating that many of its residents commute long distances to work in the greater Los Angeles region. Offering high-speed commuter rail on this section of the California high-speed rail network, could potential capture many of these commuters and encourage investment and rail-oriented development around the stations.

California's high-speed trains could also serve long-distance commuters on shorter segments of the system.

TABLE 22

Population Profile of Major Cities in California and the Southwest

	2 mi.		10 mi.		25 mi.		Projected 2040 Growth
	Pop.	Rank	Pop.	Rank	Pop.	Rank	
Los Angeles	160,000	6	3,540,000	2	9,900,000	2	15%
Phoenix	70,000	48	1,380,000	12	3,800,000	8	63%
San Francisco	340,000	2	1,280,000	14	3,400,000	13	20%
Riverside	70,000	43	1,020,000	20	3,100,000	14	83%
San Jose	110,000	12	1,470,000	10	2,600,000	18	23%
San Diego	60,000	71	1,020,000	21	2,300,000	22	46%
Sacramento	60,000	49	840,000	29	1,800,000	29	48%
Las Vegas	120,000	9	1,500,000	8	1,800,000	30	73%
Tucson	60,000	56	720,000	35	1,000,000	69	69%
Fresno	90,000	25	630,000	42	900,000	74	42%

Source: America 2050 analysis of 2000 U.S. Census and 2010 Woods and Poole Economics

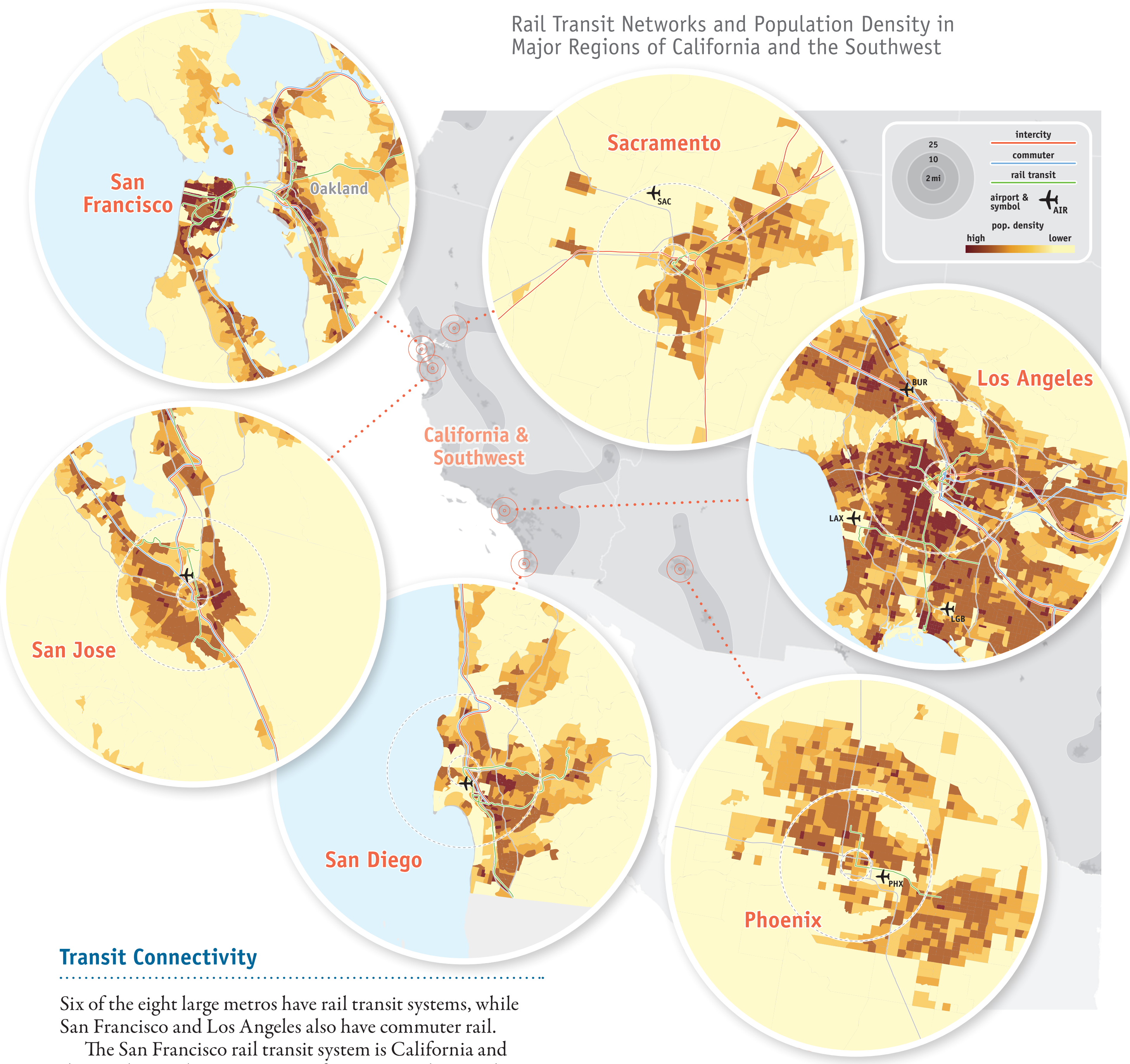
TABLE 23

Employment Profile of Major Cities in California and the Southwest

	2 mi.		10 mi.		25 mi.		Projected 2040 Growth
	Empl.	Rank	Empl.	Rank	Empl.	Rank	
San Francisco	810,000	2	1,430,000	3	2,900,000	6	26%
Los Angeles	190,000	10	1,440,000	2	4,100,000	2	23%
San Jose	90,000	24	910,000	11	1,800,000	17	35%
Phoenix	80,000	27	810,000	14	1,700,000	18	64%
San Diego	80,000	32	650,000	20	1,200,000	33	52%
Sacramento	60,000	46	420,000	41	800,000	53	51%
Fresno	60,000	47	410,000	43	600,000	73	41%
Las Vegas	60,000	50	780,000	16	900,000	50	72%
Tucson	30,000	99	300,000	65	400,000	106	79%
Riverside	20,000	126	310,000	63	1,000,000	41	62%

Source: America 2050 analysis of 2007 Bureau of Economic Analysis and 2010 Woods and Poole Economics

Rail Transit Networks and Population Density in Major Regions of California and the Southwest



Transit Connectivity

Six of the eight large metros have rail transit systems, while San Francisco and Los Angeles also have commuter rail.

The San Francisco rail transit system is California and the Southwest's largest in terms of passenger volume. It has 35 percent and 20 percent respectively of people living and working within ½–1 mile of a transit stop within 25 miles of downtown.[28] The light rail system in Phoenix only manages to capture six percent of its regional population within ½–1 mile of its stations, offering little connectivity value to an intercity high-speed rail system. However, other systems in the region offer greater connectivity. In total, more than four million people live in a transit accessible zone in these six cities. Perhaps more importantly, there are planned expansions of most of the transit systems in California and the Southwest. Los Angeles, for example, recently passed a county wide half-cent sales tax that will fund an ambitious program

TABLE 24

Transit Accessibility and Ridership by Region

	within Transit Accessible Zone				Avg. Weekday Ridership
	Population	%	Jobs	%	(Q4 2009)
Los Angeles	1,380,000	14	1,050,000	26	312,200
San Francisco	1,190,000	35	590,000	20	541,600
San Diego	540,000	24	460,000	40	91,233
Sacramento	400,000	22	390,000	47	55,833
San Jose	380,000	15	440,000	24	
Phoenix	230,000	6	280,000	16	38,933

Source: America 2050 analysis and APTA 2009 Fact Book

28 The Bay Area Rapid Transit (BART) system is categorized by APTA as a Heavy Rail Transit system not a commuter rail system, and thus may overstate transit accessibility.

TABLE 25

Reach of Commuter Rail Network in California and the Southwest

	Within 2 Miles of Commuter Rail Station	
	Population	Jobs
Los Angeles	2,760,000	890,000
San Francisco	2,150,000	880,000
Riverside	1,290,000	590,000
San Jose	1,080,000	940,000
San Diego	440,000	400,000
Sacramento	320,000	210,000

Source: America 2050 analysis

of 12 new transit projects over 30 years, which they are now attempting to accelerate and complete in 10 years (the 30/10 Initiative).[29] This approach of advancing locally-funded transit expansion concurrent with state and federally financed high-speed rail is a model for aligning transportation strategies to fully leverage public investments.

Rail Service and Plans

Outside of the Northeast and Midwest, California is one of the few regions with well-patronized intercity rail services. Amtrak's Pacific Surfliner, which runs along the coast from San Diego to San Luis Obispo, and the Capital Corridor that connects the Bay Area and Sacramento are Amtrak's second and third highest volume corridors respectively.

Building on their growing intercity ridership, as well as their expanding local and regional transit networks, California is pursuing the nation's most ambitious high-speed rail system in the nation. The system is estimated to cost in excess of $45 billion and would provide 2 hour 38 minute service between Los Angeles and San Francisco with frequencies of up to 14 trains per hour.

Congestion and Travel Market

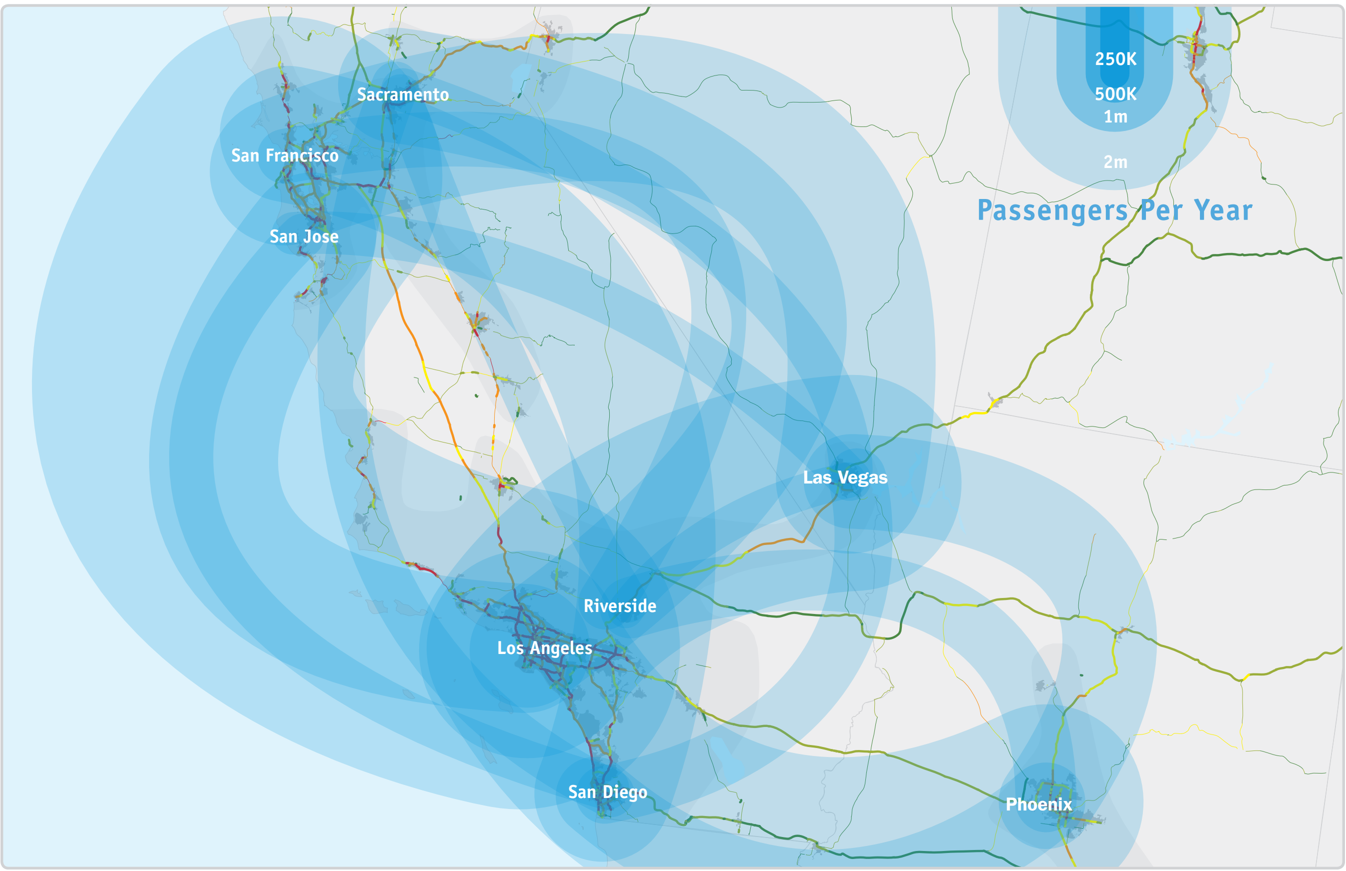
The largest short-haul air market in the nation is between the Los Angeles metro region and the San Francisco Bay area with hundreds of daily flights. The nation's second and third largest short-haul air routes connect Los Angeles to Las Vegas and Phoenix, respectively, with hundreds of additional daily flights. Las Vegas-San Francisco, San Diego-San

Existing and Proposed Rail Service in California

Source: Amtrak ridership data FY 2009

29 Los Angeles County Metropolitan Transportation Authority Website. http://www.metro.net/projects/30-10/.

Regional Air Market and Road Congestion in California and the Southwest



Source: Federal Aviation Administration 2009

Francisco, Los Angeles-San Jose, Los Angeles-Sacramento, are also in the top twenty short-haul markets, representing millions of additional annual passengers.

Based on the experience in Europe and the Northeast Corridor, rail trip times of less than three hours between Los Angeles and the Bay Area are likely to capture the vast majority of the point-to-point air travel between the two regions. And because the existing air market is so large in this region, nowhere else in the country is the potential to divert short haul air travel to rail greater than in California.

In addition to its significant regional air market, California and the Southwest contain some of the most congested highways in the nation. The major cities have among the highest metropolitan traffic congestion in the country. This auto congestion has the greatest impact on short intercity trips, such as Los Angeles-San Diego, San Francisco-San Jose and San Francisco-Sacramento. As discussed in the previous chapter, the high demand for travel on the shorter segments of rail corridors can add to the financial viability of longer HSR Core Express rail routes, such as between Northern and Southern California. In sum, the combination of two highly congested megaregions in California with large regional air markets between them suggests high likely ridership demand for HSR Core Express.

TABLE 26

Annual Passengers Originating in and Destined to Airports within California and the Southwest

Los Angeles	9,400,000
San Francisco	6,100,000
Las Vegas	5,800,000
Phoenix	4,000,000
San Diego	3,500,000
Riverside	2,600,000
Sacramento	2,200,000
San Jose	2,000,000
Tucson	800,000
Fresno	300,000

Source: America 2050 analysis of FAA 2009

Nowhere else in the country is the potential to divert regional air travel to rail greater than in California.

TABLE 27

Regional Air Markets in California and the Southwest

	Annual Passengers
San Francisco to Los Angeles	3,140,686
Las Vegas to Los Angeles	1,852,970
Phoenix to Los Angeles	1,670,913
Los Angeles to Sacramento	986,467
Las Vegas to San Francisco	1,268,996
San Diego to San Francisco	1,167,386
Los Angeles to San Jose	1,105,798
Phoenix to Las Vegas	810,541
Phoenix to San Diego	673,295
Phoenix to Riverside	523,792

Source: America 2050 analysis of FAA 2009

TABLE 28

Average Delay in Major California and Southwest Airports in 2007 (in Minutes)

Airport	Minutes	National Rank
San Francisco	10.3	12
Las Vegas	9.6	14
Phoenix	8.2	25
Los Angeles (LAX)	7.9	28

Source: FAA 2009

Scoring of Corridors in California and the Southwest

Source: America 2050

TABLE 29

Scoring of Corridors in California and the Southwest

Origin	Destinations	Length	Score	Total Employment Within 2 Miles of Major Nodes	Total Population within 25 Miles of Major Nodes	Cumulative Air Market*	Total Transit Accessible Population in Major Nodes
Los Angeles CA	San Diego CA	157	19.62	290,000	15,200,000	350,000	1,920,000
Los Angeles CA	Riverside CA	64	19.43	210,000	12,900,000	50,000	1,380,000
Los Angeles CA	Santa Barbara CA	102	18.96	240,000	10,800,000	120,000	1,380,000
Sacramento CA	San Francisco CA	139	18.21	860,000	5,200,000	50,000	1,570,000
Los Angeles CA	San Francisco CA	453	17.98	1,180,000	17,700,000	4,410,000	2,940,000
Los Angeles CA	Las Vegas NV	338	16.94	270,000	14,700,000	2,210,000	1,380,000
Sacramento CA	San Diego CA	585	16.59	460,000	20,400,000	2,230,000	2,330,000
Phoenix AZ	Tucson AZ	119	16.37	110,000	4,800,000	210,000	230,000
Los Angeles CA	San Jose CA	409	16.35	370,000	14,600,000	1,210,000	1,760,000
San Francisco CA	Reno NV	290	16.31	910,000	5,700,000	220,000	1,570,000
Phoenix AZ	Los Angeles CA	435	16.06	300,000	16,900,000	2,310,000	1,610,000
Fresno CA	Sacramento CA	172	13.42	140,000	4,300,000	-	400,000
Phoenix AZ	San Diego CA	467	12.73	190,000	9,400,000	1,250,000	770,000
Phoenix AZ	Las Vegas NV	510	9.04	140,000	5,600,000	810,000	230,000
Phoenix AZ	Albuquerque NM	584	6.26	120,000	4,700,000	400,000	230,000

*Includes annual flights among all airports located along the corridor.

Top Corridors

Like New York and Chicago in their respective megaregions, Los Angeles dominates the highest ranking corridors in the Southwest. Los Angeles-San Diego is the highest ranking corridor in the nation outside of the Northeast with a score of 19.62. This corridor also encompasses the second highest scoring segment in the region, Los Angeles-Riverside (19.43), which at only 60 miles in length represents a prime opportunity to implement high-speed commuter service blended with intercity operations.

The shorter corridors in Northern California also perform relatively well as does the larger Los Angeles-San Francisco corridor, despite its length and passage through the sparsely populated Central Valley. It is important to note that the 450-mile San Francisco-Los Angeles corridor scores significantly higher than the 400-mile Los Angles-San Jose corridor, highlighting the importance of ensuring that the high-speed intercity service continues past San Jose, up the peninsula and all the way into downtown San Francisco. An intercity network that only serves the east side of the Bay, as the Amtrak network currently does, will not generate the same ridership as one that terminates in the central business district of San Francisco.

Corridors crossing the desert to Las Vegas and Phoenix score lower than the corridors between Northern and Southern California. Corridors that do not include at least one of the major urban centers in California score even lower.

Florida

Aside from California, Florida is the only region in the nation receiving federal support to pursue a new, dedicated high-speed rail system. While Florida's population, employment, and transit ridership numbers do not lead the nation, other critical factors positioned the state at the front of the line in the competition for high-speed rail stimulus dollars: project readiness and public ownership of the right-of-way. If the state succeeds in realizing this project on-time and on-budget, it will serve as an important on-the-ground demonstration of high-speed rail in America.

Other factors that distinguish Florida are the state's rapid growth and the role of the Orlando Airport, Disney World, the Orlando Convention Center and other major tourist destinations as attractions that could potentially replace the role played by the central business district in other regions. Nevertheless, the long-term success of this system is dependent on providing links to the downtowns in Tampa, Orlando, and Miami, and providing seamless connections to those regions' existing, nascent, or future rail transit systems.

Population and Employment

There are four major population centers in the Florida megaregion: Miami, Orlando, Tampa, and Jacksonville. Miami, with 100,000 residents in its two-mile zone and 1.7 million in its ten-mile zone, is nearly twice as large as the next largest city, Orlando. Tampa, Orlando, and Jacksonville are relatively small in comparison to other cities in the country.

Although these cities are smaller and more decentralized than many of the major metropolitan centers in the other megaregions, their projected growth rates are notable. All four are expected to grow at rates of at least 30 percent over the next thirty years, with Orlando growing at double that rate. This means that although Miami is the only major population center in the state over 3.5 million today, by 2040, the state will have three metro regions of over 3 million and Miami's population will approach 5 million. This growth rate creates the potential to focus new development in central city and transit oriented communities with appropriate transit investments.

Florida will host the first on-the-ground demonstration of high-speed rail in America.

TABLE 30

Population Profile of Major Cities in Florida

	2 mi.		10 mi.		25 mi.		Projected 2040
	Pop.	Rank	Pop.	Rank	Pop.	Rank	Growth
Miami	100,000	15	1,670,000	7	3,500,000	11	40%
Tampa	50,000	100	720,000	36	2,300,000	23	34%
Orlando	50,000	76	900,000	25	1,800,000	31	64%
Jacksonville	30,000	253	450,000	64	1,100,000	54	41%

Source: America 2050 analysis of 2010 U.S. Census 2010 Woods and Poole Economics

TABLE 31

Employment Profile of Major Cities in Florida

	2 mi.		10 mi.		25 mi.		Projected 2040
	Empl.	Rank	Empl.	Rank	Empl.	Rank	Growth
Tampa	60,000	44	500,000	27	1,200,000	34	53%
Orlando	60,000	45	510,000	26	900,000	48	63%
Miami	20,000	120	760,000	17	1,500,000	21	43%
Jacksonville	10,000	165	210,000	87	500,000	79	48%

Source: America 2050 analysis of 2007 Bureau of Economic Analysis and 2010 Woods and Poole Economics

Rail Transit Networks and Population Density in Major Florida Regions

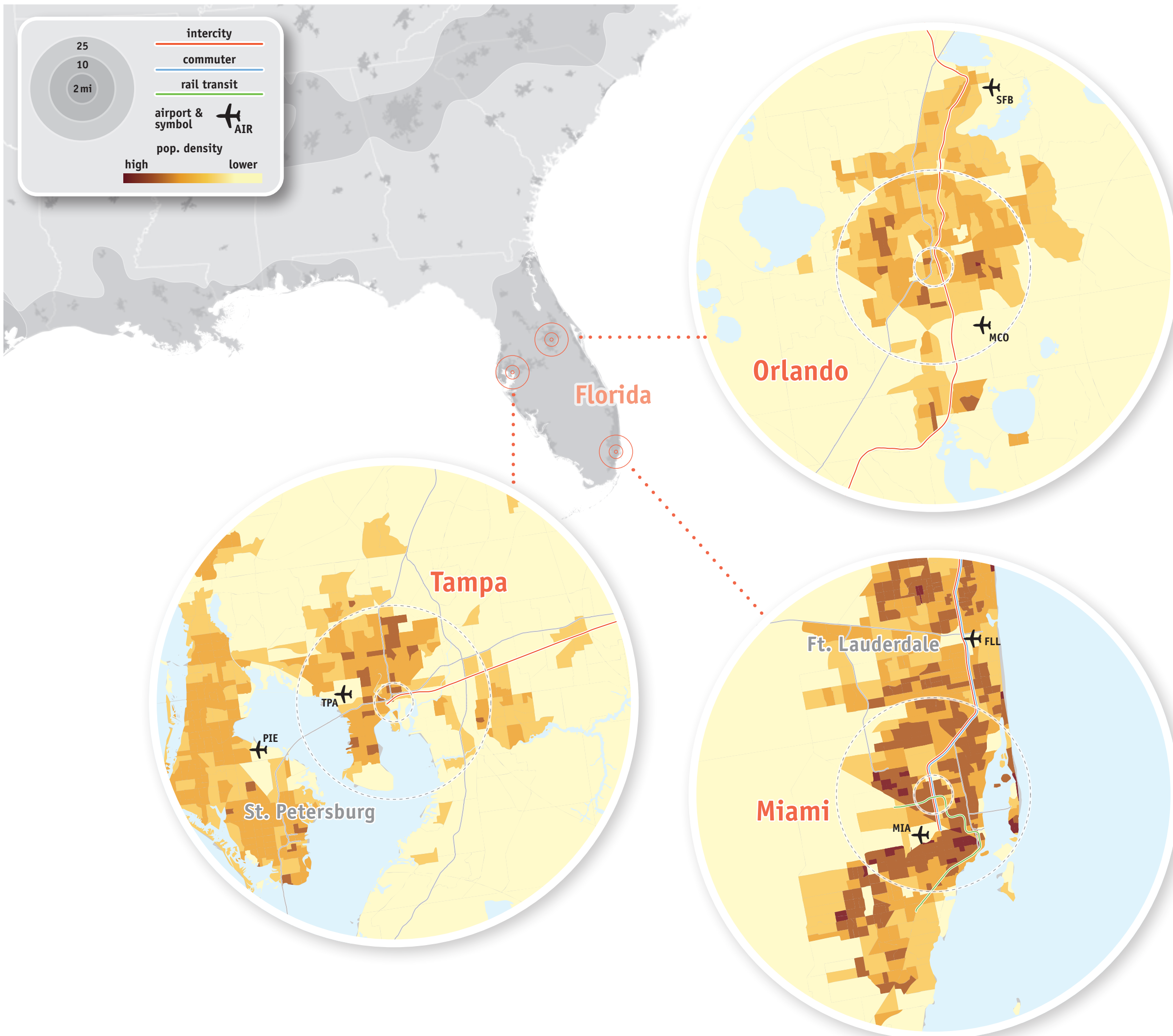


TABLE 32

Transit Accessibility and Ridership by Region

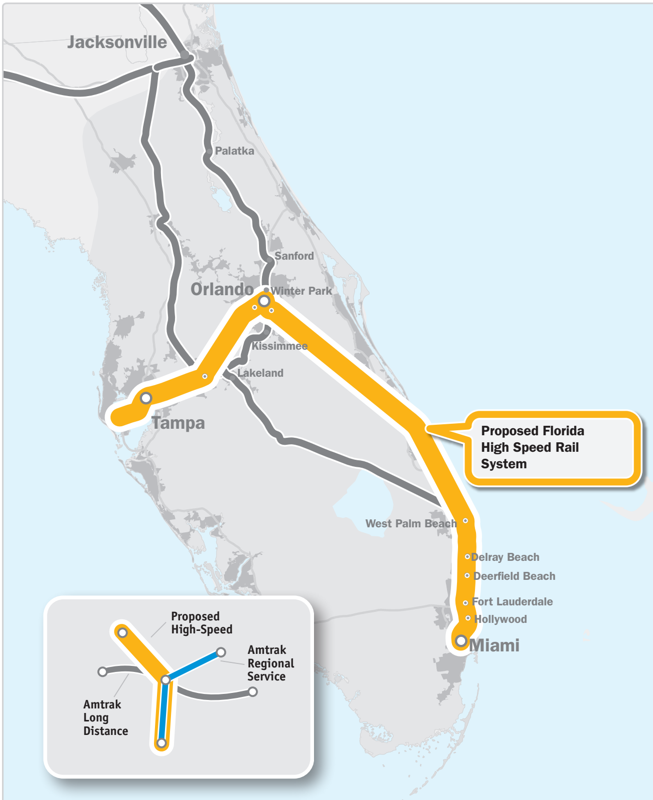
	Within Transit Accessible Zone				Avg. Weekday Ridership (Q4 2009)
	Population	%	Jobs	%	
Miami	370,000	10	300,000	20	88,733
Tampa	30,000	1	20,000	1	767

Source: America 2050 analysis and APTA 2009 Fact Book

Transit Connectivity

Transit connectivity in Florida is limited. The four primary cities in the state do not have the residential or employment density needed to sustain robust rail transit systems like cities in the Northeast or California. The largest and densest of the four, Miami, has a system that carries nearly 18 million passengers per year. This system captures 10 percent of the regional population and 20 percent of the employment within ½–1 mile of a transit station. Tampa also has a fledgling streetcar system, which with limited hours, serves primarily a tourist market (it carried 500,000 passengers in 2009 – the smallest ridership for any rail transit system in the country), but has plans to extend the system to include 40 miles of light rail. Unfortunately, a November 2010 ballot measure to help fund the expansion of Tampa's transit system did not pass.

Current Passenger Rail Service in Florida



Source: Amtrak ridership data FY 2009

Rail Service

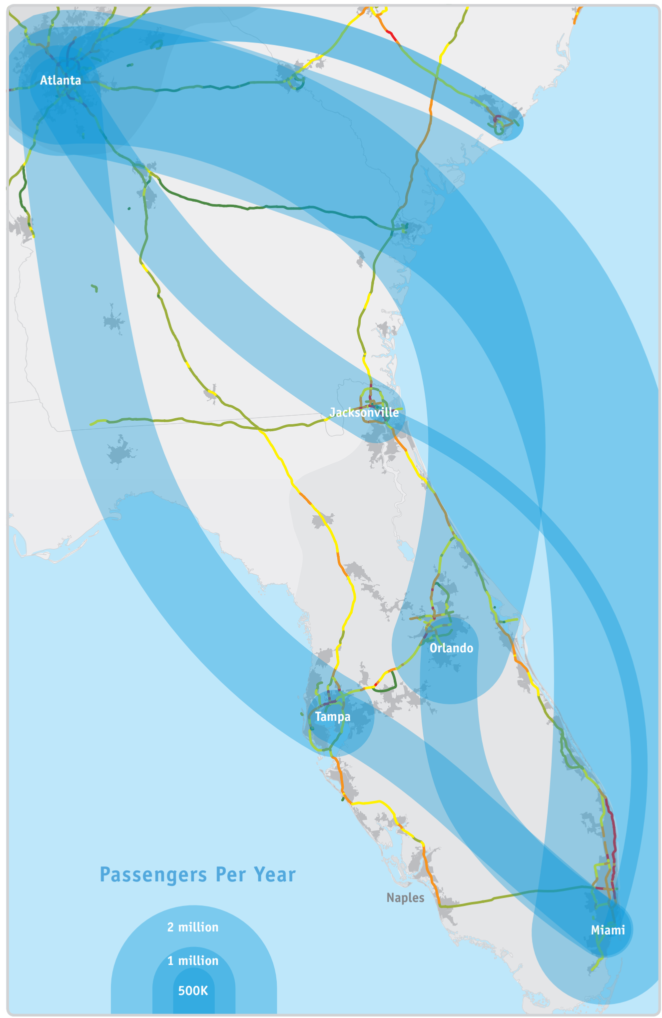
Current rail service in the state of Florida is extremely limited. The state is served by two long distance trains that run from New York to Miami. The top intrastate market is between Miami and Tampa and carried only 16,000 passengers in 2008.

Despite this lack of service, there has been no lack of planning for an improved rail system in the state over the last several decades. In the mid 1990s, the Florida Overland Express (FOX) project proposed bringing French TGV-style trains to the state. The voters passed a constitutional amendment, which was subsequently repealed, mandating the construction of a high-speed rail system to begin by 2003. The FRA awarded the state a total of $2.4 billion in 2010 to begin construction on 84 miles of track between Tampa and Orlando, suggesting that high-speed rail will finally come to the state. This is the first stage of a high-speed rail system that will ultimately connect Tampa to Miami via the Orlando International Airport.

Congestion and Travel Market

There is relatively little intrastate air travel in Florida. Tampa and Orlando are less than 100 miles apart, a distance that does not generate significant air travel anywhere in the country. The two largest intrastate markets are Miami to Orlando and Tampa, but even these routes carry many fewer passengers than the short haul air routes in California or the

Regional Air Market and Interstate Highway Congestion in Florida



Source: Federal Aviation Administration 2009

TABLE 33

Annual Passengers Originating or Destined to Another Airport within Florida

Miami*	1,500,000
Tampa	700,000
Orlando	700,000
Jacksonville	300,000

*Passenger volume numbers for Miami include Ft. Lauderdale.
Source: America 2050 analysis of FAA 2009

TABLE 34

Regional Air Markets in Florida

	Annual Passengers
Atlanta to Miami	1,740,424
Atlanta to Orlando	1,410,586
Atlanta to Tampa	981,033
Atlanta to Jacksonville	706,458
Miami to Orlando	687,821
Miami to Tampa	637,742
Jacksonville to Miami	196,199

Source: America 2050 analysis of FAA 2009

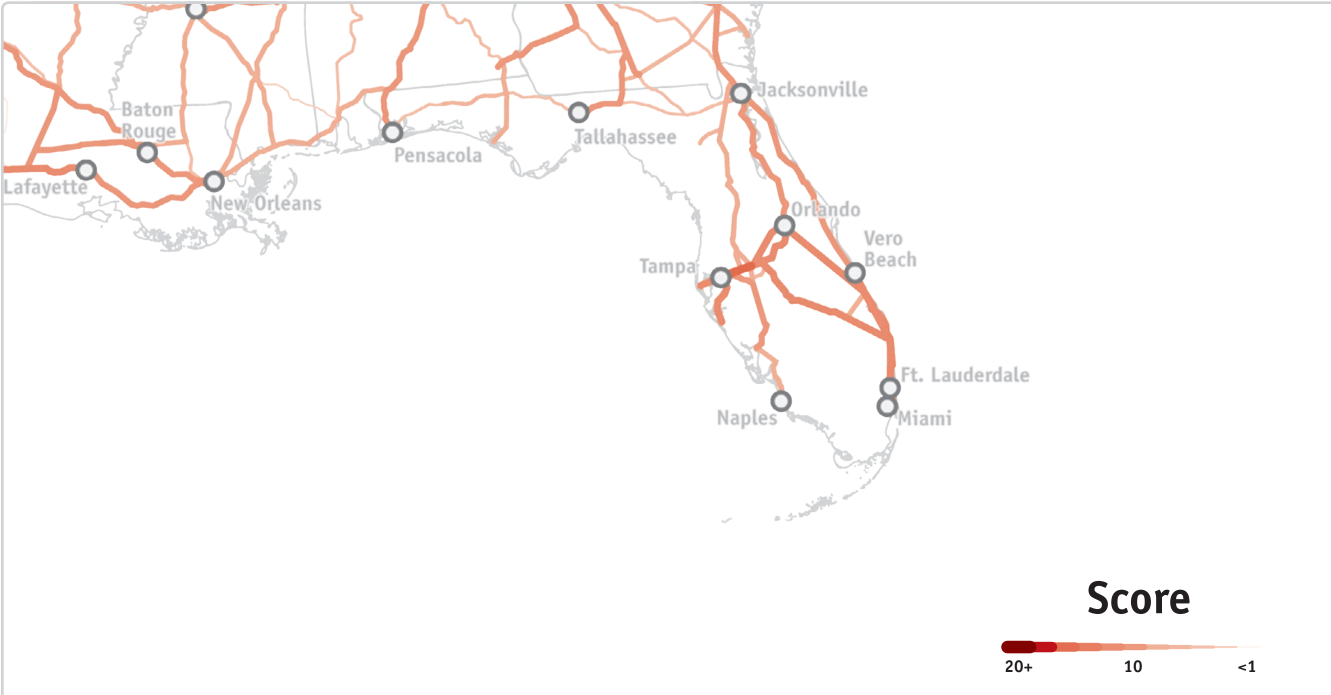
TABLE 35

Average Delay in Major Airports in Florida in 2007 (in Minutes)

Airport	Minutes	National Rank
Miami	9.0	20
Fort Lauderdale	9.0	21
Orlando	7.7	30
Tampa	6.7	32

Source: FAA 2009

Scoring of Corridors in Florida



Source: America 2050

TABLE 36

Scoring of Corridors in Florida

Origin	Destinations	Length	Score	Total Employment Within 2 Miles of Major Nodes	Total Population within 25 Miles of Major Nodes	Cumulative Air Market*	Total Transit Accessible Population in Major Nodes
Tampa FL (via Orlando)	Miami FL	319	13.93	150,000	8,190,000	1,326,500	398,000
Tampa FL	Orlando FL	84	13.63	130,000	4,650,000	600	32,000
Sebastian-Vero Beach FL	Miami FL	143	12.96	70,000	4,060,000	500	366,000
Miami FL	Orlando FL	264	11.86	80,000	5,350,000	688,300	366,000
Orlando FL	Atlanta GA	479	10.83	180,000	7,060,000	2,117,800	498,000
Jacksonville FL	Atlanta GA	332	10.79	120,000	5,250,000	706,500	498,000
Jacksonville FL	Miami FL	412	10.36	90,000	6,470,000	885,300	366,000
Jacksonville FL	Orlando FL	147	10.35	70,000	2,930,000	800	-

*Includes annual flights among all airports located along the corridor.

Northeast. The top air market of less than 600 miles for each of the four major cities in Florida is with Atlanta. These markets rank 4th (Miami-Atlanta), 5th (Orlando-Atlanta), 17th (Tampa-Atlanta), and 26th (Jacksonville-Atlanta) nationally. As can be seen in Table 35, the major airports in Florida are not particularly congested compared to other major airports across the country.

The highways in Florida are not highly congested either compared to other corridors across the country. The most congested corridor is Tampa-Jacksonville, with 39 percent of the highways congested at the peak hour, followed by Tampa-Orlando at 29 percent and Miami-Orlando 18 percent. However, with the additional growth pressures facing the state, the Federal Highway Administration projects that these percentages will increase to over 80 percent by 2035 if nothing is done to manage demand.

Top Corridors

The overall scores for the corridors in Florida are lower than in the megaregions described in previous sections. This reflects the lack of a single dominant city, such as Los Angeles, Chicago, or New York, to act as a magnet for intercity rail trips. Miami, the largest of the four, is not large enough on its own to drive ridership. While the scoring method does account for share of workforce in the tourism industry,[30] which helps bolster corridors that include Orlando, the high number of jobs in tourism and accommodations alone is not enough to lift their overall scores to compete with corridors in the Northwest, Midwest, and California.

The highest scoring corridor in Florida is Tampa-Orlando-Miami, which matches the full build out of the proposed Florida HSR plan, followed by Tampa-Orlando, the first segment of the system.

30 We combined percent of workers in "Accommodation and Food Services" and "Arts Entertainment and Recreation."

Texas and the Gulf Coast

Population and Employment

There are four major population centers in Texas, including Houston, Dallas, San Antonio, and Austin. Although Houston and Dallas rank 5th and 7th in the nation respectively in regional population with nearly 4.5 million people each, not one Texas city ranks above 28th in population in the urban core (Table 37). This stark contrast between very large regional populations and relatively small centralized populations reflects the large geographic size and relatively low density of Texan cities.

The growth in the four major Texas metro regions has been unrelenting and is projected to continue its upward trend. The projected growth rate for all four over the next thirty years in the 25 mile zone is expected to top 50 percent, raising their cumulative population from less than 12 million to more than 18 million. As with other fast growing regions like California and Florida, this affords the opportunity to guide this growth with investments in local transit and intercity rail. However, these cities face major challenges as they are already significantly larger than the cities in Florida with much less density than the cities in California. The legacy of the decades of auto-centric growth will be difficult to overcome in these already expansive metro regions.

The two Oklahoma cities in this region, Tulsa and Oklahoma City, are relatively small at all three scales, as is New Orleans.

The four biggest regions in Texas will grow in population by more than 50 percent in the next 30 years.

TABLE 37

Population Profile of Major Cities in the Texas and Gulf Coast Megaregions

	2 mi.		10 mi.		25 mi.		Projected 2040 Growth
	Pop.	Rank	Pop.	Rank	Pop.	Rank	
Houston	70,000	36	1,500,000	9	4,500,000	5	48%
Dallas	40,000	143	1,180,000	17	4,300,000	7	50%
San Antonio	60,000	52	1,010,000	22	1,700,000	34	56%
Austin	80,000	28	750,000	34	1,400,000	44	86%
Oklahoma City	30,000	222	590,000	46	1,100,000	63	33%
New Orleans	80,000	31	650,000	40	900,000	80	28%
Tulsa	40,000	166	430,000	65	800,000	88	26%

Source: America 2050 analysis of 2000 U.S. Census and 2010 Woods and Poole Economics

TABLE 38

Employment Profile of Major Cities in the Texas and Gulf Coast Megaregions

	2 mi.		10 mi.		25 mi.		Projected 2040 Growth
	Empl.	Rank	Empl.	Rank	Empl.	Rank	
Houston	140,000	15	900,000	12	2,100,000	13	56%
Dallas	130,000	16	660,000	18	2,100,000	12	47%
New Orleans	100,000	20	350,000	51	400,000	94	28%
Austin	80,000	33	440,000	34	700,000	67	88%
San Antonio	50,000	52	480,000	31	800,000	62	59%
Oklahoma City	50,000	54	350,000	50	500,000	86	36%
Tulsa	40,000	79	270,000	69	400,000	103	33%

Source: America 2050 analysis of 2007 Bureau of Economic Analysis and 2010 Woods and Poole Economics

Rail Transit Connections and Population Density in Texas and the Gulf Coast

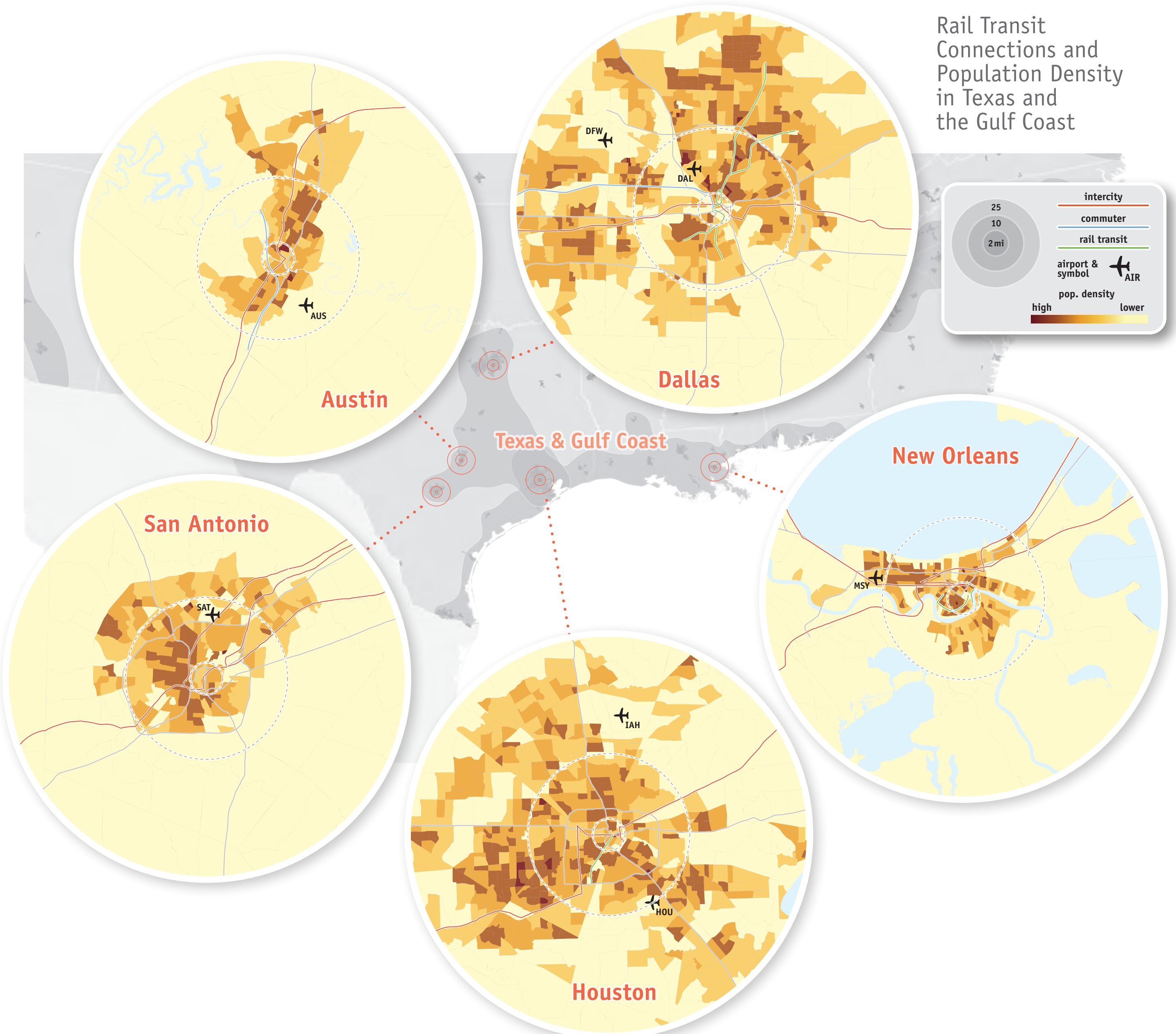


TABLE 39

Transit Accessibility and Ridership by Region

	Within Transit Accessible Zone				Avg. Weekday Ridership (Q4 2009)
	Population	%	Jobs	%	
Dallas	480,000	11	550,000	26	75,133
Houston	60,000	1	110,000	5	36,267

Source: America 2050 analysis and APTA 2009 Fact Book

TABLE 40

Reach of Commuter Rail Network in the Texas and the Gulf Coast Megaregions

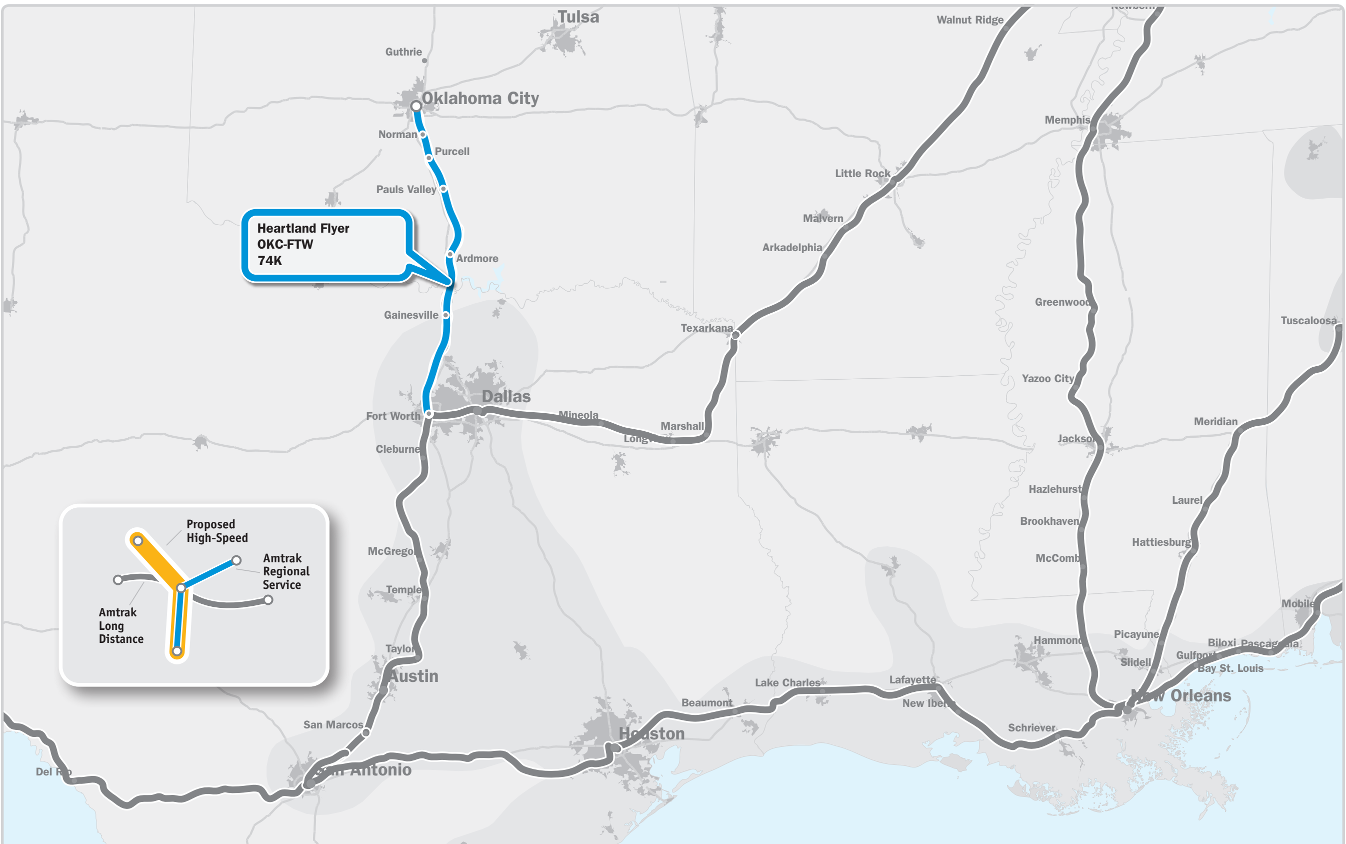
	Within 2 Miles of Commuter Rail Station	
	Population	Jobs
Dallas	570,000	450,000

Source: America 2050 analysis

Transit Connectivity

Dallas, Houston, and New Orleans all have light rail systems, with Dallas being the largest of the three carrying over 18 million annual passengers. About 10 percent of the Dallas population lives within ½–1 mile walk of transit connectivity, less than nearly all other cities with urban light rail systems, but still more than Houston, which captures only a little more than one percent of the population living within 25 miles of downtown. Houston has an aggressive expansion plan for their light rail system, which will add 30 miles to the existing 7.5 mile system and would capture a significantly higher portion of the metro population. A dramatic expansion in these systems would be necessary for them to provide the sufficient levels of connectivity with intercity rail.

Passenger Rail Service in Texas and the Gulf Coast



Source: Amtrak ridership data FY 2009

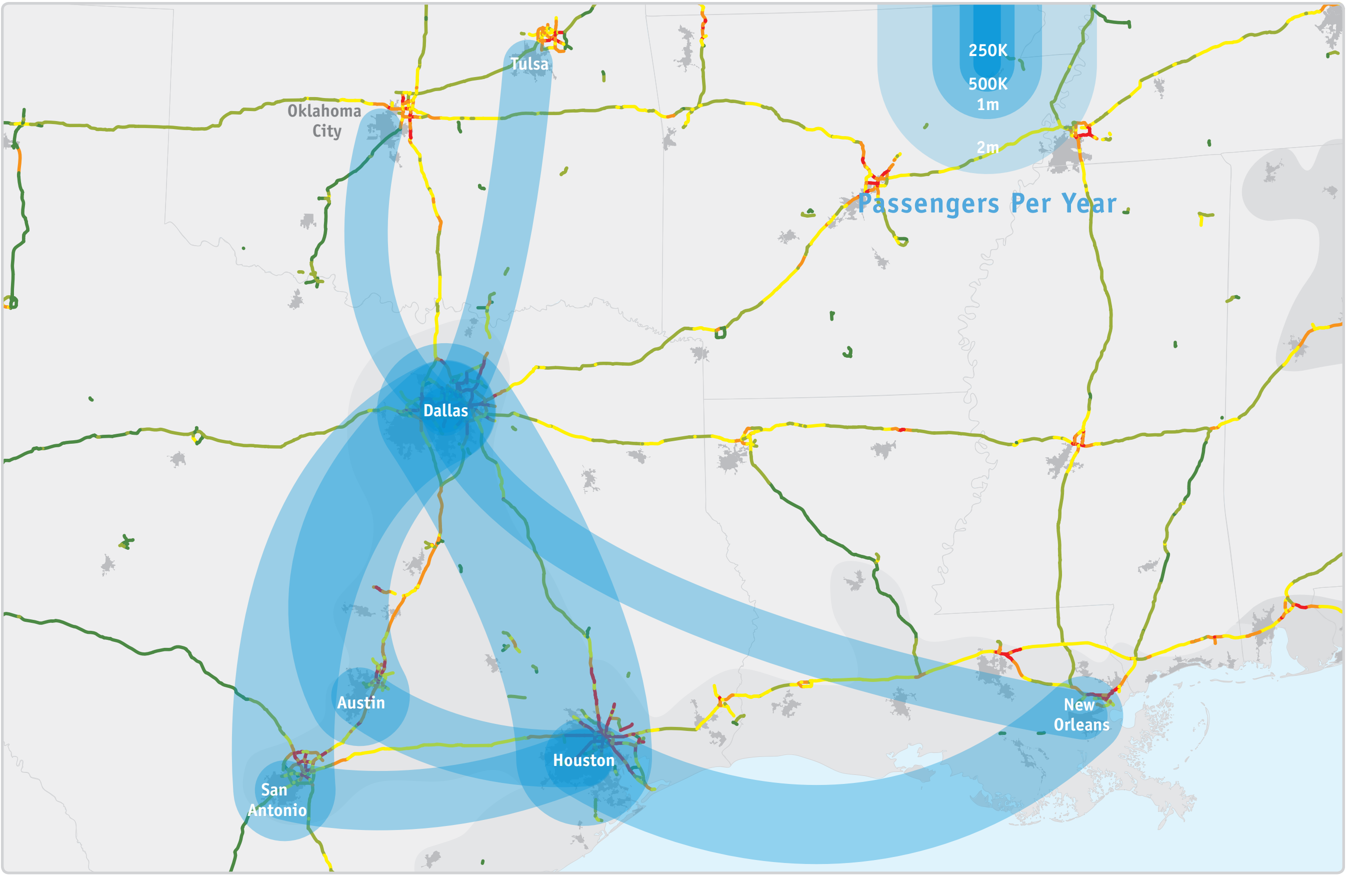
Rail Service

Currently, rail service in the Texas Triangle and along the Gulf Coast is extremely limited. There is no rail service at all between the two largest metros, Houston and Dallas, and only one train per day between San Antonio and Dallas. This trip takes 8 hours 20 minutes to travel the 275 miles between the two cities at an average speed of 33 miles per hour. A private automobile can cover the same distance in less than five hours. This route carried only 3,300 passengers in 2008, representing less than one percent of the air market between the two cities. Houston to New Orleans carried marginally more passengers, while Houston to San Antonio carried less.

There are nascent plans to improve the rail service in Texas and the Gulf Coast. The Southern High-Speed Rail Commission has incremental plans to improve service between New Orleans and major cities including Houston, however the commission lacks political backing. Also recently, the US-Japan HSR Corporation announced its interest in building a dedicated HSR route between Houston and Dallas. The company is a subsidiary of JR Central, the operator of the highest passenger volume HSR route in the world between Tokyo and Osaka, Japan.

Yet, despite more than two decades of intermittent planning for high-speed rail, the current proposals for high-speed rail in the state are still in their infancy.

Regional Air Market and Interstate Highway Congestion in Texas and the Gulf Coast



Source: Federal Aviation Administration 2009

TABLE 41

Annual Passengers Originating in and Destined to Airports in Texas and the Gulf Coast Megaregion

Dallas	4,400,000
Houston	3,500,000
San Antonio	1,500,000
Austin	1,500,000
New Orleans	1,200,000
Tulsa	700,000
Oklahoma City	600,000

Source: America 2050 analysis of FAA 2009

TABLE 42

Regional Air Markets in Texas and the Gulf Coast

	Annual Passengers
Houston to Dallas	1,237,922
San Antonio to Dallas	931,575
Austin to Dallas TX	913,624
New Orleans to Houston	720,429
San Antonio to Houston	540,277
Austin to Houston	519,389
Tulsa to Dallas	451,981
New Orleans to Dallas	435,609
Oklahoma City to Dallas	395,070

Source: America 2050 analysis of FAA 2009

TABLE 43

Average Delay in Major Airports in Texas

Airport	Minutes	National Rank
Dallas-Ft. Worth	10.2	13
Houston Intercontinental	8.7	23

Source: FAA 2009

Congestion and Travel Market

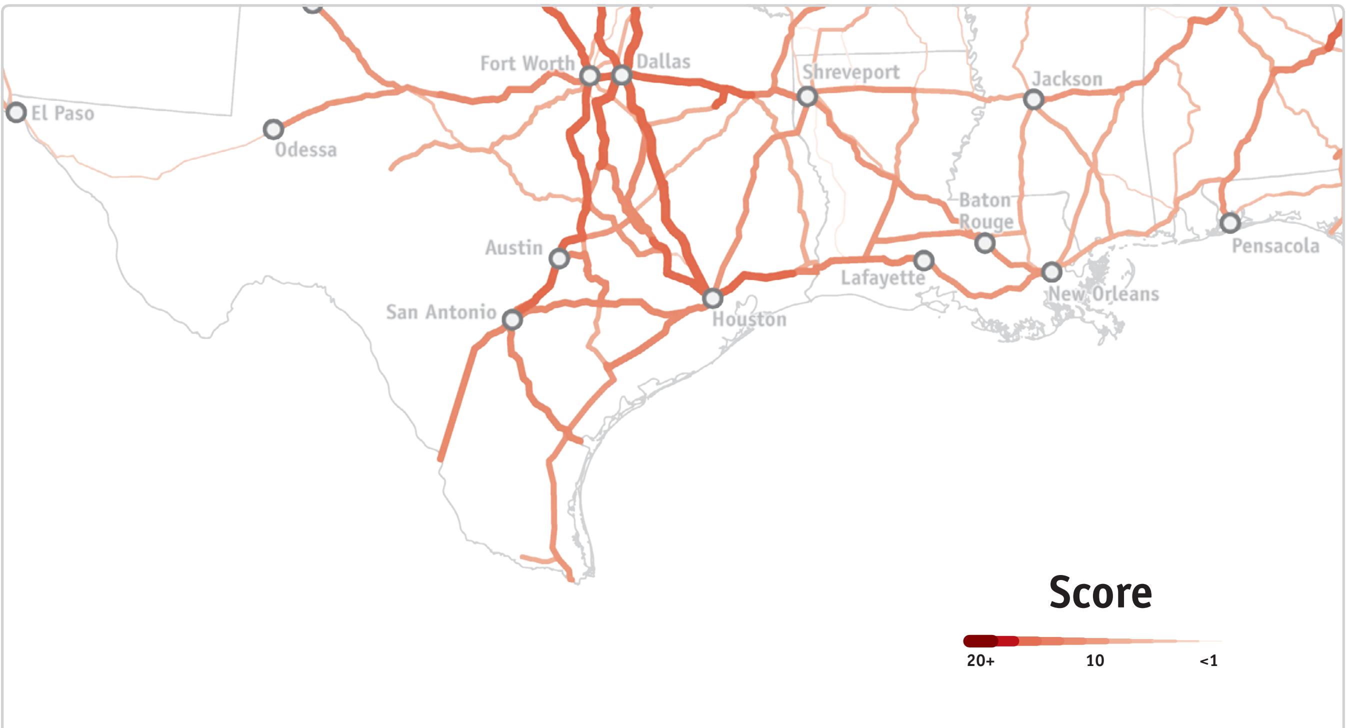
To accommodate its fast growing population, Texas has invested billions of dollars over the last decade adding more than 1,000 lane miles of highways and upgrading its major air terminals.[31] Despite this, metropolitan congestion has continued to worsen and the change in congestion in the Houston and Dallas metro regions is among the worst in the nation over the last decade.[32]

Lacking viable intercity passenger rail, the regional short haul air market is relatively robust. More than 1.2 million annual passengers moved between the Dallas and Houston metro airports in 2008, the tenth largest market of under 600 miles in the nation. The San Antonio-Dallas and Austin-Dallas routes each had nearly one million passengers. San Antonio and Austin are about 80 miles closer than Houston and Dallas, which is reflected in the air passenger markets with nearly 50 percent less volume.

31 U.S. PIRG Education Fund. 2010. The Right Track Building a 21st Century High-Speed Rail System for America.

32 Texas Transportation Institute. 2009. Urban Mobility Report.

Scoring of Corridors in Texas and the Gulf Coast



Source: America 2050

TABLE 44

Scoring of Corridors in Texas and the Gulf Coast

Origin	Destinations	Length	Score	Total Employment Within 2 Miles of Major Nodes	Total Population within 25 Miles of Major Nodes	Cumulative Air Market*	Total Transit Accessible Population in Major Nodes
Dallas TX	Houston TX	243	16.12	270,000	8,800,000	1,240,000	540,000
Dallas TX	Austin TX	233	14.86	220,000	6,000,000	910,000	480,000
San Antonio TX	Dallas TX	312	14.75	270,000	7,700,000	1,850,000	480,000
Oklahoma City OK	Dallas TX	224	14.38	190,000	5,400,000	400,000	480,000
San Antonio TX	Houston TX	211	13.92	190,000	6,200,000	540,000	60,000
Houston TX	Austin TX	213	13.82	210,000	5,900,000	520,000	60,000
San Antonio TX	Austin TX	79	13.45	130,000	3,100,000	-	-
Tulsa OK	Dallas TX	325	12.83	220,000	6,100,000	850,000	480,000
New Orleans LA	Houston TX	362	11.27	300,000	6,600,000	830,000	60,000
Little Rock AR	Dallas TX	361	10.66	200,000	5,300,000	330,000	480,000
Baton Rouge LA	New Orleans LA	73	8.48	100,000	900,000	-	-

*Includes annual flights among all airports along the corridor.

Top Corridors

The overall scores for the corridors in Texas and the Gulf Coast are higher than those in Florida, but lower than the corridors that include the major metro regions in the Northeast, Midwest, and California. The top scoring corridor in these two megaregions connects the two largest metro regions, Dallas and Houston.

Following this top corridor, all of the internal Texas corridors have very similar scores in the 13.5-15 range. These are relatively modest and result from cities that are highly decentralized in both population and employment, and lack viable transit options. Because of the particular geography of the Texas Megaregion, laid out in a triangle pattern and composed of cities with relatively modest scores, demand would most likely not support redundant infrastructure built along the "edges" of the triangle. Rather, if the state pursues high-speed rail, it should build along the San Antonio-Austin-Dallas corridor with a spur to Houston near the midpoint between San Antonio and Dallas.

The Piedmont Atlantic Megaregion

The Piedmont Atlantic Megaregion is characterized by a chain of loosely spaced, fast-growing regions in the Southeastern United States, with auto-oriented development patterns. Atlanta, with nearly 4 million people in its 25-mile zone, is the Southeast's largest metropolitan area, home to the nation's busiest airport and some of the worst traffic congestion. Charlotte is the second largest city and the only other city in the megaregion with rail transit.

While freight rail plays an important role in the megaregion's economy, passenger rail improvements have been slow to get off the ground. The exception is North Carolina, which has been investing in its Amtrak service for years and was awarded $691 million in federal funds in 2010 to improve the corridor connecting Raleigh to Charlotte.

While the megaregion as a whole has not made passenger rail a priority, its mayors, business leaders, and several universities have focused on megaregion cooperation and formed an organization called the Piedmont Alliance for Quality Growth in 2009, started by then-Mayors Shirley Franklin of Atlanta and Pat McCrory of Charlotte.[33] This collaboration could provide a forum in the future for weighing investment decisions in a multi-state passenger rail corridor.

TABLE 45

Population Profile for Major Cities in the Piedmont Atlantic Megaregion

	2 mi.		10 mi.		25 mi.		Projected 2040 Growth
	Pop.	Rank	Pop.	Rank	Pop.	Rank	
Atlanta	70,000	44	1,090,000	19	3,800,000	9	46%
Charlotte	50,000	114	670,000	39	1,600,000	38	63%
Raleigh	50,000	81	590,000	47	1,300,000	49	69%
Greensboro	50,000	109	350,000	84	1,000,000	68	27%
Birmingham	40,000	127	450,000	61	900,000	81	30%
Greenville	40,000	156	330,000	86	700,000	94	28%

Source: America 2050 analysis of 2000 U.S. Census and 2010 Woods and Poole Economics

TABLE 46

Employment Profile for Major Cities in the Piedmont Atlantic Megaregion

	2 mi.		10 mi.		25 mi.		Projected 2040 Growth
	Empl.	Rank	Empl.	Rank	Empl.	Rank	
Birmingham	90,000	23	330,000	56	500,000	90	39%
Atlanta	80,000	28	800,000	15	1,900,000	15	46%
Charlotte	70,000	38	430,000	40	800,000	55	62%
Greensboro	60,000	43	510,000	25	1,000,000	44	27%
Raleigh	50,000	53	570,000	22	1,100,000	38	66%
Greenville	20,000	115	330,000	54	600,000	70	33%

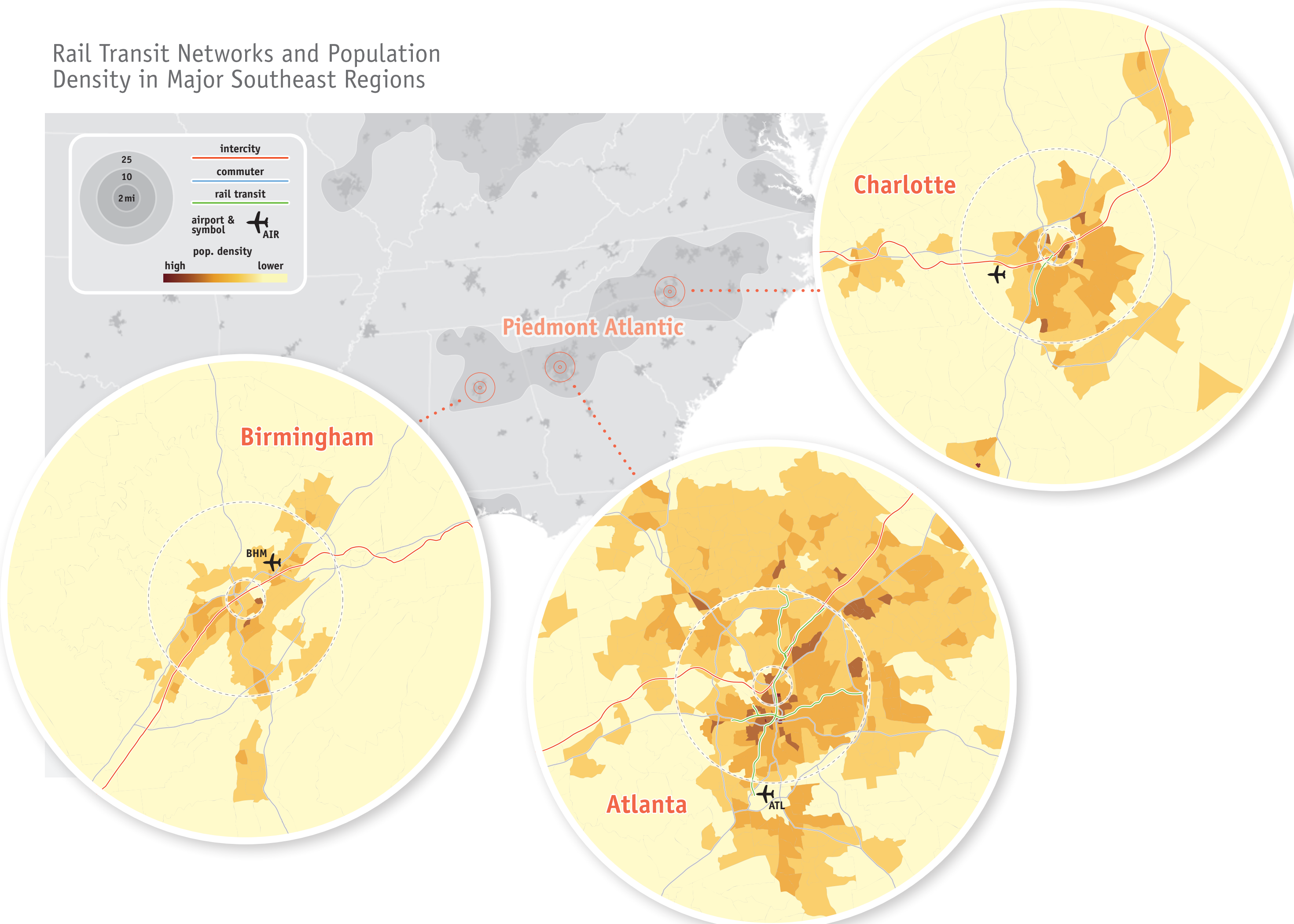
Source: America 2050 analysis of 2007 Bureau of Economic Analysis and 2010 Woods and Poole Economics

Population and Employment Profile

The Piedmont Atlantic megaregion has only two of its cities in the top 40 in the nation in population within 10 and 25 miles of the downtown – Atlanta and Charlotte (Table 45). Similar, although smaller than in Texas, cities in this megaregion also tend to be relatively low density and fast growing, all have relatively low populations in their urban core. Only Atlanta, with nearly 4 million people in its 25-mile zone, can be considered a major metropolitan area. Employment in almost all of these cities is more centralized than population.

33 More information on this alliance is housed on the Georgia Tech website at: http://www.cqgrd.gatech.edu/proceedings/paqg_2010/index.php

Rail Transit Networks and Population Density in Major Southeast Regions



Transit Connectivity

Atlanta is one of only eleven American cities with a heavy rail transit system and ranks number six in ridership with an annual volume of 80 million passengers. The only other city in the Piedmont Megaregion with rail transit is Charlotte with a new light rail system that is being expanded. Charlotte's system includes a single line of 10 miles with 15 stops. It carried four million passengers in only its third year of operation.

The MARTA system in Atlanta would provide moderate connectivity to an intercity rail system with a station in downtown Atlanta. The system already provides good connections to Atlanta Hartsfield airport and could provide vital links between the airport and a high-speed rail system. About one-quarter of Atlanta's regional employment is transit accessible – a sizeable portion for a city built at relatively low density (Table 47). While Charlotte's light rail system currently provides little connectivity, some expansion of the light rail system is underway, with more ambitious plans on hold until funding can be obtained.

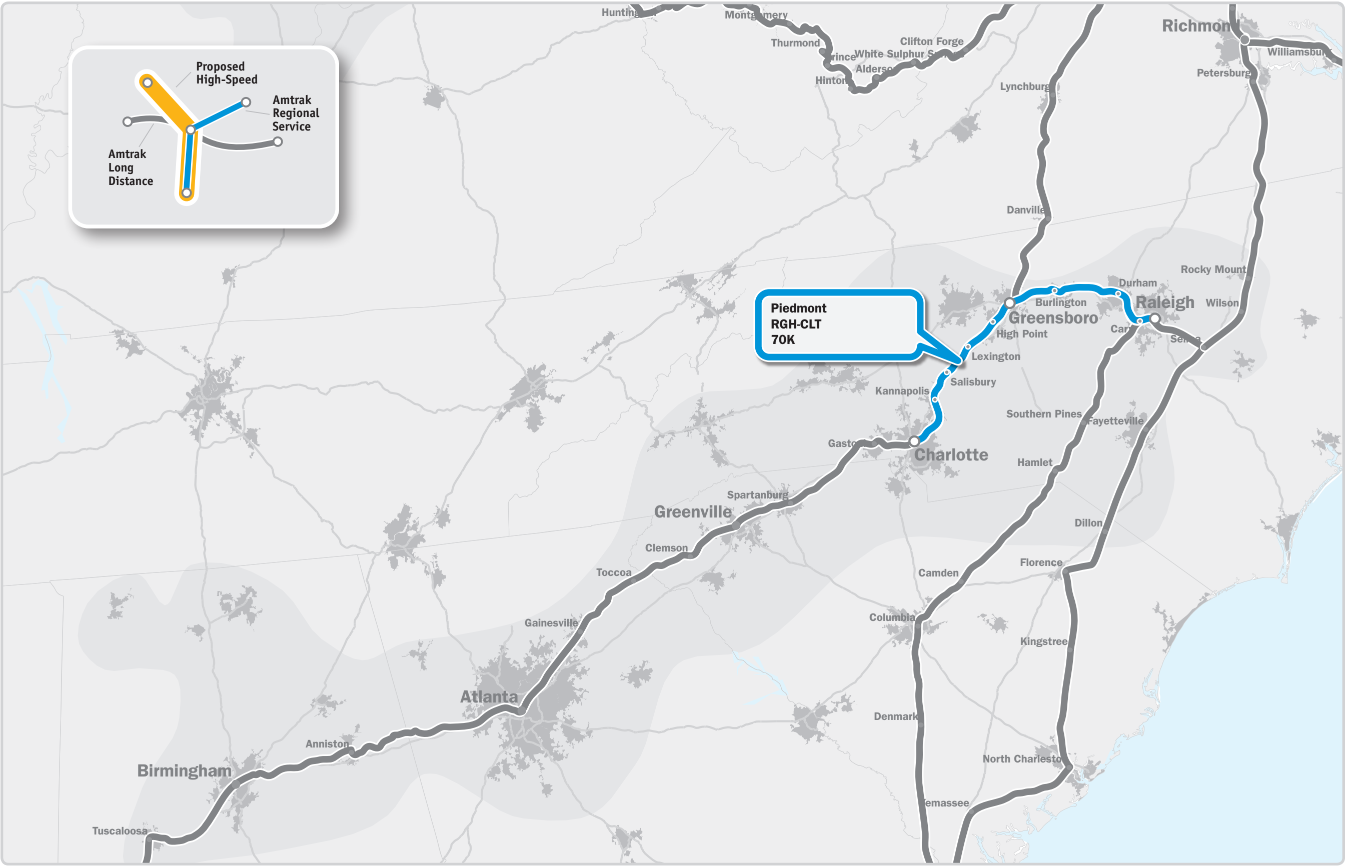
TABLE 47

Transit Accessibility and Ridership by Region

	Within Transit Accessible Zone				Avg. Weekday Ridership (Q4 2009)
	Population	%	Jobs	%	
Atlanta	500,000	13	470,000	24	247,233
Charlotte	80,000	5	150,000	18	19,467

Source: America 2050 analysis and APTA 2009 Fact Book

Passenger Rail Service in the Piedmont Atlantic Megaregion



Source: Amtrak ridership data FY 2009

Rail Service

Intercity rail service is extremely limited throughout the Piedmont Atlantic Megaregion. There is one train per day, which takes passengers from Charlotte to Atlanta, covering the 220-mile distance in 5 hours 30 minutes. The same distance can be travelled by private auto in about four hours. Yet, more than the trip time, the almost nonexistent rail market (3,600 passengers per year) can be attributed to the inconvenient schedule, which leaves Charlotte at 2:45 a.m. and arrives in Atlanta at 8:15 a.m. Intercity ridership is higher in the northeastern half of the corridor connecting Charlotte, Raleigh, and Richmond to Washington, DC.

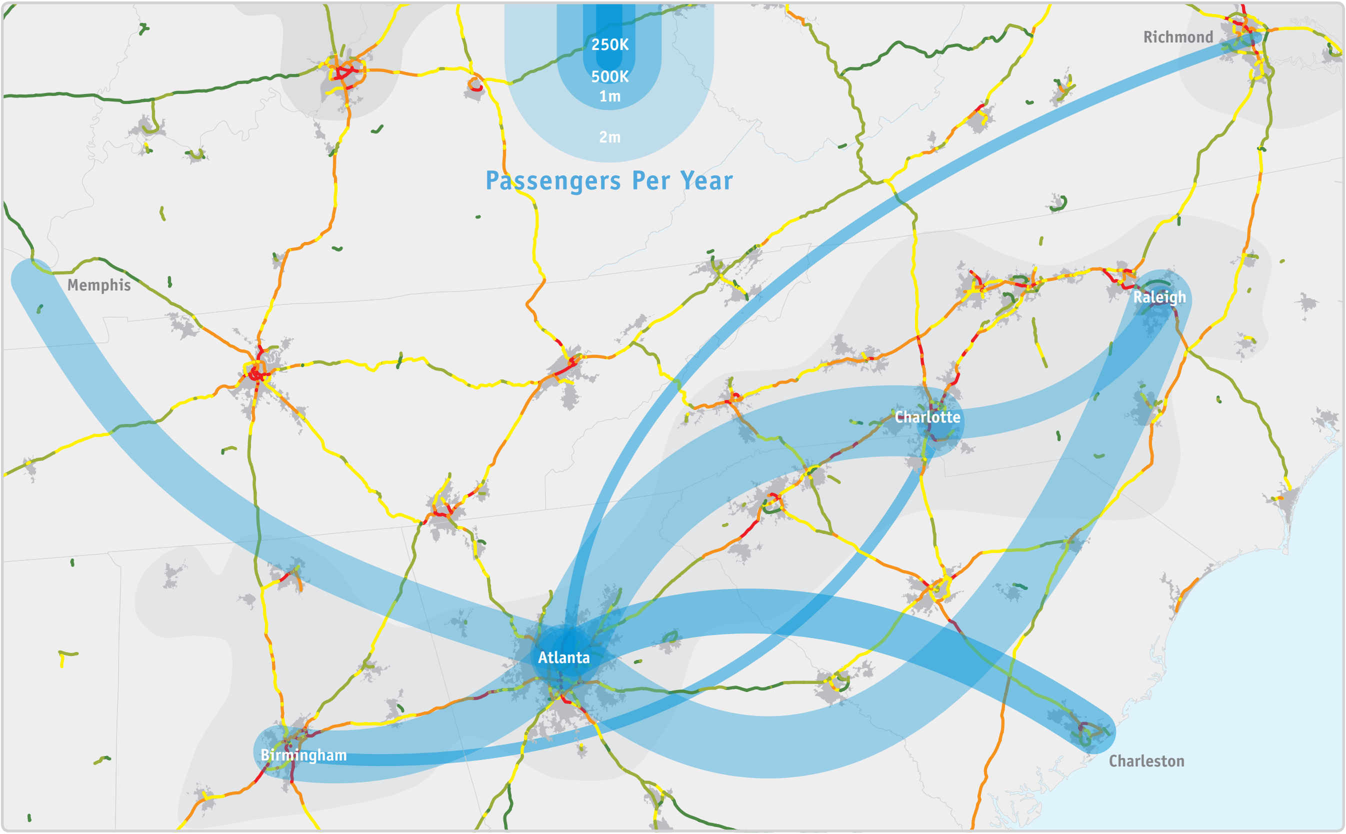
Plans for high-speed rail in the corridor are modest and currently more developed in the northeastern end of the corridor. Plans include increasing speeds to 90 miles per hour in the medium-term and 110 miles per hour in the longer-term northeast of Charlotte to Raleigh, Richmond, and connecting to the Northeast Corridor via Washington, DC.

Congestion and Travel Market

Despite being home to the busiest airport in the nation, Atlanta has a relatively small regional air market to destinations within the Piedmont Atlantic megaregion. In total, Atlanta has only 1.5 million annual total departures to Charlotte, Raleigh, and Birmingham, which represents a small fraction of its total annual volume. These numbers are significantly smaller than passenger volumes to destinations beyond the megaregion, but within 600 miles of Atlanta, such as the Florida markets. However, Atlanta to Washington, DC and Richmond are also major air markets, and when viewed cumulatively, the total annual air market on the corridor between Atlanta and Washington is 6 million passengers.

Four of the top five short-haul air markets originating in Raleigh are to destinations on the Northeast Corridor, as are two of the top three coming from Charlotte. There is at least as much demand from the cities in the northeastern portion of this megaregion to connect to Washington, DC and beyond as there is with Atlanta. This air data reinforces the decision to begin passenger rail investments in the northeastern end of the megaregion and create strong connections between the North Carolina cities and the Northeast Corridor.

Regional Air Market and Interstate Highway Congestion in the Piedmont Atlantic Megaregion



Source: Federal Aviation Administration 2009

Road congestion on the intercity corridors connecting the Piedmont Megaregion is about average for major metropolitan areas. In the Atlanta-Birmingham corridor, 46 percent of the highways operate at over 75 percent design capacity in the peak hour. The northern half of the corridor is more congested. This same figure is 54 percent in the Atlanta-Charlotte section or the corridor.

TABLE 48

Annual Passengers Originating in and Destined to Airports in the Piedmont Atlantic Megaregion

Atlanta	1,500,000
Charlotte	800,000
Birmingham	300,000
Raleigh	600,000

Source: America 2050 analysis of FAA 2009

TABLE 49

Regional Air Markets in Piedmont

	Annual Passengers
Atlanta to Charlotte	676,762
Atlanta to Raleigh	593,944
Atlanta to North Charleston	428,653
Atlanta to Richmond	419,754
Atlanta to Memphis	407,177
Raleigh to Charlotte	280,464
Birmingham to Charlotte	114,845

Source: America 2050 analysis of FAA 2009

TABLE 50

Average Delay in Major Airports in Piedmont Atlantic Megaregion

Airport	Minutes	Rank
Atlanta	14.1	5
Charlotte	10.8	8

Source: FAA 2009

Scoring of Corridors in the Piedmont Atlantic Megaregion

Source: America 2050

TABLE 51

Scoring of Corridors in the Piedmont Atlantic Megaregion

Origin	Destinations	Length	Score	Total Employment Within 2 Miles of Major Nodes	Total Population within 25 Miles of Major Nodes	Cumulative Air Market	Total Transit Accessible Population in Major Nodes
Birmingham AL	Atlanta GA	164	15.93	180,000	4,800,000	250,000	500,000
Atlanta GA	Charlotte NC	257	15.68	200,000	7,100,000	890,000	580,000
Washington DC	Charlotte NC	376	15.16	440,000	7,700,000	810,000	1,220,000
Charlotte NC	Raleigh NC	172	14.84	220,000	4,100,000	460,000	80,000
Atlanta GA	Raleigh NC	429	14.71	350,000	9,600,000	2,110,000	580,000
Charlotte NC	Richmond VA	369	11.88	260,000	5,400,000	660,000	80,000
Savannah GA	Atlanta GA	263	11.67	110,000	4,500,000	400,000	500,000
Atlanta GA	Cincinnati OH	460	9.05	160,000	6,000,000	250,000	500,000
Birmingham AL	Memphis TN	252	5.09	110,000	2,000,000	50,000	-
Birmingham AL	New Orleans LA	354	4.95	200,000	2,100,000	60,000	-

*Includes annual flights among all airports located along the corridor.

Top Corridors

All three sections of the Piedmont Corridor, including Birmingham-Atlanta, Atlanta-Charlotte, and Charlotte-Washington, DC score have scores similar to the corridors in Texas but lower than corridors in the Northeast, Midwest, and California.

Passenger rail could become a viable option for intercity travel in this region, but only if it is matched by regional planning that focuses development in city centers and continues investing in rail transit networks in regions like Atlanta and Charlotte. Efforts to maintain and expand these transit systems have stalled recently due to the recession.

Cascadia

Population and Employment Profiles

The Cascadia megaregion spans approximately 466 miles from Eugene, Oregon to Vancouver, British Columbia, Canada. It includes two medium-sized metropolitan areas – Portland and Seattle – in the United States and one larger metropolitan area – Vancouver – in British Columbia, Canada. Portland and Seattle are relatively compact compared to cities in Texas, the Piedmont Atlantic, and Florida, with consistent medium density from their urban core through their metropolitan fringe. Vancouver is Canada's third largest metro region with more than two million people. Although Cascadia has three medium to large metro regions, it lacks the one very large dominant city needed to generate large amounts of rail ridership. Despite this, the population distribution in Cascadia, with little population in between the major cities, allows for direct center city to center city connections to serve a majority of the megaregion's population.

Although not among the nation's leaders in center city population, Seattle and Portland have relatively large central business districts (Table 53). Seattle's 440,000 jobs within two miles of its train station ranks fifth in the nation, ahead of many cities with much larger populations, including Los Angeles, Houston, Dallas, and Phoenix. This increases the potential economic impact of connecting the center cities of Seattle and Portland.

Seattle's 440,000 jobs within two miles of its train station ranks fifth in the nation.

TABLE 52

Population Profile for Major Cities in the Cascadia Megaregion

	2 mi.		10 mi.		25 mi.		Projected 2040
	Pop.	Rank	Pop.	Rank	Pop.	Rank	Growth
Seattle	90,000	20	960,000	23	2,640,000	17	39%
Portland	80,000	27	1,160,000	18	2,050,000	26	48%
Salem	50,000	101	260,000	113	520,000	132	43%
Eugene	60,000	67	250,000	114	320,000	198	39%

Source: America 2050 analysis of 2000 Census and 2010 Woods and Poole Economics

TABLE 53

Employment Profile for Major Cities in the Cascadia Megaregion

	2 mi.		10 mi.		25 mi.		Projected 2040
	Empl.	Rank	Empl.	Rank	Empl.	Rank	Growth
Seattle	440,000	5	1,410,000	4	2,680,000	7	41%
Portland	150,000	14	650,000	19	1,000,000	43	44%
Eugene	30,000	87	120,000	139	150,000	210	36%
Salem	10,000	201	110,000	154	260,000	148	41%

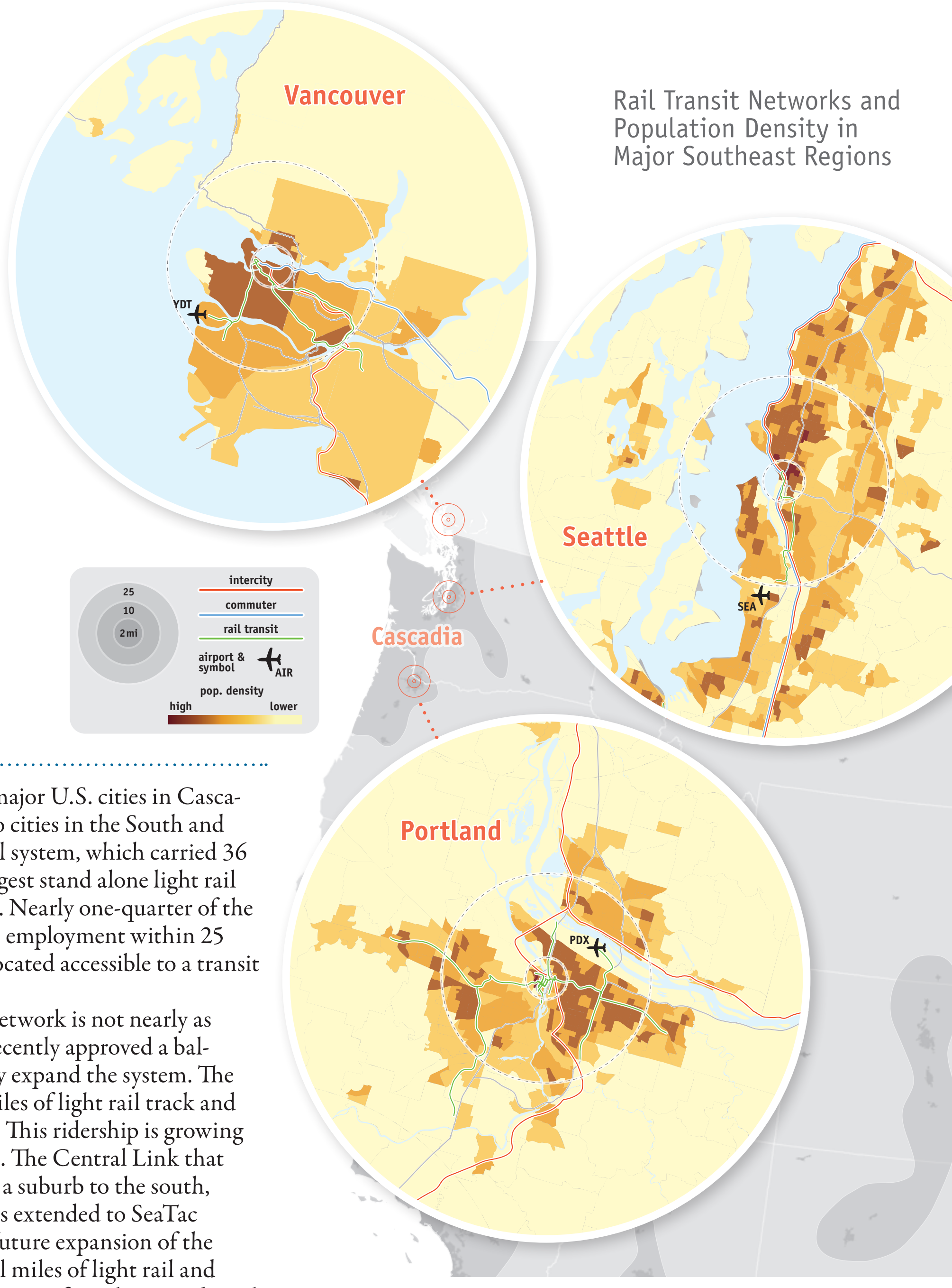
Source: America 2050 analysis of 2007 Bureau of Economic Analysis and 2010 Woods and Poole Economics

TABLE 54

Population and Employment Profile for Vancouver

	Population		Employment	
	10 Mile Equivalent	25 Mile Equivalent	10 Mile Equivalent	25 Mile Equivalent
Vancouver*	1,100,000	2,100,000	600,000	1,100,000

The CSDs included in the 10-mile equivalent for Vancouver are: Vancouver, Burnaby, North Vancouver (CY), North Vancouver (DM), West Vancouver, Richmond.
Source: Statistics Canada



Rail Transit Networks and Population Density in Major Southeast Regions

Transit Connectivity

Transit connectivity in the two major U.S. cities in Cascadia is relatively good compared to cities in the South and Southeast. The Portland light rail system, which carried 36 million people in 2009, is the largest stand alone light rail system in the nation by ridership. Nearly one-quarter of the population and 42 percent of the employment within 25 miles of downtown Portland is located accessible to a transit station (Table 55).

Although Seattle's light rail network is not nearly as robust as Portland's, the voters recently approved a ballot measure that will significantly expand the system. The network currently includes 19 miles of light rail track and carried 4 million people in 2009. This ridership is growing rapidly as the system is expanded. The Central Link that connects downtown to Tukwila, a suburb to the south, opened only in July 2009 and was extended to SeaTac airport in December 2009. The future expansion of the network would add 36 additional miles of light rail and introduce commuter rail by 2030, significantly expanding the network's connectivity to jobs and employment in the Seattle region.[34]

And Vancouver's transit network is one of the most extensive of its kind for any mid-sized metropolitan region in North America. The three automated Skytrain light rail lines comprise 42.7 miles of track, with daily ridership of 345,000. The newest, the Canada Line, was opened in 2009 ahead of the Olympic Games and connects downtown Vancouver with the Vancouver International Airport. The Main Street Skytrain Station is located adjacent to the Pacific Central Station

TABLE 55

Accessibility and Ridership by Region

	Within Transit Accessible Zone				Avg. Weekday Ridership
	Population	%	Jobs	%	(Q4 2009)
Portland	500,000	24	420,000	42	116,500
Seattle	190,000	7	280,000	10	28,500

Source: America 2050 analysis and APTA 2009 Fact Book

TABLE 56

Reach of Commuter Rail Network in the Cascadia Megaregion

	within 2 Miles of Commuter Rail Station	
	Population	Jobs
Seattle	640,000	520,000

Source: America 2050 analysis

34 Sound Transit Website. "Regional Transit System Planning." http://www.soundtransit.org/Projects-and-Plans/System-Planning-and-History.xml

Passenger Rail Service in Cascadia

Source: Amtrak ridership data FY 2009

served by Amtrak Cascades. The Skytrain Waterfront Station in the heart of downtown Vancouver provides links to West Coast Express commuter trains and the Vancouver SeaBus ferry.

Like neighboring cities in the United States, metropolitan Vancouver also has a regional growth management system, which has promoted dense population and employment centers in downtown Vancouver, and a network of compact regional centers served by frequent transit corridors.

Ridership has grown fourfold on Amtrak Cascades from 1994 to 2009.

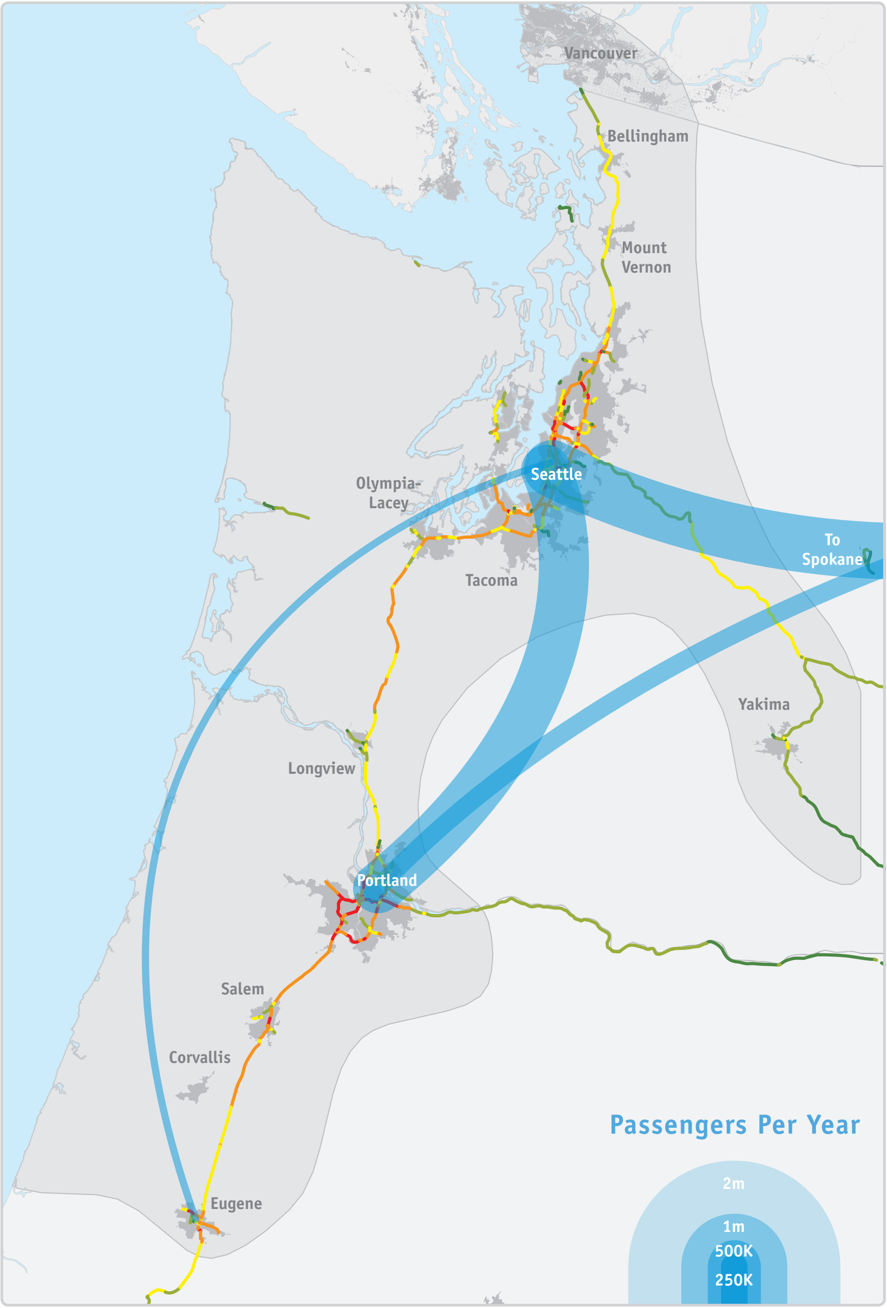
Rail Service

In addition to being served by two long distance trains (one providing service east to Chicago the other south to Los Angeles), Amtrak operates the Cascades service, which offers two daily round trips for Eugene-Portland, four daily round trips for Portland-Seattle, and two daily round trips for Seattle-Vancouver. Ridership has nearly quadrupled on the corridor, from 200,000 in 1994 to approximately 740,000 in 2009.[35]

Washington State Department of Transportation has been very active in planning a long-term vision for regional rail service in the Amtrak Cascades corridor based on incremental improvements. Current plans call for hourly service between Portland and Seattle, with more modest upgrades north of Seattle and south of Portland. Washington and Oregon were awarded approximately $794 million by the FRA in 2010 to begin implementing these incremental improvements, with the majority of the upgrades to take place in Washington State, except for renovations to Portland's train station.

35 Washington State Department of Transportation.

Regional Air Market and Interstate Highway Congestion in Cascadia



Source: Federal Aviation Administration 2009

TABLE 57

Annual Passengers Originating in and Destined to Airports in the Cascadia Megaregion

Seattle	750,000
Portland	630,000
Eugene	130,000
Vancouver	310,000

Source: America 2050 analysis of FAA 2009

TABLE 58

Regional Air Markets in Cascadia

	Annual Passengers
Seattle to Spokane	534,136
Portland to Seattle	472,468
Portland to Spokane	172,663
Eugene to Seattle	62,649

Source: America 2050 analysis of FAA 2009

TABLE 59

Delay in Major Airports in the Cascadia Megaregion

Airport	Minutes	National Rank
Seattle	9.1	18
Portland	6.2	33

Source: FAA 2009

Congestion and Travel Market

At less than 200 miles, the distance between Portland and Seattle is at the low end of the range at which air markets develop. In 2009, nearly one million passengers were carried on this route, well down the list for markets of less than 600 miles and with only four daily trips, as opposed to approximately 30 round trip flights, rail has been able to capture nearly one-quarter of the combined market, and more than that when excluding passengers connecting to long distance flights.

Traffic congestion between Portland and Seattle is about average, with nearly 50 percent of Interstate-5 operating at above 75 percent of design capacity during the peak hour.

Scoring of Corridors in the Cascadia Megaregion

Source: America 2050

TABLE 60

Scoring of Corridors in the Cascadia Megaregion

Origin	Destinations	Length	Score	Total Employment Within 2 Miles of Major Nodes	Total Population within 25 Miles of Major Nodes	Cumulative Air Market*	Total Transit Accessible Population in Major Nodes
Portland OR	Seattle WA	185	17.68	600,000	5,600,000	470,000	670,000
Eugene OR	Portland OR	124	15.42	190,000	2,900,000	60,000	500,000
Eugene OR	Bellingham WA	403	14.33	670,000	6,900,000	690,000	670,000
Seattle WA	Spokane WA	328	11.02	510,000	3,200,000	530,000	170,000

*Includes annual flights among all all airports along the corridor.:

Top Corridors

Due to its natural geography, the population of Cascadia forms a natural corridor between the Pacific Ocean and the Cascades Mountain range from Vancouver, BC, through Seattle and Portland, to Eugene, OR. The highest scoring section of this corridor is between the two large domestic metro regions, Portland and Seattle.[36] With a score of over 17, this 180-mile section compares favorably to corridors across the country. This corridor has the highest score in the nation after corridors that connect to New York City, Chicago, Los Angeles, and San Francisco, and may qualify for HSR Core Express, or certainly HSR Regional service.

For the section of the corridor north of Seattle and south of Portland, classic rail service may be more appropriate to act as a feeder to the high-speed service between Portland and Seattle. Classic rail service in this region could offer frequent connections and serve many local communities giving them access to the high-speed route.

36 Although Vancouver is included in the discussion, it was not directly included in the analysis due to lack of comparable data to the United States. We estimated that the full 320-mile Portland-Seattle-Vancouver corridor would also have a score in the 17.5-18 range.

Front Range – Intermountain West

Population and Employment

With the exception of Denver and Salt Lake City, medium sized metropolitan regions, the cities of the Front Range are relatively small (Table 61). Salt Lake City is fairly compact and served by transit, but at a distance of 500 miles from Denver, with the Rocky Mountains and no major population centers in between, high-speed rail in this corridor would be extremely expensive for the relatively few people it would serve compared to other corridors.

The other population centers, Cheyenne, Colorado Springs, Santa Fe, and Albuquerque are not in the top 80 in population, either in their urban core or larger region. The largest of these cities, Albuquerque, only has 775,000 people living within 25 miles of downtown. While small in population today, the Front Range has some of the nation's fastest growing metro regions, with projected growth rates of 50 to 70 percent for most of the cities in the megaregion. An additional 1.3 million people are expected in the 25-mile zone around Denver by 2040, growing to nearly 4 million. Albuquerque and Santa Fe, with projected growth rates of about 60 percent, will add more than half a million people by 2040.

However, even with this rapid growth, the Front Range will still be less populated than any other megaregion in 2040. With the exception of Colorado Springs less than 100 miles south of Denver, the land in between the nearly 500 miles from Denver to Albuquerque is mostly mountainous or rural and sparsely populated.

TABLE 61

Population Profile for Major Cities in the Front Range and Intermountain West

	2 mi.		10 mi.		25 mi.		Projected 2040
	Pop.	Rank	Pop.	Rank	Pop.	Rank	Growth
Denver	100,000	17	1,390,000	11	2,570,000	19	52%
Salt Lake City	70,000	35	700,000	37	1,330,000	47	55%
Omaha	50,000	97	570,000	49	780,000	85	34%
El Paso	30,000	172	420,000	66	760,000	90	64%
Colorado Springs	50,000	88	480,000	56	610,000	110	57%
Santa Fe	20,000	286	100,000	264	160,000	317	67%
Cheyenne	20,000	265	80,000	327	90,000	358	31%

Source: America 2050 analysis of 2000 U.S. Census and 2010 Woods and Poole Economics

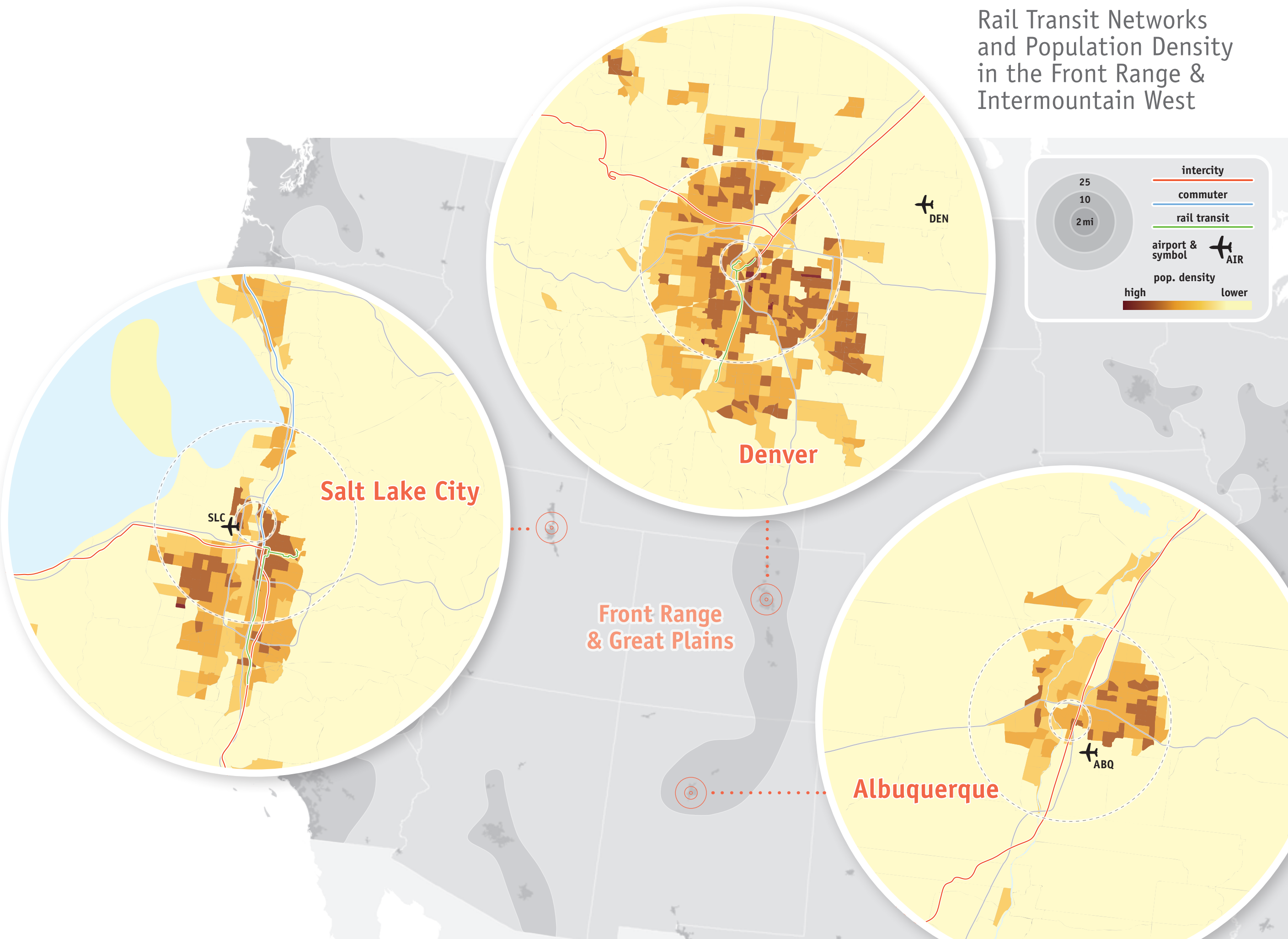
TABLE 62

Employment Profile for Major Cities in the Front Range and Intermountain West

	2 mi.		10 mi.		25 mi.		Projected 2040
	Empl.	Rank	Empl.	Rank	Empl.	Rank	Growth
Denver	280,000	7	1,040,000	8	1,860,000	16	38%
Salt Lake City	80,000	29	420,000	42	790,000	59	60%
Colorado Springs	40,000	77	230,000	82	290,000	134	55%
Omaha	40,000	78	280,000	66	410,000	96	35%
El Paso	30,000	101	170,000	102	260,000	149	67%
Cheyenne	3,000	292	20,000	352	40,000	356	39%
Santa Fe	2,000	324	30,000	328	70,000	311	59%

Source: America 2050 analysis of 2007 Bureau of Economic Analysis and 2010 Woods and Poole Economics

Rail Transit Networks and Population Density in the Front Range & Intermountain West



Transit Connectivity

Denver has a light rail system that carried 20 million passengers in 2009, the eighth largest by volume in the country, but the existing system only serves a small portion of the region. About 12 percent of the regional population lives within the transit accessible zone along its 35-mile route (Table 63). This will change in the coming years, however, as Denver is moving forward with an ambitious regional transit program to build 122 miles of commuter and light rail, and 18 miles of Bus Rapid Transit to reach four corners of the region, including connecting to Denver International Airport. The regional transit program, called "FasTracks," is funded by a .4 percent sales tax passed by the voters in 2004, approximately $1.4 billion in federal funding, and private financing, including value recapture of real estate value around stations.[37]

Salt Lake City also has an existing 64-mile network of commuter rail and light rail that has seen impressive growth in recent years. Utah Transit Authority's FrontLines 2015 program plans to more than double the system with additions of commuter and light rail.

New Mexico has recently initiated the Rail Runner, a commuter rail service that runs between Santa Fe and Albuquerque, and carried 1.4 million passengers in 2009.

TABLE 63

Transit Accessibility and Ridership by Region

	Within Transit Accessible Zone				Avg. Weekday Ridership
	Population	%	Jobs	%	(Q4 2009)
Denver	320,000	12	420,000	23	62,900
Salt Lake City	200,000	15	320,000	41	48,700

Source: America 2050 analysis and APTA 2009 Fact Book

TABLE 64

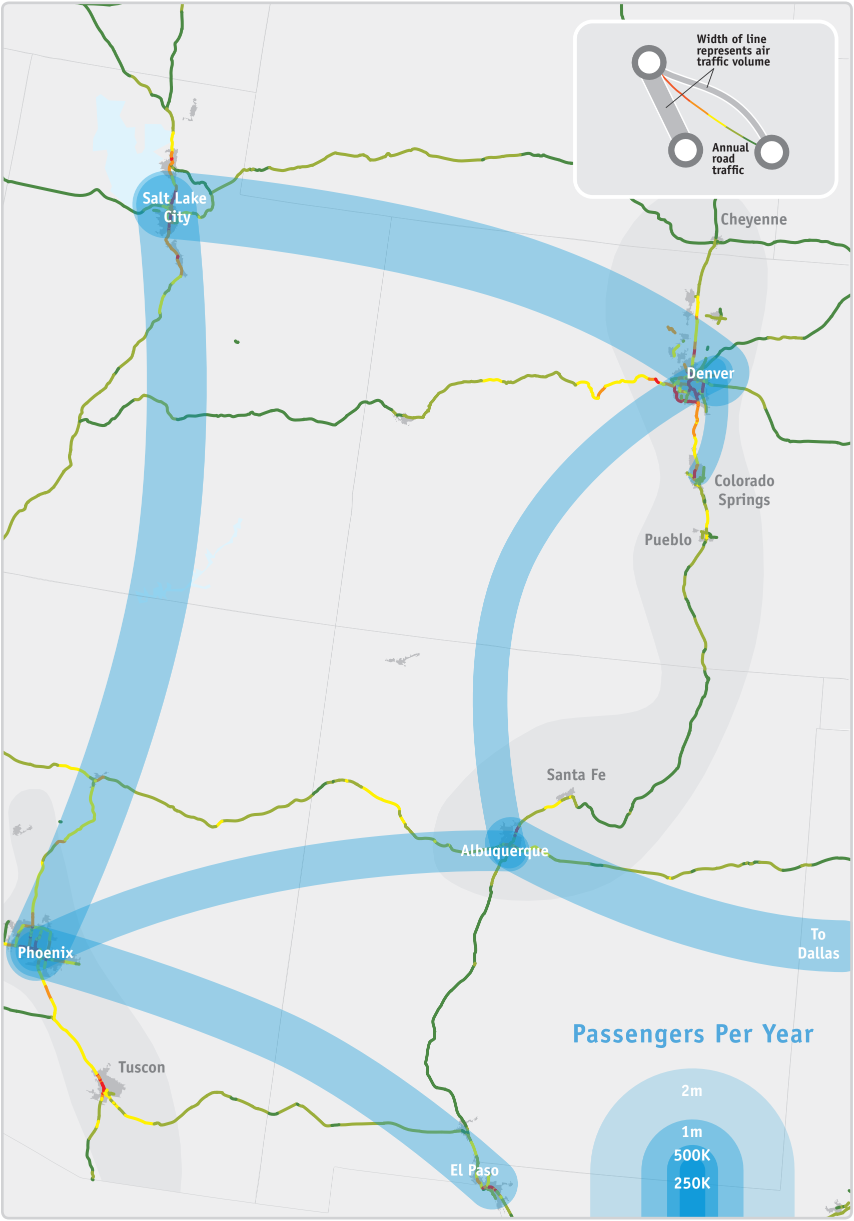
Reach of Commuter Rail Network and Ridership in Sante Fe

	within 2 Miles of Commuter Rail Station	
	Population	Jobs
Santa Fe	90,000	30,000

Source: America 2050 analysis

37 FasTracks Regional Transportation District of Denver Website, "Financing FasTracks" http://www.rtd-fastracks.com/main_33.

Regional Air Market and Interstate Highway Congestion in Front Range



Source: Federal Aviation Administration 2009

TABLE 65

Annual Passengers Originating in and Destined to Airports in the Front Range Megaregion

Denver	1,220,000
Salt Lake City	800,000
Albuquerque	480,000
Colorado Springs	260,000
El Paso	40,000

Source: America 2050 analysis of FAA 2009

TABLE 66

Regional Air Markets in the Front Range

	Annual Passengers
Denver to Salt Lake City	660,973
Phoenix to Salt Lake City	585,112
Albuquerque to Dallas	508,332
Phoenix to Albuquerque	399,706
Denver to Albuquerque	340,229
Denver to Colorado Springs	219,253

Source: America 2050 analysis of FAA 2009

TABLE 67

Delay in Major Airports in the Front Range Megaregion

Airport	Minutes	National Rank
Denver	9.6	15
Salt Lake City	7.9	26

Source: FAA 2009

Rail Service

Although Colorado and New Mexico both have long distance trains running east-west through their states, there is currently no north-south intercity rail link connecting the cities in the Front Range.

Planning for improved rail service in the Front Range Intermountain West region is in its infancy. The Western High-Speed Rail Alliance, a consortium of five metropolitan planning organizations, has been formed to determine the viability of high-speed rail. The organization is studying routes between Denver, Salt Lake City, Reno, Las Vegas, and Phoenix. These routes would still not provide any intra-megaregion rail service north-south along the I-25 corridor between Denver and Albuquerque.[38]

Meanwhile, the Colorado-based Rocky Mountain Rail Authority has recently completed a study evaluating high-speed rail opportunities along two corridors, one north-south along the Front Range and one east-west along the I-70 corridor. Despite this recent interest in high-speed rail, rail planning in the Front Range and Intermountain West region is still in its infancy.

Congestion and Travel Market

There is little intra-megaregion air travel in the Front Range. The Denver-Albuquerque air market, the largest in the Front Range, had 680,000 passengers in 2009, ranking 98th in the nation among air markets of less than 600 miles.

38 Western High-Speed Rail Alliance Plan Brochure: http://www.whsra.com

Scoring of Corridors in the Front Range Megaregion

Source: America 2050

TABLE 68

Scoring of Corridors in the Front Range Megaregion

Origin	Destinations	Length	Score	Total Employment Within 2 Miles of Major Nodes	Total Population within 25 Miles of Major Nodes	Cumulative Air Market*	Total Transit Accessible Population in Major Nodes
Pueblo CO	Denver CO	120	17.13	330,000	3,300,000	220,000	320,000
Cheyenne WY	Denver CO	106	15.51	290,000	3,100,000	-	320,000
Ogden UT	Provo UT	82	14.90	100,000	2,200,000	-	200,000
Albuquerque NM	Denver CO	476	9.91	360,000	4,100,000	560,000	320,000
Salt Lake City UT	Denver CO	568	9.53	390,000	4,500,000	810,000	520,000
Omaha NE	Denver CO	535	8.14	350,000	3,700,000	400,000	320,000
Albuquerque NM	Phoenix AZ	584	6.26	120,000	4,700,000	400,000	230,000
El Paso TX	Albuquerque NM	259	4.67	70,000	1,700,000	40,000	-

*Includes annual flights among all airports located along the corridor.

There is little intercity traffic congestion on the highways between the major cities in the Front Range and Intermountain West regions. Only 11 percent of I-25 between Albuquerque and Denver operates at over 75 percent of design capacity during the peak hour. The congestion between Denver and Salt Lake City is even less, at only five percent. These are the least congested of any major corridors considered in this study. The shorter corridors in the region have more congestion. Denver to Fort Collins, Colorado Springs, and Pueblo register congestion levels in the 30-50 percent range. Congestion in the Salt Lake City region is even greater. Nearly 80 percent of the roadway between Provo and Ogden, Utah (via Salt Lake City) operates at over 75 percent design capacity during the peak hour.

Top Corridors

The Cheyenne-Denver-Pueblo corridor, at 226 miles, is the most promising route in this megaregion, scoring 17.13 in the Cheyenne-Denver segment and 15.51 in the Denver-Pueblo segment. The strong scores for this corridor and the short corridor running north and south of Salt Lake City reflect that these two regions have invested heavily in their local and regional transit systems and focused housing and commercial development around them. The Salt Lake City corridor that runs for less than 100 miles from Ogden, Utah, south through Salt Lake City to Provo currently hosts commuter rail service and will be expanded in the coming years.

The longer corridors in the Front Range and Intermountain West regions perform poorly in this analysis. This is because they connect small to mid-sized cities spaced at the very outer limits of the range for intercity rail. These include routes such as Denver-Albuquerque, Denver-Salt Lake City, and Albuquerque-El Paso.

Appendix

To inform the analysis in this study, we created a custom database of possible rail corridors, and metropolitan areas with demographic, employment, and transit data. Variables in the database are:

- Population
- Employment
- Transit ridership
- Population and employment within areas served by transit
- Air ridership along the corridor
- Highway congestion.

The steps to calculate these are outlined below.

Selection of start and end points for corridors

To create a list of start and end points for corridors, we identified the center of each metro area. First, we took the Census Bureau's list of Metropolitan Statistical Areas for the lower 48 states (Census, 2000). For each metro area, we identified the most populated city. If an Amtrak station is located in the city, we took the station to be the metro's center point for analysis.

Where no existing station existed for that metro area, we took the center point of the city. Three hundred sixty-four center points were identified.

Calculation of corridors

Using a map of the active passenger and freight national rail network (National Atlas of Transportation Data, 2007), the shortest travel paths between MSA centers were calculated for all MSA pairs within 600 miles. In Florida and California, the proposed HSR alignments were used to calculate the distances. We calculated 12,645 corridors. If a start or end point was not directly located on the rail system, the closest section of rail network was used as a starting point.

Metro profiles

For each metropolitan area, we assembled demographic data, using Census 2000 and population projections from the 2010 Complete Economic and Demographic Data Source from Woods and Poole Economics. Employment data were drawn from Bureau of Economic Analysis (BEA) 2007 estimates and Woods and Poole projections.

For each metro area, we calculated the total within 2, 10, and 25 miles of the MSA's center. Although summary data are available for metropolitan areas, we are specifically interested in the area of each region that is directly adjacent to existing or potential rail. When a tract or zip code is not completely enclosed within the 2, 10 or 25 mile study area, population was proportionally allocated based on area.

Population data

The population information describes the current and projected population in each metro area. Population data was calculated using census tracts from Census 2000, with projections taken from Woods and Poole 2010. Projections are at the county level, and apportioned to tracts based on the share of 2000 tract population compared to 2008 county population estimates.

Employment data

Employment information describes the labor mix in the metropolitan area, including total employment and employment in the following sectors:

- Finance and insurance
- Real estate, rental and lease
- Arts, entertainment and recreation
- Accommodation and food services

Employment was calculated on zip code tabulation areas (ZCTA) with base 2007 estimates from BEA. The zip-level employment data do not include government sector employment, so we used Woods and Poole county data to estimate the share of government employment at the zip level, and estimated the complete employment by zip. Where a ZCTA is not completely enclosed within the 2, 10 or 25 mile study area, employment was proportionally allocated based on area. Employment projections to 2040 were estimated from the county to zip based on share of employment in 2008.

How metro data was aggregated onto corridors

Once the corridors were calculated, we identified all urban centers located along the route, so that the total demographics for any corridor can be calculated to assess the multiple metropolitan areas it serves.

To calculate the demographic profile along each corridor between each city pair, we added up the data for each metro along that route. Each data point was counted only once per corridor, since in some locations the 25 and 10 mile study areas overlap (e.g. many corridors in the Midwest).

Transit system data

The corridor database includes ridership, and population and employment located near to mass transit.

We used the 2009 American Public Transit Association Fact Book to look up annual ridership. With this data, we identified all metros with non-bus mass transit.

Where available, we used the National Atlas of Transportation to identify the total coverage of routes. In cases where the transit networks were not completely represented (e.g. recent extensions to the Portland light rail), we used aerial photographs in Google Earth to locate the route, and add it to our map. Once mapped, we used the map to identify and add up population by tract within 0.5 mile of heavy and light rail, and 2 miles of commuter rail stations. We carried out the same calculation for employment, at the same distances.

Air data

Air market data was obtained from the T-100 segment market data from the Federal Aviation Administration's Trans-Stats data set and described total volume between major airports. We assigned each airport to the closest city, and then calculated the total volume of travel between all destinations along each rail corridor. For example, for the New York–Washington, DC corridor, we added up the total volume of flights between these cities along the corridor: New York City, Philadelphia, Baltimore, Washington, DC.

Traffic data

The Federal Highway Administration publishes the Freight Analysis Framework data set, including estimates of volume to capacity ratio (VCR) for 2002 and 2035 on the interstate and major road network. We calculated the shortest path by road between the end points for each corridor, excluding minor rural and urban arterials. For each section of road along the calculated path, we take the estimated VCR in 2002 and 2035, and add up the values from each segment to give a percentage breakdown of the whole corridor by VCR class (< 0.25, 0.25-0.5, 0.5-0.75, 0.75-1.0, >1).

These calculations were carried out in ArcGIS, a desktop mapping and analysis tool. Network calculations were carried out with pgRouting in PostGIS, a spatial database system.

Corridor Scoring Method

Each of these corridors was given a composite score based on a subset of the criteria described above. Only corridors that passed through one of the 49 metro regions in Table 69 were selected out for scoring. This reduced the total corridors from 12,645 to 7,870.

TABLE 69

Metro Regions for which Corridors were Selected

Megaregions	Metro Regions Included
Northeast	Baltimore, Boston, Hartford, New York, Philadelphia, Providence, Richmond, Washington DC
Florida	Jacksonville, Miami, Orlando, Tampa
Piedmont	Atlanta, Birmingham, Charlotte, Greensboro, Greenville, Raleigh
Cascadia	Portland, Seattle
Front Range	Albuquerque, Denver, Salt Lake City
Texas	Austin, Dallas, Houston, New Orleans, Oklahoma City, San Antonio, Tulsa
Southwest	Fresno, Las Vegas, Los Angeles, Phoenix, Riverside, Sacramento, San Diego, San Francisco, San Jose, Tucson
Great Lakes	Chicago, Detroit, Minneapolis, Saint Louis, Cleveland, Pittsburgh, Cincinnati, Kansas City, Milwaukee, Indianapolis

Preparing Data for Equation

Prior to applying an equation to the data to create the composite corridor score, we standardized the data such that every entry in the data base was a relative rank between zero and one.

First, each criterion was divided by the total length (in miles) of the corridor. This step resulted in the data being on a per mile basis, which allows for comparison between corridors of varying lengths. Without this step, longer corridors with more data points would have had an advantage over shorter corridors.

$$\text{Value}_n \ / \ \text{Length of Corridor}_n$$

Each criterion was given a rank of zero to 7,870 based on their relative value.

$$\text{Rank } (\text{Value}_n/\text{Length}_n)$$

These ranks were then converted to a value between 0 and 1 by dividing the rank by the maximum rank in each category and subtracting that result from 1. This yielded a number between 0 and 1 for each entry with the highest value 1 and lowest 0.

$$1 - (\text{Rank}_n \ / \ \text{Maximum Rank})$$

Final Equation

The final equation was then applied to these adjusted corridor ranks.

Corridor Score = 3*(RP+ECBD) +2*(TCE+TCP+CP+CE+RPGE+RAM) + (CRP+CTC+SF+ST)

TABLE 70

Criteria Used to Develop Corridor Score

Primary Factors: Weighted 3X	
Regional Population (25Miles)	(RP)
Employment CBD (2Mile)	(ECBD)
Secondary Factors: Weighted 2X	
Transit Connectivity Employment	(TCE)
Transit Connectivity Population	(TCP)
City Population (10 Mile)	(CP)
City Employment (10 Mile)	(CE)
Regional Population Growth Factor	(RPGF)
Regional Air Market	(RAM)
Tertiary Factors: Weighted 1X	
Commuter Rail Connectivity Population	(CRP)
Corridor Traffic Congestion	(CTC)
Share of Financial Workers	(SF)
Share of Workers in Tourism Industry	(ST)

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America 2050

America 2050 is a national planning initiative to develop a framework for America's future development in face of rapid population growth, demographic change and infrastructure needs in the 21st century. A major focus of America 2050 is the emergence of megaregions - large networks of metropolitan areas, where most of the population growth by mid-century will take place – and how to organize governance, infrastructure, and land use planning at this new urban scale. A project of the independent **Regional Plan Association**, America 2050 is working to shape and support the new federal High-Speed Intercity Passenger Rail Program because of high-speed rail's potential realize the economic promise of megaregions and act as a transformative investment for America's future growth.

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