Moving Towards the Future: The Era of High Speed Rail in the U.S.

By

Lucy Olmos
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EXECUTIVE SUMMARY

Despite the economic recession, California’s population is growing rapidly from factors such as natural births and immigration. Even the most pessimistic forecast shows California’s population increasing by millions through the year 2030, and mobility seems to continue on being a problem without a solution for the near future. If a way out is not planned and implemented now, transportation will continue being a problem. Airport and highway infrastructure capacity continue to cause delays, mainly due to congestion and overcrowding. As a result, air quality continues to suffer. Automobile travel highly pollutes the air with greenhouse gas emissions. One way to help curb the greenhouse gas emissions caused by automobile travel is by making high speed rail an alternative for commuters. For example, the California high-speed rail project can provide a solution to environmental concerns. Commuters will be able take advantage of such high-speed rail features as downtown-to-downtown connections with travel with speeds of up to 220 mph.
This report addresses some concerns critics have regarding the high-speed rail, including cost and ridership forecasts. This report presents twelve different sections to help address these concerns.

I. The first section provides the purpose and need for the study of high speed rail in Southern California;

II. the second section provides the objectives;

III. the third provides the methodology used to come up with the conclusion and recommendations;

IV. the fourth section provides a background of high speed rail in the United States, California, and Southern California;

V. the fifth section analyzes existing rail transport in Southern California (intercity and commuter rail);

VI. the sixth section provides measurement of the current air and rail trips taken in Southern California and analyzes the projected ridership of the California high speed rail;

VII. the seventh section gives a case study of Florida’s Overland Express (FOX) project that was unsuccessful during the planning stages, but is now under review as the Florida High Speed Rail project;

VIII. the eighth section gives another case study, the Acela Express, which is a successful Amtrak line and is used as an example model for Southern California’s potential upgrade of existing rail;

IX. the ninth section compares the European Union’s policy on high speed rail with the United States’;
X. the tenth section lists the possible funding sources for high speed rail;

XI. the eleventh section provides an analysis of air and high speed rail transport as an alternative to automobile travel;

XII. Finally, the twelfth section provides an analysis of the estimate numbers of cost and ridership of the California high speed rail versus actual numbers taken from academic Flyvbjerg's research on estimates versus actual numbers of transportation projects.

The following is a summary of the main recommendations derived from this study:

- Rail improvements within the Orange County segment of the LOSSAN Corridor can minimize cost by creating feeder trains instead of new track system.

- Limit new high speed rail line to Los Angeles-Bakersfield-San Francisco

- Expand multimodal transit in downtown areas with high speed rail stops
Imagine being able to arrive at the train station five minutes before departure, hopping inside the train, turning on your laptop and catching up on work, and in less than three hours you arrive at your destination. Ideal? For many people it would be. Many Californians’ spend countless hours in traffic, paying a high price both in monetary and non-monetary value. When one sits in traffic there is nothing productive about it. California law prohibits the use of cell phone while driving; limiting the amount of work a person can do in an automobile. The annual delay per traveler in the Los Angeles metropolitan area is an average of 70 hours (Texas Transportation Institute 2009). In 2009, the Texas Transportation Institute issued a report that had the Los Angeles metropolitan area as the most congested region in the nation. San Francisco came in as the fifth most congested area and San Diego, not lagging too far behind, took ninth place (Texas Transportation Institute 2009). With six million additional people expected to populate Southern California in the next 30 years, mobility can only worsen (Southern California Association of Governments, 2009). Figure 2 Congestion (Wimborne 2008), shows a typical morning commute for most Californians. Increased congestion from highway, air, and rail travel continues to increase, emphasizing a pressing need for upgrades, improvements, and expansion.
Problem Statement

Once it was the image of freedom and liberty, and now for many people it has become the opposite, mainly an image of frustration and stress: the automobile. The popularity and dependency of the automobile has led to the issues we face today, mainly highway traffic congestion. Not only is it an issue for drivers, but traffic congestion creates environmental concerns. If given a choice, most people would choose not to be in traffic, however, California’s are not offered any meaningful competitive alternatives to driving an automobile. High-speed rail is an opportunity to create a viable alternative for commuters traveling throughout California.

However, whether a lack of transportation alternatives justifies the expenditure of billions in taxpayers’ dollars to build high speed rail is a question that must be analyzed before moving forward. This report will address whether building a California High Speed Rail is more cost effective than upgrading existing rail and/or creating new airports by analyzing estimated cost and demand for high speed rail service.

This report will analyze a comparative case study: Amtrak’s Acela Express rail upgrade of Boston-New York-Washington DC corridor. The U.S. Eastern Corridor rail line is a comparable case to California, with similar densities among connecting regions (San Diego, Los Angeles, and San Francisco). This report will also compare and contrast the United State’s policy on high-speed rail with that of the European Union’s. The comparison of policies will help provide an analysis of how the U.S. federal government
can play a role in the creation of a nationwide high-speed rail network. The report is conducted on behalf of the Orange County Transportation Authority.

PURPOSE AND NEED FOR IMPROVEMENT

PURPOSE

The purpose of this report is to analyze the projected ridership and cost estimates, and the public benefits of building a California high-speed rail segment.

NEED FOR IMPROVEMENT

The momentum to receive funding for the construction of high-speed rail from the U.S. federal government has never been as strong. According to U.S. Vice President Biden, California is better positioned than most states to receive federal funding, because -- "it’s been a priority of your governor, it’s been a priority of your Legislature, they’ve talked about it, a lot of planning has been done," (Reston 2009). The most current estimate of the cost of building the California high-speed rail is $45 billion (California High Speed Rail Authority 2009).

The price tag for building high-speed rail is high, but the "do nothing" scenario cost might be just as high. Most highways in Southern California have high volumes of traffic and heavily impacted local streets. Another option to alleviate traffic is to continue building more airports, roads, and highways. However, none of these options would help alleviate environmental concerns. Not only is air pollution a serious problem, but the flight delays and the cost for flying is continuing to increase and becoming a concern for the average person. Fuel prices will continue to rise as the oil reserve levels drop, yet automobile dependency is still the dominant force in transportation options.
Growth in Population and Employment

According to the California High Speed Rail Authority, California’s projected population is expected to reach 50 million in the next 20 years (California High Speed Rail Authority, 2009). Currently, Southern California has two of the top ten most congested areas in the United States: Los Angeles and San Diego (California High Speed Rail Authority, 2009). California legislation, such as Assembly Bill 32--Global Warming Solutions Act-- and Senate Bill 375--Redesigning Communities to Reduce Greenhouse Gases-- are sure to have an effect of either alleviating or worsening congestion. Both bills focus on limiting suburban sprawl by tying land use with transportation.

California’s budget problems worsened during the housing bubble in the mid years of this past decade. Since then, the California state government has been feeling the economic pressure from the effect of the housing crash and the rise of unemployment. The California State Legislature fiscal budget for 2009-10 had a gap of $60 billion, with a projected gap of $20 billion for fiscal year 2010-11 (Office of the Governor 2010). In the coming years, a challenge California will face is how to regain its previous economic competitiveness. The planning and construction of high-speed rail might be one of the solutions to solve our economic crisis. High speed rail is projected to create nearly half a million jobs and improve the quality of life for all Californian residents by reducing congestion and contributing to the reduction of greenhouse gases (California High Speed Rail Authority, 2009).
Growth in Travel Demand

Much of the growth in travel demand in Southern California in the past decades has been from the automobile. The future of reduced dependency on the automobile looks bleak if transit is not expanded. Automobile travel for many people is the only option due to the lack of alternatives for both short and long distance trips. Another factor is the distressing reality that the public is uneducated about the real price of driving an automobile. Most people believe the cost of driving ends at the gas pump. The external cost is the harm done to the environment from driving an automobile. However, the invisible cost is not talked about, nor is it calculated in the fuel price. This unseen cost has contributed to the rise of the automobile.

California is the 12th largest source of greenhouse gases on the planet, with 41% of the emissions coming from our transportation system (California High Speed Rail Authority, 2009). Projections suggest the increase in population will create a higher travel demand effect. It is paramount and critical that California increase funding of mass transit (buses, light rail, high-speed rail) to create alternative modes of transport for the projected rise in the state’s population. Higher demand for alternative modes of transit will also facilitate the implementation of key state legislation, such as: SB 375 whose goal is to reduce greenhouse gas emissions.

Capacity of current intercity air and rail travel

The Los Angeles International Airport (LAX) is the only international airport in Southern California, with eight other domestic airports (Burbank (BUR), Long Beach (LGB), Santa
Ana-Orange County (SNA), Ontario (ONT), El Centro/Imperial (IPL), Oxnard (OXR), Palmdale/Lancaster (PMD), Palm Springs (PSP), and San Diego). In 2000, Los Angeles International was ranked as the third busiest commercial airport (SCAG, 2003). The two passenger rail lines for the Southern California region are Amtrak and Metrolink. Amtrak is an intercity rail line, while Metrolink is a commuter rail line, both of which rely heavily on government subsidies and due to California’s economic crisis they have recently had to reduce service.

*Los Angeles International Airport*

Los Angeles International accounts for 15,000 general aviation operations and two percent of all airport activity (SCAG, 2003). In 2002, there were 177,000 air taxi operations with a growth forecast that is supposed to double by 2030 (SCAG, 2003). While Southern California boasts from many airports, many of them are in urban areas and are constrained due to their built out urban environment, NIMBY (not-in-my-backyard) attitude, and physical capacity for basing aircraft (SCAG, 2003).

*Orange County John Wayne Airport*

John Wayne Airport is a commercial airport with forty-two turbine aircraft and over 500 propeller driven aircraft (SCAG, 2003). The number of annual passengers that John Wayne airport is allowed to have is limited to 10.8 million under the existing Settlement Agreement (SCAG, 2003). The forecasted growth for this airport is one percent annually, reaching general aviation activity to 315,000 by 2030 (SCAG, 2003).
Rail

Existing rail in Southern California consists of intercity rail (Amtrak) and commuter rail (Metrolink). 85% of the people that take Metrolink are for work purposes, while Amtrak is known for being more of a longer destination trip train (SCAG, 2008). Neither Amtrak nor Metrolink have a reputation for their service from downtown to downtown destinations. In fact, most people that ride the trains have multiple mode splits for their total trip. Aside from having poor connections, service is limited. Due to the economic crisis, their service has been reduced to a limited number of times, days, and locations.

In order to keep up with the projected growth in population, California will have to build nearly 3,000 lane-miles of freeway, in addition to five airport runways and 90 departure gates by 2020 (California High Speed Rail Authority, 2009). Those projections are based on the same number of travelers a high-speed train system could service (California High Speed Rail Authority, 2009). The California High Speed Rail Authority plans to build the stations in downtown-to-downtown centers where passengers can more easily connect to other modes of transit network. Fast trains that connect with other transportation modes are an attractive option to consumers of travel, and are competitive with automobile travel. This trend may be the beginning of the development of a strong mass transit system in the Southern California region.
OBJECTIVES

This report will address the following objectives:

● To identify the pros and cons of upgrading the existing rail in comparison to building a high speed rail line.

● To identify the importance of the role of the U.S. federal government in implementing high speed rail versus the European Union’s role in high-speed rail.

● To capitalize on current opportunities at the state and federal levels to fund high-speed rail.
METHODOLOGY

Study activities consist of the following steps:

1. Internal focus groups with transportation peers, professional report client, and faculty advisor to discuss the high-speed rail potential for the Southern California region.

2. The literature review will include:
   a. Definitions and standards
   b. Impact on urban form and land use development
   c. Features and context on high speed rail case studies
   d. Public’s opinion on high speed rail (Editorials, Newspaper)

3. Analysis of technical reports that document ridership numbers for the ACELA case study

4. Analysis of the projected ridership data for the proposed Los Angeles to Anaheim high-speed rail segment in Southern California from the California High Speed Rail Authority reports

5. Analysis of the annual ridership numbers for the Southern California inter-city, Southern California Commuter Train Service and air trips from the Southern California Association of Government (SCAG)

6. European Union analysis and comparison to the United States Federal role in the development of high speed rail policy

7. Qualitative data includes:
   a. Interviews:
      i. Andreas Lischke, German Aerospace Center (DLR)
      ii. Dan Levitt, Deputy Director of the CA High Speed Rail Authority
BACKGROUND

Many questions face the public about high-speed rail: If high-speed rail (HSR) is built in the State of California, will there be demand for such a system? What will be the environmental benefits derived from high-speed rail? How much congestion will be reduced from highways and streets? What will be the economic impact from the job creation derived from HSR? Lastly, and most importantly, how will the $45 billion high-speed rail project be funded?

High-speed rail is not a new phenomenon. Florida’s FOX project (Florida Overland Express) and Texas (TGV Projects) have attempted to build high speed trains, but their attempts have been mostly unsuccessful and have achieved minimal outcomes to advance high speed rail in the nation (U.S. Government Accountability Office, 2009). Reports attribute the failure of high-speed rail projects to a lack of popular support and high cost. The public did not support the program because of the high cost associated with the finance of HSR, and public awareness that it would be mostly have to be paid through taxpayer’s dollars (U.S. Government Accountability Office, 2009).

In 2008, funding for high speed rail projects occurred at both the national and the state level (ARRA funds and CA Proposition 1a). The federal role for high-speed rail projects became more of a national priority starting under the leadership of President George W. Bush. The federal role became even more pronounced under President Obama. At the state level, it was under the leadership of California’s Governor Schwarzenegger. In recent years, no other state comes close to the State of California in planning and
building a high-speed rail line. Funding for high-speed rail will be discussed in detail on Section 8 of this report.

**U.S. High Speed Rail**

The vision and funding for high-speed rail prior to the Obama Administration was almost non-existent in the federal government (U.S. Government Accountability Office, 2009). It was not until the Rail Passenger Service Act of 1970 that Amtrak was created. The original intent of the Federal Government was to have Amtrak be a private enterprise, but Amtrak has been unsuccessful in getting enough revenue to cover its operating cost. In fact, Amtrak has needed substantial subsidies from the federal government to keep operating (Congressional Budget Office, 2003). From 1970 to 2001, Amtrak has received nearly $24 billion for capital and operating needs from the federal government, while the number of passengers reached about 22 million each year within the 45 states that Amtrak’s trains service (about 60,000 passengers per day, on average) (Government Accountability Office, 2001). The original purpose of Amtrak was to provide intercity passenger rail service, which had almost become obsolete since the automobile culture took force (Fisher, 2009).

As mass transit died off, so did the investment from the private sector (Fisher, 2009). This was especially evident in Southern California. Prior to the boom of the automobile, land speculators like Henry Huntington invested in light rail for the Los Angeles metropolitan area (Fisher, 2009). It was a profitable business until the post WWII era, when many factors that led to the demise of the rail lines (Fisher, 2009). The main reason for its demise was that operating costs exceeded revenue; it was an unprofitable
business (Fisher, 2009). This marked the end of private investment in passenger rail lines for the Southern California region (Fisher, 2009).

**Federally Designated High Speed Rail Corridors**

Figure 3 “President Obama’s Vision for High Speed Rail,” shows a map of the United States and the federally designated corridors across the U.S. It is important to be designated as a federal corridor in terms of federal funding because only federal corridors can apply for high-speed rail grants.

Prior to the Obama Administration, high speed rail had never received much attention or substantial funding (Government Accountability Office, 2001). Part of the reason why

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Figure 3 President Obama's Vision for High Speed Rail in the U.S.

Source: Jason Lee, White House Aid
there has been no interest from the federal government may be due to Amtrak’s inability to become a profitable or self-operating entity without any governmental subsidies (Congressional Budget Office, 2003).

*What caused the renewed interest from the federal government in high-speed rail?*

Transportation is constantly evolving as new technology emerges. The invention of the automobile benefited many and became the symbol of freedom for many Americans. Being an automobile culture has also brought problems. Most serious is the environmental degradation caused by greenhouse gas emissions and other hazard pollutants that are released through the different transportation modes.

President George W. Bush’s last term in office was the beginning of federal funding for high speed rail: allocating several billions in funds through the Passenger Rail Investment and Improvement Act. Enacted in 2008, it was an opportunity to identify the vision and goals for a U.S. high speed rail and integrate it into the national transportation system (U.S. Government Accountability Office 2009). It also authorized $1.5 billion in funding (U.S. Government Accountability Office 2009). Aside from the $1.5 billion, the recently enacted American Recovery and Reinvestment of Act of 2009 (ARRA) initiated by the Obama Administration, appropriated $8 billion solely for high-speed rail, intercity passenger rail, and capital grants (the latter of which were authorized by the PRIIA) (U.S. Government Accountability Office, 2009). Priority will be given to projects that supported the development of high-speed rail service (U.S. Government Accountability Office, 2009). U.S. Vice President Biden asserted that California was in a good position to receive a large portion of the high speed rail grant
(Reston, 2009). The deadline for that grant money was in the first week of October 2009. Out of the $8 billion stimulus money, California was awarded $2.25 billion dollars.

**California High-Speed Rail Authority**

Established in 1996, the California High-Speed Rail Authority (Authority) is the state entity responsible for planning, constructing, and operating a high-speed train system serving California's major metropolitan areas (California High Speed Rail Authority, 2009). The Authority has a nine-member policy board and a core staff to implement the high-speed train system in California. It was mandated by the State of California to direct the development and implementation of inter-city high-speed rail throughout the state (California High Speed Rail Authority, 2009). The proposed California High-Speed Train Project is a large and complex public works project on a scale comparable with the construction of Interstate 5 in California in the 1960’s and 1970’s (California High Speed Rail Authority, 2009).

Encompassing more than 800 route miles, the proposed California high-speed train system will provide intercity travel in California between the major metropolitan centers of Sacramento, the San Francisco Bay Area, the Central Valley, Los Angeles, the Inland Empire, Orange County, and San Diego (California High Speed Rail Authority, 2009). It will be using “steel on wheel” rail technology, which has already been used in Europe and Asia. The highest operating speed is expected to reach 220 mph, with capabilities of up to 250 mph (California High Speed Rail Authority, 2009). Environmental Impact Reports have predicted an expected ridership of 102.4 million passengers by the year 2035 (California High Speed Rail Authority, 2009). It will be operating on almost
exclusive track, though for the most part it will be adjacent to existing rail or highways in order to mitigate environmental impacts. Based on the Environmental Impact Reports/Environmental Impact Statements (EIR/EIS), the cost to implement the full statewide California high-speed train system is anticipated to be $45 billion (California High Speed Rail Authority, 2009).

Anaheim to Los Angeles Segment

Orange County

Orange County occupies 798 square miles and is located in Southern California - south of Los Angeles County, north of San Diego County, and west of Riverside and San Bernardino counties. There are thirty-four cities within Orange County, with a population of nearly 3.1 million (Orange County Transportation Authority, 2009). It is projected that by the year 2015 the population will increase to nearly 3.5 million, an increase of 13 percent (Orange County Transportation Authority, 2009).

Orange County's economic success is partially attributed to the amenities provided to its residents such as prestigious financial centers, numerous shopping and entertainment centers, community colleges, a California State University campus, and a University of California campus. Also, Orange County offers many amusement parks, including Disneyland, Disney California Adventure and Knott's Berry Farm. Convenient air travel is provided through John Wayne Airport, and countywide bus and rail services are provided by OCTA, Metrolink, and Amtrak.
This report will focus on the California segment going from Anaheim to Los Angeles (See Figure 4). The proposed alignment for the Anaheim to Los Angeles section will travel along the existing Los Angeles – San Diego Rail Corridor (LOSSAN) between the Anaheim Regional Transportation Intermodal Center (ARTIC) and Los Angeles Union Station. In accordance with the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA), the California High Speed Rail Authority (CHSRA), in cooperation with the Federal Railroad Administration (FRA) has begun the environmental process for the Anaheim to Los Angeles segment. The 2008-09 state budget provided $46,488,000 to continue project implementation (California High Speed Rail Authority, 2009). Of this amount, $3.5 million are local funds provided by the Orange County Transportation Agency (OCTA). This brings OCTA’s total local investment since 2007 to $7 million (California High Speed Rail Authority, 2009). It is the largest contribution of any regional transportation agency in California (Orange County Transportation Authority, 2009).
Environmental Impact Review Background

The environmental impact report for the Anaheim to Los Angeles segment identified the existing Los Angeles to San Diego (LOSSAN) Passenger Rail Corridor as the preferred alignment for this section, with stations in Irvine, Anaheim, Norwalk / Santa Fe Springs, and Los Angeles Union Station (California High Speed Rail Authority, 2009). Given the constrained nature of the corridor, high-speed trains should share the corridor with the other passenger rail operators in the area, which include trains run by the National Railroad Passenger Association (Amtrak) and the Southern California Regional Rail Authority (Metrolink). However, this is somewhat premature because agreements have not become public yet, so whether cooperation will occur between agencies is still another issue that has yet to be resolved.

While the EIR/EIS identified the preferred corridor as extending from Irvine to Los Angeles, this report will only focus on the section between Anaheim to Los Angeles that is expected to be implemented before the Irvine stop. High-speed trains will have an estimated trip time of approximately 20 minutes between the Anaheim and Los Angeles stations, with maximum speeds approaching 125 mph (California High Speed Rail Authority, 2009). The time of 20 minutes only takes into account if there are no stops between Anaheim and Los Angeles. There will most likely be more than one stop in between the connection which includes another stop in Orange County and one in Los Angeles County, location of stops have not been determined. This will undoubtedly increase the estimated trip time.
Table 1 below lists the status for each stage of the environmental process and gives a comparison for the status of the different segments of the high-speed rail train. The segment that is the most advanced is the Anaheim to Los Angeles segment. It is possible that if the region completes the environmental process before the other regions. It has a possibility of being constructed before the rest of the regions. It is imperative that such issues: as intermediate stops and new rail versus upgrading rail become solved.

Table 1: Status of Environmental Review by Initial Section

Source: California High Speed Rail Authority, 2009
The high-speed train system is projected to carry a minimum of 42 million passengers annually (32 million intercity trips and 10 million commuter trips) by the year 2020 (California High Speed Rail Authority, 2009). Once the EIR is completed and the business plan approved by the California legislature, the next process would be to satisfy the environmental review process for both state and federal laws (California High Speed Rail Authority, 2009). The following section gives a detailed background on the existing rail in California.

Existing Rail Service in California

This segment of the report will provide an overview of the existing rails in Southern California: intercity rail, commuter rail, and freight service rail.

**Intercity Passenger Rail**

In California, Amtrak runs intercity passenger rail as well as in other parts of the United States. There are four different Amtrak routes: Capitol, Pacific Surfliner, San Joaquin and Coast. The State of California, through the Department of Transportation Division of Rail, supports three Amtrak intercity passenger rail services, including the LOSSAN (Los Angeles to San Diego and San Luis Obispo) Rail Corridor’s Pacific Surfliner. The California Department of Transportation (DOT) Rail Division helps with funding and planning assistance, including operating and capital grants for station and equipment improvements (California Department of Rail Division, 2009).

Like most passenger rail services in the United States, California’s routes need government subsidies to continue operation. Generally, the revenues received from the
farebox are insufficient to cover the expenses. The problem from a consumer’s perspective is the time and cost difference that is well above that of its main competitor, the automobile. Another issue is that service is limited; a person that misses a train will have to wait sometimes a couple hours for the next available train.

**Commuter Rail**

The regional commuter rail line for Southern California is Metrolink it operates in six different counties. The Southern California Regional Rail Authority (SCRRA) provides and maintains Metrolink’s services and facilities. Metrolink systems consist of 53 stations; it carries over 36,000 passengers trips and operates 143 train trips per weekday (SCAG, 2004). The average train trip length for this rail line is 37 miles and 79% of their frequent riders take Metrolink four or more days per week (SCAG, 2004). Most of their passengers use their service to commute to work. Metrolink stations are typically not in downtown areas and about 54% of their customers use connecting transit to complete their trips (SCAG, 2004).

**Freight Service**

There are five principle rail alignments in the Southern California region, owned by two railroads: the Union Pacific Railroad and the Burlington Northern Santa Fe (BNSF). The majority of freight that comes through the Los Angeles and Long Beach ports use rail to move to other regions. To help facilitate the movement of freight, the region has been committed on improving the flow traffic by building grade separations which eases traffic in the area. However, the freight rail companies (BNSF and UP) have been very vocal about their unwillingness to cooperate and/or form partnerships with the California high-
speed rail authority. A controversial issue to having freight in high-speed trains is the weight of freight. Freight trains typically weight substantially, and in order for a high-speed train to achieve the maximum speed its weight needs to be low and with heavy freight cargo that would be almost impossible. That issue alone could be a reason for the lack of interest among the freight rail companies to cooperate with high speed rail.

ISSUES OF MEASUREMENT

This segment of the report is an analysis of the current rail and air annual ridership numbers which, will help in assessing the reliability of the projected ridership numbers for the California high speed rail segment. This section will provide the different definitions of high-speed rail and an analysis of the projected ridership numbers for the California high speed rail.

*Defining High Speed Rail and Intercity Passenger Rail (IPR) Definitions*

High speed rail will vary in speed not only within the California high speed rail segment but also in all of the United States corridors. To help differentiate the levels of high speed rail, the U.S. Federal Railroad Administration Department released the definitions each state should use when applying for federal funds. Below are the definitions used by the American Recovery and Reinvestment Act of 2009. It seems that California is unique in that it has the potential to overlap a number of the definitions listed below such as, HSR Express, HSR Regional, and Emerging HSR.
Definitions:

**HSR – Express.** Frequent, express service between major population centers 200-600 miles apart, with few intermediate stops. Top speeds of at least 150 mph on completely grade-separated, dedicated rights-of-way (with the possible exception of some shared track in terminal areas). Intended to relieve air and highway capacity constraints.

**HSR – Regional.** Relatively frequent service between major and moderate population centers 100-500 miles apart, with some intermediate stops. Top speeds of 110-150 mph, grade-separated, with some dedicated and shared track (using positive train control technology). Intended to relieve highway and, to some extent, air capacity constraints.

**Emerging HSR.** Developing corridors of 100-500 miles, with strong potential for future HSR Regional and/or Express service. Top speeds of up to 90-110 mph on primarily shared track (eventually using positive train control technology), with advanced grade crossing protection or separation. Intended to develop the passenger rail market, and provide relief to other modes.

**Conventional Rail.** Traditional intercity passenger rail services of more than 100 miles with as little as one to as many as 7-12 daily frequencies; may or may not have strong potential for future high-speed rail service. Top speeds of up to 79 mph to as high as 90 mph generally on shared track. Intended to provide travel options and to develop the passenger rail market for further development in the future.
Travel Choice Models

In California, a person has several choices to choose from when making a decision on their transportation mode (auto, rail, air). In Southern California, the most popular travel choice is automobile travel. There are 38,000 square miles connected by 9,000 lanes of freeway (SCAG, 2004). It has also been among the most congested regions in the nation since 1990. Our travel choices have caused harmed to the environment, being a large contributor to the greenhouse gas emissions. Figure 5 shows that transportation has not kept up with population and travel demand (SCAG, 2004). Ninety nine percent of all trips rely on highways or arterial networks (SCAG, 2004). Auto travel and congestion continue on being a huge problem for the region. In 2000, the total daily delay from congestion was estimated to be 2.2 million person hours (SCAG, 2004).

Rail Ridership Comparison

The California Department of Transportation (Caltrans) is the agency responsible for overseeing all rail activity. In Southern California, we have two passenger rail lines: Amtrak and Metrolink. Below are figures from Caltrans Division of Rail Operations Report from 2008-09. To summarize the findings, rail transit has decreased from the previous years. Some of the factors that can be attributed to the decreased numbers are the increased fares and the reduction of service due to budget cuts.
Caltrans Division of Rail Operations Report from 2008-09:

- 9.8% decrease in ridership from the 2007-08 numbers
- On-time performance increased by 10.7 percentage points (90.4%)
- Revenue drop of 5.1%
- Expense drop of 2.5%
- Farebox ration (49.5%) decreased by .8% from 2008 levels

In order to calculate the numbers above, Caltrans used performance indicators that measure the numbers from the previous year with the current year, as well as inputting the business goal numbers and averaging the difference (Caltrans, 2008). Table 2 Performance Indicators shows that the current rail service performances which are based on ridership, revenues, and expenses are not a profitable business. Not enough people are using the current rail service. Studies have shown that the two main factors for using public transit are cost and time. The CAHSRA will have to analyze the numbers below in great detail and try to focus on keeping the current market and on attracting a new market.
Table 2. Performance Indicators

<table>
<thead>
<tr>
<th></th>
<th>Fiscal Year 2008-2009</th>
<th>Fiscal Year 2007-08</th>
<th>Percent Change</th>
<th>FY 2008-09 Business Plan Goal</th>
<th>Percent Difference to Business Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ridership (000)</td>
<td>5,327</td>
<td>5,327</td>
<td>0.0%</td>
<td>5,651</td>
<td>-5.7%</td>
</tr>
<tr>
<td>Revenues (000)</td>
<td>$105,136</td>
<td>$103,071</td>
<td>2.6%</td>
<td>$112,315</td>
<td>-5.9%</td>
</tr>
<tr>
<td>Expenses (000)</td>
<td>$210,090</td>
<td>$201,540</td>
<td>4.2%</td>
<td>$205,526</td>
<td>2.2%</td>
</tr>
<tr>
<td>Farebox Recovery Ratio</td>
<td>50.3%</td>
<td>51.1%</td>
<td>-.8 Percentage points</td>
<td>54.6%</td>
<td>-4.3 Percentage points</td>
</tr>
<tr>
<td>On-Time Performance</td>
<td>86.6%</td>
<td>79.8%</td>
<td>10.7 Percentage Points</td>
<td>86.0%</td>
<td>.6 Percentage points</td>
</tr>
</tbody>
</table>

Source: Data retrieved from the California Department of Transportation Rail Division

The Pacific Surfliner services the LOSSAN corridor. Below is an operations report for the fiscal year 2008-09.

- Ridership was down 4.0% compared to 2007-08
- On-time Performance was 80.8% (5.5 percentage points better than 2008)
- Revenues decreased 2.4% and expenses increased 4.7% compared to the prior year
- Farebox ratio decreased to 57% (4.2 percentage points below last year)

Table 3 Transit Service Utilization in the SCAG Region breaks down the different type of transit along with the percent utilization of available seats per miles for the year 2000 (SCAG, 2004). According to Table 3 the most utilized transit was light rail for Los Angeles County and commuter rail for Orange County (its only passenger rail service).
Air Ridership Comparison

The largest airport in Southern California is Los Angeles International which ranks 5th worldwide, all the airports combined create one of the busiest regions in the nation (SCAG 2008). In 2002, seventy eight million passengers were served in the region, and the projected growth forecast is that the number is supposed to double before the year 2030 (SCAG 2008). Airports are a vital part of the local economy, every one million regional passengers creates a positive economic impact of $620 million (SCAG, 2008).

Airports while creating many economic benefits are very difficult to get approved; most people have the not-in-my-back-yard (NIMBY) attitude that ends up killing projects to expand or create new airports. The cost of expanding airports is also more expensive than upgrading existing rail. Another detriment is that urban airports are physically constrained; in order to expand most airports would have to buy out neighborhoods. High speed rail would eliminate the need for short distance flights and would free air space for out of state and international flights.
Figure 6 below shows the air ridership numbers for 2008 based on the number of miles. As is shown from the graph, we can see the highest number of departures are from those traveling anywhere from 201 to 600 miles. High speed rail would drastically reduce this number and allow longer destination flights to increase their capacity and attract more travelers to the Southern California region. The need to expand the airport would also be delayed as many of their passengers would switch to high speed trains.

Figure 6 2008 Average Air Passenger Departures by Length of Haul

![Graph showing average daily departures by length of haul.]

Source: Data retrieved from the Southern California Association of Governments, 2008

Figure 7 below shows the top ten destinations from the Southern California airport and among those top ten are: Oakland, San Francisco, San Jose, and Sacramento. All of those four locations are projected to have stops in their cities or near their cities.
Table 4 shown below shows the general aviation forecast. All the regions in Southern California are expected to grow and for some airports even double its activity. However, as mentioned in the earlier sections of this report, most of the airports are located in urban areas and are physically constrained from future growth.

Table 4 General Aviation Forecast

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imperial</td>
<td>105,250</td>
<td>110,278</td>
<td>115,556</td>
<td>115,556</td>
<td>121,875</td>
<td>131,931</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>2,130,999</td>
<td>2,282,557</td>
<td>2,432,018</td>
<td>2,432,018</td>
<td>2,380,213</td>
<td>2,780,316</td>
</tr>
<tr>
<td>Riverside</td>
<td>600,526</td>
<td>624,249</td>
<td>661,967</td>
<td>661,967</td>
<td>699,169</td>
<td>777,326</td>
</tr>
<tr>
<td>San Bernardino</td>
<td>766,859</td>
<td>811,508</td>
<td>858,893</td>
<td>858,893</td>
<td>906,961</td>
<td>1,008,278</td>
</tr>
<tr>
<td>Ventura</td>
<td>371,500</td>
<td>377,392</td>
<td>383,129</td>
<td>383,129</td>
<td>396,827</td>
<td>402,937</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>4,315,222</strong></td>
<td><strong>4,562,173</strong></td>
<td><strong>4,562,173</strong></td>
<td><strong>4,823,818</strong></td>
<td><strong>5,095,362</strong></td>
<td><strong>5,521,753</strong></td>
</tr>
</tbody>
</table>

Source: Southern California Association of Governments, 2003
As the demand increases, so will the airports physical capacity and this will lead to less profitable airlines or routes being pushed out of airports (SCAG, 2003). The less profitable routes are the airlines which service short distance flights between 200 and 600 miles and they are mainly served by smaller airlines (i.e. Southwest Airlines). However, Southwest Airlines are beginning to expand their service by providing more long distance destination flights. Such airlines might see the benefit of eliminating short destination flights and supporting the construction of high speed rail. It is estimated that by 2030, urbanized commercial and general airports will have reached their physical or legal capacity (SCAG, 2003). According to an interview with a staff from the California high speed rail Authority, small airlines did not lobby against Proposition 1a which will contribute $9.9 billion towards high speed rail (Interview 9/2009).

**California High Speed Rail Projected Ridership**

Projecting accurate ridership numbers is central to the success of high speed rail. It is important not only for California but for the rest of the nation who will witnesses our successes or our failures. If California’s high speed rail project becomes a success it might snowball to the rest of the nation who might jump on board and begin their own high speed train networks.

A ridership projection is important for a business plan because it helps determine the profitability. Once a ridership projection is estimated then the profitability can be calculated by analyzing the projected revenue from ticket fares minus the operating cost. The most recent projected ridership is estimated to average 13.5 million riders by
2020 and 41 million riders per year in 2035 for the entire 800 mile high speed rail network (California High Speed Rail Authority, 2009).

It is estimated that over a third (12 million) of the projected air ridership numbers for 2030 would be diverted to high speed rail and about 6% percent (50 million) auto travelers would switch to high speed rail (California High Speed Rail Authority, 2009). More stops will also generate an increase in the number of riders. This might have the effect of creating a fast intercity rail system instead of having a true long distance high speed rail network. However, the number of stops is difficult to negotiate because of the politics and possible money involved to help construct the high speed network.

A private company, Cambridge Systematic (CS), was contracted by the California High Speed Rail Authority to develop the ridership projection. Their analysis consisted of: modeling California’s current and future population, employment, household characteristics, highway network, air and rail services, and transit systems (California High Speed Rail Authority, 2009). Surveys were given to passengers flying into the cities with a high speed train stop and they were geared to gathering information such as: recent trips and their valuations of travel time, cost, and reliability in order to assess the diversion that would be created from such modes of travel (California High Speed Rail Authority, 2009).

The model that CS used predicted future trip making from forecasts of population and employment and then compared the travel time for each mode of travel per household
(along with other factors) (California High Speed Rail Authority, 2009). High speed trains will be able to carry anywhere from 1,300 to 950 passengers and have more room than the conventional airplane with amenities such as a cafe (California High Speed Rail Authority, 2009).

An accurate ridership projection for this scale of a project is absolutely necessary. Unlike other public transportation systems (bus/rail), high speed rail is committed to not asking for public subsidies once operations begin. The California High Speed Rail Authority Governing Board feels confident that the projections will attract the predicted ridership numbers. However, in case that the California High Speed Rail Authority (CHSRA) does not meet their projected ridership once the high speed trains go into operation then what are the possible scenarios? The twelfth section of this report goes more into detail on estimate versus actual ridership and cost numbers, as well as operation and maintenance cost.

According to a recent newspaper article in the Los Angeles Times, the California High Speed Rail Authority has not come up with possible scenarios in case they fail to meet projections (McGreevy, 2010). Jeff Barker, a spokesperson for the California High Speed Rail Authority was quoted on saying that such details will be addressed in the future (McGreevy, 2010). Eric Thronson, a fiscal and policy analyst for the Legislative Analyst Office (LAO), called a risk assessment in the business plan “incomplete and inappropriate for a project of this magnitude” (McGreevy, 2010). Assemblyman Niello (R-Fair Oaks) who sits on the Assembly Transportation Committee, also expressed his
concern for a project of this magnitude (McGreevy, 2010). It is imperative that the California High Speed Rail Authority begin to address this along with other concerns that might surface in the future. Past attempts on building high speed rail networks have illustrated the importance of political and public support for high speed rail.

REVIVED FLORIDA HIGH SPEED RAIL PROJECT

This section provides a case study of the FOX project, it was one of the first planned high speed train projects that was derailed already having gone through extensive planning. There is an analysis of potential pitfalls and lessons to be learned from a project that was unsuccessful. Also, it is important to note that this project has recently been revived due to Federal funding possibilities. The State of Florida applied for federal stimulus money for $2.3 billion dollars and has a good probability that it will receive close to that amount.

Background

The Florida high-speed rail corridor, previously known as the Florida Overland Express (FOX) project, initiated the planning of a new rail system between Miami, Orlando, and Tampa. The high-speed rail line would cover 320 miles with seven stops along the route and reach speeds of 200 mph (GAO, 1999). In 1999, the U.S. General Accounting Office (GAO) released a report on the feasibility of this new rail line. During the release of the report, the estimated cost was anywhere from $6 to 8 billion (GAO, 1999). The important players involved in this project were: Florida Department of Transportation (FDOT) and the Fox Consortium, of which included: Fluor Daniel, a U.S.-
based engineering and construction firm; Alstom, the manufacturer of French TGV trains; and Bombardier, a manufacturer of rail passenger cars (GAO, 1999).

**Analysis**

Operation of the FOX project had an expected completion date of 2005. However, the project failed. The failure of the project is largely blamed on an uncertain estimated cost, ridership forecast overestimate, finance plan, and lastly, an unattainable schedule projection (GAO, 1999). But with all major infrastructure projects money was the biggest issue: in short, no one wanted to pay for it. The federal government was unable to assist monetarily for any of the construction cost (GAO, 1999). The U.S. General Accounting Office report from 1999 indicates that the FOX project was seeking $2 billion loan amount under the Department of Transportation’s new Transportation Infrastructure Finance and Innovation Act (TIFIA) program, whose budget was limited to $530 million for all the states who sought loans for high speed train projects or rail upgrades (GAO, 1999). The TIFIA program is designed to help large infrastructure projects—those costing at least $100 million or 50 percent of a state’s federal-aid highway apportionment for the preceding fiscal year—access capital by using federal funds to leverage substantial private investment (GAO, 1999). The amount requested by the FOX project was well above what it could loan.

A recent study published by the National Research Council notes that large transportation infrastructure costs are commonly 50 to 100 percent above projections, while usage (ridership) can be 20 to 60 percent lower than projections (Skamris and Bent, 1996). Private funding was limited due the wide skepticism of being able to attain
estimated ridership. If ridership turned out to be lower, then operating cost and maintenance might have led to a huge deficit, which would have forced taxpayers to bail out the rail companies. Public opposition grew against the project because of the high cost, and by the fact that most of the cost would be shouldered by the public. The momentum was lost due to a weak public relations campaign from the FOX consortium and an uneducated public of the benefits high speed trains would create.

**Lessons Learned**

Lack of public and political support over a lengthy period is why the FOX project ultimately failed (GAO, 2009). The FOX project failed under a political administration that did not support the project (GAO, 2009). Prior to that administration, the State of Florida had committed to provide $70 million annually to the project, but withdrew that obligation under Governor Jeb Bush’s leadership (GAO, 2009). Public skepticism of the projected ridership made it easier for the governor to terminate the funding (GAO, 2009).

It is very important for the California High Speed Rail Authority to not lose the momentum, especially public and political support. Transparency and confidence in the project will play a major role in determining whether the project fails or succeeds.

**Future of HSR in Florida**

Florida has experience with high speed trains, already having gone through extensive planning in for their high-speed rail corridor. No longer called the FOX project, it has been renamed to be called the Florida High Speed Rail Project. The estimated cost for the Tampa to Orlando section is $3.5 billion while, the section from Orlando to Miami is
projected to cost $8.5 billion (FDOT, 2010). Their previous experience made Florida a very a strong candidate to receive a large portion of the requested $2.6 billion grant application for their Tampa-to-Orlando high-speed rail line (Goll, 2010). On January 28, 2010, the Federal Railroad Administration (FRA) announced the Florida Department of Transportation (FDOT) would receive $1.25 billion as part of the High Speed Intercity Passenger Rail Program (FDOT, 2010). The first phase of construction that is listed on their website is the Tampa to Orlando segment (FDOT, 2010). It is possible that the revived interest in high speed rail has been due to the influx of federal grant money towards high speed rail. It is very probable that Florida will have a high speed rail in service in the near future; their past experience will have served as lessons learned for the possible issues that can come up in the coming years of continued planning.

**ACELA CASE STUDY**

The Acela Express Amtrak service is the closest project to being the first case study of emerging high speed rail in the United States. It is located in the Northeast region of the United States and it is the first attempt in constructing and running an incremental high speed rail system (Government Accountability Office, 2006). The Acela Express corridor travels through some of the densest areas in the Eastern United States, such as: Washington D.C., New York City, and Boston. It can be compared to the California high speed rail project in terms of having similar densities: San Diego, Los Angeles, and San Francisco. This segment of the report will give an overview of the Acela Express, including its successes and failures. An analysis of the Acela Express will help the California High Speed Rail Authority prevent similar pitfalls in the planning of the
California high speed rail project. It will also help analyze whether upgrading existing rail is more cost effective than the construction of new dedicated high speed rail lines.

Overview

Acela Express began as a small improvement project through Amtrak and ended up evolving into a high speed rail system (Government Accountability Office, 2006). The Northeast corridor is the busiest passenger rail in the country; serving about 2/3 the passengers combined from all Amtrak rail lines (Government Accountability Office, 2006). The Acela express rail line is the busiest of all rail lines, generating the most revenue for Amtrak (Government Accountability Office, 2006). However, its success has not come without problems, mainly due to the lack of planning that happened prior to its construction. As a consequence the system has undergone many challenges that might have been prevented if more time had been spent on a thorough planning analysis of the project (Government Accountability Office, 2006).

Acela Express Analysis

Development of Acela Express Analysis

Acela Express was developed because there was a need for improving the rail system, but also for reducing travel time between some of the densest corridors in the northeast region of the United States. Acela was developed as part of the Northeast Corridor Improvement Project (NCIP), a plan that goes back to the 1970s and consist of a variety of improvement projects, among them being the three hour train ride from Boston, New York, to Washington D.C. (Government Accountability Office, 2006). The technology for Acela was based on the French TGV (train à grande vitesse, French for “high speed
train”). In 1996, Amtrak executed contracts with train manufacturers Bombardier and Alstom to build 20 high-speed train sets and 15 electric high horsepower locomotives; construct three maintenance facilities; and provide maintenance services for the Acela’s train sets (Government Accountability Office, 2006).

Below is a timeline and a background on the problems Amtrak experienced during the development of the Acela Express program (Government Accountability Office, 2006).

Key Dates and Issues:

- Operation began in 2000
- In 2002 Acela was shut down for two months (resulting in huge image loss for the system and a legal fight between Amtrak and the train set company)
- Since then, Amtrak has faced broader challenges in managing other large-scale projects
Figure 8 Timeline of Key Events (Acela Express)

May 1996 – Amtrak and the Consortium execute the contracts.

October 2000 – The Consortium delivers the first trainset to Amtrak over 1 year late.

November 2001 – Bombardier files a $200 million suit against Amtrak.

November 2002 – Amtrak files a $200 million suit against the Consortium.

October 2006 – Amtrak conditionally assumes responsibility for the trainsets.

March 2004 – Amtrak and the Consortium sign settlement agreement.

August 2002 – Amtrak and Consortium officials begin negotiations.

Late 2002 – Amtrak removed trainsets from service due to equipment problems. Complete service not restored until October 2002.

April 2005 – Amtrak removed trainsets from service due to brake problems. Service not expected to be completely restored until Fall 2005.

2013 – Amtrak was originally scheduled to take over trainset management and maintenance.

2021 – Last warranty expires.

Successes

Aside from some of the technical and maintenance difficulties, Acela Express has managed to become the most profitable and self sustaining route from all the Amtrak corridors. For fiscal year 2004, Amtrak’s Acela program accounted for about 44 percent of the total revenue on the Northeast Corridor, Amtrak’s busiest rail route (Government Accountability Study, 2006). In 2006, 2,668,174 passenger journeys were made on an 8.8% increase over 2005 (Government Accountability Study, 2006). The numbers keep rising and it is predicted that they will continue to rise as more improvements are made to the rail lines and as people become more environmentally conscious.

Acela Express has been able to divert air and highway users to using mass transit and most of it has been due to its competitive time schedule in comparison to air travel (avoiding excessive security/delays/comfort) and highway users (traffic delays). Acela’s name was derived from the terms excellence and acceleration and only years later renamed to Acela Express (Government Accountability Study, 2006). The idea behind the name was to create a brand for the service based on those two concepts, excellence and acceleration (Government Accountability Study, 2006). The marketing and branding of the Acela Express as fast, comfortable, low prices, and reliable has been one of the most important successes that Amtrak has accomplished. Acela Express executives were focused on designing products that meet travelers’ needs and focused on building the brand around ideas that came directly from customers (Cassedy, 2002).
Acela Express is a major improvement in rail service being the only rail to come close to competing with airline industries. The fastest Acela Express timing for the 456 mile Washington, DC to Boston's South is just over 6 1/2 hours, an average of 72mph (116km/h) (Government Accountability, 2006). The stretch from New York Penn Station to Washington, DC 225 miles takes 2 hours 48 minutes, an average of 80mph (129km/h) (Government Accountability, 2006). Even with all its successes Acela Express still lags far behind its international high speed rail counterparts in terms of speed.

**Failures**

Most of the failures that Acela Express experienced occurred during the initial years of planning and service, such as: keeping the Acela project on schedule and attaining the project goal of a 3 hour trip time between Boston and New York City (Government Accountability Office, 2006). Many critics blame the United States Federal Rail Administration for Acela’s problems specifically for not being able to keep its original 3 hour trip from NYC-Boston-DC (McCaughrin 2007). The restrictions imposed have prevented Acela Express to come close to being like that of its counterpart in France and Japan (McCaughrin 2007). Such regulations dealt with weight limitations and buffering standards which caused slower speeds, faster wear tear problems, higher prices, and possible higher risk in case of collisions (McCaughrin 2007).

Key Issues that the Acela Express faced (Government Accountability Office, 2006):

- new technology
- impacts from new safety standards to accommodate high-speed rail
- manufacturing and production delays,
- abbreviated testing of the trains prior to placement in revenue service

Acela Express also went through a legal suit with the manufacturing of the trains and had to stop service in 2002 and again in 2005, which hurt Acela’s image and ridership numbers. However, it has overcome most of the failures and its future looks bright.

Federal law limits train sets to not go above 110 mph in urban areas. Amtrak trains were able to upgrade their tracks and trains to allow for such higher speeds and at much lower cost than it would be to build dedicated rail for high speed service. The Southern California region consists of mostly urban areas, which will limit the speed a train can go. Train sets like Acela Express can serve as feeder trains for Southern California’s high speed rail service. Acela Express is still considered high speed rail because of its capability to go faster therefore, the California trains would also be considered high speed trains but with a lower price tag. It would save a large amount of taxpayer’s dollars to consider feeder trains, like Acela Express to serve most of the Southern California and parts of the Northern California region, while limiting high speed service to major urban hubs, such as: Los Angeles and San Francisco.

The California High Speed Rail Authority should emulate the Acela Express in corridors where federal limits its speed, mainly urban areas. The lower price tag can help increase the number of feeder trains in the corridor and can help increase construction speed on the Los Angeles to San Francisco rail lines, which would be the only true High
Speed Rail Express under the federal definition. Increasing the number of feeder trains will be very appealing in comparison to an air travel. The time difference would also not be much different because the upgraded train sets would be capable of going faster.

**ANALYSIS OF EUROPEAN HIGH SPEED RAIL**

This segment of the report will analyze the European Union’s vision for high speed rail. It will also compare and contrast Europe’s transit with the United States by looking at different factors: urban characteristics, transit quality, and lastly, transit behavior.

**EU’s Vision for High Speed Rail**

Public transit is not a new phenomenon for European countries; high speed rail is but an extension of public transportation. With the integration of European countries into the European Union, transportation integration for the movement of goods and people has become a forefront issue within member countries. The European Union Treaty obliges the EU countries to contribute to the organization and development of Trans-European Networks (TENs) in the areas of transport, telecommunications and energy supply infrastructure. European Commission Treaty (Articles 154 and 155), focuses on the establishment and development of trans-European networks in the area of transport (European Commission, 2006). One of the initial concerns was technical and operational barriers to trade, since most European countries have developed high speed rail were built from a national perspective (European Commission, 2003).

A large part of the investments in TENtransport (about 25% in 1996/97) is currently concentrated on high-speed railway lines, often connecting major conurbations
The European Union policy is focused on limiting suburban sprawl by tying transportation to its land use plans (similar policy only happened recently in California with the passage of SB 375). High speed rail plays a central role in continuing to integrating land use and transportation.

**European Union High Speed Rail Policy**

A key difference between the U.S. and Europe is the harmonization of their high speed rail policy among all the member states of the European Union. The European Union's spatial development policy and urban development measures plays a big role in influencing the behavior of local business and the population in order to improve the possibilities for a shift from road traffic to transit (European Commission, 2006). European Union's commitment to mass transit is apparent, we just have to analyze the increase of passenger traffic from rail which increased from 217 billion to 290 billion passengers from 1970 to 1998 (European Commission, 2006). The European Union realizes the importance of mass transit, specifically high speed rail and have outlined priority projects that includes several high speed rail lines in different European countries (European Commission, 2006).

In order to attract more passengers to rail and to reduce greenhouse gas emissions the European Commission formed the "railway package" measures which are laid out in the White Paper (European Commission, 2006). Below is a list of key issues relating to rail found in EU's White Paper.

Key points:
• ensuring high-quality rail services;
• removing barriers to entry to the rail freight market;
• improving the environmental performance of rail freight services;
• gradually setting up a dedicated rail freight network;
• progressively opening up the market in passenger services by rail;
• improving rail passengers' rights.

**The German Intercity Express**

Germany's passenger high speed rail services can be compared to California's planned high speed rail in that both offer intercity rail destinations. Another similarity is that California is developing its rail system based on similar concepts the Germans had when they first developed their plans for a passenger rail system. The development of Germany's high-speed Intercity Express (ICE) service came in response to the declining share of the transportation market that rail faced in the 1960s, combined with capacity problems on the nation's highway, air, and rail networks (Vaca, 1993). The German national policy response was a decision to shift as much passenger and freight traffic as possible onto the rail mode (Vaca, 1993). While the California high speed trains will be exclusively for passengers, there can be future collaboration opportunities. In an interview with Andreas Lischke from the German Aerospace Center (DLR) (1-26-10), he emphasized again that the decision to implement high speed rail was not to solve the congestion problem but to create a competitive option to the air industry.

Intercity Express (ICE) service began with two routes between Hamburg-Munich and Basel via Mannheim. Since then, the line has expanded to include many more
domestic stops, as well as international connections such as the: Paris-Brussels-KoIn-Amsterdam service. Key to the implementation of high speed trains in Germany is that the decision to build the new infrastructure was not based upon any feasibility study or demand projection showing that the service and capacity were needed (Vaca, 1993). Rather, it was more of a policy decision to meet an obviously growing transportation demand with rail.

During the initial planning of the ICE rail system, Deutsche Bundesbahn (DB), the German national railway, roughly estimated that the increased speed and comfort would cause rail ridership to rise by about 30 percent while decreasing the number of air passengers (Vaca, 1993). DB was accurate in their rough estimate of ridership numbers. Lufthansa did, in fact, experience a 50 percent drop in ridership on the Hannover-Frankfurt corridor once the ICE began operation, and the rail ridership in fact increased by about 30 percent (Vaca, 1993). The Berlin to Hannover high speed rail line began in 1998, and soon after it led to the elimination of the air route for this segment (Lischke Interview, 1-26-10).

**Urban Form Characteristics**

European Union member countries developed their high speed rail using different business plans which caused frustration with integrated transport policies. Since the development of the EU, the European Commission has developed policies focused on establishing an integrated transport system. In France, part of the Netherlands, Italy and South Belgium, high speed trains carry passengers on long distance trips, on dedicated passengers' rail lines, without connecting medium-sized towns along the way
(European Commission, 2006). While in Germany, Spain, and part of Italy, Great Britain and North Belgium, high speed rail creates an intercity network connecting regional and local cities at a maximum speed of 200-250 km/h (European Commission, 2006). In the United States, the Acela Express carries passengers on long distance trips. While the California High Speed Rail Authority can be compared to Germany’s high speed network, connecting medium-sized towns along the way. The stops that are being planned for California’s high speed trains are similar to Europe’s model where they will have downtown to downtown stations.

**Transit Quality**

In order to make the railways more attractive, the European Commission strengthened their passengers’ rights policy to better protect the passenger - particularly with regard to reimbursement for train delays (European Commission, 2006). The European Commission also directed for easier access to information and fares, and the option of buying international rail tickets more easily (European Commission, 2006). For Europe the cost comparison from flying or taking a high speed train can be higher than air travel. Just like air travel, the sooner in advance a passenger books a ticket the better price the ticket will be. However, the ticket for a high speed train also takes into account excellent customer service that many claim European airlines lack (Tremlett, 2009). Another benefit is that passengers do not have to go through airport controls and can arrive just minutes before the train leaves. The European high speed rail shares similar characteristics to Acela Express, in that passengers prefer the comfort of extra room, flexibility, and customer service to that of the competing airline industries.
Travel Behavior

Europe’s mass transit system is more advanced than the United States in terms of technology and ridership numbers. However, like in the United States, Europe also faces the challenge of an increased number of people driving automobiles. Between 1970 and 2000, the number of cars in the European Union increased from 62.5 million to nearly 175 million, carrying 79% of passenger traffic (European Commission, 2006). While the number of automobile owners has increased, their use of high speed rail and mass transit system has also increased.

Contrast between the U.S. and the European Experience

The ultimate difference between the United States and European countries is that their central government generally funds the majority of up-front costs of their country’s respective high speed rail projects, and they do so without the expectation that their investment will be recouped through ticket revenues (GAO, 2009). Even Spain’s high speed network which is considered to be among one of the most successful in Europe still needs public subsidies (GAO, 2009). Spanish officials told the U.S. GAO that the original high speed line in Spain between Madrid and Seville has been profitable on an operating cost basis but has not covered all of its costs, including the original construction costs and it is predicted by a Spanish academic that future high speed lines might not cover even their operating costs (GAO, 2009).

Although Europe has a more advanced high speed rail network than the United States, their stages for planning are very elementary. Most European countries lack available data on ridership numbers before the construction of their high speed rail projects.
Unlike the U.S., many of the European investors rely less on ridership forecasts and more on policy goals for justification of spending billions on a transport system (Vaca, 1996). In Europe, most people use and are familiar with mass transit, and the demand for public transport is high, while the opposite is true for most places in California where the demand for public transport is low (Vaca, 1996). In California, rail or mass transit hardly exists in most places. Therefore, a transition to high speed rail and eventually mass transit system is a new idea and one that leads investor to believe is a riskier investment.

**FUNDING SOURCES FOR CALIFORNIA HIGH SPEED RAIL**

Central to this analysis, is the question of how high speed rail will be funded in California. In this section, I will analyze several different funding sources: Federal, State, Local, and Public-Private Partnerships.

**Federal**

The American Recovery Restoration Act of 2009 allowed states to apply for corridor-wide infrastructure improvements. There were two different application options each state could have chosen or combined; improving existing rail or creating new rail. While a comprehensive phasing strategy would have helped meet current demands, Governor Schwarzenegger opted to apply solely for the new rail line grant.

According to the California High Speed Rail Authority, “California is the best-prepared state in the nation to receive and maximize the benefit of a $4.7 billion share of $8 billion in federal funding for high-speed train development under the American Recovery
and Reinvestment Act (ARRA)” (California High Speed Rail Authority, 2009). Below are facts from California High Speed Rail Authority website:

- The only project offering 200+ MPH service
- No other state is farther along in planning and development
- Prepared to break ground as early as 2011
- The only high-speed train in America backed with state and local funds
- Matching state and local financial support – billions of dollars in voter-approved financing
- A decade of engineering and design work in place

The required criteria listed to apply for ARRA funds include (Federal Register, 2009):

- Project and program selection should focus on achieving trip time reductions on key operational segments of the LOSSAN Corridor, as well as reducing overall trip time between Los Angeles and San Diego.
  
- Los Angeles – Anaheim: 20 minutes (current 40 minutes) – 50 percent reduction
- Los Angeles – San Diego: 2 hours or less (current 2 hours 51 minutes) – 42 percent reduction

In addition to the ARRA grant in August 2009, California applied for another $1.1 billion for improvements to existing intercity passenger rail services and near-term job creation.

### State and Local Funding

Ever since the creation of the California High Speed Rail Authority, the California state government has provided funds for studies for the feasibility of a statewide network of a high speed rail system. The 2007-08 California State budget provided $20.7 million to continue project implementation, including the preparation of a project financial plan,
project management activities, identification of critical rights-of-way acquisitions and the continuation of detailed project design and related environmental studies (California High Speed Rail Authority, 2009). A $9.95 billion dollar bond measure was on the November 2008 ballot with $9 billion for implementing high speed rail and $950 million for improvements to other rail services that connect to the high-speed rail service and it passed by the voters of California (California High Speed Rail Authority, 2009). The funding will largely come from bond money.

Local funding contribution will come from stations where the high-speed train system shares corridors with existing services, such as: Metrolink between Los Angeles and Anaheim (California High Speed Rail Authority, 2009). However, the state’s current financial crisis has investors choosing to put their money in other investments over California’s bonds. If the state cannot sell bond money, then high speed rail is in a position where its construction might be delayed for an unknown period. Local funding will also be difficult being that they are also dealing with cuts from state funding. Metrolink has had to reduce its service to certain counties to deal with the loss of funds.

Public-Private Partnerships

The California High Speed Rail Authority anticipates private sector contribution for the construction and operation of the high speed rail, including project debt financing, vendor financing, system operations and private ownership (California High Speed Rail Authority, 2009). In order to gage the amount of interest the private sector would have in investing into the high speed rail project, the Authority released a Request for
Expression of Interest (REFI) (California High Speed Rail Authority, 2009). Some of the results from the REFI showed that despite uncertainty in the financial markets, private sector interest remains strong (California High Speed Rail Authority, 2009). The Authority expects public-private partnership contribution to the high speed rail project to be anywhere from $10 to $12 billion (California High Speed Rail Authority, 2009).

The amount of private investment being asked is very high amounts than what the private sector is used to contributing. Below is an analysis of past private investments into mass transit transportation and current investment into mass transit in the Los Angeles region.

**Analysis of Private Investment**

Current large-scale transit projects such as the Exposition Light Rail Line are very costly. The Exposition Line is expected to be roughly $640 million dollars and will be financed through mostly Proposition C, the ½ cent sales tax. This means that everyone in Los Angeles County who shops will pay for a light rail system that they may not use. Joseph Giglio and William D Ankner proposed in their 1998 article “Public – Private Partnership: Brave New World” that much of the nation’s transportation system is commercially viable and should not be treated as a true public good. They feel that private industries should take a role in public transit and that public agencies would benefit from the competitive nature of the private sector (Giglio, 1998). With growing concern about the funding of large-scale transportation projects many economists suggest a public – private partnership or just private rail system could be more cost effective. In Los Angeles during the 1920’s public transit policy was completely in the
hands of private industries and subsequently failed. The policy set forth in the 20’s was inherently flawed and should serve as a guide for what should not be done to fund current transit programs such as the Expo Light Rail Line.

**Historic Policy:** In the 1920’s Los Angeles had the Red Cars, one of the most extensive rail lines in the United States with 1,150 miles of track and 109 million annual passengers. Forty years later in 1960 the Red Cars were all shut down and many of the rail lines torn out. There are many theories on why this occurred, from a General Motors Conspiracy to the public’s general dislike of slow rail, to the public’s growing desire to have an automobile. David J. St. Clair concludes that the fall of the Red Line was purely economical and that one of the main contributing factors was the public transit policy that was prevalent in the 1920’s. According to St. Clair “Public transit policy in the 1920’s was generally based on the franchise system. The transit franchisee, a private transit company, acquired a legal monopoly over public transit operations in the area and in exchange the transit company paid the city a franchise fee. The private industry also provided services for the city such as street maintenance (St. Claire, 1986).” The transit operators benefited from this monopoly through transit revenue and real estate development profits. This proved to be their downfall as the automobile became much more attractive for travelers and the real estate development profits were a onetime deal. The private industries were then unable to pay off the debt they owed for the capital improvements and many went out of business or taken over by public transit agencies.
Comparison of historic and contemporary issue: The funding of transit projects has always been an issue of debate because public transit is generally regarded as a public service that only is used by a small percentage of the population. The 1920’s policy of providing the private industry with an exclusive monopoly of public transit is just not good planning because of the inherent nature of public transit today. As we can see from the past, private industries are motivated by revenue generation and are not concerned about providing access and mobility to people who have no other alternative. The problem with funding such a public service is the question of who pays. Back in the 1920’s the private industries paid for transit projects because they got benefits from other sources than farebox revenue. Now the operating costs of transit projects far outweigh the revenue generated from the farebox. Public transit operates at a loss in Los Angeles; the government subsidizes it to provide a service to the community, not to make money. Michael Brooks describes public transit as a public good and therefore “it is likely that in a market economy people will under allocate resources to the production of public goods” (Brooks, 2002). The responsibility of funding public transit projects is now in the hands of the public agencies because the role of public transit shifted in the 1920’s. The rate of automobile travel grew in leaps and bounds because the automobile was growing in prevalence due to its inherent benefits over the Red Cars. A public-private venture would be irresponsible because the two’s core ideologies are mutually exclusive.

The 1920’s policy of providing private agencies a franchise would not work for contemporary transportations projects. The whole system in Los Angeles has changed
and it is impossible to duplicate the success that occurred in the 1920’s because of the domination of the automobile and the public service role that public transit has now shifted to. A better solution to funding issues in the Los Angeles area would be putting the cost on to the automobile drivers because drivers were the cause of the fall of public transit and are also more responsible for the other sorts of damage that public transit industries try to alleviate. The other problems that the MTA has to alleviate are congestion issues, and air quality problems. So a way to solve the funding crises of the many public transit agencies would be to impose either a higher gas tax or mileage fee. Europeans currently pay much more for gas, in London they have a mileage fee, and their transit ridership is much higher than ours. This would provide a large sum of revenue and also increase transit ridership in our system while reducing congestion and therefore improving air quality.
**Air versus High Speed Rail?**

The following section provides an analysis of the advantages and disadvantages of air travel and high speed rail as a viable solution to intercity travel.

Currently, in Southern California the automobile covers the majority of intercity transportation. The domination of the automobile raises some concern because the automobile is not a viable solution to dealing with the large increase in intercity travel for several reasons. First, California’s freeway networks are becoming increasingly congested and construction of new freeways will not be able to keep up with the projected growth in intercity travel nor will construction of new freeways actually solve the problem of congestion. Second, automobiles are environmentally damaging because automobiles pollute the air while only transporting a few passengers. Third, the automobile is unable to provide the timesaving benefits that other modes of travel such as high speed rail or airplanes can provide for long distance intercity travel.

**Advantages of Air Travel as a viable solution to intercity travel**

Airplanes have many attributes that make them a desirable alternative to the automobile or high-speed rail for long intercity travel. John D. Kasarda mentions that airports are the fifth wave in transportation induced urban development. According to Kasarda, airplanes are flying the country into the 21-century because the need for speed, flexibility and reliability in the movement of people and products is taking center stage in our fast paced global environment (Kasarda, 2000). Airplanes such as a Boeing 747 can travel 567 miles per hour and can provide nonstop travel to anywhere an airport exists for roughly 900 passengers (Kasarda, 2000). Kasarda mentions that intellectual
capital is becoming the key to success in the business atmosphere so the time saving benefits provided by airplanes are unmatched. The airplane does not require rights of way so travel can be nonstop and reliable because there are fewer issues of congestion or accidents. High-speed rail would require its own right of way because the curvatures of high-speed rail need to be less significant because of higher travel speeds. This leads to a higher capital cost. Air does not rely on fixed capital improvements such as rail lines. If there is some reason why travel between two cities decreases high-speed rail does not have the flexibility to divert to another city without building more tracks. Air can easily change their schedule to an area where an airport exists.

Other benefits such as low fare airlines (i.e. Southwest Airlines) and frequent flier mile are incentive programs that encourage intercity travel. Low cost airlines also give the consumer a choice of the type of service they want. If the intercity traveler wants to pay more they are fully capable of going first class with all the perks while another person is also able to go bare bones and pay for a no frills airline like Southwest. The airline industry also thrives in areas where there are concentrated areas of development surrounded by generally barren areas. California fits this scenario rather well because the areas of San Francisco, Los Angeles, and San Diego are large metropolitan areas but their surrounding cities are urban sprawl. Even areas outside of California have similar attributes. Arizona, Nevada, Oregon, Washington, New Mexico all have the majority of their population situated about a larger urban area and airport while being surrounded by large tracts of underdeveloped territory.
The Institute of Transportation Studies at the University of California Berkeley conducted an extensive research report titled, “The Full Cost of Intercity Transportation – A Comparison of High Speed Rail, Air and Highway Transportation in California”. This report by David Levinson, David Gillen Abid Kanafani and Jean-Michel Mathieu concluded that the most economical option for the California Corridor was air transportation.

Figure 9 Full Cost Comparisons

Source: Levinson et al., 1996
The cost per passenger-kilometer traveled (pkt) for air transportation was $0.1315 for air, which was significantly lower than high-speed rail ($0.2350/pkt) and highway ($0.2302/pkt) (Levinson et al., 1996). Their extensive research took into account the external costs (accidents, congestion, noise, and air pollution) internal costs (construction, operations and maintenance) and user time costs. The cost break down according to their report is as follows:

Figure 10 Cost of Air in California Corridor

### Long Run Average Cost of Air in California Corridor

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Average Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure: Airways (ARTCC)</td>
<td>$0.0034</td>
</tr>
<tr>
<td>Infrastructure: Airways (TRACON)</td>
<td>$0.0015</td>
</tr>
<tr>
<td>Infrastructure: Airways (ACTC)</td>
<td>$0.0009</td>
</tr>
<tr>
<td>Infrastructure: Airways (FSS)</td>
<td>$0.0008</td>
</tr>
<tr>
<td>Infrastructure: Airport Terminal</td>
<td>$0.0094</td>
</tr>
<tr>
<td>Infrastructure: Airport Airside</td>
<td>$0.0022</td>
</tr>
<tr>
<td>Carrier: Capital Cost (Planes)</td>
<td>$0.0606</td>
</tr>
<tr>
<td>Carrier: Operating Cost (airline operations)</td>
<td>$0.0340</td>
</tr>
<tr>
<td>External: Accidents</td>
<td>$0.0004</td>
</tr>
<tr>
<td>External: Congestion</td>
<td>$0.0017</td>
</tr>
<tr>
<td>External: Noise</td>
<td>$0.0043</td>
</tr>
<tr>
<td>External: Pollution</td>
<td>$0.0009</td>
</tr>
<tr>
<td>User: Time</td>
<td>$0.0114</td>
</tr>
<tr>
<td>Total Cost by Air</td>
<td>$0.1315</td>
</tr>
</tbody>
</table>

*note: $/pkt*

Source: Levinson et al., 1996

ARTCC is air route traffic control centers, TRACON is terminal radar control areas, ATCT is air traffic control towers, and FSS is flight service centers. Capital costs make up the bulk of the total cost with the cost of planes consisting of almost 50%. The external/social costs only make up 6% of the total cost. High-speed rail does have
lower external/social costs but overall it is a small percentage that air can offset this disadvantage through mitigation efforts like soundproofing nearby areas.

**Disadvantages of Air Travel as a viable solution to intercity travel**

Airports and airplanes create tremendous benefits for travelers but the question still remains whether airplanes are the best alternative to the car or high-speed rail for intercity travel in California. While airplanes do not require the construction or maintenance of expensive right of ways like cars and high-speed rails require, airports do create their own set of problems.

Airports are very expensive structures that take up a lot of space. In order to provide the time saving benefits airports must be located within urban areas. This causes numerous problems. One of the major problems is that airports are a significant cause of air pollution. In Southern California our air quality is one of the poorest in the nation and Los Angeles International Airport (LAX) is the third largest source of smog in Southern California (SCAG, 2004). The reason for this is because U.S aircraft remain largely exempt from air pollution rules. The International Civil Aviation Organization governs airports. Noise pollution being another major is also a concern for areas around airports where the average population density is around 85,000 people in the 65-decibel noise contour, which is high enough to warrant federal soundproofing (Erie, 2004).

All of these factors contribute to a “not-in-my-back-yard” (NIMBY) attitude when it comes to creating or expanding airports. In order for LAX to be a viable solution to
intercity travel LAX will need to expand its passenger handling capacity to account for the future growth of the region. The public for the reasons listed above vehemently opposed the master plan LAX expansion proposed by former Los Angeles City Mayor Richard Riordan. An alternative to the LAX expansion was moving the entire facility to Palmdale, which is a remote area of Los Angeles that would be able to house a very large structure without expensive right of way acquisitions and community opposition. The move to Palmdale would effectively erode many of the time saving benefits of the airplane because Palmdale is 60 miles away from LAX. The Levinson et al report created in 1996 does not take into account the September 11th tragedy. Since then former Mayor James Hahn refocused the LAX master plan to stress security and modernization rather than excess capacity. The September 11th terrorist attack has had major influence on the shape and growth of air travel. Security is now a priority so the time delay figure will be increased as well as capital costs because expanded security-screening technology.

**High Speed Rail as a solution to the growth in intercity travel**

High Speed Rail (HSR) can be very effective in carrying a large amount of passengers at a high rate of speed while consuming far less energy and emitting less toxic emissions then air transit.

The proposed high speed rail plan connects to downtown to downtown locations. This is beneficial because rail operates best where there is a high density of people all going to one area. Downtown Los Angeles would benefit from high speed rail because of the already existing mass transit connections (light rail and bus) from Union Station to many
parts of Los Angeles County. Another advantage besides the time saving benefits is the location of being close to the central business district which has the potential to induce more business. Since high speed rail is fitted to a dedicated right of way the risk of terrorism is lower and therefore even more time can be saved because the security check in process would be considerable shorter than air travel. Levinson’s report showed that high speed rail has the lowest levels of external costs (Levinson et al., 1996).

Figure 11 Average Cost of High Speed Rail

**Long Run Average Cost of High Speed Rail**

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Average Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure: Construction and Maintenance</td>
<td>0.129</td>
</tr>
<tr>
<td>Carrier: Capital Cost (Trains)</td>
<td>0.010</td>
</tr>
<tr>
<td>Carrier: Operating Cost (Railroad operations)</td>
<td>0.050</td>
</tr>
<tr>
<td>External: Accidents</td>
<td>0.000</td>
</tr>
<tr>
<td>External: Congestion</td>
<td>0.000</td>
</tr>
<tr>
<td>External: Noise</td>
<td>0.002</td>
</tr>
<tr>
<td>External: Pollution</td>
<td>0.000</td>
</tr>
<tr>
<td>User: Time</td>
<td>0.044</td>
</tr>
<tr>
<td>Total Cost by HSR</td>
<td>0.235</td>
</tr>
</tbody>
</table>

*Source: Levinson et al, 1996*

One of the major benefits of high speed rail is that the external costs are virtually nonexistent except for noise. Accident rates are low because the whole system is grade separated, pollution levels are nearly zero because the high speed rail is electric and the cost of energy is absorbed into the cost of producing electricity in general. Since it is a dedicated right of way there are no congestion levels. Basing the decision of which service would be best for California on only one factor such as total cost effectiveness is not really good planning, taking account of external/social costs is very important. With environmental problems and community opposition growing against air
travel, high speed rail provides a great alternative that is cleaner and friendlier to neighborhoods. Since LAX is having a very difficult time trying to expand high speed rail might be a more feasible solution but not necessarily the most cost effective. High speed rail would only require a couple of lanes of rail laid out. Existing right of way could be modified to compensate for the increased speeds of rail and the costs could be lowered because of this. Another major benefit of high speed rail is that it has the potential to spur growth in underdeveloped areas. Access to the Central Valley will increase and unlike air, high speed rail would stop in those areas and economic growth could occur.

**Disadvantages of High Speed Rail**

High-speed rail has it shares of disadvantages that cast doubt on its viability in becoming the mode of choice for the expected growth in intercity travel in California. The Business Plan for the high speed rail system estimates the whole system to cost to be up to $45 billion dollars. This is a large sum of money that is used solely for one purpose. Airports do cost a lot of money but they have secondary uses because they are used for transporting people and cargo from other countries and other states, unlike a fixed capital expenditure like the high speed rail lines. David Levinson also points out that new rail lines sometimes spur denser development around stations but states that mostly they promote dispersion with park and ride lots encouraging sprawling type suburban living (Levinson, 1996). Also the central valley citizens would have cause for complaint because the plan does not have that many stops in the area but the rail line will cut through their neighborhoods and farmlands disrupting cities and business while not providing many benefits. Some experts argue that high speed rail has worked well
in Japan and France and therefore it should work for California. The problem with this is that Japan has what Adib Kanafani calls concentrated demand. California’s population is mostly bipolar with lots of people in Los Angeles and San Francisco and few in between. Japan has many areas where population levels are quite high, so this would be a great area for the skip stop patterns of rail (Kanafani, 1994). The levels of demand then would be lower than the train is capable of handling so there would be a waste of resources because the trains would be emptier and thus decrease the value of such an expensive structure. Figure 12 shows a comparison between the population clusters of California and Japan along where the high speed rail route would go through.

Figure 12 Population Comparison Japan and California

Analysis of Actual versus Estimate Numbers (Cost & Ridership)

Synopsis of Government Contract Process

The California High Speed Rail Authority contracts out projects to consultants who are in charge of calculating the cost and ridership numbers for high speed rail passengers as well as the alternatives to high speed rail (air and highway). Government contracts usually go through an extensive competitive process to receive such projects. Most of the work being done in regards to cost and ridership has been through the consulting firm Parsons Brinckerhoff and Cambridge Systematic. Typically these are contracts that are substantially valuable in monetary terms. Being that the consulting firms benefit tremendously from such contracts, there is no incentive to provide accurate numbers besides honesty and integrity. Transportation infrastructure projects are not the only projects that have been underestimated in cost and overestimated in ridership. Accuracy in demand forecast for rail projects is important to consider for many factors. The demand forecast is used to then calculate the environmental and socioeconomic benefits. Aside from that, it also serves allocate scarce funds.

Role of Academia in Assessing Accuracy

There are opponents that criticize high speed rail based on unfounded reasons. However, there are also others who do not criticize high speed rail itself, but do criticize the accuracy of numbers such as: ridership and cost estimates. Mainly, it is within academia that we see much of the criticism which is surrounds the facts and accuracy of numbers derived from consultant’s works. In particular, Bent Flyvbjerg stands out as one of the leading academics who has presented case studies and research which
proves that the majority of the estimates of infrastructure projects are underestimated in cost and overestimated in ridership numbers.

The objective of Flyvbjerg’s et al. article, “How (In)accurate Are Demand Forecasts in Public Works Projects?,” is to answer the question of accuracy of demand in transportation projects by establishing a sample of transportation projects that is large enough to permit statistically valid answers. The article concludes that the majority of rail projects overestimated their demand forecast. The formula Flyvbjerg uses to find the inaccuracy is one I also use to compare California high speed rail demand forecast, which is the actual minus forecasted traffic in percentage of forecasted traffic (Flyvbjerg, 2005). Actual traffic is counted for the first year of operations, similarly to forecasted traffic which is the estimate for the first year of operations (Flyvbjerg, 2005). Flyvbjerg uses a total of 210 transportation projects, including both rail and road projects in developed and developing countries to measure the inaccuracy of traffic forecast (Flyvbjerg, 2005).

Flyvbjerg’s results present a striking reality of forecast demands for rail projects. Flyvbjerg’s findings are that “rail passenger forecast were overestimated by an average of 105.6%, resulting in actual traffic that was on average 52.4% lower than forecasted traffic,” both numbers were at the 95% confidence interval (Flyvbjerg, 2005). Flyvbjerg concludes that rail forecast estimates are significantly misleading and that policymakers and planners should take more into account risk assessment and management regarding travel demand (Flyvbjerg, 2005).
Bent Flyvberg’s second article on the subject, “Cost Overruns and Demand Shortfalls in Urban Rail and Other Infrastructure,” demonstrates the general point that urban rail projects are grossly underestimated in terms of cost projection. His conclusion, if used, would help improve economic and financial risk assessment of large infrastructure projects (Flyvbjerg, 2007). Flyvbjerg’s study consists of comparing 434 urban rail projects with 214 other transportation infrastructure projects; his conclusions provide statistically significant results in regards to risk assessment of building a project (Flyvbjerg, 2007). The article emphasizes the current lack of accountability to produce sound empirical results of estimating cost projections for large infrastructure projects.

This report takes the same methods that Flyvbjerg used to calculate the difference between forecast and actual construction costs, which are actual costs minus forecast costs in % of forecast costs (Flyvbjerg, 2007).

Flyvbjerg’s findings show that rail has the largest cost escalations with an average of 44.7% in comparison with bridges, tunnels, roads, and other projects and for 25% of urban rail projects cost escalations are at least 60% with an actual ridership that is on average 51% lower than forecast (Flyvbjerg, 2007). Flyvbjerg concludes that the economic risk for urban rail projects turn out to be substantially more expensive than said at the time of the decision to build (Flyvbjerg, 2007). Again, we see Flyvbjerg’s strong emphasis on assessment and management of risk which he strongly urges should be central when assessing whether an infrastructure project should be built.
Analysis

Using Flyvbjerg’s research, Table 5 Benchmarking of the California High Speed Rail, the numbers for the California high speed rail were recalculated to show the difference between the actual and the estimate, both in terms of cost and demand. In terms of cost, there is an underestimate of $18 billion and ridership is overestimated by 5 million riders. The numbers used to calculate the difference are found in Table 6 Flyvberg’s cost escalation and ridership for 12 urban rail projects.

Table 5. Benchmarking of the California High Speed Rail

<table>
<thead>
<tr>
<th>CA HSRA</th>
<th>Benchmark (average practice)</th>
<th>Difference between CAHSRA and benchmark (Flyvberg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Escalation % (constant prices)</td>
<td>$45 Billion</td>
<td>40%</td>
</tr>
<tr>
<td>Ridership Shortfall %</td>
<td>10 million per year (by 2020)</td>
<td>-47.8</td>
</tr>
</tbody>
</table>

Table 6. Flyvberg’s cost escalation and ridership for 12 urban rail projects

<table>
<thead>
<tr>
<th>Quartiles (25/50/75%)</th>
<th>Average difference between actual and forecast development %</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs</td>
<td>28/45/56</td>
<td>40.3</td>
</tr>
<tr>
<td>Ridership</td>
<td>-67/-52/-34</td>
<td>-47.8</td>
</tr>
</tbody>
</table>

Source: Flyvgjerg, 2007

Operation Estimates

The estimates derived from the private consultants studies show that the operation cost for aviation would be $65.7 million per year, in comparison the California high speed rail which would be $152.5 annually; this is based on 2003 dollars (CAHSRA, 2004). The annual operations and maintenance costs of the high speed rail alternative is based on
system indicators, including operating speed, travel time, station configuration, maintenance and storage facility, and operating schedule (CAHSRA, 2004). Annual operation and maintenance (O&M) costs associated with aviation are based on the actual O&M costs for airports in each region, as reported in their annual financial statements (CAHSRA, 2004).

Table 7. Annual Operating Cost (Millions of 2003 Dollars) (Airports versus HSR)

<table>
<thead>
<tr>
<th>Modal</th>
<th>Air</th>
<th>CA HSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Cost</td>
<td>$65.7</td>
<td>$152.5</td>
</tr>
</tbody>
</table>

Source: California High Speed Rail Authority, 2004

The question of what will happen if the California high speed rail authority fails to meet the basic operating costs has been avoided by the California high speed rail authority staff and leadership. In Table 5 we see that the projected ridership is overestimated by $5 million riders, which will have a snowball effect in all the rest of their numbers, decreasing revenue by a large sum, including projected farebox revenue. Operating cost as seen in Table 7 are substantial, almost triple the amount of air operations. If the California high speed rail authority does not meet its projected quote of ridership, there will be a deficit amount and the question remains: who will step up and pay the remainder amount of the operation cost? Being that the California High Speed Rail Authority is a government branch of the California state government, we can assume that the cost of operations will fall on taxpayers. If past experiences apply, specifically looking at Flyvbjerg’s articles then, how will the California high speed rail surpass the projected shortcomings? The recommendations that follow this section provide suggestions on how the California high speed rail might be able to minimize cost and attract a larger number of riders.
RECOMMENDATIONS

The California High Speed Rail will be a success if other mass transit projects are also funded (i.e. light rail, subways, buses). Downtown to downtown destination is a great concept, but one that also needs to invest in local mass transit options. If people get off the high speed train and do not have other public transportation to get them to their destination, then high speed rail will not have as much impact. Below are recommendations that should be considered for the first phases of high speed rail segment from Anaheim to Los Angeles.

- Rail improvements within the Orange County segment of the LOSSAN Corridor to create feeder trains to the high speed rail stations

- Limit new tracks of high speed rail to Los Angeles – Bakersfield – San Francisco

- Identify and nominate projects that focus on near-term job creation and passenger rail improvements

- Multimodal transit needs to be expanded in all the train station and urban centers

- A stronger education campaign and outreach to community residents on the benefits of creating a high speed train system

- Create stronger partnerships with the regional transportation agencies, so they can help create community support for the project

Throughout the California High Speed Rail Authority should also strategically prepare for future implementation of high-speed rail service and connecting conventional rail service.
FUTURE OF HIGH SPEED RAIL

The demand for high speed rail might not be apparent now, but it will be in the near future as air and highway capacity continues to be exacerbated. However, it is important to emphasize that high speed rail will not work if mass transit is not built as well and suburban sprawl is limited creating denser nodes around rail stations. Europe’s high speed rail was not based on ridership projections but on policy. Their high speed trains complement the rest of their mass transit. Though our economy might be slow, it might help improve California’s economy by the job growth it will create. Federal grants will be extremely important to help finance high speed trains and to spur the state’s economy. A recovering California economy is crucial for the high speed train project. Once the economy recovers, it will be easier for California to sell bonds that will help finance the construction of the system. A strong economy will likely attract a large number of private investors into the project. Aside from funding the California High Speed Rail Authority will have to develop and foster strong partnerships with all the regional transportation agencies that can help disseminate information and gather key players in all the different regions to keep the project moving along.
REFERENCES


U.S. General Accounting Office. (2005). *Acela’s continued problems underscore the importance of meeting broader challenges in managing large-scale...*


### APPENDICES

### LIST OF TABLES AND FIGURES

#### Table 1

**FRA-Designated High-Speed Rail Corridors**

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Endpoint Cities</th>
<th>Miles</th>
<th>Top Speeds</th>
</tr>
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<tbody>
<tr>
<td>California</td>
<td>Sacramento-San Diego</td>
<td>680</td>
<td>ns</td>
</tr>
<tr>
<td>Empire</td>
<td>New York-Buffalo</td>
<td>439</td>
<td>125</td>
</tr>
<tr>
<td>Florida</td>
<td>Tampa-Orlando-Miami</td>
<td>356</td>
<td>120</td>
</tr>
<tr>
<td>Gulf Coast</td>
<td>Houston-Atlanta with New Orleans-Mobile branch</td>
<td>1,022</td>
<td>110</td>
</tr>
<tr>
<td>Keystone</td>
<td>Philadelphia-Pittsburgh</td>
<td>349</td>
<td>110</td>
</tr>
<tr>
<td>Midwest</td>
<td>Chicago-Minneapolis, Chicago-Detroit, Chicago-Cleveland, Chicago-Cincinnati, Chicago-St. Louis St. Louis-Kansas City, Indianapolis-Louisville</td>
<td>1,920</td>
<td>110</td>
</tr>
<tr>
<td>New England</td>
<td>Portland-Boston-Montreal</td>
<td>489</td>
<td>110</td>
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<tr>
<td>Northeast</td>
<td>Boston-Washington, DC</td>
<td>456</td>
<td>150</td>
</tr>
<tr>
<td>Pacific Northwest</td>
<td>Eugene-Vancouver, BC</td>
<td>466</td>
<td>110</td>
</tr>
<tr>
<td>South Central</td>
<td>San Antonio-Tulsa with Dallas-Little Rock branch</td>
<td>994</td>
<td>ns</td>
</tr>
<tr>
<td>Southeast</td>
<td>Washington, DC-Atlanta-Macon with Richmond-Hampton Roads branch</td>
<td>874</td>
<td>110</td>
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